NATURAL GAS

Meeting the Challenges of the Nation's Growing Natural Gas Demand

Volume III
APPENDICES

A Report of the
National Petroleum Council

December 1999

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A Report of the
National Petroleum Council

Committee on Natural Gas
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December 1999

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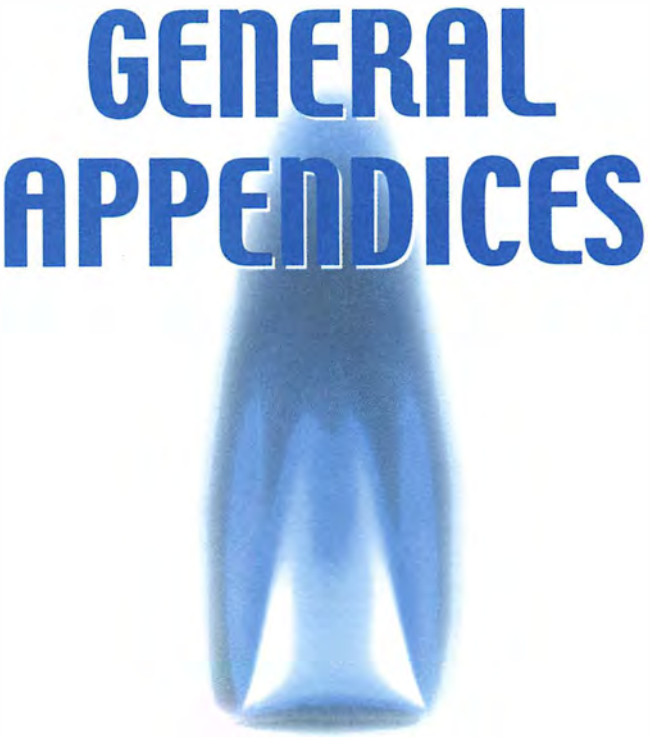

COMPARISON OF KEY RESULTS FOR THE NPC REFERENCE CASE AND TEN SENSITIVITY CASES

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Supply Task Group

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March 2000

NPC Sensitivity Cases

North American Consumption

Total North American Gas Consumption (TCF)	1995	1996	1997	1996	1999	2006	2001	2002	2003	2004	2006	2008	2007	2006	2006	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	24.13	25.24	24.59	25.01	25.59	26.05	26.46	27.64	28.71	29.55	29.73	30.04	30.37	31.02	31.61	32.65	33.78	34.37	34.57	34.69	35.15
Increased Oil Prices (NPC99D)	24.13	25.24	24.59	25.01	25.65	26.08	26.66	27.96	29.08	29.95	30.30	30.78	31.11	31.65	32.26	33.39	34.64	35.48	35.96	36.71	37.27
Decreased Oil Prices (NPC99E)	24.13	25.24	24.59	25.01	25.47	25.98	26.10	27.02	28.04	28.93	29.17	29.30	29.47	30.01	30.71	31.58	32.63	32.96	32.72	32.67	33.24
Higher GDP Growth Rate (NPC99F)	24.13	25.24	24.59	25.01	25.59	26.05	26.48	27.71	28.88	29.87	30.20	30.52	30.76	31.23	32.09	33.37	34.88	35.56	35.58	35.73	36.29
Lower GDP Growth Rate (NPC99G)	24.13	25.24	24.59	25.01	25.59	26.03	26.43	27.50	28.46	29.21	29.39	29.65	29.88	30.29	30.74	31.60	32.61	33.38	33.57	33.70	33.91
Faster Technology Advancement (NPC99H)	24.13	25.24	24.59	25.01	25.59	26.03	26.43	27.64	28.77	29.68	30.07	30.59	30.93	31.70	32.54	33.44	34.61	35.43	35.72	36.00	36.37
Slower Technology Advancement (NPC99I)	24.13	25.24	24.59	25.01	25.59	26.03	26.42	27.59	28.64	29.44	29.52	29.64	29.80	30.30	30.90	31.88	33.01	33.34	33.17	32.99	33.54
Larger Resource Base (NPC99K)	24.13	25.24	24.59	25.01	25.59	26.08	26.59	27.88	29.05	30.04	30.47	31.15	31.83	32.91	33.72	34.66	35.46	35.78	35.77	36.26	37.19
Smaller Resource Base (NPC99L)	24.13	25.24	24.59	25.01	25.59	25.88	26.07	27.12	28.05	28.86	29.13	29.52	29.65	29.80	30.14	31.11	32.35	32.74	32.80	32.70	32.79
Increased Access (NPC99R)	24.13	25.24	24.59	25.01	25.59	26.04	26.46	27.65	28.75	29.61	29.93	30.22	30.56	31.29	32.11	33.10	34.25	35.16	35.52	36.02	36.66
Reduced Access (NPC99S)	24.13	25.24	24.59	25.01	25.59	26.00	26.35	27.50	28.58	29.45	29.67	29.86	30.02	30.48	31.20	32.27	33.54	34.07	34.27	34.65	34.95

North American End-Use Demand (TCF)	1995	1996	1997	1998	1999	2006	2001	2002	2003	2004	2006	2008	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	21.95	22.42	22.40	21.76	23.11	23.35	23.74	24.78	25.74	26.53	26.72	27.01	27.31	27.93	28.42	29.37	30.40	30.96	31.17	31.37	31.83
Increased Oil Prices (NPC99D)	21.95	22.42	22.40	21.76	23.17	23.38	23.93	25.08	26.06	26.88	27.23	27.66	27.95	28.51	29.03	30.01	31.14	31.92	32.38	33.06	33.68
Decreased Oil Prices (NPC99E)	21.95	22.42	22.40	21.76	23.00	23.28	23.40	24.23	25.12	25.97	26.21	26.33	26.50	27.03	27.63	28.42	29.38	29.71	29.54	29.49	30.06
Higher GDP Growth Rate (NPC99F)	21.95	22.42	22.40	21.76	23.11	23.35	23.76	24.85	25.89	26.82	27.16	27.43	27.66	28.12	28.81	30.01	31.39	32.03	32.11	32.26	32.74
Lower GDP Growth Rate (NPC99G)	21.95	22.42	22.40	21.76	23.11	23.33	23.70	24.65	25.50	26.22	26.39	26.65	26.84	27.25	27.64	28.43	29.36	30.06	30.26	30.43	30.69
Faster Technology Advancement (NPC99H)	21.95	22.42	22.40	21.76	23.11	23.33	23.71	24.79	25.79	26.65	27.03	27.48	27.80	28.54	29.24	30.12	31.19	31.95	32.21	32.54	32.92
Slower Technology Advancement (NPC99I)	21.95	22.42	22.40	21.76	23.11	23.33	23.71	24.75	25.67	26.43	26.53	26.67	26.79	27.29	27.78	28.67	29.71	30.04	29.94	29.84	30.26
Larger Resource Base (NPC99K)	21.95	22.42	22.40	21.76	23.11	23.38	23.85	25.00	26.04	26.98	27.39	28.01	28.62	29.66	30.37	31.24	32.00	32.33	32.33	32.83	33.66
Smaller Resource Base (NPC99L)	21.95	22.42	22.40	21.76	23.11	23.19	23.40	24.32	25.14	25.91	26.18	26.52	26.63	26.80	27.08	27.95	29.10	29.48	29.52	29.46	29.61
Increased Access (NPC99R)	21.95	22.42	22.40	21.76	23.11	23.34	23.73	24.79	25.76	26.58	26.90	27.16	27.46	28.17	28.87	29.78	30.83	31.67	32.04	32.56	33.18
Reduced Access (NPC99S)	21.95	22.42	22.40	21.76	23.11	23.31	23.65	24.67	25.63	26.46	26.70	26.85	26.98	27.45	28.04	28.99	30.18	30.67	30.85	31.22	31.59

North American Residential Demand (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2006	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.97	6.02	6.12	6.17	6.24	6.30	6.39	6.41	6.46	6.52	6.63	6.66	6.72	6.77
Increased Oil Prices (NPC99D)	5.41	5.86	5.57	5.08	5.57	5.88	5.90	5.94	5.99	6.11	6.16	6.24	6.30	6.38	6.39	6.44	6.50	6.60	6.64	6.71	6.77
Decreased Oil Prices (NPC99E)	5.41	5.86	5.57	5.08	5.57	5.89	5.93	5.99	6.04	6.14	6.19	6.26	6.32	6.41	6.43	6.48	6.55	6.65	6.68	6.74	6.79
Higher GDP Growth Rate (NPC99F)	5.41	5.86	5.57	5.08	5.57	5.89	5.92	5.97	6.03	6.14	6.20	6.28	6.35	6.44	6.46	6.52	6.60	6.72	6.76	6.84	6.90
Lower GDP Growth Rate (NPC99G)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.96	6.01	6.11	6.15	6.21	6.26	6.34	6.34	6.38	6.44	6.53	6.56	6.61	6.65
Faster Technology Advancement (NPC99H)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.97	6.02	6.12	6.18	6.25	6.32	6.41	6.43	6.49	6.56	6.66	6.70	6.76	6.81
Slower Technology Advancement (NPC99I)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.97	6.02	6.12	6.17	6.24	6.29	6.37	6.38	6.43	6.49	6.60	6.63	6.68	6.73
Larger Resource Base (NPC99K)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.97	6.03	6.14	6.19	6.27	6.34	6.44	6.47	6.54	6.61	6.71	6.73	6.78	6.82
Smaller Resource Base (NPC99L)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.96	6.00	6.10	6.14	6.22	6.28	6.36	6.37	6.42	6.47	6.57	6.60	6.66	6.71
Increased Access (NPC99R)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.97	6.02	6.12	6.17	6.25	6.31	6.40	6.41	6.47	6.53	6.64	6.68	6.75	6.80
Reduced Access (NPC99S)	5.41	5.86	5.57	5.08	5.57	5.89	5.91	5.96	6.01	6.12	6.17	6.24	6.30	6.38	6.39	6.44	6.50	6.61	6.65	6.71	6.76

North American Commercial Demand (TCF)	1995	1996	1997	1996	1999	2006	2001	2002	2003	2004	2006	2008	2007	2008	2006	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.97	4.00	4.09	4.15	4.22	4.26	4.32	4.33	4.36	4.42	4.50	4.54	4.59	4.62
Increased Oil Prices (NPC99D)	3.44	3.60	3.63	3.40	3.69	3.88	3.90	3.93	3.96	4.06	4.13	4.21	4.26	4.30	4.30	4.33	4.38	4.47	4.51	4.58	4.62
Decreased Oil Prices (NPC99E)	3.44	3.60	3.63	3.40	3.70	3.91	3.96	4.00	4.04	4.13	4.18	4.24	4.29	4.35	4.37	4.40	4.46	4.55	4.58	4.63	4.66
Higher GDP Growth Rate (NPC99F)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.97	4.01	4.10	4.17	4.24	4.29	4.35	4.36	4.40	4.47	4.56	4.62	4.68	4.73
Lower GDP Growth Rate (NPC99G)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.97	4.00	4.08	4.14	4.20	4.24	4.29	4.29	4.31	4.35	4.43	4.47	4.52	4.54
Faster Technology Advancement (NPC99H)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.96	4.00	4.09	4.16	4.23	4.29	4.35	4.37	4.41	4.47	4.56	4.60	4.66	4.69
Slower Technology Advancement (NPC99I)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.96	4.00	4.09	4.14	4.21	4.25	4.29	4.29	4.32	4.37	4.46	4.49	4.54	4.56
Larger Resource Base (NPC99K)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.97	4.01	4.11	4.18	4.27	4.33	4.41	4.44	4.49	4.56	4.64	4.66	4.69	4.71
Smaller Resource Base (NPC99L)	3.44	3.60	3.63	3.40	3.69	3.90	3.92	3.95	3.97	4.05	4.11	4.17	4.22	4.27	4.27	4.30	4.34	4.42	4.46	4.51	4.53
Increased Access (NPC99R)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.97	4.00	4.09	4.15	4.23	4.27	4.33	4.34	4.38	4.44	4.53	4.57	4.63	4.68
Reduced Access (NPC99S)	3.44	3.60	3.63	3.40	3.69	3.90	3.93	3.96	3.99	4.08	4.14	4.21	4.25	4.30	4.30	4.34	4.39	4.48	4.52	4.58	4.62

NPC Sensitivity Cases

North American Consumption

North American Industrial Demand (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	9.86	10.22	10.22	10.05	10.26	10.05	10.19	10.61	10.98	11.24	11.26	11.28	11.36	11.52	11.66	11.99	12.36	12.51	12.56	12.57	12.68
Increased Oil Prices (NPC99D)	9.86	10.22	10.22	10.05	10.32	10.16	10.39	10.83	11.18	11.45	11.51	11.61	11.69	11.81	11.95	12.30	12.69	12.92	13.05	13.22	13.28
Decreased Oil Prices (NPC99E)	9.86	10.22	10.22	10.05	10.15	9.91	9.93	10.23	10.58	10.89	10.93	10.94	11.00	11.17	11.36	11.64	11.96	12.09	12.09	12.14	12.33
Higher GDP Growth Rate (NPC99F)	9.86	10.22	10.22	10.05	10.26	10.06	10.18	10.59	10.98	11.29	11.33	11.34	11.39	11.49	11.71	12.09	12.54	12.72	12.76	12.87	13.07
Lower GDP Growth Rate (NPC99G)	9.86	10.22	10.22	10.05	10.26	10.07	10.22	10.62	10.96	11.22	11.23	11.29	11.34	11.44	11.57	11.86	12.20	12.42	12.46	12.45	12.41
Faster Technology Advancement (NPC99H)	9.86	10.22	10.22	10.05	10.26	10.05	10.18	10.61	11.00	11.29	11.38	11.47	11.55	11.75	11.97	12.26	12.62	12.85	12.90	12.94	12.97
Slower Technology Advancement (NPC99I)	9.86	10.22	10.22	10.05	10.26	10.05	10.18	10.59	10.95	11.21	11.18	11.15	11.17	11.31	11.46	11.77	12.13	12.22	12.21	12.23	12.39
Larger Resource Base (NPC99K)	9.86	10.22	10.22	10.05	10.26	10.07	10.25	10.70	11.10	11.42	11.51	11.66	11.85	12.16	12.37	12.67	12.90	12.94	12.89	13.01	13.22
Smaller Resource Base (NPC99L)	9.86	10.22	10.22	10.05	10.26	9.98	10.05	10.42	10.74	11.02	11.06	11.13	11.15	11.16	11.26	11.56	11.96	12.07	12.12	12.16	12.27
Increased Access (NPC99R)	9.86	10.22	10.22	10.05	10.26	10.05	10.19	10.61	10.99	11.26	11.33	11.34	11.42	11.61	11.83	12.15	12.52	12.78	12.86	12.97	13.07
Reduced Access (NPC99S)	9.86	10.22	10.22	10.05	10.26	10.03	10.15	10.56	10.94	11.22	11.26	11.22	11.24	11.35	11.53	11.87	12.28	12.41	12.46	12.54	12.63

North American Power Gen Demand (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	3.24	2.74	2.98	3.22	3.59	3.51	3.70	4.24	4.74	5.07	5.14	5.26	5.38	5.70	6.03	6.56	7.11	7.32	7.42	7.49	7.76
Increased Oil Prices (NPC99D)	3.24	2.74	2.98	3.22	3.60	3.46	3.75	4.38	4.92	5.27	5.43	5.60	5.71	6.02	6.39	6.95	7.58	7.93	8.19	8.55	9.00
Decreased Oil Prices (NPC99E)	3.24	2.74	2.98	3.22	3.58	3.56	3.59	4.00	4.45	4.81	4.92	4.90	4.89	5.10	5.48	5.90	6.40	6.43	6.19	5.98	6.28
Higher GDP Growth Rate (NPC99F)	3.24	2.74	2.98	3.22	3.59	3.52	3.74	4.32	4.87	5.29	5.46	5.57	5.63	5.83	6.28	7.00	7.78	8.03	7.97	7.87	8.05
Lower GDP Growth Rate (NPC99G)	3.24	2.74	2.98	3.22	3.59	3.48	3.64	4.11	4.53	4.82	4.87	4.94	4.99	5.18	5.44	5.87	6.37	6.68	6.77	6.86	7.08
Faster Technology Advancement (NPC99H)	3.24	2.74	2.98	3.22	3.59	3.50	3.69	4.25	4.78	5.15	5.32	5.52	5.64	6.03	6.47	6.95	7.54	7.87	8.01	8.19	8.45
Slower Technology Advancement (NPC99I)	3.24	2.74	2.98	3.22	3.59	3.50	3.69	4.22	4.70	5.01	5.04	5.08	5.08	5.32	5.65	6.15	6.72	6.77	6.61	6.40	6.58
Larger Resource Base (NPC99K)	3.24	2.74	2.98	3.22	3.59	3.53	3.76	4.36	4.91	5.31	5.51	5.81	6.10	6.65	7.09	7.54	7.93	8.04	8.05	8.35	8.91
Smaller Resource Base (NPC99L)	3.24	2.74	2.98	3.22	3.59	3.43	3.52	4.00	4.42	4.74	4.87	5.01	4.99	5.00	5.18	5.68	6.33	6.42	6.35	6.12	6.09
Increased Access (NPC99R)	3.24	2.74	2.98	3.22	3.59	3.51	3.70	4.25	4.76	5.10	5.24	5.35	5.46	5.84	6.28	6.78	7.34	7.71	7.92	8.20	8.63
Reduced Access (NPC99S)	3.24	2.74	2.98	3.22	3.59	3.49	3.66	4.18	4.68	5.03	5.14	5.18	5.20	5.42	5.81	6.35	7.00	7.17	7.23	7.38	7.58

North American Lease&Plant Demand (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.48	1.52	1.51	1.52	1.55	1.57	1.58	1.63	1.68	1.72	1.73	1.73	1.75	1.79	1.82	1.87	1.92	1.94	1.95	1.96	1.98
Increased Oil Prices (NPC99D)	1.48	1.52	1.51	1.52	1.55	1.57	1.59	1.64	1.70	1.74	1.75	1.77	1.79	1.82	1.85	1.90	1.95	1.99	2.02	2.06	2.09
Decreased Oil Prices (NPC99E)	1.48	1.52	1.51	1.52	1.54	1.56	1.56	1.60	1.65	1.69	1.70	1.70	1.71	1.74	1.78	1.83	1.86	1.87	1.86	1.86	1.89
Higher GDP Growth Rate (NPC99F)	1.48	1.52	1.51	1.52	1.55	1.57	1.58	1.63	1.69	1.73	1.75	1.76	1.77	1.80	1.84	1.90	1.96	2.00	2.00	2.01	2.04
Lower GDP Growth Rate (NPC99G)	1.48	1.52	1.51	1.52	1.55	1.56	1.58	1.62	1.67	1.70	1.71	1.72	1.73	1.76	1.78	1.83	1.87	1.90	1.90	1.91	1.93
Faster Technology Advancement (NPC99H)	1.48	1.52	1.51	1.52	1.55	1.56	1.58	1.63	1.68	1.73	1.74	1.76	1.78	1.82	1.86	1.91	1.95	1.99	2.01	2.02	2.04
Slower Technology Advancement (NPC99I)	1.48	1.52	1.51	1.52	1.55	1.56	1.58	1.63	1.68	1.71	1.72	1.72	1.73	1.76	1.79	1.84	1.88	1.89	1.88	1.87	1.90
Larger Resource Base (NPC99K)	1.48	1.52	1.51	1.52	1.55	1.57	1.59	1.64	1.69	1.74	1.76	1.78	1.81	1.87	1.91	1.96	2.00	2.02	2.02	2.05	2.10
Smaller Resource Base (NPC99L)	1.48	1.52	1.51	1.52	1.55	1.56	1.56	1.60	1.64	1.68	1.70	1.70	1.71	1.72	1.74	1.78	1.82	1.84	1.85	1.84	1.84
Increased Access (NPC99R)	1.48	1.53	1.51	1.52	1.55	1.57	1.58	1.63	1.68	1.73	1.74	1.75	1.77	1.80	1.84	1.89	1.93	1.97	1.98	2.01	2.05
Reduced Access (NPC99S)	1.48	1.52	1.51	1.52	1.55	1.56	1.57	1.62	1.67	1.71	1.73	1.73	1.75	1.78	1.82	1.87	1.91	1.94	1.95	1.97	1.99

North American Pipeline Fuel Demand (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.90	0.94	0.93	0.91	0.96	0.97	0.97	1.00	1.04	1.06	1.06	1.06	1.08	1.10	1.12	1.15	1.18	1.20	1.19	1.19	1.18
Increased Oil Prices (NPC99D)	0.90	0.94	0.93	0.91	0.96	0.97	0.97	1.01	1.06	1.08	1.08	1.09	1.10	1.11	1.13	1.18	1.21	1.24	1.25	1.28	1.28
Decreased Oil Prices (NPC99E)	0.90	0.94	0.93	0.91	0.95	0.97	0.97	0.98	1.01	1.03	1.04	1.04	1.05	1.07	1.09	1.11	1.14	1.15	1.14	1.13	1.13
Higher GDP Growth Rate (NPC99F)	0.90	0.94	0.93	0.91	0.96	0.97	0.97	1.00	1.04	1.07	1.08	1.08	1.10	1.11	1.14	1.19	1.23	1.26	1.24	1.23	1.24
Lower GDP Growth Rate (NPC99G)	0.90	0.94	0.93	0.91	0.96	0.97	0.97	1.00	1.04	1.06	1.06	1.06	1.07	1.08	1.10	1.12	1.15	1.18	1.18	1.17	1.15
Faster Technology Advancement (NPC99H)	0.90	0.94	0.93	0.91	0.96	0.97	0.97	1.00	1.04	1.07	1.08	1.09	1.10	1.11	1.13	1.16	1.19	1.22	1.21	1.21	1.21
Slower Technology Advancement (NPC99I)	0.90	0.94	0.93	0.91	0.96	0.97	0.97	1.00	1.04	1.06	1.05	1.05	1.06	1.08	1.10	1.13	1.16	1.17	1.16	1.14	1.14
Larger Resource Base (NPC99K)	0.90	0.94	0.93	0.91	0.96	0.97	0.98	1.01	1.05	1.08	1.09	1.10	1.12	1.14	1.17	1.19	1.21	1.21	1.20	1.21	1.24
Smaller Resource Base (NPC99L)	0.90	0.94	0.93	0.91	0.96	0.97	0.96	0.98	1.02	1.04	1.05	1.06	1.07	1.08	1.09	1.12	1.16	1.16	1.15	1.14	1.13
Increased Access (NPC99R)	0.90	0.94	0.93	0.91	0.96	0.97	0.97	1.00	1.04	1.07	1.07	1.07	1.09	1.11	1.14	1.17	1.20	1.24	1.23	1.25	1.25
Reduced Access (NPC99S)	0.90	0.94	0.93	0.91	0.96	0.97	0.96	0.98	1.02	1.05	1.05	1.05	1.07	1.08	1.11	1.14	1.18	1.20	1.20	1.21	1.20

NPC Sensitivity Cases

North American Consumption

North American Mexican Exports (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Increased Oil Prices (NPC99D)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Decreased Oil Prices (NPC99E)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Higher GDP Growth Rate (NPC99F)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Lower GDP Growth Rate (NPC99G)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Faster Technology Advancement (NPC99H)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Slower Technology Advancement (NPC99I)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Larger Resource Base (NPC99K)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Smaller Resource Base (NPC99L)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Increased Access (NPC99R)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Reduced Access (NPC99S)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44

U.S. Gas Consumption

Total U.S. Gas Consumption (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	21.43	22.34	21.64	22.02	22.64	22.99	23.35	24.46	25.47	26.22	26.41	26.60	26.88	27.49	28.05	29.05	30.08	30.61	30.75	30.85	31.28
Increased Oil Prices (NPC99D)	21.43	22.34	21.64	22.02	22.70	23.02	23.54	24.78	25.83	26.61	26.96	27.31	27.59	28.11	28.69	29.78	30.94	31.72	32.11	32.82	33.32
Decreased Oil Prices (NPC99E)	21.43	22.34	21.64	22.02	22.53	22.93	23.01	23.87	24.82	25.64	25.88	25.89	26.02	26.53	27.18	28.01	28.95	29.22	28.93	28.88	29.43
Higher GDP Growth Rate (NPC99F)	21.43	22.34	21.64	22.02	22.64	23.00	23.36	24.52	25.62	26.51	26.84	27.03	27.21	27.63	28.44	29.66	31.06	31.67	31.62	31.75	32.25
Lower GDP Growth Rate (NPC99G)	21.43	22.34	21.64	22.02	22.64	22.98	23.33	24.35	25.24	25.92	26.10	26.27	26.46	26.84	27.27	28.10	29.04	29.74	29.88	29.99	30.18
Faster Technology Advancement (NPC99H)	21.43	22.34	21.64	22.02	22.64	22.98	23.32	24.47	25.53	26.36	26.75	27.13	27.42	28.14	28.91	29.79	30.88	31.63	31.85	32.11	32.45
Slower Technology Advancement (NPC99I)	21.43	22.34	21.64	22.02	22.64	22.97	23.32	24.42	25.40	26.12	26.20	26.22	26.34	26.82	27.39	28.32	29.35	29.61	29.38	29.20	29.71
Larger Resource Base (NPC99K)	21.43	22.34	21.64	22.02	22.64	23.03	23.47	24.70	25.79	26.69	27.12	27.67	28.28	29.28	30.05	30.94	31.70	31.97	31.88	32.33	33.23
Smaller Resource Base (NPC99L)	21.43	22.34	21.64	22.02	22.64	22.83	22.97	23.97	24.84	25.57	25.84	26.10	26.19	26.30	26.62	27.54	28.69	29.04	29.05	28.96	29.04
Increased Access (NPC99R)	21.43	22.34	21.64	22.03	22.64	22.99	23.35	24.48	25.51	26.28	26.60	26.77	27.06	27.76	28.54	29.48	30.55	31.38	31.67	32.15	32.75
Reduced Access (NPC99S)	21.43	22.34	21.64	22.02	22.64	22.95	23.24	24.33	25.34	26.13	26.35	26.42	26.53	26.96	27.63	28.66	29.83	30.30	30.44	30.80	31.08

U.S. End-Use Gas Consumption (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	19.70	20.05	20.03	19.39	20.65	20.85	21.22	22.21	23.12	23.85	24.01	24.25	24.51	25.09	25.56	26.45	27.42	27.92	28.10	28.26	28.68
Increased Oil Prices (NPC99D)	19.70	20.05	20.03	19.39	20.71	20.88	21.41	22.50	23.43	24.19	24.50	24.88	25.14	25.65	26.15	27.08	28.15	28.87	29.29	29.91	30.49
Decreased Oil Prices (NPC99E)	19.70	20.05	20.03	19.39	20.54	20.79	20.89	21.68	22.52	23.30	23.51	23.60	23.73	24.21	24.78	25.52	26.41	26.69	26.49	26.41	26.94
Higher GDP Growth Rate (NPC99F)	19.70	20.05	20.03	19.39	20.65	20.86	21.23	22.27	23.25	24.11	24.40	24.63	24.81	25.23	25.88	27.02	28.31	28.88	28.92	29.01	29.44
Lower GDP Growth Rate (NPC99G)	19.70	20.05	20.03	19.39	20.65	20.84	21.19	22.10	22.90	23.57	23.71	23.93	24.10	24.47	24.84	25.59	26.47	27.12	27.29	27.44	27.67
Faster Technology Advancement (NPC99H)	19.70	20.05	20.03	19.39	20.65	20.84	21.19	22.22	23.17	23.97	24.31	24.71	24.99	25.67	26.35	27.17	28.18	28.88	29.11	29.40	29.74
Slower Technology Advancement (NPC99I)	19.70	20.05	20.03	19.39	20.65	20.84	21.19	22.18	23.05	23.76	23.82	23.93	24.01	24.47	24.94	25.77	26.76	27.03	26.90	26.77	27.14
Larger Resource Base (NPC99K)	19.70	20.05	20.03	19.39	20.65	20.88	21.33	22.42	23.41	24.28	24.65	25.22	25.78	26.75	27.43	28.25	28.97	29.25	29.22	29.68	30.47
Smaller Resource Base (NPC99L)	19.70	20.05	20.03	19.39	20.65	20.70	20.89	21.77	22.54	23.25	23.48	23.78	23.86	23.99	24.25	25.07	26.15	26.48	26.50	26.40	26.51
Increased Access (NPC99R)	19.70	20.05	20.03	19.39	20.65	20.85	21.21	22.22	23.14	23.90	24.18	24.40	24.66	25.32	25.99	26.85	27.84	28.61	28.95	29.42	30.00
Reduced Access (NPC99S)	19.70	20.05	20.03	19.39	20.65	20.81	21.13	22.10	23.01	23.78	23.99	24.09	24.19	24.62	25.18	26.08	27.20	27.63	27.79	28.11	28.45

U.S. Residential Gas Consumption (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2006	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.38	5.43	5.52	5.56	5.62	5.68	5.75	5.76	5.81	5.86	5.96	5.98	6.03	6.07
Increased Oil Prices (NPC99D)	4.83	5.24	4.97	4.55	5.01	5.31	5.32	5.36	5.41	5.50	5.55	5.62	5.67	5.74	5.75	5.79	5.84	5.94	5.97	6.03	6.08
Decreased Oil Prices (NPC99E)	4.83	5.24	4.97	4.55	5.01	5.32	5.35	5.40	5.45	5.54	5.58	5.64	5.69	5.77	5.78	5.83	5.89	5.98	6.00	6.05	6.10
Higher GDP Growth Rate (NPC99F)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.39	5.44	5.54	5.59	5.66	5.72	5.80	5.81	5.87	5.93	6.04	6.07	6.14	6.19
Lower GDP Growth Rate (NPC99G)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.38	5.42	5.51	5.54	5.60	5.64	5.70	5.71	5.74	5.79	5.87	5.89	5.94	5.97
Faster Technology Advancement (NPC99H)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.38	5.43	5.52	5.57	5.63	5.69	5.77	5.79	5.84	5.89	5.99	6.02	6.07	6.11
Slower Technology Advancement (NPC99I)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.38	5.43	5.52	5.56	5.62	5.67	5.73	5.74	5.78	5.84	5.93	5.95	6.00	6.04
Larger Resource Base (NPC99K)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.39	5.43	5.53	5.58	5.65	5.71	5.80	5.82	5.88	5.94	6.03	6.05	6.09	6.12
Smaller Resource Base (NPC99L)	4.83	5.24	4.97	4.55	5.01	5.31	5.33	5.37	5.41	5.50	5.54	5.60	5.65	5.72	5.73	5.77	5.82	5.91	5.93	5.98	6.02
Increased Access (NPC99R)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.38	5.43	5.52	5.56	5.63	5.68	5.76	5.77	5.82	5.88	5.97	6.00	6.06	6.11
Reduced Access (NPC99S)	4.83	5.24	4.97	4.55	5.01	5.32	5.34	5.38	5.42	5.52	5.56	5.62	5.67	5.74	5.75	5.79	5.85	5.94	5.97	6.02	6.07

NPC Sensitivity Cases

U.S. Gas Consumption

U.S. Commercial Gas Consumption (TCF)	1995	1996	1997	1998	1995	2000	2001	2002	2003	2004	2006	2006	2007	2008	2006	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	3.03	3.16	3.22	2.96	3.22	3.41	3.44	3.48	3.52	3.60	3.65	3.71	3.76	3.80	3.82	3.85	3.90	3.98	4.01	4.06	4.09
Increased Oil Prices (NPC99D)	3.03	3.16	3.22	2.96	3.22	3.40	3.42	3.45	3.48	3.57	3.64	3.71	3.75	3.79	3.79	3.82	3.87	3.95	3.99	4.05	4.09
Decreased Oil Prices (NPC99E)	3.03	3.16	3.22	2.96	3.22	3.42	3.47	3.52	3.55	3.63	3.68	3.74	3.78	3.84	3.85	3.89	3.94	4.02	4.05	4.09	4.12
Higher GDP Growth Rate (NPC99F)	3.03	3.16	3.22	2.96	3.22	3.41	3.45	3.48	3.52	3.61	3.67	3.74	3.78	3.83	3.85	3.88	3.94	4.03	4.08	4.14	4.18
Lower GDP Growth Rate (NPC99G)	3.03	3.16	3.22	2.96	3.22	3.41	3.45	3.48	3.51	3.59	3.64	3.70	3.74	3.78	3.78	3.80	3.85	3.92	3.95	4.00	4.02
Faster Technology Advancement (NPC99H)	3.03	3.16	3.22	2.96	3.22	3.41	3.44	3.48	3.52	3.60	3.66	3.73	3.78	3.83	3.85	3.89	3.95	4.03	4.07	4.12	4.15
Slower Technology Advancement (NPC99I)	3.03	3.16	3.22	2.96	3.22	3.41	3.44	3.48	3.51	3.60	3.65	3.71	3.74	3.78	3.78	3.81	3.86	3.94	3.97	4.01	4.04
Larger Resource Base (NPC99K)	3.03	3.16	3.22	2.96	3.22	3.41	3.45	3.49	3.53	3.62	3.68	3.76	3.81	3.88	3.91	3.96	4.02	4.10	4.12	4.15	4.17
Smaller Resource Base (NPC99L)	3.03	3.16	3.22	2.96	3.22	3.41	3.44	3.47	3.49	3.57	3.61	3.68	3.72	3.76	3.77	3.79	3.83	3.91	3.94	3.99	4.01
Increased Access (NPC99R)	3.03	3.16	3.22	2.96	3.22	3.41	3.44	3.48	3.52	3.60	3.66	3.72	3.76	3.81	3.83	3.86	3.92	4.00	4.04	4.10	4.14
Reduced Access (NPC99S)	3.03	3.16	3.22	2.96	3.22	3.41	3.44	3.48	3.51	3.59	3.65	3.71	3.75	3.79	3.80	3.83	3.88	3.96	4.00	4.05	4.08

U.S. Industrial Gas Consumption (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	8.58	8.91	8.84	8.66	8.82	8.61	8.73	9.10	9.43	9.66	9.65	9.64	9.70	9.83	9.95	10.24	10.55	10.66	10.69	10.68	10.76
Increased Oil Prices (NPC99D)	8.58	8.91	8.84	8.66	8.88	8.72	8.92	9.31	9.62	9.85	9.88	9.96	10.01	10.10	10.21	10.53	10.86	11.05	11.15	11.29	11.32
Decreased Oil Prices (NPC99E)	8.58	8.91	8.84	8.66	8.73	8.48	8.48	8.75	9.06	9.32	9.34	9.32	9.37	9.50	9.66	9.90	10.18	10.27	10.25	10.28	10.44
Higher GDP Growth Rate (NPC99F)	8.58	8.91	8.84	8.66	8.82	8.61	8.71	9.08	9.42	9.67	9.69	9.66	9.68	9.76	9.94	10.26	10.65	10.78	10.79	10.86	11.02
Lower GDP Growth Rate (NPC99G)	8.58	8.91	8.84	8.66	8.82	8.63	8.77	9.12	9.43	9.66	9.66	9.69	9.73	9.81	9.92	10.17	10.47	10.65	10.68	10.65	10.60
Faster Technology Advancement (NPC99H)	8.58	8.91	8.84	8.66	8.82	8.61	8.72	9.10	9.45	9.70	9.76	9.83	9.88	10.05	10.24	10.49	10.80	10.99	11.01	11.03	11.03
Slower Technology Advancement (NPC99I)	8.58	8.91	8.84	8.66	8.82	8.61	8.72	9.09	9.41	9.63	9.58	9.53	9.53	9.63	9.76	10.03	10.34	10.39	10.37	10.36	10.49
Larger Resource Base (NPC99K)	8.58	8.91	8.84	8.66	8.82	8.63	8.78	9.19	9.54	9.82	9.88	10.01	10.16	10.43	10.61	10.87	11.07	11.08	11.00	11.09	11.26
Smaller Resource Base (NPC99L)	8.58	8.91	8.84	8.66	8.82	8.55	8.59	8.92	9.21	9.45	9.46	9.50	9.50	9.50	9.58	9.83	10.17	10.25	10.28	10.31	10.38
Increased Access (NPC99R)	8.58	8.91	8.84	8.66	8.83	8.61	8.73	9.11	9.44	9.68	9.71	9.70	9.75	9.92	10.11	10.39	10.71	10.92	10.98	11.06	11.13
Reduced Access (NPC99S)	8.58	8.91	8.84	8.66	8.82	8.60	8.69	9.06	9.39	9.63	9.65	9.59	9.58	9.67	9.83	10.12	10.47	10.56	10.59	10.65	10.71

U.S. Power Gen Gas Consumption (TCF)	1995	1998	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2006	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	3.24	2.74	2.93	3.22	3.59	3.51	3.70	4.24	4.74	5.07	5.14	5.26	5.38	5.70	6.03	6.56	7.11	7.32	7.42	7.49	7.76
Increased Oil Prices (NPC99D)	3.24	2.74	2.93	3.22	3.60	3.46	3.75	4.38	4.92	5.27	5.43	5.60	5.71	6.02	6.39	6.95	7.58	7.93	8.19	8.55	9.00
Decreased Oil Prices (NPC99E)	3.24	2.74	2.93	3.22	3.58	3.56	3.59	4.00	4.45	4.81	4.92	4.90	4.89	5.10	5.48	5.90	6.40	6.43	6.19	5.98	6.28
Higher GDP Growth Rate (NPC99F)	3.24	2.74	2.93	3.22	3.59	3.52	3.74	4.32	4.87	5.29	5.46	5.57	5.63	5.83	6.28	7.00	7.78	8.03	7.97	7.87	8.05
Lower GDP Growth Rate (NPC99G)	3.24	2.74	2.93	3.22	3.59	3.48	3.64	4.11	4.53	4.82	4.87	4.94	4.99	5.18	5.44	5.87	6.37	6.68	6.77	6.86	7.08
Faster Technology Advancement (NPC99H)	3.24	2.74	2.93	3.22	3.59	3.50	3.69	4.25	4.78	5.15	5.32	5.52	5.64	6.03	6.47	6.95	7.54	7.87	8.01	8.19	8.45
Slower Technology Advancement (NPC99I)	3.24	2.74	2.93	3.22	3.59	3.50	3.69	4.22	4.70	5.01	5.04	5.08	5.08	5.32	5.65	6.15	6.72	6.77	6.61	6.40	6.58
Larger Resource Base (NPC99K)	3.24	2.74	2.93	3.22	3.59	3.53	3.76	4.36	4.91	5.31	5.51	5.81	6.10	6.65	7.09	7.54	7.93	8.04	8.05	8.35	8.91
Smaller Resource Base (NPC99L)	3.24	2.74	2.93	3.22	3.59	3.43	3.52	4.00	4.42	4.74	4.87	5.01	4.99	5.00	5.18	5.68	6.33	6.42	6.35	6.12	6.09
Increased Access (NPC99R)	3.24	2.74	2.93	3.22	3.59	3.51	3.70	4.25	4.76	5.10	5.24	5.35	5.46	5.84	6.28	6.78	7.34	7.71	7.92	8.20	8.63
Reduced Access (NPC99S)	3.24	2.74	2.93	3.22	3.59	3.49	3.66	4.18	4.68	5.03	5.14	5.18	5.20	5.42	5.81	6.35	7.00	7.17	7.23	7.38	7.58

U.S. Lease&Piant Gas Consumption (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006	2006	2007	2008	2006	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.21	1.25	1.23	1.24	1.25	1.26	1.27	1.31	1.35	1.37	1.37	1.37	1.38	1.41	1.45	1.50	1.54	1.56	1.57	1.58	1.60
Increased Oil Prices (NPC99D)	1.21	1.25	1.23	1.24	1.26	1.26	1.27	1.32	1.36	1.39	1.39	1.40	1.41	1.44	1.49	1.55	1.59	1.63	1.65	1.67	1.69
Decreased Oil Prices (NPC99E)	1.21	1.25	1.23	1.24	1.25	1.26	1.25	1.28	1.32	1.35	1.35	1.34	1.35	1.38	1.42	1.46	1.49	1.50	1.49	1.49	1.53
Higher GDP Growth Rate (NPC99F)	1.21	1.25	1.23	1.24	1.25	1.26	1.27	1.31	1.35	1.38	1.39	1.39	1.39	1.42	1.47	1.53	1.58	1.61	1.61	1.62	1.64
Lower GDP Growth Rate (NPC99G)	1.21	1.25	1.23	1.24	1.25	1.26	1.26	1.30	1.34	1.36	1.36	1.36	1.37	1.39	1.42	1.47	1.50	1.53	1.54	1.55	1.56
Faster Technology Advancement (NPC99H)	1.21	1.25	1.23	1.24	1.25	1.26	1.26	1.31	1.35	1.38	1.39	1.39	1.40	1.44	1.48	1.53	1.57	1.60	1.62	1.63	1.66
Slower Technology Advancement (NPC99I)	1.21	1.25	1.23	1.24	1.25	1.26	1.26	1.31	1.35	1.37	1.36	1.35	1.36	1.39	1.43	1.48	1.51	1.51	1.51	1.50	1.52
Larger Resource Base (NPC99K)	1.21	1.25	1.23	1.24	1.25	1.26	1.27	1.31	1.36	1.39	1.40	1.41	1.43	1.47	1.51	1.56	1.60	1.61	1.61	1.63	1.67
Smaller Resource Base (NPC99L)	1.21	1.25	1.23	1.24	1.25	1.25	1.25	1.28	1.32	1.34	1.34	1.34	1.34	1.35	1.37	1.42	1.45	1.47	1.48	1.48	1.49
Increased Access (NPC99R)	1.21	1.25	1.23	1.24	1.25	1.26	1.27	1.31	1.35	1.38	1.38	1.38	1.39	1.43	1.47	1.52	1.56	1.59	1.61	1.63	1.67
Reduced Access (NPC99S)	1.21	1.25	1.23	1.24	1.25	1.26	1.26	1.30	1.34	1.36	1.37	1.37	1.37	1.40	1.44	1.49	1.53	1.56	1.57	1.59	1.61

NPC Sensitivity Cases

U.S. Gas Consumption

U.S. Pipeline Fuel Gas Consumption (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006	2006	2007	2006	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.70	0.74	0.73	0.71	0.75	0.77	0.77	0.80	0.83	0.84	0.84	0.84	0.85	0.88	0.90	0.93	0.94	0.94	0.94	0.93	0.93
Increased Oil Prices (NPC99D)	0.70	0.74	0.73	0.71	0.76	0.76	0.77	0.81	0.84	0.86	0.85	0.86	0.87	0.89	0.91	0.95	0.96	0.99	0.99	1.02	1.02
Decreased Oil Prices (NPC99E)	0.70	0.74	0.73	0.71	0.75	0.77	0.77	0.78	0.81	0.83	0.82	0.82	0.83	0.85	0.87	0.90	0.90	0.90	0.88	0.88	0.88
Higher GDP Growth Rate (NPC99F)	0.70	0.74	0.73	0.71	0.75	0.77	0.77	0.80	0.83	0.85	0.85	0.86	0.87	0.88	0.91	0.95	0.97	1.00	0.98	0.97	0.98
Lower GDP Growth Rate (NPC99G)	0.70	0.74	0.73	0.71	0.75	0.76	0.77	0.80	0.83	0.84	0.83	0.83	0.85	0.86	0.88	0.91	0.92	0.93	0.93	0.92	0.91
Faster Technology Advancement (NPC99H)	0.70	0.74	0.73	0.71	0.75	0.77	0.77	0.80	0.83	0.85	0.85	0.86	0.87	0.88	0.91	0.92	0.94	0.96	0.95	0.95	0.95
Slower Technology Advancement (NPC99I)	0.70	0.74	0.73	0.71	0.75	0.77	0.77	0.80	0.83	0.84	0.83	0.83	0.84	0.86	0.89	0.92	0.92	0.92	0.90	0.89	0.90
Larger Resource Base (NPC99K)	0.70	0.74	0.73	0.71	0.75	0.77	0.78	0.80	0.84	0.86	0.86	0.87	0.89	0.90	0.93	0.96	0.97	0.97	0.95	0.96	0.98
Smaller Resource Base (NPC99L)	0.70	0.74	0.73	0.71	0.75	0.76	0.76	0.78	0.81	0.82	0.83	0.83	0.84	0.85	0.87	0.89	0.90	0.91	0.90	0.90	0.89
Increased Access (NPC99R)	0.70	0.74	0.73	0.71	0.75	0.77	0.77	0.80	0.83	0.85	0.85	0.85	0.86	0.88	0.92	0.95	0.96	0.98	0.97	0.99	1.00
Reduced Access (NPC99S)	0.70	0.74	0.73	0.71	0.75	0.76	0.76	0.78	0.81	0.83	0.83	0.83	0.84	0.85	0.88	0.91	0.92	0.93	0.93	0.95	0.94

U.S. Mexican Exports (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006	2006	2007	2006	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Increased Oil Prices (NPC99D)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Decreased Oil Prices (NPC99E)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Higher GDP Growth Rate (NPC99F)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Lower GDP Growth Rate (NPC99G)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Faster Technology Advancement (NPC99H)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Slower Technology Advancement (NPC99I)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Larger Resource Base (NPC99K)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Smaller Resource Base (NPC99L)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Increased Access (NPC99R)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
Reduced Access (NPC99S)	-0.05	-0.02	-0.02	-0.07	-0.09	-0.13	-0.16	-0.18	-0.22	-0.26	-0.30	-0.34	-0.37	-0.40	-0.42	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44

North American Gas Supply

Total North American Gas Supply (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	24.13	25.24	24.59	25.01	25.59	26.05	26.46	27.64	28.71	29.55	29.73	30.04	30.37	31.02	31.61	32.65	33.78	34.37	34.57	34.69	35.15
Increased Oil Prices (NPC99D)	24.13	25.24	24.59	25.01	25.65	26.08	26.66	27.96	29.08	29.95	30.30	30.78	31.11	31.65	32.26	33.39	34.64	35.48	35.96	36.71	37.27
Decreased Oil Prices (NPC99E)	24.13	25.24	24.59	25.01	25.47	25.98	26.10	27.02	28.04	28.93	29.17	29.30	29.47	30.01	30.71	31.58	32.63	32.96	32.72	32.67	33.24
Higher GDP Growth Rate (NPC99F)	24.13	25.24	24.59	25.01	25.59	26.05	26.48	27.71	28.88	29.87	30.20	30.52	30.76	31.23	32.09	33.37	34.88	35.56	35.58	35.73	36.29
Lower GDP Growth Rate (NPC99G)	24.13	25.24	24.59	25.01	25.59	26.03	26.43	27.50	28.46	29.21	29.39	29.65	29.88	30.29	30.74	31.60	32.61	33.38	33.57	33.70	33.91
Faster Technology Advancement (NPC99H)	24.13	25.24	24.59	25.01	25.59	26.03	26.43	27.64	28.77	29.68	30.07	30.59	30.93	31.70	32.54	33.44	34.61	35.43	35.72	36.00	36.37
Slower Technology Advancement (NPC99I)	24.13	25.24	24.59	25.01	25.59	26.03	26.42	27.59	28.64	29.44	29.52	29.64	29.80	30.30	30.90	31.88	33.01	33.34	33.17	32.99	33.54
Larger Resource Base (NPC99K)	24.13	25.24	24.59	25.01	25.59	26.08	26.59	27.88	29.05	30.04	30.47	31.15	31.83	32.91	33.72	34.66	35.46	35.78	35.77	36.26	37.19
Smaller Resource Base (NPC99L)	24.13	25.24	24.59	25.01	25.59	25.88	26.07	27.12	28.05	28.86	29.13	29.52	29.65	29.80	30.14	31.11	32.35	32.74	32.80	32.70	32.79
Increased Access (NPC99R)	24.13	25.24	24.59	25.01	25.59	26.04	26.46	27.65	28.75	29.61	29.93	30.22	30.56	31.29	32.11	33.10	34.25	35.16	35.52	36.02	36.66
Reduced Access (NPC99S)	24.13	25.24	24.59	25.01	25.59	26.00	26.35	27.50	28.58	29.45	29.67	29.86	30.02	30.48	31.20	32.27	33.54	34.07	34.27	34.65	34.95

Total North American Production (TCF)	1995	1998	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2006	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	24.16	25.13	24.81	24.91	25.47	25.95	26.36	27.46	28.54	29.38	29.62	29.87	30.23	30.92	31.51	32.49	33.56	34.11	34.23	34.28	34.69
Increased Oil Prices (NPC99D)	24.16	25.13	24.81	24.91	25.53	25.98	26.56	27.78	28.91	29.79	30.19	30.61	30.97	31.55	32.16	33.23	34.41	35.22	35.62	36.31	36.82
Decreased Oil Prices (NPC99E)	24.16	25.13	24.81	24.91	25.35	25.88	26.00	26.84	27.86	28.76	29.05	29.13	29.32	29.91	30.61	31.42	32.40	32.69	32.37	32.26	32.79
Higher GDP Growth Rate (NPC99F)	24.16	25.13	24.81	24.91	25.47	25.96	26.38	27.53	28.71	29.71	30.09	30.35	30.61	31.12	31.98	33.21	34.65	35.30	35.24	35.33	35.84
Lower GDP Growth Rate (NPC99G)	24.16	25.13	24.81	24.91	25.47	25.94	26.33	27.32	28.28	29.05	29.26	29.48	29.73	30.18	30.64	31.44	32.39	33.12	33.22	33.29	33.45
Faster Technology Advancement (NPC99H)	24.16	25.13	24.81	24.91	25.47	25.94	26.33	27.46	28.60	29.52	29.96	30.42	30.78	31.60	32.44	33.28	34.38	35.17	35.37	35.60	35.92
Slower Technology Advancement (NPC99I)	24.16	25.13	24.81	24.91	25.47	25.94	26.32	27.41	28.46	29.28	29.39	29.47	29.65	30.20	30.80	31.72	32.79	33.08	32.82	32.59	33.08
Larger Resource Base (NPC99K)	24.16	25.13	24.81	24.91	25.47	25.99	26.49	27.70	28.88	29.88	30.36	30.98	31.68	32.81	33.61	34.50	35.24	35.52	35.42	35.85	36.74
Smaller Resource Base (NPC99L)	24.16	25.13	24.81	24.91	25.47	25.78	25.97	26.95	27.88	28.70	29.02	29.35	29.51	29.70	30.04	30.95	32.13	32.48	32.46	32.30	32.34
Increased Access (NPC99R)	24.17	25.13	24.81	24.91	25.47	25.95	26.36	27.47	28.57	29.45	29.81	30.05	30.41	31.19	32.01	32.94	34.03	34.90	35.17	35.62	36.20
Reduced Access (NPC99S)	24.16	25.13	24.81	24.91	25.47	25.91	26.25	27.32	28.40	29.29	29.55	29.69	29.87	30.38	31.09	32.11	33.32	33.81	33.92	34.24	34.50

NPC Sensitivity Cases

North American Gas Supply

No. American Associated Gas Production (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	3.46	3.51	3.53	3.55	3.63	3.56	3.54	3.61	3.70	3.79	3.90	3.97	4.05	4.13	4.21	4.28	4.34	4.39	4.40	4.40	4.38
Increased Oil Prices (NPC99D)	3.46	3.51	3.53	3.55	3.63	3.56	3.57	3.67	3.78	3.89	4.02	4.13	4.22	4.31	4.40	4.47	4.54	4.61	4.63	4.66	4.67
Decreased Oil Prices (NPC99E)	3.46	3.51	3.53	3.55	3.63	3.56	3.50	3.52	3.56	3.61	3.67	3.71	3.78	3.86	3.92	4.00	4.05	4.09	4.10	4.11	4.13
Higher GDP Growth Rate (NPC99F)	3.46	3.51	3.53	3.55	3.63	3.56	3.54	3.61	3.70	3.80	3.91	3.98	4.05	4.12	4.20	4.29	4.37	4.43	4.43	4.42	4.42
Lower GDP Growth Rate (NPC99G)	3.46	3.51	3.53	3.55	3.63	3.56	3.54	3.61	3.69	3.79	3.88	3.97	4.04	4.13	4.20	4.26	4.30	4.35	4.36	4.36	4.33
Faster Technology Advancement (NPC99H)	3.46	3.51	3.53	3.55	3.63	3.56	3.54	3.61	3.70	3.81	3.94	4.04	4.13	4.24	4.39	4.51	4.62	4.72	4.78	4.82	4.85
Slower Technology Advancement (NPC99I)	3.46	3.51	3.53	3.55	3.63	3.56	3.54	3.61	3.68	3.76	3.83	3.88	3.94	4.00	4.05	4.09	4.12	4.13	4.10	4.06	4.04
Larger Resource Base (NPC99K)	3.46	3.51	3.53	3.55	3.63	3.54	3.54	3.64	3.74	3.87	3.98	4.09	4.19	4.30	4.38	4.45	4.51	4.54	4.53	4.55	4.54
Smaller Resource Base (NPC99L)	3.46	3.51	3.53	3.55	3.63	3.56	3.54	3.62	3.70	3.80	3.92	4.01	4.08	4.16	4.22	4.31	4.39	4.46	4.46	4.44	4.44
Increased Access (NPC99R)	3.46	3.51	3.53	3.55	3.63	3.56	3.54	3.61	3.70	3.80	3.90	3.99	4.09	4.20	4.31	4.41	4.49	4.57	4.60	4.62	4.59
Reduced Access (NPC99S)	3.46	3.51	3.53	3.55	3.63	3.55	3.52	3.59	3.68	3.77	3.83	3.88	3.94	4.00	4.06	4.13	4.19	4.24	4.24	4.23	4.20

No. American Non-Assoc Gas Production (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	20.70	21.61	21.28	21.35	21.84	22.40	22.82	23.84	24.84	25.59	25.72	25.90	26.18	26.78	27.30	28.21	29.22	29.73	29.83	29.89	30.32
Increased Oil Prices (NPC99D)	20.70	21.61	21.28	21.35	21.90	22.43	23.00	24.12	25.13	25.90	26.16	26.47	26.75	27.23	27.76	28.76	29.87	30.61	30.99	31.64	32.15
Decreased Oil Prices (NPC99E)	20.70	21.61	21.28	21.35	21.72	22.33	22.50	23.32	24.30	25.15	25.38	25.42	25.55	26.05	26.69	27.43	28.35	28.61	28.28	28.15	28.66
Higher GDP Growth Rate (NPC99F)	20.70	21.61	21.28	21.35	21.84	22.40	22.84	23.92	25.01	25.91	26.19	26.37	26.57	27.00	27.78	28.91	30.28	30.87	30.81	30.91	31.42
Lower GDP Growth Rate (NPC99G)	20.70	21.61	21.28	21.35	21.84	22.38	22.80	23.71	24.59	25.26	25.38	25.51	25.69	26.05	26.45	27.18	28.09	28.76	28.86	28.93	29.12
Faster Technology Advancement (NPC99H)	20.70	21.61	21.28	21.35	21.84	22.38	22.79	23.85	24.89	25.71	26.02	26.38	26.65	27.36	28.05	28.76	29.76	30.45	30.60	30.77	31.07
Slower Technology Advancement (NPC99I)	20.70	21.61	21.28	21.35	21.84	22.38	22.79	23.81	24.79	25.52	25.56	25.59	25.71	26.20	26.76	27.63	28.67	28.95	28.72	28.53	29.04
Larger Resource Base (NPC99K)	20.70	21.61	21.28	21.35	21.84	22.44	22.95	24.07	25.13	26.01	26.37	26.89	27.49	28.51	29.23	30.04	30.73	30.99	30.89	31.31	32.20
Smaller Resource Base (NPC99L)	20.70	21.61	21.28	21.35	21.84	22.23	22.43	23.33	24.18	24.90	25.10	25.34	25.42	25.54	25.82	26.64	27.74	28.03	28.00	27.85	27.89
Increased Access (NPC99R)	20.70	21.61	21.28	21.36	21.84	22.39	22.82	23.86	24.88	25.65	25.91	26.06	26.32	26.99	27.70	28.53	29.54	30.33	30.57	31.00	31.61
Reduced Access (NPC99S)	20.70	21.61	21.28	21.35	21.84	22.35	22.73	23.73	24.73	25.52	25.72	25.81	25.94	26.38	27.03	27.98	29.13	29.57	29.68	30.02	30.30

North American Supplemental Gas (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Increased Oil Prices (NPC99D)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Decreased Oil Prices (NPC99E)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Higher GDP Growth Rate (NPC99F)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Lower GDP Growth Rate (NPC99G)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Faster Technology Advancement (NPC99H)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Slower Technology Advancement (NPC99I)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Larger Resource Base (NPC99K)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Smaller Resource Base (NPC99L)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Increased Access (NPC99R)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Reduced Access (NPC99S)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

North American LNG Imports (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Increased Oil Prices (NPC99D)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Decreased Oil Prices (NPC99E)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Higher GDP Growth Rate (NPC99F)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Lower GDP Growth Rate (NPC99G)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Faster Technology Advancement (NPC99H)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Slower Technology Advancement (NPC99I)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Larger Resource Base (NPC99K)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Smaller Resource Base (NPC99L)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Increased Access (NPC99R)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Reduced Access (NPC99S)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78

NPC Sensitivity Cases

U.S. Gas Supply

Total U.S. Gas Supply (TCF)	1995	1998	1997	1998	1999	2006	2001	2002	2003	2004	2005	2006	2007	2008	2006	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	21.43	22.34	21.64	22.02	22.64	22.99	23.35	24.46	25.47	26.22	26.41	26.60	26.88	27.49	28.05	29.05	30.08	30.61	30.75	30.85	31.28
Increased Oil Prices (NPC99D)	21.43	22.34	21.64	22.02	22.70	23.02	23.54	24.78	25.83	26.61	26.96	27.31	27.59	28.11	28.69	29.78	30.94	31.72	32.11	32.82	33.32
Decreased Oil Prices (NPC99E)	21.43	22.34	21.64	22.02	22.53	22.93	23.01	23.87	24.82	25.64	25.88	25.89	26.02	26.53	27.18	28.01	28.95	29.22	28.93	28.88	29.43
Higher GDP Growth Rate (NPC99F)	21.43	22.34	21.64	22.02	22.64	23.00	23.36	24.52	25.62	26.51	26.84	27.03	27.21	27.63	28.44	29.66	31.06	31.67	31.62	31.75	32.25
Lower GDP Growth Rate (NPC99G)	21.43	22.34	21.64	22.02	22.64	22.98	23.33	24.35	25.24	25.92	26.10	26.27	26.46	26.84	27.27	28.10	29.04	29.74	29.88	29.99	30.18
Faster Technology Advancement (NPC99H)	21.43	22.34	21.64	22.02	22.64	22.98	23.32	24.47	25.53	26.36	26.75	27.13	27.42	28.14	28.91	29.79	30.88	31.63	31.85	32.11	32.45
Slower Technology Advancement (NPC99I)	21.43	22.34	21.64	22.02	22.64	22.97	23.32	24.42	25.40	26.12	26.20	26.22	26.34	26.82	27.39	28.32	29.35	29.61	29.38	29.20	29.71
Larger Resource Base (NPC99K)	21.43	22.34	21.64	22.02	22.64	23.03	23.47	24.70	25.79	26.69	27.12	27.67	28.28	29.28	30.05	30.94	31.70	31.97	31.88	32.33	33.23
Smaller Resource Base (NPC99L)	21.43	22.34	21.64	22.02	22.64	22.83	22.97	23.97	24.84	25.57	25.84	26.10	26.19	26.30	26.62	27.54	28.69	29.04	29.05	28.96	29.04
Increased Access (NPC99R)	21.43	22.34	21.64	22.03	22.64	22.99	23.35	24.48	25.51	26.28	26.60	26.77	27.06	27.76	28.54	29.48	30.55	31.38	31.67	32.15	32.75
Reduced Access (NPC99S)	21.43	22.34	21.64	22.02	22.64	22.95	23.24	24.33	25.34	26.13	26.35	26.42	26.53	26.96	27.63	28.66	29.83	30.30	30.44	30.80	31.08

Total U.S. Production (TCF)	1995	1998	1997	1998	1999	2006	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	18.56	19.59	18.90	19.29	19.59	19.89	20.06	21.01	21.92	22.41	22.45	22.58	22.77	23.41	24.09	25.05	25.64	25.98	26.14	26.12	26.50
Increased Oil Prices (NPC99D)	18.56	19.59	18.90	19.29	19.63	19.89	20.22	21.29	22.22	22.73	22.98	23.27	23.43	24.07	24.86	25.90	26.58	27.28	27.64	28.04	28.33
Decreased Oil Prices (NPC99E)	18.56	19.59	18.90	19.29	19.50	19.87	19.75	20.45	21.36	21.95	22.04	21.99	22.08	22.64	23.37	24.15	24.61	24.68	24.41	24.35	24.91
Higher GDP Growth Rate (NPC99F)	18.56	19.59	18.90	19.29	19.59	19.89	20.06	21.06	22.06	22.69	22.88	23.00	23.05	23.51	24.43	25.53	26.43	26.95	26.90	26.95	27.40
Lower GDP Growth Rate (NPC99G)	18.56	19.59	18.90	19.29	19.59	19.88	20.04	20.90	21.70	22.14	22.17	22.29	22.44	22.89	23.46	24.27	24.77	25.26	25.40	25.43	25.58
Faster Technology Advancement (NPC99H)	18.56	19.59	18.90	19.29	19.59	19.86	20.02	21.02	21.98	22.55	22.79	23.09	23.25	23.88	24.80	25.62	26.29	26.91	27.08	27.23	27.59
Slower Technology Advancement (NPC99I)	18.56	19.59	18.90	19.29	19.59	19.86	20.02	20.97	21.86	22.33	22.28	22.25	22.35	22.93	23.63	24.49	25.01	25.03	24.82	24.55	25.03
Larger Resource Base (NPC99K)	18.56	19.59	18.90	19.29	19.59	19.92	20.15	21.19	22.16	22.78	23.08	23.57	24.03	24.79	25.67	26.57	27.22	27.36	27.13	27.40	28.26
Smaller Resource Base (NPC99L)	18.56	19.59	18.90	19.29	19.59	19.71	19.69	20.52	21.32	21.79	21.92	22.10	22.08	22.23	22.65	23.48	24.14	24.50	24.63	24.56	24.68
Increased Access (NPC99R)	18.56	19.59	18.90	19.29	19.60	19.88	20.05	21.03	21.96	22.48	22.66	22.76	22.93	23.71	24.61	25.55	26.16	26.80	27.10	27.49	28.05
Reduced Access (NPC99S)	18.56	19.59	18.90	19.29	19.59	19.83	19.94	20.86	21.78	22.31	22.37	22.36	22.36	22.82	23.60	24.53	25.18	25.58	25.72	26.03	26.28

U.S. Associated Gas Production (TCF)	1995	1998	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2006	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	2.83	2.88	2.90	2.92	3.00	2.90	2.84	2.89	2.97	3.07	3.18	3.28	3.37	3.47	3.55	3.63	3.68	3.72	3.72	3.73	3.72
Increased Oil Prices (NPC99D)	2.83	2.88	2.90	2.92	3.00	2.90	2.87	2.93	3.03	3.14	3.28	3.39	3.50	3.61	3.69	3.77	3.83	3.90	3.92	3.96	3.98
Decreased Oil Prices (NPC99E)	2.83	2.88	2.90	2.92	3.00	2.90	2.82	2.82	2.87	2.93	3.01	3.07	3.15	3.24	3.31	3.38	3.43	3.46	3.47	3.48	3.51
Higher GDP Growth Rate (NPC99F)	2.83	2.88	2.90	2.92	3.00	2.90	2.84	2.89	2.97	3.07	3.19	3.29	3.38	3.47	3.55	3.63	3.69	3.74	3.74	3.75	3.76
Lower GDP Growth Rate (NPC99G)	2.83	2.88	2.90	2.92	3.00	2.90	2.84	2.89	2.97	3.07	3.18	3.28	3.37	3.47	3.54	3.60	3.65	3.68	3.69	3.69	3.67
Faster Technology Advancement (NPC99H)	2.83	2.88	2.90	2.92	3.00	2.90	2.85	2.90	2.98	3.09	3.23	3.34	3.45	3.58	3.69	3.80	3.89	3.98	4.03	4.08	4.11
Slower Technology Advancement (NPC99I)	2.83	2.88	2.90	2.92	3.00	2.90	2.85	2.89	2.96	3.05	3.15	3.22	3.30	3.37	3.43	3.48	3.51	3.52	3.49	3.46	3.44
Larger Resource Base (NPC99K)	2.83	2.88	2.90	2.92	3.00	2.89	2.84	2.91	3.01	3.14	3.27	3.40	3.51	3.64	3.73	3.81	3.88	3.92	3.93	3.95	3.96
Smaller Resource Base (NPC99L)	2.83	2.88	2.90	2.92	3.00	2.90	2.85	2.90	2.98	3.08	3.20	3.30	3.39	3.48	3.56	3.64	3.70	3.75	3.76	3.77	3.78
Increased Access (NPC99R)	2.83	2.88	2.90	2.92	3.00	2.90	2.85	2.89	2.97	3.07	3.19	3.30	3.41	3.54	3.65	3.75	3.83	3.89	3.92	3.94	3.93
Reduced Access (NPC99S)	2.83	2.88	2.90	2.92	3.00	2.89	2.83	2.87	2.95	3.05	3.12	3.19	3.26	3.34	3.41	3.47	3.51	3.55	3.55	3.56	3.55

U.S. Non-Associated Gas Production (TCF)	1995	1998	1997	1998	1999	2006	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	15.93	16.71	16.36	16.37	16.60	16.99	17.21	18.12	18.95	19.34	19.27	19.30	19.39	19.94	20.54	21.42	21.97	22.26	22.41	22.39	22.78
Increased Oil Prices (NPC99D)	15.93	16.71	16.36	16.37	16.64	17.00	17.36	18.36	19.19	19.59	19.70	19.88	19.93	20.46	21.16	22.12	22.75	23.39	23.71	24.08	24.35
Decreased Oil Prices (NPC99E)	15.93	16.71	16.36	16.37	16.50	16.97	16.93	17.63	18.49	19.02	19.03	18.92	18.93	19.40	20.06	20.77	21.18	21.23	20.94	20.86	21.41
Higher GDP Growth Rate (NPC99F)	15.93	16.71	16.36	16.37	16.60	16.99	17.22	18.17	19.09	19.62	19.69	19.71	19.67	20.04	20.88	21.89	22.74	23.21	23.16	23.20	23.64
Lower GDP Growth Rate (NPC99G)	15.93	16.71	16.36	16.37	16.60	16.98	17.20	18.01	18.73	19.08	18.99	19.01	19.07	19.43	19.92	20.67	21.12	21.58	21.71	21.73	21.91
Faster Technology Advancement (NPC99H)	15.93	16.71	16.36	16.37	16.60	16.97	17.18	18.12	19.00	19.46	19.57	19.75	19.79	20.31	21.11	21.83	22.40	22.94	23.05	23.16	23.47
Slower Technology Advancement (NPC99I)	15.93	16.71	16.36	16.37	16.60	16.97	17.17	18.08	18.90	19.28	19.13	19.02	19.05	19.55	20.20	21.01	21.50	21.51	21.33	21.09	21.59
Larger Resource Base (NPC99K)	15.93	16.71	16.36	16.37	16.60	17.04	17.30	18.28	19.14	19.64	19.81	20.17	20.51	21.16	21.94	22.76	23.33	23.44	23.20	23.45	24.31
Smaller Resource Base (NPC99L)	15.93	16.71	16.36	16.37	16.60	16.82	16.84	17.63	18.34	18.71	18.72	18.80	18.69	18.75	19.09	19.84	20.43	20.75	20.87	20.79	20.91
Increased Access (NPC99R)	15.93	16.71	16.36	16.37	16.60	16.98	17.21	18.13	18.98	19.41	19.47	19.46	19.52	20.18	20.96	21.79	22.33	22.91	23.18	23.56	24.13
Reduced Access (NPC99S)	15.93	16.71	16.36	16.37	16.60	16.94	17.11	17.99	18.83	19.26	19.25	19.17	19.09	19.48	20.19	21.06	21.67	22.04	22.17	22.47	22.73

NPC Sensitivity Cases

U.S. Gas Supply

U.S. Supplemental Gas (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2005	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Increased Oil Prices (NPC99D)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Decreased Oil Prices (NPC99E)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Higher GDP Growth Rate (NPC99F)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Lower GDP Growth Rate (NPC99G)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Faster Technology Advancement (NPC99H)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Slower Technology Advancement (NPC99I)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Larger Resource Base (NPC99K)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Smaller Resource Base (NPC99L)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Increased Access (NPC99R)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Reduced Access (NPC99S)	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

U.S. LNG Imports (TCF)	1995	1996	1997	1998	1999	2008	2001	2002	2003	2004	2005	2005	2007	2005	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Increased Oil Prices (NPC99D)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Decreased Oil Prices (NPC99E)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Higher GDP Growth Rate (NPC99F)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Lower GDP Growth Rate (NPC99G)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Faster Technology Advancement (NPC99H)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Slower Technology Advancement (NPC99I)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Larger Resource Base (NPC99K)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Smaller Resource Base (NPC99L)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Increased Access (NPC99R)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78
Reduced Access (NPC99S)	-0.05	-0.03	0.02	0.06	0.10	0.12	0.14	0.24	0.29	0.33	0.37	0.40	0.40	0.41	0.41	0.49	0.55	0.61	0.67	0.73	0.78

Spot Prices

Average Henry Hub Prices ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.82	2.87	2.52	2.08	2.27	3.23	3.23	2.91	2.66	2.63	2.87	3.12	3.27	3.35	3.38	3.23	3.11	3.26	3.43	3.66	3.81
Increased Oil Prices (NPC99D)	1.82	2.87	2.52	2.08	2.38	3.69	3.54	3.07	2.70	2.65	2.89	3.15	3.39	3.58	3.63	3.41	3.19	3.27	3.44	3.55	3.83
Decreased Oil Prices (NPC99E)	1.82	2.87	2.52	2.08	2.17	2.78	2.94	2.77	2.58	2.51	2.65	2.87	3.02	3.09	3.05	2.96	2.88	3.04	3.24	3.45	3.51
Higher GDP Growth Rate (NPC99F)	1.82	2.87	2.52	2.08	2.27	3.25	3.32	3.04	2.82	2.78	3.02	3.33	3.57	3.77	3.74	3.58	3.42	3.58	3.82	4.02	4.15
Lower GDP Growth Rate (NPC99G)	1.82	2.87	2.52	2.08	2.27	3.18	3.12	2.78	2.51	2.41	2.61	2.79	2.95	3.07	3.08	2.92	2.75	2.76	2.92	3.17	3.43
Faster Technology Advancement (NPC99H)	1.82	2.87	2.52	2.08	2.27	3.24	3.25	2.91	2.63	2.55	2.69	2.85	3.02	3.07	3.01	2.91	2.77	2.81	3.01	3.23	3.47
Slower Technology Advancement (NPC99I)	1.82	2.87	2.52	2.08	2.27	3.24	3.25	2.93	2.69	2.67	2.96	3.28	3.51	3.62	3.63	3.50	3.38	3.60	3.85	4.11	4.26
Larger Resource Base (NPC99K)	1.82	2.87	2.52	2.08	2.27	3.21	3.16	2.78	2.48	2.34	2.48	2.58	2.60	2.53	2.44	2.27	2.24	2.64	3.01	3.14	3.15
Smaller Resource Base (NPC99L)	1.82	2.87	2.52	2.08	2.27	3.34	3.45	3.17	2.98	2.93	3.12	3.30	3.54	3.82	3.92	3.79	3.61	3.78	3.95	4.22	4.47
Increased Access (NPC99R)	1.82	2.87	2.52	2.08	2.27	3.24	3.23	2.90	2.65	2.59	2.77	3.03	3.19	3.22	3.15	3.02	2.88	2.89	3.06	3.20	3.36
Reduced Access (NPC99S)	1.82	2.87	2.52	2.08	2.27	3.26	3.29	2.97	2.72	2.66	2.86	3.20	3.43	3.58	3.55	3.39	3.23	3.40	3.57	3.73	3.89

Average AECO Prices ($1998/MMBtu)	1995	1996	1997	1998	1995	2008	2001	2002	2003	2004	2005	2006	2007	2005	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.91	1.10	1.31	1.38	1.82	2.48	2.76	2.47	2.20	2.03	1.90	1.97	2.41	2.86	3.05	2.98	2.64	2.50	2.59	3.19	3.42
Increased Oil Prices (NPC99D)	0.91	1.10	1.31	1.38	1.91	2.82	3.03	2.59	2.17	1.93	1.42	1.54	2.45	3.17	3.39	3.22	2.72	2.61	2.37	2.90	3.07
Decreased Oil Prices (NPC99E)	0.91	1.10	1.31	1.38	1.73	2.16	2.50	2.35	2.18	2.06	2.06	2.22	2.45	2.70	2.75	2.71	2.49	2.42	2.66	3.10	3.24
Higher GDP Growth Rate (NPC99F)	0.91	1.10	1.31	1.38	1.82	2.50	2.85	2.59	2.36	2.16	2.03	2.12	2.76	3.33	3.42	3.27	2.49	2.63	2.99	3.55	3.78
Lower GDP Growth Rate (NPC99G)	0.91	1.10	1.31	1.38	1.82	2.45	2.66	2.34	2.05	1.88	1.83	1.95	2.32	2.63	2.74	2.65	2.33	2.12	2.15	2.54	2.95
Faster Technology Advancement (NPC99H)	0.91	1.10	1.31	1.38	1.82	2.49	2.78	2.46	2.17	1.97	1.62	1.71	2.25	2.57	2.73	2.69	2.34	2.24	2.48	2.75	3.00
Slower Technology Advancement (NPC99I)	0.91	1.10	1.31	1.38	1.82	2.49	2.78	2.48	2.24	2.08	2.09	2.30	2.92	3.24	3.37	3.30	3.00	2.90	3.10	3.65	3.87
Larger Resource Base (NPC99K)	0.91	1.10	1.31	1.38	1.82	2.47	2.68	2.32	1.99	1.69	1.36	1.32	1.74	1.93	2.15	2.20	2.25	2.50	2.70	2.73	2.75
Smaller Resource Base (NPC99L)	0.91	1.10	1.31	1.38	1.82	2.58	2.98	2.72	2.53	2.42	2.31	2.28	2.73	3.36	3.56	3.47	2.90	3.25	3.50	3.97	4.32
Increased Access (NPC99R)	0.91	1.10	1.31	1.38	1.82	2.49	2.76	2.46	2.19	2.01	1.89	1.96	2.50	2.83	2.89	2.83	2.54	2.30	2.35	2.75	2.96
Reduced Access (NPC99S)	0.91	1.10	1.31	1.38	1.82	2.51	2.82	2.53	2.26	2.09	1.98	2.09	2.61	3.07	3.16	3.04	2.39	2.35	2.57	3.02	3.39

NPC Sensitivity Cases

Spot Prices

Average NYC Prices ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	2.40	4.02	2.89	2.35	2.62	3.86	3.88	3.59	3.41	3.24	3.50	3.81	4.03	4.20	4.36	4.36	3.92	4.15	4.44	4.75	4.85
Increased Oil Prices (NPC99D)	2.40	4.02	2.89	2.35	2.74	4.35	4.24	3.80	3.54	3.34	3.60	3.93	4.25	4.53	4.71	4.56	4.08	4.22	4.45	4.59	4.73
Decreased Oil Prices (NPC99E)	2.40	4.02	2.89	2.35	2.52	3.36	3.53	3.39	3.26	3.10	3.25	3.53	3.77	3.92	4.04	4.05	3.65	3.88	4.17	4.41	4.42
Higher GDP Growth Rate (NPC99F)	2.40	4.02	2.89	2.35	2.62	3.88	3.99	3.74	3.61	3.46	3.73	4.13	4.46	4.75	4.93	4.79	4.45	4.73	4.97	5.22	5.22
Lower GDP Growth Rate (NPC99G)	2.40	4.02	2.89	2.35	2.62	3.80	3.76	3.44	3.23	3.02	3.21	3.45	3.69	3.88	4.03	3.99	3.46	3.52	3.78	4.06	4.20
Faster Technology Advancement (NPC99H)	2.40	4.02	2.89	2.35	2.62	3.87	3.90	3.58	3.39	3.18	3.34	3.57	3.80	3.76	3.84	3.85	3.58	3.72	3.99	4.22	4.53
Slower Technology Advancement (NPC99I)	2.40	4.02	2.89	2.35	2.62	3.87	3.90	3.60	3.44	3.30	3.60	3.98	4.32	4.53	4.72	4.72	4.20	4.52	4.86	5.18	5.19
Larger Resource Base (NPC99K)	2.40	4.02	2.89	2.35	2.62	3.84	3.82	3.48	3.27	3.01	3.18	3.36	3.47	3.21	3.27	3.30	3.23	3.53	3.85	4.02	4.31
Smaller Resource Base (NPC99L)	2.40	4.02	2.89	2.35	2.62	3.96	4.10	3.84	3.71	3.56	3.77	4.04	4.36	4.70	4.94	4.93	4.43	4.69	4.96	5.24	5.39
Increased Access (NPC99R)	2.40	4.02	2.89	2.35	2.62	3.86	3.89	3.58	3.40	3.21	3.41	3.73	3.97	4.10	4.21	4.22	3.74	3.86	4.11	4.37	4.47
Reduced Access (NPC99S)	2.40	4.02	2.89	2.35	2.62	3.88	3.94	3.65	3.46	3.27	3.49	3.87	4.17	4.38	4.48	4.45	3.98	4.24	4.52	4.79	4.89

Average Chicago Prices ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.82	3.37	2.64	2.15	2.37	3.44	3.42	3.11	2.87	2.82	3.07	3.33	3.48	3.58	3.65	3.55	3.42	3.61	3.82	4.07	4.29
Increased Oil Prices (NPC99D)	1.82	3.37	2.64	2.15	2.48	3.90	3.73	3.27	2.92	2.86	3.10	3.38	3.61	3.83	3.94	3.78	3.56	3.66	3.82	3.87	4.15
Decreased Oil Prices (NPC99E)	1.82	3.37	2.64	2.15	2.27	2.98	3.11	2.96	2.78	2.70	2.84	3.08	3.24	3.33	3.33	3.26	3.18	3.37	3.59	3.80	3.91
Higher GDP Growth Rate (NPC99F)	1.82	3.37	2.64	2.15	2.37	3.46	3.51	3.25	3.04	3.00	3.24	3.59	3.82	4.04	4.13	4.04	3.91	4.17	4.30	4.45	4.66
Lower GDP Growth Rate (NPC99G)	1.82	3.37	2.64	2.15	2.37	3.39	3.30	2.97	2.70	2.59	2.79	2.98	3.13	3.27	3.31	3.17	2.98	3.01	3.16	3.42	3.70
Faster Technology Advancement (NPC99H)	1.82	3.37	2.64	2.15	2.37	3.45	3.43	3.11	2.84	2.75	2.90	3.08	3.25	3.31	3.32	3.27	3.13	3.23	3.41	3.67	3.97
Slower Technology Advancement (NPC99I)	1.82	3.37	2.64	2.15	2.37	3.45	3.44	3.13	2.90	2.86	3.16	3.48	3.71	3.85	3.91	3.84	3.68	3.94	4.19	4.48	4.63
Larger Resource Base (NPC99K)	1.82	3.37	2.64	2.15	2.37	3.42	3.35	2.99	2.69	2.55	2.70	2.83	2.85	2.79	2.80	2.76	2.80	3.10	3.39	3.51	3.73
Smaller Resource Base (NPC99L)	1.82	3.37	2.64	2.15	2.37	3.54	3.64	3.37	3.19	3.14	3.33	3.53	3.76	4.06	4.20	4.11	3.92	4.14	4.33	4.57	4.87
Increased Access (NPC99R)	1.82	3.37	2.64	2.15	2.37	3.45	3.42	3.10	2.85	2.79	2.96	3.25	3.41	3.47	3.46	3.37	3.24	3.30	3.44	3.66	3.88
Reduced Access (NPC99S)	1.82	3.37	2.64	2.15	2.37	3.47	3.47	3.17	2.93	2.86	3.06	3.40	3.63	3.79	3.80	3.68	3.50	3.72	3.91	4.13	4.35

Average Midcontinent Prices ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.54	2.42	2.40	2.02	2.19	3.13	3.15	2.84	2.60	2.56	2.80	3.06	3.20	3.26	3.29	3.13	3.01	3.16	3.34	3.57	3.72
Increased Oil Prices (NPC99D)	1.54	2.42	2.40	2.02	2.30	3.57	3.44	2.98	2.63	2.58	2.82	3.08	3.31	3.50	3.55	3.31	3.08	3.16	3.30	3.39	3.67
Decreased Oil Prices (NPC99E)	1.54	2.42	2.40	2.02	2.09	2.70	2.87	2.71	2.53	2.46	2.60	2.82	2.97	3.02	2.98	2.88	2.80	2.97	3.17	3.39	3.45
Higher GDP Growth Rate (NPC99F)	1.54	2.42	2.40	2.02	2.19	3.16	3.24	2.97	2.75	2.72	2.95	3.26	3.49	3.69	3.64	3.46	3.30	3.46	3.71	3.91	4.05
Lower GDP Growth Rate (NPC99G)	1.54	2.42	2.40	2.02	2.19	3.09	3.04	2.71	2.44	2.35	2.55	2.73	2.88	2.99	2.99	2.83	2.65	2.68	2.83	3.09	3.36
Faster Technology Advancement (NPC99H)	1.54	2.42	2.40	2.02	2.19	3.14	3.17	2.84	2.56	2.48	2.63	2.80	2.96	3.01	2.94	2.84	2.71	2.77	2.96	3.18	3.42
Slower Technology Advancement (NPC99I)	1.54	2.42	2.40	2.02	2.19	3.14	3.17	2.85	2.63	2.60	2.89	3.21	3.42	3.53	3.53	3.39	3.27	3.50	3.75	4.02	4.17
Larger Resource Base (NPC99K)	1.54	2.42	2.40	2.02	2.19	3.11	3.08	2.72	2.42	2.29	2.43	2.54	2.56	2.49	2.41	2.22	2.19	2.58	2.93	3.06	3.06
Smaller Resource Base (NPC99L)	1.54	2.42	2.40	2.02	2.19	3.24	3.37	3.10	2.91	2.87	3.05	3.24	3.47	3.74	3.83	3.68	3.50	3.68	3.86	4.15	4.41
Increased Access (NPC99R)	1.54	2.42	2.40	2.02	2.19	3.14	3.15	2.83	2.58	2.53	2.70	2.97	3.12	3.15	3.08	2.92	2.79	2.81	2.98	3.11	3.27
Reduced Access (NPC99S)	1.54	2.42	2.40	2.02	2.19	3.16	3.21	2.91	2.66	2.60	2.81	3.14	3.36	3.50	3.46	3.30	3.13	3.29	3.45	3.61	3.78

Average Opal Prices ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.11	1.64	1.90	1.82	1.90	2.62	2.76	2.45	2.14	2.03	1.95	1.89	2.37	2.56	2.80	2.11	1.83	1.60	2.37	3.15	3.26
Increased Oil Prices (NPC99D)	1.11	1.64	1.90	1.82	1.99	3.02	3.02	2.57	2.13	2.01	1.87	2.08	2.74	3.08	3.15	2.85	2.40	1.60	1.66	2.58	2.71
Decreased Oil Prices (NPC99E)	1.11	1.64	1.90	1.82	1.81	2.24	2.52	2.39	2.15	2.04	2.00	1.98	2.37	2.47	2.51	2.08	2.25	2.19	2.56	3.03	3.04
Higher GDP Growth Rate (NPC99F)	1.11	1.64	1.90	1.82	1.90	2.65	2.84	2.57	2.27	2.13	2.23	2.25	2.99	3.32	3.15	1.75	1.76	2.44	2.99	3.38	3.39
Lower GDP Growth Rate (NPC99G)	1.11	1.64	1.90	1.82	1.90	2.58	2.65	2.33	2.01	1.90	1.92	1.91	2.25	2.43	2.55	2.15	2.00	1.52	1.92	2.35	2.66
Faster Technology Advancement (NPC99H)	1.11	1.64	1.90	1.82	1.90	2.63	2.77	2.45	2.11	1.96	1.67	2.10	2.41	2.34	1.71	1.24	1.30	1.54	2.45	2.75	2.90
Slower Technology Advancement (NPC99I)	1.11	1.64	1.90	1.82	1.90	2.63	2.77	2.47	2.17	2.08	2.11	2.11	2.75	2.85	3.01	1.89	1.74	1.67	2.90	3.60	3.64
Larger Resource Base (NPC99K)	1.11	1.64	1.90	1.82	1.90	2.61	2.68	2.34	2.00	1.84	1.77	1.78	2.03	1.91	1.89	1.56	1.42	1.41	2.47	2.60	1.86
Smaller Resource Base (NPC99L)	1.11	1.64	1.90	1.82	1.90	2.73	2.98	2.72	2.50	2.40	2.27	2.07	2.68	3.10	3.33	2.57	2.30	1.67	2.64	3.66	3.90
Increased Access (NPC99R)	1.11	1.64	1.90	1.82	1.90	2.63	2.75	2.44	2.11	2.00	1.98	2.05	2.76	2.77	2.71	2.46	2.27	1.96	2.04	2.53	2.03
ReducedAccess (NPC99S)	1.11	1.64	1.90	1.82	1.90	2.70	2.86	2.58	2.35	2.29	2.40	2.53	2.93	3.11	3.06	2.76	2.33	1.49	1.30	1.83	2.20

NPC Sensitivity Cases

Spot Prices

Avg Southern California Prices ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2008	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.55	1.87	2.22	2.03	2.52	3.08	3.13	2.83	2.60	2.60	2.87	3.15	3.31	3.40	3.39	3.26	3.11	3.24	3.41	3.62	3.79
Increased Oil Prices (NPC99D)	1.55	1.87	2.22	2.03	2.77	3.51	3.43	2.97	2.63	2.61	2.89	3.17	3.41	3.62	3.64	3.41	3.15	3.22	3.37	3.41	3.72
Decreased Oil Prices (NPC99E)	1.55	1.87	2.22	2.03	2.29	2.65	2.85	2.70	2.54	2.49	2.67	2.92	3.06	3.14	3.06	2.98	2.89	3.04	3.24	3.44	3.51
Higher GDP Growth Rate (NPC99F)	1.55	1.87	2.22	2.03	2.52	3.10	3.22	2.96	2.76	2.76	3.02	3.35	3.59	3.79	3.76	3.60	3.40	3.50	3.75	3.96	4.09
Lower GDP Growth Rate (NPC99G)	1.55	1.87	2.22	2.03	2.52	3.03	3.02	2.70	2.45	2.38	2.61	2.82	2.98	3.11	3.07	2.92	2.72	2.74	2.88	3.12	3.41
Faster Technology Advancement (NPC99H)	1.55	1.87	2.22	2.03	2.52	3.09	3.15	2.82	2.57	2.52	2.70	2.87	3.07	3.14	3.07	2.97	2.81	2.83	3.02	3.25	3.50
Slower Technology Advancement (NPC99I)	1.55	1.87	2.22	2.03	2.52	3.09	3.15	2.84	2.63	2.64	2.97	3.31	3.54	3.66	3.64	3.51	3.37	3.58	3.83	4.06	4.22
Larger Resource Base (NPC99K)	1.55	1.87	2.22	2.03	2.52	3.06	3.06	2.71	2.44	2.33	2.52	2.65	2.70	2.64	2.56	2.47	2.56	2.81	3.10	3.23	3.32
Smaller Resource Base (NPC99L)	1.55	1.87	2.22	2.03	2.52	3.18	3.36	3.09	2.91	2.90	3.12	3.34	3.59	3.88	3.94	3.82	3.62	3.78	3.95	4.21	4.47
Increased Access (NPC99R)	1.55	1.87	2.22	2.03	2.52	3.08	3.13	2.82	2.58	2.56	2.77	3.06	3.21	3.26	3.18	3.04	2.88	2.88	3.03	3.14	3.34
Reduced Access (NPC99S)	1.55	1.87	2.22	2.03	2.52	3.12	3.20	2.91	2.68	2.64	2.87	3.23	3.47	3.62	3.57	3.42	3.22	3.39	3.55	3.66	3.86

Pipeline Basis

Henry Hub to NYC ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2008	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.58	1.15	0.37	0.27	0.35	0.63	0.65	0.68	0.75	0.61	0.63	0.69	0.76	0.84	0.98	1.13	0.80	0.89	1.01	1.08	1.04
Increased Oil Prices (NPC99D)	0.58	1.15	0.37	0.27	0.35	0.66	0.70	0.73	0.84	0.69	0.71	0.78	0.86	0.95	1.08	1.15	0.89	0.95	1.01	1.04	0.90
Decreased Oil Prices (NPC99E)	0.58	1.15	0.37	0.27	0.34	0.59	0.60	0.61	0.68	0.59	0.60	0.66	0.75	0.83	0.99	1.09	0.76	0.84	0.93	0.95	0.91
Higher GDP Growth Rate (NPC99F)	0.58	1.15	0.37	0.27	0.35	0.63	0.66	0.70	0.79	0.67	0.71	0.80	0.89	0.98	1.18	1.21	1.03	1.15	1.16	1.20	1.07
Lower GDP Growth Rate (NPC99G)	0.58	1.15	0.37	0.27	0.35	0.62	0.64	0.66	0.72	0.61	0.60	0.66	0.74	0.81	0.96	1.07	0.71	0.76	0.86	0.89	0.77
Faster Technology Advancement (NPC99H)	0.58	1.15	0.37	0.27	0.35	0.62	0.65	0.68	0.76	0.63	0.65	0.72	0.78	0.69	0.83	0.95	0.81	0.90	0.98	1.00	1.06
Slower Technology Advancement (NPC99I)	0.58	1.15	0.37	0.27	0.35	0.62	0.65	0.67	0.75	0.63	0.64	0.70	0.81	0.91	1.09	1.23	0.82	0.91	1.00	1.07	0.93
Larger Resource Base (NPC99K)	0.58	1.15	0.37	0.27	0.35	0.63	0.67	0.69	0.79	0.67	0.70	0.79	0.87	0.69	0.83	1.04	0.99	0.89	0.84	0.88	1.17
Smaller Resource Base (NPC99L)	0.58	1.15	0.37	0.27	0.35	0.62	0.65	0.67	0.73	0.63	0.65	0.74	0.82	0.88	1.03	1.14	0.82	0.91	1.01	1.02	0.92
Increased Access (NPC99R)	0.58	1.15	0.37	0.27	0.35	0.62	0.65	0.68	0.75	0.62	0.64	0.70	0.78	0.88	1.05	1.21	0.86	0.96	1.05	1.17	1.11
Reduced Access (NPC99S)	0.58	1.15	0.37	0.27	0.35	0.62	0.65	0.67	0.74	0.61	0.62	0.67	0.74	0.80	0.93	1.06	0.75	0.84	0.96	1.06	1.00

Henry Hub to Chicago ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.00	0.50	0.13	0.07	0.09	0.21	0.19	0.20	0.21	0.20	0.19	0.21	0.21	0.23	0.27	0.32	0.31	0.35	0.38	0.41	0.48
Increased Oil Prices (NPC99D)	0.00	0.50	0.13	0.07	0.09	0.21	0.19	0.20	0.22	0.21	0.21	0.23	0.22	0.25	0.31	0.37	0.37	0.39	0.38	0.32	0.32
Decreased Oil Prices (NPC99E)	0.00	0.50	0.13	0.07	0.09	0.21	0.18	0.19	0.20	0.19	0.19	0.20	0.21	0.24	0.28	0.30	0.30	0.33	0.35	0.34	0.40
Higher GDP Growth Rate (NPC99F)	0.00	0.50	0.13	0.07	0.09	0.21	0.19	0.20	0.22	0.22	0.22	0.26	0.24	0.28	0.39	0.47	0.49	0.59	0.48	0.43	0.51
Lower GDP Growth Rate (NPC99G)	0.00	0.50	0.13	0.07	0.09	0.21	0.18	0.19	0.19	0.18	0.18	0.19	0.18	0.20	0.23	0.25	0.24	0.24	0.24	0.25	0.27
Faster Technology Advancement (NPC99H)	0.00	0.50	0.13	0.07	0.09	0.21	0.18	0.20	0.21	0.20	0.21	0.23	0.22	0.24	0.31	0.36	0.37	0.42	0.40	0.44	0.50
Slower Technology Advancement (NPC99I)	0.00	0.50	0.13	0.07	0.09	0.21	0.18	0.20	0.21	0.20	0.19	0.21	0.21	0.24	0.28	0.35	0.30	0.34	0.34	0.38	0.37
Larger Resource Base (NPC99K)	0.00	0.50	0.13	0.07	0.09	0.22	0.19	0.20	0.21	0.21	0.22	0.25	0.25	0.27	0.36	0.50	0.56	0.45	0.38	0.37	0.58
Smaller Resource Base (NPC99L)	0.00	0.50	0.13	0.07	0.09	0.21	0.18	0.20	0.21	0.20	0.21	0.23	0.22	0.23	0.28	0.32	0.31	0.36	0.38	0.35	0.40
Increased Access (NPC99R)	0.00	0.50	0.13	0.07	0.09	0.21	0.19	0.20	0.21	0.20	0.20	0.22	0.21	0.24	0.30	0.35	0.36	0.41	0.38	0.46	0.52
Reduced Access (NPC99S)	0.00	0.50	0.13	0.07	0.09	0.21	0.19	0.20	0.21	0.20	0.20	0.21	0.20	0.21	0.25	0.29	0.28	0.32	0.35	0.40	0.46

AECO to Chicago ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2008	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.91	2.26	1.33	0.77	0.55	0.96	0.66	0.64	0.67	0.79	1.17	1.37	1.07	0.72	0.59	0.57	0.79	1.11	1.23	0.88	0.87
Increased Oil Prices (NPC99D)	0.91	2.26	1.33	0.77	0.56	1.08	0.70	0.68	0.75	0.93	1.68	1.84	1.16	0.67	0.56	0.57	0.84	1.05	1.45	0.97	1.08
Decreased Oil Prices (NPC99E)	0.91	2.26	1.33	0.77	0.54	0.82	0.61	0.61	0.60	0.64	0.79	0.86	0.78	0.63	0.57	0.55	0.69	0.95	0.93	0.70	0.67
Higher GDP Growth Rate (NPC99F)	0.91	2.26	1.33	0.77	0.55	0.96	0.66	0.66	0.68	0.84	1.21	1.47	1.06	0.72	0.71	0.77	1.42	1.53	1.31	0.90	0.88
Lower GDP Growth Rate (NPC99G)	0.91	2.26	1.33	0.77	0.55	0.94	0.65	0.63	0.65	0.71	0.96	1.03	0.81	0.64	0.57	0.52	0.65	0.89	1.01	0.88	0.75
Faster Technology Advancement (NPC99H)	0.91	2.26	1.33	0.77	0.55	0.96	0.66	0.64	0.67	0.78	1.27	1.37	1.00	0.75	0.59	0.57	0.79	0.99	0.93	0.92	0.97
Slower Technology Advancement (NPC99I)	0.91	2.26	1.33	0.77	0.55	0.96	0.66	0.64	0.66	0.78	1.06	1.19	0.80	0.62	0.54	0.54	0.67	1.05	1.09	0.83	0.76
Larger Resource Base (NPC99K)	0.91	2.26	1.33	0.77	0.55	0.95	0.67	0.66	0.71	0.87	1.35	1.51	1.12	0.86	0.65	0.57	0.54	0.59	0.69	0.78	0.98
Smaller Resource Base (NPC99L)	0.91	2.26	1.33	0.77	0.55	0.97	0.66	0.65	0.66	0.72	1.02	1.25	1.03	0.70	0.64	0.64	1.01	0.89	0.83	0.61	0.54
Increased Access (NPC99R)	0.91	2.26	1.33	0.77	0.55	0.96	0.66	0.64	0.67	0.78	1.07	1.29	0.91	0.64	0.57	0.54	0.70	1.00	1.09	0.91	0.92
Reduced Access (NPC99S)	0.91	2.26	1.33	0.77	0.55	0.96	0.66	0.65	0.66	0.77	1.08	1.32	1.02	0.73	0.64	0.65	1.12	1.37	1.34	1.12	0.96

NPC Sensitivity Cases

Pipeline Basis

AECO vs. Henry Hub ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.91	1.76	1.20	0.70	0.45	0.75	0.47	0.45	0.46	0.59	0.97	1.15	0.86	0.49	0.33	0.26	0.48	0.76	0.84	0.47	0.38
Increased Oil Prices (NPC99D)	0.91	1.76	1.20	0.70	0.47	0.87	0.51	0.48	0.53	0.72	1.47	1.61	0.94	0.41	0.24	0.19	0.47	0.66	1.07	0.65	0.76
Decreased Oil Prices (NPC99E)	0.91	1.76	1.20	0.70	0.44	0.62	0.44	0.42	0.40	0.45	0.60	0.66	0.57	0.39	0.29	0.25	0.40	0.62	0.58	0.36	0.26
Higher GDP Growth Rate (NPC99F)	0.91	1.76	1.20	0.70	0.45	0.75	0.47	0.45	0.46	0.62	0.99	1.21	0.82	0.44	0.32	0.30	0.93	0.94	0.83	0.46	0.37
Lower GDP Growth Rate (NPC99G)	0.91	1.76	1.20	0.70	0.45	0.73	0.47	0.44	0.46	0.53	0.78	0.85	0.62	0.44	0.34	0.27	0.42	0.65	0.77	0.63	0.48
Faster Technology Advancement (NPC99H)	0.91	1.76	1.20	0.70	0.45	0.76	0.47	0.44	0.46	0.58	1.07	1.13	0.78	0.51	0.28	0.21	0.43	0.58	0.52	0.48	0.47
Slower Technology Advancement (NPC99I)	0.91	1.76	1.20	0.70	0.45	0.76	0.47	0.44	0.46	0.58	0.87	0.98	0.59	0.38	0.26	0.19	0.38	0.70	0.75	0.45	0.39
Larger Resource Base (NPC99K)	0.91	1.76	1.20	0.70	0.45	0.74	0.48	0.46	0.49	0.65	1.13	1.25	0.86	0.60	0.29	0.07	-0.01	0.14	0.31	0.41	0.39
Smaller Resource Base (NPC99L)	0.91	1.76	1.20	0.70	0.45	0.76	0.48	0.45	0.45	0.51	0.81	1.02	0.81	0.46	0.36	0.32	0.70	0.53	0.45	0.26	0.15
Increased Access (NPC99R)	0.91	1.76	1.20	0.70	0.45	0.75	0.47	0.44	0.46	0.58	0.88	1.07	0.70	0.40	0.27	0.19	0.34	0.59	0.71	0.45	0.39
Reduced Access (NPC99S)	0.91	1.76	1.20	0.70	0.45	0.75	0.47	0.45	0.46	0.56	0.88	1.11	0.82	0.51	0.39	0.36	0.84	1.05	1.00	0.71	0.50

Opal vs. Henry Hub ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.71	1.23	0.62	0.27	0.38	0.61	0.48	0.46	0.52	0.60	0.92	1.23	0.90	0.79	0.58	1.12	1.29	1.66	1.06	0.51	0.55
Increased Oil Prices (NPC99D)	0.71	1.23	0.62	0.27	0.39	0.67	0.53	0.50	0.57	0.63	1.02	1.07	0.65	0.50	0.48	0.56	0.80	1.67	1.78	0.97	1.13
Decreased Oil Prices (NPC99E)	0.71	1.23	0.62	0.27	0.37	0.54	0.42	0.39	0.43	0.46	0.66	0.89	0.66	0.62	0.54	0.88	0.64	0.85	0.68	0.42	0.47
Higher GDP Growth Rate (NPC99F)	0.71	1.23	0.62	0.27	0.38	0.61	0.48	0.47	0.55	0.65	0.79	1.08	0.58	0.44	0.59	1.83	1.66	1.13	0.83	0.63	0.76
Lower GDP Growth Rate (NPC99G)	0.71	1.23	0.62	0.27	0.38	0.60	0.47	0.45	0.49	0.51	0.70	0.88	0.70	0.64	0.53	0.77	0.75	1.25	1.00	0.82	0.77
Faster Technology Advancement (NPC99H)	0.71	1.23	0.62	0.27	0.38	0.61	0.48	0.46	0.52	0.58	1.02	0.75	0.62	0.73	1.29	1.67	1.47	1.28	0.56	0.48	0.57
Slower Technology Advancement (NPC99I)	0.71	1.23	0.62	0.27	0.38	0.61	0.48	0.46	0.53	0.58	0.85	1.17	0.75	0.76	0.62	1.61	1.64	1.93	0.95	0.50	0.61
Larger Resource Base (NPC99K)	0.71	1.23	0.62	0.27	0.38	0.60	0.47	0.44	0.48	0.50	0.71	0.79	0.57	0.62	0.55	0.70	0.82	1.24	0.54	0.54	1.29
Smaller Resource Base (NPC99L)	0.71	1.23	0.62	0.27	0.38	0.60	0.47	0.45	0.48	0.53	0.85	1.23	0.86	0.72	0.59	1.21	1.31	2.11	1.31	0.57	0.57
Increased Access (NPC99R)	0.71	1.23	0.62	0.27	0.38	0.61	0.48	0.46	0.53	0.60	0.78	0.99	0.43	0.45	0.44	0.56	0.62	0.94	1.02	0.67	1.33
Reduced Access (NPC99S)	0.71	1.23	0.62	0.27	0.38	0.56	0.43	0.39	0.37	0.37	0.46	0.67	0.50	0.47	0.49	0.64	0.89	1.91	2.26	1.90	1.69

Midcontinent vs. Henry Hub ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Midcontinent vs. Henry Hub ($1998/MMBtu)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.07	0.07	0.06	0.07	0.06	0.08	0.09	0.10	0.10	0.10	0.10	0.10	0.09	0.08
Increased Oil Prices (NPC99D)	0.28	0.45	0.12	0.07	0.08	0.11	0.10	0.09	0.08	0.07	0.07	0.07	0.08	0.08	0.08	0.10	0.11	0.11	0.14	0.16	0.17
Decreased Oil Prices (NPC99E)	0.28	0.45	0.12	0.07	0.08	0.08	0.07	0.06	0.05	0.05	0.05	0.05	0.06	0.07	0.06	0.08	0.08	0.07	0.07	0.06	0.06
Higher GDP Growth Rate (NPC99F)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.08	0.07	0.06	0.07	0.07	0.08	0.08	0.10	0.12	0.12	0.12	0.11	0.10	0.10
Lower GDP Growth Rate (NPC99G)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.09	0.09	0.08	0.07
Faster Technology Advancement (NPC99H)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.07	0.07	0.06	0.06	0.05	0.06	0.06	0.07	0.07	0.06	0.05	0.05	0.05	0.04
Slower Technology Advancement (NPC99I)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.09	0.09	0.10	0.11	0.10	0.10	0.09	0.09
Larger Resource Base (NPC99K)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.07	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.04	0.05	0.06	0.08	0.08	0.08
Smaller Resource Base (NPC99L)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.07	0.07	0.06	0.07	0.06	0.07	0.08	0.09	0.11	0.11	0.10	0.09	0.08	0.06
Increased Access (NPC99R)	0.28	0.45	0.12	0.07	0.08	0.10	0.08	0.07	0.07	0.06	0.07	0.06	0.07	0.07	0.08	0.09	0.09	0.09	0.08	0.09	0.09
Reduced Access (NPC99S)	0.28	0.45	0.12	0.07	0.08	0.09	0.08	0.07	0.06	0.05	0.06	0.06	0.07	0.08	0.09	0.09	0.10	0.10	0.11	0.12	0.11

Opal to SoCal ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.44	0.23	0.32	0.21	0.62	0.46	0.38	0.38	0.46	0.57	0.92	1.26	0.93	0.84	0.58	1.14	1.28	1.64	1.04	0.47	0.53
Increased Oil Prices (NPC99D)	0.44	0.23	0.32	0.21	0.78	0.49	0.41	0.41	0.50	0.59	1.02	1.09	0.66	0.53	0.49	0.55	0.76	1.63	1.71	0.83	1.02
Decreased Oil Prices (NPC99E)	0.44	0.23	0.32	0.21	0.48	0.42	0.33	0.32	0.39	0.45	0.67	0.94	0.69	0.67	0.55	0.90	0.65	0.85	0.68	0.40	0.48
Higher GDP Growth Rate (NPC99F)	0.44	0.23	0.32	0.21	0.62	0.46	0.38	0.39	0.49	0.63	0.79	1.10	0.60	0.47	0.61	1.85	1.63	1.06	0.76	0.58	0.70
Lower GDP Growth Rate (NPC99G)	0.44	0.23	0.32	0.21	0.62	0.45	0.37	0.36	0.43	0.48	0.69	0.90	0.73	0.68	0.53	0.77	0.72	1.22	0.96	0.77	0.75
Faster Technology Advancement (NPC99H)	0.44	0.23	0.32	0.21	0.62	0.46	0.38	0.38	0.46	0.56	1.03	0.77	0.66	0.80	1.36	1.73	1.51	1.30	0.57	0.50	0.60
Slower Technology Advancement (NPC99I)	0.44	0.23	0.32	0.21	0.62	0.46	0.38	0.38	0.47	0.56	0.86	1.20	0.79	0.81	0.63	1.62	1.64	1.91	0.93	0.46	0.57
Larger Resource Base (NPC99K)	0.44	0.23	0.32	0.21	0.62	0.45	0.38	0.37	0.44	0.49	0.75	0.87	0.67	0.74	0.67	0.91	1.14	1.41	0.62	0.62	1.46
Smaller Resource Base (NPC99L)	0.44	0.23	0.32	0.21	0.62	0.45	0.37	0.37	0.42	0.50	0.84	1.26	0.91	0.77	0.61	1.24	1.32	2.11	1.31	0.55	0.57
Increased Access (NPC99R)	0.44	0.23	0.32	0.21	0.62	0.46	0.38	0.38	0.47	0.57	0.79	1.02	0.45	0.49	0.47	0.58	0.61	0.93	0.99	0.62	1.30
Reduced Access (NPC99S)	0.44	0.23	0.32	0.21	0.62	0.42	0.34	0.32	0.33	0.35	0.47	0.71	0.54	0.52	0.51	0.66	0.88	1.89	2.24	1.83	1.67

NPC Sensitivity Cases

Pipeline Basis

AECO to SoCal ($1998/MMBtu)	1995	1996	1997	1998	1998	2008	2001	2002	2003	2004	2005	2006	2007	2008	2008	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.64	0.77	0.91	0.65	0.70	0.60	0.37	0.36	0.40	0.56	0.97	1.18	0.89	0.54	0.33	0.28	0.47	0.74	0.82	0.43	0.37
Increased Oil Prices (NPC99D)	0.64	0.77	0.91	0.65	0.86	0.69	0.39	0.38	0.46	0.68	1.46	1.63	0.95	0.45	0.26	0.19	0.43	0.61	1.00	0.51	0.65
Decreased Oil Prices (NPC99E)	0.64	0.77	0.91	0.65	0.56	0.49	0.34	0.35	0.36	0.43	0.61	0.70	0.61	0.44	0.31	0.27	0.41	0.62	0.58	0.34	0.27
Higher GDP Growth Rate (NPC99F)	0.64	0.77	0.91	0.65	0.70	0.60	0.37	0.37	0.41	0.60	0.98	1.24	0.84	0.46	0.34	0.33	0.90	0.87	0.76	0.41	0.31
Lower GDP Growth Rate (NPC99G)	0.64	0.77	0.91	0.65	0.70	0.59	0.37	0.36	0.40	0.50	0.78	0.87	0.65	0.48	0.33	0.27	0.39	0.62	0.73	0.59	0.46
Faster Technology Advancement (NPC99H)	0.64	0.77	0.91	0.65	0.70	0.60	0.37	0.36	0.40	0.55	1.08	1.16	0.83	0.58	0.34	0.28	0.47	0.60	0.53	0.50	0.50
Slower Technology Advancement (NPC99I)	0.64	0.77	0.91	0.65	0.70	0.60	0.37	0.36	0.40	0.55	0.87	1.01	0.63	0.42	0.27	0.21	0.37	0.69	0.73	0.41	0.35
Larger Resource Base (NPC99K)	0.64	0.77	0.91	0.65	0.70	0.59	0.38	0.39	0.45	0.64	1.16	1.33	0.96	0.71	0.41	0.27	0.31	0.31	0.40	0.50	0.57
Smaller Resource Base (NPC99L)	0.64	0.77	0.91	0.65	0.70	0.61	0.38	0.37	0.38	0.48	0.81	1.05	0.86	0.52	0.38	0.35	0.72	0.54	0.45	0.24	0.14
Increased Access (NPC99R)	0.64	0.77	0.91	0.65	0.70	0.60	0.37	0.36	0.40	0.55	0.88	1.10	0.71	0.43	0.29	0.21	0.33	0.58	0.68	0.40	0.37
Reduced Access (NPC99S)	0.64	0.77	0.91	0.65	0.70	0.60	0.38	0.38	0.42	0.55	0.89	1.15	0.86	0.56	0.42	0.38	0.83	1.03	0.98	0.65	0.47

Average U.S. Prices and T&D Margins

Pipeline Acquisition ($1998/MMBtu)	1995	1996	1997	1998	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2008	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.51	2.34	2.14	1.88	2.07	3.02	3.09	2.78	2.51	2.42	2.55	2.75	3.01	3.14	3.11	3.02	2.83	2.89	3.11	3.39	3.54
Increased Oil Prices (NPC99D)	1.51	2.34	2.14	1.88	2.19	3.47	3.41	2.95	2.56	2.44	2.54	2.81	3.16	3.43	3.47	3.26	2.98	2.94	3.04	3.24	3.47
Decreased Oil Prices (NPC99E)	1.51	2.34	2.14	1.88	1.95	2.58	2.79	2.63	2.44	2.34	2.42	2.64	2.81	2.90	2.85	2.76	2.66	2.76	2.97	3.22	3.30
Higher GDP Growth Rate (NPC99F)	1.51	2.34	2.14	1.88	2.07	3.04	3.17	2.90	2.67	2.57	2.71	2.99	3.31	3.55	3.54	3.29	3.01	3.19	3.46	3.71	3.85
Lower GDP Growth Rate (NPC99G)	1.51	2.34	2.14	1.88	2.07	2.98	2.99	2.66	2.38	2.25	2.37	2.54	2.76	2.91	2.87	2.77	2.56	2.49	2.65	2.91	3.17
Faster Technology Advancement (NPC99H)	1.51	2.34	2.14	1.88	2.07	3.03	3.11	2.78	2.48	2.36	2.40	2.58	2.80	2.86	2.79	2.68	2.52	2.53	2.78	3.03	3.26
Slower Technology Advancement (NPC99I)	1.51	2.34	2.14	1.88	2.07	3.03	3.11	2.80	2.56	2.47	2.66	2.98	3.28	3.41	3.42	3.23	3.05	3.18	3.51	3.82	3.98
Larger Resource Base (NPC99K)	1.51	2.34	2.14	1.88	2.07	3.00	3.02	2.65	2.33	2.13	2.18	2.28	2.38	2.37	2.33	2.20	2.18	2.51	2.88	2.99	2.96
Smaller Resource Base (NPC99L)	1.51	2.34	2.14	1.88	2.07	3.12	3.31	3.03	2.82	2.71	2.80	2.93	3.27	3.59	3.58	3.52	3.23	3.32	3.57	3.94	4.22
Increased Access (NPC99R)	1.51	2.34	2.14	1.88	2.07	3.03	3.09	2.77	2.50	2.40	2.51	2.76	2.98	3.05	3.01	2.89	2.73	2.68	2.79	2.95	3.04
Reduced Access (NPC99S)	1.51	2.34	2.14	1.88	2.07	3.06	3.16	2.85	2.59	2.48	2.60	2.87	3.19	3.36	3.26	3.18	2.92	2.95	3.08	3.25	3.49

Transmission Margin ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2008	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.70	0.69	0.70	0.74	0.76	0.74	0.71	0.73	0.71	0.70	0.72	0.72	0.70	0.69
Increased Oil Prices (NPC99D)	0.81	0.80	0.95	0.74	0.75	0.76	0.73	0.71	0.72	0.73	0.78	0.78	0.76	0.73	0.71	0.70	0.70	0.73	0.74	0.73	0.71
Decreased Oil Prices (NPC99E)	0.81	0.80	0.95	0.74	0.75	0.73	0.71	0.68	0.67	0.66	0.68	0.67	0.67	0.66	0.67	0.67	0.66	0.67	0.68	0.67	0.66
Higher GDP Growth Rate (NPC99F)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.70	0.70	0.71	0.74	0.75	0.75	0.73	0.73	0.75	0.78	0.80	0.78	0.76	0.75
Lower GDP Growth Rate (NPC99G)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.69	0.68	0.68	0.70	0.70	0.69	0.67	0.69	0.67	0.65	0.66	0.66	0.66	0.64
Faster Technology Advancement (NPC99H)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.70	0.69	0.70	0.73	0.73	0.72	0.70	0.69	0.70	0.69	0.71	0.69	0.68	0.66
Slower Technology Advancement (NPC99I)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.70	0.69	0.70	0.73	0.73	0.72	0.71	0.71	0.73	0.72	0.75	0.74	0.72	0.70
Larger Resource Base (NPC99K)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.70	0.69	0.70	0.73	0.74	0.73	0.69	0.68	0.68	0.67	0.66	0.63	0.62	0.64
Smaller Resource Base (NPC99L)	0.81	0.80	0.95	0.74	0.75	0.75	0.73	0.71	0.71	0.72	0.75	0.78	0.76	0.74	0.79	0.76	0.76	0.79	0.78	0.75	0.73
Increased Access (NPC99R)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.70	0.69	0.70	0.71	0.72	0.71	0.69	0.67	0.67	0.65	0.67	0.68	0.69	0.71
Reduced Access (NPC99S)	0.81	0.80	0.95	0.74	0.75	0.74	0.72	0.69	0.69	0.69	0.72	0.74	0.72	0.70	0.72	0.69	0.69	0.74	0.77	0.79	0.78

Citygate Price ($1998/MMBtu)	1995	1996	1997	1998	1998	2008	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	2.32	3.15	3.09	2.62	2.81	3.77	3.82	3.48	3.21	3.13	3.29	3.52	3.75	3.86	3.85	3.73	3.54	3.62	3.83	4.10	4.23
Increased Oil Prices (NPC99D)	2.32	3.15	3.09	2.62	2.94	4.23	4.15	3.67	3.28	3.18	3.32	3.60	3.93	4.16	4.18	3.97	3.68	3.67	3.79	3.97	4.18
Decreased Oil Prices (NPC99E)	2.32	3.15	3.09	2.62	2.70	3.31	3.50	3.32	3.12	3.01	3.10	3.32	3.49	3.57	3.52	3.43	3.32	3.43	3.65	3.90	3.96
Higher GDP Growth Rate (NPC99F)	2.32	3.15	3.09	2.62	2.81	3.79	3.90	3.60	3.37	3.29	3.46	3.75	4.06	4.28	4.27	4.05	3.80	3.99	4.25	4.48	4.60
Lower GDP Growth Rate (NPC99G)	2.32	3.15	3.09	2.62	2.81	3.73	3.71	3.36	3.07	2.93	3.08	3.25	3.45	3.58	3.56	3.44	3.21	3.15	3.31	3.57	3.81
Faster Technology Advancement (NPC99H)	2.32	3.15	3.09	2.62	2.81	3.78	3.83	3.48	3.18	3.06	3.13	3.31	3.52	3.57	3.49	3.38	3.22	3.25	3.48	3.71	3.93
Slower Technology Advancement (NPC99I)	2.32	3.15	3.09	2.62	2.81	3.78	3.84	3.50	3.25	3.17	3.40	3.72	4.00	4.12	4.13	3.96	3.78	3.94	4.25	4.54	4.68
Larger Resource Base (NPC99K)	2.32	3.15	3.09	2.62	2.81	3.75	3.74	3.35	3.03	2.84	2.92	3.02	3.12	3.07	3.01	2.88	2.86	3.18	3.51	3.61	3.61
Smaller Resource Base (NPC99L)	2.32	3.15	3.09	2.62	2.81	3.87	4.04	3.74	3.53	3.43	3.56	3.71	4.03	4.34	4.37	4.29	4.00	4.12	4.36	4.70	4.95
Increased Access (NPC99R)	2.32	3.15	3.09	2.62	2.81	3.77	3.82	3.47	3.19	3.10	3.23	3.48	3.69	3.74	3.69	3.56	3.39	3.35	3.47	3.64	3.75
Reduced Access (NPC99S)	2.32	3.15	3.09	2.62	2.81	3.80	3.88	3.55	3.28	3.17	3.32	3.61	3.91	4.06	3.99	3.88	3.62	3.70	3.86	4.04	4.27

NPC Sensitivity Cases

Average U.S. Prices and T&D Margins

Distribution Margin ($1998/MMBtu)	1995	1996	1997	1998	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1.56	1.30	1.48	1.55	1.40	1.41	1.39	1.34	1.30	1.28	1.27	1.26	1.24	1.22	1.20	1.16	1.13	1.12	1.11	1.10	1.09
Increased Oil Prices (NPC99D)	1.56	1.30	1.48	1.55	1.40	1.41	1.38	1.33	1.28	1.26	1.25	1.23	1.22	1.20	1.18	1.14	1.11	1.09	1.08	1.06	1.04
Decreased Oil Prices (NPC99E)	1.56	1.30	1.48	1.55	1.41	1.42	1.41	1.37	1.33	1.30	1.29	1.28	1.28	1.26	1.23	1.20	1.17	1.17	1.17	1.17	1.15
Higher GDP Growth Rate (NPC99F)	1.56	1.30	1.48	1.55	1.40	1.41	1.39	1.34	1.30	1.27	1.26	1.25	1.24	1.22	1.19	1.15	1.12	1.11	1.10	1.10	1.09
Lower GDP Growth Rate (NPC99G)	1.56	1.30	1.48	1.55	1.40	1.42	1.39	1.35	1.31	1.29	1.28	1.27	1.26	1.24	1.22	1.18	1.15	1.14	1.12	1.12	1.10
Faster Technology Advancement (NPC99H)	1.56	1.30	1.48	1.55	1.40	1.41	1.39	1.34	1.30	1.27	1.26	1.24	1.23	1.21	1.18	1.15	1.12	1.10	1.09	1.08	1.07
Slower Technology Advancement (NPC99I)	1.56	1.30	1.48	1.55	1.40	1.41	1.39	1.34	1.30	1.28	1.27	1.27	1.26	1.24	1.21	1.18	1.15	1.14	1.14	1.15	1.13
Larger Resource Base (NPC99K)	1.56	1.30	1.48	1.55	1.40	1.41	1.38	1.33	1.29	1.26	1.25	1.23	1.21	1.18	1.15	1.12	1.10	1.10	1.09	1.07	1.05
Smaller Resource Base (NPC99L)	1.56	1.30	1.48	1.55	1.40	1.42	1.40	1.36	1.32	1.30	1.28	1.27	1.26	1.26	1.24	1.20	1.17	1.16	1.15	1.16	1.15
Increased Access (NPC99R)	1.56	1.30	1.48	1.55	1.40	1.41	1.39	1.34	1.30	1.27	1.26	1.25	1.24	1.22	1.18	1.15	1.12	1.11	1.09	1.08	1.06
Reduced Access (NPC99S)	1.56	1.30	1.48	1.55	1.40	1.42	1.39	1.35	1.30	1.28	1.27	1.26	1.25	1.24	1.21	1.17	1.14	1.13	1.12	1.11	1.09

Burner-Tip ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	3.88	4.45	4.58	4.17	4.22	5.18	5.20	4.82	4.51	4.40	4.56	4.77	4.99	5.08	5.05	4.90	4.67	4.74	4.95	5.20	5.32
Increased Oil Prices (NPC99D)	3.88	4.45	4.58	4.17	4.34	5.64	5.53	5.00	4.57	4.44	4.57	4.83	5.15	5.36	5.36	5.11	4.79	4.77	4.87	5.03	5.23
Decreased Oil Prices (NPC99E)	3.88	4.45	4.58	4.17	4.10	4.73	4.91	4.68	4.44	4.31	4.39	4.60	4.77	4.83	4.75	4.63	4.49	4.60	4.82	5.06	5.11
Higher GDP Growth Rate (NPC99F)	3.88	4.45	4.58	4.17	4.22	5.20	5.29	4.94	4.67	4.55	4.71	5.00	5.30	5.50	5.46	5.20	4.91	5.10	5.35	5.58	5.69
Lower GDP Growth Rate (NPC99G)	3.88	4.45	4.58	4.17	4.22	5.14	5.10	4.70	4.38	4.22	4.35	4.51	4.71	4.82	4.78	4.62	4.37	4.29	4.43	4.68	4.92
Faster Technology Advancement (NPC99H)	3.88	4.45	4.58	4.17	4.22	5.20	5.22	4.82	4.48	4.33	4.39	4.55	4.75	4.77	4.67	4.53	4.34	4.35	4.57	4.79	4.99
Slower Technology Advancement (NPC99I)	3.88	4.45	4.58	4.17	4.22	5.20	5.23	4.84	4.55	4.45	4.68	4.98	5.26	5.37	5.34	5.14	4.93	5.09	5.40	5.69	5.81
Larger Resource Base (NPC99K)	3.88	4.45	4.58	4.17	4.22	5.16	5.13	4.68	4.32	4.10	4.17	4.25	4.32	4.25	4.16	4.00	3.96	4.28	4.60	4.69	4.65
Smaller Resource Base (NPC99L)	3.88	4.45	4.58	4.17	4.22	5.29	5.44	5.10	4.85	4.72	4.84	4.98	5.30	5.60	5.61	5.49	5.16	5.28	5.51	5.85	6.10
Increased Access (NPC99R)	3.88	4.45	4.58	4.17	4.22	5.19	5.21	4.81	4.49	4.38	4.49	4.73	4.93	4.96	4.87	4.71	4.51	4.46	4.56	4.72	4.81
Reduced Access (NPC99S)	3.88	4.45	4.58	4.17	4.22	5.22	5.27	4.89	4.58	4.45	4.59	4.87	5.17	5.30	5.19	5.05	4.76	4.83	4.98	5.15	5.37

Residential Burner-Tip ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	6.07	6.35	6.81	6.61	6.41	7.40	7.44	7.07	6.74	6.59	6.68	6.84	7.12	7.20	7.13	7.00	6.76	6.76	6.99	7.20	7.32
Increased Oil Prices (NPC99D)	6.07	6.35	6.81	6.61	6.57	7.93	7.86	7.35	6.87	6.68	6.71	6.97	7.38	7.59	7.54	7.29	6.98	6.85	6.92	7.14	7.31
Decreased Oil Prices (NPC99E)	6.07	6.35	6.81	6.61	6.25	6.88	7.05	6.83	6.58	6.42	6.46	6.63	6.79	6.83	6.75	6.63	6.48	6.54	6.74	6.99	7.05
Higher GDP Growth Rate (NPC99F)	6.07	6.35	6.81	6.61	6.41	7.42	7.52	7.19	6.90	6.76	6.84	7.09	7.42	7.60	7.56	7.27	6.97	7.16	7.41	7.61	7.72
Lower GDP Growth Rate (NPC99G)	6.07	6.35	6.81	6.61	6.41	7.36	7.35	6.95	6.60	6.40	6.48	6.62	6.84	6.93	6.86	6.72	6.46	6.31	6.45	6.69	6.90
Faster Technology Advancement (NPC99H)	6.07	6.35	6.81	6.61	6.41	7.41	7.46	7.07	6.71	6.53	6.50	6.67	6.89	6.91	6.78	6.62	6.44	6.41	6.64	6.85	7.04
Slower Technology Advancement (NPC99I)	6.07	6.35	6.81	6.61	6.41	7.41	7.46	7.09	6.79	6.65	6.80	7.08	7.38	7.45	7.41	7.19	6.98	7.07	7.41	7.67	7.83
Larger Resource Base (NPC99K)	6.07	6.35	6.81	6.61	6.41	7.38	7.36	6.94	6.54	6.27	6.27	6.33	6.46	6.42	6.33	6.13	6.06	6.35	6.66	6.72	6.66
Smaller Resource Base (NPC99L)	6.07	6.35	6.81	6.61	6.41	7.50	7.66	7.33	7.06	6.90	6.96	7.05	7.40	7.68	7.66	7.56	7.20	7.24	7.46	7.88	8.17
Increased Access (NPC99R)	6.07	6.35	6.81	6.61	6.41	7.40	7.44	7.07	6.72	6.58	6.64	6.83	7.07	7.09	6.99	6.83	6.65	6.54	6.61	6.75	6.82
Reduced Access (NPC99S)	6.07	6.35	6.81	6.61	6.41	7.43	7.50	7.15	6.82	6.66	6.73	6.96	7.28	7.39	7.26	7.13	6.84	6.80	6.94	7.11	7.37

Commercial Burner-Tip ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	5.11	5.44	5.73	5.36	5.34	6.31	6.36	6.01	5.70	5.57	5.68	5.86	6.13	6.23	6.19	6.08	5.84	5.87	6.10	6.34	6.47
Increased Oil Prices (NPC99D)	5.11	5.44	5.73	5.36	5.49	6.82	6.75	6.26	5.81	5.65	5.71	5.98	6.37	6.60	6.59	6.36	6.04	5.95	6.05	6.26	6.45
Decreased Oil Prices (NPC99E)	5.11	5.44	5.73	5.36	5.20	5.82	6.00	5.79	5.56	5.42	5.47	5.66	5.82	5.89	5.83	5.73	5.58	5.66	5.87	6.12	6.19
Higher GDP Growth Rate (NPC99F)	5.11	5.44	5.73	5.36	5.34	6.33	6.44	6.13	5.86	5.73	5.85	6.11	6.44	6.65	6.64	6.37	6.08	6.28	6.53	6.75	6.87
Lower GDP Growth Rate (NPC99G)	5.11	5.44	5.73	5.36	5.34	6.27	6.27	5.89	5.56	5.37	5.47	5.63	5.85	5.96	5.91	5.78	5.53	5.41	5.56	5.80	6.03
Faster Technology Advancement (NPC99H)	5.11	5.44	5.73	5.36	5.34	6.32	6.38	6.01	5.67	5.51	5.51	5.69	5.90	5.93	5.83	5.69	5.52	5.52	5.75	5.98	6.21
Slower Technology Advancement (NPC99I)	5.11	5.44	5.73	5.36	5.34	6.32	6.38	6.03	5.75	5.62	5.79	6.09	6.39	6.49	6.48	6.28	6.06	6.18	6.51	6.79	6.96
Larger Resource Base (NPC99K)	5.11	5.44	5.73	5.36	5.34	6.29	6.29	5.88	5.51	5.26	5.29	5.37	5.50	5.45	5.38	5.22	5.18	5.46	5.78	5.87	5.84
Smaller Resource Base (NPC99L)	5.11	5.44	5.73	5.36	5.34	6.41	6.58	6.26	6.02	5.87	5.95	6.07	6.41	6.71	6.71	6.63	6.28	6.35	6.59	6.97	7.25
Increased Access (NPC99R)	5.11	5.44	5.73	5.36	5.34	6.32	6.37	6.00	5.69	5.55	5.64	5.85	6.08	6.13	6.06	5.92	5.73	5.65	5.74	5.89	5.98
Reduced Access (NPC99S)	5.11	5.44	5.73	5.36	5.34	6.35	6.43	6.08	5.78	5.63	5.73	5.97	6.29	6.42	6.32	6.21	5.92	5.91	6.06	6.24	6.50

NPC Sensitivity Cases

Average U.S. Prices and T&D Margins

Industrial Burner-Tip ($1998/MMBtu)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	2.87	3.49	3.49	3.14	3.22	4.10	4.13	3.81	3.57	3.49	3.68	3.90	4.11	4.22	4.23	4.11	3.93	4.03	4.23	4.51	4.65
Increased Oil Prices (NPC99D)	2.87	3.49	3.49	3.14	3.33	4.52	4.43	3.97	3.62	3.53	3.69	3.95	4.24	4.48	4.53	4.32	4.03	4.05	4.18	4.34	4.58
Decreased Oil Prices (NPC99E)	2.87	3.49	3.49	3.14	3.12	3.68	3.85	3.68	3.49	3.39	3.50	3.72	3.88	3.97	3.93	3.84	3.73	3.86	4.07	4.30	4.36
Higher GDP Growth Rate (NPC99F)	2.87	3.49	3.49	3.14	3.22	4.12	4.22	3.95	3.73	3.66	3.84	4.14	4.44	4.67	4.67	4.47	4.22	4.42	4.67	4.90	5.03
Lower GDP Growth Rate (NPC99G)	2.87	3.49	3.49	3.14	3.22	4.05	4.02	3.68	3.42	3.30	3.44	3.61	3.79	3.93	3.92	3.79	3.57	3.53	3.67	3.94	4.20
Faster Technology Advancement (NPC99H)	2.87	3.49	3.49	3.14	3.22	4.11	4.15	3.81	3.54	3.43	3.52	3.69	3.88	3.93	3.87	3.77	3.61	3.65	3.87	4.10	4.33
Slower Technology Advancement (NPC99I)	2.87	3.49	3.49	3.14	3.22	4.11	4.15	3.83	3.60	3.54	3.78	4.08	4.36	4.49	4.51	4.36	4.18	4.36	4.65	4.95	5.08
Larger Resource Base (NPC99K)	2.87	3.49	3.49	3.14	3.22	4.08	4.06	3.69	3.39	3.23	3.32	3.42	3.49	3.43	3.38	3.27	3.25	3.57	3.90	4.01	4.02
Smaller Resource Base (NPC99L)	2.87	3.49	3.49	3.14	3.22	4.20	4.35	4.07	3.87	3.79	3.93	4.09	4.39	4.71	4.76	4.66	4.40	4.55	4.77	5.08	5.32
Increased Access (NPC99R)	2.87	3.49	3.49	3.14	3.22	4.10	4.13	3.81	3.55	3.47	3.61	3.85	4.05	4.11	4.06	3.94	3.76	3.74	3.86	4.04	4.17
Reduced Access (NPC99S)	2.87	3.49	3.49	3.14	3.22	4.13	4.19	3.88	3.63	3.54	3.70	4.00	4.27	4.44	4.38	4.27	4.01	4.12	4.29	4.48	4.69

Power Gen Burner-Tip ($1998/MMBtu)	1995	1996	1997	1996	1999	2000	2001	2002	2003	2004	2006	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	2.12	2.77	2.79	2.38	2.58	3.38	3.42	3.13	2.94	2.90	3.13	3.37	3.55	3.65	3.66	3.56	3.40	3.52	3.69	3.94	4.06
Increased Oil Prices (NPC99D)	2.12	2.77	2.79	2.38	2.68	3.79	3.71	3.29	3.00	2.97	3.19	3.48	3.73	3.94	3.99	3.80	3.54	3.60	3.72	3.86	4.07
Decreased Oil Prices (NPC99E)	2.12	2.77	2.79	2.38	2.49	2.97	3.14	2.99	2.85	2.78	2.91	3.14	3.28	3.36	3.33	3.26	3.17	3.29	3.48	3.68	3.73
Higher GDP Growth Rate (NPC99F)	2.12	2.77	2.79	2.38	2.58	3.40	3.51	3.27	3.11	3.08	3.30	3.60	3.85	4.06	4.05	3.88	3.68	3.86	4.09	4.30	4.41
Lower GDP Growth Rate (NPC99G)	2.12	2.77	2.79	2.38	2.58	3.33	3.31	3.00	2.78	2.70	2.88	3.06	3.23	3.36	3.35	3.25	3.05	3.06	3.20	3.43	3.67
Faster Technology Advancement (NPC99H)	2.12	2.77	2.79	2.38	2.58	3.39	3.43	3.13	2.91	2.84	2.98	3.15	3.33	3.38	3.34	3.25	3.11	3.16	3.36	3.57	3.77
Slower Technology Advancement (NPC99I)	2.12	2.77	2.79	2.38	2.58	3.39	3.44	3.15	2.97	2.94	3.21	3.53	3.76	3.89	3.91	3.78	3.63	3.81	4.07	4.33	4.42
Larger Resource Base (NPC99K)	2.12	2.77	2.79	2.38	2.58	3.36	3.35	3.02	2.78	2.67	2.80	2.92	2.98	2.92	2.87	2.76	2.76	3.09	3.41	3.51	3.51
Smaller Resource Base (NPC99L)	2.12	2.77	2.79	2.38	2.58	3.47	3.62	3.37	3.23	3.18	3.36	3.54	3.80	4.08	4.11	4.04	3.83	3.98	4.19	4.43	4.61
Increased Access (NPC99R)	2.12	2.77	2.79	2.38	2.58	3.38	3.42	3.12	2.92	2.88	3.05	3.32	3.48	3.53	3.50	3.39	3.23	3.23	3.36	3.52	3.63
Reduced Access (NPC99S)	2.12	2.77	2.79	2.38	2.58	3.41	3.47	3.19	3.00	2.94	3.13	3.44	3.69	3.84	3.78	3.70	3.48	3.61	3.76	3.92	4.08

Industry Revenues

Total Revenues ($1998 million)	1995	1998	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	78,193	91,144	93735	82,707	88,987	110,529	112,939	109,499	106,666	107,370	111,959	118,332	125,169	130,367	131,851	132,389	130,959	135,326	141,940	150,061	155,836
Increased Oil Prices (NPC99D)	78,193	91,144	93,735	82,707	91,867	120,524	121,057	114,977	109,447	109,884	114,368	122,982	132,444	140,767	143,346	141,464	137,813	140,601	145,639	153,783	162,797
Decreased Oil Prices (NPC99E)	78,193	91,144	93,735	82,707	86,170	100,594	104,884	103,847	102,327	102,585	105,514	111,055	115,632	119,458	120,404	120,818	121,108	125,326	130,257	136,495	140,367
Higher GDP Growth Rate (NPC99F)	78,193	91,144	93,735	82,707	88,987	110,989	114,848	112,583	110,954	112,338	117,580	125,906	134,435	142,010	144,527	143,656	142,144	150,453	159,033	165,209	171,055
Lower GDP Growth Rate (NPC99G)	78,193	91,144	93,735	82,707	88,987	109,573	110,618	106,289	102,491	101,657	105,498	110,470	115,997	120,676	121,294	120,840	118,053	118,817	123,553	131,169	138,874
Faster Technology Advancement (NPC99H)	78,192	91,144	93,735	82,707	88,987	110,706	113,208	109,456	106,127	106,211	108,987	115,002	121,367	125,321	125,758	125,759	124,927	126,379	135,879	143,758	151,630
Slower Technology Advancement (NPC99I)	78,192	91,144	93,735	82,707	88,987	110,706	113,253	109,780	107,367	108,193	113,857	121,946	129,241	134,284	136,193	135,428	134,694	140,395	148,213	155,406	161,057
Larger Resource Base (NPC99K)	78,193	91,144	93,735	82,707	88,987	110,227	111,790	107,425	103,408	101,916	105,026	109,624	114,037	116,279	116,816	115,642	117,338	127,928	137,396	142,139	144,862
Smaller Resource Base (NPC99L)	78,193	91,144	93,735	82,707	88,975	112,065	116,244	113,452	111,731	112,293	116,134	121,144	129,232	137,356	139,146	140,625	137,921	142,865	149,115	157,647	165,045
Increased Access (NPC99R)	78,191	91,141	93,732	82,705	88,977	110,606	112,980	109,390	106,362	107,008	111,102	118,039	124,386	128,470	129,500	129,314	126,323	130,398	134,901	141,705	147,259
Reduced Access (NPC99S)	78,194	91,143	93,734	82,707	88,986	111,058	113,907	110,642	107,850	108,255	112,529	120,079	127,819	133,428	133,705	134,708	132,199	136,220	141,267	147,875	155,826

Production and Gathering Revenues ($1998mm)	1995	1998	1997	1998	1999	2000	2001	2002	2003	2004	2006	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	30,386	48,039	43,900	37,237	43,640	64,518	67,151	63,202	59,527	59,162	62,774	68,401	75,489	80,708	81,441	81,767	79,563	82,644	89,340	97,923	103,848
Increased Oil Prices (NPC99D)	30,386	48,039	43,900	37,237	46,410	74,211	74,791	68,047	61,419	60,538	63,662	71,608	81,368	90,188	92,920	90,445	85,765	86,802	91,173	99,136	108,091
Decreased Oil Prices (NPC99E)	30,386	48,039	43,900	37,237	40,971	54,937	59,713	58,420	56,367	55,916	58,339	63,860	68,371	71,898	72,424	72,054	71,832	75,270	80,347	86,892	90,731
Higher GDP Growth Rate (NPC99F)	30,386	48,039	43,900	37,237	43,640	64,966	69,009	66,121	63,544	63,608	67,752	75,529	84,086	91,667	93,732	91,119	87,352	94,134	102,411	110,104	115,958
Lower GDP Growth Rate (NPC99G)	30,386	48,039	43,900	37,237	43,640	63,595	64,909	60,215	55,851	54,252	57,529	62,244	68,049	72,822	72,975	72,447	69,340	69,102	73,864	81,481	89,646
Faster Technology Advancement (NPC99H)	30,384	48,039	43,900	37,237	43,640	64,703	67,447	63,161	58,947	57,964	59,691	65,295	71,592	75,257	75,364	74,517	72801	74,936	82,807	91,030	99,213
Slower Technology Advancement (NPC99I)	30,384	48,039	43,900	37,237	43,640	64,703	67,495	63,501	60,346	60,119	64,951	72,994	80,544	85,539	87,246	85,206	83,619	88,080	96,517	104,318	110,235
Larger Resource Base (NPC99K)	30,385	48,039	43,900	37,237	43,640	64,192	65,883	60,909	55,893	53,705	55,128	58,857	62,858	65,104	65,496	63,562	64,729	75,257	86,006	90,900	92,226
Smaller Resource Base (NPC99L)	30,385	48,039	43,900	37,237	43,626	66,169	70,722	67,479	65036	64,429	67,285	71,293	79,765	88,253	88,875	90,348	86,402	90,059	96,724	106,197	114,214
Increased Access (NPC99R)	30,386	48,039	43,898	37,236	43,631	64,598	67,191	63,078	59,183	58,810	62,253	68,926	75,285	79,177	80,198	79,331	77,799	78,520	83,547	88,711	93,173
Reduced Access (NPC99S)	30,387	48,039	43,900	37,237	43,640	65,124	68,261	64,556	61,001	60,403	63,882	70,877	79,088	84,770	83,976	84,948	81,265	83,483	87,561	93,322	101,382

NPC Sensitivity Cases

Industry Revenues

Transportation Revenues ($1998 million)	1995	1998	1997	1998	1999	2008	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	15,230	14,716	17,871	13,392	14,163	13,548	13,276	13,644	14,348	15,076	16,001	16,530	15,989	15,590	16,386	16,429	17,053	18,035	17,808	17,099	16,793
Increased Oil Prices (NPC99D)	15,230	14,716	17,871	13,392	14,136	13,514	13,482	14,081	15,129	16,088	17,319	17,606	16,962	16,024	15,866	16,367	17,307	18,744	19,253	18,974	18,734
Decreased Oil Prices (NPC99E)	15,230	14,716	17,871	13,392	14,176	13,550	12,976	13,073	13,434	13,792	14,277	14,101	13,990	13,986	14,409	15,084	15,371	15,867	15,760	15,303	15,179
Higher GDP Growth Rate (NPC99F)	15,230	14,716	17,871	13,392	14,163	13,537	13,250	13,678	14,410	15,313	16,240	16,452	16,066	15,645	16,015	17,639	19,649	20,572	19,668	18,882	18,603
Lower GDP Growth Rate (NPC99G)	15,230	14,716	17,871	13,392	14,163	13,545	13,274	13,555	14,050	14,548	15,102	15,190	14,738	14,387	14,990	14,979	15,229	16,009	15,937	15,763	15,186
Faster Technology Advancement (NPC99H)	15,231	14,716	17,871	13,392	14,163	13,539	13,253	13,646	14,389	15,100	16,075	16,143	15,957	15,920	16,248	17,016	17,676	18,595	18,044	17,481	16,988
Slower Technology Advancement (NPC99I)	15,231	14,716	17,871	13,392	14,163	13,539	13,249	13,633	14,229	14,953	15,738	15,535	15,036	14,766	14,978	16,243	16,923	17,878	17,117	16,371	15,917
Larger Resource Base (NPC99K)	15,230	14,716	17,871	13,392	14,163	13,570	13,366	13,840	14,693	15,641	16,612	17,176	17,295	16,869	16,955	17,582	17,915	17,545	16,109	15,826	17,177
Smaller Resource Base (NPC99L)	15,231	14,716	17,871	13,392	14,165	13,435	13,034	13,391	14,002	14,880	15,820	16,622	15,925	15,201	16,509	16,346	17,500	18,544	17,997	16,774	15,969
Increased Access (NPC99R)	15,227	14,714	17,870	13,390	14,162	13,543	13,276	13,660	14,388	15,052	15,587	15,582	15,287	15,138	15,090	15,631	15,970	16,972	17,388	17,733	16,584
Reduced Access (NPC99S)	15,229	14,716	17,871	13,392	14,162	13,474	13,152	13,471	14,094	14,749	15,455	15,782	15,043	14,664	15,814	15,632	16,662	18,215	19,183	19,775	19,425

Distribution Revenues ($1998 million)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	31,489	26,615	30,367	30,701	29,607	30,156	30,150	30,470	30,742	31,142	31,105	31,162	31,181	31,362	31,276	31,468	31,775	32,015	31,901	31,860	31,884
Increased Oil Prices (NPC99D)	31,489	26,615	30,367	30,701	29,648	30,164	30,165	30,521	30,799	31,228	31,280	31,411	31,420	31,541	31,426	31,619	31,947	32,268	32,257	32,411	32,485
Decreased Oil Prices (NPC99E)	31,489	26,615	30,367	30,701	29,539	30,124	30,055	30,314	30,568	30,972	30,944	30,968	30,965	31,146	31,118	31,286	31,574	31,765	31,552	31,467	31,538
Higher GDP Growth Rate (NPC99F)	31,489	26,615	30,367	30,701	29,607	30,161	30,158	30,498	30,812	31,282	31,325	31,408	31,426	31,578	31,574	31,871	32,321	32,632	32,548	32,586	32,698
Lower GDP Growth Rate (NPC99G)	31,489	26,615	30,367	30,701	29,607	30,161	30,152	30,438	30,661	31,019	30,949	30,984	30,936	31,014	30,861	30,970	31,211	31,483	31,350	31,278	31,181
Faster Technology Advancement (NPC99H)	31,489	26,615	30,367	30,701	29,607	30,148	30,135	30,467	30,761	31,194	31,241	31,381	31,425	31,675	31,680	31,863	32,191	32,509	32,406	32,402	32,366
Slower Technology Advancement (NPC99I)	31,489	26,615	30,367	30,701	29,607	30,148	30,134	30,452	30,713	31,098	31,016	31,015	30,947	31,068	30,965	31,126	31,431	31,606	31,406	31,291	31,326
Larger Resource Base (NPC99K)	31,489	26,615	30,367	30,701	29,607	30,168	30,200	30,573	30,901	31,383	31,457	31,659	31,826	32,219	32,260	32,474	32,674	32,818	32,582	32,587	32,643
Smaller Resource Base (NPC99L)	31,489	26,615	30,367	30,701	29,608	30,087	29,989	30,240	30,434	30,800	30,778	30,870	30,831	30,859	30,697	30,841	31,163	31,335	31,190	31,117	31,073
Increased Access (NPC99R)	31,489	26,615	30,367	30,701	29,608	30,153	30,147	30,473	30,754	31,166	31,183	31,240	31,259	31,476	31,466	31,657	31,980	32,334	32,288	32,371	32,449
Reduced Access (NPC99S)	31,490	26,615	30,367	30,701	29,607	30,136	30,105	30,408	30,677	31,086	31,074	31,080	31,033	31,150	31,088	31,278	31,630	31,856	31,754	31,788	31,795

Pipeline Fuel Revenues ($1998 million)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	1,088	1,774	1,596	1,378	1,576	2,307	2,363	2,183	2,049	1,990	2,078	2,239	2,510	2,707	2,748	2,725	2,568	2,631	2,891	3,178	3,311
Increased Oil Prices (NPC99D)	1,088	1,774	1,596	1,378	1,673	2,635	2,599	2,328	2,100	2,030	2,107	2,357	2,695	3,014	3,134	3,034	2,794	2,786	2,956	3,262	3,485
Decreased Oil Prices (NPC99E)	1,088	1,774	1,596	1,378	1,484	1,982	2,141	2,039	1,959	1,904	1,954	2,126	2,306	2,429	2,453	2,395	2,331	2,424	2,598	2,833	2,919
Higher GDP Growth Rate (NPC99F)	1,088	1,774	1,596	1,378	1,576	2,324	2,431	2,287	2,188	2,135	2,263	2,517	2,855	3,120	3,207	3,028	2,822	3,115	3,406	3,637	3,796
Lower GDP Growth Rate (NPC99G)	1,088	1,774	1,596	1,378	1,576	2,272	2,283	2,082	1,928	1,838	1,918	2,052	2,274	2,454	2,468	2,444	2,273	2,223	2,403	2,646	2,861
Faster Technology Advancement (NPC99H)	1,088	1,774	1,596	1,378	1,576	2,316	2,373	2,182	2,030	1,953	1,980	2,183	2,393	2,469	2,446	2,363	2,259	2,338	2,622	2,845	3,063
Slower Technology Advancement (NPC99I)	1,088	1,774	1,596	1,378	1,576	2,316	2,374	2,193	2,079	2,024	2,153	2,403	2,714	2,911	3,004	2,853	2,720	2,831	3,173	3,426	3,579
Larger Resource Base (NPC99K)	1,088	1,774	1,596	1,378	1,576	2,297	2,321	2,102	1,920	1,787	1,829	1,932	2,059	2,086	2,106	2,024	2,021	2,313	2,700	2,826	2,816
Smaller Resource Base (NPC99L)	1,088	1,774	1,596	1,378	1,576	2,374	2,498	2,340	2,259	2,185	2,251	2,360	2,713	3,042	3,065	3,089	2,856	2,928	3,204	3,558	3,789
Increased Access (NPC99R)	1,088	1,774	1,596	1,378	1,576	2,312	2,365	2,179	2,037	1,980	2,079	2,291	2,554	2,680	2,745	2,695	2,574	2,572	2,678	2,890	2,953
Reduced Access (NPC99S)	1,088	1,774	1,596	1,378	1,576	2,324	2,388	2,207	2,077	2,016	2,119	2,340	2,655	2,844	2,827	2,850	2,643	2,666	2,769	2,990	3,225

Lower-48 Pipeline & Storage Statistics

Interregional Pipeline Capacity (BCF/D)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-	-	122.90	129.11	130.22	133.10	133.30	134.62	136.37	138.47	139.80	142.43	143.90	145.38	146.55	148.08	148.58	149.93	151.23	152.38	152.38
Increased Oil Prices (NPC99D)	-	-	122.90	129.11	130.22	133.10	133.30	134.62	136.37	139.27	141.10	144.09	145.56	147.10	148.63	150.16	150.76	152.76	154.56	155.66	155.66
Decreased Oil Prices (NPC99E)	-	-	122.90	129.11	130.22	133.10	133.30	134.44	135.84	137.84	139.16	141.23	142.50	143.74	144.73	146.18	146.63	147.75	148.35	149.26	149.26
Higher GDP Growth Rate (NPC99F)	-	-	122.90	129.11	130.22	133.10	133.30	134.82	136.57	139.37	140.80	143.73	145.60	146.38	147.55	149.33	150.83	152.73	153.43	154.48	154.48
Lower GDP Growth Rate (NPC99G)	-	-	122.90	129.11	130.22	133.10	133.30	134.62	135.97	137.57	138.90	141.35	142.23	143.33	144.43	145.88	146.28	147.38	147.68	148.78	148.78
Faster Technology Advancement (NPC99H)	-	-	122.90	129.11	130.22	133.10	133.30	134.85	136.80	139.54	141.56	144.52	146.00	147.00	147.91	149.33	149.93	151.30	151.80	152.87	152.87
Slower Technology Advancement (NPC99I)	-	-	122.90	129.11	130.22	133.10	133.25	134.50	135.95	137.61	138.93	141.38	142.65	143.70	144.80	146.33	146.48	147.76	148.96	150.04	150.04
Larger Resource Base (NPC99K)	-	-	122.90	129.11	130.20	133.10	133.30	134.70	136.50	138.60	140.30	143.10	145.50	147.20	148.40	150.00	150.60	151.80	152.60	153.50	153.50
Smaller Resource Base (NPC99L)	-	-	122.90	129.11	130.20	133.10	133.20	134.40	135.90	138.00	139.30	141.70	142.90	143.90	144.90	146.40	146.50	154.70	148.10	149.20	149.20
Increased Access (NPC99R)	-	-	122.90	129.10	130.20	133.10	133.30	134.60	136.40	139.20	140.70	144.10	145.80	147.30	148.50	150.00	151.00	152.50	153.80	155.00	155.00
Reduced Access (NPC99S)	-	-	122.90	129.10	130.20	133.10	133.30	134.60	136.40	138.50	139.80	142.40	143.90	145.10	146.00	147.50	148.00	148.90	150.20	151.20	151.20

NPC Sensitivity Cases

Lower-48 Pipeline & Storage Statistics

Interregional Pipeline Flows (BCF/D)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-	-	80.10	77.21	77.87	81.32	81.45	86.29	91.51	93.61	93.94	95.85	96.27	97.84	99.95	102.32	102.82	103.60	103.14	102.70	101.94
Increased Oil Prices (NPC99D)	-	-	80.10	77.21	78.13	81.32	81.71	87.24	92.73	95.40	96.65	98.12	97.96	99.44	101.96	103.61	104.47	106.47	106.33	107.09	106.47
Decreased Oil Prices (NPC99E)	-	-	80.10	77.21	77.48	81.46	80.51	84.16	88.84	91.53	92.40	93.07	93.06	94.58	97.26	98.67	98.98	99.14	97.61	97.17	97.62
Higher GDP Growth Rate (NPC99F)	-	-	80.10	77.21	77.87	81.32	81.45	86.69	92.05	95.33	96.17	97.88	97.85	98.07	101.52	104.23	106.18	107.67	105.71	104.89	104.43
Lower GDP Growth Rate (NPC99G)	-	-	80.10	77.21	77.87	81.19	81.31	85.89	90.29	92.31	92.92	94.42	94.30	95.31	97.49	99.20	99.47	101.25	100.42	100.28	99.09
Faster Technology Advancement (NPC99H)	-	-	80.10	77.21	77.87	81.32	81.18	86.44	91.93	94.61	95.84	98.56	98.55	99.81	102.35	104.38	105.85	108.18	107.48	107.47	106.86
Slower Technology Advancement (NPC99I)	-	-	80.10	77.21	77.87	81.32	81.15	86.08	90.95	92.89	93.22	94.44	94.15	95.42	97.89	99.94	100.19	100.62	99.06	97.68	97.23
Larger Resource Base (NPC99K)	-	-	80.10	77.21	77.86	81.59	81.85	87.42	92.82	95.50	97.23	100.03	101.85	102.89	105.81	107.85	108.58	108.39	106.97	108.06	110.37
Smaller Resource Base (NPC99L)	-	-	80.10	77.21	77.86	80.92	80.19	84.94	89.83	92.05	93.05	95.65	95.46	95.41	96.94	98.53	99.03	105.04	99.23	98.92	98.02
Increased Access (NPC99R)	-	-	80.10	77.20	77.86	81.32	81.31	86.28	91.52	94.10	95.11	96.55	96.37	97.81	100.53	102.30	102.98	104.46	103.82	104.32	104.16
Reduced Access (NPC99S)	-	-	80.10	77.20	77.86	81.19	80.91	85.61	90.98	93.21	93.95	95.41	95.26	95.91	98.84	101.33	102.12	102.74	102.74	102.97	102.06

Interregional Pipeline Load Factor (%)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-	-	65.2%	59.8%	59.8%	61.1%	61.1%	64.1%	67.1%	67.6%	67.2%	67.3%	66.9%	67.3%	68.2%	69.1%	69.2%	69.1%	68.2%	67.4%	66.9%
Increased Oil Prices (NPC99D)	-	-	65.2%	59.8%	60.0%	61.1%	61.3%	64.8%	68.0%	68.5%	68.5%	68.1%	67.3%	67.6%	68.6%	69.0%	69.3%	69.7%	68.8%	68.8%	68.4%
Decreased Oil Prices (NPC99E)	-	-	65.2%	59.8%	59.5%	61.2%	60.4%	62.6%	65.4%	66.4%	66.4%	65.9%	65.3%	65.8%	67.2%	67.5%	67.5%	67.1%	65.8%	65.1%	65.4%
Higher GDP Growth Rate (NPC99F)	-	-	65.2%	59.8%	59.8%	61.1%	61.1%	64.3%	67.4%	68.4%	68.3%	68.1%	67.2%	67.0%	68.8%	69.8%	70.4%	70.5%	68.9%	67.9%	67.6%
Lower GDP Growth Rate (NPC99G)	-	-	65.2%	59.8%	59.8%	61.0%	61.0%	63.8%	66.4%	67.1%	66.9%	66.8%	66.3%	66.5%	67.5%	68.0%	68.0%	68.7%	68.0%	67.4%	66.6%
Faster Technology Advancement (NPC99H)	-	-	65.2%	59.8%	59.8%	61.1%	60.9%	64.1%	67.2%	67.8%	67.7%	68.2%	67.5%	67.9%	69.2%	69.9%	70.6%	71.5%	70.8%	70.3%	69.9%
Slower Technology Advancement (NPC99I)	-	-	65.2%	59.8%	59.8%	61.1%	60.9%	64.0%	66.9%	67.5%	67.1%	66.8%	66.0%	66.4%	67.6%	68.3%	68.4%	68.1%	66.5%	65.1%	64.8%
Larger Resource Base (NPC99K)	-	-	65.2%	59.8%	59.8%	61.3%	61.4%	64.9%	68.0%	68.9%	69.3%	69.9%	70.0%	69.9%	71.3%	71.9%	72.1%	71.4%	70.1%	70.4%	71.9%
Smaller Resource Base (NPC99L)	-	-	65.2%	59.8%	59.8%	60.8%	60.2%	63.2%	66.1%	66.7%	66.8%	67.5%	66.8%	66.3%	66.9%	67.3%	67.6%	67.9%	67.0%	66.3%	65.7%
Increased Access (NPC99R)	-	-	65.2%	59.8%	59.8%	61.1%	61.0%	64.1%	67.1%	67.6%	67.6%	67.0%	66.1%	66.4%	67.7%	68.2%	68.2%	68.5%	67.5%	67.3%	67.2%
Reduced Access (NPC99S)	-	-	65.2%	59.8%	59.8%	61.0%	60.7%	63.6%	66.7%	67.3%	67.2%	67.0%	66.2%	66.1%	67.7%	68.7%	69.0%	69.0%	68.4%	68.1%	67.5%

Storage Working Gas Capacity (BCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,897	3,921	3,970	4,038	4,093	4,151	4,210	4,255	4,372	4,462	4,565	4,565
Increased Oil Prices (NPC99D)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,867	3,900	3,930	3,996	4,093	4,169	4,255	4,335	4,386	4,566	4,636	4,816	4,816
Decreased Oil Prices (NPC99E)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,847	3,871	3,901	3,929	3,976	4,034	4,081	4,138	4,188	4,222	4,301	4,341	4,399	4,399
Higher GDP Growth Rate (NPC99F)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,869	3,904	3,932	3,986	4,062	4,122	4,187	4,253	4,313	4,449	4,559	4,675	4,675
Lower GDP Growth Rate (NPC99G)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,892	3,917	3,960	4,026	4,073	4,129	4,180	4,216	4,316	4,366	4,455	4,455
Faster Technology Advancement (NPC99H)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,894	3,918	3,964	4,032	4,084	4,142	4,198	4,243	4,354	4,424	4,523	4,523
Slower Technology Advancement (NPC99I)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,897	3,921	3,970	4,038	4,093	4,151	4,210	4,255	4,372	4,462	4,565	4,565
Larger Resource Base (NPC99K)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,898	3,924	3,974	4,045	4,099	4,159	4,220	4,277	4,409	4,513	4,618	4,618
Smaller Resource Base (NPC99L)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,897	3,921	3,970	4,038	4,093	4,151	4,212	4,276	4,431	4,556	4,700	4,700
Increased Access (NPC99R)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,897	3,921	3,970	4,038	4,093	4,151	4,210	4,255	4,372	4,462	4,565	4,565
Reduced Access (NPC99S)	3,667	3,669	3,754	3,779	3,797	3,810	3,823	3,844	3,866	3,897	3,921	3,970	4,038	4,093	4,151	4,210	4,255	4,372	4,462	4,565	4,565

Canadian Pipeline & Storage Statistics

Export Pipeline Capacity (BCF/D)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	15.20	15.50	15.60	16.10	16.40	16.50	16.60	17.30	17.30	17.30	17.40	17.80
Increased Oil Prices (NPC99D)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	15.20	15.50	15.60	16.10	16.40	16.50	16.60	17.30	17.30	17.40	17.90	18.30
Decreased Oil Prices (NPC99E)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	14.90	15.20	15.30	15.50	15.70	15.80	15.90	16.60	16.60	16.60	16.70	17.10
Higher GDP Growth Rate (NPC99F)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	15.20	15.50	16.60	16.10	16.40	16.50	16.60	17.30	17.30	17.40	17.90	18.30
Lower GDP Growth Rate (NPC99G)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	14.90	15.20	15.30	15.80	15.80	15.80	15.90	16.60	16.60	16.60	16.70	17.10
Faster Technology Advancement (NPC99H)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	15.20	15.50	15.60	16.20	16.90	16.90	17.00	17.70	17.70	17.70	17.80	18.20
Slower Technology Advancement (NPC99I)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	14.90	15.20	15.30	15.80	15.90	16.00	16.10	16.80	16.80	16.80	16.90	17.30
Larger Resource Base (NPC99K)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.30	15.30	15.60	15.70	16.40	17.50	17.60	17.70	18.40	18.40	18.50	19.10	19.10
Smaller Resource Base (NPC99L)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	14.10	15.20	15.30	15.80	16.10	16.20	16.30	17.00	17.00	17.00	17.10	17.50
Increased Access (NPC99R)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	15.20	15.50	15.60	16.10	16.40	16.50	16.60	17.30	17.30	17.30	17.40	17.80
Reduced Access (NPC99S)	10.40	10.40	10.40	10.80	12.00	12.30	14.10	14.10	14.20	15.20	15.50	15.60	16.10	16.40	16.50	16.60	17.30	17.30	17.30	17.40	17.80

NPC Sensitivity Cases

Canadian Pipeline & Storage Statistics

Export Pipeline Flows (BCF/D)	1994	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	8.60	8.60	8.60	8.50	9.50	9.77	10.30	10.70	11.10	11.80	12.14	12.30	12.70	12.60	12.40	12.40	13.30	13.70	13.50	13.60	13.50
Increased Oil Prices (NPC99D)	8.60	8.60	8.60	8.50	9.50	9.80	10.40	10.80	11.30	12.00	12.30	12.50	13.00	12.60	12.20	12.30	13.20	13.40	13.30	14.10	14.40
Decreased Oil Prices (NPC99E)	8.60	8.60	8.60	8.50	9.50	9.60	10.20	10.50	10.80	11.40	11.70	11.90	12.10	12.00	11.90	12.00	12.90	13.30	13.10	12.90	12.70
Higher GDP Growth Rate (NPC99F)	8.60	8.60	8.60	8.50	9.50	9.80	10.30	10.70	11.10	11.80	12.20	12.40	12.80	12.70	12.50	12.70	13.80	13.90	13.80	13.90	13.80
Lower GDP Growth Rate (NPC99G)	8.60	8.60	8.60	8.50	9.50	9.80	10.30	10.70	11.14	11.70	12.10	12.30	12.40	12.30	12.10	12.00	13.00	13.40	13.30	13.30	13.20
Faster Technology Advancement (NPC99H)	8.60	8.60	8.60	8.50	9.50	9.80	10.30	10.70	11.10	11.80	12.20	12.50	12.90	13.00	12.80	12.80	13.80	14.00	14.00	14.10	13.80
Slower Technology Advancement (NPC99I)	8.60	8.60	8.60	8.50	9.50	9.80	10.30	10.70	11.00	11.70	12.00	12.20	12.30	12.10	11.80	11.90	13.00	13.50	13.30	13.30	13.20
Larger Resource Base (NPC99K)	8.60	8.60	8.60	8.50	9.50	9.80	10.40	10.80	11.30	12.10	12.50	12.70	13.20	13.70	13.60	13.50	13.50	13.70	13.80	14.10	14.10
Smaller Resource Base (NPC99L)	8.60	8.60	8.60	8.50	9.50	9.80	10.30	10.60	10.90	11.60	12.00	12.30	12.60	12.50	12.30	12.50	13.50	13.30	12.80	12.60	12.20
Increased Access (NPC99R)	8.60	8.60	8.60	8.50	9.50	9.80	10.30	10.70	11.10	11.80	12.10	12.40	12.80	12.60	12.40	12.30	13.30	13.70	13.50	13.50	13.40
Reduced Access (NPC99S)	8.60	8.60	8.60	8.50	9.50	9.80	10.30	10.70	11.10	11.80	12.20	12.40	12.80	12.70	12.50	12.70	13.80	13.90	13.70	13.70	13.50

Export Pipeline Load Factor (BCF/D)	1994	1996	2008	2010	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015	2015
Reference Case (NPC99)	82.7%	82.7%	82.7%	78.7%	79.2%	79.4%	73.0%	75.9%	78.2%	77.6%	78.3%	78.8%	78.9%	76.8%	75.2%	74.7%	76.9%	79.2%	78.0%	78.2%	75.8%
Increased Oil Prices (NPC99D)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.8%	76.6%	79.6%	78.9%	79.4%	80.1%	80.7%	76.8%	73.9%	74.1%	76.3%	77.5%	76.4%	78.8%	78.7%
Decreased Oil Prices (NPC99E)	82.7%	82.7%	82.7%	78.7%	79.2%	78.0%	72.3%	74.5%	76.1%	76.5%	77.0%	77.8%	78.1%	76.4%	75.3%	75.5%	77.7%	80.1%	78.9%	77.2%	74.3%
Higher GDP Growth Rate (NPC99F)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.0%	75.9%	78.2%	77.6%	78.7%	74.7%	79.5%	77.4%	75.8%	76.5%	79.8%	80.3%	79.3%	77.7%	75.4%
Lower GDP Growth Rate (NPC99G)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.0%	75.9%	78.5%	78.5%	79.6%	80.4%	78.5%	77.8%	76.6%	75.5%	78.3%	80.7%	80.1%	79.6%	77.2%
Faster Technology Advancement (NPC99H)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.0%	75.9%	78.2%	77.6%	78.7%	80.1%	79.6%	76.9%	75.7%	75.3%	78.0%	79.1%	79.1%	79.2%	75.8%
Slower Technology Advancement (NPC99I)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.0%	75.9%	77.5%	78.5%	78.9%	79.7%	77.8%	76.1%	73.8%	73.9%	77.4%	80.4%	79.2%	78.7%	76.3%
Larger Resource Base (NPC99K)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.8%	76.6%	79.0%	79.1%	80.1%	80.9%	80.5%	78.3%	77.3%	76.3%	73.4%	74.5%	74.6%	73.8%	73.8%
Smaller Resource Base (NPC99L)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.0%	75.2%	76.8%	82.3%	78.9%	80.4%	79.7%	77.6%	75.9%	76.7%	79.4%	78.2%	75.3%	73.7%	69.7%
Increased Access (NPC99R)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.0%	75.9%	78.2%	77.6%	78.1%	79.5%	79.5%	76.8%	75.2%	74.1%	76.9%	79.2%	78.0%	77.6%	75.3%
Reduced Access (NPC99S)	82.7%	82.7%	82.7%	78.7%	79.2%	79.7%	73.0%	75.9%	78.2%	77.6%	78.7%	79.5%	79.5%	77.4%	75.8%	76.5%	79.8%	80.3%	79.2%	78.7%	75.8%

Storage Working Gas Capacity (BCF)	1995	1998	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.04	529.29	535.54	541.79	548.04	554.29	560.54	566.79	566.79	566.79	596.79	596.79	596.79
Increased Oil Prices (NPC99D)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.04	529.29	536.79	544.29	551.79	559.29	566.79	574.29	574.29	574.29	609.29	609.29	609.29
Decreased Oil Prices (NPC99E)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	522.23	527.67	533.11	538.55	543.99	549.43	554.87	560.31	560.31	560.31	590.64	590.64	590.64
Higher GDP Growth Rate (NPC99F)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.87	530.95	538.03	545.11	552.19	560.73	569.27	577.81	577.81	587.81	626.98	626.98	626.98
Lower GDP Growth Rate (NPC99G)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	520.54	524.29	528.04	531.79	535.54	539.29	543.04	546.79	546.79	546.79	571.79	571.79	571.79
Faster Technology Advancement (NPC99H)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	521.79	526.79	531.79	536.79	540.12	543.45	546.78	550.11	550.11	550.11	574.11	574.11	574.11
Slower Technology Advancement (NPC99I)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.04	529.29	535.54	541.79	548.04	554.29	560.54	566.79	566.79	566.79	596.79	596.79	596.79
Larger Resource Base (NPC99K)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.04	529.29	535.54	541.79	548.04	554.29	560.54	566.79	566.79	566.79	596.79	596.79	596.79
Smaller Resource Base (NPC99L)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.04	529.29	535.54	541.79	548.04	554.29	560.54	566.79	566.79	566.79	608.39	608.39	608.39
Increased Access (NPC99R)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.04	529.29	535.54	541.79	548.04	554.29	560.54	566.79	566.79	566.79	596.79	596.79	596.79
Reduced Access (NPC99S)	484.00	508.60	508.60	516.79	516.79	516.79	516.79	516.79	523.04	529.29	535.54	541.79	548.04	554.29	560.54	566.79	566.79	566.79	596.79	596.79	596.79

North American Seasonal Demand Summary (BCF/D)

January Demand	1994	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	87.92	95.79	95.28	85.81	94.58	98.12	99.67	102.99	106.56	109.01	109.55	110.56	111.51	113.48	115.38	118.52	121.96	123.58	125.00	125.67	126.58
Increased Oil Prices (NPC99D)	87.92	95.79	95.28	85.81	94.58	98.11	100.23	104.02	107.94	110.54	111.63	112.87	113.89	115.60	117.58	121.23	125.17	127.74	130.38	132.34	134.01
Decreased Oil Prices (NPC99E)	87.92	95.79	95.28	85.81	94.58	98.12	98.69	101.26	104.50	107.15	107.99	108.46	109.06	110.63	112.84	115.37	118.47	119.36	119.33	119.47	121.09
Higher GDP Growth Rate (NPC99F)	87.92	95.79	95.28	85.81	94.58	98.12	99.66	102.96	106.63	109.60	110.73	111.47	112.32	113.95	116.34	120.36	124.69	126.56	127.79	128.35	128.82
Lower GDP Growth Rate (NPC99G)	87.92	95.79	95.28	85.81	94.58	98.12	99.66	102.88	106.25	108.75	109.10	109.90	110.31	111.62	113.06	116.02	119.32	121.50	122.85	123.06	123.63
Faster Technology Advancement (NPC99H)	87.92	95.79	95.28	85.81	94.58	98.06	99.57	103.00	106.73	109.61	110.67	112.03	113.05	115.37	117.92	120.72	124.66	127.03	128.60	129.34	130.49
Slower Technology Advancement (NPC99I)	87.92	95.79	95.28	85.81	94.58	98.06	99.56	102.85	106.31	108.63	108.85	109.31	109.76	111.42	113.23	116.24	119.54	120.35	120.83	120.52	121.11
Larger Resource Base (NPC99K)	87.92	95.79	95.28	85.81	94.58	98.23	100.06	103.88	107.99	111.00	112.27	114.31	116.23	120.05	122.63	125.56	128.46	128.86	129.43	131.24	133.94
Smaller Resource Base (NPC99L)	87.92	95.79	95.28	85.81	94.58	97.58	98.52	101.29	104.20	106.55	107.62	108.94	109.28	109.93	110.93	113.60	117.41	118.48	119.74	119.31	118.91
Increased Access (NPC99R)	87.92	95.79	95.28	85.82	94.59	98.10	99.66	103.04	106.66	109.26	110.38	111.16	112.12	114.24	116.97	119.96	123.41	125.88	128.18	129.78	131.53
Reduced Access (NPC99S)	87.92	95.79	95.28	85.81	94.58	97.97	99.37	102.55	106.10	108.62	109.46	109.82	110.45	111.87	114.01	117.17	120.86	122.55	123.77	125.38	125.89

NPC Sensitivity Cases

North American Seasonal Demand Summary (BCF/D)

August Demand	1995	1996	1997	1998	1998	2006	2001	2002	2003	2004	2006	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	55.65	52.51	54.03	54.85	57.82	57.68	59.25	62.42	65.38	67.06	66.93	67.41	68.85	70.55	72.24	75.01	77.75	78.25	78.84	79.87	81.63
Increased Oil Prices (NPC99D)	55.65	52.51	54.03	54.85	58.22	57.87	59.93	63.52	66.71	68.30	68.73	69.40	70.71	72.19	73.94	76.67	79.72	80.93	82.21	84.60	86.83
Decreased Oil Prices (NPC99E)	55.65	52.51	54.03	54.85	57.03	57.56	58.26	60.66	63.38	65.44	65.82	65.65	66.28	67.60	69.68	71.24	74.69	74.79	74.41	74.43	75.96
Higher GDP Growth Rate (NPC99F)	55.65	52.51	54.03	54.85	57.82	57.76	59.33	62.61	65.74	67.82	68.40	68.77	69.82	71.05	73.18	76.46	79.76	81.39	81.79	81.44	83.34
Lower GDP Growth Rate (NPC99G)	55.65	52.51	54.03	54.85	57.82	57.65	59.16	62.13	64.96	66.48	66.34	66.60	67.49	68.42	69.94	72.04	74.81	75.74	76.54	77.23	78.18
Faster Technology Advancement (NPC99H)	55.65	52.51	54.03	54.85	57.82	57.62	59.17	62.43	65.61	67.51	67.96	69.08	70.20	72.16	74.48	76.70	79.70	81.15	82.45	83.57	84.62
Slower Technology Advancement (NPC99I)	55.65	52.51	54.03	54.85	57.82	57.62	59.14	62.29	65.13	66.81	66.44	66.79	67.34	68.44	70.21	72.68	75.87	75.76	75.62	75.61	76.52
Larger Resource Base (NPC99K)	55.65	52.51	54.03	54.85	57.82	57.77	59.61	63.21	66.45	68.40	69.17	70.52	72.39	75.30	77.92	80.26	82.36	82.17	82.50	84.06	86.55
Smaller Resource Base (NPC99L)	55.64	52.51	54.03	54.85	57.81	57.25	58.24	60.92	63.33	65.20	65.48	66.31	66.65	66.99	68.24	70.62	73.71	74.21	74.22	73.88	74.49
Increased Access (NPC99R)	55.65	52.51	54.03	54.85	57.82	57.67	59.24	62.46	65.50	67.23	67.63	67.88	69.49	71.35	73.66	76.11	79.05	80.62	81.76	83.54	85.36
Reduced Access (NPC99S)	55.67	52.51	54.03	54.85	57.82	57.55	58.94	62.00	64.97	66.95	67.25	67.25	67.99	69.11	71.21	73.81	77.21	77.46	78.08	79.12	80.93

Jan/Aug Demand	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2006	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	158.0%	182.4%	176.3%	156.5%	163.6%	170.1%	168.2%	165.0%	163.0%	162.6%	163.7%	164.0%	162.0%	160.8%	159.7%	158.0%	156.9%	157.9%	158.5%	157.4%	155.1%
Increased Oil Prices (NPC99D)	158.0%	182.4%	176.3%	156.5%	162.4%	169.5%	167.2%	163.8%	161.8%	161.9%	162.4%	162.6%	161.1%	160.1%	159.0%	158.1%	157.0%	157.8%	158.6%	156.4%	154.3%
Decreased Oil Prices (NPC99E)	158.0%	182.4%	176.3%	156.5%	165.8%	170.5%	169.4%	166.9%	164.9%	163.8%	164.1%	165.2%	164.6%	163.6%	161.9%	161.9%	158.6%	159.6%	160.4%	160.5%	159.4%
Higher GDP Growth Rate (NPC99F)	158.0%	182.4%	176.3%	156.5%	163.6%	169.9%	168.0%	164.5%	162.2%	161.6%	161.9%	162.1%	160.9%	160.4%	159.0%	157.4%	156.3%	155.5%	156.2%	157.6%	154.6%
Lower GDP Growth Rate (NPC99G)	158.0%	182.4%	176.3%	156.5%	163.6%	170.2%	168.4%	165.6%	163.6%	163.6%	164.4%	165.0%	163.4%	163.1%	161.6%	161.1%	159.5%	160.4%	160.5%	159.3%	158.1%
Faster Technology Advancement (NPC99H)	158.0%	182.4%	176.3%	156.5%	163.6%	170.2%	168.3%	165.0%	162.7%	162.3%	162.8%	162.2%	161.0%	159.9%	158.3%	157.4%	156.4%	156.5%	156.0%	154.8%	154.2%
Slower Technology Advancement (NPC99I)	158.0%	182.4%	176.3%	156.5%	163.6%	170.2%	168.3%	165.1%	163.2%	162.6%	163.8%	163.7%	163.0%	162.8%	161.3%	159.9%	157.5%	158.9%	159.8%	159.4%	158.3%
Larger Resource Base (NPC99K)	158.0%	182.4%	176.3%	156.5%	163.6%	170.0%	167.8%	164.4%	162.5%	162.3%	162.3%	162.1%	160.6%	159.4%	157.4%	156.4%	156.0%	156.8%	156.9%	156.1%	154.8%
Smaller Resource Base (NPC99L)	158.0%	182.4%	176.3%	156.5%	163.6%	170.4%	169.2%	166.3%	164.5%	163.4%	164.4%	164.3%	164.0%	164.1%	162.6%	160.9%	159.3%	159.6%	161.3%	161.5%	159.6%
Increased Access (NPC99R)	158.0%	182.4%	176.3%	156.4%	163.6%	170.1%	168.2%	165.0%	162.9%	162.5%	163.2%	163.8%	161.4%	160.1%	158.8%	157.6%	156.1%	156.1%	156.8%	155.3%	154.1%
Reduced Access (NPC99S)	157.9%	182.4%	176.3%	156.5%	163.6%	170.2%	168.6%	165.4%	163.3%	162.2%	162.8%	163.3%	162.5%	161.9%	160.1%	158.7%	156.5%	158.2%	158.5%	158.5%	155.5%

Cumulative Capital Cost of Lower-48 Pipeline & Storage Infrastructure Added Between 1999 and 2015 ($1998 billion)	1998	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-	2.70	7.10	8.70	10.40	12.40	13.90	15.50	19.50	21.90	24.60	26.90	29.10	30.50	33.30	35.70	37.90	38.70
Increased Oil Prices (NPC99D)	-	2.70	7.10	8.70	10.50	12.50	14.10	16.10	20.70	23.30	26.20	29.20	31.50	33.50	36.90	40.40	42.70	43.60
Decreased Oil Prices (NPC99E)	-	2.70	7.10	8.60	10.10	11.80	13.30	14.90	17.90	20.00	22.50	24.50	26.60	27.80	30.20	31.70	33.00	33.80
Higher GDP Growth Rate (NPC99F)	-	2.70	7.10	8.80	10.60	12.70	14.90	16.60	20.90	23.90	26.00	28.70	31.40	33.80	37.80	40.60	42.80	43.70
Lower GDP Growth Rate (NPC99G)	-	2.70	7.00	8.40	10.00	11.60	12.90	14.40	18.10	19.70	21.60	23.70	25.80	27.00	29.40	30.80	32.80	33.60
Faster Technology Advancement (NPC99H)	-	2.70	7.10	8.60	10.50	12.50	14.50	16.40	20.20	22.60	24.70	26.70	28.70	30.10	33.10	34.60	36.50	37.30
Slower Technology Advancement (NPC99I)	-	2.70	7.10	8.60	10.30	12.00	13.50	15.00	18.90	21.20	23.70	26.00	28.10	29.20	31.90	34.00	36.00	36.90
Larger Resource Base (NPC99K)	-	2.70	7.10	8.70	10.50	12.40	14.00	15.70	19.90	22.60	25.20	27.60	29.60	30.90	33.50	35.30	36.90	37.80
Smaller Resource Base (NPC99L)	-	2.70	7.00	8.50	10.10	11.80	13.30	14.90	18.70	21.00	23.40	25.50	27.70	29.00	31.40	33.50	35.80	36.60
Increased Access (NPC99R)	-	2.70	7.10	8.70	10.40	12.40	14.60	16.20	20.70	23.10	26.10	28.30	30.70	32.50	35.50	38.00	40.20	41.00
Reduced Access (NPC99S)	-	2.70	7.10	8.60	10.40	12.30	13.90	15.40	19.30	21.70	24.00	25.90	28.10	29.50	31.90	34.30	36.30	37.10

Cumulative Capital Cost of Lower-48 Pipeline & Storage Infrastructure Added Between 1999 and 2015 ($1998 billion)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.20	5.10	6.30	6.70	9.20	9.90	10.00	10.10	10.30	10.70	10.80
Increased Oil Prices (NPC99D)	-	1.00	2.50	2.60	2.60	3.70	3.90	4.20	5.10	6.30	6.80	9.30	9.90	10.00	10.10	10.60	11.20	11.20
Decreased Oil Prices (NPC99E)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.20	4.80	5.90	6.30	8.80	9.50	9.60	9.70	9.80	10.30	10.90
Higher GDP Growth Rate (NPC99F)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.30	5.10	6.30	6.80	9.30	10.00	10.10	10.20	10.70	11.20	11.30
Lower GDP Growth Rate (NPC99G)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.10	4.90	5.70	5.90	8.40	9.00	9.10	9.20	9.40	9.80	9.90
Faster Technology Advancement (NPC99H)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.20	5.10	6.70	7.00	9.50	10.10	10.20	10.30	10.50	11.00	11.00
Slower Technology Advancement (NPC99I)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.20	5.10	6.00	6.40	8.90	9.60	9.70	9.80	10.00	10.40	10.50
Larger Resource Base (NPC99K)	-	0.90	2.50	2.60	2.70	3.70	3.90	4.30	5.10	7.00	7.50	10.00	10.60	10.70	10.70	10.90	11.60	11.60
Smaller Resource Base (NPC99L)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.20	5.10	6.30	6.70	9.20	9.90	10.00	10.10	10.30	10.70	10.80
Increased Access (NPC99R)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.20	5.10	6.30	6.70	9.20	9.90	10.00	10.10	10.30	10.70	10.80
Reduced Access (NPC99S)	-	0.90	2.50	2.60	2.60	3.60	3.90	4.20	5.10	6.30	6.80	9.20	9.90	10.00	10.10	10.30	10.70	10.80

NPC Sensitivity Cases

Regional Capital Cost of New Interregional Pipeline Added Between 1999 and 2015 ($billion)	N. Eng	M. Atl.	S. Atl.	Florida	ESC	MW	Up. MW	Central	SC	SW	Mount.	WNC	NW	Calif	Shelf	Slope	CA&AK
Reference Case (NPC99)	1.30	0.80	0.10	1.20	1.70	5.50	0.10	1.10	1.30	0.20	6.10	0.10	1.10	0.30	0.80	1.20	9.20
Increased Oil Prices (NPC99D)	1.30	1.00	0.10	1.30	1.90	6.60	0.10	1.40	1.30	0.20	7.20	-	1.20	0.40	0.90	1.30	9.50
Decreased Oil Prices (NPC99E)	1.30	0.50	0.10	0.50	1.40	4.80	-	0.70	1.30	0.20	5.00	-	1.00	0.30	0.80	1.20	8.80
Higher GDP Growth Rate (NPC99F)	1.30	1.10	0.20	1.20	2.00	6.70	0.10	1.50	1.30	0.30	6.70	0.10	1.20	0.40	0.80	1.30	9.50
Lower GDP Growth Rate (NPC99G)	1.30	0.40	0.10	0.90	1.40	4.50	-	1.10	1.20	0.20	5.30	-	1.00	0.30	0.60	1.20	8.50
Faster Technology Advancement (NPC99H)	1.60	0.80	0.10	1.30	1.90	6.70	-	0.90	1.30	0.10	5.20	-	1.10	0.30	0.90	1.30	10.00
Slower Technology Advancement (NPC99I)	1.30	0.50	0.10	0.80	1.40	5.50	0.10	1.10	1.30	0.20	5.90	-	1.00	0.30	0.70	1.00	8.90
Larger Resource Base (NPC99K)	1.90	0.80	0.10	1.30	1.80	5.50	0.10	0.60	1.30	0.20	4.40	-	1.00	0.30	0.90	1.40	10.00
Smaller Resource Base (NPC99L)	1.30	0.50	0.10	0.70	1.40	5.50	-	1.00	1.20	0.20	5.50	-	1.00	0.30	0.70	1.00	9.20
Increased Access (NPC99R)	1.30	0.80	0.10	1.20	1.70	5.50	0.10	1.50	1.30	0.30	7.70	-	1.10	0.40	0.80	1.20	9.20
Reduced Access (NPC99S)	1.30	0.80	0.10	1.20	1.70	5.50	0.10	0.80	1.30	0.20	4.90	-	1.10	0.30	0.80	1.20	9.20

U.S. Net Storage Injections/Withdrawals (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.09	-0.05	-0.01	-0.02	-0.03	-0.04	-0.03	-0.06	-0.06	0.01	0.01	0.02	-0.02	-0.06	-0.06
Increased Oil Prices (NPC99D)	-0.41	0.00	-0.03	0.52	-0.20	-0.08	-0.10	-0.04	0.00	0.00	-0.01	-0.03	-0.03	-0.07	-0.06	0.00	0.03	0.05	-0.02	-0.01	-0.08
Decreased Oil Prices (NPC99E)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.08	-0.06	-0.02	-0.02	-0.02	-0.04	-0.04	-0.05	-0.04	-0.01	-0.01	0.00	-0.04	-0.04	-0.04
Higher GDP Growth Rate (NPC99F)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.10	-0.06	-0.02	-0.02	-0.03	-0.05	-0.06	-0.08	-0.03	0.01	0.03	0.03	-0.04	-0.03	-0.04
Lower GDP Growth Rate (NPC99G)	-0.41	0.00	-0.03	0.52	-0.19	-0.07	-0.08	-0.04	0.00	-0.01	-0.01	-0.03	-0.02	-0.05	-0.04	-0.02	0.00	0.02	-0.02	-0.04	-0.09
Faster Technology Advancement (NPC99H)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.09	-0.05	-0.01	-0.01	-0.01	-0.03	-0.03	-0.04	-0.02	-0.01	0.00	0.03	-0.03	-0.04	-0.08
Slower Technology Advancement (NPC99I)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.09	-0.05	-0.01	-0.02	-0.03	-0.05	-0.05	-0.07	-0.05	0.01	0.00	0.02	-0.05	-0.05	-0.04
Larger Resource Base (NPC99K)	-0.41	0.00	-0.03	0.52	-0.19	-0.07	-0.09	-0.04	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00	0.01	0.00	-0.01	-0.06	-0.06	-0.06
Smaller Resource Base (NPC99L)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.11	-0.06	-0.03	-0.03	-0.04	-0.04	-0.04	-0.08	-0.05	0.01	0.01	0.03	-0.04	-0.01	-0.04
Increased Access (NPC99R)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.09	-0.05	-0.01	-0.01	-0.02	-0.04	-0.04	-0.05	-0.04	-0.01	0.01	0.04	-0.01	-0.02	-0.06
Reduced Access (NPC99S)	-0.41	0.00	-0.03	0.52	-0.19	-0.08	-0.10	-0.05	-0.02	-0.02	-0.03	-0.05	-0.05	-0.07	-0.05	-0.01	0.02	0.02	-0.01	-0.04	-0.06

Net Canadian Imports (BCF/D)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	7.41	7.20	7.13	7.20	8.01	8.22	8.75	8.97	9.25	9.96	10.34	10.54	10.87	10.83	10.56	10.51	11.56	11.91	11.69	11.85	11.84
Increased Oil Prices (NPC99D)	7.41	7.20	7.13	7.20	8.05	8.26	8.82	9.06	9.39	10.12	10.41	10.61	11.00	10.73	10.22	10.21	11.32	11.37	11.32	11.97	12.41
Decreased Oil Prices (NPC99E)	7.41	7.20	7.13	7.20	7.95	8.10	8.66	8.88	9.02	9.60	10.02	10.23	10.40	10.32	10.16	10.14	11.29	11.66	11.46	11.30	11.12
Higher GDP Growth Rate (NPC99F)	7.41	7.20	7.13	7.20	8.01	8.22	8.75	8.99	9.25	9.97	10.35	10.58	10.99	10.94	10.70	10.88	12.06	12.17	11.98	12.04	12.03
Lower GDP Growth Rate (NPC99G)	7.41	7.20	7.13	7.20	8.01	8.20	8.74	8.95	9.22	9.86	10.27	10.44	10.59	10.47	10.16	10.05	11.09	11.48	11.32	11.39	11.36
Faster Technology Advancement (NPC99H)	7.41	7.20	7.13	7.20	8.01	8.22	8.76	8.96	9.24	9.95	10.33	10.60	11.01	11.32	10.98	10.98	11.95	12.15	12.13	12.25	12.08
Slower Technology Advancement (NPC99I)	7.41	7.20	7.13	7.20	8.01	8.22	8.76	8.96	9.21	9.91	10.25	10.43	10.52	10.32	10.02	10.05	11.29	11.78	11.57	11.63	11.58
Larger Resource Base (NPC99K)	7.41	7.20	7.13	7.20	8.01	8.21	8.83	9.12	9.47	10.22	10.56	10.76	11.24	11.95	11.71	11.53	11.66	11.85	12.08	12.40	12.36
Smaller Resource Base (NPC99L)	7.41	7.20	7.13	7.20	8.01	8.23	8.72	8.95	9.16	9.85	10.24	10.49	10.84	10.83	10.60	10.70	11.86	11.66	11.17	10.94	10.68
Increased Access (NPC99R)	7.41	7.20	7.13	7.20	8.01	8.22	8.75	8.97	9.24	9.94	10.31	10.54	10.92	10.74	10.47	10.34	11.41	11.77	11.57	11.65	11.62
Reduced Access (NPC99S)	7.41	7.20	7.13	7.20	8.01	8.23	8.77	9.01	9.28	9.99	10.41	10.67	11.04	11.00	10.77	10.89	12.14	12.15	11.99	11.96	11.91

Balancing Item (TCF)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Reference Case (NPC99)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.20	0.19	0.17	0.22	0.19	0.17	0.17	0.20	0.15	0.18	0.16	0.16	0.14	0.13
Increased Oil Prices (NPC99D)	0.25	0.31	-0.25	0.17	0.17	0.19	0.19	0.19	0.19	0.18	0.22	0.19	0.20	0.19	0.20	0.21	0.21	0.19	0.20	0.22	0.21
Decreased Oil Prices (NPC99E)	0.25	0.31	-0.25	0.17	0.18	0.19	0.17	0.19	0.20	0.19	0.21	0.17	0.15	0.15	0.15	0.14	0.16	0.13	0.11	0.14	0.12
Higher GDP Growth Rate (NPC99F)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.21	0.20	0.19	0.23	0.21	0.19	0.19	0.22	0.16	0.18	0.16	0.16	0.18	0.22
Lower GDP Growth Rate (NPC99G)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.19	0.18	0.16	0.21	0.17	0.16	0.17	0.17	0.15	0.15	0.14	0.14	0.12	0.13
Faster Technology Advancement (NPC99H)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.19	0.19	0.17	0.21	0.19	0.18	0.18	0.20	0.17	0.19	0.16	0.21	0.17	0.19
Slower Technology Advancement (NPC99I)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.19	0.19	0.18	0.22	0.17	0.18	0.16	0.19	0.14	0.16	0.13	0.12	0.10	0.19
Larger Resource Base (NPC99K)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.20	0.18	0.16	0.21	0.18	0.17	0.16	0.17	0.16	0.16	0.15	0.17	0.13	0.16
Smaller Resource Base (NPC99L)	0.25	0.31	-0.25	0.17	0.18	0.19	0.18	0.20	0.20	0.18	0.23	0.19	0.18	0.19	0.17	0.16	0.17	0.15	0.20	0.19	0.18
Increased Access (NPC99R)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.20	0.19	0.17	0.22	0.19	0.19	0.18	0.20	0.17	0.19	0.16	0.15	0.14	0.15
Reduced Access (NPC99S)	0.25	0.31	-0.25	0.17	0.18	0.19	0.19	0.20	0.19	0.18	0.19	0.19	0.18	0.16	0.18	0.18	0.16	0.15	0.16	0.19	0.14

SUPPLY RESULTS
NPC REFERENCE CASE

Prepared for:

National Petroleum Council
Supply Task Group

Prepared by:

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October 12, 1999

NATURAL GAS ULTIMATE RECOVERY
AND UNDISCOVERED RESOURCES AS OF 1/1/98
1999 NPC Study - Reference Case - Current Technology
(BCF dry; total gas)
(Technically recoverable resource)

	Model Region	Cumulative Production	Proven Reserves	Ultimate Recovery	Old Field Appreciation	Discovered Undeveloped	New Fields	Shale	Coalbed	Tight	Other	Total Unproven	Expected All Time Recovery
1	*A: Appalachia*	43,433	9,717	53,150	2,301		24,968	17,683	14,717	13,398		73,067	126,217
2	*B: Eastern Gulf Onshore*	12,756	1,955	14,711	5,069		7,806		4,651			17,526	32,237
3	*C: North Central*	5,524	2,195	7,719	2,718		8,815	15,327	1,908			28,768	36,487
4	*D: Arkla - East Texas*	75,216	12,017	87,233	25,864		19,716	5,779		23,577		74,936	162,169
5	*E: South Louisiana*	99,127	5,855	104,982	20,361		10,654					31,015	135,997
6	*G: Texas Gulf Onshore*	140,468	14,858	155,326	54,341		47,732			8,336		110,409	265,735
7	*WL: Williston Basin*	4,488	1,241	5,729	2,653		2,723					5,376	11,105
8	*FR: Rocky Mtn. Foreland*	30,038	17,312	47,350	28,949		88,528		22,791	104,806	14,689	259,763	307,113
9	*SJB: San Juan Basin*	21,482	14,872	36,354	11,673		1,884		8,593			22,150	58,504
10	*OV: Overthrust Belt*	1,700	2,917	4,617	702		6,160					6,862	11,479
11	*JN: Mid-Continent*	181,445	25,942	207,387	48,430		35,447		5,732	12,788		102,397	309,784
12	*JS: Permian Basin*	87,976	12,293	100,269	22,319		28,074			14,677		65,070	165,339
13	*L: West Coast Onshore*	32,298	2,217	34,515	5,717		18,371					24,088	58,603
14	*BO: Eastern Gulf of Mexico*	1,500	5,700	7,200	2,160		36,723					38,883	46,083
15	*EGO: Cent. & West. Gulf of Mex.*	141,843	26,927	168,770	70,661		188,373					259,034	427,804
16	*LO: West Coast Offshore*	2,405	600	3,005	1,039		18,900					19,939	22,944
17	*AO: Atlantic Offshore*	0	0	0	0		27,800					27,800	27,800
	Lower-48 total	**881,699**	**156,618**	**1,038,317**	**304,957**		**572,674**	**38,789**	**58,392**	**177,582**	**14,689**	**1,167,083**	**2,205,400**
20	*ASM: Alberta, Sas. Man.*	89,677	51,864	141,541	18,620		56,348		59,184	65,023	1,365	200,540	342,081
21	*BC: British Columbia*	11,585	8,734	20,319	3,283		29,195					32,478	52,797
22	*NWC: Northwest Canada*	408	316	724	0	10,000	72,876					82,876	83,600
23	*EC: Eastern Canada*	1,042	2,932	3,974	478	11,000	86,905					98,383	102,357
24	*ART: Arctic Canada*	0	0	0	0	14,000	100,867					114,867	114,867
	Canada total	**102,712**	**63,846**	**166,558**	**22,381**	**35,000**	**346,191**	**0**	**59,184**	**65,023**	**1,365**	**529,144**	**695,702**

NATURAL GAS ULTIMATE RECOVERY
AND UNDISCOVERED RESOURCES AS OF 1/1/98
1999 NPC Study - Reference Case - Advanced Technology
(BCF dry; total gas)
(Technically recoverable resource)

	Model Region	Cumulative Production	Proven Reserves	Ultimate Recovery	Old Field Appreciation	Discovered Undeveloped	New Fields	Shale	Coalbed	Tight	Other	Total Unproven	Expected All Time Recovery
1	*A: Appalachia*	43,433	9,717	53,150	2,301		27,772	23,389	19,433	18,266		91,161	144,311
2	*B: Eastern Gulf Onshore*	12,756	1,955	14,711	5,069		8,674		5,209			18,952	33,663
3	*C: North Central*	5,524	2,195	7,719	2,718		9,796	21,950	2,518			36,982	44,701
4	*D: Arkla - East Texas*	75,216	12,017	87,233	25,864		22,196	7,207		29,816		85,083	172,316
5	*E: South Louisiana*	99,127	5,855	104,982	20,361		11,838					32,199	137,181
6	*G: Texas Gulf Onshore*	140,468	14,858	155,326	54,341		52,550			9,114		116,005	271,331
7	*WL: Williston Basin*	4,488	1,241	5,729	2,653		3,088					5,741	11,470
8	*FR: Rocky Mtn. Foreland*	30,038	17,312	47,350	28,949		99,180		29,371	136,972	14,689	309,161	356,511
9	*SJB: San Juan Basin*	21,482	14,872	36,354	11,673		2,209		10,058			23,940	60,294
10	*OV: Overthrust Belt*	1,700	2,917	4,617	702		6,731					7,433	12,050
11	*JN: Mid-Continent*	181,445	25,942	207,387	48,430		39,675		7,449	16,923		112,477	319,864
12	*JS: Permian Basin*	87,976	12,293	100,269	22,319		31,353			19,521		73,193	173,462
13	*L: West Coast Onshore*	32,298	2,217	34,515	5,717		20,205					25,922	60,437
14	*BO: Eastern Gulf of Mexico*	1,500	5,700	7,200	2,160		40,655					42,815	50,015
15	*EGO: Cent. & West. Gulf of Mex.*	141,843	26,927	168,770	70,661		205,328					275,989	444,759
16	*LO: West Coast Offshore*	2,405	600	3,005	1,039		20,790					21,829	24,834
17	*AO: Atlantic Offshore*	0	0	0	0		30,580					30,580	30,580
	Lower-48 total	**881,699**	**156,618**	**1,038,317**	**304,957**		**632,620**	**52,546**	**74,038**	**230,612**	**14,689**	**1,309,462**	**2,347,779**
20	*ASM: Alberta, Sas., Man.*	89,677	51,864	141,541	18,620		62,548		74,007	86,827	1,353	243,355	384,896
21	*BC: British Columbia*	11,585	8,734	20,319	3,283		32,465					35,748	56,067
22	*NWC: Northwest Canada*	408	316	724	0	10,000	80,972					90,972	91,696
23	*EC: Eastern Canada*	1,042	2,932	3,974	478	11,000	96,497					107,975	111,949
24	*ART: Arctic Canada*	0	0	0	0	14,000	111,051					125,051	125,051
	Canada total	**102,712**	**63,846**	**166,558**	**22,381**	**35,000**	**383,533**	**0**	**74,007**	**86,827**	**1,353**	**603,101**	**769,659**

CRUDE OIL PRICES

	1999 NPC Study (1998 dollars) (RACC)	1992 NPC Study (1998 dollars) (RACC)		1999 EIA (1998 dollars) (World Price)
	Reference Case	High Reference	Low Reference	AEO
2000	$16.50	$25.97	$20.93	$21.19
2005	$16.50	$30.94	$22.77	$20.49
2010	$16.50	$34.28	$24.62	$21.00
2015	$16.50			$21.53

GAS PRICE RESULTS
(Henry Hub Spot, $/MMBtu)

	1999 NPC Study (1998 dollars)	1992 NPC Study (1998 dollars)	
	Reference Case	High Reference	Low Reference
2000	$3.23	$3.68	$3.05
2005	$2.87	$3.53	$3.15
2010	$3.23	$4.38	$3.51
2015	$3.81	NA	NA

SELECTED ANNUAL DATA

U.S. Lower-48 Data

	Total Wells	Gas Wells	Gas Production
1995	22,192	8,953	18,412
1996	24,245	9,874	19,217
1997	29,307	11,549	18,873
1998	25,899	12,268	18,897
1999	21,318	11,591	19,172
2000	23,116	11,593	19,465
2001	29,447	15,245	19,637
2002	30,445	15,736	20,585
2003	29,401	14,555	21,495
2004	26,539	12,437	21,987
2005	25,180	11,400	22,039
2006	26,843	12,269	22,180
2007	30,621	14,147	22,366
2008	34,357	15,643	23,012
2009	36,856	16,721	23,687
2010	37,252	16,505	24,640
2011	36,882	15,868	25,230
2012	37,641	16,505	25,560
2013	37,819	16,773	25,718
2014	42,909	21,024	25,702
2015	48,438	23,830	26,071

Canadian Data

	Total Wells	Gas Wells	Gas Production
1995	9,966	3,695	5,435
1996	12,027	4,364	5,584
1997	15,422	5,132	5,617
1998	12,596	5,823	5,677
1999	10,002	4,573	5,932
2000	10,385	4,616	6,117
2001	13,029	5,996	6,336
2002	14,104	6,915	6,456
2003	13,759	6,701	6,616
2004	12,055	6,135	6,961
2005	8,845	4,631	7,138
2006	8,020	3,930	7,256
2007	6,971	3,411	7,425
2008	7,236	3,464	7,465
2009	7,436	3,625	7,376
2010	7,566	3,732	7,402
2011	7,396	3,651	7,885
2012	7,148	3,623	8,112
2013	6,417	3,554	8,065
2014	7,553	4,291	8,136
2015	10,955	6,113	8,166

Note: Historical data represent model results that may not agree with actuals.

Regional Comparison of Gas Reserves

Year-end total gas reserves (BCF)

	NPC Reference Case (NPC99A)					Increased Oil Prices (NPC99D)					Decreased Oil Prices (NPC99E)					Faster Technology Advance (NPC99H)					Slower Technology Advance (NPC99I)					Larger Resource Base (NPC99K)				
Region	1995	2000	2005	2010	2015	1995	2000	2005	2010	2010	1995	2000	2005	2010	2015	1995	2000	2005	2010	2010	1995	2000	2005	2010	2010	1995	2000	2005	2010	2015
1 A: Appalachia	8,037	9,685	11,389	10,531	10,749	8,037	9,699	11,569	10,771	11,598	8,037	9,685	11,198	10,219	9,503	8,037	9,694	11,459	10,658	10,895	8,037	9,693	11,319	10,248	10,435	8,078	9,531	11,880	11,876	11,311
2 B: MAFLA Onshore	2,021	1,635	2,684	3,476	4,209	2,021	1,645	2,736	3,617	4,478	2,021	1,596	2,451	3,224	3,830	2,021	1,636	2,747	3,444	3,876	2,021	1,635	2,578	3,229	4,068	2,110	1,766	3,105	4,251	3,769
3 C: Midwest	1,863	3,244	4,530	4,157	4,850	1,863	3,260	4,764	4,570	5,985	1,863	3,242	4,441	3,872	3,875	1,863	3,244	4,565	4,153	4,664	1,863	3,244	4,476	4,057	4,771	1,865	3,008	4,713	3,861	3,557
4 D: Ark-La-Tex	11,192	12,264	14,423	19,083	21,452	11,192	12,425	15,062	20,657	21,629	11,192	12,264	13,998	18,780	21,223	11,193	12,260	14,479	19,074	22,014	11,193	12,260	14,263	18,861	20,927	11,224	12,218	14,146	18,500	21,893
5 E: South LA	6,014	5,299	3,857	3,235	2,694	6,014	5,291	3,934	3,078	2,702	6,014	5,169	3,895	3,132	2,613	6,014	5,228	3,950	3,125	2,838	6,014	5,228	3,821	3,093	2,502	6,183	5,830	5,602	6,679	5,146
6 G: South Texas	13,814	13,659	13,483	15,176	18,031	13,814	13,833	14,194	16,174	19,097	13,814	13,541	13,064	14,157	16,080	13,815	13,660	13,734	15,404	18,914	13,815	13,657	13,014	14,535	16,174	13,790	13,797	14,240	15,656	15,428
7 Wt.: Williston, NGP	1,327	1,466	1,465	1,454	1,381	1,327	1,483	1,482	1,560	1,449	1,327	1,460	1,390	1,324	1,273	1,327	1,465	1,467	1,496	1,444	1,327	1,465	1,445	1,392	1,290	1,328	1,473	1,464	1,438	1,367
8 FR: Foreland	17,566	20,578	28,923	35,900	37,570	17,566	20,889	29,291	37,781	44,487	17,566	20,355	28,396	35,106	36,099	17,567	20,578	29,147	35,283	36,102	17,567	20,577	28,543	36,346	37,525	17,789	20,590	28,260	33,605	34,566
9 SJB: San Juan	16,378	11,376	8,557	8,304	9,079	16,378	11,365	8,646	8,423	8,969	16,378	11,275	8,466	8,207	8,870	16,378	11,401	8,580	8,157	9,002	16,378	11,401	8,567	8,302	9,015	16,384	11,398	8,717	7,704	8,392
10 OV: Western Thrust Belt	1,591	1,067	1,442	2,259	1,820	1,591	1,065	1,453	2,397	1,976	1,591	1,059	1,429	2,183	1,728	1,591	1,067	1,484	2,428	1,976	1,591	1,066	1,405	2,145	1,711	1,679	1,224	1,674	2,918	3,115
11 JN: Midcontinent	27,266	24,360	20,278	18,720	16,978	27,266	24,757	21,083	18,906	17,422	27,266	24,217	19,708	18,314	16,514	27,268	24,363	20,604	18,971	17,500	27,268	24,362	20,092	18,221	15,804	27,446	24,833	22,157	23,616	24,635
12 JS: Permian	13,286	13,148	12,192	13,249	12,827	13,286	13,210	12,714	13,986	13,700	13,286	13,119	11,751	12,329	10,859	13,286	13,149	12,295	13,664	12,829	13,286	13,147	11,933	12,796	12,199	13,309	13,110	11,971	13,401	13,015
13 L: West	2,255	2,183	2,061	2,323	2,491	2,255	2,181	2,080	2,348	2,513	2,255	2,176	2,048	2,300	2,476	2,255	2,185	2,098	2,488	2,802	2,255	2,185	2,035	2,186	2,232	2,255	2,172	2,054	2,317	2,502
14 BO: East GOM	3,920	3,936	5,516	6,551	5,530	3,920	3,925	5,551	6,520	5,503	3,920	3,838	5,493	6,538	5,508	3,924	3,807	5,643	6,994	5,974	3,924	3,807	5,326	6,373	5,320	3,920	3,811	5,371	6,340	5,652
15 EGO: Cen. & West GOM	28,198	32,032	37,727	37,238	33,211	28,198	32,143	38,969	38,286	33,342	28,198	30,989	36,178	35,492	31,895	28,188	32,031	39,368	40,932	36,757	28,188	32,012	37,037	36,127	30,876	28,215	32,150	40,518	40,786	38,676
16 LO: Pacific Offshore	1,165	1,213	1,169	1,148	1,133	1,165	1,218	1,193	1,163	1,133	1,165	1,208	1,161	1,114	1,078	1,160	1,208	1,175	1,165	1,163	1,160	1,208	1,165	1,145	1,122	1,165	1,213	1,167	1,125	1,111
17 AO: Atlantic Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 AKS: Alaska South	1,790	1,054	2,269	5,131	10,350																									
19 AKN: Alaska North	27,775	27,950	27,344	26,913	27,487																									
20 ASM: Alb., Sask., Man.	61,145	62,007	60,821	50,158	44,533	61,145	62,430	62,143	48,650	48,093	61,145	61,378	58,473	49,123	42,251	61,113	61,829	61,682	49,329	44,665	61,113	61,815	58,992	49,757	45,726	61,270	62,684	63,003	49,482	44,850
21 BC: British Columbia	7,702	6,095	8,723	10,765	11,096	7,702	6,089	8,692	10,340	11,295	7,702	6,083	8,546	10,911	10,371	7,681	6,031	8,646	11,196	12,618	7,681	6,030	8,066	10,080	9,675	7,929	7,208	11,254	15,419	19,672
22 NWC: Northwest Can.	204	204	782	2,522	6,571	204	204	1,223	4,630	6,499	204	204	771	2,300	7,116	204	204	986	3,220	8,548	204	204	766	2,409	5,587	204	204	204	204	204
23 EC: Eastern Can.	1,788	2,851	7,003	8,267	6,942	1,788	2,873	6,979	8,235	6,920	1,788	2,845	7,044	8,448	7,026	1,789	2,902	7,173	8,124	6,439	1,789	2,901	6,929	8,116	6,554	1,963	3,308	8,476	11,212	11,036
24 ART: Arctic Can.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	-	-	-	-	-	6	6	6	6	6
Lower-48 US	155,893	157,145	169,696	182,804	184,005	155,893	158,389	174,721	190,237	195,983	155,893	155,193	165,067	176,291	173,424	155,887	156,976	172,795	187,436	188,750	155,887	156,947	167,019	179,056	175,971	156,740	158,124	177,039	194,073	194,135
Canada	70,845	71,163	77,335	71,718	69,148	70,845	71,602	79,043	71,861	72,813	70,845	70,516	74,840	70,788	66,770	70,793	70,972	78,493	71,875	72,276	70,787	70,950	74,753	70,362	67,542	71,372	73,410	82,943	76,323	75,768

Regional Comparison of Gas Wells

Annual gas well completions

	NPC Reference Case (NPC99A)					Increased Oil Prices (NPC99D)					Decreased Oil Prices (NPC99E)					Faster Technology Advance (NPC99H)					Slower Technology Advance (NPC99I)					Larger Resource Base (NPC99K)				
Region	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015
1 A: Appalachia	1,448	2,096	1,997	1,307	3,897	1,448	2,139	2,114	1,655	4,829	1,448	2,061	1,907	1,093	2,684	1,449	2,112	2,010	1,143	3,681	1,449	2,111	1,964	1,204	4,008	1,460	1,820	2,141	896	2,004
2 B: MAFLA Onshore	180	213	403	496	1,018	180	230	412	570	1,026	180	199	366	430	1,046	180	213	405	445	961	180	212	388	438	1,033	181	201	412	432	558
3 C: Midwest	774	1,347	457	889	1,875	774	1,357	558	1,135	2,647	774	1,346	421	679	1,051	774	1,347	466	747	1,488	774	1,347	445	907	1,995	774	1,143	672	620	808
4 D: Arkla Tex	940	1,162	1,575	2,159	2,076	940	1,311	1,662	2,360	2,027	940	1,160	1,582	2,051	2,194	940	1,162	1,583	2,111	2,252	940	1,162	1,473	2,037	2,146	940	1,143	1,392	2,027	2,340
5 E: South LA	132	211	114	188	193	132	213	114	174	192	132	181	113	166	197	132	215	115	170	199	132	215	106	166	194	136	244	190	294	242
6 G: South Texas	1,166	965	1,193	2,077	3,102	1,166	1,048	1,281	2,423	2,833	1,166	883	1,046	1,845	2,557	1,166	967	1,201	2,202	3,248	1,166	965	1,033	1,960	2,644	1,091	993	1,106	1,601	2,186
7 WL: Williston, NGP	105	186	129	174	183	105	222	120	196	183	105	184	98	165	190	105	186	114	184	185	105	186	106	167	185	106	190	112	152	223
8 FR: Foreland	1,080	1,836	2,036	2,878	3,447	1,080	2,085	2,043	3,065	3,145	1,080	1,580	2,046	2,081	3,364	1,080	1,835	2,036	1,624	3,690	1,080	1,834	2,011	2,674	3,684	1,141	1,699	2,013	2,207	3,305
9 SJB: San Juan	243	625	679	1,481	2,244	243	614	689	1,639	1,874	243	453	705	1,504	2,387	243	632	671	1,561	2,241	243	632	673	1,552	2,429	247	655	710	1,120	2,733
10 OV: Western Thrust Belt	7	34	123	173	52	7	34	124	229	65	7	33	123	148	44	7	34	127	187	58	7	34	119	156	47	37	46	183	369	347
11 JN: Midcontinent	1,769	1,831	1,688	2,801	3,311	1,769	2,078	1,873	2,952	3,321	1,769	1,657	1,517	2,811	2,999	1,770	1,832	1,805	2,872	3,162	1,770	1,830	1,553	2,789	3,297	1,768	1,957	2,001	3,841	4,429
12 JS; Permian	824	680	693	1,455	1,936	824	699	779	1,682	1,997	824	672	470	1,126	1,528	824	681	629	1,518	1,640	824	680	520	1,431	1,961	824	692	515	1,034	1,482
13 L: West	40	40	61	99	123	40	39	62	102	120	40	39	62	103	123	40	40	63	106	132	40	40	60	95	115	40	39	61	98	131
14 BO: East GOM	4	10	27	25	15	4	10	27	25	16	4	8	26	25	14	4	9	28	28	16	4	9	26	24	13	4	9	26	23	15
15 EGO: Cen. & West GOM	241	355	225	301	356	241	351	250	352	325	241	262	217	297	257	242	362	286	390	353	242	362	217	341	324	237	350	246	277	358
16 LO: Pacific Offshore	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17 AO: Atlantic Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 AKS: Alaska South	2	3	10	31	53																									
19 AKN: Alaska North	1	1	1	5	22																									
20 ASM: Alb., Sask., Man.	3,361	4,497	4,067	2,958	4,912	3,361	4,868	4,260	3,099	5,130	3,361	3,965	3,557	2,612	4,976	3,378	4,537	4,128	2,701	4,690	3,378	4,522	3,391	2,985	5,843	3,343	4,393	3,568	2,664	2,467
21 BC: British Columbia	262	96	505	732	1,151	262	101	460	731	872	262	92	483	690	964	259	90	483	726	1,266	259	90	418	670	921	258	156	580	1,214	1,535
22 NWC: Northwest Can.	-	-	26	32	42	-	-	26	53	33	-	-	25	31	36	-	-	27	34	46	-	-	25	30	37	-	-	-	-	-
23 EC. Eastern Can.	71	23	34	10	8	71	30	33	11	8	71	23	34	11	7	71	23	33	12	10	71	23	30	11	7	145	79	420	640	8
24 ART: Arctic Can.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower-48 US	8,954	11,592	11,401	16,504	23,829	8,954	12,431	12,109	18,560	24,601	8,954	10,719	10,700	14,525	20,636	8,957	11,628	11,540	15,289	23,307	8,957	11,620	10,695	15,942	24,076	8,987	11,182	11,781	14,992	21,162
Canada	3,694	4,616	4,632	3,732	6,113	3,694	4,999	4,779	3,894	6,043	3,694	4,080	4,099	3,344	5,983	3,708	4,650	4,671	3,473	6,012	3,708	4,635	3,864	3,696	6,808	3,746	4,628	4,568	4,518	4,010

Regional Comparison of Gas Production

Annual total gas production (BCF)

Region	NPC Reference Case (NPC99A)					Increased Oil Prices (NPC99D)					Decreased Oil Prices (NPC99E)					Faster Technology Advance (NPC99H)					Slower Technology Advance (NPC99I)					Larger Resource Base (NPC99K)				
	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015	1995	2000	2005	2010	2015
1 A: Appalachia	548	626	865	967	1,134	548	629	875	987	1,227	548	620	843	933	975	548	627	864	981	1,157	548	627	862	937	1,089	548	613	881	1,096	1,206
2 B: MAFLA Onshore	286	224	342	504	560	286	224	343	520	601	286	224	317	462	516	286	224	351	508	553	286	224	330	466	519	286	247	374	642	631
3 C: Midwest	240	262	481	389	505	240	262	505	437	635	240	262	471	360	400	240	262	484	394	501	240	262	475	373	485	240	241	509	367	361
4 D: Arkla Tex	1,391	1,504	1,867	2,409	2,829	1,391	1,505	1,913	2,651	2,970	1,391	1,505	1,799	2,395	2,790	1,391	1,509	1,862	2,415	2,904	1,391	1,509	1,864	2,405	2,738	1,391	1,501	1,854	2,303	2,878
5 E: South LA	1,155	1,064	851	713	670	1,155	1,066	851	681	664	1,155	1,061	860	711	637	1,155	1,045	860	691	696	1,155	1,045	853	706	610	1,155	1,083	1,081	1,365	1,273
6 G: South Texas	2,427	2,584	2,323	2,563	3,045	2,427	2,584	2,413	2,663	3,283	2,427	2,586	2,286	2,425	2,755	2,427	2,587	2,366	2,575	3,207	2,427	2,587	2,275	2,466	2,729	2,427	2,586	2,410	2,745	2,770
7 WL: Williston, NGP	108	95	102	107	110	108	95	103	120	120	108	95	95	92	93	108	95	103	112	119	108	95	100	101	97	108	96	102	106	107
8 FR: Foreland	1,027	1,354	1,867	2,658	3,185	1,027	1,355	1,877	2,812	3,985	1,027	1,352	1,844	2,585	2,989	1,027	1,354	1,894	2,487	2,984	1,027	1,354	1,859	2,693	3,155	1,027	1,342	1,787	2,404	2,848
9 SJB: San Juan	1,202	1,381	1,158	940	951	1,202	1,381	1,166	949	952	1,202	1,382	1,151	920	935	1,202	1,382	1,161	926	944	1,202	1,382	1,159	936	940	1,202	1,381	1,174	895	875
10 OV: Western Thrust Belt	220	150	162	255	261	220	150	162	265	283	220	150	163	251	248	220	150	163	254	282	220	150	161	242	245	220	161	175	293	369
11 JN: Midcontinent	2,934	2,759	2,807	2,832	2,664	2,934	2,759	2,873	2,837	2,759	2,934	2,757	2,732	2,762	2,610	2,933	2,758	2,832	2,853	2,765	2,933	2,758	2,793	2,761	2,477	2,933	2,775	2,966	3,258	3,513
12 JS; Permian	1,518	1,515	1,551	1,882	2,001	1,518	1,515	1,601	1,958	2,142	1,518	1,515	1,513	1,778	1,720	1,519	1,515	1,565	1,942	2,051	1,519	1,515	1,533	1,827	1,877	1,518	1,514	1,518	1,900	2,183
13 L: West	204	225	265	374	486	204	225	264	376	490	204	225	263	371	485	204	225	268	397	541	204	225	262	357	444	204	224	261	371	487
14 BO: East GOM	374	454	559	750	709	374	455	555	748	706	374	453	557	748	706	374	451	556	795	764	374	451	546	731	684	374	449	536	724	706
15 EGO: Cen. & West GOM	4,737	5,220	6,798	7,262	6,932	4,737	5,221	7,018	7,436	7,001	4,737	5,216	6,699	6,940	6,623	4,737	5,213	7,012	7,855	7,630	4,737	5,213	6,752	7,052	6,489	4,737	5,243	7,005	7,681	7,638
16 LO: Pacific Offshore	42	46	41	35	30	42	46	42	36	30	42	46	41	34	28	42	46	41	36	31	42	46	41	35	30	42	46	41	35	29
17 AO: Atlantic Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 AKS: Alaska South	178	193	183	174	184																									
19 AKN: Alaska North	269	298	309	308	309																									
20 ASM: Alb., Sask., Man.	4,805	5,395	6,040	5,836	5,468	4,805	5,408	6,094	5,639	5,765	4,805	5,353	5,910	5,712	5,226	4,805	5,398	6,052	5,808	5,506	4,805	5,398	6,009	5,691	5,462	4,805	5,395	6,077	5,784	5,603
21 BC: British Columbia	614	707	756	1,107	1,294	614	717	745	1,056	1,274	614	695	742	1,105	1,233	614	707	748	1,110	1,372	614	707	742	1,043	1,168	614	703	835	1,391	1,959
22 NWC: Northwest Can.	-	-	-	66	580	-	-	-	214	580	-	-	-	22	580	-	-	-	104	579	-	-	-	62	580	-	-	-	-	-
23 EC. Eastern Can.	16	15	342	394	825	16	15	342	394	840	16	15	341	394	813	16	15	341	588	842	16	15	342	394	816	16	15	338	701	856
24 ART: Arctic Can.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower-48 US	18,413	19,463	22,039	24,640	26,072	18,413	19,472	22,561	25,476	27,848	18,413	19,449	21,634	23,767	24,510	18,413	19,443	22,382	25,221	27,129	18,413	19,443	21,865	24,088	24,608	18,412	19,502	22,674	26,185	27,874
Canada	5,435	6,117	7,138	7,403	8,167	5,435	6,140	7,181	7,303	8,459	5,435	6,063	6,993	7,233	7,852	5,435	6,120	7,141	7,610	8,299	5,435	6,120	7,093	7,190	8,026	5,435	6,113	7,250	7,876	8,418

GAS PRODUCTION BY TYPE
Reference Case
(BCF/year)

	1995						2000						2005						2010						2015					
	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total
1 A: Appalachia	63	107	222	143	12	547	68	109	233	177	39	626	36	196	200	294	140	866	23	286	205	268	185	967	22	360	399	223	130	1,134
2 B: MAFLA Onshore	23	150	-	-	113	286	35	96	-	-	93	224	31	235	-	-	76	342	38	359	-	-	107	504	41	342	-	-	176	559
3 C: Midwest	82	57	-	101	-	240	9	82	-	170	1	262	5	158	-	303	15	481	8	120	-	191	70	389	19	105	-	252	128	504
4 D: Arkla Tex	123	676	581	12	-	1,392	117	590	763	35	-	1,505	123	676	896	172	-	1,867	118	647	1,303	340	-	2,408	113	643	1,844	228	-	2,828
5 E: South LA	127	1,028	-	-	-	1,155	122	942	-	-	-	1,064	69	782	-	-	-	851	43	670	-	-	-	713	34	637	-	-	-	671
6 G: South Texas	225	1,602	600	-	-	2,427	153	1,896	535	-	-	2,584	127	1,753	444	-	-	2,324	109	1,852	601	-	-	2,562	123	2,061	861	-	-	3,045
7 WL: Williston, NGP	59	41	8	-	-	108	33	56	6	-	-	95	23	72	8	-	-	103	26	74	8	-	-	108	29	74	7	-	-	110
8 FR: Foreland	226	336	451	-	13	1,026	199	382	655	-	117	1,353	85	444	929	-	409	1,867	85	546	1,154	-	874	2,659	86	589	1,450	-	1,059	3,184
9 SJB: San Juan	14	114	479	-	595	1,202	8	126	573	-	675	1,382	8	122	587	-	441	1,158	11	105	587	-	236	939	14	80	536	-	320	950
10 OV: Western Thrust Belt	20	200	-	-	-	220	5	145	-	-	-	150	14	148	-	-	-	162	29	226	-	-	-	255	31	230	-	-	-	261
11 JN: Midcontinent	241	2,530	160	-	3	2,934	188	2,426	138	-	7	2,759	219	2,409	154	-	25	2,807	230	2,304	189	-	109	2,832	240	1,995	191	-	238	2,664
12 JS; Permian	498	680	340	-	-	1,518	517	645	353	-	-	1,515	497	719	334	-	-	1,550	482	1,041	358	-	-	1,881	471	1,094	435	-	-	2,000
13 L: West	118	86	-	-	-	204	143	82	-	-	-	225	120	145	-	-	-	265	110	264	-	-	-	374	107	380	-	-	-	487
14 BO: East GOM	4	370	-	-	-	374	-	454	-	-	-	454	45	514	-	-	-	559	128	622	-	-	-	750	131	578	-	-	-	709
15 EGO: Cen. & West GOM	674	4,062	-	-	-	4,736	949	4,271	-	-	-	5,220	1,478	5,321	-	-	-	6,799	1,913	5,349	-	-	-	7,262	1,998	4,934	-	-	-	6,932
16 LO: Pacific Offshore	42	-	-	-	-	42	46	-	-	-	-	46	41	-	-	-	-	41	35	-	-	-	-	35	30	-	-	-	-	30
17 AO: Atlantic Offshore	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 AKS: Alaska South	50	128	-	-	-	178	39	153	-	-	-	192	17	166	-	-	-	183	17	157	-	-		174	18	166	-	-	-	184
19 AKN: Alaska North	269	-	-	-	-	269	295	3	-	-	-	298	282	27	-	-	-	309	261	48	-	-		309	250	59	-	-	-	309
20 ASM: Alb., Sask., Man.	632	2,560	1,612	-	-	4,804	692	3,099	1,594	-	10	5,395	688	3,394	1,864	-	94	6,040	592	2,892	1,963	-	389	5,836	530	1,907	1,930	-	1,100	5,467
21 BC: British Columbia	19	212	382	-	-	613	19	231	457	-	-	707	20	188	548	-	-	756	22	187	898	-	-	1,107	25	233	1,035	-	-	1,293
22 NWC: Northwest Can.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	45	-	-	-	66	82	497	-	-	-	579
23 EC. Eastern Can.	16	-	-	-	-	16	9	6	-	-	-	15	7	336	-	-	-	343	6	387	-	-	-	393	6	819	-	-	-	825
24 ART: Arctic Can.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lower-48 US	2,539	12,039	2,841	256	736	18,411	2,592	12,302	3,256	382	932	19,464	2,921	13,694	3,552	769	1,106	22,042	3,388	14,465	4,405	799	1,581	24,638	3,489	14,102	5,723	703	2,051	26,068
Canada	667	2,772	1,994	-	-	5,433	720	3,336	2,051	-	10	6,117	715	3,918	2,412	-	94	7,139	641	3,511	2,861	-	389	7,402	643	3,456	2,965	-	1,100	8,164

Note: Historical data are from model and do not reflect actual production. Coalbed methane production is understated by approximately 200 BCF in 1995 (mostly in SJB) and low perm & tight is overstated by a similar amount.

GAS PRODUCTION BY DEPTH
Reference Case
(BCF/year)

	1995						2000						2005						2010						2015					
	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total	Assoc. Dislvd.	High Perm	Low Perm & Tight	Shale	CBM	Total
Onshore Lower-48																														
0-5,000 ft	715	1,540	724	222	733	3,934	544	1,193	804	332	929	3,802	435	1,077	804	583	1,104	4,003	386	946	814	447	1,579	4,172	369	804	962	466	2,050	4,651
5-10,000 ft	850	2,845	1,411	33	3	5,142	774	2,795	1,698	50	3	5,320	667	2,710	1,795	186	2	5,360	650	2,704	1,890	352	1	5,597	652	2,642	2,321	238	1	5,854
10-15,000 ft	251	2,443	546	-	-	3,240	272	2,763	642	-	-	3,677	249	2,785	806	-	-	3,840	270	2,997	1,506	-	-	4,773	297	3,334	2,248	-	-	5,879
>15,000 ft	4	781	136	-	-	921	7	826	113	-	-	946	5	1,286	146	-	-	1,437	8	1,846	196	-	-	2,050	12	1,813	213	-	-	2,038
All L48 Onshore	1,820	7,609	2,817	255	736	13,237	1,597	7,577	3,257	382	932	13,745	1,356	7,858	3,551	769	1,106	14,640	1,314	8,493	4,406	799	1,580	16,592	1,330	8,593	5,744	704	2,051	18,422
Gulf of Mexico Offshore																														
Conventional Depths																														
Shelf 0-40 meters	232	2,185	-	-	-	2,417	187	1,631	-	-	-	1,818	138	1,402	-	-	-	1,540	98	1,105	-	-	-	1,203	58	1,042	-	-	-	1,100
Shelf 40-200 meters	294	1,703	-	-	-	1,997	223	1,536	-	-	-	1,759	168	1,569	-	-	-	1,737	127	1,399	-	-	-	1,526	79	1,155	-	-	-	1,234
Slope 200-1,000 meters	147	254	-	-	-	401	395	701	-	-	-	1,096	605	1,283	-	-	-	1,888	695	1,308	-	-	-	2,003	643	1,092	-	-	-	1,735
Slope 1,000-1,500 meters	-	-	-	-	-	-	84	127	-	-	-	211	313	371	-	-	-	684	511	497	-	-	-	1,008	571	495	-	-	-	1,066
Slope >1,500 meters	-	-	-	-	-	-	35	64	-	-	-	99	192	317	-	-	-	509	387	559	-	-	-	946	527	651	-	-	-	1,178
Subsalt Depths																														
Shelf 40-200 meters	1	4	-	-	-	5	13	162	-	-	-	175	22	234	-	-	-	256	28	266	-	-	-	294	31	259	-	-	-	290
Slope 200-1,000 meters	2	18	-	-	-	20	10	47	-	-	-	57	27	108	-	-	-	135	40	145	-	-	-	185	50	156	-	-	-	206
Slope >1,000 meters	-	-	-	-	-	-	1	4	-	-	-	5	12	35	-	-	-	47	28	70	-	-	-	98	39	84	-	-	-	123
Total GOM Offshore	676	4,164	-	-	-	4,840	948	4,272	-	-	-	5,220	1,477	5,319	-	-	-	6,796	1,914	5,349	-	-	-	7,263	1,998	4,934	-	-	-	6,932

Note: Historical data are from model and do not reflect actual production. Coalbed methane production is understated by approximately 200 BCF in 1995 and low perm & tight is overstated by a similar amount.

RIG-RELATED RESULTS
NPC REFERENCE CASE

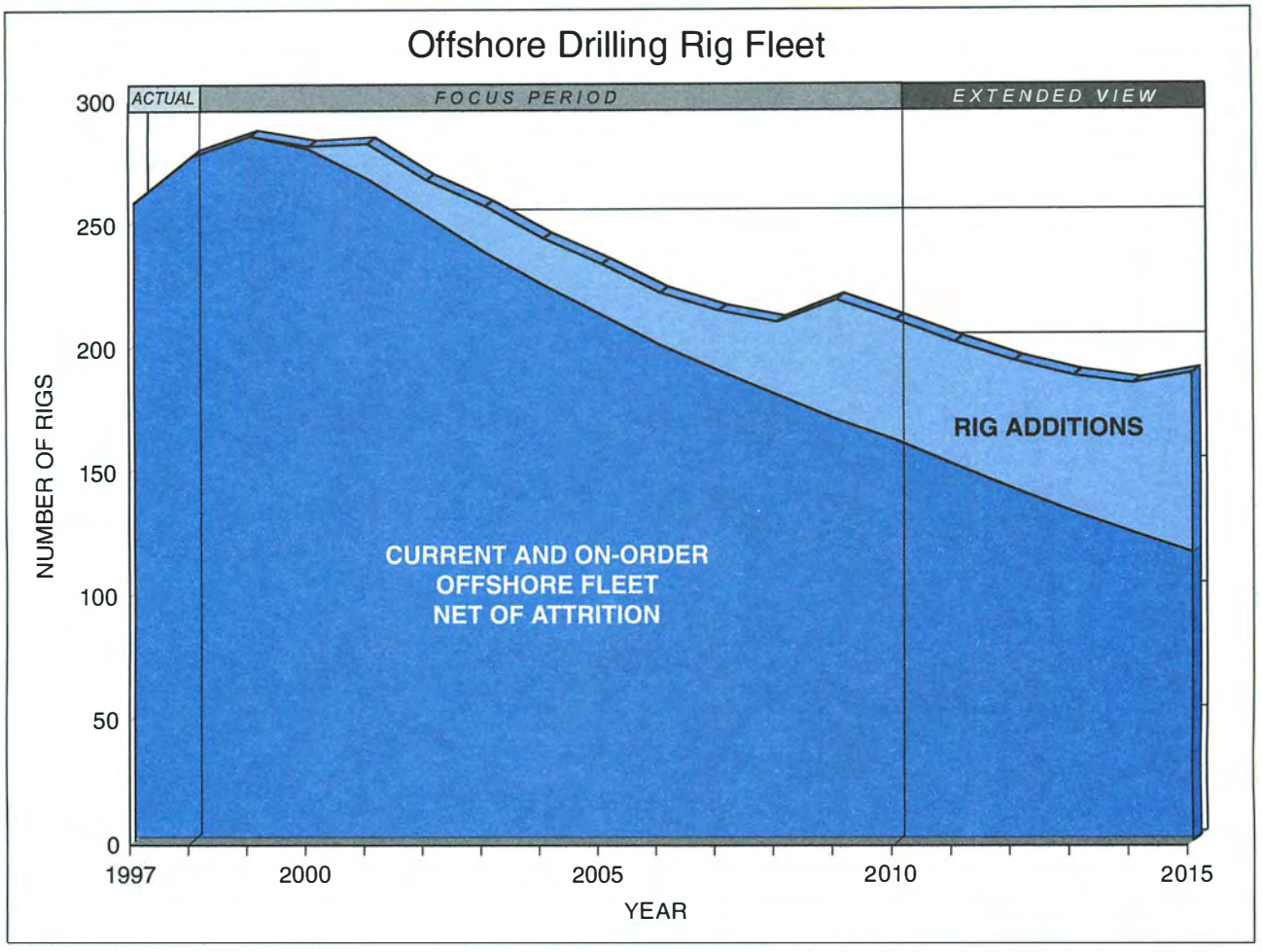
Prepared for:

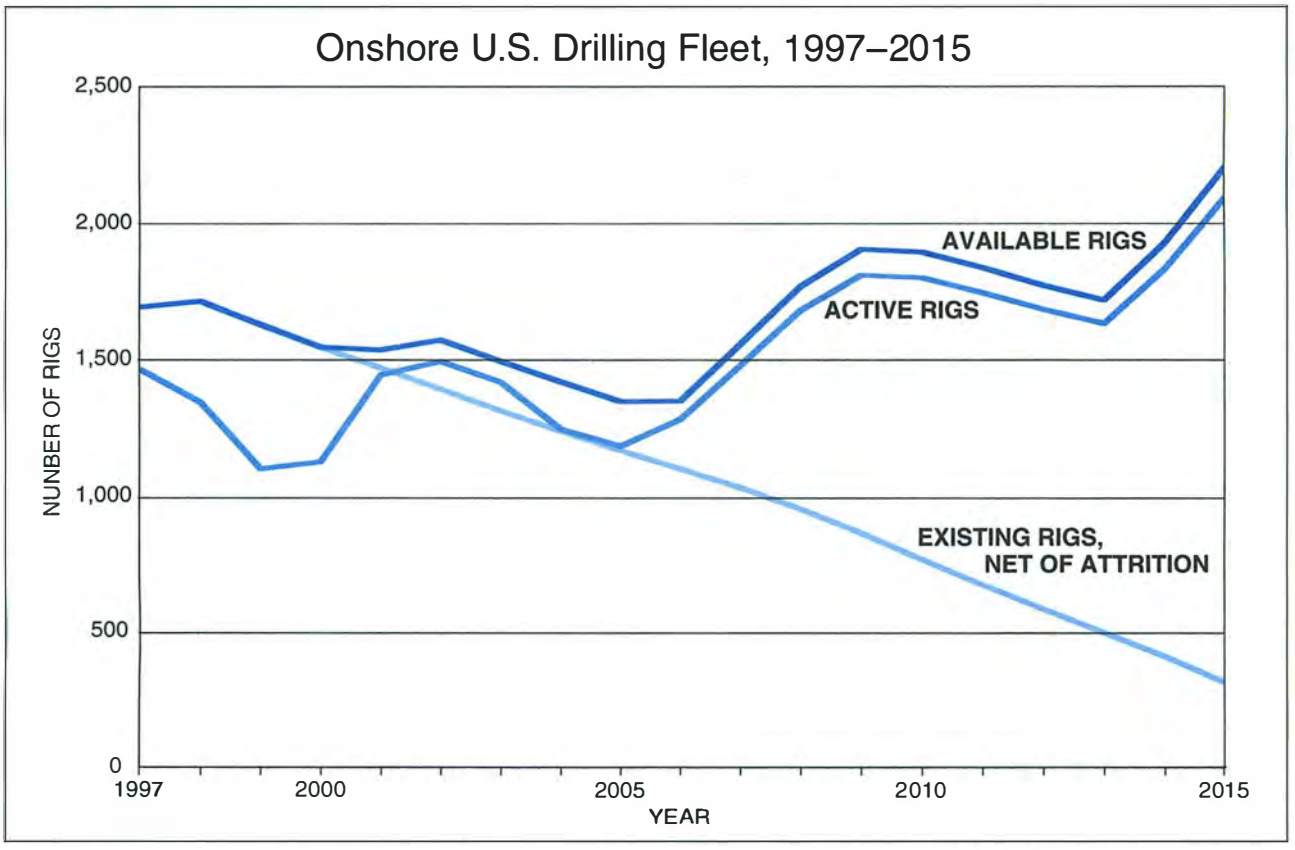
National Petroleum Council
Supply Task Group

Prepared by:

Energy and Environmental Analysis, Inc.
1655 North Fort Myer Drive
Arlington, Virginia 22209

October 20, 1999


Offshore Drilling Rig Fleet
ACTUAL
FOCUS PERIOD
EXTENDED VIEW
300
250
200
150
100
50
0
NUMBER OF RIGS
RIG ADDITIONS
CURRENT AND ON-ORDER
OFFSHORE FLEET
NET OF ATTRITION
1997
2000
2005
2010
2015
YEAR


Onshore U.S. Drilling Fleet, 1997–2015
2,500
2,000
1,500
1,000
500
0
NUNBER OF RIGS
AVAILABLE RIGS
ACTIVE RIGS
EXISTING RIGS,
NET OF ATTRITION
1997
2000
2005
2010
2015
YEAR

ONSHORE U.S. RIG AND DAY RATE BALANCE: 1997

	Hughes Operating	Reed Active	Reed Available	Reed Utilization
Rigs Counted by Hughes & Reed	821	1,235	1,428	86%
Other (Truck Mounted)	101	233	270	86%
	922	1,468	1,698	86%

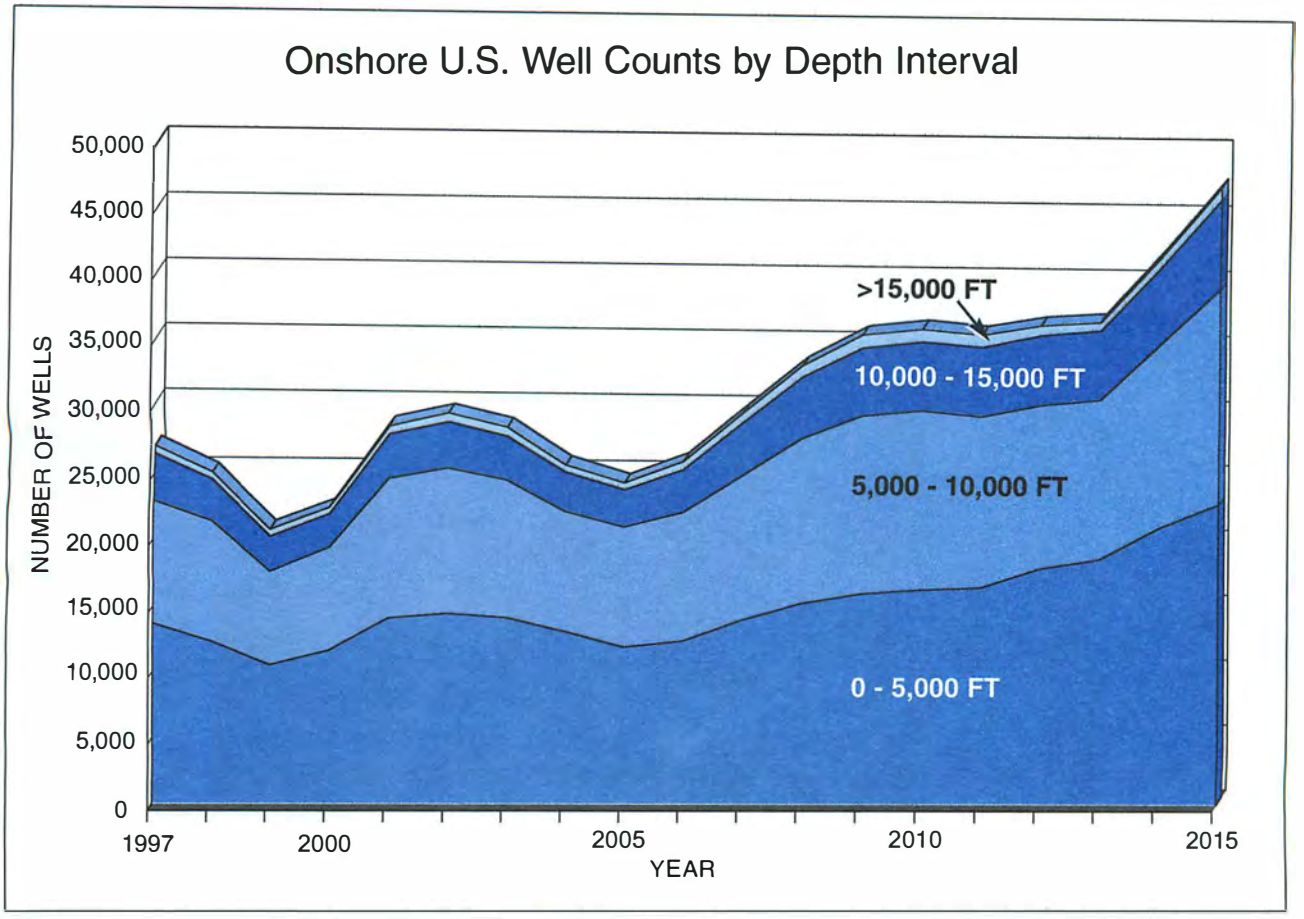
	0-5,000 ft Depth 1	5-10,000 ft Depth 2	10-15,000 ft Depth 3	>15,000 ft Depth 4	Total
Wells	13,661	9,254	3,527	614	27,056
Ft/Well	2,510	6,905	11,773	16,890	5,547
Footage	34,291,000	63,900,000	41,521,793	10,370,200	150,082,993
Non-Drilling Days/Well	4	8	15	29	7.37
Drilling ROP (Feet/Day)	750	525	343	216	446
Drilling ROP (Feet/Year)	273,783	191,765	125,108	78,907	162,819
All Rig Time (Reed Census Concept)					
Days per Well	8	21	49	107	19.8
Total Days	105,570	191,932	172,485	65,732	535,719
Active Rigs	289	526	473	180	1,468
Drilling Time Only (Hughes Survey Concept)					
Days per Well	3	13	34	78	12.4
Total Days	45,716	121,625	121,139	47,969	336,449
Operating Rigs	125	333	332	131	922
Ratio Hughes/Reed Concept	0.43	0.63	0.70	0.73	0.63
1997 Day Rates	4,500	5,500	7,000	9,500	6,277
Dollars	475,065,074	1,055,626,202	1,207,393,952	624,456,677	3,362,541,906
$/ft for rig	$13.85	$16.52	$29.08	$60.22	$22.40
$/ft for well	$49.45	$62.49	$106.51	$244.35	$84.26
Rig cost as % of well	28%	26%	27%	25%	27%

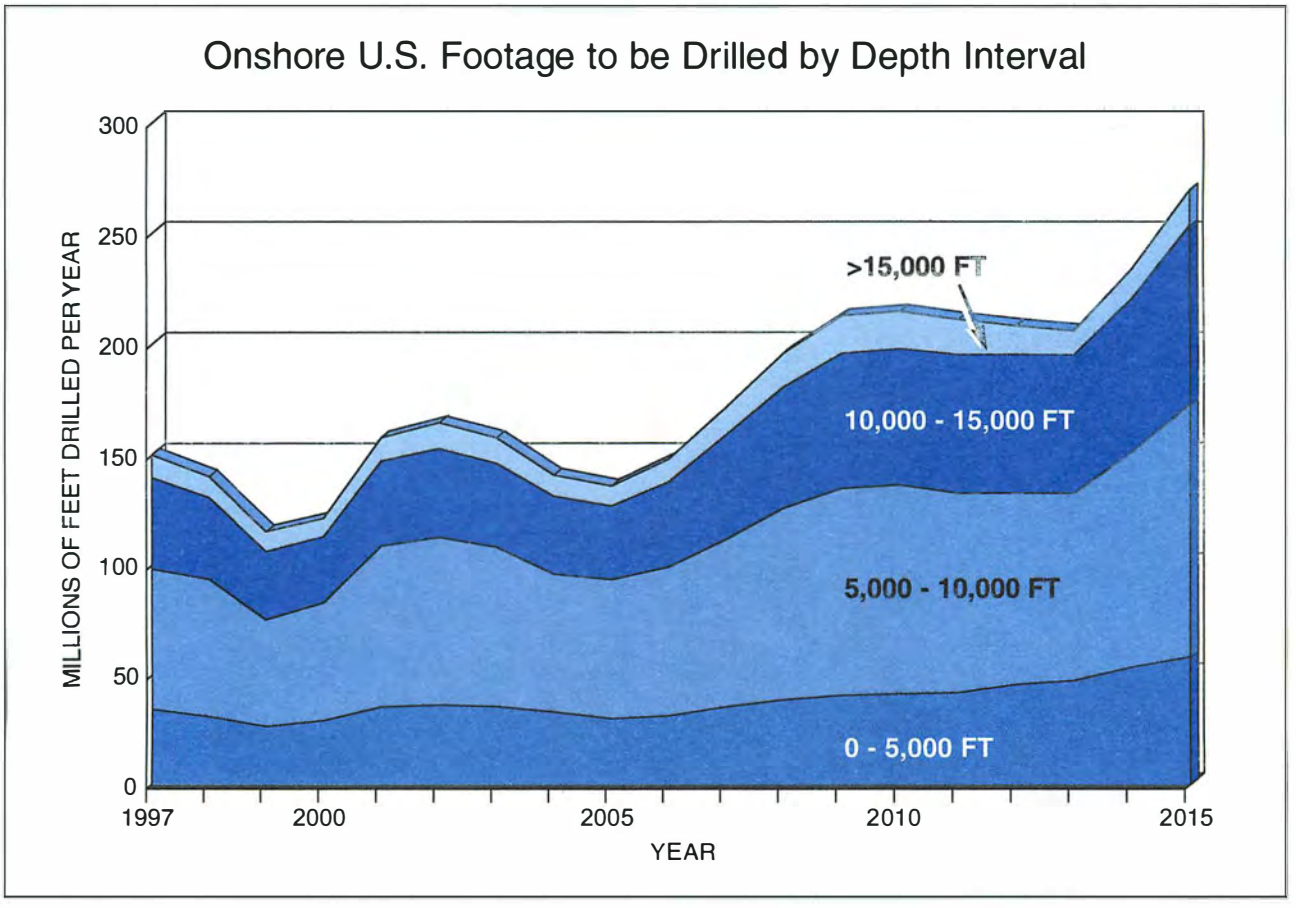
Lower-48 Onshore Drilling Projection and Rig Requirements - Reference Case (NPC99A) Includes all shallow wells

	Rigs Needed (Reed "Active" Concept)						Reed "Available" Rigs					Attrition Rate 5.0% Rigs Lost to Attrition				
	D1	D2	D3	D4	All Onshore	Average ft/rig/yr	D1	D2	D3	D4	All Onshore	D1	D2	D3	D4	All Onshore
1997	289	526	473	180	1,468	102,255	370	469	588	270	1,697					
1998	257	510	418	164	1,349	104,050	366	460	600	292	1,718	18	23	30	15	86
1999	217	393	342	153	1,105	104,264	348	437	570	277	1,632	17	22	29	14	82
2000	237	426	327	140	1,130	107,235	330	415	542	264	1,550	17	21	27	13	78
2001	284	573	417	174	1,449	108,898	314	461	514	250	1,540	16	23	26	13	77
2002	288	590	429	191	1,497	109,843	303	547	489	238	1,576	15	27	24	12	79
2003	278	553	402	188	1,421	111,034	288	519	464	226	1,497	14	26	23	11	75
2004	255	474	368	152	1,249	112,717	273	493	441	215	1,422	14	25	22	11	71
2005	229	471	344	142	1,186	114,489	260	469	419	204	1,351	13	23	21	10	68
2006	235	498	393	159	1,285	115,088	248	513	398	194	1,353	12	26	20	10	68
2007	262	554	475	191	1,482	115,640	276	583	500	201	1,560	14	29	25	10	78
2008	284	624	544	232	1,683	116,374	298	656	572	244	1,771	15	33	29	12	89
2009	293	666	597	256	1,813	117,347	309	701	629	270	1,908	15	35	31	13	95
2010	296	663	595	250	1,804	119,031	311	698	626	263	1,899	16	35	31	13	95
2011	295	626	597	231	1,749	120,551	307	663	622	250	1,842	15	33	31	13	92
2012	317	593	590	187	1,688	123,317	318	630	590	238	1,777	16	32	30	12	89
2013	326	573	583	154	1,635	125,852	336	599	561	226	1,722	17	30	28	11	86
2014	364	649	635	188	1,837	127,236	383	684	653	214	1,934	19	34	33	11	97
2015	391	752	734	223	2,099	128,429	411	791	773	235	2,210	21	40	39	12	110
												284	516	498	215	1,513

Lower-48 Onshore Drilling Projection and Rig Requirements - Reference Case (NPC99A) Includes all shallow wells

	Rigs Available: Cumulative Deep to Shallow				Rigs Needed: Cumulative Deep to Shallow				Rigs Added					Maximum Utilization 95% Cum Utilization Rate (D1=overall)			
	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	All Onshore	D1	D2	D3	D4
1997	1697	1327	858	270	1468	1178	653	180						86%	89%	76%	67%
1998	1718	1352	892	292	1349	1092	582	164						79%	81%	65%	56%
1999	1632	1284	847	277	1105	887	495	153	0	0	0	0	0	68%	69%	58%	55%
2000	1550	1220	805	264	1130	893	467	140	0	0	0	0	0	73%	73%	58%	53%
2001	1540	1226	765	250	1449	1165	592	174	0	67	0	0	67	94%	95%	77%	70%
2002	1576	1273	727	238	1497	1210	620	191	5	108	0	0	113	95%	95%	85%	80%
2003	1497	1210	690	226	1421	1143	590	188	0	0	0	0	0	95%	95%	86%	83%
2004	1422	1149	656	215	1249	994	520	152	0	0	0	0	0	88%	87%	79%	71%
2005	1351	1092	623	204	1186	957	486	142	0	0	0	0	0	88%	88%	78%	70%
2006	1353	1105	592	194	1285	1050	552	159	1	68	0	0	69	95%	95%	93%	82%
2007	1560	1283	701	201	1482	1219	666	191	41	95	121	17	275	95%	95%	95%	95%
2008	1771	1473	816	244	1683	1399	775	232	36	103	98	53	290	95%	95%	95%	95%
2009	1908	1599	899	270	1813	1519	854	256	25	77	85	38	226	95%	95%	95%	95%
2010	1899	1588	889	263	1804	1508	845	250	18	33	29	7	86	95%	95%	95%	95%
2011	1842	1535	872	250	1749	1454	828	231	11	0	27	0	38	95%	95%	95%	93%
2012	1777	1458	828	238	1688	1370	777	187	27	0	0	0	27	95%	94%	94%	79%
2013	1722	1385	787	226	1635	1310	737	154	34	0	0	0	34	95%	95%	94%	68%
2014	1934	1551	867	214	1837	1473	824	188	64	115	120	0	298	95%	95%	95%	88%
2015	2210	1799	1007	235	2099	1709	957	223	47	142	153	31	373	95%	95%	95%	95%
									309	808	632	146	1894				

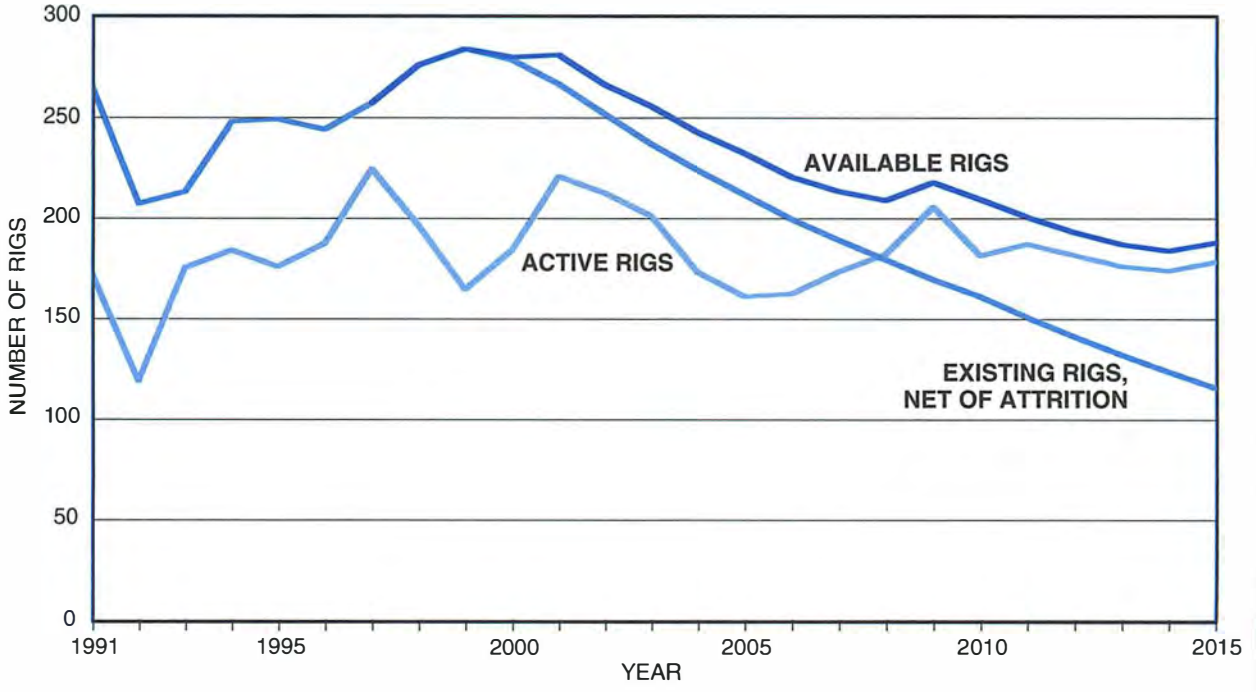

Onshore U.S. Well Counts by Depth Interval
NUMBER OF WELLS
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1997
2000
2005
2010
2015
YEAR
>15,000 FT
10,000 - 15,000 FT
5,000 - 10,000 FT
0 - 5,000 FT


Onshore U.S. Footage to be Drilled by Depth Interval
MILLIONS OF FEET DRILLED PER YEAR
300
250
200
150
100
50
0
1997
2000
2005
2010
2015
YEAR
>15,000 FT
10,000 - 15,000 FT
5,000 - 10,000 FT
0 - 5,000 FT

Lower-48 Onshore Drilling Projection and Rig Requirements - Reference Case (NPC99A) Includes all shallow wells

	Total Wells					Total Footage						Efficiency Improvement 1.25% Days per Well (Reed "Active" Concept)				
	0-5k	5-10k	10-15k	>15k	All Onshore	0-5k	5-10k	10-15k	>15k	All Onshore	ft/well	D1	D2	D3	D4	All Onshore
1997	13,661	9,254	3,527	614	27,056	34,289,110	63,898,870	41,523,371	10,370,460	150,081,811	5,547	7.7	20.7	48.9	107.1	19.8
1998	12,302	9,080	3,159	566	25,108	30,878,441	62,699,911	37,193,850	9,563,963	140,336,165	5,589	7.6	20.5	48.3	105.7	19.6
1999	10,520	7,088	2,617	534	20,759	26,404,888	48,939,344	30,806,262	9,026,649	115,177,144	5,548	7.5	20.2	47.7	104.4	19.4
2000	11,641	7,793	2,533	495	22,462	29,218,676	53,811,646	29,824,136	8,353,425	121,207,883	5,396	7.4	20.0	47.1	103.1	18.4
2001	14,115	10,607	3,274	625	28,622	35,429,239	73,242,022	38,548,168	10,558,018	157,777,448	5,513	7.3	19.7	46.5	101.8	18.5
2002	14,472	11,048	3,408	694	29,623	36,324,631	76,288,992	40,122,386	11,724,587	164,460,595	5,552	7.3	19.5	45.9	100.5	18.4
2003	14,173	10,493	3,239	691	28,596	35,575,440	72,451,989	38,132,748	11,664,008	157,824,185	5,519	7.2	19.2	45.3	99.3	18.1
2004	13,147	9,110	3,000	566	25,822	32,998,320	62,903,462	35,319,000	9,556,249	140,777,032	5,452	7.1	19.0	44.8	98.0	17.7
2005	11,960	9,164	2,842	535	24,501	30,019,275	63,276,876	33,458,866	9,034,405	135,789,422	5,542	7.0	18.8	44.2	96.8	17.7
2006	12,446	9,810	3,282	608	26,146	31,240,553	67,737,778	38,638,986	10,268,247	147,885,564	5,656	6.9	18.5	43.7	95.6	17.9
2007	14,054	11,048	4,018	738	29,859	35,276,086	76,289,756	47,298,028	12,472,829	171,336,699	5,738	6.8	18.3	43.1	94.4	18.1
2008	15,379	12,603	4,659	908	33,549	38,601,290	87,023,715	54,850,407	15,336,120	195,811,532	5,837	6.7	18.1	42.6	93.2	18.3
2009	16,117	13,624	5,184	1,017	35,942	40,453,670	94,073,720	61,031,232	17,177,130	212,735,752	5,919	6.6	17.8	42.1	92.1	18.4
2010	16,448	13,749	5,228	1,004	36,429	41,284,480	94,936,845	61,549,244	16,957,560	214,728,129	5,894	6.6	17.6	41.5	90.9	18.1
2011	16,627	13,144	5,310	941	36,022	41,733,770	90,759,320	62,514,630	15,893,490	210,901,210	5,855	6.5	17.4	41.0	89.8	17.7
2012	18,105	12,605	5,322	769	36,801	45,443,550	87,037,525	62,655,906	12,988,410	208,125,391	5,655	6.4	17.2	40.5	88.6	16.7
2013	18,810	12,325	5,323	642	37,100	47,213,100	85,104,125	62,667,679	10,843,380	205,828,284	5,548	6.3	17.0	40.0	87.5	16.1
2014	21,292	14,154	5,872	795	42,113	53,442,920	97,733,370	69,131,056	13,427,550	233,734,896	5,550	6.2	16.7	39.5	86.4	15.9
2015	23,134	16,592	6,870	954	47,550	58,066,340	114,567,760	80,880,510	16,113,060	269,627,670	5,670	6.2	16.5	39.0	85.4	16.1

Offshore Drilling Rig Fleet, 1997–2015



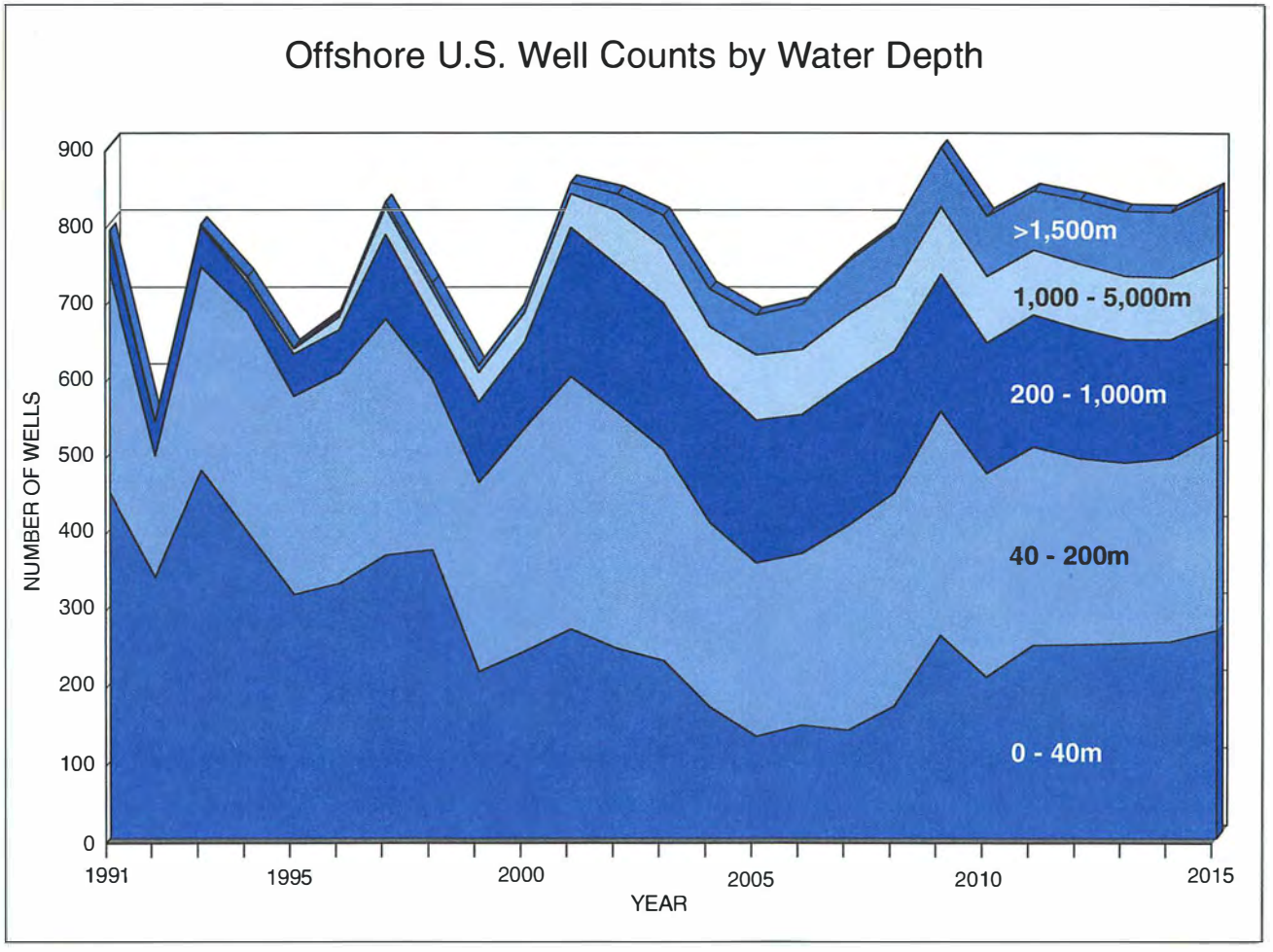
Gulf of Mexico Rig Inventory

	Total	Marketed	Contracted	Not Marketed
Jackups	139	119	105	20
Semis	38	34	27	4
Drillships	3	3	3	0
Submersibles	7	1	1	6
Total Mobile	187	157	136	30
Platform	78	57	37	21
Inland Barges	95	70	34	25
All offshore	**360**	**284**	**207**	**76**

Source: Offshore Data Services, September 24, 1999

Offshore Rigs
Reed Census (October 1999)

	Available					Reed	Operating		ODS	Rd Act/	Smoothed		Historical
	Inland Barge	Floating	Offshore Platform	Bottom Supported	Total	Active	Hughes	Ratio	Contracted	ODS	"Active"	old est	target
1990	54	30	46	129	259	205	108	0.53			196		
1991	51	24	48	122	245	179	81	0.45			147	197	172
1992	47	20	41	79	187	103	52	0.50			95	135	115
1993	46	19	36	92	193	159	82	0.52			149	199	174
1994	45	21	39	123	228	172	102	0.59			185	182	184
1995	45	19	43	122	229	185	101	0.55			184	158	171
1996	46	22	39	117	224	192	108	0.56			196	178	187
1997	44	28	42	123	237	212	122	0.58	223	0.951	222	213	217
1998	47	35	45	129	256	213	123	0.58	195	1.092	224	186	205
1999	46	37	45	132	260	161	102	0.63	183	0.880	185	156	171
Active 1999	21	27	17	96	161			0.55		0.974	1587	1604	
	45.7%	73.0%	37.8%	72.7%	61.9%								


Offshore U.S. Well Counts by Water Depth
NUMBER OF WELLS
900
800
700
600
500
400
300
200
100
0
1991
1995
2000
2005
2010
2015
YEAR
>1,500m
1,000 - 5,000m
200 - 1,000m
40 - 200m
0 - 40m

Offshore Drilling and Rig Needs - Reference Case (NPC99A)

Western, Central, and Eastern Gulf of Mexico (Regions EGO and BO)

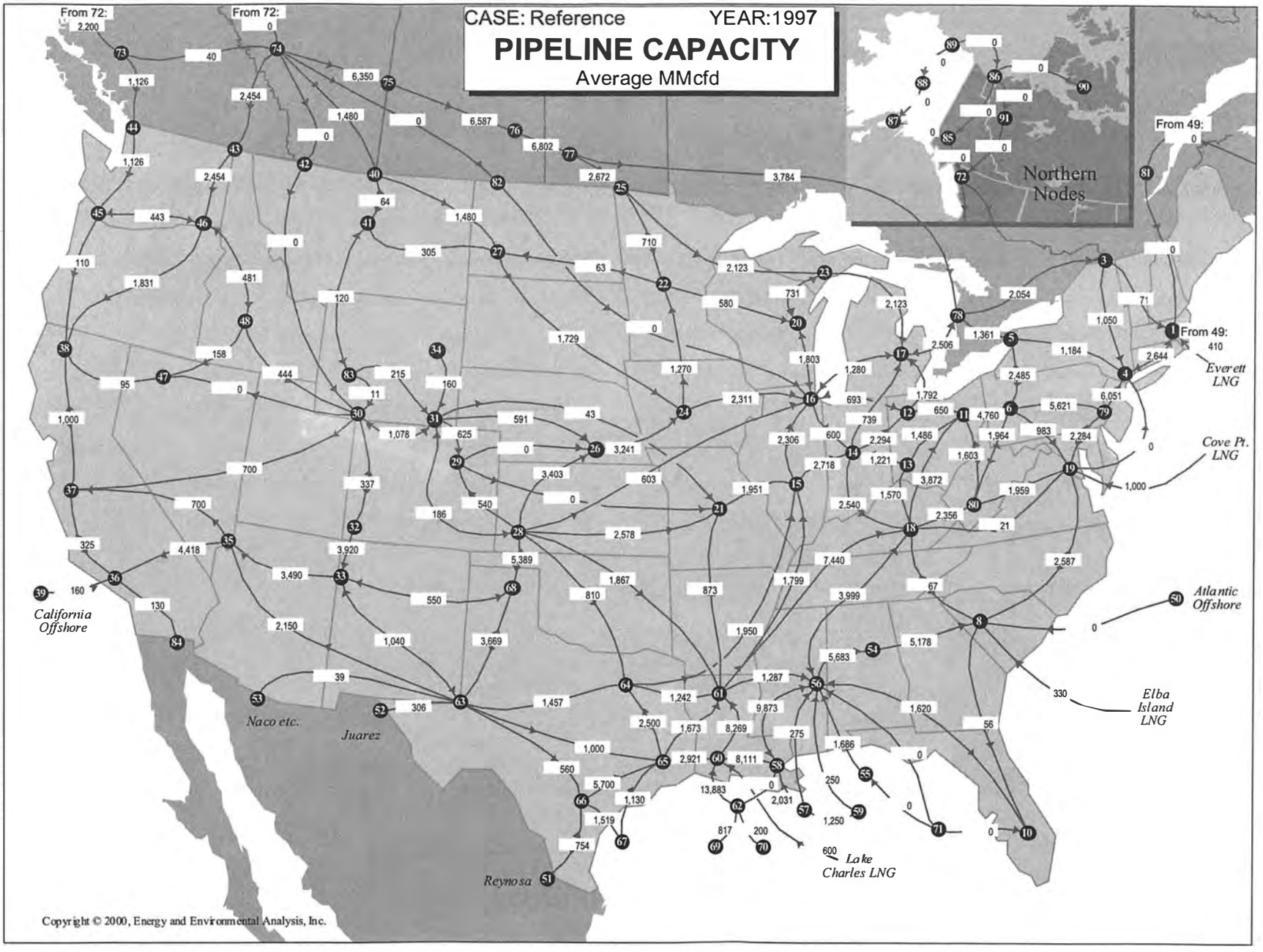
Max Util. Rate 0.95

	W,C&E GOM TOTAL WELLS						Approximate W,C & E GOM Active Rig Needs (SM #8)						Slope Only							Shelf Only							Platform Rigs		
													Active Rigs Needed			-5.0%				Rigs Needed			-7.0%				-7.0%		
														20.0%		Existing &	Cumulative	1.50%			30.0%		Existing					Existing	Cumulative
	0-40m	40-200m	200-1,000m	1,000-1,500m	over 1,500m	Total	0-40m	40-200m	200-1,000m	1,000-1,500m	over 1,500m	Total	Total	Platform	Mobile	Planned Mobile (1)	Unplanned Mobile	Efficiency Gains	Wells/Rig /Year	Total	Platform	Mobile	Available Mobile & Barges	Unplanned Mobile	1.25% Efficiency Gains	Wells/Rig /Year	Needed Platform	Marketed Platform	Unplanned Platform
1991	447	290	45	7	1	790	97	63	10	2	0	172	12	2	10					160	48	112					50		
1992	336	160	45	0	0	541	73	35	10	0	0	119	10	2	8					108	33	76					35		
1993	477	266	52	1	2	798	104	58	12	0	0	175	13	3	10					162	49	114					51		
1994	395	289	39	6	1	730	100	74	9	1	0	184	11	2	9					173	52	121					54		
1995	314	260	55	7	2	638	88	73	13	2	0	176	15	3	12					161	48	113					51		
1996	328	276	57	17	4	682	92	77	13	4	1	187	18	4	14					169	51	119					54		
1997	365	310	110	35	7	827	102	87	25	8	2	224	35	7	28					189	57	132					64		
1998	372	225	78	38	9	722	104	63	18	9	2	196	29	6	23					167	50	117					56		
1999	214	247	106	39	9	614	60	69	25	9	2	165	36	7	28	37	0	1.00	4.3	129	39	90	190	0	1.00	3.6	46	57	0
2000	240	292	112	39	11	694	66	81	26	9	3	184	37	7	30	49	0	1.02	4.4	147	44	103	177	0	1.01	3.6	52	53	1
2001	269	331	194	44	14	852	74	91	44	10	3	221	57	11	45	53	0	1.03	4.5	164	49	115	164	0	1.03	3.7	61	49	14
2002	244	311	191	71	22	838	66	84	42	16	5	212	63	13	50	53	0	1.05	4.5	150	45	105	153	0	1.04	3.7	57	46	15
2003	228	276	192	75	40	810	61	74	42	16	9	201	67	13	53	52	4	1.06	4.6	134	40	94	142	0	1.05	3.7	54	43	15
2004	169	240	192	66	49	714	44	63	41	14	11	173	66	13	53	52	4	1.08	4.7	108	32	75	132	0	1.06	3.8	45	40	15
2005	131	225	188	86	52	680	34	58	40	18	11	161	69	14	55	52	6	1.09	4.7	92	28	65	123	0	1.08	3.8	41	37	15
2006	145	222	183	85	59	694	37	57	38	18	12	162	68	14	55	51	6	1.11	4.8	94	28	66	114	0	1.09	3.9	42	34	15
2007	139	266	190	88	69	750	35	67	39	18	14	174	71	14	57	51	9	1.13	4.9	103	31	72	106	0	1.10	3.9	45	32	15
2008	170	278	186	86	75	794	42	70	38	17	15	182	70	14	56	51	9	1.14	4.9	112	34	78	99	0	1.12	4.0	48	30	21
2009	261	294	179	88	77	898	65	73	36	17	15	206	68	14	55	50	9	1.16	5.0	137	41	96	92	9	1.13	4.0	55	28	30
2010	207	266	171	87	78	809	51	65	34	17	15	182	66	13	53	50	9	1.18	5.1	116	35	81	86	9	1.15	4.1	48	26	30
2011	248	260	173	85	77	842	60	63	33	16	15	187	65	13	52	48	9	1.20	5.2	123	37	86	80	11	1.16	4.1	50	24	30
2012	249	244	170	84	83	830	59	58	32	16	16	182	64	13	51	45	9	1.21	5.2	118	35	82	74	13	1.18	4.2	48	22	30
2013	251	237	162	83	84	815	59	56	30	15	16	176	62	12	49	43	9	1.23	5.3	115	34	80	69	16	1.19	4.2	47	21	30
2014	253	240	156	81	85	814	59	56	29	15	16	174	59	12	47	41	9	1.25	5.4	115	34	80	64	21	1.20	4.3	46	19	30
2015	268	258	150	80	87	843	62	59	27	15	16	179	58	12	46	39	10	1.27	5.5	121	36	85	59	30	1.22	4.4	48	18	32

(1) Inventory fixed through 2010 based on assumed plans, then stated attrition begins.

TRANSMISSION MAPS

- Pipeline Capacity
- Flow
- Load Factor
- Basis


CASE: Reference
YEAR:1997
PIPELINE CAPACITY
Average MMcfd
Northern Nodes
From 72:
From 49:
Everett LNG
Cove Pt. LNG
Atlantic Offshore
Elba Island LNG
Lake Charles LNG
California Offshore
Naco etc.
Juarez
Reynosa
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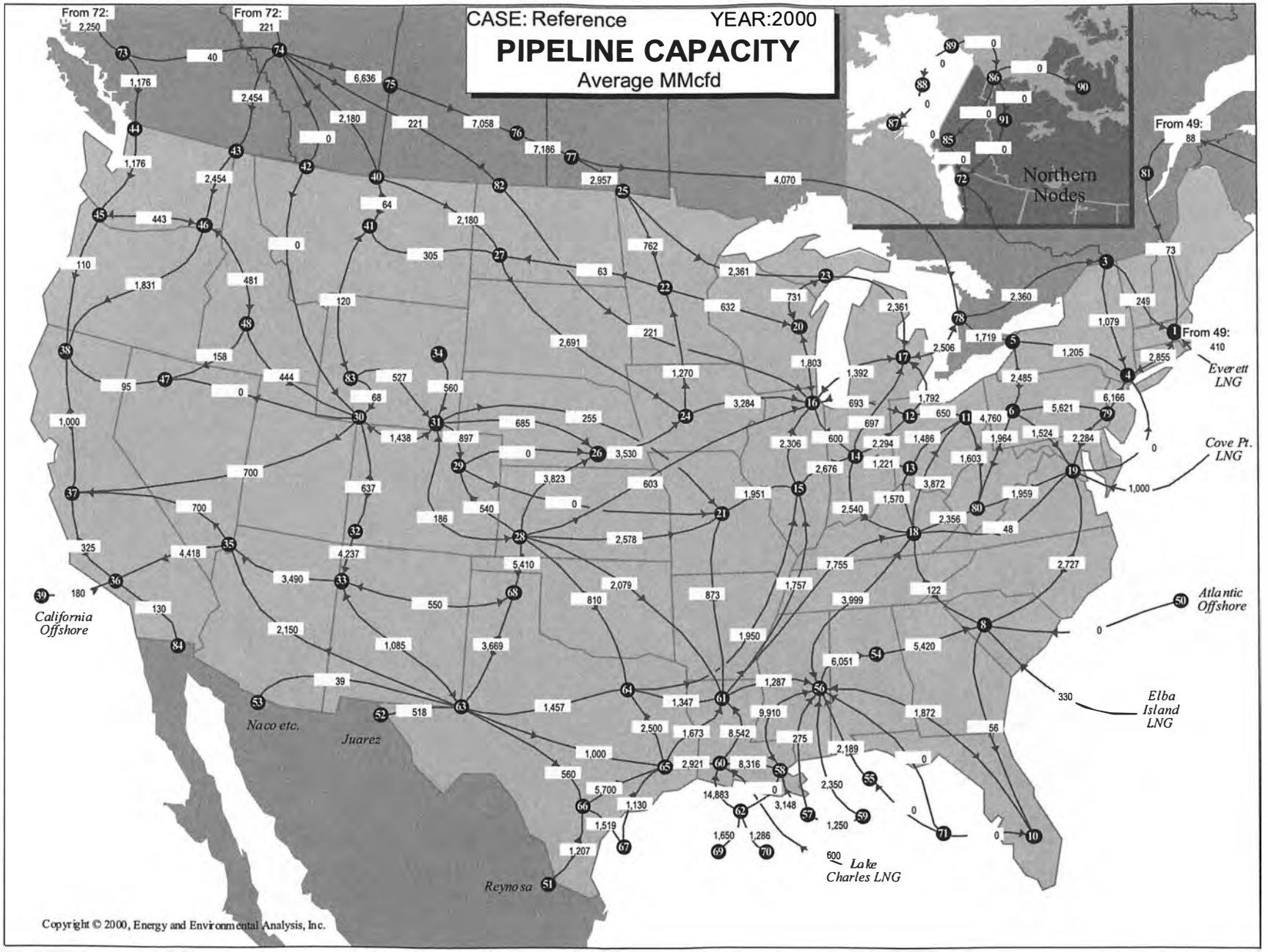
CASE: Reference
YEAR:2000
PIPELINE CAPACITY
Average MMcfd
Northern Nodes
From 72:
From 72:
From 49:
From 49:
Everett LNG
Cove Pt. LNG
Atlantic Offshore
Elba Island LNG
Lake Charles LNG
California Offshore
Naco etc.
Juarez
Reynosa
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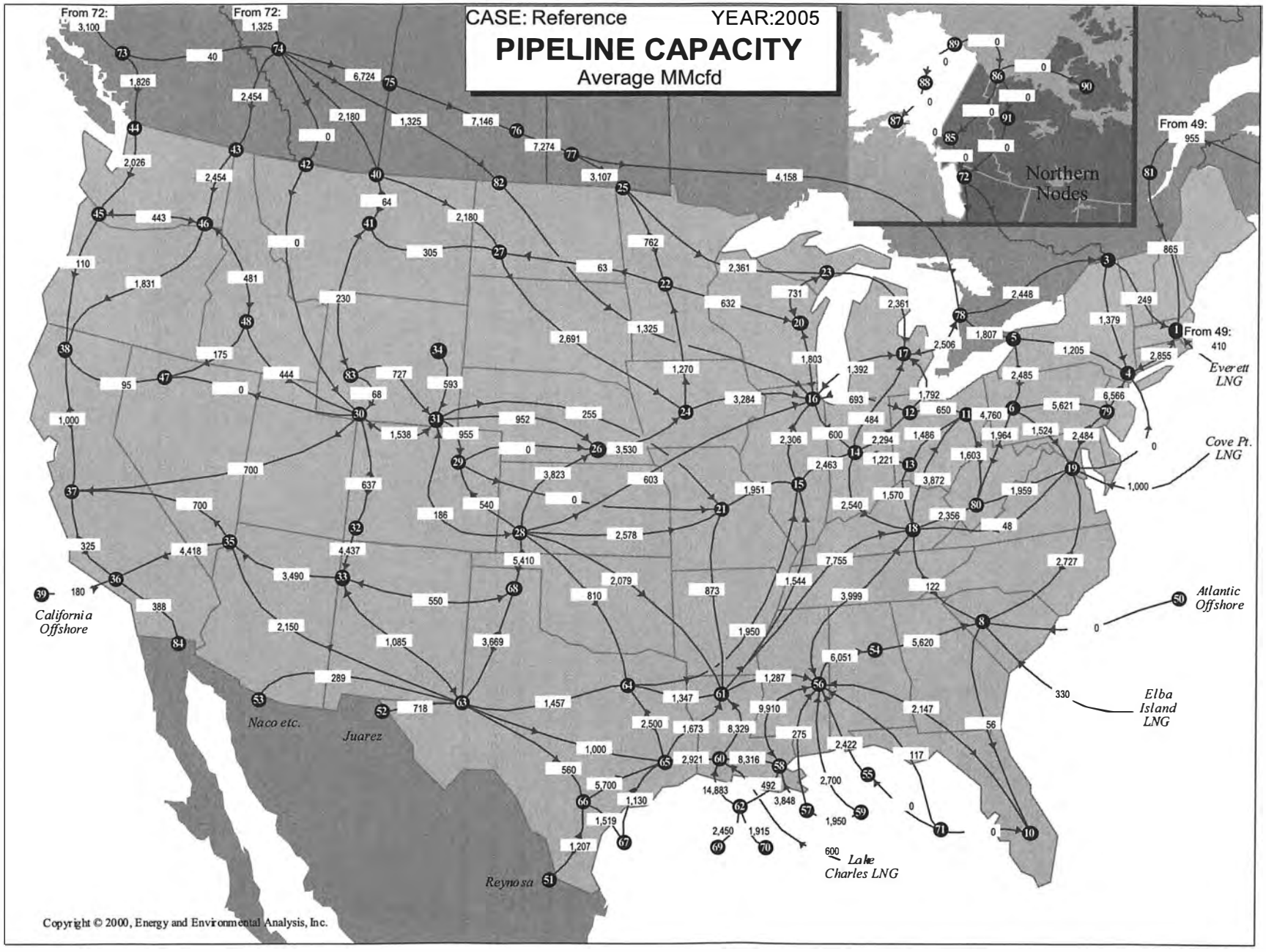
CASE: Reference
YEAR:2005
PIPELINE CAPACITY
Average MMcfd
Northern Nodes
From 72: 3,100
From 72: 1,325
From 49: 955
From 49: 410
Everett LNG
Cove Pt. LNG
1,000
Atlantic Offshore
0
California Offshore
180
Naco etc.
Juarez
Reynosa
330
Elba Island LNG
600
Lake Charles LNG
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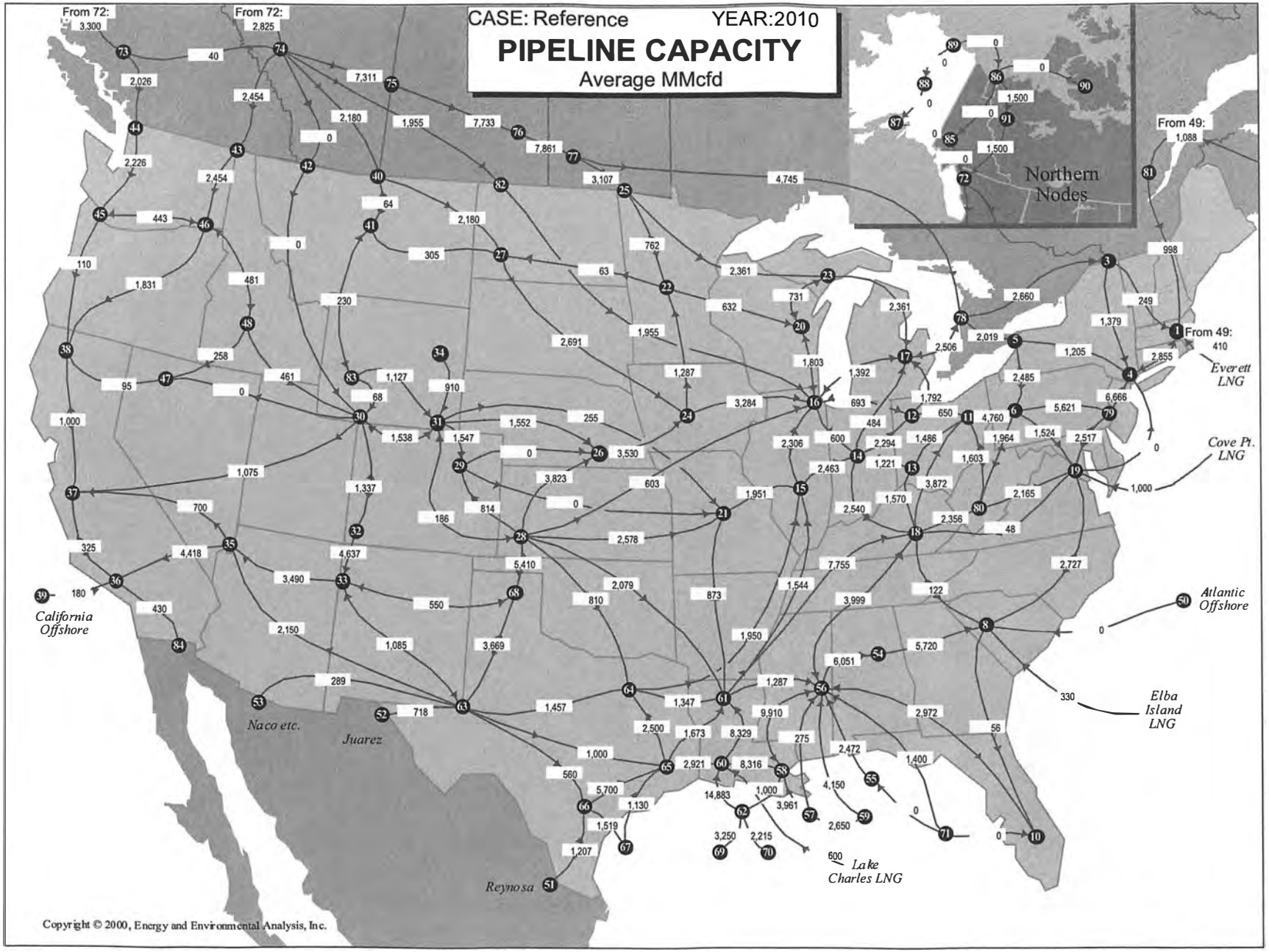
CASE: Reference
YEAR:2010
PIPELINE CAPACITY
Average MMcfd
Northern Nodes
From 72: 3,300
From 72: 2,825
From 49: 1,088
From 49: 410
Everett LNG
Cove Pt. LNG
Atlantic Offshore
Elba Island LNG
Lake Charles LNG
California Offshore
Naco etc.
Juarez
Reynosa
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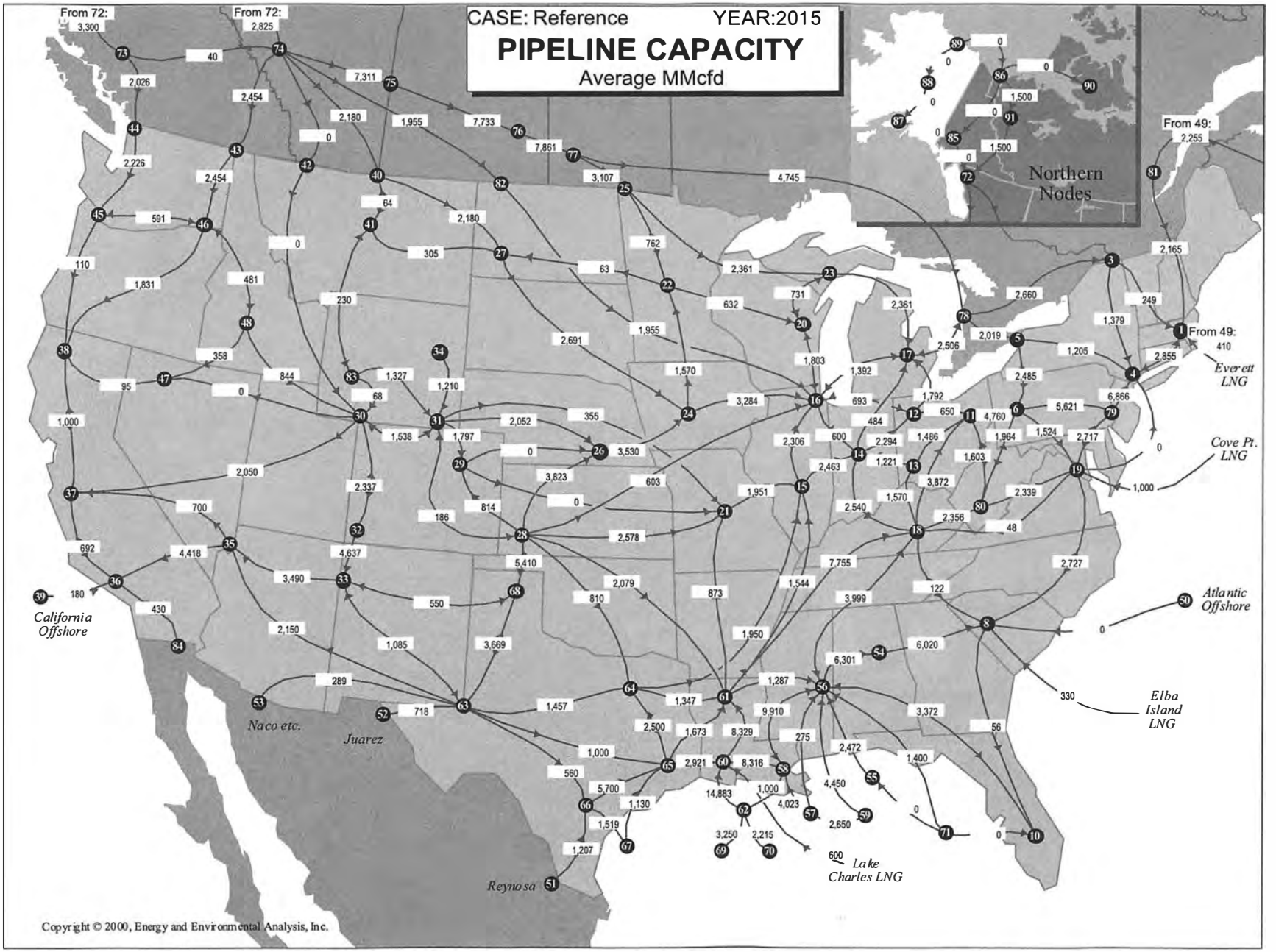
CASE: Reference
YEAR:2015
PIPELINE CAPACITY
Average MMcfd
Northern Nodes
From 72:
From 49:
Everett LNG
Cove Pt. LNG
Elba Island LNG
Lake Charles LNG
Atlantic Offshore
California Offshore
Naco etc.
Juarez
Reynosa
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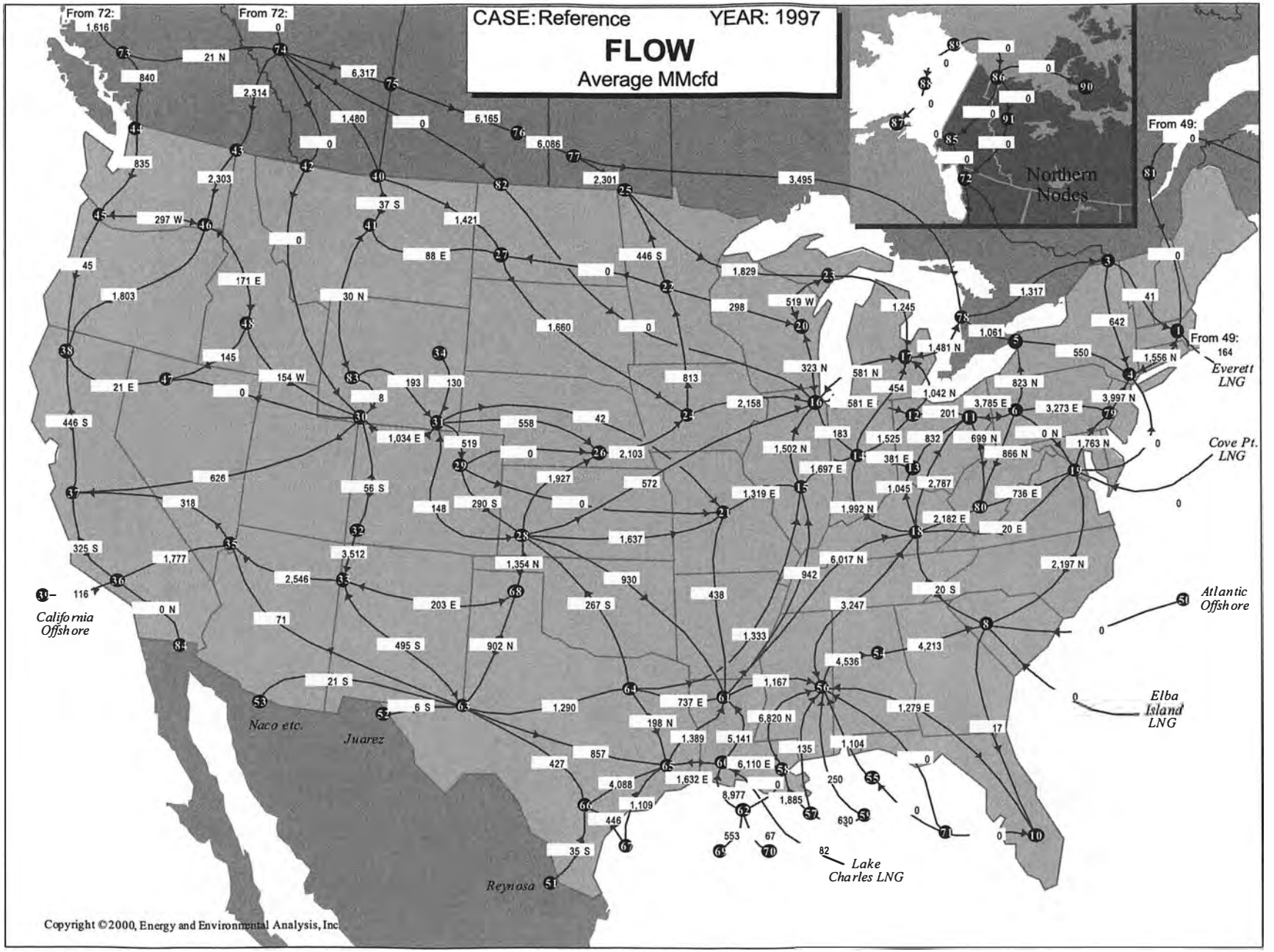
CASE: Reference
YEAR: 1997
FLOW
Average MMcfd
Northern Nodes
From 72:
From 49:
Everett LNG
Cove Pt. LNG
Atlantic Offshore
Elba Island LNG
Lake Charles LNG
California Offshore
Naco etc.
Juarez
Reynosa
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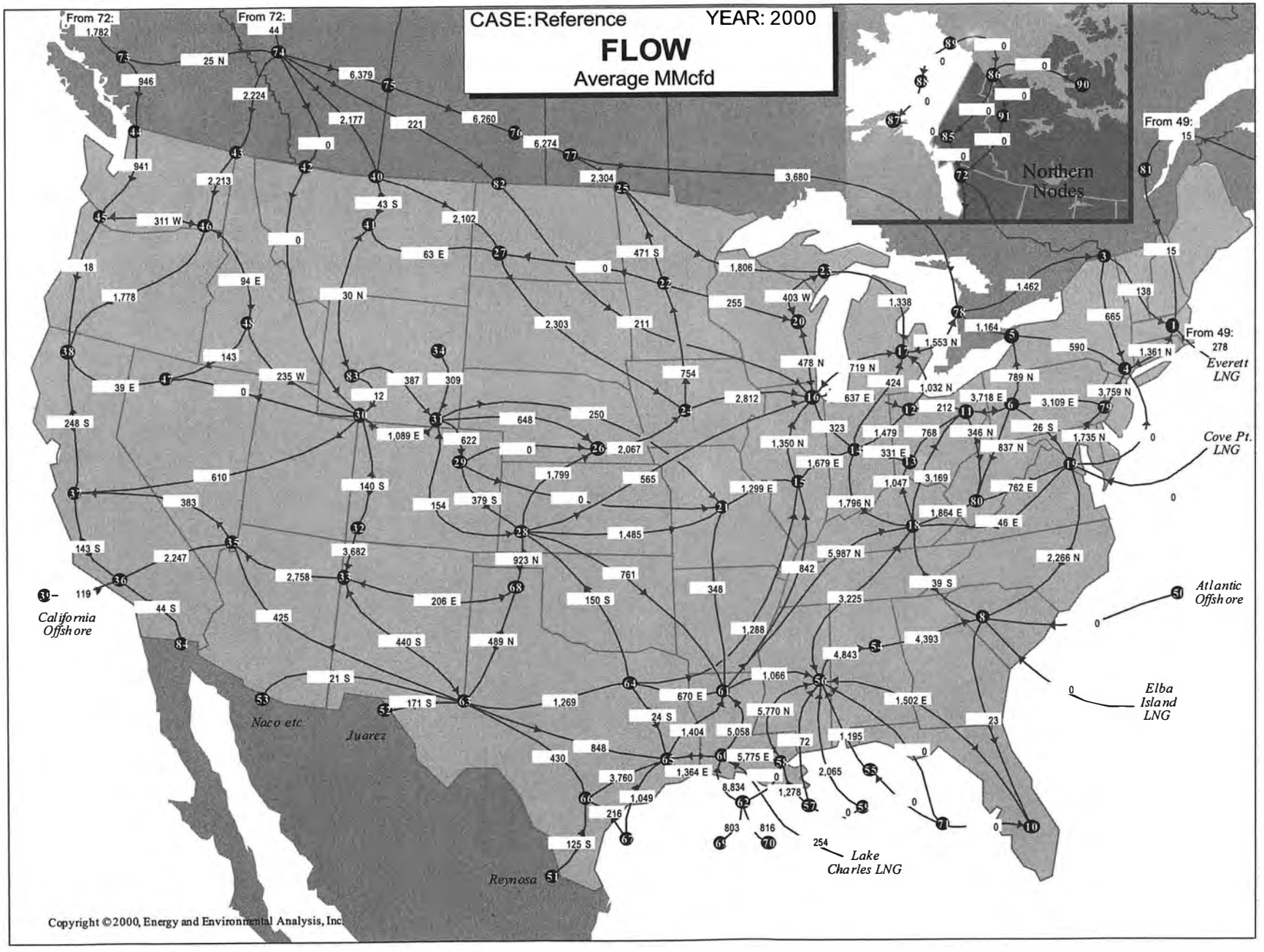
CASE: Reference
YEAR: 2000
FLOW
Average MMcfd
Northern Nodes
From 72:
From 72:
From 49:
From 49:
Everett LNG
Cove Pt. LNG
Atlantic Offshore
Elba Island LNG
Lake Charles LNG
California Offshore
Naco etc.
Juarez
Reynosa
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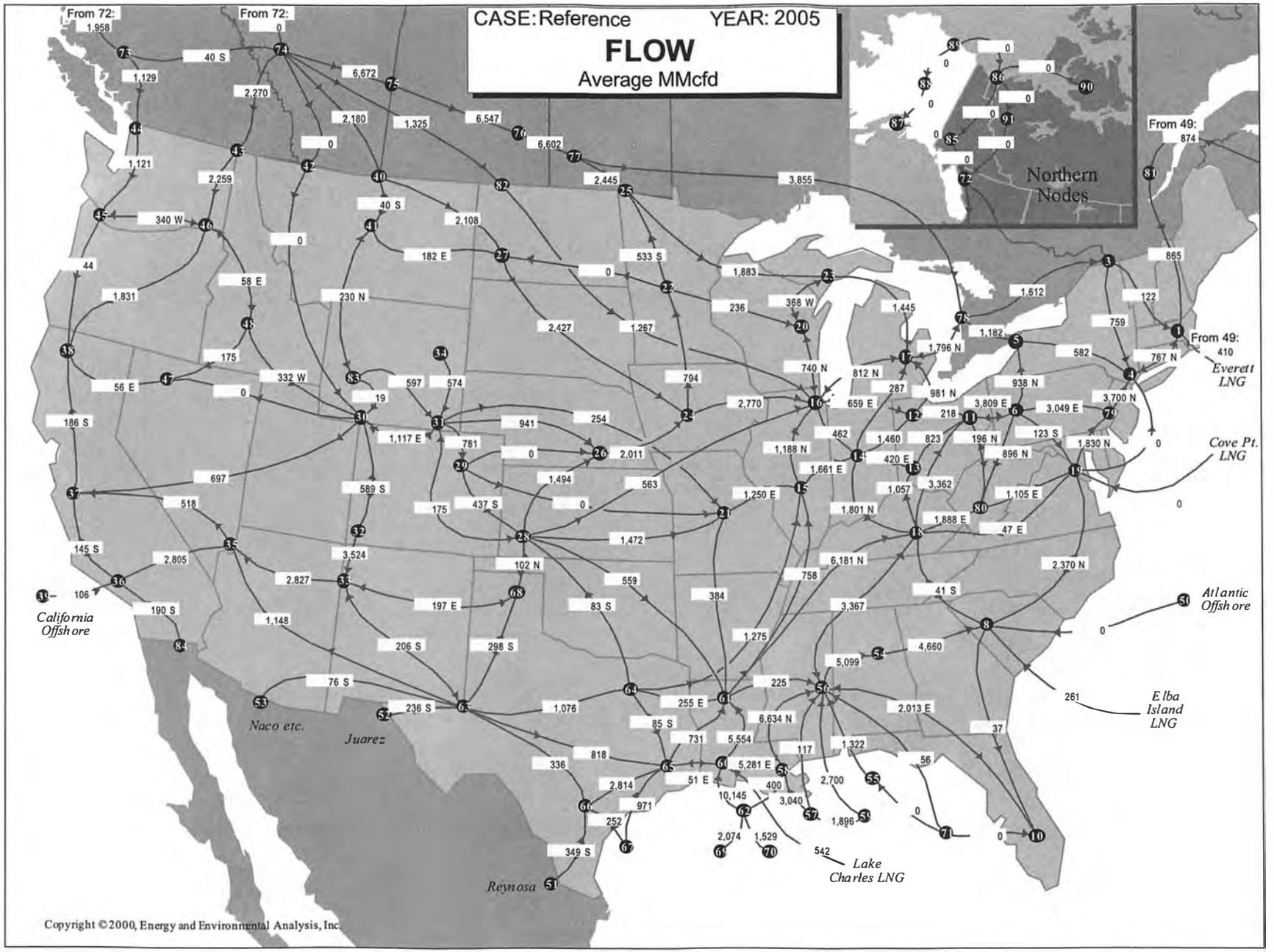
CASE: Reference
YEAR: 2005
FLOW
Average MMcfd
Northern Nodes
From 72:
From 49:
Everett LNG
Cove Pt. LNG
Atlantic Offshore
California Offshore
Elba Island LNG
Lake Charles LNG
Naco etc.
Juarez
Reynosa
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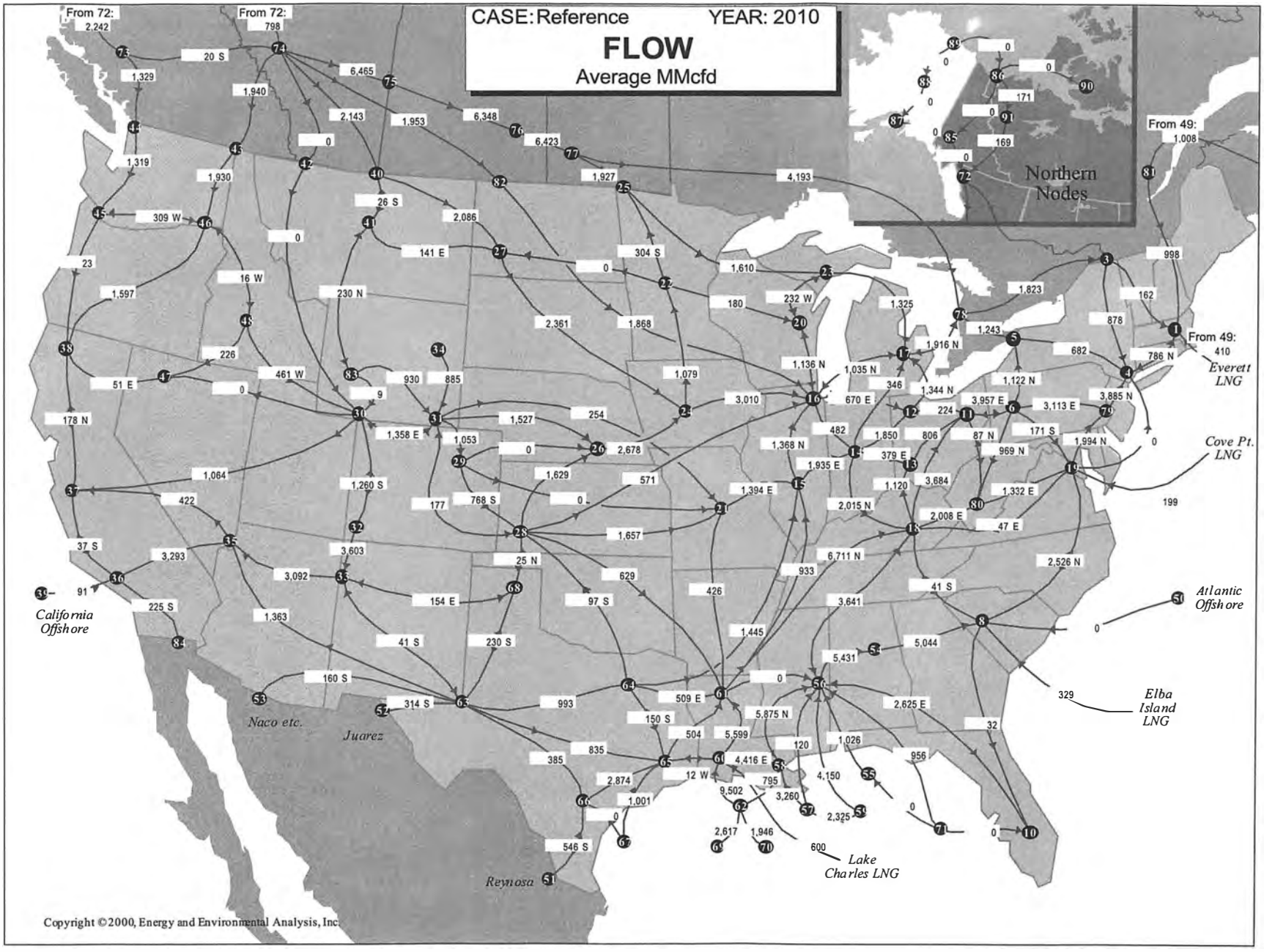
CASE: Reference
YEAR: 2010
FLOW
Average MMcfd
Northern Nodes
From 72: 2,242
From 72: 798
From 49: 1,008
From 49: 410
Everett LNG
Cove Pt. LNG
Atlantic Offshore
Elba Island LNG
Lake Charles LNG
California Offshore
Naco etc.
Juarez
Reynosa
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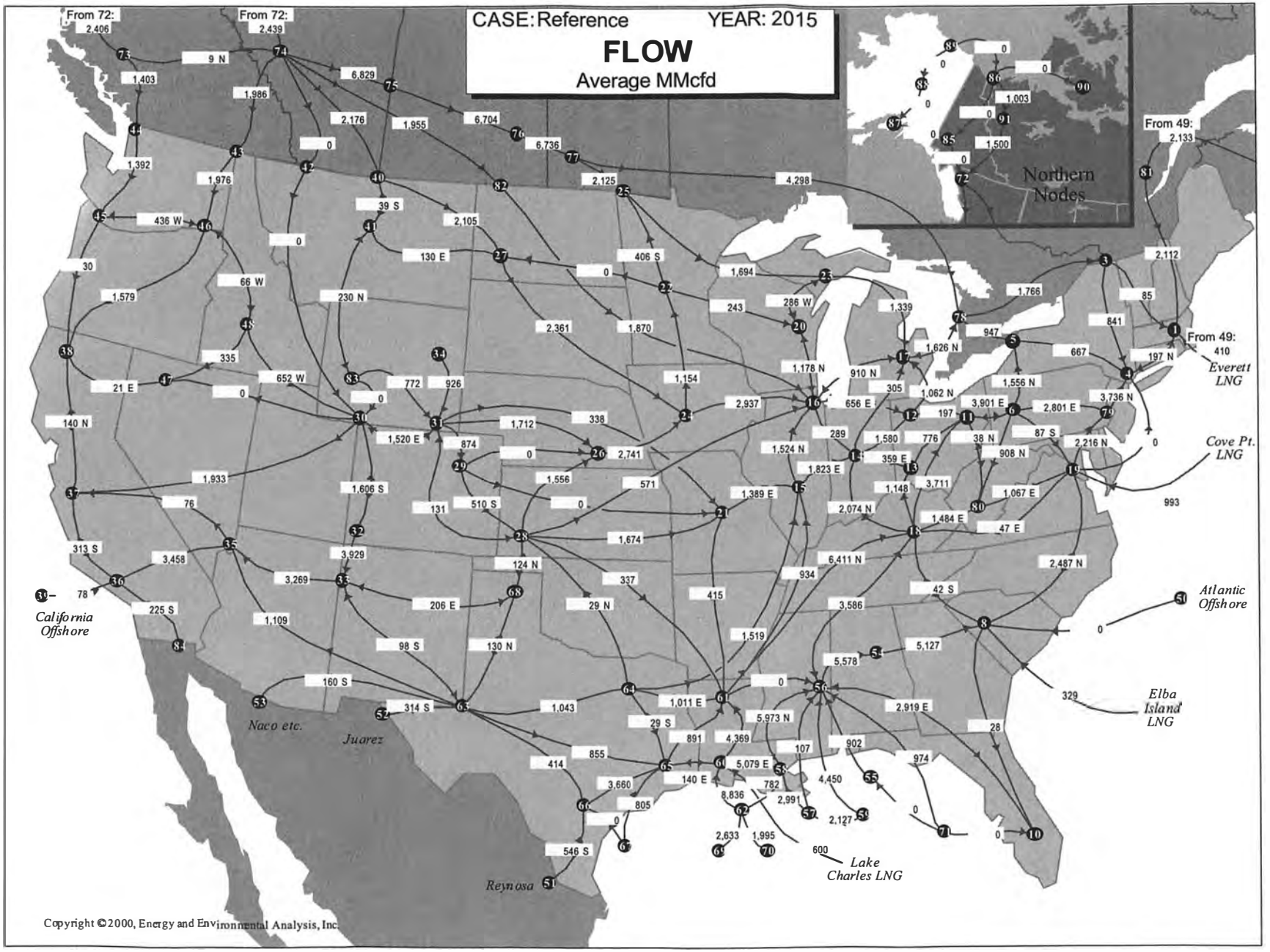
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California Offshore
Naco etc.
Juarez
Reynosa
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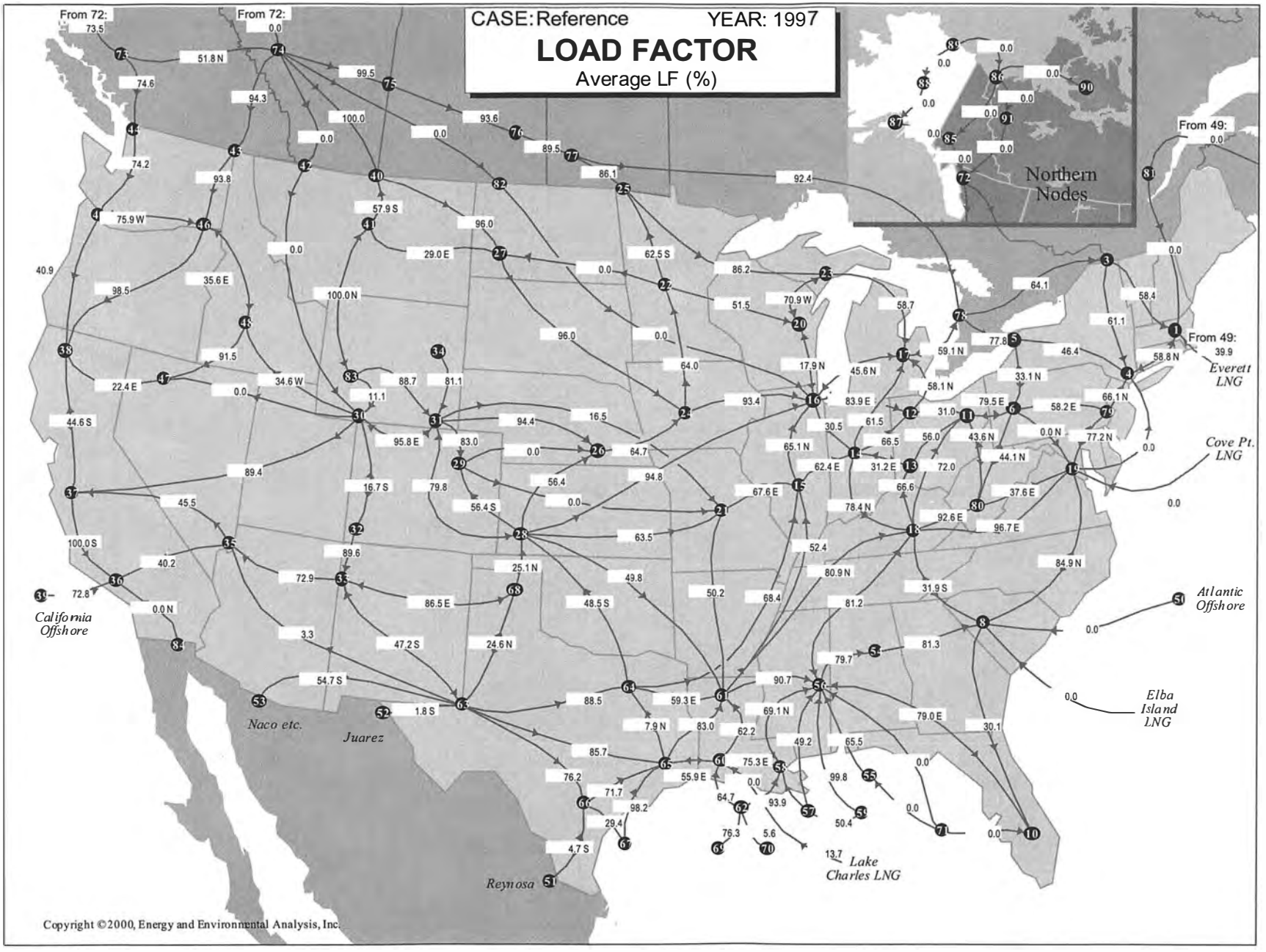
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Juarez
Reynosa
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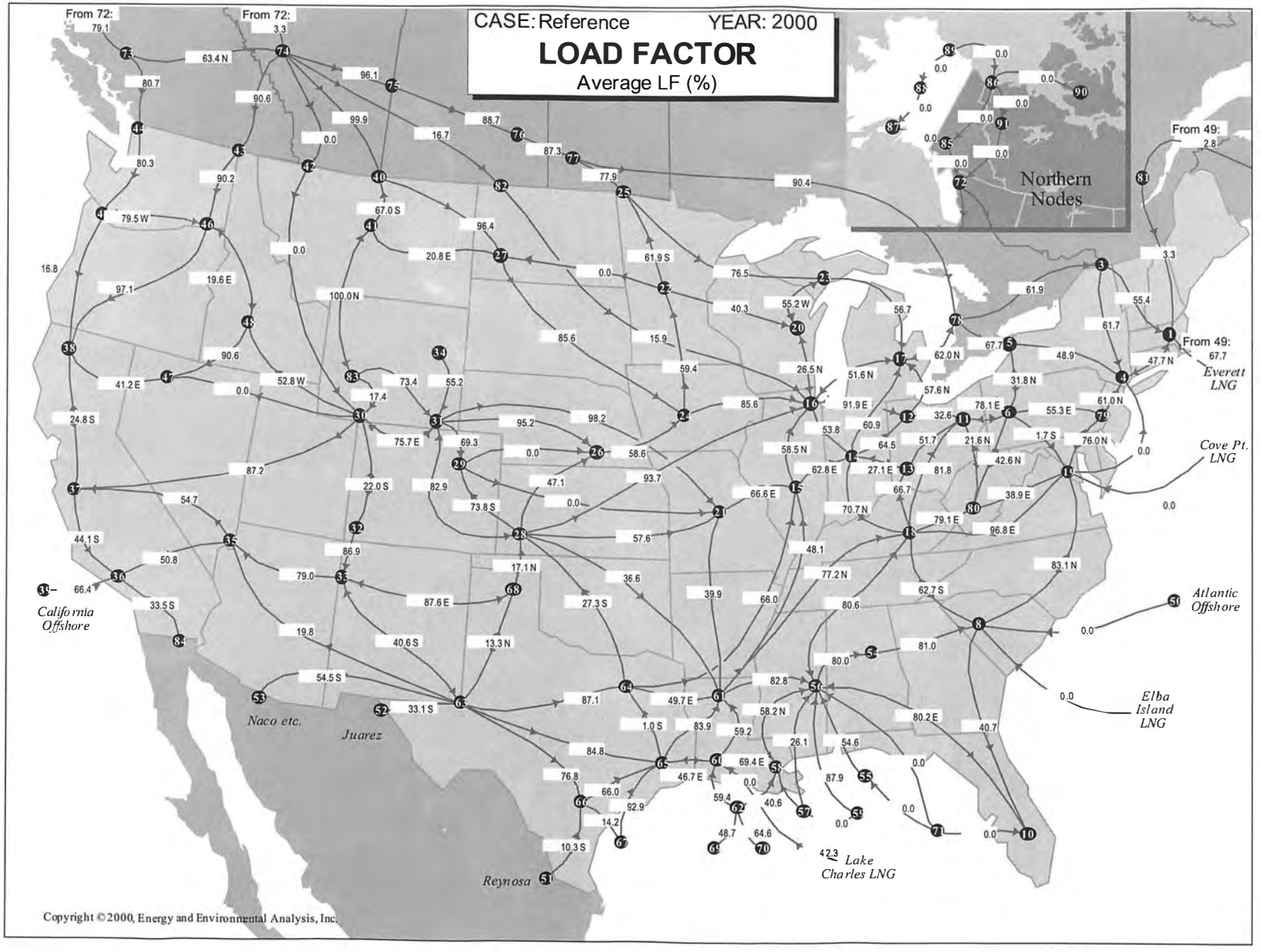
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California Offshore
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Juarez
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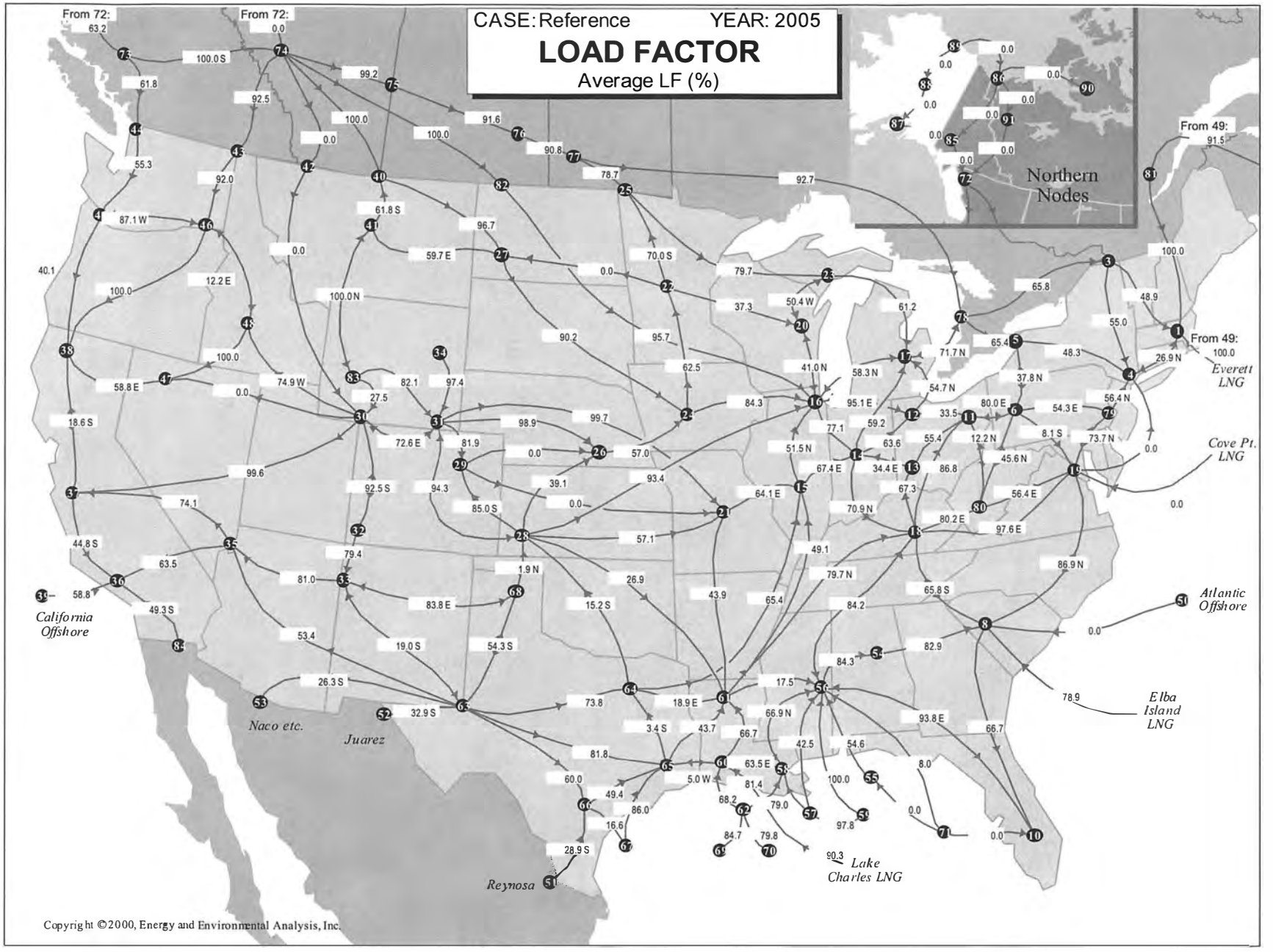
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California Offshore
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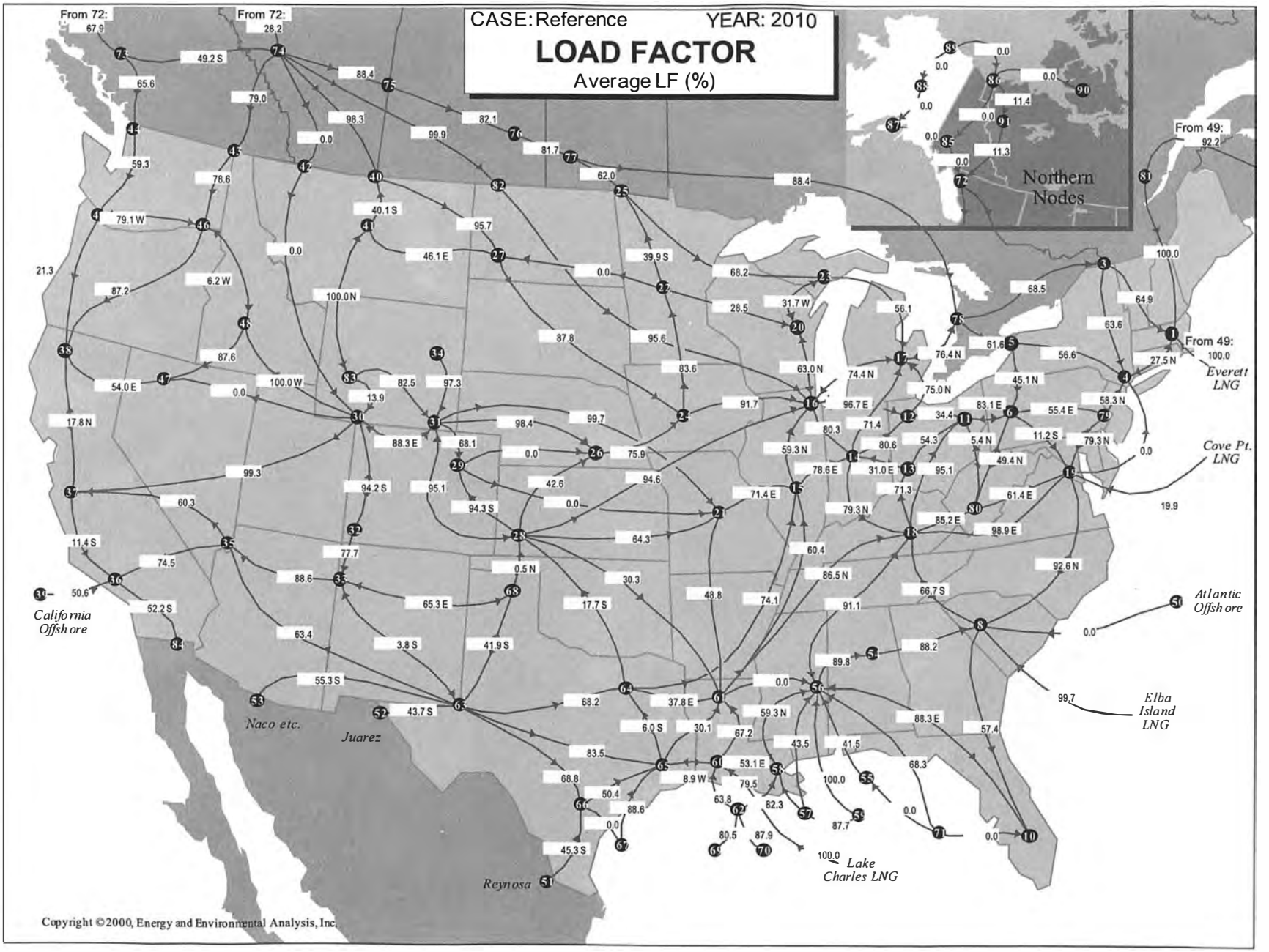
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Reynosa
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Atlantic Offshore
Everett LNG
Cove Pt. LNG
Elba Island LNG
Lake Charles LNG
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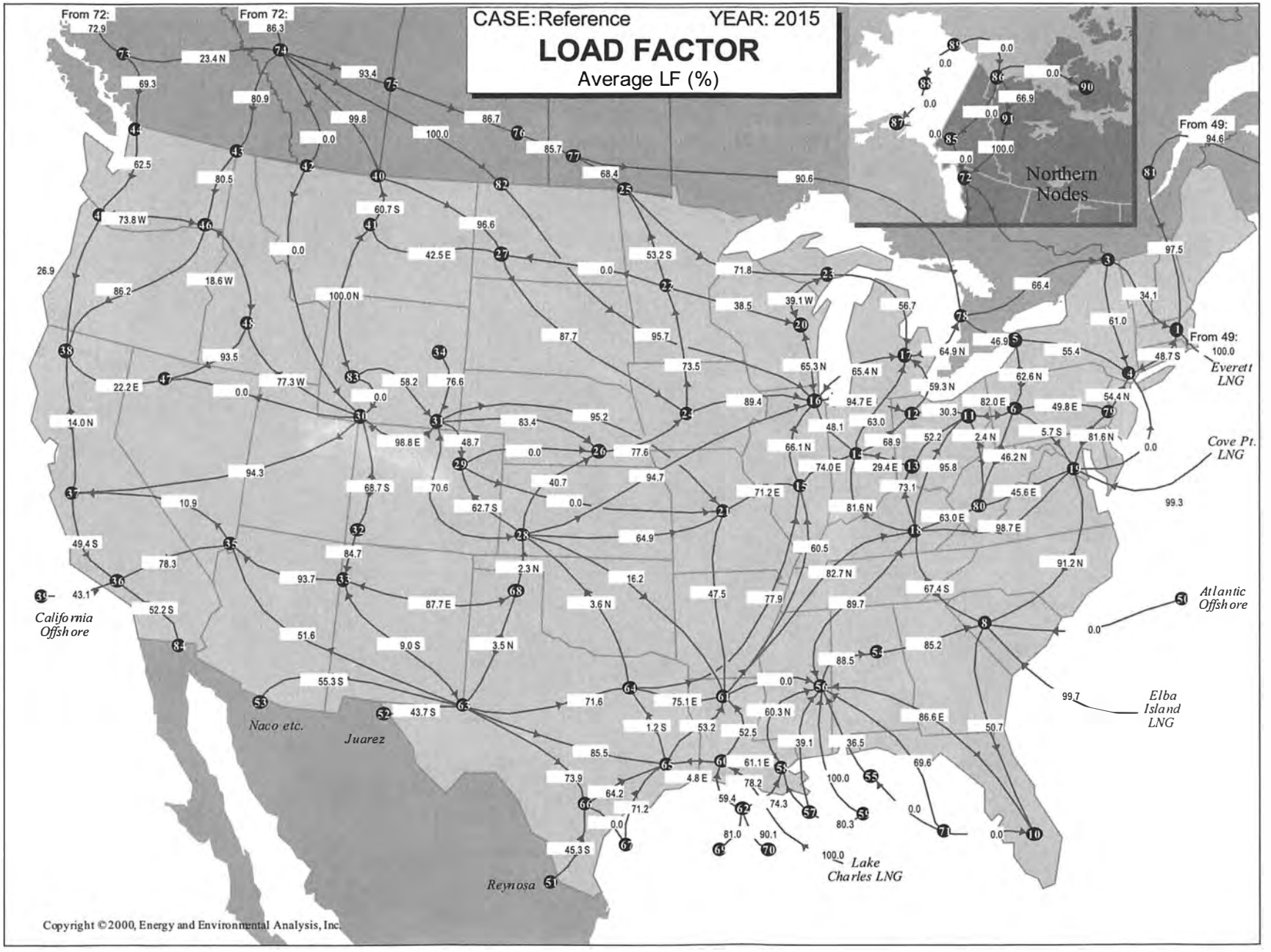
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California Offshore
Naco etc.
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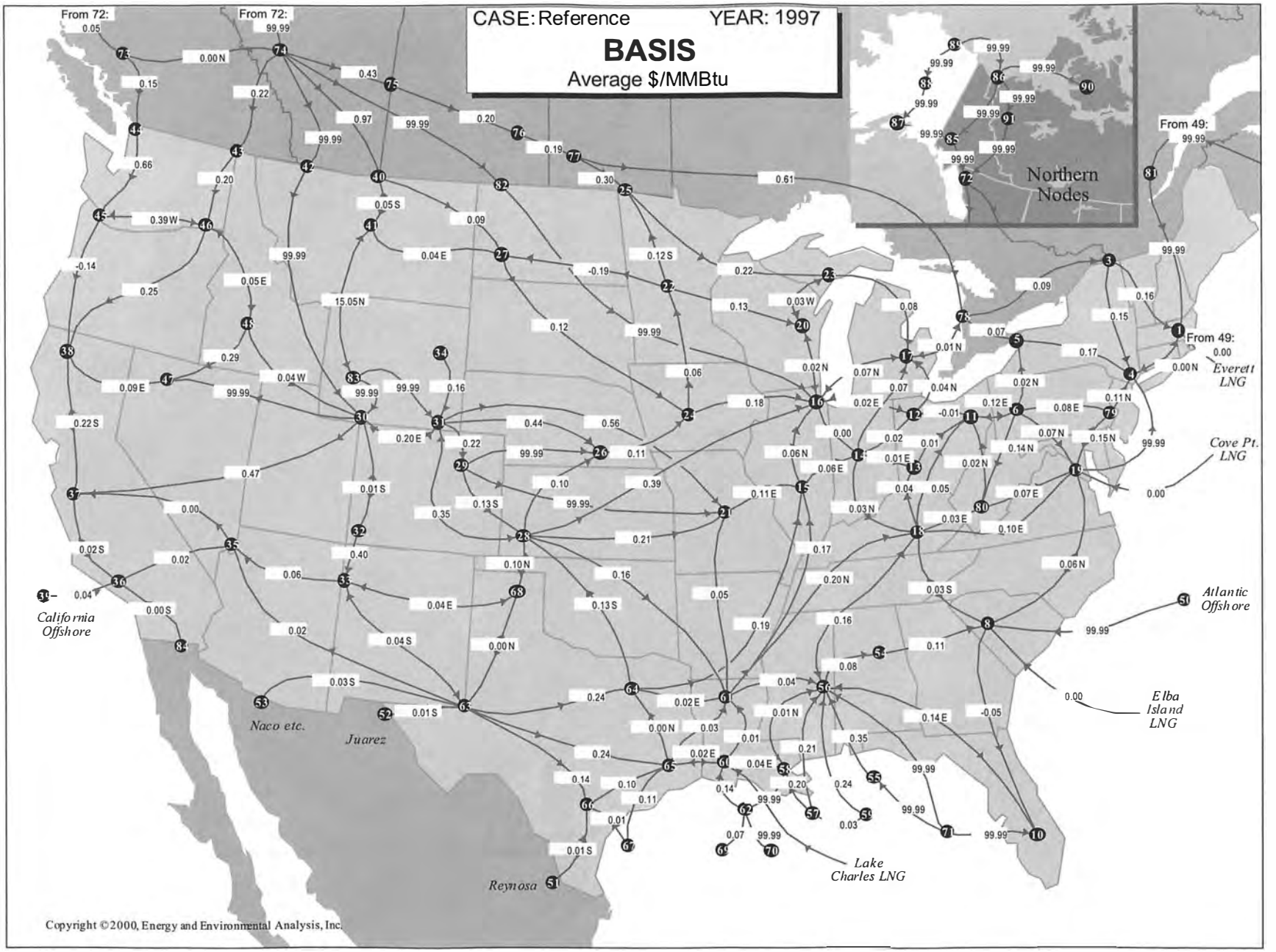
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Elba Island LNG
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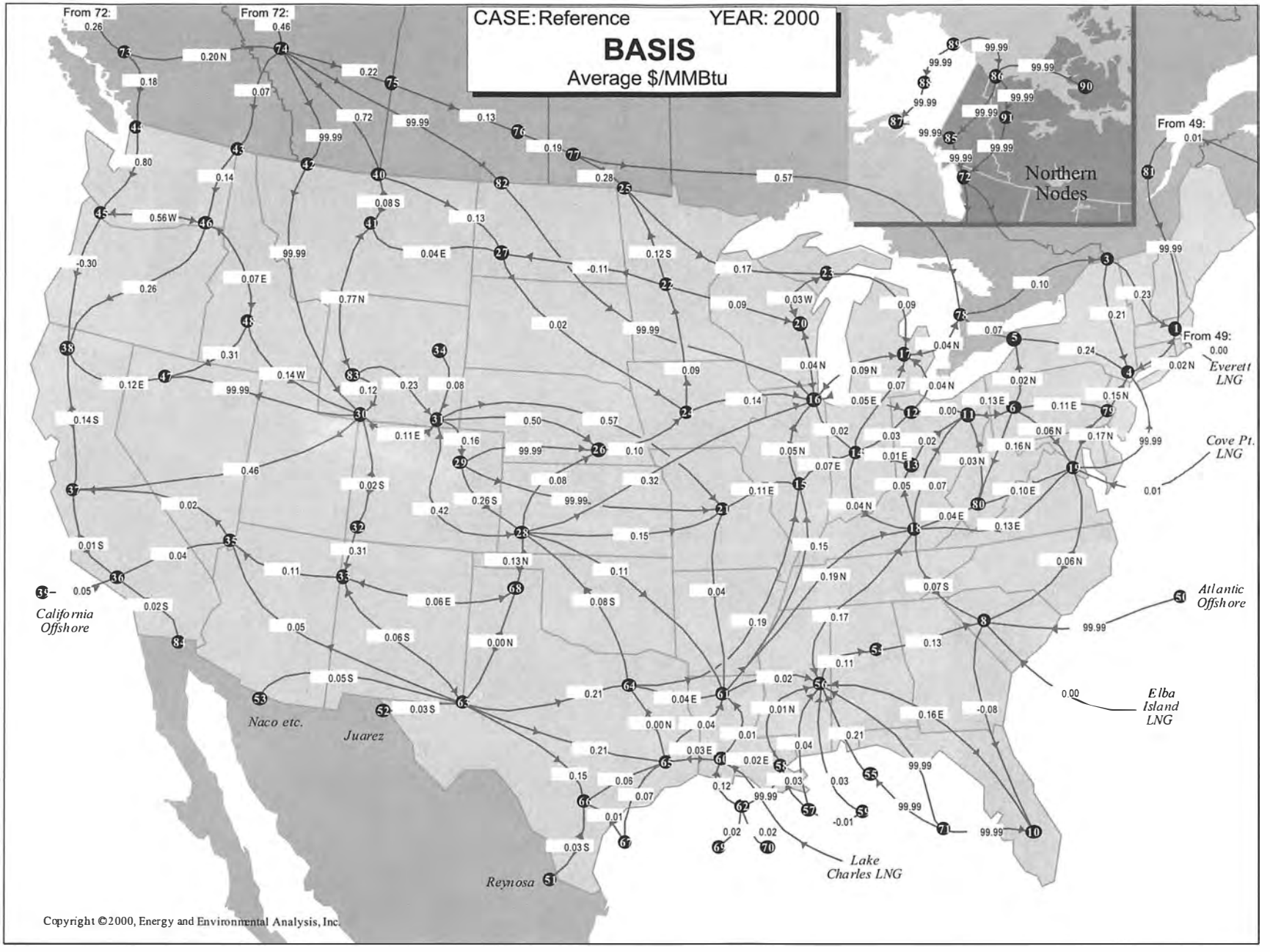
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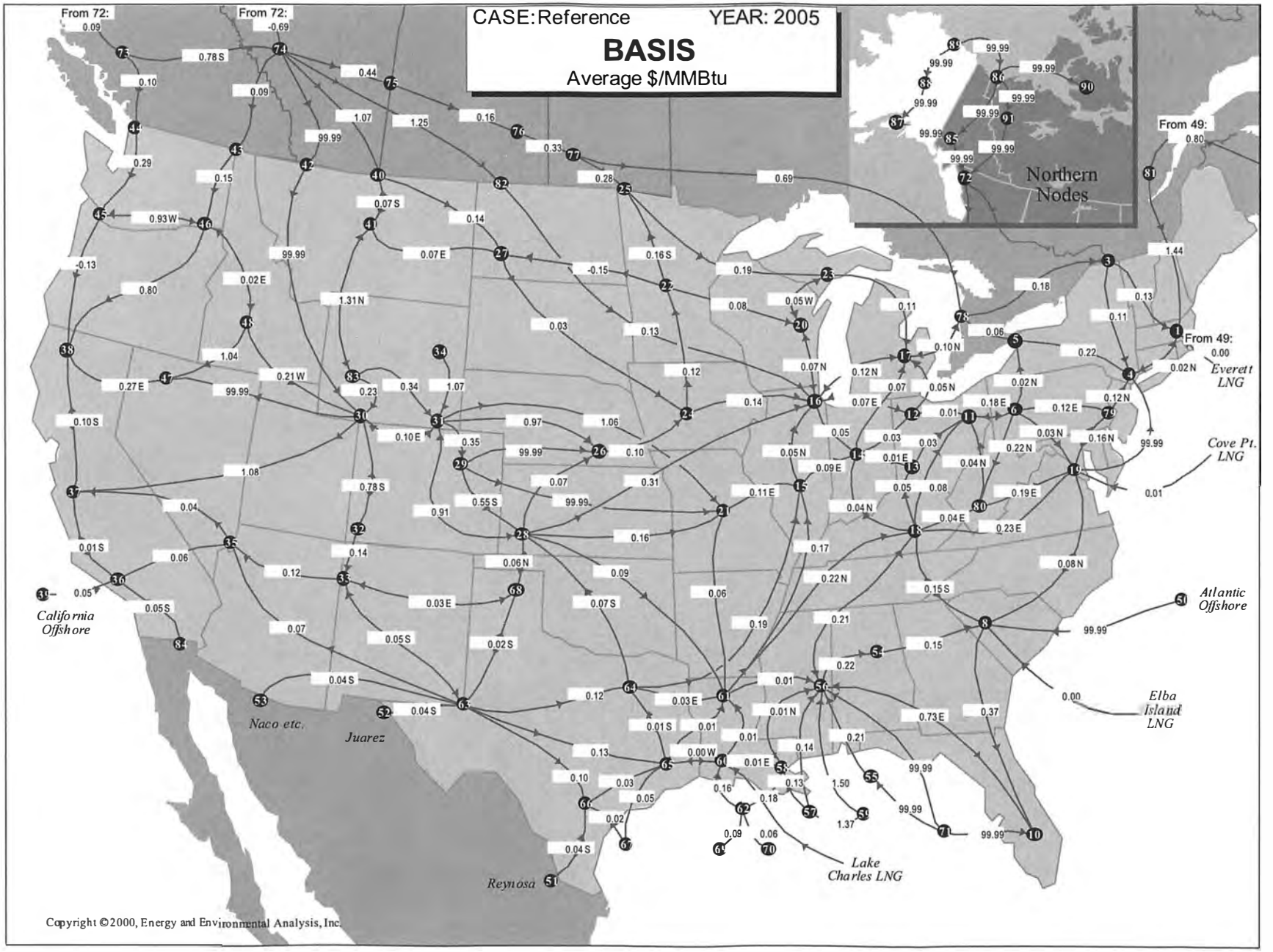
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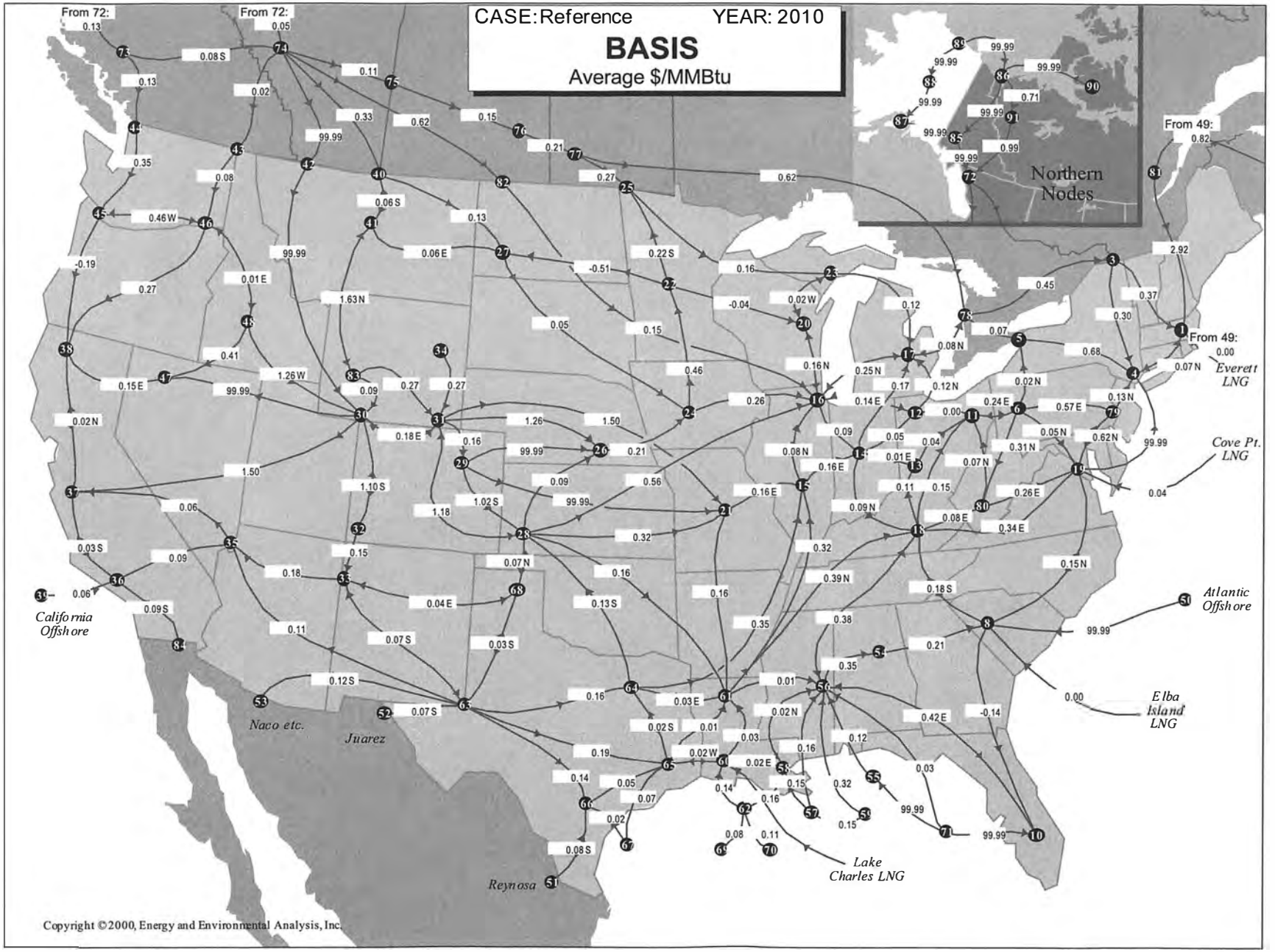
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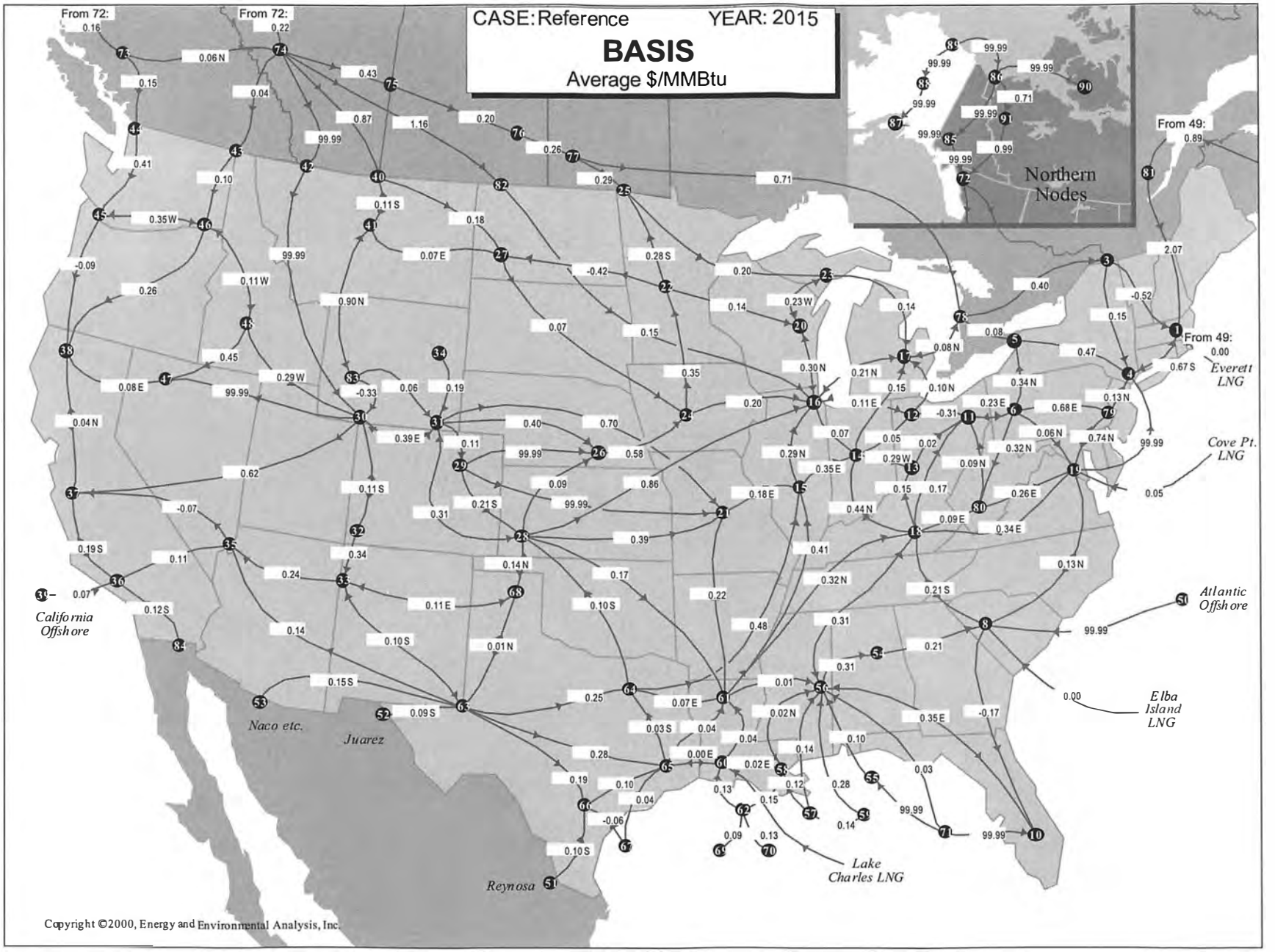
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Appendix D

Comparison of 1999 NPC Gas Results to Other Estimates

Comparison of Gas Resource Assessments

The assessment of North American gas resources can be compared to the estimates of several other organizations. Differences between the 1999 and 1992 NPC assessments can also be evaluated. U.S. organizations publishing gas resource assessments include the Potential Gas Committee (PGC), the Gas Research Institute (GRI), the U.S. Geological Survey (USGS), the Minerals Management Service (MMS), and periodically, the Energy Information Administration. Canadian groups publishing estimates of Canada's gas resource base include the National Energy Board (NEB), the Canadian Gas Potential Committee (CGPC), and the Geological Survey of Canada (GSC).

U.S. Organizations

The Potential Gas Committee consists of volunteer members from the gas industry, government agencies, and academic organizations. It publishes gas resource estimates for the U.S. every two years. The current assessment was published in 1999 and has an assessment basis of year-end 1998. Resource categories include "probable," "possible," and "speculative" resources. Probable resources are equivalent to reserve appreciation, while possible and speculative resources are new fields. The strength of the PGC assessment is that it is developed by geologists who understand the regional geology of each basin. Onshore gas is assessed by depth interval, providing one of the few sources of information on deep gas resources. However, the PGC assessment may be considered conservative in that it generally assesses volumes that are accessible or economic with current technology, and only assesses a portion of the nonconventional resource base.

GRI publishes estimates of U.S. and Canadian gas resources as part of its Baseline Projection of oil and gas activity and markets. Assessments are based upon extensive analysis of historical trends in new field discoveries, reserve appreciation, and nonconventional resources. Assessments incorporate information from other organizations, especially in frontier areas or depth intervals lacking adequate field data for analysis. Special assessments have been completed in areas such as the deepwater Gulf of Mexico. GRI estimates can be directly compared to NPC estimates because they have both been developed for the Hydrocarbon Supply Model. Current estimates are those used for the 2000 Baseline and are on a year-end 1998 basis.

The most recent assessments of the U.S. Geological Survey and Minerals Management Service were published in 1995. The USGS covers onshore and state offshore areas and the MMS evaluates federal offshore areas. Assessments are developed for both technically and economically recoverable resources, and conventional and nonconventional gas are assessed separately. The assessment was developed by geologists at the play level, and

regional assessments are aggregations of play assessments. A portion of the assessment is attributed to speculative or conceptual plays. Onshore regions differ from those of the Hydrocarbon Supply Model, making some regional comparisons difficult, especially for the onshore Gulf Coast. The assessments of continuous or nonconventional gas resources contain extensive information on potentially productive area and well recoveries, and some of this information was incorporated into the 1999 NPC Study.

Canadian Organizations

The Canadian Geological Survey periodically publishes oil and gas assessments. The most recent work of this organization was an extensive assessment of the Western Canadian Sedimentary Basin, which was assessed by geological interval and area. The CGS has also published national assessments, and has done extensive work on frontier regions such as the Beaufort/Mackenzie Delta, the Arctic, and eastern offshore areas. However, some of the frontier assessments are now more than a decade old, and are the only available information for those areas (i.e., the Arctic assessment). The CGS assessments have almost exclusively been for conventional oil and gas fields.

The National Energy Board prepares projections of energy supply and demand, and periodically publishes these projections and the underlying assumptions, including the gas resource base. The current projection was published in 1999. The resource assessment is based upon industry, NEB, provincial agency, and GSC assessments. Both high and low resource estimates are published, with about 75 trillion cubic feet (TCF) of difference between the two cases, all of which is in the western basin.

The Canadian Gas Potential Committee is an organization of industry volunteers that published its first assessment of Canadian resources in 1997. The assessment was developed at the play level, and the number of discovered and undiscovered pools for each play is estimated. The 1997 assessment includes conventional and coalbed gas resources. The coalbed estimates were developed by evaluating coal volumes, applying cutoffs for depth and permeability, and estimating gas content. Both eastern and western coal gas was assessed. Some frontier regions were not assessed or were only partially assessed, and a national total is are not carried on the comparison table.

Lower-48 Comparisons

Table D-1 presents a summary of lower-48 and Canadian gas resource assessments. Categories include ultimate recovery (cumulative production plus proved reserves), old field appreciation, conventional new fields, shale, coalbed, tight, and "other," which includes resources such as low-Btu gas. The ultimate recovery data shown here are from a series developed for NPC and may differ from published values. Volumes represent recoverable total gas (non-associated plus associated-dissolved). "Advanced technology" resources are shown where technology is specified.

The 1999 Study lower-48 assessment indicates a Total All-Time Recovery of 2,347 TCF. This value is 294 TCF higher than that of the 1992 Study, 374 TCF higher than the USGS/MMS assessment, 640 TCF higher than the PGC assessment, and is 392 TCF lower than the GRI assessment.

In comparison to the 1992 Study, the current assessment has higher volumes of reserve appreciation and new fields. The new field differential results primarily from a re-assessment of the deepwater Gulf of Mexico, which resulted in a larger oil and gas resource base. The larger volume of reserve appreciation potential reflects a different method of assessment and the additional years of growth data.

In comparison to the USGS/MMS, the greatest difference is in the new field assessment. The 1999 Study indicates a potential for over 600 TCF of new field gas resources, while the USGS/MMS value is only 332 TCF. Again, one of the large areas of difference is the potential assigned to the deepwater play. The USGS also has a conservative assessment of some onshore basins for which the NPC assessment carries large volumes of technically recoverable deep gas resources. The USGS value for reserve appreciation is close to the current assessment.

The PGC assessment of the lower-48 is shown to be much lower than the 1999 NPC estimate. As mentioned above, many consider the PGC assessment to be very conservative because it excludes much of the nonconventional gas

TABLE D-1

1999 National Petroleum Council Gas Study

COMPARISON OF GAS RESOURCE ASSESSMENTS

(Trillion cubic feet of total gas)

Lower-48		**1999 NPC**	1992 NPC	2000 GRI	1995 USGS/MMS	1999 PGC
	As of:	**(1-1-98)**	(1-1-91)	(1-1-98)	(1-1-94)	(1-1-99)
	Technology:	**2015**	2010	2015	1995	1999
(Proved) ultimate recovery		**1,038**	918	1,038	962	1,055
Reserve appreciation		**305**	236	422	323	158
Conventional new fields		**633**	493	754	332	420
Shale		**52**	57	131	84	0
Coalbed		**74**	98	101	50	74
Tight		**230**	235	236	222	0
Other		**15**	15	57	0	0
All-Time Recovery		**2,347**	2,052	2,739	1,973	1,707
Assessed Additional Resources		**1,309**	1,134	1,701	1,011	652

Canada		**1999 NPC**	1992 NPC	2000 GRI	1999 NEB High	1999 NEB Low	1997 CGPC	1997 GSC
	As of:	**(1-1-98)**	(1-1-91)	(1-1-98)	(1-1-98)	(1-1-98)	(1-1-94)	(various)
	Technology:	**2015**	2010	2015	1998	1998	1997	
(Proved) ultimate recovery		**167**	139	167	167	167	149	---
Reserve appreciation		**22**	24	33	---	---	31	---
Undeveloped (frontier)		**35**	47	35	44	44	35	---
Conventional new fields		**384**	380	477	460	389	155+	430
Shale		**0**	0	0	0	0	0	---
Coalbed		**74**	128	125	75	75	140-273	---
Tight		**87**	89	87	0	0	n/a	---
Other		**1**	0	1	0	0	0	---
All-Time Recovery		**770**	807	925	746	675	n/a	---
Assessed Additional Resources		**603**	668	758	579	508		

Notes:
Canadian Gas Potential Committee new field assessment does not include some frontier areas
Ultimate recoveries are from C.A.P.P. series and may differ from those published with assessments
1999 NEB assessment is the "high" assessment

Western Canada Sedimentary Basin (ASM + BC)

		1999 NPC	1992 NPC	2000 GRI	1999 NEB High	1999 NEB Low	1997 CGPC	1997 GSC
	As of:	**(1-1-98)**	(1-1-91)	(1-1-98)	(1-1-98)	(1-1-98)	(1-1-94)	(various)
	Technology:	**2015**	2010	2015	1998	1998	1997	
(Proved) ultimate recovery		**162**	137	162	162	162	147	---
Reserve appreciation		**22**	24	33	---	---	31	---
Undeveloped		**0**	0	0	0	0	0	---
Conventional new fields		**95**	109	177	176	105	91	209
Shale		**0**	0	0	0	0	0	---
Coalbed		**74**	129	125	75	75	135-261	---
Tight		**87**	89	87	0	0	n/a	---
Other		**1**	0	0	0	0	0	---
All-Time Recovery		**441**	488	584	413	342	404-530	---
Assessed Additional Resources		**279**	351	422	251	180	257-383	

Notes:
n/a = not assessed
Ultimate recoveries are from C.A.P.P. series and may differ from those published with assessments
1999 NEB assessment is the "high" assessment

Organizations:

NPC	National Petroleum Council
GRI	Gas Research Institute
USGS/MMS	U.S. Geological Survey/ Minerals Mgmt. Service
PGC	Potential Gas Committee
NEB	National Energy Board
CGPC	Canadian Gas Potential Committee
GSC	Geological Survey of Canada

resource and has a low estimate of reserve appreciation.

The GRI assessment is shown to have much greater volumes of reserve appreciation potential than current study (422 vs. 305 TCF). The GRI assessment of reserve appreciation is based upon a different method of evaluating and projecting historical growth. For new fields, GRI is about 120 TCF higher, primarily reflecting higher assessments for the Gulf Coast, Overthrust, and Mid-Continent regions.

Table D-2 presents the regional reserve appreciation assessments of the 1992 and 1999 NPC studies. Most of the regional assessments are in the same range as those of the original study. Regions of increased potential include Arkla-East Texas, South Texas, and the Rocky Mountain Foreland. Regions with reduced potential include the Overthrust Belt and Eastern Gulf of Mexico.

Table D-3 presents the new field comparison. Again, most of the assessments are in the same range as the 1992 Study. Regions with increased potential include the Central and Western Gulf of Mexico (an increase of almost 100 TCF), the Rocky Mountain Foreland (an increase of 35 TCF), and the Eastern Gulf of Mexico (an increase of 25 TCF). In the Eastern Gulf, it should be noted that the assessment change did not greatly affect the production

TABLE D-2
ESTIMATES OF OLD FIELD RESERVE APPRECIATION
U.S. LOWER-48 AND CANADA BY REGION
(Billion cubic feet of total gas)

		1992 NPC Study (As of 1/1/91)	1999 NPC Study (As of 1/1/98)
A	Appalachia	1,642	2,301
B	Eastern Gulf Onshore	5,128	5,069
C	North Central	2,920	2,718
D	Arkla - East Texas	14,818	25,864
E	South Louisiana	21,535	20,361
G	Texas Gulf Onshore	36,242	54,341
WL	Williston Basin	1,153	2,653
FR	Rocky Mtn. Foreland	11,570	28,949
SJB	San Juan Basin	7,647	11,673
OV	Overthrust Belt	8,327	702
JN	Mid-Continent	33,637	48,430
JS	Permian Basin	23,078	22,319
L	West Coast Onshore	3,138	5,717
BO	Eastern Gulf of Mexico	3,555	2,160
EGO	Cent. & West. Gulf of Mex.	61,159	70,661
LO	West Coast Offshore	765	1,039
AO	Atlantic Offshore	0	0
	Total Lower-48	**236,314**	**304,957**
ASM	Alberta, Sas. Man.	20,800	18,620
BC	British Columbia	2,700	3,283
NWC	Northwest Canada	0	0
EC	Eastern Canada	300	478
ART	Arctic Canada	0	0
	Total Canada	**23,800**	**22,381**

* Old Field Reserve Appreciation from the 1992 Study reflects reallocation of certain resources among categories consistent with the 1999 Study.

TABLE D-3

ESTIMATES OF NEW FIELD POTENTIAL
U.S. LOWER-48 AND CANADA BY REGION
(Billion cubic feet of total gas)

		1992 NPC Study (As of 1/1/91)	1999 NPC Study (As of 1/1/98)
A	Appalachia	27,302	27,772
B	Eastern Gulf Onshore	11,999	8,674
C	North Central	9,328	9,796
D	Arkla - East Texas	22,060	22,196
E	South Louisiana	16,715	11,838
G	Texas Gulf Onshore	53,502	52,550
WL	Williston Basin	3,006	3,088
FR	Rocky Mtn. Foreland	64,023	99,180
SJB	San Juan Basin	3,988	2,209
OV	Overthrust Belt	13,430	6,731
JN	Mid-Continent	59,215	39,675
JS	Permian Basin	30,318	31,353
L	West Coast Onshore	19,283	20,205
BO	Eastern Gulf of Mexico	15,376	40,655
EGO	Cent. & West. Gulf of Mex.	110,613	205,328
LO	West Coast Offshore	14,312	20,790
AO	Atlantic Offshore	18,714	30,580
Total Lower-48		**493,184**	**632,620**
ASM	Alberta, Sas. Man.	78,559	62,548
BC	British Columbia	30,727	32,465
NWC	Northwest Canada	74,202	80,972
EC	Eastern Canada	89,735	96,497
ART	Arctic Canada	106,381	111,051
Total Canada		**379,604**	**383,533**

projection, since much of this area is inaccessible in the Reference Case. Offshore Atlantic and Pacific resources were also increased (based upon the MMS assessment). These areas are also essentially inaccessible and the increase did not affect the projection.

Canada Comparisons

Table D-1 shows that published assessments of Canadian gas resources tend to fall within a fairly narrow range of variability. The 1999 Study estimate for All-Time Recovery is 770 TCF, which is 37 TCF low to the 1992 Study, 155 TCF low to the GRI estimate, and 24 TCF high to the NEB upper resource case. No total has been carried for the Canadian Gas Potential Committee, since that assessment excluded some frontier regions. A new field total only is shown for the GSC, and reflects a compilation of the most recent assessments for each region of the country.

In comparison with the 1992 Study, the current Canada assessment is very similar except for coalbed methane. The coalbed assessment for the Western Basin was reduced by approximately 50 TCF relative to the 1992 study, reflecting poor results from limited tests and the lack of industry activity. The tight gas resource characterization was modified in the current study, resulting in lower well recoveries than indicated in the earlier assessment (although this is not reflected in the resource table).

The current assessment cannot be compared on a national level to that of the CPGC, as mentioned above, because the CPGC volumes exclude some frontier regions and are not comparable. The Western Basin assessment can be compared, as discussed below. The CPGC reserve appreciation value of 31 TCF is shown to be somewhat higher than the current NPC estimate of 22 TCF. The CPGC estimate is derived from a 1992 study published by the Alberta Energy and Utilities Board.

Western Canadian Sedimentary Basin Comparisons

The lower portion of Table D-1 presents a comparison of assessments of the Western Canadian Sedimentary Basin (WCSB). In the Hydrocarbon Supply Model, this represents the combined total of the Alberta-Saskatchewan-Manitoba region and the British Columbia region. Included in these are assessments are estimates for both the Alberta Basin and the Disturbed Belt or Foothills.

As mentioned above, the major difference between the 1999 and 1992 NPC studies is the assessment of western coalbed methane potential, which has been reduced relative to the initial study.

The GRI Baseline projection includes about twice as much new field potential in western Canada than the current study (177 vs. 95 TCF). However, this higher GRI assessment is roughly equivalent to the NEB (high) assessment, and is actually low to the (aggregate) GSC assessment of 209 TCF. The current NPC assessment is about the same as that published by the CPGC.

Gulf of Mexico Comparisons

Table D-4 presents the total gas resource assessments for the Central and Western Gulf of Mexico (region EGO). Reserve appreciation and new field potential are shown separately. The current estimate of 71 TCF of reserve appreciation potential is in the same range as the 1992 estimate of 61 TCF. GRI is on the higher end of the reserve appreciation assessments with 111 TCF, while MMS and PGC have relatively low assessments.

For new fields, the current estimate of 205 TCF is almost twice the 1992 Study estimate of 110 TCF. Most of the increase is in the deepwater, which was re-assessed for the current study. In addition, the 1992 Study did not include a separate assessment of subsalt resources, which are estimated to be 38 TCF. The subsalt play occurs across the outer shelf and deepwater intervals, and a rough assessment of the play was developed from published maps and information.

Nonconventional Gas Comparisons

SHALE GAS

Table D-5 presents a comparison of lower-48 shale gas assessments. Lower-48 shale gas resources are estimated in the 1999 Study to be 53 TCF, or about 4 TCF lower than the 1992 estimate. The Appalachian Devonian Shale assessment was reduced substantially (20 TCF), reflecting diminished expectations relative to the initial study. The Antrim Shale (Michigan Basin) assessment was also reduced, primarily as a result of the lack of success in extending the play to the southern portion of the basin. However, new resources were added to represent the Illinois Basin New Albany Shale and the Cincinnati Arch New Albany Shale. These assessments were based upon the 1995 USGS study. The Fort Worth Basin Barnett Shale was also added to the model.

COALBED GAS

Table D-6 presents a comparison of lower-48 coalbed methane assessments. Recoverable coalbed gas resources are estimated to be 76 TCF. The reduction of 21 TCF from the previous assessment results largely from reductions in the Warrior Basin in Alabama, the San Juan Basin in New Mexico, and the Piceance Basin in Colorado. In the Rockies, the previous NPC category of "Raton and Miscellaneous Basins" was eliminated and individual basins were characterized, primarily through analysis of the 1995 USGS assessments. The Powder River Basin was assessed, and is estimated to contain about 6 TCF of recoverable gas. In the San Juan Basin, the Fruitland coalbed potential was reduced, primarily reflecting the large volume of reserve additions that have occurred.

TABLE D-4

COMPARISONS OF PUBLISHED RESOURCE ASSESSMENTS FOR WESTERN AND CENTRAL GULF OF MEXICO (Region EGO or equivalent)

RESERVE APPRECIATION

Total Gas (TCF)

	Water depth	as of: technology:	**1999 NPC (1-1-98) 2015**	1992 NPC (1-1-91) 2010	2000 GRI (1-1-98) 2015	1995 MMS (1-1-94) 1995	1999 PGC (1-1-99) 1999
Shelf	0-200 meters		**65**	56	102	29	9
Slope	200-1000 meters		**6**	5	9	7	4
Region total			**71**	61	111	36	13

NEW FIELDS

Total Gas (TCF)

	Water depth	as of: technology:	**1999 NPC (1-1-98) 2015**	1992 NPC (1-1-91) 2010	2000 GRI (1-1-98) 2015	1995 MMS (1-1-94) 1995	1999 PGC (1-1-99) 1999
Shelf	0-40 meters		**27**	28	31	---	---
	40-200 meters		**39**	25	69	---	---
Shelf total			**66**	53	100	42	25
Slope	200-1000 meters		**53**	17	46	10	17
	1000+ meters		**86**	40	94	36	48
Slope total			**139**	57	140	46	65
Region total			**205**	110	240	88	90
Breakout of subsalt vs traditional							
Subsalt			**38**	0	55	---	---
Traditional			**167**	110	185	---	---
Total			**205**	110	240	88	90

TABLE D-5

COMPARISON OF SHALE RESOURCE ASSESSMENTS

TCF recoverable

Region	Basin	as of: tech:	**1999 NPC (1-1-98) 2010**	1992 NPC (1-1-91) 2010	2000 GRI (1-1-98) 2015	1995 USGS (1-1-94) 1995
A: Appalachia	Appalachian		**23.39**	42.50	90.73	15.32
C: North Central	MIchigan Antrim		**16.88**	14.70	40.67	18.87
	Illinois New Albany		**2.91**	0.00	0.00	1.89
	Cincinnati Arch		**2.16**	0.00	0.00	1.39
	Total		**21.95**	14.70	40.67	22.15
D: Arkla - East Texas	Fort Worth Barnett		**7.21**	0.00	0.00	3.36
WL: Williston Basin	N. Cent. MT		**0**	0.00	0.00	41.27
	Williston		**0**	0.00	0.00	1.89
	Total		**0.00**	0.00	0.00	43.16
Lower-48			**52.55**	57.20	131.40	83.99

Notes: USGS shale plays in regions FR and SJB are oil plays and are not shown

TABLE D-6

COMPARISON OF COALBED GAS RESOURCE ASSESSMENTS

TCF recoverable

Region	Basin	as of: tech:	**1999 NPC (1-1-98) 2015**	1992 NPC (1-1-91) 2010	2000 GRI (1-1-98) 2015	1995 USGS (1-1-94) 1995	1999 PGC (1-1-99) 1999
A: Appalachia	C. Appalachian		**4.77**	0.00	2.41	3.07	na
	N. Appalachian		**14.66**	15.00	41.67	11.48	na
	Total		**19.43**	15.00	44.08	14.55	12.94
B: Eastern Gulf Onshore	Warrior		**5.21**	10.00	13.90	2.60	4.35
C: North Central	Illinois		**2.52**	0.00	0.00	1.63	2.14
FR: Rocky Mtn. Foreland	Piceance		**10.56**	27.00	13.77	7.46	5.53
	Uinta		**4.54**	0.00	0.00	3.21	na
	Raton		**2.24**	12.00	4.44	1.77	3.49
	Wind River		**0.64**	0.00	0.00	0.43	2.45
	Green River		**5.56**	0.00	0.00	3.89	1.13
	Powder River		**5.84**	0.00	0.00	1.11	9.33
	Big Horn		**0.00**	0.00	0.00	0.00	0.83
	Denver, etc		**0.00**	0.00	0.00	0.00	0.30
	Paradox		**0.00**	0.00	0.00	0.00	2.75
	Plateau. Blk Mesa		**0.00**	0.00	0.00	0.00	0.18
	Total		**29.38**	39.00	18.21	17.87	25.99
OV: Overthrust Belt	Total		**0.00**	0.00	0.00	0.00	2.50
SJB: San Juan Basin	San Juan Fruitland		**10.06**	21.00	25.03	7.53	11.57
	San Juan Menefee		**1.94**	12.00	0.00	0.00	0.00
	Total		**12.00**	33.00	25.03	7.53	11.57
JN: Mid-Continent	Forest City		**0.70**	0.00	0.00	0.45	na
	Cherokee		**2.93**	0.00	0.00	1.91	2.80
	Arkoma		**3.82**	0.00	0.00	2.64	1.75
	Anadarko		**0.00**	0.00	0.00	0.00	5.78
	Total		**7.45**	0.00	0.00	5.00	10.33
L: West Coast Onshore	Western Oregon		**0.00**	0.00	0.00	0.71	1.97
WL: Williston Basin	Williston Basin		**0.00**	0.00	0.00	0.00	0.50
	Sweetgrass Arch		**0.00**	0.00	0.00	0.00	1.20
	Total		**0.00**	0.00	0.00	0.00	1.70
Lower-48			**75.99**	97.00	101.22	49.89	73.49

Several basins were added to the model for the 1999 Study. These include the Central Appalachian Basin and several Mid-Continent basins.

TIGHT GAS

Table D-7 presents the lower-48 tight gas assessments. The 1999 NPC assessment is basically unchanged from the 1992 Study assessment. The 1995 USGS assessment of 222 TCF, shown in the last column, was not used for the 1999 Study.

Comparison of Supply and Demand Projections

Key supply and demand results for the NPC Reference and Sensitivity Cases are compared with forecasts and projections issued by other organizations in Table D-8. [Note: Some differences among the projections in Table D-8 may be due to how certain items are accounted for, i.e., some treat exports to Mexico as a demand item while others net such exports out of imports as a supply item.

TABLE D-7

COMPARISON OF TIGHT GAS RESOURCE ASSESSMENTS

TCF recoverable

Region	Basin	As of: Tech:	**1999 NPC (1-1-98) 2015**	1992 NPC (1-1-91) 2010	2000 GRI (1-1-98) 2015	1995 USGS (1-1-94) 1995
A: Appalachia	Appalachian		**18.27**	17.86	17.07	45.90
D: Arkla - East Texas	East Texas		**22.15**	20.55	22.08	6.03
	Arkla		**7.67**	7.72	8.29	0.00
	Total		**29.82**	28.27	30.37	6.03
G: Texas Gulf Onshore	Texas Gulf Coast		**9.11**	9.11	9.11	0.00
FR: Rocky Mtn. Foreland	Piceance		**29.00**	29.00	29.00	16.71
	Uinta		**6.52**	6.52	6.52	w/Pic
	Wind River		**12.68**	12.68	12.68	0.00
	Green River		**84.61**	84.79	84.79	119.17
	Denver		**4.17**	4.16	4.16	0.83
	Total		**136.98**	137.15	137.15	136.71
SJB: San Juan Basin	San Juan*		**0.00**	5.63	5.62	21.06
JN: Mid-Continent	Anadarko		**15.57**	15.57	15.57	0.00
	Arkoma		**1.35**	1.35	1.35	0.00
	Total		**16.92**	16.92	16.92	0.00
JS: Permian Basin	Permian		**19.52**	19.52	19.52	0.00
L: West Coast Onshore	Oregon/Wash		**0.00**	0.00	0.00	12.20
Lower-48			**230.62**	234.46	235.76	221.90

For NPC and GRI, this table includes "ERM" or very tight portion of tight resource in HSM.
In the San Juan Basin, the 1992 NPC Study included a separate tight infill category of about 6 TCF; that is now included in reserve appreciation.

TABLE D-8
COMPARISON OF NPC REFERENCE AND SENSITIVITY CASES WITH OTHER ORGANIZATIONS' FORECASTS

Total U.S. Gas Consumption (TCF)	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	**23.06**	**26.62**	**29.47**	**31.84**	-
Increased Oil Prices (NPC99D)	19.54	19.88	17.28	18.72	21.53	21.99	23.08	27.15	30.16	33.82	-
Decreased Oil Prices (NPC99E)	19.54	19.88	17.28	18.72	21.53	21.99	22.99	26.09	28.46	29.97	-
Higher GDP Growth Rate (NPC99F)	19.54	19.88	17.28	18.72	21.53	21.99	23.06	27.05	30.07	32.69	-
Lower GDP Growth Rate (NPC99G)	19.54	19.88	17.28	18.72	21.53	21.99	23.04	26.31	28.55	30.77	-
Faster Technology Advancement (NPC99H)	19.54	19.88	17.28	18.72	21.53	21.99	23.04	26.95	30.21	32.97	-
Slower Technology Advancement (NPC99I)	19.54	19.88	17.28	18.72	21.53	21.99	23.04	26.42	28.75	30.19	-
Larger Resource Base (NPC99K)	19.54	19.88	17.28	18.72	21.53	21.99	23.09	27.31	31.35	33.75	-
Smaller Resource Base (NPC99L)	19.54	19.88	17.28	18.72	21.53	21.99	22.89	26.05	27.96	29.52	-
Increased Access (NPC99R)	19.54	19.88	17.28	18.72	21.53	21.99	23.05	26.81	29.90	33.29	-
Reduced Access (NPC99S)	19.54	19.88	17.28	18.72	21.53	21.99	23.01	26.59	29.06	31.62	-
INGAA 30 TCF Study	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	-	-	**30.33**	-	-
EIA/AEO 2000	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	-	**23.91**	**26.95**	**29.88**	**31.53**
1998 AGA-TERA Base Case	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	**22.72**	**25.20**	**28.93**	**30.92**	-
WPA/AGF's Fueling the Future (Current Trajectory)	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	-	-	**26.78**	**27.72**	**28.77**
DRI U.S. Outlook, Spring/Summer 1998	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	-	-	-	**30.00**	**31.24**
GRI 2000 Baseline Projection	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	**22.20**	**25.48**	**28.39**	**32.46**	-
IPAA 1998 Long Term Report	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	**23.01**	**24.86**	**27.16**	-	-
WEFA '99	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	-	-	-	**32.55**	**34.57**
NRC's Canadian Natural Gas Review '99	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	-	**25.44**	-	-	-
NEB's Supply & Demand to 2025	-	-	-	-	-	-	-	-	-	-	-
Average Non-NPC	**19.54**	**19.88**	**17.28**	**18.72**	**21.53**	**21.99**	**22.64**	**24.98**	**28.09**	**30.59**	**31.53**

Total U.S. Gas Production (TCF)	1975	1980	1985	1990	1985	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	**19.89**	**22.45**	**25.05**	**26.50**	-
Increased Oil Prices (NPC99D)	19.24	19.40	16.45	17.81	18.56	18.90	19.89	22.98	25.90	28.33	-
Decreased Oil Prices (NPC99E)	19.24	19.40	16.45	17.81	18.56	18.90	19.87	22.04	24.15	24.91	-
Higher GDP Growth Rate (NPC99F)	19.24	19.40	16.45	17.81	18.56	18.90	19.89	22.88	25.53	27.40	-
Lower GDP Growth Rate (NPC99G)	19.24	19.40	16.45	17.81	18.56	18.90	19.88	22.17	24.27	25.58	-
Faster Technology Advancement (NPC99H)	19.24	19.40	16.45	17.81	18.56	18.90	19.86	22.79	25.62	27.59	-
Slower Technology Advancement (NPC99I)	19.24	19.40	16.45	17.81	18.56	18.90	19.86	22.28	24.49	25.03	-
Larger Resource Base (NPC99K)	19.24	19.40	16.45	17.81	18.56	18.90	19.92	23.08	26.57	28.26	-
Smaller Resource Base (NPC99L)	19.24	19.40	16.45	17.81	18.56	18.90	19.71	21.92	23.48	24.68	-
Increased Access (NPC99R)	19.24	19.40	16.45	17.81	18.56	18.90	19.88	22.66	25.55	28.05	-
Reduced Access (NPC99S)	19.24	19.40	16.45	17.81	18.56	18.90	19.83	22.37	24.53	26.28	-
INGAA 30 TCF Study	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	-	-	**26.27**	-	-
EIA/AEO 2000	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	-	**19.70**	**22.46**	**25.03**	**26.40**
1998 AGA-TERA Base Case	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	**19.29**	**21.48**	**25.02**	**26.76**	-
WPA/AGF's Fueling the Future (Current Trajectory)	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	-	-	**22.77**	**23.25**	**24.22**
DRI U.S. Outlook, Spring/Summer 1999	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	-	-	-	**24.74**	**25.67**
GRI 2000 Baseline Projection	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	**19.42**	**21.86**	**24.54**	**28.58**	-
IPAA 1998 Long Term Report	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	**19.86**	**21.23**	**22.75**	-	-
WEFA '99	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	-	-	-	**27.24**	**28.74**
NRC's Canadian Natural Gas Review '99	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	-	**21.39**	-	-	-
NEB's Supply & Demand to 2025	-	-	-	-	-	-	-	-	-	-	-
Average Non-NPC	**19.24**	**19.40**	**16.45**	**17.81**	**18.56**	**18.90**	**19.52**	**21.13**	**23.97**	**25.93**	**26.26**

TABLE D-8 (CONTINUED)

Net Canadian Imports (TCF)											
	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**3.00**	**3.77**	**3.84**	**4.32**	**-**
Increased Oil Prices (NPC99D)	0.95	0.98	0.95	1.53	2.74	2.84	3.02	3.80	3.73	4.53	-
Decreased Oil Prices (NPC99E)	0.95	0.98	0.95	1.53	2.74	2.84	2.96	3.66	3.70	4.06	-
Higher GDP Growth Rate (NPC99F)	0.95	0.98	0.95	1.53	2.74	2.84	3.00	3.78	3.97	4.39	-
Lower GDP Growth Rate (NPC99G)	0.95	0.98	0.95	1.53	2.74	2.84	2.99	3.75	3.67	4.15	-
Faster Technology Advancement (NPC99H)	0.95	0.98	0.95	1.53	2.74	2.84	3.00	3.77	4.01	4.41	-
Slower Technology Advancement (NPC99I)	0.95	0.98	0.95	1.53	2.74	2.84	3.00	3.74	3.67	4.23	-
Larger Resource Base (NPC99K)	0.95	0.98	0.95	1.53	2.74	2.84	3.00	3.85	4.21	4.51	-
Smaller Resource Base (NPC99L)	0.95	0.98	0.95	1.53	2.74	2.84	3.00	3.74	3.90	3.90	-
Increased Access (NPC99R)	0.95	0.98	0.95	1.53	2.74	2.84	3.00	3.76	3.78	4.24	-
Reduced Access (NPC99S)	0.95	0.98	0.95	1.53	2.74	2.84	3.00	3.80	3.97	4.35	-
INGAA 30 TCF Study	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**-**	**-**	**-**	**-**	**-**
EIA/AEO 2000	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**-**	**3.98**	**4.32**	**4.72**	**5.01**
1998 AGA-TERA Base Case	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**3.50**	**3.81**	**4.00**	**4.26**	**-**
WPA/AGF's Fueling the Future (Current Trajectory)	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**-**	**-**	**3.95**	**4.42**	**4.55**
DRI U.S. Outlook, April 1998	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**-**	**-**	**-**	**5.20**	**5.41**
GRI 2000 Baseline Projection	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**2.99**	**3.77**	**4.10**	**4.13**	**-**
IPAA 1998 Long Term Report	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**3.27**	**3.74**	**4.19**	**-**	**-**
WEFA	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**-**	**-**	**-**	**5.14**	**-**
NRC's Canadian Natural Gas Review '99	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**3.61**	**3.95**	**-**	**-**	**-**
NEB's Supply & Demand to 2025	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Average Non-NPC	**0.95**	**0.98**	**0.95**	**1.53**	**2.74**	**2.84**	**3.25**	**3.82**	**4.11**	**4.64**	**4.99**

U.S. Residential Gas Consumption (TCF)											
	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**5.32**	**5.56**	**5.81**	**6.07**	**-**
Increased Oil Prices (NPC99D)	4.92	4.75	4.43	4.39	4.83	4.97	5.31	5.55	5.79	6.08	-
Decreased Oil Prices (NPC99E)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.58	5.83	6.10	-
Higher GDP Growth Rate (NPC99F)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.59	5.87	6.19	-
Lower GDP Growth Rate (NPC99G)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.54	5.74	5.97	-
Faster Technology Advancement (NPC99H)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.57	5.84	6.11	-
Slower Technology Advancement (NPC99I)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.56	5.78	6.04	-
Larger Resource Base (NPC99K)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.58	5.88	6.12	-
Smaller Resource Base (NPC99L)	4.92	4.75	4.43	4.39	4.83	4.97	5.31	5.54	5.77	6.02	-
Increased Access (NPC99R)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.56	5.82	6.11	-
Reduced Access (NPC99S)	4.92	4.75	4.43	4.39	4.83	4.97	5.32	5.56	5.79	6.07	-
INGAA 30 TCF Study	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**-**	**-**	**6.01**	**-**	**-**
EIA/AEO 2000	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**-**	**5.07**	**5.30**	**5.49**	**5.69**
1998 AGA-TERA Base Case	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**5.51**	**5.83**	**6.08**	**6.23**	**-**
WPA/AGF's Fueling the Future (Current Trajectory)	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**-**	**-**	**5.23**	**5.47**	**5.47**
DRI U.S. Outlook, Summer/Spring 1998	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**-**	**-**	**-**	**5.54**	**5.79**
GRI 2000 Baseline Projection	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**4.94**	**5.16**	**5.39**	**5.65**	**-**
IPAA 1998 Long Term Report	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**5.23**	**5.46**	**5.72**	**na**	**-**
WEFA '99	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**-**	**-**	**-**	**5.65**	**5.76**
NRC's Canadian Natural Gas Review '99											
NEB's Supply & Demand to 2025	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Average Non-NPC	**4.92**	**4.75**	**4.43**	**4.39**	**4.83**	**4.97**	**5.23**	**5.38**	**5.62**	**5.67**	**5.68**

TABLE D-8 (CONTINUED)

U.S. Commercial Gas Consumption (TCF)	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**3.41**	**3.65**	**3.85**	**4.09**	**-**
Increased Oil Prices (NPC99D)	2.51	2.61	2.43	2.62	3.03	3.22	3.40	3.64	3.82	4.09	-
Decreased Oil Prices (NPC99E)	2.51	2.61	2.43	2.62	3.03	3.22	3.42	3.68	3.89	4.12	-
Higher GDP Growth Rate (NPC99F)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.67	3.88	4.18	-
Lower GDP Growth Rate (NPC99G)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.64	3.80	4.02	-
Faster Technology Advancement (NPC99H)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.66	3.89	4.15	-
Slower Technology Advancement (NPC99I)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.65	3.81	4.04	-
Larger Resource Base (NPC99K)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.68	3.96	4.17	-
Smaller Resource Base (NPC99L)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.61	3.79	4.01	-
Increased Access (NPC99R)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.66	3.86	4.14	-
Reduced Access (NPC99S)	2.51	2.61	2.43	2.62	3.03	3.22	3.41	3.65	3.83	4.08	-
INGAA 30 TCF Study	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**-**	**-**	**3.80**	**-**	**-**
EIA/AEO 2000	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**-**	**3.34**	**3.48**	**3.61**	**3.65**
1998 AGA-TERA Base Case	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**3.46**	**3.55**	**3.78**	**4.01**	**-**
WPA/AGF's Fueling the Future (Current Trajectory)	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**-**	**-**	**3.95**	**4.17**	**4.23**
DRI U.S. Outlook, Summer/Spring 1998	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**-**	**-**	**-**	**3.64**	**3.62**
GRI 2000 Baseline Projection	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**3.30**	**3.48**	**3.78**	**4.13**	**-**
IPAA 1998 Long Term Report	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**3.33**	**3.51**	**3.69**	**-**	**-**
WEFA '99	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**-**	**-**	**-**	**3.85**	**3.98**
NRC's Canadian Natural Gas Review '99											
NEB's Supply & Demand to 2025	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Average Non-NPC	**2.51**	**2.61**	**2.43**	**2.62**	**3.03**	**3.22**	**3.37**	**3.47**	**3.75**	**3.90**	**3.87**

U.S. Industrial Gas Consumption (TCF)	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**8.61**	**9.65**	**10.24**	**10.76**	**-**
Increased Oil Prices (NPC99D)	6.97	7.17	5.90	7.02	8.58	8.84	8.72	9.88	10.53	11.32	-
Decreased Oil Prices (NPC99E)	6.97	7.17	5.90	7.02	8.58	8.84	8.48	9.34	9.90	10.44	-
Higher GDP Growth Rate (NPC99F)	6.97	7.17	5.90	7.02	8.58	8.84	8.61	9.69	10.26	11.02	-
Lower GDP Growth Rate (NPC99G)	6.97	7.17	5.90	7.02	8.58	8.84	8.63	9.66	10.17	10.60	-
Faster Technology Advancement (NPC99H)	6.97	7.17	5.90	7.02	8.58	8.84	8.61	9.76	10.49	11.03	-
Slower Technology Advancement (NPC99I)	6.97	7.17	5.90	7.02	8.58	8.84	8.61	9.58	10.03	10.49	-
Larger Resource Base (NPC99K)	6.97	7.17	5.90	7.02	8.58	8.84	8.63	9.88	10.87	11.26	-
Smaller Resource Base (NPC99L)	6.97	7.17	5.90	7.02	8.58	8.84	8.55	9.46	9.83	10.38	-
Increased Access (NPC99R)	6.97	7.17	5.90	7.02	8.58	8.84	8.61	9.71	10.39	11.13	-
Reduced Access (NPC99S)	6.97	7.17	5.90	7.02	8.58	8.84	8.60	9.65	10.12	10.71	-
INGAA 30 TCF Study	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**-**	**-**	**11.41**	**-**	**-**
EIA/AEO 2000	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**-**	**8.81**	**9.22**	**9.64**	**9.99**
1998 AGA-TERA Base Case	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**8.43**	**9.24**	**10.35**	**10.83**	**-**
WPA/AGF's Fueling the Future (Current Trajectory)	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**-**	**-**	**9.72**	**10.04**	**10.28**
DRI U.S. Outlook, Summer/Spring 1998	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**-**	**-**	**-**	**8.61**	**8.74**
GRI 2000 Baseline Projection	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**8.55**	**9.45**	**10.33**	**10.95**	**-**
IPAA 1998 Long Term Report	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**9.15**	**9.55**	**10.14**	**-**	**-**
WEFA '99	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**-**	**-**	**-**	**9.74**	**9.96**
NRC's Canadian Natural Gas Review '99	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
NEB's Supply & Demand to 2025	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Average Non-NPC	**6.97**	**7.17**	**5.90**	**7.02**	**8.58**	**8.84**	**8.71**	**9.26**	**10.19**	**9.97**	**9.74**

TABLE D-8 (CONTINUED)

U.S. Power Gen Gas Consumption (TCF)											
	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**3.51**	**5.14**	**6.56**	**7.76**	**-**
Increased Oil Prices (NPC99D)	3.14	3.69	3.06	2.79	3.24	2.93	3.46	5.43	6.95	9.00	-
Decreased Oil Prices (NPC99E)	3.14	3.69	3.06	2.79	3.24	2.93	3.56	4.92	5.90	6.28	-
Higher GDP Growth Rate (NPC99F)	3.14	3.69	3.06	2.79	3.24	2.93	3.52	5.46	7.00	8.05	-
Lower GDP Growth Rate (NPC99G)	3.14	3.69	3.06	2.79	3.24	2.93	3.48	4.87	5.87	7.08	-
Faster Technology Advancement (NPC99H)	3.14	3.69	3.06	2.79	3.24	2.93	3.50	5.32	6.95	8.45	-
Slower Technology Advancement (NPC99I)	3.14	3.69	3.06	2.79	3.24	2.93	3.50	5.04	6.15	6.58	-
Larger Resource Base (NPC99K)	3.14	3.69	3.06	2.79	3.24	2.93	3.53	5.51	7.54	8.91	-
Smaller Resource Base (NPC99L)	3.14	3.69	3.06	2.79	3.24	2.93	3.43	4.87	5.68	6.09	-
Increased Access (NPC99R)	3.14	3.69	3.06	2.79	3.24	2.93	3.51	5.24	6.78	8.63	-
Reduced Access (NPC99S)	3.14	3.69	3.06	2.79	3.24	2.93	3.49	5.14	6.35	7.58	-
INGAA 30 TCF Study	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**-**	**-**	**6.62**	**-**	**-**
EIA/AEO 2000	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**-**	**4.53**	**6.45**	**8.37**	**9.26**
1998 AGA-TERA Base Case	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**3.16**	**4.18**	**5.99**	**6.72**	**-**
WPA/AGF's Fueling the Future (Current Trajectory)	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**-**	**-**	**6.59**	**6.66**	**7.43**
DRI U.S. Outlook, Summer/Spring 1998	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**-**	**-**	**-**	**9.28**	**10.02**
GRI 2000 Baseline Projection	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**3.55**	**5.23**	**6.39**	**8.64**	**-**
IPAA 1998 Long Term Report	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**3.19**	**4.08**	**5.14**	**na**	**-**
WEFA '99	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**-**	**-**	**-**	**10.66**	**12.06**
NRC's Canadian Natural Gas Review '99	-	-	-	-	-	-	-	-	-	-	-
NEB's Supply & Demand to 2025	-	-	-	-	-	-	-	-	-	-	-
Average Non-NPC	**3.14**	**3.69**	**3.06**	**2.79**	**3.24**	**2.93**	**3.30**	**4.50**	**6.20**	**8.39**	**9.69**

Other***											
	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**2.20**	**2.61**	**3.01**	**3.16**	**-**
Increased Oil Prices (NPC99D)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.65	3.07	3.34	-
Decreased Oil Prices (NPC99E)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.58	2.94	3.04	-
Higher GDP Growth Rate (NPC99F)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.65	3.05	3.25	-
Lower GDP Growth Rate (NPC99G)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.60	2.96	3.09	-
Faster Technology Advancement (NPC99H)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.64	3.03	3.23	-
Slower Technology Advancement (NPC99I)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.60	2.97	3.05	-
Larger Resource Base (NPC99K)	1.98	1.67	1.48	1.90	1.85	1.91	2.21	2.66	3.10	3.28	-
Smaller Resource Base (NPC99L)	1.98	1.67	1.48	1.90	1.85	1.91	2.19	2.57	2.89	3.01	-
Increased Access (NPC99R)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.63	3.05	3.29	-
Reduced Access (NPC99S)	1.98	1.67	1.48	1.90	1.85	1.91	2.20	2.60	2.98	3.18	-
INGAA 30 TCF Study	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**-**	**-**	**2.48**	**-**	**-**
EIA/AEO 2000	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**-**	**2.16**	**2.50**	**2.77**	**2.94**
1998 AGA-TERA Base Case	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**2.16**	**2.40**	**2.73**	**3.14**	**-**
WPA/AGF's Fueling the Future (Current Trajectory)	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**-**	**-**	**1.26**	**1.35**	**1.36**
DRI U.S. Outlook, Summer/Spring 1998	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**-**	**-**	**-**	**2.93**	**3.07**
GRI 2000 Baseline Projection	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**#REF!**	**#REF!**	**#REF!**	**#REF!**	**-**
IPAA 1998 Long Term Report	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**2.10**	**2.27**	**2.48**	**-**	**-**
WEFA '99	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**-**	**-**	**-**	**2.65**	**2.81**
NRC's Canadian Natural Gas Review '99	-	-	-	-	-	-	-	-	-	-	-
NEB's Supply & Demand to 2025	-	-	-	-	-	-	-	-	-	-	-
Average Non-NPC	**1.98**	**1.67**	**1.48**	**1.90**	**1.85**	**1.91**	**#REF!**	**#REF!**	**#REF!**	**#REF!**	**2.55**

***Consists of lease, plant and pipeline fuel as well as any discrepancy or balancing item, except for the WPA/AGF projection, which does not include any discrepancy or balancing item.

TABLE D-8 (CONTINUED)

Canadian Demand											
	1975	1980	1985	1990	1985	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	-	-	-	**2.34**	**2.86**	**2.85**	**3.01**	**3.30**	**3.51**	**3.78**	-
Increased Oil Prices (NPC99D)	-	-	-	2.34	2.86	2.85	3.01	3.32	3.52	3.85	-
Decreased Oil Prices (NPC99E)	-	-	-	2.34	2.86	2.85	2.99	3.27	3.48	3.74	-
Higher GDP Growth Rate (NPC99F)	-	-	-	2.34	2.86	2.85	3.01	3.34	3.61	3.95	-
Lower GDP Growth Rate (NPC99G)	-	-	-	2.34	2.86	2.85	3.00	3.26	3.41	3.63	-
Faster Technology Advancement (NPC99H)	-	-	-	2.34	2.86	2.85	3.01	3.31	3.55	3.83	-
Slower Technology Advancement (NPC99I)	-	-	-	2.34	2.86	2.85	3.01	3.29	3.47	3.74	-
Larger Resource Base (NPC99K)	-	-	-	2.34	2.86	2.85	3.01	3.33	3.62	3.87	-
Smaller Resource Base (NPC99L)	-	-	-	2.34	2.86	2.85	3.00	3.27	3.47	3.68	-
Increased Access (NPC99R)	-	-	-	2.34	2.86	2.85	3.01	3.30	3.52	3.82	-
Reduced Access (NPC99S)	-	-	-	2.34	2.86	2.85	3.00	3.30	3.51	3.78	-
INGAA 30 TCF Study	-	-	-	**2.34**	**2.86**	**2.85**	-	-	**3.54**	-	-
EIA/AEO 2000	-	-	-	**2.34**	**2.86**	**2.85**	-	-	-	-	-
1998 AGA-TERA Base Case	-	-	-	**2.34**	**2.86**	**2.85**	-	-	-	-	-
WPA/AGF's Fueling the Future (Current Trajectory)	-	-	-	-	-	-	-	-	-	-	-
DRI U.S. Outlook, April 1998	-	-	-	**2.34**	**2.86**	**2.85**	-	-	-	-	-
GRI 2000 Baseline Projection	-	-	-	**2.34**	**2.86**	**2.85**	-	-	-	-	-
IPAA 1998 Long Term Report	-	-	-	**2.34**	**2.86**	**2.85**	-	-	-	-	-
WEFA	-	-	-	**2.34**	**2.86**	**2.85**	-	-	-	-	-
NRC's Canadian Natural Gas Review '99	-	-	-	**2.34**	**2.86**	**2.85**	-	**3.37**	-	-	-
NEB's Supply & Demand to 2025	-	-	-	-	-	-	-	-	-	-	-
Average Non-NPC				**2.34**	**2.86**	**2.85**		**3.37**	**3.54**		

Canadian Production											
	1975	1980	1985	1990	1985	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	**6.07**	**7.16**	**7.44**	**8.19**	-
Increased Oil Prices (NPC99D)	2.57	2.46	2.72	3.48	5.23	5.61	6.09	7.21	7.34	8.49	-
Decreased Oil Prices (NPC99E)	2.57	2.46	2.72	3.48	5.23	5.61	6.01	7.01	7.28	7.88	-
Higher GDP Growth Rate (NPC99F)	2.57	2.46	2.72	3.48	5.23	5.61	6.07	7.21	7.68	8.44	-
Lower GDP Growth Rate (NPC99G)	2.57	2.46	2.72	3.48	5.23	5.61	6.06	7.09	7.17	7.87	-
Faster Technology Advancement (NPC99H)	2.57	2.46	2.72	3.48	5.23	5.61	6.07	7.16	7.65	8.33	-
Slower Technology Advancement (NPC99I)	2.57	2.46	2.72	3.48	5.23	5.61	6.07	7.12	7.23	8.05	-
Larger Resource Base (NPC99K)	2.57	2.46	2.72	3.48	5.23	5.61	6.07	7.27	7.92	8.48	-
Smaller Resource Base (NPC99L)	2.57	2.46	2.72	3.48	5.23	5.61	6.07	7.09	7.47	7.65	-
Increased Access (NPC99R)	2.57	2.46	2.72	3.48	5.23	5.61	6.07	7.15	7.39	8.15	-
Reduced Access (NPC99S)	2.57	2.46	2.72	3.48	5.23	5.61	6.07	7.18	7.59	8.22	-
INGAA 30 TCF Study	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	-	-	**8.40**	-	-
EIA/AEO 2000	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	-	-	-	-	-
1998 AGA-TERA Base Case	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	-	-	-	-	-
WPA/AGF's Fueling the Future (Current Trajectory)	-	-	-	-	-	-	-	-	-	-	-
DRI U.S. Outlook, April 1998	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	-	-	-	-	-
GRI 2000 Baseline Projection	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	**5.96**	**6.96**	**7.54**	**7.71**	-
IPAA 1998 Long Term Report	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	-	-	-	-	-
WEFA	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	-	-	-	-	-
NRC's Canadian Natural Gas Review '99	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	-	**7.32**	-	-	-
NEB's Supply & Demand to 2025	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	**6.33**	**7.18**	**7.80**	**8.54**	**8.89**
Average Non-NPC	**2.57**	**2.46**	**2.72**	**3.48**	**5.23**	**5.61**	**6.15**	**7.15**	**7.91**	**8.12**	**8.89**

TABLE D-8 (CONTINUED)

U.S. GDP (Billion $1998)											
	1975	1980	1985	1990	1985	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**8,902**	**10,072**	**11,395**	**12,893**	**-**
Increased Oil Prices (NPC99D)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
Decreased Oil Prices (NPC99E)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
Higher GDP Growth Rate (NPC99F)	4,395	5,244	6,060	6,980	7,666	8,266	9,033	10,471	12,139	14,073	-
Lower GDP Growth Rate (NPC99G)	4,395	5,244	6,060	6,980	7,666	8,266	8,772	9,685	10,693	11,806	-
Faster Technology Advancement (NPC99H)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
Slower Technology Advancement (NPC99I)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
Larger Resource Base (NPC99K)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
Smaller Resource Base (NPC99L)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
Increased Access (NPC99R)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
Reduced Access (NPC99S)	4,395	5,244	6,060	6,980	7,666	8,266	8,902	10,072	11,395	12,893	-
INGAA 30 TCF Study	4,395	5,244	6,060	6,980	7,666	8,266	**8,941**	**10,190**	**11,614**	**13,236**	**-**
EIA/AEO 2000	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**-**	**10,297**	**11,432**	**12,675**	**13,848**
1998 AGA-TERA Base Case	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**8,266**	**8,266**	**8,266**	**8,266**	**-**
WPA/AGF's Fueling the Future (Current Trajectory)	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**-**	**-**	**10,655**	**11,764**	**12,988.8**
DRI U.S. Outlook, April 1998	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**-**	**-**	**-**	**-**	**-**
GRI 2000 Baseline Projection	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**8,892**	**10,042**	**11,246**	**12,297**	**-**
IPAA 1998 Long Term Report	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**8,802**	**9,814**	**10,932**	**-**	**-**
WEFA	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**-**	**-**	**-**	**-**	**-**
NRC's Canadian Natural Gas Review '99	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
NEB's Supply & Demand to 2025	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Average Non-NPC	**4,395**	**5,244**	**6,060**	**6,980**	**7,666**	**8,266**	**8,725**	**9,722**	**10,691**	**11,648**	**13,418**

Population											
	1975	1980	1985	1990	1985	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**275.1**	**286.6**	**298.4**	**310.6**	**-**
Increased Oil Prices (NPC99D)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Decreased Oil Prices (NPC99E)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Higher GDP Growth Rate (NPC99F)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Lower GDP Growth Rate (NPC99G)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Faster Technology Advancement (NPC99H)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Slower Technology Advancement (NPC99I)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Larger Resource Base (NPC99K)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Smaller Resource Base (NPC99L)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Increased Access (NPC99R)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
Reduced Access (NPC99S)	215.5	226.5	238.7	248.7	263.6	268.2	275.1	286.6	298.4	310.6	-
INGAA 30 TCF Study	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**-**	**-**	**-**	**-**	**-**
EIA/AEO 2000	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**-**	**286.6**	**298.3**	**310.8**	**323.4**
1998 AGA-TERA Base Case	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**278.8**	**297.4**	**317.2**	**338.4**	**361.0**
WPA/AGF's Fueling the Future (Current Trajectory)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
DRI U.S. Outlook, April 1998	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**-**	**-**	**-**	**-**	**-**
GRI 2000 Baseline Projection	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**275.1**	**286.6**	**298.4**	**310.6**	**-**
IPAA 1998 Long Term Report	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**-**	**-**	**-**	**-**	**-**
WEFA	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**-**	**-**	**-**	**-**	**-**
NRC's Canadian Natural Gas Review '99	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
NEB's Supply & Demand to 2025	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Average Non-NPC	**215.5**	**226.5**	**238.7**	**248.7**	**263.6**	**268.2**	**277.0**	**290.2**	**304.6**	**319.9**	**342.2**

TABLE D-8 (CONTINUED)

Lower-48 Natural Gas Wellhead Prices ($1998)											
	1975	1980	1985	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	**$2.97**	**$2.53**	**$2.96**	**$3.61**	-
Increased Oil Prices (NPC99D)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$3.41	$2.56	$3.20	$3.53	-
Decreased Oil Prices (NPC99E)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$2.53	$2.37	$2.71	$3.32	-
Higher GDP Growth Rate (NPC99F)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$2.99	$2.70	$3.26	$3.93	-
Lower GDP Growth Rate (NPC99G)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$2.92	$2.31	$2.69	$3.20	-
Faster Technology Advancement (NPC99H)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$2.98	$2.38	$2.60	$3.28	-
Slower Technology Advancement (NPC99I)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$2.98	$2.62	$3.16	$4.04	-
Larger Resource Base (NPC99K)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$2.95	$2.20	$2.10	$2.91	-
Smaller Resource Base (NPC99L)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$3.08	$2.75	$3.49	$4.26	-
Increased Access (NPC99R)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$2.98	$2.48	$2.82	$3.04	-
Reduced Access (NPC99S)	$1.18	$2.99	$3.64	$2.08	$1.61	$2.39	$3.01	$2.57	$3.16	$3.54	-
INGAA 30 TCF Study	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	-	-	-	-	-
EIA/AEO 2000	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	-	**$2.34**	**$2.60**	**$2.71**	**$2.81**
1998 AGA-TERA Base Case	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	**$2.11**	**$2.13**	**$2.17**	**$2.27**	-
WPA/AGF's Fueling the Future (Current Trajectory)	-	-	-	-	-	-	-	-	-	-	-
DRI U.S. Outlook, Spring/Summer 1999	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	-	-	-	**$2.41**	**$2.65**
GRI 2000 Baseline Projection	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	**$2.12**	**$1.88**	**$1.84**	**$1.81**	-
IPAA 1998 Long Term Report	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	-	-	-	-	-
WEFA '99	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	-	-	-	**$2.51**	**2.66**
NRC's Canadian Natural Gas Review '99	-	-	-	-	-	-	-	-	-	-	-
NEB's Supply & Demand to 2025	-	-	-	-	-	-	-	-	-	-	-
Average Non-NPC	**$1.18**	**$2.99**	**$3.64**	**$2.08**	**$1.61**	**$2.39**	**$2.12**	**$2.12**	**$2.20**	**$2.34**	**$2.71**

World Crude Oil Prices ($1998)											
	1975	1980	1995	1990	1995	1997	2000	2005	2010	2015	2020
NPC Reference Case (NPC99)	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	**$16.01**	**$16.01**	**$16.02**	**$16.02**	-
Increased Oil Prices (NPC99D)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$19.10	$19.10	$19.10	$19.10	-
Decreased Oil Prices (NPC99E)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$13.02	$13.02	$13.02	$13.03	-
Higher GDP Growth Rate (NPC99F)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
Lower GDP Growth Rate (NPC99G)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
Faster Technology Advancement (NPC99H)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
Slower Technology Advancement (NPC99I)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
Larger Resource Base (NPC99K)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
Smaller Resource Base (NPC99L)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
Increased Access (NPC99R)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
Reduced Access (NPC99S)	$37.53	$63.80	$39.15	$26.44	$18.14	$18.71	$16.01	$16.01	$16.02	$16.02	-
INGAA 30 TCF Study	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	-	-	**$16.40**	-	-
EIA/AEO 2000	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	-	**$20.49**	**$21.00**	**$21.53**	**$22.04**
1998 AGA-TERA Base Case	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	**$18.29**	**$18.51**	**$18.66**	**$18.66**	-
WPA/AGF's Fueling the Future (Current Trajectory)	-	-	-	-	-	-	-	-	-	-	-
DRI U.S. Outlook, April 1998	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	-	-	-	-	-
GRI 2000 Baseline Projection	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	**$17.80**	**$17.80**	**$17.80**	**$17.80**	-
IPAA 1998 Long Term Report	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	-	-	-	-	-
WEFA	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	-	-	-	-	-
NRC's Canadian Natural Gas Review '99	-	-	-	-	-	-	-	-	-	-	-
NEB's Supply & Demand to 2025	-	-	-	-	-	-	-	-	-	-	-
Average Non-NPC	**$37.53**	**$63.80**	**$39.15**	**$26.44**	**$18.14**	**$18.71**	**$18.04**	**$18.93**	**$18.47**	**$19.33**	**$22.04**

Appendix E

Retrospective of the 1992 NPC Study Results

This section presents a retrospective of the 1992 NPC Study projections for supply and demand. The retrospective is a comparison between what was projected in 1992 and what actually occurred. The demand retrospective is presented as a comparison with historical data through 1998. The supply retrospective consists of a detailed regional look at what was projected for the year 1996 and what actually occurred.

Demand Retrospective

Figure E-1 compares the 1992 Study's GDP projections with what occurred. The 1992 high case assumed an average annual GDP growth rate of 2.4% a year between 1990 and 1998, while the 1992 low case assumed an annual GDP growth rate of 2.0%. The actual GDP growth rate was 2.6% a year and resulted in 1998 GDP being 1.8% higher than the 1992 study's high case projection.

Figure E-2 compares the 1992 Study's electricity projections with what occurred. The 1992 Study assumed that demand for electricity would grow at an average rate of 1.4% between 1990 and 1998 in the high case and 1.1% per year in the low case. Actual electricity demand grew at an average annual rate of 2.2% between 1990 and 1998. Actual 1998 electricity demand was 7% higher than the 1992 high case projection. This reflects the general tendency in the 1992 Study to understate energy demand in all sectors. This error was a result of the assumption that energy efficiency would improve to a much greater extent than it actually did.

Figure E-3 compares the 1992 Study's spot price projections with what occurred. The projected Henry Hub price in the 1992 Study grew at an average annual rate of 5.7% between 1990 and 1998 in the high case and 3.7% per year in the low case. Actual Henry Hub prices were much more volatile. The actual price was above the high case projection in 1992, 1993, and 1996 and below the low case projection in 1994, 1995, and 1998. Overall, the average actual growth rate of Henry Hub prices between 1990 and 1998 was 0.3% per year.

Figure E-4 compares the 1992 Study's crude oil price projections with what occurred. The refinery acquisition crude oil cost (RACC) was assumed to decline by 1.4% a year between 1990 and 1998 in the high case and 3.8% a year in the low case. Actual RACC prices have generally been lower than assumed in the 1992 low case. RACC prices were below the low case in every year except for 1996. In 1998, the actual RACC price was 36% lower than the 1992 low case and 47% lower than the high case.

Figure E-5 compares the 1992 Study's residential demand projections with what occurred. The 1992 Study projected residential gas consumption to grow at an average annual rate of 1% for both the high and low cases between 1990 and 1998. After 1992, actual residential consumption was higher in all years except for 1998, when due to very warm weather consumption was 4% lower than the low case projection.

Figure E-1. U.S. Gross Domestic Product

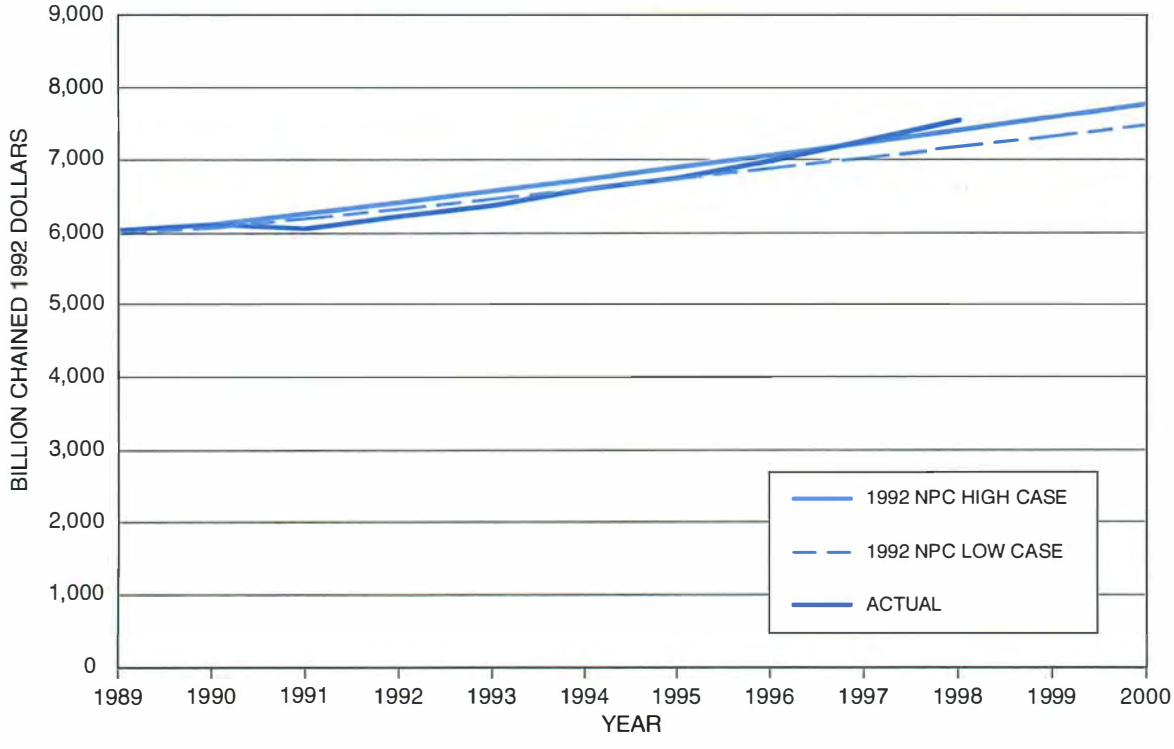


Figure E-2. Total U.S. Electricity Demand

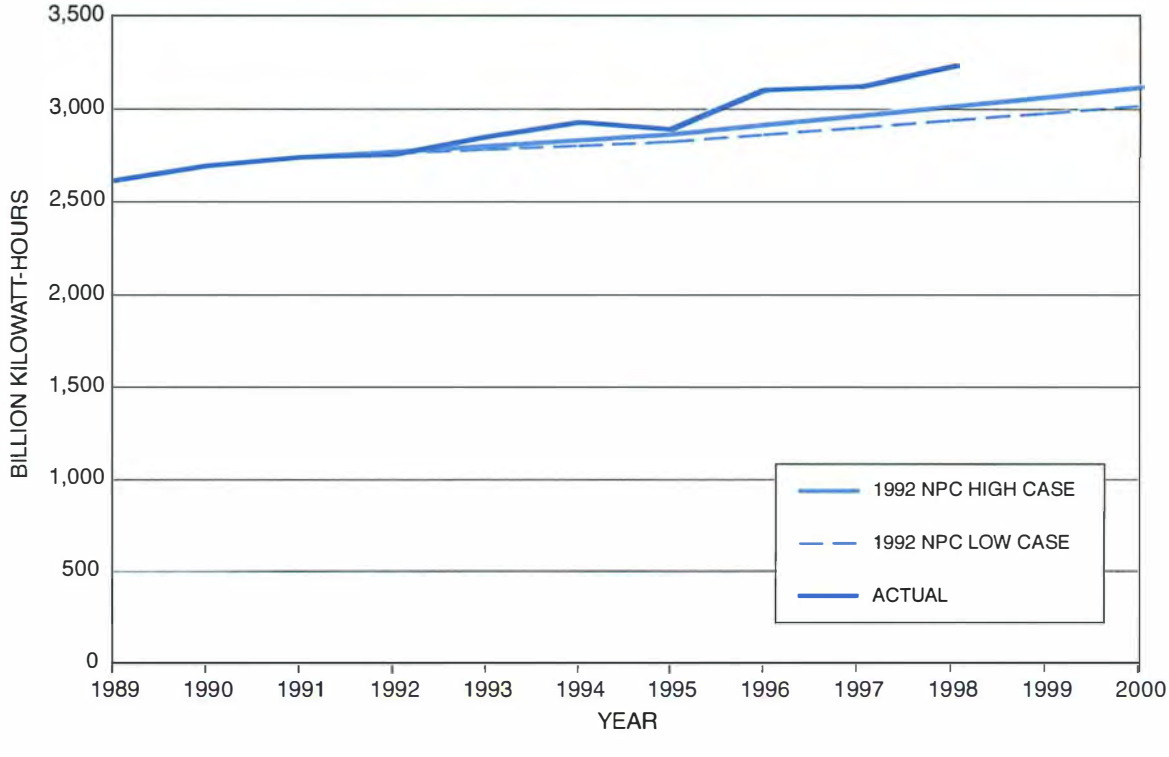


Figure E-3. Henry Hub Spot Prices

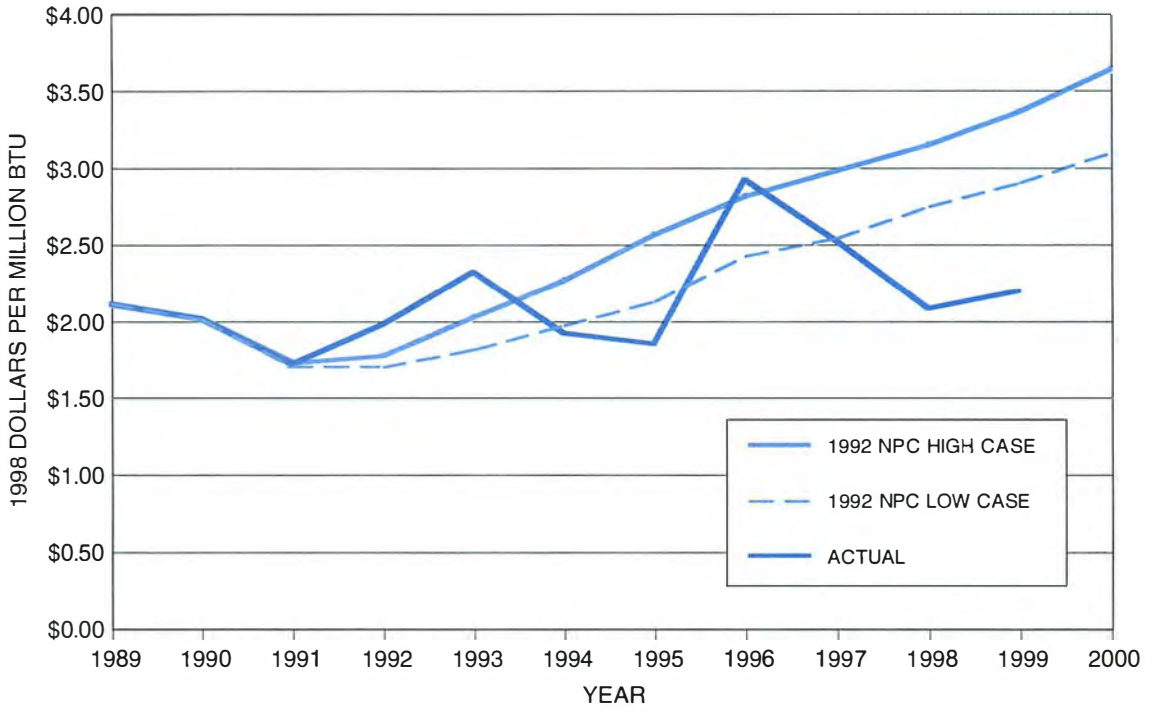


Figure E-4. U.S. Average Crude Oil RACC Price

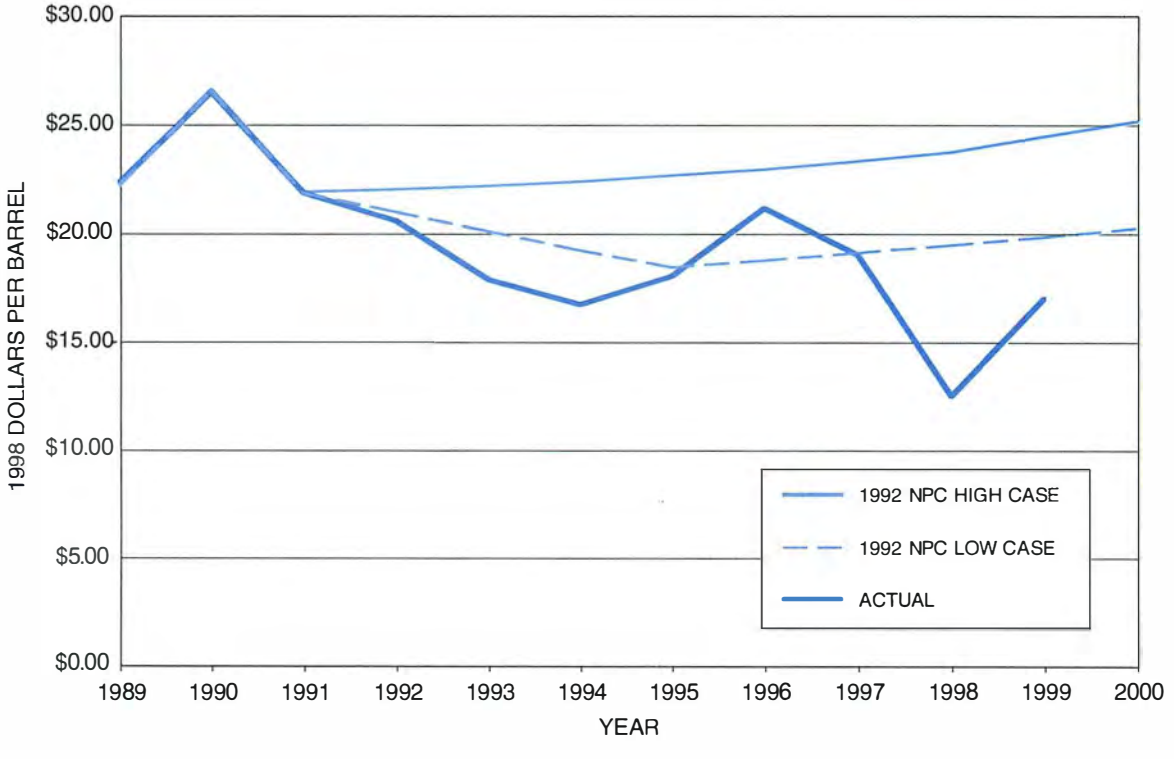


Figure E-5. U.S. Residential Natural Gas Demand

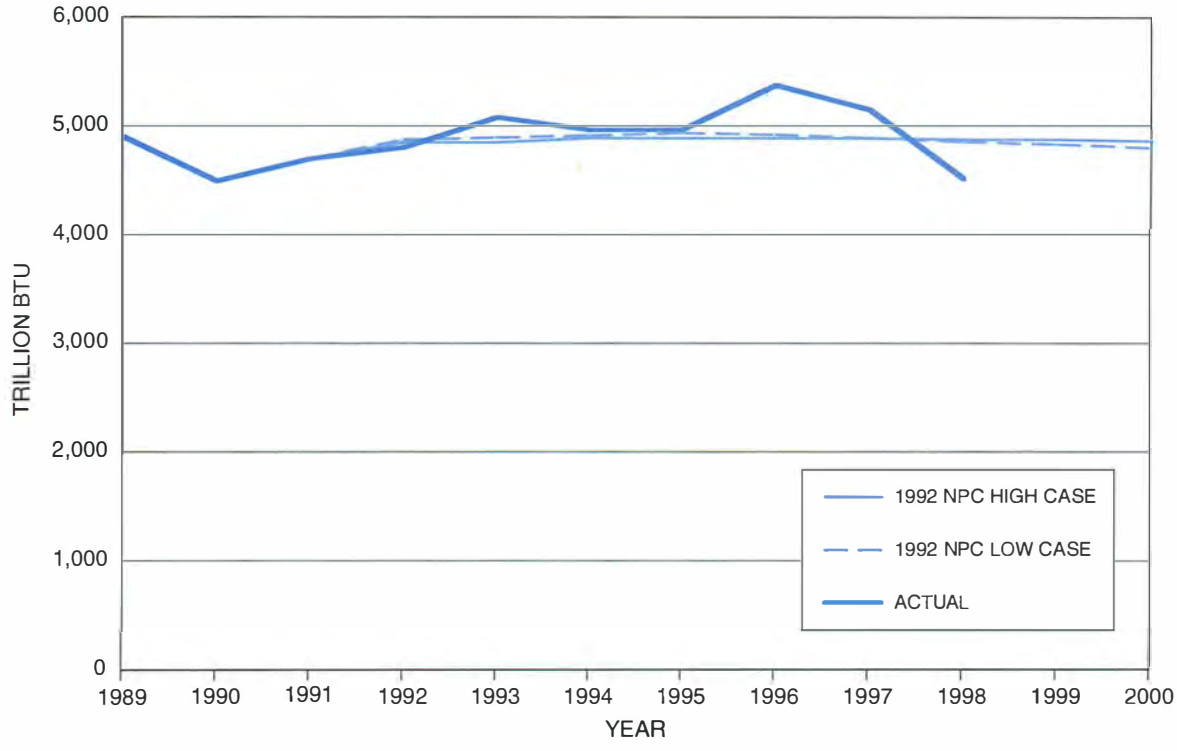


Figure E-6 compares the 1992 Study's commercial demand projections with what occurred. The 1992 Study projected commercial gas consumption to grow at an average annual rate of 0.7% between 1990 and 1998 in the high case and 0.4% in the low case. Actual commercial gas consumption grew at an average annual rate of 1.9% per year between 1990 and 1998. Actual 1998 commercial gas demand was 10% higher than the 1992 Study high case projection despite the unusually warm weather.

Figure E-7 compares the 1992 Study's industrial demand projections with what occurred. The 1992 Study projected industrial gas consumption to grow at an average annual rate of 1.3% between 1990 and 1998 in the high case and to fall at 0.4% a year in the low case. Actual industrial gas consumption grew at an average annual rate of 2.7% per year between 1990 and 1998. Actual 1998 industrial gas demand was 12% higher than the 1992 Study high case projection and 27% higher than the low case projection. (See the Demand Task Group Report for discussion of classification problems in the consumption data.)

Figure E-8 compares the 1992 Study's electricity generation demand projections with what occurred. The 1992 Study projected gas consumption for electricity generation to grow at an average annual rate of 2.5% between 1990 and 1998 in the high case and 0.6% a year in the low case. Actual gas consumption for electricity generation grew at an average annual rate of 2.1% per year between 1990 and 1998. (See the Demand Task Group Report for discussion of classification problems in the consumption data.)

Figure E-9 compares the 1992 Study's total end-use demand projections with what occurred. The 1992 Study projected end-use gas consumption to grow at an average annual rate of 1.3% between 1990 and 1998 in the high case and to fall at 0.3% a year in the low case. Actual end-use gas consumption grew at an average annual rate of 1.9% per year between 1990 and 1998. Actual 1998 end-use gas demand was 5% higher than the 1992 Study high case projection.

Figure E-6. U.S. Commercial Natural Gas Demand

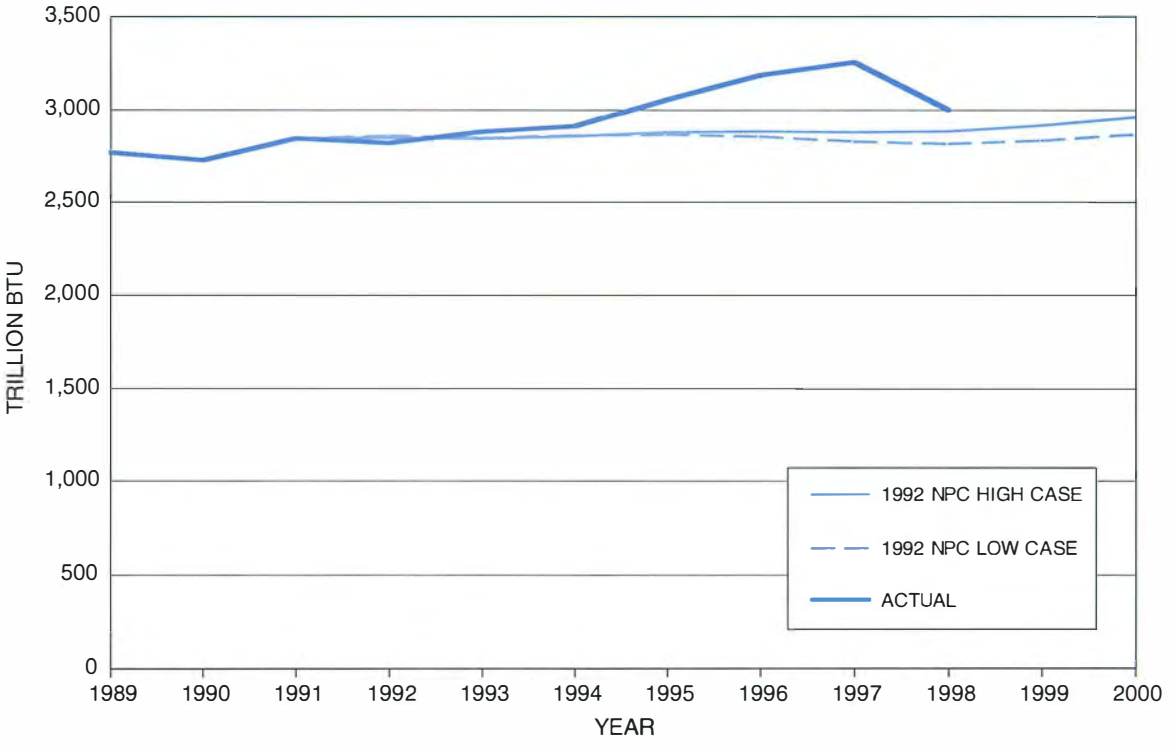


Figure E-7. U.S. Industrial Natural Gas Demand

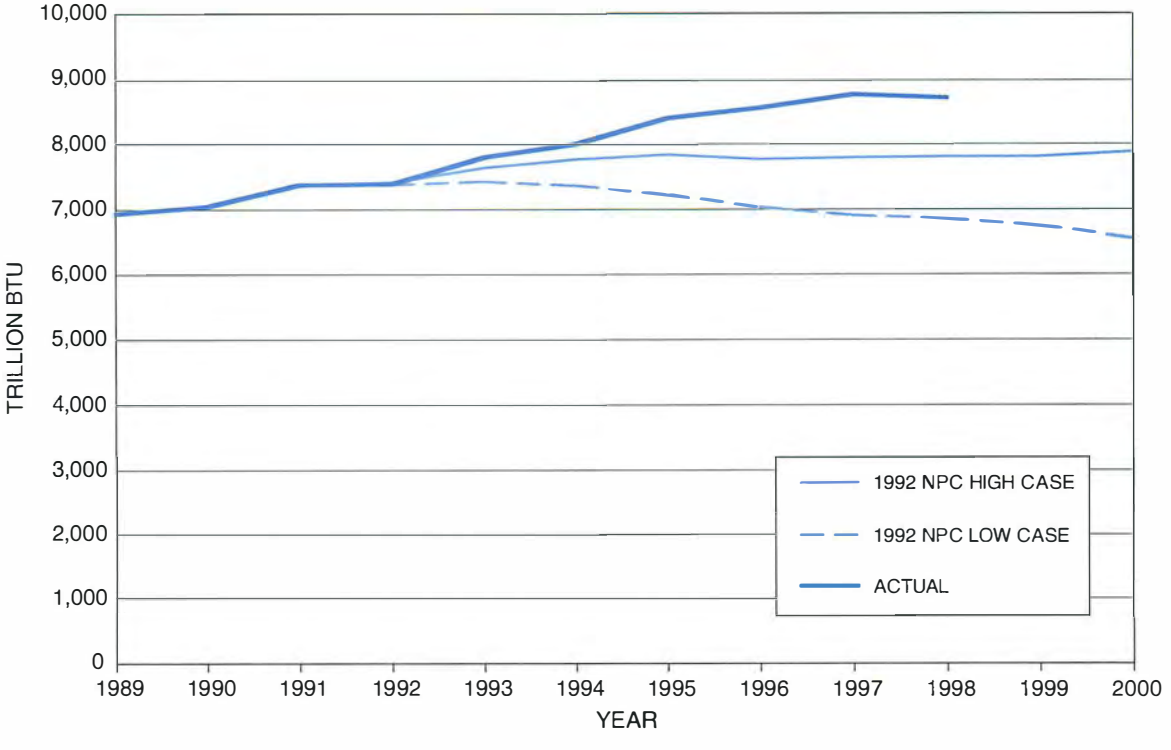


Figure E-8. U.S. Natural Gas Demand for Electricity Generation

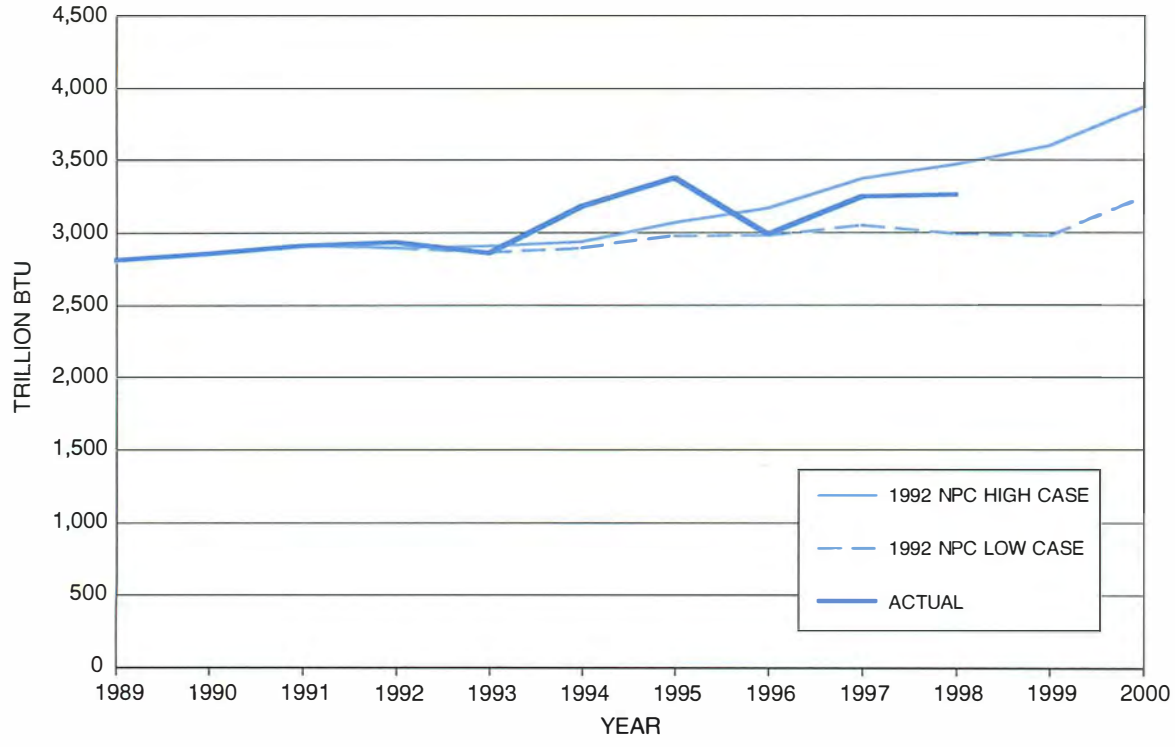


Figure E-9. Total U.S. End-Use Natural Gas Demand

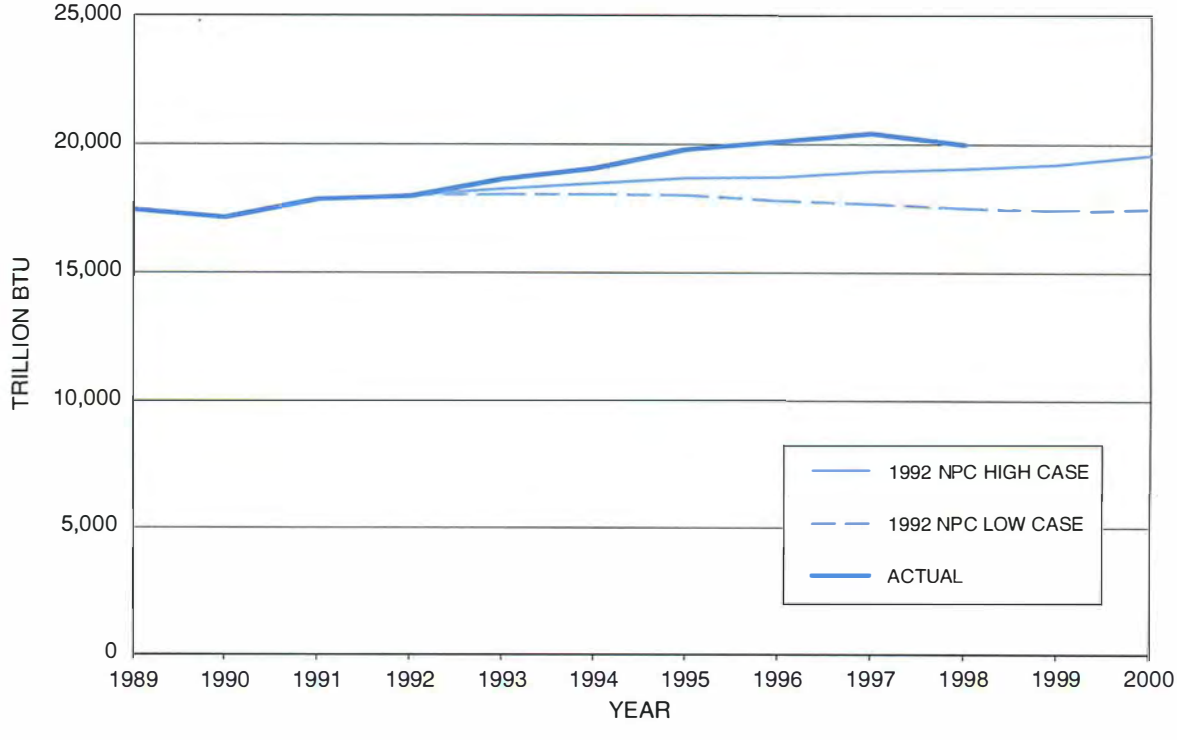


TABLE E-1

RETROSPECTIVE OF 1992 NPC PROJECTIONS OF GAS WELLS COMPARISONS OF REGIONAL PROJECTIONS WITH 1996 ACTUAL (Number of Wells)

Lower-48 Gas Well Projections versus Actual

Region		Projected 1996 Gas Wells	Actual 1996 Gas Wells	Difference	Percent Difference	Comment
A	Appalachia	1,604	1,889	-285	-15%	Underestimated
B	East Gulf Onshore	508	169	339	201%	Overestimated
C	North Central	839	758	81	11%	Overestimated
D	Arkla - East Texas	1,420	1,103	317	29%	Overestimated
E	South Louisiana	230	217	13	6%	
G	Texas Gulf Onshore	1,243	1,351	-108	-8%	Underestimated
WL	Williston Basin	86	63	23	37%	Overestimated
FR	Rocky Mtn. Foreland	500	776	-276	-36%	Underestimated
SJ	San Juan Basin	660	230	430	187%	Overestimated
OV	Overthrust Belt	66	8	58	725%	Overestimated
JN	Mid-Continent	2,195	1,913	282	15%	Overestimated
JS	Permian Basin	672	700	-28	-4%	
L	West Coast Onshore	150	54	96	178%	Overestimated
BO	Norphlet Trend	10	0	10	—	
EGO	Gulf of Mexico	277	247	30	12%	Overestimated
LO	West Coast Offshore	1	0	1	—	
AO	Atlantic Offshore	0	0	0	—	
Lower-48 Total		10,461	9,478	983	10%	

Canada Gas Well Projections versus Actual

ASM	Alberta, Saskatchewan, Manitoba	2,464	3,883	-1,419	-37%	Underestimated
BC	British Columbia	243	133	110	83%	Overestimated
EC	Eastern Canada	28	8	20	250%	Overestimated
	Canada Total	2,735	4,024	-1,289	-32%	

TABLE E-2

RETROSPECTIVE OF 1992 NPC PROJECTIONS OF GAS PRODUCTION COMPARISONS OF REGIONAL PROJECTIONS WITH 1996 ACTUAL (Billion Cubic Feet)

Lower-48 Total Gas Projections versus Actual

Region		Projected 1996 Production	Actual 1996 Production	Difference	Percent Difference	Comment
A	Appalachia	624	564	60	11%	
B	East Gulf Onshore	448	280	168	60%	Overestimated
C	North Central	228	208	20	10%	
D	Arkla - East Texas	1,268	1,352	-84	-6%	
E	South Louisiana	1,000	957	43	4%	
G	Texas Gulf Onshore	1,867	2,395	-528	-22%	Underestimated
WL	Williston Basin	114	97	17	18%	
FR	Rocky Mtn. Foreland	961	1,065	-104	-10%	
SJ	San Juan Basin	992	1,270	-278	-22%	Underestimated
OV	Overthrust Belt	274	158	116	73%	Overestimated
JN	Mid-Continent	3,274	2,917	357	12%	
JS	Permian Basin	1,396	1,454	-58	-4%	
L	West Coast Onshore	363	209	154	74%	Overestimated
BO	Norphlet Trend	642	350	292	83%	Overestimated
EGO	Gulf of Mexico	4,129	5,045	-916	-18%	Underestimated
LO	West Coast Offshore	66	57	9	16%	
AO	Atlantic Offshore	0	0	0	0%	
Lower-48 Total		17,646	18,378	-732	-4%	

Canada Total Gas Projections versus Actual

ASM	Alberta, Saskatchwan, Manitoba	4,356	4,900	-544	-11%	Underestimated
BC	British Columbia	613	685	-72	-11%	Underestimated
EC	Eastern Canada	29	16	13	81%	Overestimated
	Canada Total	4,998	5,601	-603	-11%	

Supply Retrospective

The 1992 Study projected gas supply to the year 2010 and had an assessment and projection basis of year-end 1990. The supply retrospective compares projected gas production and gas well completion activity in 1996 to actual history in each Hydrocarbon Supply Model region. Supply team members used this analysis as a tool to better understand industry trends and to adjust the resource base, cost components or activity levels in the model for the 1999 Study.

Table E-1 is a comparison of projected 1996 gas production with actual production by region, and Table E-2 is a comparison of annual gas well activity. Regions whose 1996 actual production diverged significantly from projected levels are discussed below.

Lower-48 Overview

Projected 1996 lower-48 gas production was 17.6 TCF, which fell about 4% short of the actual production of 18.4 TCF. Annual gas completion activity was overestimated by about 10%. In general terms, operators were able to increase deliverability and production with fewer-than-expected new wells, especially in areas of nonconventional production such as the San Juan Basin. In other areas such as the Western Overthrust Belt, the resource assessments and supply projections turned out to be overly optimistic.

East Gulf Onshore

Annual gas production was overestimated by 168 billion cubic feet (BCF) per year, or 60%, and annual gas completion activity was greatly overestimated. Coalbed methane production from the Warrior Basin was 96 BCF per year lower than anticipated (145 vs. 209 BCF), with the remaining shortfall from high permeability reservoirs. At the time of the 1992 Study, Warrior Basin coalbed methane production and annual completion activity were increasing rapidly. However, starting in 1992, activity declined to a level of 100 to 200 completions per year from pre-1992 activity of over 1,000 completions per year. Coalbed methane production in the Warrior Basin did increase somewhat in 1997 and 1998.

Texas Gulf Onshore

Annual gas production was underestimated by 528 BCF per year, or 22%, and annual gas completion activity was underestimated by 8%. Almost all the shortfall is represented by tight gas. Tight gas production in South Texas has more than doubled since 1991, to a level of about 960 BCF per year (Source: GRI nonconventional gas database). The 1992 Study projected that annual production from tight gas would be relatively constant in the range of about 300 BCF per year. The Lobo play in District 4 has been the most important contributor to increased tight production in this region, and Lobo activity is expected to continue.

San Juan Basin

Annual gas production was underestimated by 278 BCF per year, or 22%. Most of the shortfall was in the projection of Fruitland coalbed methane, which experienced 1996 production of 824 BCF (GRI database) compared to a projected volume of only 660 BCF. Annual coalbed methane production increased rapidly through 1996, with moderate increases in 1997 and 1998. Annual completion activity was overestimated by over 400 completions per year. Operators were able to continue to increase coalbed methane production with far fewer new well completions than anticipated. This has resulted from new completion methods such as open hole dynamic cavity completions. Tight gas production in the basin was also underestimated, accounting for about 100 BCF per year of the 278 BCF total shortfall.

Overthrust Belt

Annual gas production was overestimated by 116 BCF per year, or 73%, and gas completion activity was greatly overestimated. Few wildcat wells were drilled and very few discoveries were made in the Overthrust Belt in the 1990s, and production was sustained at a level of about 150 BCF per year through reserve appreciation activity. Because of the low activity level in this region, estimates of remaining potential were reduced substantially in the current study.

West Coast Onshore

Annual gas production was overestimated by 154 BCF, or 74%, and gas completion activity was overestimated by over 100%. Non-associated gas production in the region fell from 137 BCF in 1991 to 77 BCF in 1996. Associated gas production in the region has been stable. The decline in non-associated gas primarily resulted from a drilling decline in the Sacramento Basin, which is the main historical non-associated gas basin in the region.

Norphlet Trend

Annual gas production was overestimated by 292 BCF or 83%. Almost all of the existing gas fields were discovered in the 1980s to early 1990s, and exploration activity in recent years has declined. Annual gas production increased through 1994, reaching a level of about 340 BCF. Since 1994, production has continued to increase at a slower rate of growth. Gas from the Norphlet trend requires special processing, and production levels are capped by processing capacity.

Central & Western Gulf of Mexico

Annual gas production was underestimated by 916 BCF, or 18%, and completion activity was slightly overestimated. Most of the underestimation of gas production was on the shelf (because the deepwater play was just starting to ramp up). The improved performance of the shelf during this period is attributed to the widespread application of 3D seismic in and around existing fields (reserve appreciation). In addition, a large fraction of new gas completions in the Gulf of Mexico in recent years has been recompletions and sidetracks, and these are not counted as new gas wells. This partly explains the increasing production with about the same number of gas wells as projected in the 1992 Study.

Alberta, Saskatchewan, and Manitoba

Annual gas production was underestimated by 544 BCF per year, or 11%. Annual gas well completions in 1996 were underestimated by 37%. Much of the gas drilling was in the shallow Cretaceous plays of eastern Alberta.

Appendix F

Historical Overview of Natural Gas Industry

Natural gas has been consumed as a fuel in this country since 1816, when gas manufactured from coal was used to illuminate the streets of Baltimore, Maryland. Consumers of gas in the 1800s burned gas produced or manufactured locally, as the technology to transport gas long distances did not yet exist. A national market, supplied by interstate pipeline transmissions systems, began to evolve in the 1920s with the development of seamless welded pipe. This technology allowed the long distance transportation of remote supplies of "natural" gas for which no market existed to markets previously served by more expensive manufactured gas or less desirable fuels, primarily coal. The gas market continued to evolve and grow over the next 50 years in spite of major wars, economic recessions, and regulatory enactments. Annual gas consumption grew from 2 trillion cubic feet (TCF) in 1930 to a level of 22 TCF in 1972.

Much of the growth in demand in the 1960s and early 1970s was driven by below-market prices attributable primarily to the artificially low field prices produced by federal regulation. Low field prices produced inadequate returns for producers, with the result that exploration and development fell off and supply declined. The resulting imbalance between supply and demand resulted in curtailment proceedings at the federal and state levels in which available supply was allocated among end-users. As a result of these proceeedings, natural gas gained a reputation as an unreliable fuel. Subsequent deregulation of field prices produced a temporary price spike, which further dampened demand and produced the impression that gas was only available at a premium to market clearing prices. The passage of the Natural Gas Policy Act of 1978 (NGPA) and the opening of the nation's gas transmission systems eventually produced a balance between supply and demand at market clearing prices.

Natural Gas Act of 1938

As already noted, the development of seamless welded pipe made the long-distance transmission of natural gas possible and allowed the large gas discoveries of the 1920s and 1930s to reach previously unserved interstate markets. The courts held that state regulatory agencies lacked power to regulate the rates and services of interstate pipelines. This upstream "regulatory gap" led to the passage of the Natural Gas Act in 1938. The Federal Power Commission (FPC, forerunner of the Federal Energy Regulatory Commission) quickly assumed jurisdiction over the rates and services of interstate pipelines and the issuance of certificates of public convenience and necessity to construct pipeline facilities.

The Phillips Decision

Because the FPC believed it lacked jurisdiction, it did not regulate the price of gas at the wellhead (field prices) in the years immediately following the passage of the Natural

Gas Act. However, in *Phillips Petroleum Co. v. Wisconsin*, 347 U.S. 672 (1954), the Supreme Court ruled that the Natural Gas Act required regulation of the price of natural gas at the wellhead.

Since traditional cost-of-service regulation would have been administratively impossible for individual gas contracts, the FPC developed various schemes to establish field prices on a broader basis, including "in-line pricing," "area prices," and "vintaging." The Commission unfortunately erred on the side of low prices. Field prices of gas sold into the unregulated intrastate market gradually rose above the price of newly contracted interstate gas and diverted supplies away from the interstate market. The effect of artificially low interstate gas prices stimulated demand, yet discouraged natural gas exploration activities. By the early 1970s, spot shortages of gas began to appear and industrial users became subject to frequent interruption. Gas was allocated to end-users in curtailment proceedings instead of by market forces. During the harsh winter of 1976–77, the artificially induced shortage became severe and gas deliveries throughout the Northeast, Midwest, and Mid-Atlantic states were curtailed to varying degrees.

Natural Gas Policy Act of 1978

The emergency of the winter of 1976–77 produced a general consensus that legislative action was necessary to remedy natural gas shortages. With that consensus and against a backdrop of competing interests Congress produced a complex series of compromises that became the Natural Gas Policy Act of 1978.

The objective of the NGPA and its companion legislation, the Power Plant and Industrial Fuel Use Act, was to raise gas prices in order to encourage gas production while restricting its consumption by non-core market segments. Complete and immediate decontrol of wellhead prices was not achievable due to consuming states' concerns about the impact of a rapid price rise on their citizens. What passed was a "phased decontrol" of a complete array of different categories of gas. That decontrol is now complete, and restrictions on the use of gas for various purposes have been eliminated.

The higher prices for new gas that resulted from the passage of the NGPA were effective in increasing the exploration and production of natural gas. Interstate pipelines and local distribution companies (LDCs), inspired by memories of past shortages, quickly contracted for new supplies under pricing provisions that produced premium prices. The higher gas prices, however, discouraged demand. By the early 1980s, the cumulative effect of increased supply, demand erosion, end-use restrictions, and recession had turned a gas supply shortage into a gas supply surplus. A spot market consisting of new supplies developed and the spot price quickly fell below the weighted average cost of the mix of pipeline supplies. Industrial customers who could switch to alternative fuels did so, thus further depressing gas demand. Proposals to allow access to spot market gas to service industrial users who would otherwise switch to alternative fuels were proposed by the pipelines and approved by the Federal Energy Regulatory Commission (FERC) as "special marketing programs."

In the 1985 case of *Maryland People's Counsel v. FERC*, the D.C. Court of Appeals held that such preferential access to spot market gas was discriminatory and FERC was directed to respond by providing non-discriminatory access. Order 436, issued in October of 1985, required that pipelines provide non-discriminatory access to transportation systems and services. As pipelines began to transport spot gas for resale customers under this order, they displaced their own sales gas and their "take-or-pay" liabilities under existing contracts, already large, mushroomed.

FERC Orders 500 and 528

FERC Order 500 allowed pipelines to "direct bill" a portion (generally, 50%) of their take-or-pay costs to LDC customers on the basis of past purchase levels from the affected pipelines. With the possibility of at least partial recovery of "take-or-pay" costs, pipelines quickly entered into negotiations with producers to quantify those costs. As a result of these negotiations, above-market contracts were restructured or eliminated altogether in return (generally) for large, up-front cash payments. The D.C. Court of Appeals, after having first

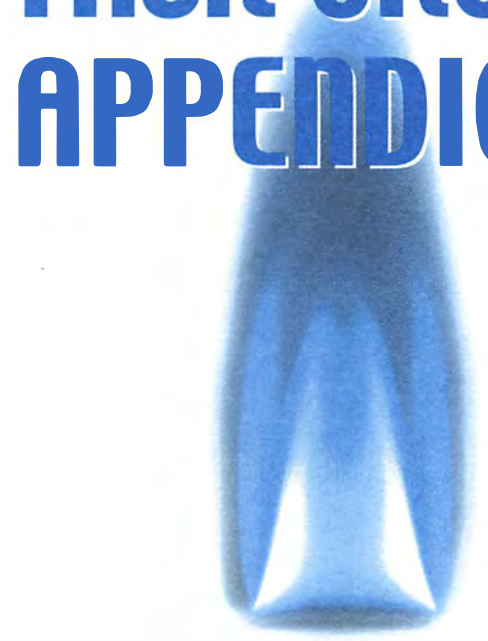
invalidated the "direct bill" provisions of Order 500 due to its retroactive nature, ultimately agreed to the substitute allocation method promulgated by FERC in Order 528.

FERC Orders 636, 636A, and 636B

FERC Orders 636, 636A, and 636B virtually eliminated the pipeline merchant functions and converted interstate pipelines into common carriers. Gas purchasing responsibilities were transferred to LDCs and direct purchasers. State regulators inherited the responsibility for regulatory oversight of gas purchasing practices. In turn, many state commissions have mandated transportation of gas by LDCs with the result that end-users can purchase gas directly from producers and arrange transportation through both pipelines and LDCs.

Natural gas is now sold to LDCs, various intermediaries, and a range of gas users by a large number of gas producers, independent marketers, marketing associations, storage companies, and the like. Pipelines and LDCs transport this gas between buyer and seller. In addition to cash markets, there is an active futures market on the New York Mercantile Exchange (NYMEX), and even longer term arrangements to buy or sell gas can be arranged privately through derivative instruments. In contrast with the distortions produced by the heavy regulatory hand of the past, it is generally recognized that the markets for gas—though volatile because of changing perceptions concerning weather, inventories, and other supply/demand factors—are both competitive and orderly.

DEMAND TASK GROUP APPENDICES



Appendix G

Productivity Improvements

Remarks of Alan Greenspan

As noted in Chapter One, one of the principal reasons for the underestimation of gas demand in the 1992 NPC study was the use of an assumption concerning growth (2.4 percent) in GDP which was lower than the experienced since the date of the study (2.6 percent). GDP growth for 1998 was 3.9 percent and for 1999 is estimated to be approximately 4.0 percent.

It is strongly suspected that the explanation for rapid growth in GDP without significant inflation is due to increases in productivity not fully reflected in official productivity data. Chairman Alan B. Greenspan of the Federal Reserve System addressed this issue in his semiannual report on monetary policy contained in testimony given before the Senate Committee on Banking, Housing and Urban Affairs on July 28, 1999. The following are relevant portions of his testimony:

> In testimony before this committee several years ago, I raised the possibility that we were entering a period of technological innovation that occurs perhaps once every fifty or one-hundred years. The evidence then was only marginal and inconclusive. Of course, tremendous advances in computing and tele-communications were apparent, but their translations into improved overall economic efficiency and rising national productivity were conjectural at best. While the growth of output per hour had shown some signs of quickening, the normal variations exhibited by such data in the past were quite large. More intriguing was the remarkable surge in capital investment after 1993, especially in high-tech goods, a full two years after a general recovery was under way. This suggested a marked increase in the perceived prospective rates of return on the newer technologies.
>
> That American productivity growth has picked up over the past five years or so has become increasingly evident. Nonfarm business productivity (on a methodologically consistent basis) grew at an average rate of a bit over 1 percent per year in the 1980s. In recent years, productivity growth has picked up to more than 2 percent, with the past year averaging about 2-1/2 percent.
>
> To gauge the potential for similar, if not larger, gains in productivity going forward, we need to attempt to arrive at some understanding of what has occurred to date. A good deal of the acceleration in output per hour has reflected the sizable increase in the stock of labor-saving equipment. But that is not the whole story. Output has grown beyond what normally would have been expected from increase inputs of labor and capital alone. Business restructuring and the synergies of the new technologies have enhanced productive efficiencies.

American industry quite generally has shared an improved level of efficiency and cost containment through high-tech capital investment, not solely newer industries at the cutting edge of innovation. Our century-old motor vehicle industry, for example, has raised output per hour by a dramatic 4-1/2 percent annually on average in the past two years, compared with a lackluster 1-1/4 percent on average earlier this decade. Much the same is true of many other mature industries, such as steel, textiles, and other stalwarts of an earlier age. This has confirmed the earlier indications of an underlying improvement in rates of return on the newer technologies and their profitable synergies with the existing capital stock.

These developments have created a broad range of potential innovations that have granted firms greater ability to profitably displace costly factors of production whenever profit margins have been threatened. Moreover, the accelerating use of newer technologies has markedly enhanced the flexibility of our productive facilities. It has dramatically reduced the lead times on the acquisition of new equipment and enabled firms to adjust quickly to changing market demands. This has indirectly increased productive capacity and effectively, at least for now, eliminated production bottlenecks and the shortages and price pressures they inevitably breed. . .

The acceleration in productivity owes importantly to new information technologies. Prior to this IT revolution, most of twentieth-century business decisionmaking had been hampered by limited information. Owing to the paucity of timely knowledge of customers' needs, the location of inventories, and the status of material flows throughout complex production systems, businesses build in substantial redundancies.

Doubling up on materials and staffing was essential as a cushion against the inevitable misjudgments made in real time when decisions were based on information that was hours, days, or even weeks old. While business people must still operate in an uncertain world, the recent years' remarkable surge in the availability of real-time information has enabled them to remove large swaths of inventory safety stocks, redundant capital equipment, and layers of workers, while arming them with detailed data to fine-tune specifications to most individual customer needs.

Despite the remarkable progress witnessed to date, history counsels us to be quite modest about our ability to project the future path and pace of technology and its implications for productivity and economic growth. We must remember that the pickup in productivity is relatively recent, and a key question is whether that growth will persist at a high rate, drop back toward the slower standard of much of the last twenty-five years, or climb even more. By the last I do not just mean that productivity will continue to grow, but that it will grow at an increasingly faster pace through a continuation of the process that has so successfully contained inflation and supported economic growth in recent years.

The business and financial community does not as yet appear to sense a pending flattening in this process of increasing productivity *growth*. This is certainly the wide-spread impression imparted by corporate executives. And it is further evidenced by the earnings forecasts of more than a thousand securities analysts who regularly follow S&P 500 companies on a firm-by-firm basis, which presumably embody what corporate executives are telling them. While the level of these estimates is no doubt upwardly biased, unless these biases have significantly changed over time, the revisions of these estimates should be suggestive of changes in underlying economic forces. Except for a short hiatus in the latter part of 1998, analysts' expectations of five-year earnings growth

have been revised up continually since early 1995. If anything the pace of those upward revisions has quickened of late. True, some of that may reflect a pickup in expected earnings of foreign affiliates, especially in Europe, Japan, and the rest of Asia. But most of this year's increase almost surely owes to domestic influences.

There are only a limited number of ways that the expected long-term growth of domestic profits can increase, and some we can reasonably rule out. There is little evidence that company executives or security analysts have significantly changed their views in recent months of the longer-term outlook for continued price containment, the share of profits relative to wages, or anticipated growth of hours worked. Rather, analysts and the company executives they talk to appear to expect that unit costs will be held in check, or even lowered, as sales expand. Hence, implicit in upward revisions of their forecasts, when consolidated, is higher expected national productivity growth.

Independent data on costs and prices in recent years tend to confirm what aggregate data on output and hours worked indicate: that productivity growth has risen. With price inflation stable and domestic operating profit margins rising, the rate of increase in total consolidated unit costs must have been falling.

Even taking into account the evidence of declining unit interests costs of nonfinancial corporations, unit labor cost increases (which constitute three quarters of total unit costs) must also be slowing. Because until very recently growth of compensation per hour has been rising, albeit modestly, it follows that productivity *growth* must have been rising these past five years, as well. Accelerating productivity is thus evident in underlying consolidated income statements of nonfinancial corporations, as well as in our direct, though doubtless partly flawed, measures of output and input. . . .

> . . . [T]he impressive productivity growth of recent years also has had important implications for the growth of aggregate demand. If productivity is driving up real incomes and profits—and, hence, gross domestic *income*—then gross domestic product must mirror this rise with some combination of higher sales of motor vehicles, other consumer goods, new homes, capital equipment, and net exports. By themselves, surges in economic growth are not necessarily unsustainable—provided they do not exceed the sum of the rate of growth in the labor force and productivity for a protracted period. However, when productivity is accelerating, it is very difficult to gauge when an economy is in the process of overheating.

It should also be noted that in September 1999 the Federal Reserve released certain proposed changes in the method of computing GDP, which are expected to result in an upward restatement of past and future rates of growth.

It may well be that the Council's assumption that the rate of growth in GDP will be 2.5 percent is too low and will result in an underestimate of gas demand in 2010 and 2015. Note, however, that the deltas for growth in GDP are 2.0 percent in one case and 3.0 percent in the other, or a 0.5 percent swing in either direction. In the event of 2.0 percent growth in GDP, U.S. gas demand in 2010 would fall by 920 BCF and in 2015 by 1,075 BCF from the Reference Case. In the event of 3.0 percent growth in GDP, U.S. gas demand would grow by 605 BCF in 2010 and 850 BCF in 2015 above the Reference Case.

Appendix H

Electric Utility Issues Affecting Gas Demand for Electricity Generation

As is outlined in the Demand Task Group Report, the most significant increase in gas demand over the study period will be in gas consumed for electricity generation. Gas for electricity generation will be purchased by various electricity generators. The factors driving gas demand for electricity generation are many and varied. Although those factors have not changed much over the years, the weight given to many of them by decision makers has changed significantly since the 1992 study. Some background on electricity generation, utility regulation, and competition is useful in understanding the rapidly increasing demand for gas used in generating electricity.

Basic Differences Between Electric and Gas Industries

It is important to note that there have traditionally been basic organizational and physical differences between the electric and gas industries; the common point occurs when making a fuel decision at an electricity generating plant. The gas industry has always been compartmentalized into three functions: exploration and production, transmission, and distribution. While there have frequently been overlaps in certain companies involving pairs of these functions, even within the same company the functions performed have always been separated. This separation is in large part due to the differing regulatory environments applicable to each segment. On the other hand, most electric utilities have chosen to engage in generation, transmission, and distribution and the three functions have largely been integrated for efficiency. Even gas pipelines and local distribution companies (LDCs) that have integrated backward into production can provide only a tiny fraction of throughput with their own production. Typically, a traditional electric utility would generate the overwhelming majority of the electricity distributed to its end users. For these reasons, a traditional electric utility has much more control over its operations and costs than the traditional gas utility.

As a matter of physics, gas and electricity are quite different. Although they can each be measured in units of energy, the physical characteristics of gas and electricity are sufficiently different that varied control and regulatory issues are presented. Electricity moves at the speed of light—186,000 miles per second—while gas moves through long-distance, large-diameter pipelines at approximately 15 miles per hour. Electricity in utility-size volumes is difficult to store. Gas in utility size volumes is relatively easy to store. Electricity is thus an instantaneous, and for that reason a sometimes inflexible, source of energy. Gas takes a long time to get anywhere, and therefore managers frequently have time to manage supply by controlling flow rates and storage injections/withdrawals, and to manage load by adding/subtracting alternative fuel customers.

The Traditional, Regulated Electric Utility

The traditional electric utility generally had an exclusive franchise to provide electricity in a defined territory. That franchise carried with it an "obligation to serve" all customers in that territory, providing reliable service and doing so at the lowest possible cost.

Investor-owned utilities are subject to regulation concerning rates and services by state utility commissions, and in the case of wholesale transactions, by the FERC. Among other things, regulatory commissions approve rates charged to electricity customers and, historically, approved construction of major facilities. As a part of their responsibility, regulatory commissions review the prudence of decisions made by the management of investor-owned utilities. Such reviews extend to all costs, including the cost of input energy used by the utility to generate electricity.

Like investor-owned firms in other industries, the management of electric utilities also has an obligation to their shareholders to provide a reasonable return on investment. When a utility commission denies recovery through rates charged to customers of any part of the cost that has been incurred by the utility, that cost is borne by the shareholders. Thus the management of an electric utility is constantly faced with the responsibility of assuring that its actions are found to be prudent so that costs incurred—whether for capital, operations and maintenance, fuel, or power purchases—can be recovered through rates paid by customers.

Major Changes in Electric Utility Industry

The years since the 1992 NPC report have been characterized by enormous change in the form and function of electric utilities. A consensus has emerged among many regulators that the three traditional functions performed by electric utilities should be separated. Generation, it is felt, can be made competitive. By various means, generating facilities (regardless of ownership) are compelled to compete against each other. By FERC order, electric transmission lines are being opened up much as gas pipelines have been opened in the past. Basically, the push is to make electric transmission lines common carriers. FERC will still approve tariffs and review conditions of service for transmission (or "wheeling"), but access is to be opened to all on a nondiscriminatory basis. Electricity distribution, too, is being opened in more and more jurisdictions, but state regulators will establish fees for the distribution of electricity within their jurisdictions. In fully restructured states, end users are allowed to choose an electricity supplier, the transmission system will move it from the generator to the distributors, and the electricity distribution utility will transport the electricity to the end user.

Many issues concerning deregulation remain to be worked out. As noted at the outset, there are unusual control problems in the case of electricity because it is essentially instantaneous and many decisions concerning control must be made very quickly and without opportunity for much human intervention. Thus access is perhaps less "open" at critical time periods than some would prefer, but clearly open access is becoming a fact of life throughout the electric utility industry.

As the gas and electric industries have moved toward open access they have become more alike than in the past. Increasingly, electricity generation, transmission, and distribution functions have separated. Some companies will exclusively generate; others may simply engage in transmission or distribution. Ten years ago the *combination* electric and gas utility was an anomaly. In recent years, new combinations of electricity and gas enterprises have been formed with regulatory and shareholder approval. Regulators appear to feel that deregulated electricity generation, coupled with open access, will assure ample competition between the two fuels.

With deregulation and open access has come a shift in the obligation to serve. Formerly, the vertically integrated electric utility was solely responsible for the adequacy and cost of electricity within its service territory. When the supply functions are unbundled and no one party can control the entire process, the obligation to meet a customer's needs typically falls on the party closest to the customer. In the case of electric industry restructuring, that party is usually the one owning the wire connected to customer's meter. The situation is compli-

cated when that is not the party to whom the customer pays their bill for service. Clearly the relationships between the generator, transmitter, distributor, and the supplier of choice must be determined, and that responsibility falls on the state utility commissions.

Regardless of how the commissions establish those relationships, the utility still must analyze various ways of meeting demand from customers for whom it is the supplier of power. In order to do so, it must determine the peak demand in kilowatts of all such customers and anticipated growth therein. It must also estimate the total electricity that will be consumed by these customers (kilowatt-hours). It must also determine whether it has adequate transmission and distribution capacities for its own customers and for customers who purchase electricity elsewhere and transport on the utility's facilities.

In the restructured environment, the processes for performing those functions change significantly and vary significantly from state to state. One thing that appears to be consistent is that control of the transmission system will be the responsibility of an entity who will ensure the system is operated without deference to any particular generator or load customer. Whether the transmission of electricity falls to an Independent System Operator (ISO), Regional Transmission Operator (RTO), or other variation of power pools, they have or will generally have the same primary functions:

- Ensure open access to the transmission lines within their control
- Stability and reliability of the transmission system (voltage control, frequency control, etc.)
- Provide the above using the lowest cost generation, although some states are setting aside certain portions for renewables and natural gas.

The grid operator will employ modern technology to match the load with available generation, but will also use a principle used by the regulated utilities—economic dispatch.

Economic Dispatch

As indicated in the Demand Task Group Report, *base load* units are generally kept running most of the time that they are available. However, they may run at less than full capacity. If base load units run at less than capacity (perhaps in the middle of the night) and customers increase their demand for electricity, dispatchers operating on behalf of the power pool increase the output from the base load units (perhaps by increasing the fuel input). As demand for electricity continues to increase, "cycling" or intermediate load units are brought on-line. And if demand continues to grow (perhaps on a hot afternoon in August!), "peaking" units are brought on-line.

As demand subsides, peaking and then cycling units are taken off-line and, eventually, base load units are run at a lower level of output. The underlying objective is to run the lowest incremental cost units first and the highest incremental cost units last. The concept is called *economic dispatch* of generating units.

The *incremental* cost of producing electricity from a generating unit is, in general, the governing factor used by dispatchers in determining which unit to bring on-line or take off-line. *Incremental cost* is the difference in the cost of producing electricity from a generating unit when it is being run and not run. It is sometimes defined as the cost of the next megawatt to be put on the wires. It consists primarily of two components: *fuel cost* and *fuel conversion efficiency*. Thus, hydro and nuclear units are generally dispatched first, followed by coal-fired units, and then oil- and natural gas-fired units. That dispatch sequence may change because of hydro reservoir management issues, energy conversion efficiency, and the incremental cost of fuel. For example, although a gas-fired plant may have an efficiency of 55%, it may be dispatched after a 38% coal-fired plant because the fuel costs allow the incremental cost of the coal-fired plant to be lower.

Very simplistically, when a power pool is formed, power plant operators decide what they need to charge the pool for the electricity they generate. The price that they "bid" into the pool reflects the cost of fuel, operating and maintenance, capital recovery, profit, and other financial concerns. The pool operator

then selects the lowest bidder available to provide the next increment of generation to the grid. In doing so, all generators are forced to compete with each other, and the customers receive energy at the lowest total cost.

Impact of Environmental Quality Regulation on Choice of Fuel

The 1992 Clean Air Act Amendments set the stage for significant reductions in the amount of power plant emissions. Oxides of sulfur (SOx), oxides of nitrogen (NOx), hazardous air pollutants (HAPs), and particulate emissions received higher scrutiny regarding their effect on the environment.

In December of 1996, the Environmental Protection Agency (EPA) proposed revisions to the National Ambient Air Quality Standards (NAAQS) for particulates and ozone. Ozone concentrations are affected by the concentration of NOx, so power plant emissions were again affected. States in the northeast cited concern that emissions from states to the west and south were being carried into their states, thereby affecting their ability to meet the new standards. Degradation of visibility in national parks triggered additional studies, leading some to conclude that power plants were part of the cause. Although broadly disputed, there is growing sentiment that carbon dioxide greenhouse gas emissions must be controlled in order to reverse the trend of global climate change.

Each situation mentioned above, and many more like them, including the July 1 release of the Toxic Release Inventory, has had or may have the effect of causing generation plants to carefully consider their environmental emissions. Concurrent with that consideration are the cost of environmental control systems to limit the extent of emission stemming from the use of a particular fuel, and weighing that cost against the cost of the generation. Without going into great detail each new regulation applicable to coal plant emissions provides an additional incentive for operators to choose gas-fired plants.

Impact of Time Line on Choice of Fuel

A substantial difference exists between the time required to construct a gas-fired generating plant and a coal-fired generating plant. From the time the decision to proceed is made, approximately eighteen months is required to construct a gas fired plant and place it in service. This time line appears to be increasing by up to a year because of the backlog of orders that has recently developed for gas turbine generators. By contrast approximately seven years is required to construct and place in operation a coal-fired generating plant, assuming that such a plant can comply with environmental regulations. The estimated capital cost of a modern gas-fired combined cycle plant is $500-650 per kilowatt of capacity depending on the scale of the plant. The estimated cost of a modern coal-fired plant meeting environmental standards varies widely by time and place.

Less lead time and lower capital cost have added importance in today's competitive generating market. Increasingly open access means that the newest, lowest cost generating plant needs to sell as much electricity as possible before a competitor over the horizon builds a plant that produces cheaper electricity.

SUPPLY TASK GROUP APPENDICES

Appendix I

Sustainability of North American Natural Gas Supply

The current NPC study projects supply and demand to the year 2015. However, the long-range sustainability of gas supply beyond 2015 is a matter of great interest, especially to new gas customers and companies making decisions requiring large capital outlays to transport or use natural gas. Most oil and gas industry forecasts do not extend beyond the 2015 or 2020 timeframe. This is because the level of uncertainty in longer-range forecasts increases substantially due to various limitations, including gas resource assessment, understanding of long-term technology effects, economic activity and demand, and the availability of competing fuels.

The Supply Task Group has assessed the discovered and undiscovered gas potential of North America, and this assessment has been incorporated into the Reference Case. The assessment included reserve appreciation, new conventional fields, tight gas, coalbed methane, and shale gas. NPC groups also evaluated potential production from several frontier areas that are not yet producing. The projected impact of advanced technology was also incorporated into the model.

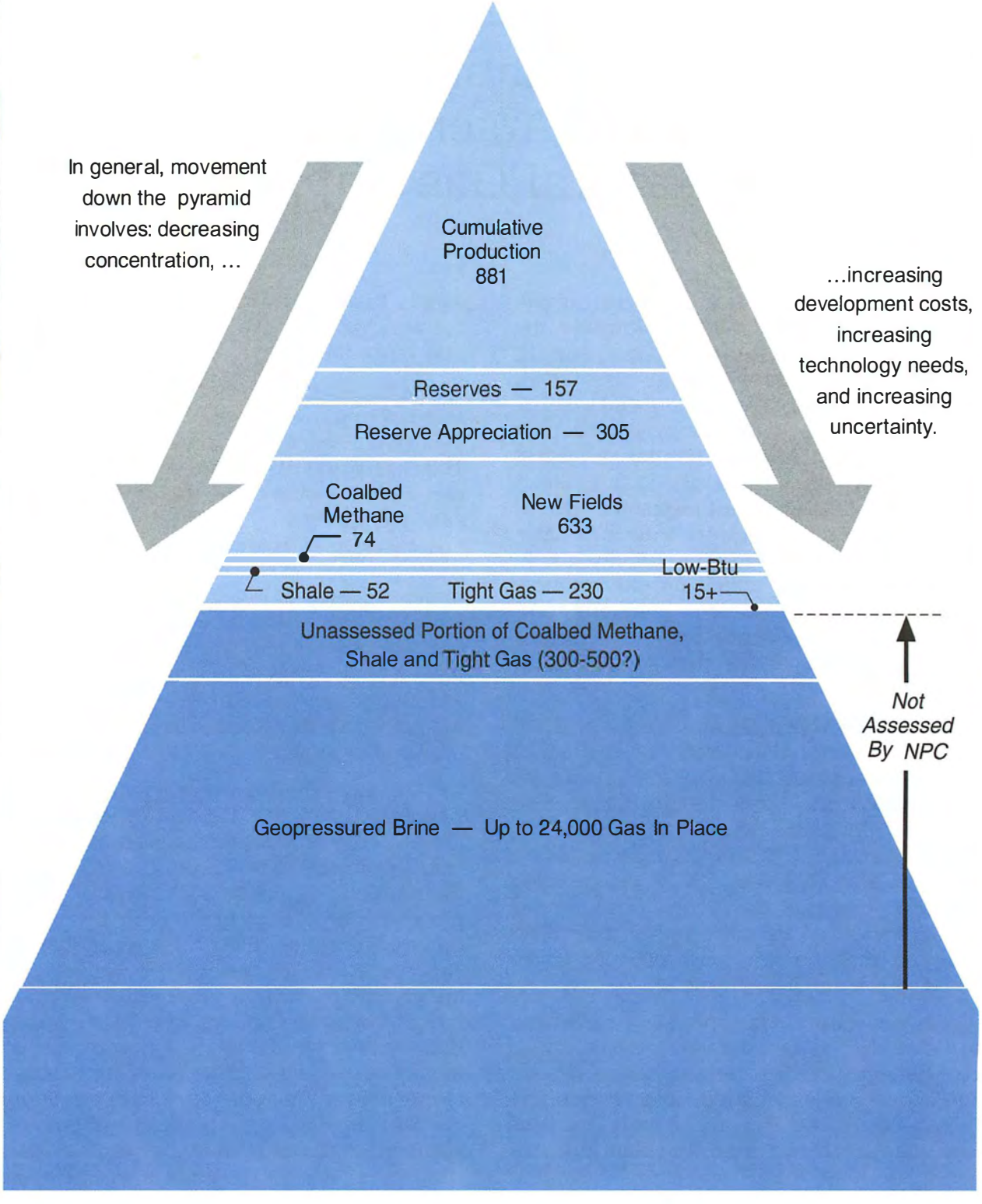
In gas supply assessment and modeling, however, the assessed resource base often may be considered to be that which is relatively well known or accessible to industry. This is not to say that all of these areas or resources will be accessed, but that industry activity in these areas is considered feasible within the projection timeframe. Sources of supply that are known to exist but which are not anticipated to play a role in the forecast may be excluded.

Assessments of the ultimately recoverable gas resource base of North America have increased consistently over the past 15 years. This has primarily resulted from the emergence of new plays and the development of new technologies. The best example of a major new play is the Gulf of Mexico deepwater play, which was not included or greatly underestimated in assessments as recently as ten years ago. Coalbed methane is an example of a resource that was known to industry, but was not included in assessments because technology was inadequate and industry had not gained sufficient experience to make production economic.

An important concept when evaluating sustainability is the distribution of resource quality. Natural resources such as gas, oil, coal, or mineral deposits occur across a wide distribution of quality, with most of the in-place resource associated with the poorer quality deposits. Figure I-1 illustrates the concept of the gas resource pyramid. The apex of the pyramid is represented by cumulative production and proven reserves (ultimate recovery). Ultimate recovery consists largely of production from older, high permeability conventional deposits. Reserve appreciation in existing fields, undiscovered conventional fields, and nonconventional sources occupy successively lower positions on the pyramid. In general, as one moves

Figure I-1. The Lower-48 Gas Resource Pyramid
1999 NPC Assessment

Recoverable Portion of In-Place Gas Resource – Trillion Cubic Feet



down the pyramid, the resource is characterized by decreasing concentration or quality, increasing development costs, increasing technology requirements, and increasing uncertainty in estimates of recoverable volumes. The importance of the resource pyramid concept is the assurance that an ever-increasing amount of gas-in-place is available with higher wellhead prices, reduced costs, or improved technology.

There are numerous potential sources of long-term North American gas supply. Most or all of these sources should contribute to U.S. gas supply after 2015.

- Emergence of new conventional gas plays
- Development of frontier areas of Canada and Alaska
- Unassessed portion of coalbed methane and tight gas
- Drilling and completion technology breakthroughs
- Access to currently restricted offshore areas
- Expanded LNG imports
- Expanded imports from Mexico or South America
- Geopressured brine
- Gas hydrates.

Emergence of New Conventional Gas Plays

Assessments of remaining oil and gas resources are inherently conservative in that they typically attribute the great majority of the remaining resource to established plays. The deepwater play in the Gulf of Mexico is an example of a new play in an area previously believed to be maturing. The discovery of this play resulted in a complete re-assessment of the Gulf of Mexico. New conventional plays continue to emerge in the lower-48 states. Examples include the recent deep gas play in the San Joaquin Basin and the Cretaceous carbonate trend in the Gulf of Mexico. While the "normal" emergence of new plays is included in the current NPC assessment, the onset of very large plays representing new concepts may not be.

Development of Frontier Areas of Canada and Alaska

After 2015, the frontier regions of Canada and Alaska will play an increasingly important role. In the arctic regions of Canada and Alaska, extremely large volumes of gas have been discovered but have not been brought to market because of the cost to build new pipeline. This resource includes gas on the North Slope and the Beaufort-Mackenzie Delta. Construction of a pipeline to these areas should also result in a new phase of exploration and the discovery of additional fields. In Eastern Canada, the gas resources of the Scotian Shelf are under development, and exploration is beginning in deepwater areas as well. Additional discoveries have been made in offshore Newfoundland and Labrador. These discoveries have not been developed and do not currently have access to the pipeline network.

Unassessed Portion of Coalbed Methane and Tight Gas

The current study includes coalbed methane potential in the established basins. However, this resource is rapidly emerging, with new areas of activity being announced on a regular basis. The current NPC assessment should be considered conservative in light of the fact that vast quantities of coal are present in the lower-48 states, Canada, and Alaska in areas that have not been assessed for coalbed methane potential. Agencies such as the United States Geological Survey (USGS) and their counterparts in Canada are in the process of assessing these resources, and it is anticipated that future published assessments will increase substantially. Another potential source of gas is coalbed methane in the deeper portions of lower-48 basins, such as in the Piceance Basin of northwestern Colorado.

Similarly, the NPC tight gas assessment can be considered conservative in that it primarily represents areas and formations that have experienced some historical activity.

Drilling and Completion Technology Breakthroughs

There is potential for large increases in gas production if technology breakthroughs can be achieved in drilling and completion. Perhaps the greatest potential is associated with tight gas resources. The lower-48 states have tremendous resources of gas-in-place in deep, tight sands. Most of this resource base is found in the Rocky Mountain Foreland Province, although the Mid-Continent and Gulf Coast also have large resources. The USGS has estimated that several thousand TCF of gas-in-place are present just in the Green River Basin of southwest Wyoming. Industry has been developing methods to produce this gas economically and much progress has been made over the past decade. The drilling of horizontal wells perpendicular to natural fracture sets appears to hold great promise, especially in blanket sands such as the Frontier formation in the Green River Basin.

Access to Currently Restricted Offshore Areas

In the United States, leasing and drilling moratoria are in effect for the Atlantic and Pacific offshore, and most of the eastern Gulf of Mexico. The Central & Western Gulf of Mexico is the only area that is accessible to industry. In the current NPC Reference Case, the existing drilling bans remain throughout the projection. The opening of at least a part of this vast area, especially in gas-prone areas, would be expected to have a large impact on supply after 2015.

It is also important to note that there is a significant level of uncertainty in the resource assessments of these areas that have been kept off limits to exploration. The potential in areas such as the eastern Gulf and the Atlantic OCS could be much greater than we currently estimate.

Expanded LNG Imports

LNG imports are expected to play a larger role in meeting U.S. demand after 2015. In the NPC Reference Case, no new LNG import facilities are constructed throughout the projection. Beyond 2015, however, it is likely that LNG will play an increasing role, and new and expanded import facilities could be expected.

Expanded Imports from Mexico or South America

Northeastern Mexico may emerge over the coming decade as a large-scale gas producing region with the deliverability to export large volumes to the United States. This region has similar geology to the prolific onshore Texas Gulf Coast Tertiary province. However, the area has not been extensively developed because Pemex has concentrated on oil development. Pemex is now carrying out a project to develop the non-associated gas fields of this region. U.S. imports from Mexico have been small relative to U.S. demand. However, imports are expected to gradually increase, and post-2015 imports from Mexico could be substantial. Another possible long-term supply source is a gas pipeline from Venezuela through Mexico.

Geopressured Brine

A large but controversial resource of dissolved gas exists in deep overpressured sandstone reservoirs of the Gulf Coast province (onshore and offshore). This resource has been termed geopressured brine, or geopressured-geothermal energy. Estimates have been published of up to 24,000 TCF of gas-in-place. The resource is present in overpressured sandstone reservoirs at depths below 10,000 feet. Recovery of this gas with current technology requires production of formation water at very high flow rates and capturing the methane that is produced with the water. The geothermal energy of the water may be used to generate electricity. A principal problem is the need for an environmentally satisfactory method of brine disposal. While geopressured brine was the focus of a federally funded field research effort in the 1970s, it is now inactive and no known assessments have been published recently.

Gas Hydrates

The USGS has assessed the in-place gas hydrate resources of the United States at over

300,000 TCF. This includes deposits in all of the OCS areas of the lower-48 states and Alaska, as well as onshore deposits on the North Slope. The USGS has not estimated recoverable resources, and research into the recoverability of hydrates is in its early stages. Government agencies in Japan and India are carrying out research on offshore hydrates, and research is underway on the potential for producing arctic hydrates in the Mackenzie Delta area. While the majority of hydrates may not be economic under any scenario because the energy content is too dispersed and the reservoir conditions are poor, the resource volumes are so great that it appears possible or likely that areas of greater concentration will be developed and hydrates will begin contributing to supply after the 2015 to 2020 timeframe.

THE IMPACT OF FEDERAL AND INDIAN LANDS ACCESS RESTRICTIONS ON NATURAL GAS RESOURCES

STUDY METHODOLOGY AND RESULTS

Report Prepared for:

National Petroleum Council
1999 Natural Gas Study
Policy Subgroup of the
Supply Task Group

Prepared by:

Advanced Resources International, Inc.
September 1999

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List of Tables and Figures

Introduction

As part of its 1999 Natural Gas Study, the National Petroleum Council, with assistance of the U.S. Department of Energy, sponsored an analysis of the resource impacts associated with land access restrictions and related environmental stipulations in the Rocky Mountain region of the United States. The analysis was conducted during July and August 1999 based upon data supplied by federal agencies, particularly the Bureau of Land Management (BLM) and the Forest Service (FS). Geographical Information System (GIS) data processing was provided by Premier Data Services, Inc., of Denver, Colorado and data processing and analysis were provided by Advanced Resources International, Inc., of Arlington, Virginia. The work was performed under the close guidance of the National Petroleum Council Natural Gas Supply Task Force Policy Group (Policy Group). Policy Group membership is listed in Addendum 1 to this Appendix.

The analysis examined 12 Rocky Mountain basins (Table 1), which are correlative with 13 United States Geological Survey (USGS) geologic provinces.[1] Figures 1 and 2 show the location of the study and federal/Indian lands examined. The study area comprises over 156 million acres of federal/Indian lands.

Table 1. Rocky Mountain Basins Examined

Big Horn	Raton
Denver	San Juan
Greater Green River	Sweet Grass Arch
Paradox	Western Overthrust Belt
Piceance	Williston
Powder River	Wind River

To provide the most robust results in the short timeframe given for the analysis by the Policy Group, a two-phased approach was used.

(a) "Calibration areas" (CAs), determined by BLM and FS jurisdictions, were examined in detail by mapping environmental stipulations and comparing these stipulated areas to underlying remaining natural gas resource (comprising Proved Reserves[2] and Assessed Additional Resources)[3] on a township basis. The objective of Phase I was to provide a detailed examination of the remaining resource associated with the various land access stipulation types.

[1] As defined in the USGS 1995 Oil and Gas Assessment (release 2, data DDS-30 on CD ROM).

[2] Proved Reserves are defined as the most certain of the resource base categories representing estimated quantities which analysis of geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Generally, these gas deposits have been "booked," or accounted for as assets on the SEC financial statements of their respective companies.

[3] Assessed Additional Resources are the sum of natural gas deposits estimated to be in-place (using accepted geological and engineering models and analytical tools) that will become recoverable in the future at various assumed technology levels. This category includes old field reserve appreciation, new field resources and unconventional resources.

Figure 1. Rocky Mountain Basins Study Area

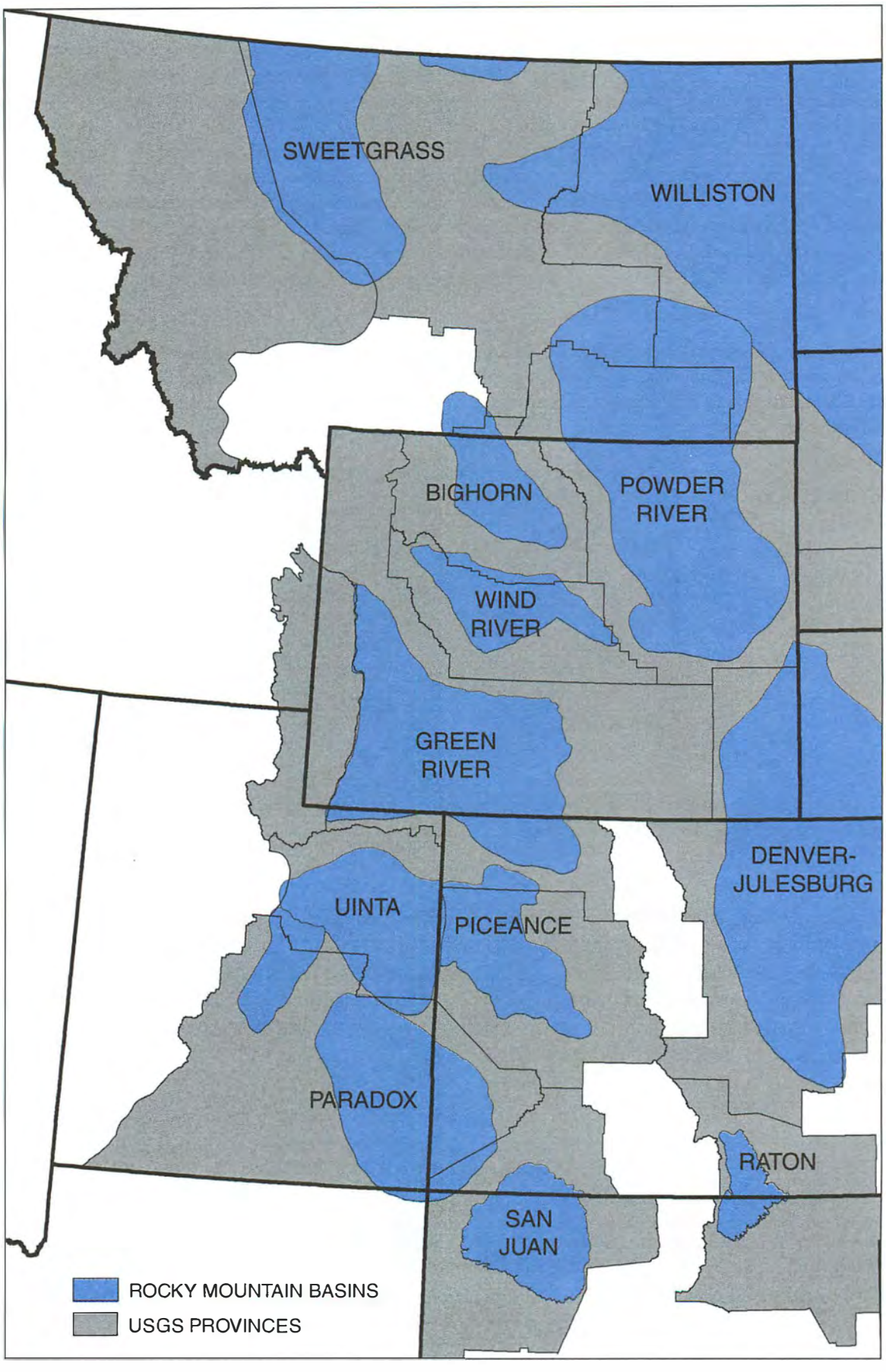
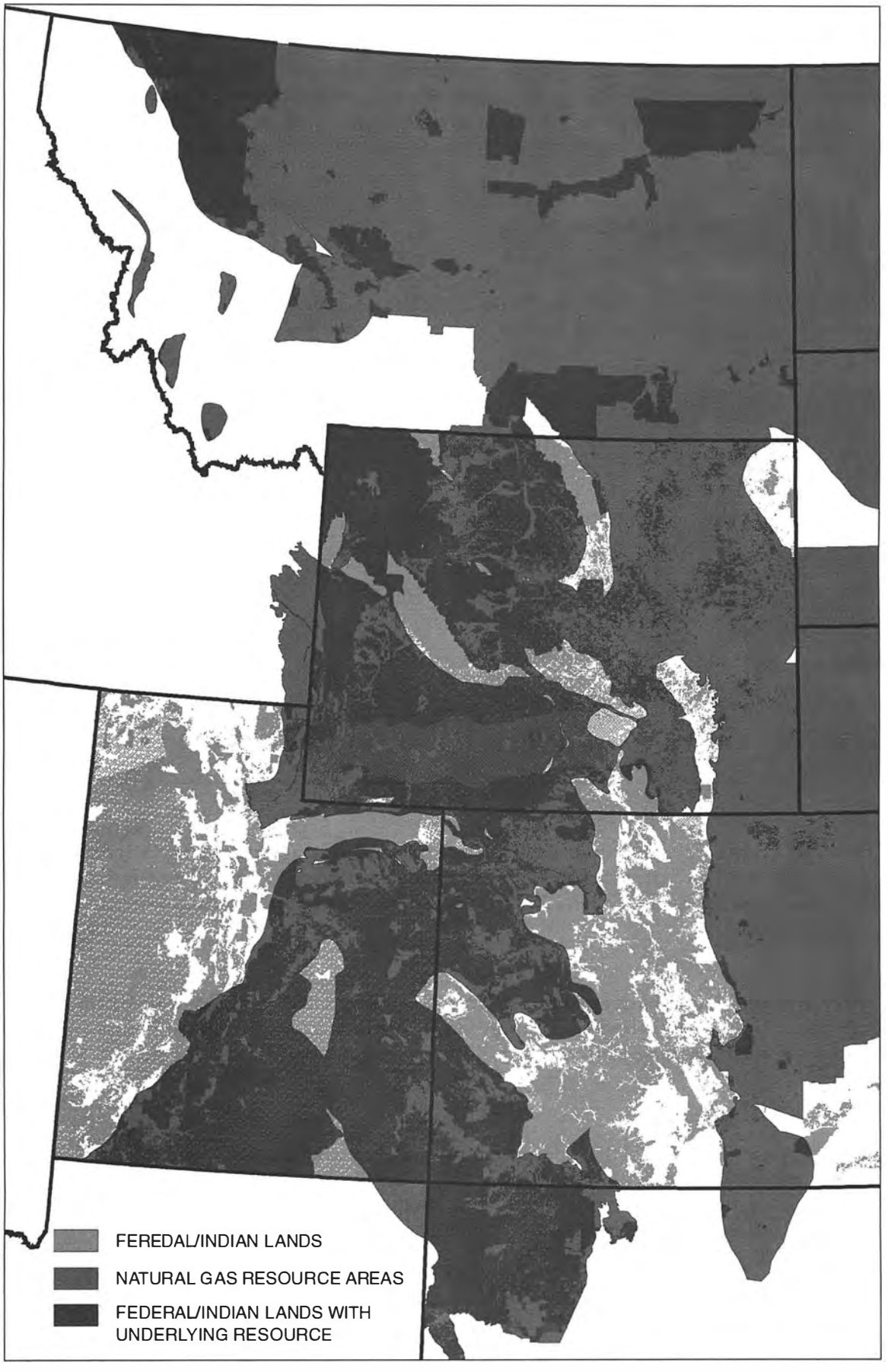


Figure 2. Federal/Indian Lands and Natural Gas Resource Areas



(b) The second phase involved the extrapolation of the results from the calibration areas into a generalized estimate of resources impacted throughout the Rocky Mountain basins. A sensitivity analysis was also performed relative to lands that are currently under consideration as wilderness areas ("potential wilderness areas"). The objective of Phase II was to provide a robust but rapid assessment of the impact of land access stipulations upon remaining resources throughout the Rocky Mountain basins. In addition to the above, an assessment was made of nonfederal lands surrounded by federal lands as these lands experience similar environmental requirements with respect to development as adjoining federal lands.

Phase I. Calibration Areas

In Phase I, the following six CAs (Table 2; see Figure 3 for locations) were examined in detail, comprising a total area of over 14.8 million acres.

Table 2. Calibration Areas

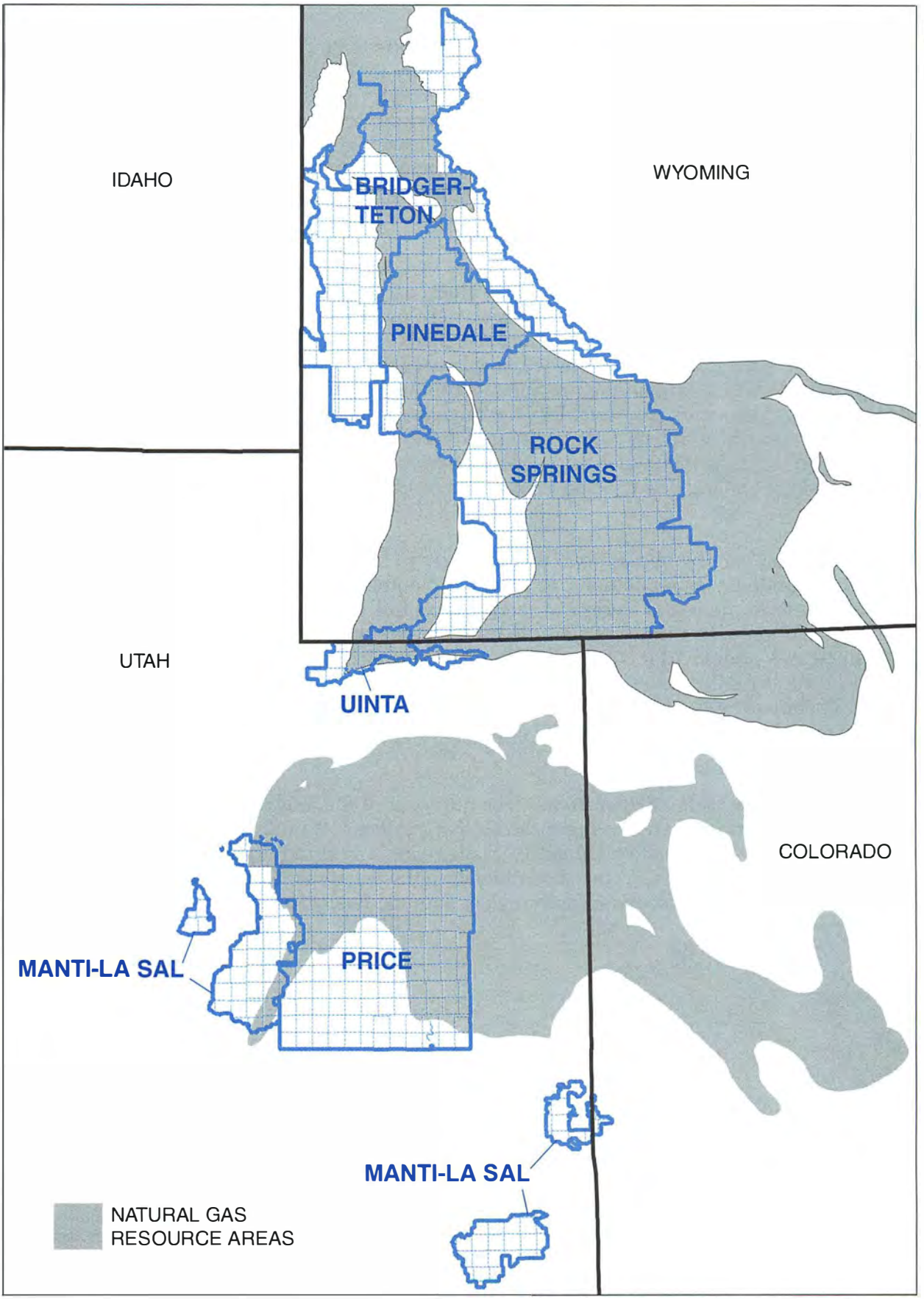
Calibration Area	Dominant Federal Lands Manager	Stipulations Description
Bridger-Teton	(Forest Service)	Addendum 2
Manti-La Sal	(Forest Service)	Addendum 3
Uinta	(Forest Service)	Addendum 4
Pinedale	(BLM)	Addendum 5
Price	(BLM)	Addendum 6
Rock Springs	(BLM)	Addendum 7

The CAs were selected on the basis of federal land manager, industry activity and relative resource endowment. To perform the analysis for each of the CAs, Advanced Resources inventoried individual townships by federal land type, land access stipulations and underlying resource as described below.

Federal/Indian Land. Advanced Resources obtained a GIS file of federal lands from the BLM showing the distribution of Federal/Indian lands in the western U.S., (see Figure 2) which was used to inventory the acreage associated with the various federal/Indian land types within each of the CAs.

Stipulations. For each of the calibration areas, data were obtained from the BLM or FS showing the mapped environmental stipulation areas. Generally, the maps were in digital format. In some portions of the Pinedale and Price CAs, maps were digitized by Premier Data Services and/or translated into an ArcView "shape" file format, projected in decimal degree latitude/longitude coordinates and sent electronically to Advanced Resources for additional processing and analysis.

Figure 3. Calibration Areas



In addition the BLM and FS field offices provided descriptions of the stipulations in each of the CAs (presented as Addendae 2 through 7).

Stipulations[4] are conditions, promises, or demands to be part of a lease when the environmental and planning record demonstrates the necessity for the stipulations. Stipulations, as such, are neither "standard" nor "special", but rather a necessary modification of the terms of the lease. In order to accommodate the variety of resources encountered on federal lands, stipulations are categorized as to how the stipulation modifies the lease rights, not by the resource(s) to be protected. What, why, and how this mitigation/protection is to be accomplished is determined by the land management agency through land use planning and National Environmental Policy Act (NEPA) analysis.

If, upon weighing the relative resource values, uses, and/or users, conflict with oil and gas operations is identified that cannot be adequately managed and/or accommodated on other lands, a lease stipulation is necessary. Land use plans serve as the primary vehicle for determining the necessity for lease stipulations (BLM Manual 1624). Documentation of the necessity for a stipulation is disclosed in planning documents or through site-specific analysis. Land use plans and/or NEPA documents also establish the guidelines by which future waivers, exceptions, or modifications may be granted. Substantial modification or waiver subsequent to lease issuance is subject to public review for at least a 30-day period in accordance with Section 5102.f of the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOLRA).

Stipulations may be necessary if the authority to control the activity on the lease does not already exist under laws, regulations, or orders. An authorized federal officer has the authority to modify the site location and design of facilities, control the rate of development and timing of activities and require other mitigation under standard lease terms (BLM Form 3100-11, Attachment A-1 and 43 CFR 3101.1-2). The necessity for individual lease stipulations is documented in the lease-file record with reference to the appropriate land use plan or other leasing analysis document. The necessity for exception, waivers, or modifications is documented in the lease-file record through reference to the appropriate plan or other analysis.

Categorization of the Stipulations. For purposes of the analysis, areal distributions of the land access stipulations were recategorized so that a given plot of land within a township would be subject to a single stipulation category. Maintaining a geographical independence among the stipulated areas allowed for increased confidence in the assignment of resource to a given stipulation category. Based on discussions and review with the Policy Group, the stipulations were limited to a few basic types:

[4] The following information pertaining to lease stipulations is taken from the booklet, "Uniform Format for Oil and Gas Lease Stipulations," prepared by the Rocky Mountain Regional Coordinating Committee in March, 1989. These guidelines were developed by the BLM and the Forest Service. See also Addendum 4 (Uinta Calibration Area) to this report, pages A-2 to A-4, A-7, and A-8 for a good general discussion of stipulations.

- Timing Limitations (TL)
- Areal and Temporal Combinations of Controlled Surface Usage and TLs
- Controlled Surface Usage (CSUs)
- Not Available (NA, comprising No Leasing (NL) and No Surface Occupancy (NSO) areas)
- No Restrictions (Standard Lease Terms, SLT)

In addition, stipulated areas were often recategorized where appropriate to capture the practical effects of the stipulation on resource development. For example, TL areas, which preclude drilling activity during certain times of the year (e.g., Pinedale – November 15 to April 30 to protect big game winter range), were generally retained as stipulated areas for purposes of analysis where the timing limitation was greater than three months or less than nine months. Based on discussions with federal agencies and industry, TL of less than three months were considered to have no tangible impact on resource development activity and were recategorized as SLT areas for purposes of analysis. Conversely, areas with greater than nine consecutive months of TL stipulation were considered to preclude drilling and were recategorized as NA areas.

Based on discussions with federal agency personnel at BLM, some TLs were areally pro-rated where appropriate (e.g., typically, in less than 25% of permit applications within raptor areas are the bird nests actually located and thus restrict drilling). Where practicable, various types of TLs were kept separate, e.g. big game TLs and bird TLs were generally evaluated separately.

CSU areas were ignored where areally small (~100 acres or less) or linear (trails), as directional drilling could be used in these situations, but were generally retained as a stipulation category otherwise. Areas with both TLs and CSUs were combined into a single stipulation category (CSU/TL) for purposes of this study.

Some stipulation areas were combined as the effect upon gas resource development would be the same. For example, NL and NSO areas were combined as "NA" (Not Available for drilling) as both preclude drilling. SLT areas were considered to be unencumbered with respect to drilling for natural gas resources. Stipulation categories considered in this analysis are shown in Table 3.

Remaining Natural Gas Resources. Figure 2 shows the areal extent of resources that underlie the CAs. To determine the natural gas resources associated with the various stipulation categories, both Proved Reserves and Assessed Additional Resources were examined, by play. The analysis was conducted using a township as a workable unit of analysis so as to limit error associated with assignment of resources within specific stipulation categories to a relatively small geographic area.

Proved Reserves were captured using GASIS (Gas Information System, a database of gas reservoirs in the U.S. developed by Energy and Environmental Analysis Inc. (EEA) under funding by the Department of Energy). The remaining reserves (RUR field designation in GASIS) for over 700 reservoirs in the Rocky Mountains were analyzed geographically and based on specific play assignments were allocated to specific townships in the CAs.

Table 3. Stipulation Categories

Stipulation Categories	Acronym	Effect on Drilling
Timing Limitation	TL	Precludes drilling during certain time of the year
Birds	B	Generally February to July
Elk Calving	EC	Generally May to June
Big Game	BG	Generally November through April
Threatened Species	TS	Drilling can be performed with mitigation plan
Controlled Surface Use	CSU	Varied, may be mitigated
No Lease	NL	No drilling (not available, NA)
No Surface Occupancy	NSO	No drilling (not available, NA)
Standard Lease Terms	SLT	

Assessed Additional Resources were calculated for existing field reserve appreciation and new field resources (both conventional and unconventional). For reserve appreciation, proved reserves were multiplied by a factor of five to account for reserves growth associated with the discovered resource. Although reserves growth factors can vary widely by field in the U.S., a reserves growth factor of five is appropriate for Rocky Mountain Basins based on industry studies.

New field resources were examined using the USGS 1995 Oil and Gas Assessment (release 2, data DDS-30 on CD ROM). In the analysis, the mean potential natural gas reserves additions for each play was utilized. For a given play, typically the resource was assumed to be homogeneously distributed. To supplement the USGS data, resource analyses performed by Advanced Resources, the Utah Geologic Survey and the Potential Gas Committee were used. Specific plays that were examined include the Frontier and Mesaverde plays (the Greater Green River Basin in SW Wyoming), and the Emery and the Tight Uinta Tertiary (East and West) plays of the Uinta Basin in Utah.

Impacted Resource Estimation and Results. To estimate the portion of resource impacted by the various environmental stipulations, Advanced Resources used geographic determinations of federal land type, stipulation coverage and underlying resource. Calculations of resource underlying each stipulation category were made for each of the plays with resource in a given township. For three of the largest plays in the CAs--the Frontier and Mesaverde in the Greater Green River Basin and the Emery Play of the Uinta Basin--the resource distribution was varied by township; all other plays were assumed to have a homogenous distribution of resource.

For each CA, the aggregated resource by stipulation category was compared to total remaining resource to determine the relative portion of resource associated with each stipulation category. The results from the analysis are shown in Table 4.

The results indicate that TLs range in application from about 3 percent of the remaining resource in the Bridger Teton CA to a maximum of 46 percent in Pinedale. CSUs range from no resource affected (Bridger Teton) to over 11 percent of the resource in Rock Springs. The combination of TLs and CSUs range in application from no resource affected in Manti-La Sal to a maximum of about 53 percent in Pinedale. (In the Manti-La Sal CA, the stipulations were designed by the FS to be geographically independent with respect to TL and CSU areas and thus does not have a CSU/TL category.) Standard Lease Terms (SLTs) range in application from 32 percent of the resource in Pinedale to over 72 percent in Uinta. The relative magnitude of resource, by CA, is shown in Table 5.

Consistent with the implied geology, Forest Service areas (which tend to be mountainous) have lesser amounts of resource than basinal areas. Further, CAs that overlie both basinal and mountainous terranes show an uneven distribution of resource with respect to the total area of the CA; for instance, in the Bridger-Teton CA the majority of remaining resource is associated with the Greater Green River Basin, which comprises a minor portion of that CA. To provide insight into the areal distribution of environmental stipulations independent of resource, an estimate of the areas covered by the various stipulations was made. These results, shown in Table 6, indicate that of the total area examined in the CAs, 51 percent of the land area is under stipulation, and of the stipulated area, 47 percent is not available (NA) for drilling.

Table 4 Portion of Natural Gas Resource Under Respective Stipulation on Select Federal Lands (Calibration Areas)

Calibration Area	Dominant Fed. Land Manager	TL				CSU/TL					CSU	NA	SLT	Totals
		Undiff	B TL	BG& B TL	BG TL	Undiff	TS, TS & EC	CSU & B TL	CSU & BG & B TL	CSU & BG TL				
Bridger Teton	FS				3.3%		1.4%				0.0%	36.5%	58.8%	100.0%
Manti La Sal	FS	43.0%				0.0%					1.0%	0.5%	55.6%	100.0%
Uinta	FS	4.4%				0.6%					6.8%	15.6%	72.5%	100.0%
Pinedale	BLM		7.3%	20.5%	18.2%	0.0%					0.0%	15.5%	38.5%	100.0%
Price	BLM	6.8%				53.5%					0.2%	7.5%	32.1%	100.0%
Rock Springs	BLM		4.4%	10.2%	18.1%			2.7%	0.9%	3.2%	11.3%	8.8%	40.3%	100.0%

Table 5. Remaining Natural Gas Resources by Calibration Area

Calibration Area	Dominant Fed. Land	Remaining Resource (Tcf)
Bridger Teton	FS	10.0
Manti La Sal	FS	2.4
Uinta	FS	0.4
Pinedale	BLM	31.8
Price	BLM	14.2
Rock Springs	BLM	78.0
Total		136.8

Table 6 Acres of Land under Respective Stipulation for Calibration Areas

Calibration Area	Dominant Fed. Land Manager	TL				CSU/TL					CSU	NA	SLT	Totals
		Undiff	B TL	BG & B TL	BG TL	Undiff	TS, TS & EC	CSU & B TL	CSU & BG & B TL	CSU & BG TL				
Bridger Teton	FS				93,340 2.9%		8,191 0.3%				-	2,663,158 81.4%	507,953 15.5%	3,272,642 acres 100%
Manti La Sal	FS	204,464 14.4%				-					122,939 8.7%	24,758 1.7%	1,066,744 75.2%	1,418,905 acres 100.0%
Uinta	FS	14,802 4.6%				18,931 5.9%					50,060 15.6%	128,379 40.0%	108,441 33.8%	320,613 acres 100.0%
Pinedale	BLM		222,749 14.1%	191,183 12.1%	239,731 15.2%		-				-	72,121 4.6%	850,029 53.9%	1,575,812 acres 100.0%
Price	BLM	161,884 5.6%				630,511 21.8%					10,414 0.4%	261,285 9.0%	1,823,845 63.2%	2,887,939 acres 100.0%
Rock Springs	BLM		453,218 8.5%	354,590 6.6%	632,309 11.8%			79,623 1.5%	41,009 0.8%	144,454 2.7%	314,034 5.9%	409,381 7.6%	2,927,614 54.7%	5,356,233 acres 100.0%

Phase II. Extrapolation to the Rocky Mountain Region

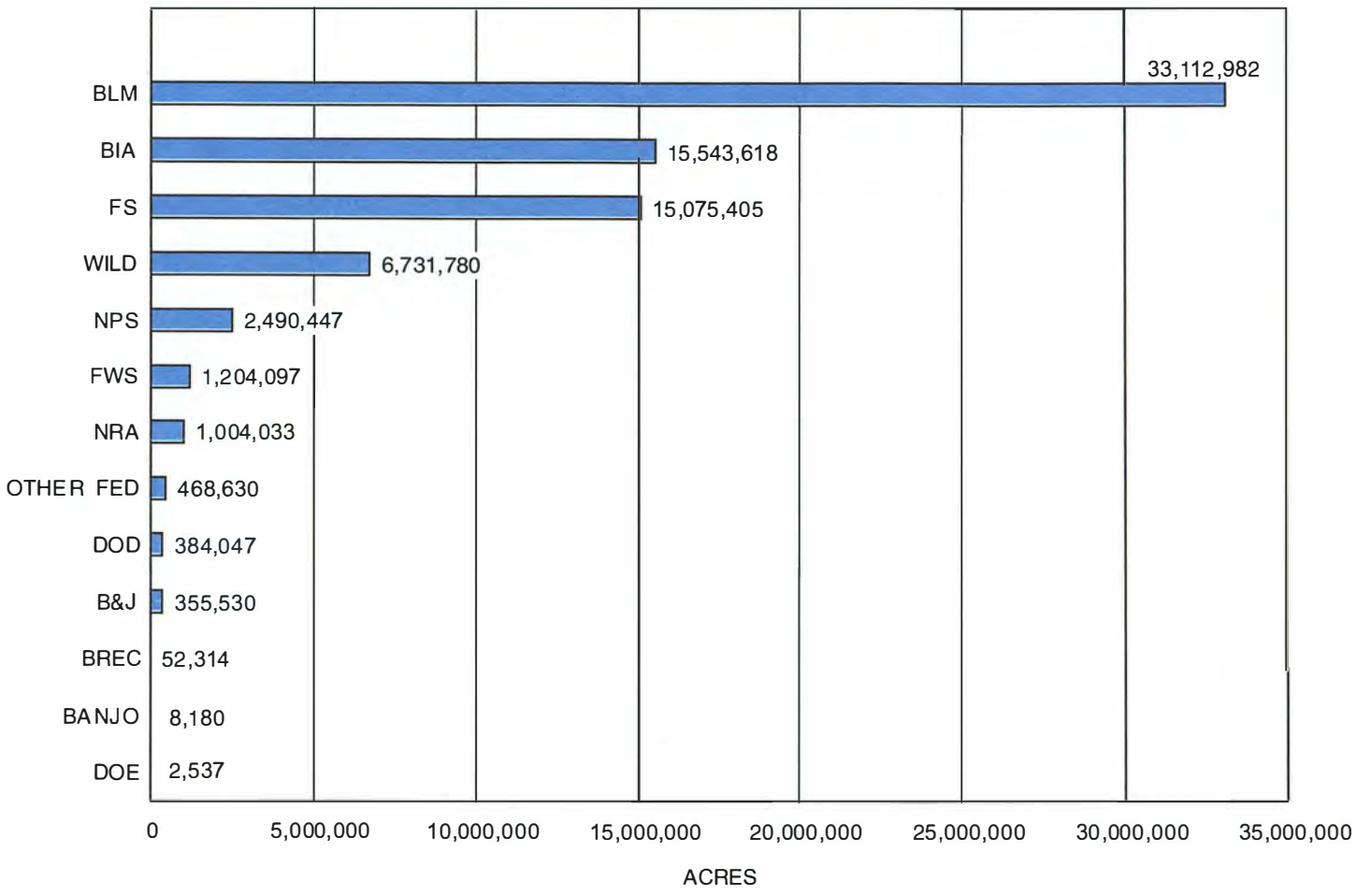
The second phase of the analysis involved extrapolation of results from the calibration areas to the remaining natural gas resources in the Rocky Mountain basins. The method of analysis used was similar to that for the CAs and is described below.

Federal/Indian Land. Fourteen federal/Indian land types for the Rocky Mountain region were characterized (see Table 7 below). The federal lands map obtained from BLM covered the states of Montana, Wyoming, Colorado, Utah and New Mexico and was subsequently updated for current Wilderness Areas and was used to inventory the acreage associated with the various federal/Indian land types. The results of that inventory (Figure 4) show that the BLM is the dominant manager of federal lands overlying resource areas in those states (overseeing about 43 percent of resource-endowed lands), managing more resource-endowed land than the following two agencies (BIA and FS) combined. Wilderness Areas comprise the fourth significant federal land holding (9 percent) overlying resources, with the balance of federal agencies making up about 8 percent.

Table 7. Federal/Indian Lands Analyzed

Agency	Abbreviation
Bureau of Indian Affairs	BIA
-	B&J
-	BANJO
Bureau of Land Management	BLM
Bureau of Reclamation	BREC
Department of Defense	DOD
Department of Energy	DOE
Forest Service	FS
Fish & Wildlife Service	FWS
National Park Service	NPS
National Recreation Area	NRA
Wilderness Area	WILD
Other Federal	OTHER FED
Patented (under private control)	PAT'D
State/Private-owned	STATE/PRIVATE

Figure 4. Federal/Indian Management of Lands Overlying Resources in Colorado, Montana, Northern New Mexico, Utah, and Wyoming



Stipulations Extrapolation. Results determined for the stipulation-encumbered resources (Table 3) from Phase I were extrapolated for general application to the Rocky Mountain basins. For simplification, the stipulation categories were generalized to TL, CSU/TL, CSU, NA, and SLT. Averages of the stipulation categories of the calibration areas from Table 3 were made for BLM and FS lands. For lesser federal land positions (BREC, DOD, DOE) and Indian lands, educated guesses were made by the Policy Group. NPS, FWS, NRA and Wilderness Areas were considered "Not Available" (NA), areas that would preclude drilling by the industry. Because the Greater Green River Basin constitutes a large resource area in the Rocky Mountains, averages were also made of the Pinedale and Rock Springs CAs to be applied to plays in that basin. The extrapolation results are as follows:

Table 8. Extrapolation of Stipulated Portion of Resources

	TL	CSU/TL	CSU	NA	SLT	Totals
BIA				2%	98%	100%
B&J					100%	100%
BANJO				100%		100%
BLM	29%	20%	4%	11%	37%	100%
BREC				100%		100%
DOD				98%	2%	100%
DOE				100%		100%
FS	17%	1%	3%	18%	62%	100%
FWS				100%		100%
NPS				100%		100%
NRA				100%		100%
WILD				100%		100%
Other FED				100%		100%
Greater Green River Basin	39%	3%	6%	12%	39%	100%

Remaining Natural Gas Resources. Estimation of the impacts on natural gas resources as a function of environmental stipulations was made using a method similar to that for the CAs, i.e., on the basis of federal land type, stipulation coverage and underlying resource. For each play in the Rocky Mountains region, calculations of resource impacted were made using the percentages developed in Table 8. For larger plays in the Rocky Mountains region, namely the Frontier and Mesaverde in the Greater Green River Basin, the Emery, Uinta Tertiary Tight Gas (East and West) in the Uinta-Piceance basin, estimates generated by Advanced Resources and the Potential Gas Committee (PGC; estimates were generated by Logan McMillan) were used. To supplement the USGS play list, resource estimates for the Montana Folded Belt (developed by the PGC) and coalbed methane in the Grand Staircase-Escalante National Monument (developed by the Utah Geological Survey) were used. Results of the estimates, by play, are shown in Table 9.

Remaining natural gas resources underlie about 77 of the total 156 million acres of federal/Indian lands examined in the study. Results show that BLM and the FS manage lands that have the greatest natural gas resource impacts due to environment stipulations, compared to all federal/Indian land types. Together, BLM and FS-managed lands overlie 45 percent of the resource base under federal/Indian lands in the Rocky Mountain Region. On BLM-managed lands, approximately 30 Tcf of gas are Not Available (NA) for development by the industry, 103 Tcf of natural gas resource are estimated to be directly affected by environmental stipulations, and approximately 80 Tcf of gas are estimated to be developable under Standard Lease Terms (SLT).

Similarly, for Forest Service lands, approximately 4 Tcf of resource are Not Available for drilling, about 7 Tcf of natural gas resource are estimated to be directly affected by environmental stipulations and 14 Tcf are available under Standard Lease Terms.

Outside of BLM and FS areas, federal/Indian land areas that are Not Available to drilling -- lands managed as/by Wilderness Areas, Fish and Wildlife Service, National Park Service and National Recreation Areas -- overlie approximately 15 Tcf of resource.

Overall the results indicate that slightly over half the 288 Tcf of technically recoverable resource on federal lands is impacted by stipulations--about 17 percent is not available for drilling; another 38 percent can be developed, but with timing or surface occupancy limitations. About 44 percent of the resource is developable under standard lease terms.

Table 9
Inventory of Resource Impacts Due to Environmental Stipulations for the Rocky Mountain Region

USGS Province Basin	USGS Play Number	Total Undisc. + Discov. (Bcf)	Type	Federal & Indian Lands Classification - Undiscovered + Discovered Remaining Resources (BCF)														
				BIA			B&J	BANJO	BLM						BREC	DOD		
				NA	SLT	STTL	SLT	NA	TL	CSU/TL	CSU	NA	SLT	STTL	NA	NA	SLT	STTL
#20 Uintah-Piceance	2001	1,365	C	-	-	-	-	-	161	113	22	60	208	564	-	-	-	-
	2002	625	C	4	185	198	-	-	45	32	6	17	59	159	-	-	-	-
Basins within Province	2003	1,577	C	1	29	30	-	-	326	230	44	121	423	1,145	-	-	-	-
Uintah	2004	856	C	0	10	11	-	-	116	82	16	43	150	407	-	-	-	-
Piceance	2005	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wasatch (partial)	2007	4,870	U	-	-	-	-	-	496	350	67	185	643	1,740	-	158	2	159
	2008	28	U	0	0	0	-	-	3	2	0	1	4	10	-	-	-	-
	2010	5,403	U	-	-	-	-	-	566	399	76	211	734	1,988	-	151	2	153
	2014	18	C	0	1	1	-	-	1	1	0	0	2	4	-	0	0	0
	2015	18,503	U	108	5,283	5,391	-	-	2,391	1,685	322	890	3,100	8,389	-	-	-	-
	2016	16,905	U	13	628	641	-	-	3,643	2,568	490	1,356	4,723	12,780	-	-	-	-
	2018	3,764	U	17	838	855	-	-	501	353	67	186	649	1,757	-	-	-	-
	2020	574	U	3	167	170	-	-	5	4	1	2	6	18	-	-	-	-
	2050	1,941	U	-	-	-	-	-	254	179	34	94	329	890	-	-	-	-
	2051	521	U	1	65	66	-	-	96	68	13	36	124	337	-	-	-	-
	2052	5,000	U	-	-	-	-	-	530	374	71	197	687	1,860	-	-	-	-
	2053	330	U	-	-	-	-	-	65	46	9	24	85	229	-	-	-	-
	2054	6,492	U	-	-	-	-	-	848	598	114	316	1,100	2,978	-	41	1	42
	2055	241	U	-	-	-	-	-	18	12	2	7	23	62	-	0	0	0
	2056	397	U	-	-	-	-	-	6	4	1	2	8	22	-	-	-	-
	2057	35	U	-	-	-	-	-	0	0	0	0	0	1	-	-	-	-
#21 Paradox Basin	2101	294	C	0	0	0	-	-	63	45	9	24	82	222	-	0	0	0
	2102	108	C	1	34	35	-	-	8	5	1	3	10	26	0	-	-	-
Basins within Province	2103	184	U	0	22	22	-	-	24	17	3	9	31	85	0	0	0	0
Paradox	2104	48	C	-	-	-	-	-	0	0	0	0	0	1	-	-	-	-
	2105	351	C	0	0	0	-	-	55	39	7	21	71	193	-	0	0	0
	2106	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2107	210	C	-	-	-	-	-	39	27	5	14	50	135	-	0	0	0
	GS/E-CBM	6,570	U	-	-	-	-	-	-	-	-	6,570	-	-	-	-	-	-
#22 San Juan	2204	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2205	22,045	U	65	3,161	3,226	-	-	4,876	3,396	629	1,740	6,062	16,404	34	-	-	-
Basins within Province	2206	55	C	0	16	16	-	-	0	0	0	0	1	2	0	0	0	0
San Juan	2207	344	C	2	95	97	-	-	35	25	5	13	45	123	0	0	0	0
Paradox (small portion)	2208	94	U	1	38	38	-	-	8	5	1	3	10	26	0	-	-	-
	2209	34,933	U	86	4,233	4,319	-	-	859	605	116	320	1,113	3,013	39	-	-	-
	2210	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2211	14,721	U	60	2,926	2,985	-	-	1,365	962	184	508	1,769	4,787	13	-	-	-
	2212	411	C	3	124	127	-	-	33	23	4	12	43	115	1	-	-	-
	2250	36,374	U	233	11,413	11,646	-	-	6,430	4,532	865	2,393	8,336	22,556	74	-	-	-
	2252	2,144	U	15	729	743	-	-	273	192	37	102	354	957	2	-	-	-
	2253	1,224	U	12	585	597	-	-	101	72	14	38	132	356	-	-	-	-
#27 Montana Thrust Belt	2701	1,830	C	3	156	160	-	-	-	-	-	-	-	-	-	-	-	-
	PGC P575	10,790		18	922	941	-	-	-	-	-	-	-	-	-	-	-	-
	2703	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	2704	42	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Montana Thrust Belt	2705	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2706	13	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2707	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
#28 North-Central Montana	2801	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2802	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	2803	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Powder River (partial)	2804	13	U	0	1	1	-	-	-	-	-	-	-	-	-	-	-	-
Big Horn (partial)	2805	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Williston (partial)	2806	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2807	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2808	81	C	0	6	6	-	-	-	-	-	-	-	-	-	-	-	-
	2809	400	C	0	20	20	-	-	-	-	-	-	-	-	-	-	-	-
	2810	5,437	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2811	20,480	U	32	1,559	1,591	-	-	-	-	-	-	-	-	-	-	-	-
	2812	15,354	U	6	310	316	-	-	-	-	-	-	-	-	-	-	-	-
#31 Williston	3101	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3102	318	C	0	14	15	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	3103	71	C	0	3	3	-	-	-	-	-	-	-	-	-	-	-	-
Powder River (partial)	3105	111	C	0	10	10	-	-	-	-	-	-	-	-	-	-	-	-
Williston (majority)	3106	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3107	95	C	0	2	2	-	-	-	-	-	-	-	-	-	-	-	-
	3111	56	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3112	7	U	0	2	2	-	-	-	-	-	-	-	-	-	-	-	-
#33 Powder River	3301	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3302	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	3303	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Powder River (majority)	3304	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3305	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3306	0	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3307	397	C	0	12	13	10	-	9	6	1	3	12	32	-	0	0	0
	3308	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3309	71	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3310	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CSU = Controlled Surface Use
CSU/TL = Controlled Surface Use/Timing Limitation
NSO = No Surface Occupancy
SLT = Standard Lease Terms
NA = No Access (NL/NSO)

NL = No Lease
TL = Timing Limitation
C = Conventional
U = Unconventional
PGC=Potential Gas Committee

UGS=Utah Geological Survey
GS/E CBM = Grand Staircase-Escalante coalbed methane
STTL = Sub-total
Bcf = Billion cubic feet

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Table 9
Inventory of Resource Impacts Due to Environmental Stipulations for the Rocky Mountain Region
(Continued)

USGS Province Basin	USGS Play Number	Total Undisc. + Discov. (Bcf)	Type	Federal & Indian Lands Classification - Undiscovered + Discovered Remaining Resources (BCF)														
				BIA			B&J	BANJO	BLM						BREC	DOD		
				NA	SLT	STTL	SLT	NA	TL	CSU/TL	CSU	NA	SLT	STTL	NA	NA	SLT	STTL
#33 Powder River	3311	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3312	1	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	3313	21	C	-	-	-	-	-	1	1	0	0	1	4	-	-	-	-
Powder River (majority)	3315	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3350	682	U	0	0	0	26	-	5	4	1	2	7	18	-	0	0	0
	3351	425	U	0	0	0	-	-	13	9	2	5	17	46	-	-	-	-
#34 Big Horn	3401	40	C	-	-	-	-	-	5	4	1	2	7	18	-	-	-	-
	3402	895	C	0	2	2	-	-	144	101	19	63	186	504	-	0	0	0
Basins within Province	3403	127	C	-	-	-	-	-	24	17	3	9	31	84	0	-	-	-
Big Horn (majority)	3404	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wind River (partial)	3405	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3406	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3407	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3408	174	C	0	2	2	-	-	28	20	4	10	36	98	0	0	0	0
	3410	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3411	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3412	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3413	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3414	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3416	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3417	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
#35 Wind River	3501	175	C	0	20	20	-	-	16	11	2	6	21	57	-	6	0	6
	3502	1,805	C	3	170	174	-	-	129	91	17	48	167	451	-	0	0	0
Basins within Province	3503	2,987	C	9	447	456	-	-	515	363	69	182	668	1,808	-	-	-	-
Wind River (majority)	3504	176	C	0	18	18	-	-	24	17	3	9	32	85	-	0	0	0
	3505	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3506	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3509	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3510	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3511	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3512	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3513	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3516	66	C	0	11	11	-	-	7	5	1	2	9	23	-	-	-	-
	3518	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3550	426	U	3	145	148	-	-	50	35	7	19	65	176	-	-	-	-
#36 Wyoming Thrust Belt	3601	2,906	C	-	-	-	-	-	66	47	9	25	86	232	-	-	-	-
	3602	388	C	-	-	-	-	-	12	8	2	4	16	42	-	-	-	-
Basins within Province	3603	3,098	C	-	-	-	-	-	12	8	2	4	15	42	-	-	-	-
Wyoming Thrust Belt	3604	3,077	C	-	-	-	-	-	92	65	12	34	119	322	-	-	-	-
	3606	445	C	-	-	-	-	-	51	36	7	19	66	179	-	-	-	-
	3607	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
#37 SW Wyoming	3701	7,144	C	-	-	-	-	-	1,519	132	218	469	1,520	3,858	-	-	-	-
	3702	2,174	C	-	-	-	-	-	235	20	34	72	235	596	-	-	-	-
Basins within Province	3703	16	C	-	-	-	-	-	2	0	0	1	2	6	-	-	-	-
Greater Green River	3704	4,422	C	-	-	-	-	-	1,076	93	154	332	1,076	2,730	2	-	-	-
	3705	9,334	C	-	-	-	-	-	1,647	134	222	478	1,648	3,929	-	-	-	-
	3706	70	C	0	0	0	-	-	10	1	1	3	10	25	-	-	-	-
	3707	1,235	C	0	0	0	-	-	402	35	58	124	402	1,020	-	-	-	-
	3708	30	C	-	-	-	-	-	0	0	0	0	0	0	-	-	-	-
	3740	49,908	U	-	-	-	-	-	12,598	1,091	1,807	3,892	12,610	31,997	176	-	-	-
	3741	78,592	U	-	-	-	-	-	20,317	1,758	2,914	6,276	20,336	51,603	15	-	-	-
	3742	19,625	U	-	-	-	-	-	5,231	453	750	1,616	5,236	13,286	-	-	-	-
	3743	10,224	U	-	-	-	-	-	2,732	237	392	844	2,735	6,938	4	-	-	-
	3744	986	U	-	-	-	-	-	202	18	29	62	202	514	-	-	-	-
	3750	693	U	-	-	-	-	-	139	12	20	43	140	354	-	-	-	-
	3751	377	U	-	-	-	-	-	24	2	3	8	24	62	-	-	-	-
	3752	1,385	U	-	-	-	-	-	38	3	6	12	38	98	-	-	-	-
	3753	795	U	-	-	-	-	-	140	12	20	43	140	356	-	-	-	-
	3754	230	U	-	-	-	-	-	48	4	7	15	48	121	-	-	-	-
	3785	408	U	-	-	-	-	-	67	5	8	17	57	144	0	-	-	-
#39 Denver	3901	241	C	-	-	-	-	-	0	0	0	0	0	1	-	0	0	0
	3903	1,030	C	-	-	-	-	-	0	0	0	0	0	0	-	-	-	-
Basins within Province	3904	3,790	U	-	-	-	-	-	0	0	0	0	0	0	-	17	0	17
Denver-Julesberg	3905	80	C	0	0	0	-	-	0	0	0	0	0	0	-	0	0	0
	3906	2,723	U	-	-	-	-	-	0	0	0	0	0	1	-	2	0	3
	3907	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3908	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3910	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3911	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3920	32	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3921	53	U	-	-	-	-	-	0	0	0	0	0	0	-	0	0	0
#41 Raton	4101	34	C	-	-	-	-	-	0	0	0	0	0	0	-	-	-	-
Basins within Province	4102	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Raton	4150	914	U	-	-	-	-	-	2	1	0	1	2	6	-	-	-	-
	4151	289	U	-	-	-	-	-	0	0	0	0	0	1	-	-	-	-
	4152	571	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals:		460,335		703	34,423	35,126	36	-	71,562	21,805	10,041	30,274	79,089	206,202	362	375	6	381

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C = Conventional
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UGS=Utah Geological Survey
GS/E CBM = Grand Staircase-Escalante coalbed methane
STTL = Sub-total
Bcf = Billion cubic feet

T9P2

Table 9
Inventory of Resource Impacts Due to Environmental Stipulations for the Rocky Mountain Region
(Continued)

USGS Province Basin	USGS Play Number	Total Undisc. + Discov. (Bcf)	Type	Federal & Indian Lands Classification - Undiscovered + Discovered Remaining Resources (BCF)													STATE/ PAT'D/ PRIVATE
				DOE	FS						FWS	NPS	NRA	WILD	OTHER FED		
				NA	TL	CSU/TL	CSU	NA	SLT	STTL	NA	NA	NA	NA	STL		
#20 Uinta-Piceance	2001	1,385	C	-	-	-	-	-	-	-	-	-	-	-	-	-	801
	2002	625	C	-	2	0	0	2	6	10	0	-	-	-	-	-	256
Basins within Province	2003	1,577	C	-	7	0	1	7	27	43	-	-	-	-	47	-	313
Uinta	2004	856	C	-	2	0	0	2	8	9	-	-	-	-	31	-	398
Piceance	2005	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wasatch (partial)	2007	4,870	U	-	184	7	25	170	604	988	-	1	-	-	-	-	2,002
	2009	28	U	-	0	0	0	0	1	1	-	-	-	0	-	-	17
	2010	5,403	U	-	78	3	12	79	281	452	-	-	-	54	-	-	2,757
	2014	18	C	-	0	0	0	0	1	2	-	0	-	5	-	-	8
	2015	18,503	U	-	79	3	12	82	290	466	-	-	-	-	-	-	4,256
	2016	18,905	U	-	390	18	60	404	1,437	2,306	-	-	-	-	-	-	1,178
	2018	3,784	U	-	17	1	3	18	62	100	35	-	-	-	-	-	1,037
	2020	574	U	-	-	-	-	-	-	-	-	-	-	-	-	-	386
	2050	1,941	U	-	-	-	-	-	-	-	-	-	-	-	-	-	1,052
	2051	521	U	-	-	-	-	-	-	-	-	-	-	9	-	-	109
	2052	5,000	U	-	318	13	49	329	1,171	1,879	-	-	-	-	-	-	1,261
	2053	330	U	-	-	-	-	-	-	-	-	-	-	2	-	-	98
	2054	6,492	U	-	194	8	30	201	715	1,147	-	-	-	121	-	-	2,208
	2055	241	U	-	1	0	0	1	4	7	-	-	-	-	-	-	172
	2056	397	U	-	46	2	7	49	176	282	-	-	-	-	-	-	92
	2057	35	U	-	3	0	0	3	9	15	-	-	-	14	-	-	5
#21 Paradox Basin	2101	294	C	-	3	0	1	3	12	19	-	8	0	7	-	-	39
	2102	108	C	-	2	0	0	2	8	9	-	1	1	2	1	-	32
Basins within Province	2103	194	U	-	4	0	1	4	15	24	-	9	5	1	3	-	45
Paradox	2104	49	C	-	8	0	1	8	22	35	-	-	-	3	-	-	10
	2105	351	C	-	8	0	1	8	28	45	-	17	0	8	-	-	88
	2106	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2107	210	C	-	10	0	2	10	37	59	-	-	-	-	-	-	18
	GS/E CBM	8,570	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-
#22 San Juan	2204	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2205	22,045	U	-	94	4	14	97	345	554	-	-	-	3	115	-	1,709
Basins within Province	2206	55	C	-	0	0	0	0	2	2	-	0	-	-	1	-	33
San Juan	2207	344	C	-	0	0	0	0	1	2	-	0	-	1	3	-	118
Paradox (small portion)	2208	94	U	-	1	0	0	1	3	5	-	-	-	1	1	-	22
	2209	34,933	U	-	110	4	17	114	405	650	-	-	-	103	134	-	26,674
	2210	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2211	14,721	U	-	80	2	9	62	185	355	-	-	-	35	46	-	6,535
	2212	411	C	-	3	0	0	3	11	18	-	-	-	-	4	-	147
	2250	36,374	U	-	73	3	11	75	268	430	-	-	-	-	67	-	1,602
	2252	2,144	U	-	0	0	0	0	0	0	-	-	-	-	1	-	439
	2253	1,224	U	-	13	1	2	14	48	77	-	-	-	23	15	-	156
#27 Montana Thrust Belt	2701	1,830	C	-	91	4	14	95	337	540	-	299	-	460	28	-	344
	PGC P575	10,790		-	538	22	83	557	1,984	3,184	-	1,781	-	2,711	188	-	2,025
	2703	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	2704	42	C	-	1	0	0	1	5	7	-	-	-	-	0	-	35
Montana Thrust Belt	2705	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2708	13	C	-	0	0	0	0	1	1	0	2	-	-	0	-	9
	2707	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
#28 North-Central Montana	2801	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2802	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	2803	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Powder River (partial)	2804	13	U	-	0	0	0	0	0	1	0	0	-	-	0	-	11
Big Horn (partial)	2805	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Williston (partial)	2806	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2807	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2808	91	C	-	0	0	0	0	1	1	1	0	-	-	0	-	83
	2809	400	C	-	1	0	0	1	3	5	7	0	-	-	0	-	387
	2810	5,437	U	-	-	-	-	-	-	-	24	-	-	-	10	-	5,402
	2811	20,480	U	-	-	-	-	-	-	-	1,000	-	-	-	6	-	17,884
	2812	15,354	U	-	-	-	-	-	-	-	82	-	-	-	3	-	14,952
#31 Williston	3101	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3102	318	C	-	0	0	0	0	0	1	1	-	-	-	0	-	302
Basins within Province	3103	71	C	-	0	0	0	0	0	0	0	-	-	-	0	-	87
Powder River (partial)	3105	111	C	-	-	-	-	-	-	-	0	-	-	-	0	-	101
Williston (majority)	3108	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3107	95	C	-	-	-	-	-	-	-	0	-	-	-	0	-	93
	3111	58	U	-	-	-	-	-	-	-	-	-	-	-	0	-	58
	3112	7	U	-	-	-	-	-	-	-	0	-	-	-	-	-	5
#33 Powder River	3301	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3302	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basins within Province	3303	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Powder River (majority)	3304	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3305	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3306	0	C	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	3307	397	C	-	2	0	0	2	6	13	-	0	-	0	0	-	330
	3308	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3309	71	C	-	-	-	-	-	-	-	-	-	-	-	-	-	71
	3310	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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T9 P3

Table 9
Inventory of Resource Impacts Due to Environmental Stipulations for the Rocky Mountain Region
(Continued)

USGS Province Basin	USGS Play Number	Total Undisc. + Discov. (Bcf)	Type	Federal & Indian Lands Classification - Undiscovered + Discovered Remaining Resources (BCF)												STATE/ PAT'D/ PRIVATE
				DOE	FS						FWS	NPS	NRA	WILD	OTHER FED	
				NA	TL	CS /TL	CSU	NA	SLT	STTL	NA	NA	NA	NA	STL	
#33 Powder River	3311	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-
	3312	1	C	-	-	-	-	-	-	-	-	-	-	-	-	1
Basins within Province	3313	21	C	-	-	-	-	-	-	-	-	-	-	0	-	18
Powder River (majority)	3315	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3350	682	U	-	1	0	0	1	5	8	-	-	-	-	3	626
	3351	425	U	-	0	0	0	0	0	0	-	-	-	2	-	376
#34 Big Horn	3401	40	C	-	1	0	0	1	5	7	-	-	-	0	-	14
	3402	895	C	-	0	0	0	0	1	2	-	1	-	10	-	377
Basins within Province	3403	127	C	-	0	0	0	0	0	0	-	-	-	6	-	36
Big Horn (majority)	3404	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-
Wind River (partial)	3405	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3406	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3407	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3408	174	C	-	0	0	0	0	1	2	-	0	-	4	-	69
	3410	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3411	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3412	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3413	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3414	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3416	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3417	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
#35 Wind River	3501	175	C	-	1	0	0	1	4	6	0	-	-	3	-	83
	3502	1,805	C	-	0	0	0	0	0	0	-	-	-	-	-	1,179
Basins within Province	3503	2,887	C	-	-	-	-	-	-	-	-	-	-	-	-	623
Wind River (majority)	3504	176	C	-	-	-	-	-	-	-	-	-	-	-	-	74
	3505	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-
	3506	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3509	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3510	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3511	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3512	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3513	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3515	55	C	-	-	-	-	-	-	-	-	-	-	-	-	21
	3518	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3550	426	U	-	-	-	-	-	-	-	-	-	-	-	-	101
#36 Wyoming Thrust Belt	3601	2,906	C	-	430	18	68	445	1,585	2,543	-	-	-	4	-	127
	3602	366	C	-	0	0	0	0	1	1	-	-	-	3	-	319
Basins within Province	3603	3,098	C	-	226	9	35	234	833	1,338	-	-	-	230	-	1,490
Wyoming Thrust Belt	3604	3,077	C	-	21	1	3	22	78	125	-	5	-	1	-	2,623
	3606	445	C	-	8	0	1	9	31	49	-	-	-	7	-	209
	3607	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
#37 SW Wyoming	3701	7,144	C	-	-	-	-	-	-	-	-	-	-	69	-	3,217
	3702	2,174	C	-	-	-	-	-	-	-	-	-	-	-	-	1,579
Basins within Province	3703	16	C	-	0	0	0	0	0	1	0	1	-	1	-	10
Greater Green River	3704	4,422	C	-	4	0	1	1	4	11	1	-	-	-	0	1,676
	3705	9,334	C	-	1,330	115	191	411	1,332	3,379	-	-	0	386	-	1,640
	3706	70	C	-	8	1	1	2	6	18	-	-	2	5	-	21
	3707	1,235	C	-	1	0	0	0	1	1	0	-	-	-	-	214
	3708	30	C	-	2	0	0	1	2	6	0	17	-	4	-	3
	3740	49,908	U	-	340	29	49	105	340	864	71	-	-	1,532	1	15,269
	3741	78,582	U	-	609	53	87	188	610	1,547	-	-	-	3,277	-	22,140
	3742	19,625	U	-	-	-	-	-	-	-	-	-	-	1,100	-	5,239
	3743	10,224	U	-	136	12	19	42	136	345	-	-	-	621	-	2,314
	3744	986	U	-	-	-	-	-	-	-	-	-	-	284	-	189
	3750	893	U	-	-	-	-	-	-	-	-	-	-	-	0	339
	3751	377	U	-	15	1	2	5	15	37	-	-	-	-	-	278
	3752	1,385	U	-	98	8	14	30	98	248	-	-	-	-	-	1,039
	3753	795	U	-	19	2	3	6	19	47	-	-	-	19	-	373
	3754	230	U	-	1	0	0	0	1	4	-	-	-	6	-	100
	3755	408	U	-	0	0	0	0	0	1	0	-	0	4	0	258
#39 Denver	3901	241	C	0	0	0	0	0	1	1	-	0	-	-	0	239
	3903	1,030	C	-	0	0	0	0	0	0	-	-	-	-	-	1,030
Basins within Province	3904	3,790	U	2	12	0	2	12	43	69	-	-	-	-	2	3,699
Denver-Julesberg	3905	80	C	0	0	0	0	0	0	0	-	0	-	0	0	79
	3906	2,723	U	-	5	0	1	5	19	31	-	-	-	-	-	2,689
	3907	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3908	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3910	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
	3911	-	U	-	-	-	-	-	-	-	-	-	-	-	-	-
	3920	32	U	-	-	-	-	-	-	-	-	-	-	-	-	32
	3921	53	U	-	0	0	0	0	1	1	-	-	-	-	-	52
#41 Raton	4101	34	C	-	0	0	0	0	1	2	-	-	-	1	-	32
Basins within Province	4102	-	C	-	-	-	-	-	-	-	-	-	-	-	-	-
Raton	4150	914	U	-	13	1	2	13	47	76	-	-	-	-	-	832
	4151	289	U	-	-	-	-	-	-	-	-	-	-	-	-	288
	4152	571	U	-	1	0	0	1	4	6	-	-	-	-	-	565
Totals:		460,335		2	5,602	346	834	3,941	13,738	24,498	1,223	2,122	9	11,221	613	172,007

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T9 P4

Sensitivity to Potential Wilderness Areas. To assess the natural gas resource impacts that can be associated with "potential" wilderness areas, Advanced Resources performed a sensitivity analysis using the same methodology previously described. The potential wilderness areas are lands under study or examination with respect to designation as wilderness areas and comprise:

- Wilderness study areas (UT, CO, WY)
- Wilderness re-inventory areas/Lands with wilderness characteristics (UT)
- Quasi-wilderness and related lands (CO)
- Colorado Wilderness Act of 1999 proposed lands
- Lewis and Clark National Forest proposed withdrawal (MT)

Results of that estimate are shown in Table 10. If these potential wilderness areas were to be redesignated as Wilderness Areas and thus be unavailable for drilling, up to approximately 17 Tcf of developable resource could be affected. Most of this gas (about 15 Tcf) would underlie lands currently under management by BLM.

Table 10
Resource Impacts Associated with "Potential" Wilderness Areas

USGS Province Basin	USGS Play Number	Federal & Indian Lands Classification - Undiscovered + Discovered Remaining Resources (BCF) Net CHANGES in resource counts as a function of Potential Wilderness Areas												
		BIA	B&J	BANJO	BLM	BREC	DOD	DOE	FS	FWS	NPS	NRA	WILD	OTHER FED
#20 Uintah-Piceance	2001				(3)								3	
	2002				(30)								30	
Basins within Province	2003				(64)								64	
Uintah	2004				(108)								108	
Piceance	2005													
Wasatch (partial)	2007													
	2009													
	2010				(11)								11	
	2014				(0)								0	
	2015				(2,156)								2,156	
	2016				(4,992)								4,992	
	2018				(389)								389	
	2020													
	2050				(542)								542	
	2051				(106)								106	
	2052													
	2053				(1)								1	
	2054				(13)								13	
	2055													
	2056													
	2057													
#21 Paradox Basin	2101				(30)				(0)				30	
	2102				(8)				(0)				8	
Basins within Province	2103				(26)				(0)				26	
Paradox	2104													
	2105				(40)								40	
	2106													
	2107				(1)								1	
	GS/E CBM													
#22 San Juan	2204													
	2205													
Basins within Province	2206				(0)								0	
San Juan	2207													
Paradox (small portion)	2208													
	2209													
	2210													
	2211													
	2212													
	2250													
	2252													
	2253													
#27 Montana Thrust Belt	2701								(319)				319	
	PGC P575								(1,879)				1,879	
	2703													
Basins within Province	2704													
Montana Thrust Belt	2705													
	2706													
	2707													
#28 North-Central Montana	2801													
	2802													
Basins within Province	2803													
Powder River (partial)	2804													
Big Horn (partial)	2805													
Williston (partial)	2806													
	2807													
	2808													
	2809													
	2810													
	2811													
	2812													
#31 Williston	3101													
	3102													
Basins within Province	3103													
Powder River (partial)	3105													
Williston (majority)	3106													
	3107													
	3111													
	3112													
#33 Powder River	3301													
	3302													
Basins within Province	3303													
Powder River (majority)	3304													
	3305													
	3306													
	3307				(0)								0	
	3308													
	3309													
	3310													
	3311													
	3312													
	3313													
	3315													
	3350													
	3351				(2)								2	

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UGS=Utah Geological Survey
GS/E CBM = Grand Staircase-Escalante coalbed methane
STTL = Sub-total
Bcf = Billion cubic feet
USGS=US Geological Survey

T10P1

Table 10
Resource Impacts Associated with "Potential" Wilderness Areas
(Continued)

USGS Province Basin	USGS Play Number	Federal & Indian Lands Classification - Undiscovered + Discovered Remaining Resources (BCF) Net CHANGES in resource counts as a function of Potential Wilderness Areas												
		BIA	B&J	BANJO	BLM	BREC	DOD	DOE	FS	FWS	NPS	NRA	WILD	OTHER FED
#34 Big Horn	3401													
	3402				(8)								8	
Basins within Province	3403													
Big Horn (majority)	3404													
Wind River (partial)	3405													
	3406													
	3407													
	3408				(4)								4	
	3410													
	3411													
	3412													
	3413													
	3414													
	3416													
	3417													
#35 Wind River	3501													
	3502													
Basins within Province	3503													
Wind River (majority)	3504													
	3505													
	3506													
	3509													
	3510													
	3511													
	3512													
	3513													
	3515													
	3518													
	3550													
#36 Wyoming Thrust Belt	3601													
	3602													
Basins within Province	3603													
Wyoming Thrust Belt	3604													
	3606													
	3607													
#37 SW Wyoming	3701				(83)								83	
	3702													
Basins within Province	3703				(0)								0	
Greater Green River	3704													
	3705				(156)								156	
	3706				(0)								0	
	3707				(0)								0	
	3708													
	3740				(1,339)								1,339	
	3741				(2,999)								2,999	
	3742				(992)								992	
	3743				(517)								517	
	3744				(262)								262	
	3750				(0)								0	
	3751													
	3752													
	3753				(0)								0	
	3754				(2)								2	
	3755				(4)								4	
#39 Denver	3901													
	3903													
Basins within Province	3904													
Denver-Julesberg	3905				(0)								0	
	3906													
	3907													
	3908													
	3910													
	3911													
	3920													
	3921													
#41 Raton	4101													
Basins within Province	4102													
Raton	4150													
	4151													
	4152													
Totals:		-	-	-	(14,887)	-	-	-	(2,197)	-	-	-	17,084	-

CSU = Controlled Surface Use
CSU/TL = Controlled Surface Use/Timing Limitation
NSO = No Surface Occupancy
SLT = Standard Lease Terms
NA = No Access (NL/NSO)

NL = No Lease
TL = Timing Limitation
C = Conventional
U = Unconventional
PGC=Potential Gas Committee

UGS=Utah Geological Survey
GS/E CBM = Grand Staircase-Escalante coalbed methane
STTL = Sub-total
Bcf = Billion cubic feet
USGS= US Geological Survey

T10P2

Nonfederal Lands Surrounded by Federal/Indian Lands. Nonfederal lands that are entirely surrounded by federal/Indian lands are often subjected to development constraints similar to federal lands. For example, road access to the surrounded nonfederal land would be subject to stipulations associated with the adjoining federal lands. Advanced Resources, at the request of the Policy Group, developed an estimate of the acreage of nonfederal lands in each of the states in the study area. These results, presented in Table 11, show that over 9.7 million acres in the Rocky Mountain region are affected.

Table 11. Nonfederal Lands That Are Surrounded By Federal Lands

	Area, Acres
Montana	211,466
Wyoming	4,821,222
Colorado	1,194,668
Northern New Mexico	605,303
Utah	2,900,564
Total	**9,733,223**

National Petroleum Council
1999 Natural Gas Study Supply Task Group
and Policy Subgroup

Membership:

Chair
John S. Hull
Texaco Natural Gas

Co-Chair
Ed Gilliard
Burlington Resources, Inc.

Robert L. Brown
Natural Gas Business Consultant

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Union Pacific Resources

Ed Porter
American Petroleum Institute

John Pyrdol
Department of Energy
Office of Fossil Energy

Harry Vidas
Energy & Environmental Analysis

BRIDGER-TETON NATIONAL FOREST

Cross Reference to Oil & Gas Leasing (FY94)

NOT AVAILABLE FOR LEASING - GIS MAP 1

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
WILDERNESS is any portion of the parcel within MA 91 (Teton Wilderness); MA 92 (Gros Ventre Wilderness); or MA 96 (Bridger Wilderness) DFC's 6A-6D) (p.189)	nlwild.t	Designated wilderness are legislatively withdrawn from leasing. Unless BLM can identify unavailable lands using a surveyed wilderness boundary, unavailable lands must be identified using public land survey lines. For example, available lands within a 1/41/4 section containing wilderness lands will not be available for leasing until the wilderness boundary has been surveyed.	
KRUG MEMORANDUM is any portion of the parcel north of the 11th Standard parallel (p. 263)	krug.t	Within MA 61, lands north of the 11th Standard Parallel were withheld indefinitely from leasing by the Krug Memorandum of 1947.	
SHOAL CREEK WSA is any portion of the parcel within the Shoal Creek Wilderness Study Area (MA 93) designated by the 1984 Wyoming Wilderness Act (p. 196)	nlwild.t	The Shoal Creek WSA is legislatively withdrawn from leasing pending completion of a wilderness study during a future Forest Plan Revision. Unless BLM can identify unavailable lands using a surveyed boundary, unavailable lands must be identified using public land survey lines. For example, available lands within a 1.41.4 section containing wilderness study area lands will not be available for leasing until the wilderness study area lands will not be available for leasing until the wilderness study area boundary has been surveyed.	
DFC/MA COMBINATIONS is any portion of the parcel within: DFC 2A MA12 (p. 217), MA13 (p.319), MA 35 (p. 299), MA 41 (p. 277), MA44 (p. 271), MA 47 (p. 287); or DFC 2B MA 35 (p.), MA 41 (p. 277), MA 44 (p.), or MA 62 (p. 265); or DFC 4 MA 32, (p.); or DFC 9A MA 41, (p.); or DFC 9B MA 41, (p. 277)	nldfc.t		

NOT AVAILABLE FOR LEASING - GIS MAP 1 (continued)

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
MA 32 is any portion of the parcel within the DFC 10 area just south of Alpine (p.)	no GIS	This area is not available for leasing. Unless BLM can identify unavailable lands using a surveyed boundary, unavailable lands must be identified using public land survey lines. For example, available lands within a 1/41/4 section containing unavailable lands will not be available for leasing unless the DFC and/or MA boundary has been surveyed.	
PERIODIC SPRINGS is any portion of the parcel within the DFC 4 area surrounding Periodic Springs and its recharge area, within MA's 33 and 34 (p. 301, p.)	nla.t	This area is not available for leasing. Unless BLM can identify unavailable lands using a surveyed boundary, unavailable lands must be identified using public land survey lines. For example, available lands within a 1/41/4 section containing unavailable lands will not be available for leasing unless the DFC and/or MA boundary has been surveyed.	
KENDALL WARM SPRINGS is any portion of the parcel within the 1200 acre area affected by the Kendall Warm Springs withdrawal standard, within MA 72? (p. 287, and ROD Attachment One, p. 4-5)	no GIS	This area is not available for leasing. Unavailable lands will be identified using public land survey lines.	
SWEENY LAKES is any portion of the parcel within the DFC 2A area around Sweeny Lakes, in MA 73? (p. 289)	nlb.t	This area is not available for leasing. Unless BLM can identify unavailable lands using a surveyed boundary, unavailable lands must be identified using public land survey lines. For example, available lands within a 1/41/4 section containing unavailable lands will not be available for leasing unless the DFC and/or MA boundary has been surveyed.	
MA 75 is any portion of the parcel within the DFC 2A areas at the head of Big Sandy Creek and at the south end of the Wind River Range? (p. 293)	nlb.t	These areas re not available for leasing. Unless BLM can identify unavailable lands using a surveyed boundary, unavailable lands must be identified using public land survey lines. For example, available lands within a 1/41/4 section containing unavailable lands will not be available for leasing unless the DFC and/or MA boundary has been surveyed.	

TECHNICAL NO SURFACE OCCUPANCY STIPULATION AREAS - GIS MAP 1 <tnso>

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
STEEP SLOPES, UNSTABLE SOILS, LANDSLIDE AREAS Does any portion of the parcel contain slopes in excess of 40 percent, technically unsuitable soils, or unstable landslide areas? (Forest Plan Appendix B, p. 8 and FEIS Appendix B, p. 34-41)	tnso	These areas require a Technical No Surface Occupancy Stipulation, which prohibits surface occupancy of areas with slopes in excess of 40 percent, technically unsuitable soils, or unstable landslides.	

FREMONT AND "SPECIAL LAKES" STIPULATION AREAS - GIS MAP 1 included in <anso>

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
FREMONT LAKE (MA 73) is any portion of the parcel within 1000 feet of the shoreline of Fremont Lake or its outlet? (p. 289, Appendix B, p. 7)	nso3.t	This area requires the Fremont Lake Stipulation, which prohibits surface occupancy and directional drilling, in order to protect the integrity of the lake and its watershed.	
NEW FORK, WILLOW, HALF MOON, BURNT, AN D BOULDER LAKES (MA'S 72 AND 73) is any portion of the parcel within 1000 feet of the shoreline or outlets of New Fork Lakes, Willow Lake, Half Moon Lake, Burnt Lake, or Boulder Lake? (p. 287, 289, Appendix B, p. 7)	nsolakes.t	These areas require a "Special Lakes" Stipulation, which, prohibits surface occupancy, in order to protect the integrity of these lakes and water quality.	

ADMINISTRATIVE NO SURFACE OCCUPANCY STIPULATION AREAS - GIS MAP 1 <anso>

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
RECREATION MANAGEMENT AREAS (DFC/MA COMBINATIONS) is any portion of the parcel within: DFC 2 MA 25 (p. 163,311); MA 26 (p. 163, 313); MA 32 (p. 163, 297); MA 48 (p. 163, 283); MA 49 (p. 163, 285); MA 61 (p. 163, 263); or MA 72 (p. 163, 287); or DFC 2B MA 72 (p. 169, 287)?	nso6..t	These areas require a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to maintain the quality of recreation experience.	
DFC 3 is any portion of the parcel within DFC 3? (p. 176)	nsodfc..t	These areas require a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect acenic values and maintain the quality of river recreation experiences.	

ADMINISTRATIVE NO SURFACE OCCUPANCY STIPULATION AREAS - GIS MAP 1 <anso> (continued)

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
MA 22 and MA 49 Is any portion of the parcel located within the bighorn sheep area which straddles the boundary between the two MA's? (refer to O&G Leasing EA's for MA's 22/23 and MA 49)	map 1bhs	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect crucial wildlife habitat.	
MA 23 Is any portion of the parcel within the elk feedground located along the Hoback River? (refer to O&G Leasing EA for MA's 22/23)	no GIS	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect the elk feedground.	
MA 26 Is any portion of the parcel within the bighorn sheep area in MA 26? (p. 313)	map1bhs	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect important bighorn sheep habitat.	
COMMISSARY RIDGE is any portion of the parcel located in DFC 12 within 1 mile of the crest of Commissary Ridge, in MA 11 or MA 12? (p. 315, O&G Leasing EA for MA 12)	nso6.t	Areas affected which are available for leasing require a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect DFC 12 areas near Commissary Ridge.	
SALT RIVER OR WYOMING RANGE CRESTS Is any portion of the parcel within 0.5 miles of the crests of the Salt River or Wyoming Ranges in MA's 11, 22, 23, 24, 25, 26, 31, 32, 33, 34, 35, 48, or 49? (p.)	no GIS	Areas affected which are available for leasing require a No Surface Occupancy Stipulation, which prohibits surface occupancy. The one-mile-wide strip along the crests is protected in order to maintain the quality of recreation experiences, including the National Recreational Trail along the crest of the Wyoming Range.	
WILD & SCENIC RIVERS Is any portion of the parcel within an area which requires a No Surface Occupancy Stipulation in order to protect watercourses eligible for designation? (refer to Forest Plan Amendment No. 2, p.)	no GIS	Areas identified require a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect watercourses eligible for designation.	
NATIONAL TRAILS Does any portion of the parcel contain designated or proposed National Recreational, Scenic or Historic Trails? (p. 141,)	no GIS	Trails affected require a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to maintain the quality of recreation experiences.	
RESEARCH NATURAL AREAS Is any portion of the parcel within a designed, proposed, or candidate Research National Area? (p. <fwaoma>	map1ma	Areas affected require a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to maintain the area in its natural condition.	

TIMING STIPULATION AREAS - GIS MAP 2

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
JACKSON ELK HERD Is any portion of the parcel within crucial elk winter range in MA'S 42, 43, 44, 45, 46, AND 71? (p. 261, 267, 269, 271, 273, 279, Appendix B, p. 9, and ROD Attachment One, p. 5)	map2jeh	These areas require a Jackson Elk Herd Stipulation, which, restricts activity and disturbance between November 15 and April 30 in order to protect the Jackson Elk Herd and its crucial winter range.	
CRUCIAL WINTER RANGES Is any portion of the parcel within crucial winter range (excluding crucial winter ranges requiring a No Surface Occupancy Stipulation, and excluding elk winter ranges within MA's 42, 43, 44, 45, 46, and 71 which require the Jackson Elk Her Stipulation)? Check G&F maps accepted by the FS as the official maps. (p. 124)	map2cwrstip map2cwr	These areas require a Timing Stipulation, which restricts human activity and disturbance between November 15 and April 30 if big game are present in the area, in order to protect wintering big game. Same as above with specie lines dissolved for cleaner plots.	
ELK CALVING AREAS Is any portion of the parcel within an elk calving area? (p. 124)	map2epa	These areas require a Timing Stipulation, which restricts human activity and disturbance between May 15 and June 30 of elk are present in the area	
BIG GAME PARTURITION AREAS Is any portion of the parcel within a parturition (birthing) area for any other big game animals? (p.)	no GIS	These areas require a Timing Stipulation, which restricts human activity and disturbance between May 15 and June 30 if specified big game animals are present in the area.	Requires IDT
GRIZZLY BEAR Is any portion of the parcel within DFC 7A or DFC 7B in MA's 45, 61, or 62? (P. 204, 210-211)	no GIS	These areas require a Timing Stipulation, which restricts human activity and disturbance between _____ if grizzly bears are present in the area. The Timing Stipulation can be applied within all, parts, or none of DFC 12, as appropriate, in order to protect wildlife values.	Requires IDT
DFC 12 Is any portion of the parcel within DFC 12? (p. 245, and the Regional Forester's Conveyance Letter of 2/20/90, p. 18)	no GIS		Requires IDT

CONTROLLED SURFACE USE STIPULATION AREAS - GIS MAP 3

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
GRIZZLY BEARS Is any portion of the parcel within DFC 7A or DFC 7B, in MA's 45, 61, or 62? (p. 204, 210-211, Appendix B, p. 8-9)	csu	These areas require a Controlled Surface Use Stipulation, to mitigate the effects of roading , exploration, and development on the grizzly bear, minimize human-grizzly contact, end facilitate the recovery of the grizzly bear.	
MA 11 Is any portion of the parcel within ? (p.)	no GIS	This area requires a Controlled Surface Use Stipulation, to _____.	

CONTROLLED SURFACE USE STIPULATION AREAS - GIS MAP 3 (continued)

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
MA 13 Is any portion of the parcel within crucial elk winter range located on Tunp Ridge? (p. 319)	no GIS: D1	This area requires a Controlled Surface Use Stipulation. Impacts on wildlife are mitigated by requiring off-site production facilities.	
MA 21 Is any portion of the parcel within crucial elk winter range located on Raspberry Ridge? (p. 305)	map3csu21	This area requires a Controlled Surface Use Stipulation. Impacts on wildlife are mitigated by requiring off-site production facilities.	
DFC 12 Is any portion of the parcel within DFC 12? (p. 245, and the Regional Forester's Conveyance Letter of 2/20/90, p. 18)	no GIS	This area requires a Controlled Surface Use Stipulation can be applied within all, parts, or none of DFC 12, as appropriate, in order to mitigate effects on wildlife.	Requires IDT

OTHER STIPULATION AREAS - GIS MAP 3

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
BRIDGER-TETON NATIONAL FOREST Does the parcel contain lands administered by the Bridger-Teton National Forest? (refer to Forest Plan Amendment No. 1, and Appendix B, p. 3)	no GIS	The Stipulation for Lands Administered by the Bridger-Teton National Forest is required. The USDA Standard Stipulation also is required.	
TETON NATIONAL FOREST Is any portion of the parcel within the Teton National Forest? (Appendix B, p. 12-13)	Jhasnl	The Jackson Hole Area Stipulation is required for all lands south of the 11th Standard Parallel, within the Teton National Forest, which are available for leasing, the wording for this stipulation was established by the Krug Memorandum of 1947.	
PALISADES WSA Is any portion of the parcel within the Palisades Wilderness Study Area (MA's 95 and 95)? (p. 257, Appendix B, p. 10-11)	pal	The Palisades Conditional No Surface Occupancy Stipulation and the Palisades Coordinated Exploration Stipulation are required for the Palisades Wilderness Study Area in order to protect special resource values and maintain eligibility for Congressional designation as a wilderness.	
GRIZZLY BEAR Is any portion of the parcel within DFC 7A or DFC 7B, in MA's 45, 61, or 62? (p. 204, 210-211, Appendix B, p. 8-9)	griz	This area requires the Grizzly Bear Conditional No Surface Occupancy Stipulation, to ensure the continued recovery of the grizzly bear if it is delisted.	Not standard plot

LEASE NOTICE AREAS - GIS MAP 4 and Others

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
RESTRICTED OR PROHIBITED ACCESS Would access to this parcel need to cross any area which is not available for leasing, or which is available for leasing only what technical no surface occupancy, special "lakes" no surface occupancy, no surface occupancy, or conditional no surface occupancy stipulation? (refer to Forest Plan Amendments No. 1)	no GIS	Review the Forest-wide, Management Area, and Desired Future Condition direction for the area involved, to determine what restrictions and conditions. If any, apply to new road construction. If standards may preclude, or will preclude road access to a well location, or if steep slopes, unsuitable soils or landslides surround the area, use a Lease Notice for Difficult or impossible Access to make the leaseholder aware that road access to the parcel may be difficult or impossible.	
VISUAL QUALITY OBJECTIVES Have visual quality objectives been adopted? (refer to Forest Plan Amendment No. 1)	no GIS	Consider whether the Lease Notice for Visual Quality Objectives needs to be required for this parcel.	
THREATENED OR ENDANGERED SPECIES Are there any concerns related to a Threatened or Endangered Species? (refer to Forest Plan Amendment No. 1)	map4birds	Consider whether the Lease Notice for Threatened and Endangered Species needs to be required for this parcel. Identify the species of concern on the notice, i.e., grizzly bear, bald eagle, peregrine falcon, trumpeter swan, or whooping crane.	
SENSITIVE SPECIES Are there any concerns related to a Sensitive Species? (refer to Forest Plan Amendment No.1)	no GIS	Consider whether the Lease Notice for Sensitive Species needs to be required for this parcel. Identify the species of concern on the notice.	
OLD GROWTH Does any portion of the parcel contain old growth stand(s) which need to have old growth management emphasized? (p. 129, O&G Leasing EA for MA 12)	no GIS	Consider whether the Lease Notice for Old Growth Stands needs to be required for this parcel.	Requires IDT validation

OTHER CONCERNS - DETERMINE WHETHER A FOREST PLAN AMENDMENT IS NEEDED

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
CULTURAL, HISTORICAL, OR PALEONTOLOGICAL RESOURCES Are there any special concerns that are not addressed by the standard lease terms?	proprietary	Consider whether a special lease notice or stipulation is needed.	In GIS, only accessible by Forest Archeologist
COORDINATION Is any portion of the parcel within 1 mile of lands administered or regulated by another FS unit or another agency?	no GIS	Confer with any adjoining unit or other agencies to document management needs and/or coordinate leasing analyses.	

OTHER CONCERNS - DETERMINE WHETHER A FOREST PLAN AMENDMENT IS NEEDED (continued)

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
NATIONAL SCENIC BYWAYS Has any portion of the parcel been designated bas a National Scenic Byway? (ROD Attachment One, p. 2)	no GIS	Consider whether a special lease notice or stipulation is needed. Consider with any adjoining unit or other agencies to document management needs and/or coordinate leasing analyses.	
GRAND TETON NATIONAL PARK VISUAL QUALITY STANDARD Is any portion of the parcel visible from the Signal Mountain Overlook? Can any portion of the parcel be seen by boaters along the Snake Rive or motorist along roads within Grand Teton National Park? Is the parcel within MA's 43, 61, or 62? (ROD Attachment One, p. 4)	no GIS	Consider whether a special lease notice or stipulation is needed. Consider with any adjoining unit or other agencies to document management needs and/or coordinate leasing anlyses.	Required IDT
OTHER VISUAL QUALITY CONCERNS Are there any concerns that are not addressed?	no GIS	Consider whether a special lease notice or stipulation is needed.	Required IDT
SPECIAL AREAS (NATIONAL LANDMARKS) Does an existing or proposed National Natural Landmark occur within any portion of the parcel? (48, 142)	no GIS	Consider whether a special lease notice or stipulation is needed in order to preserve the integrity of the landmark.	Required IDT
WILD & SCENIC RIVERS Does the parcel contain water courses eligible for designation or is the parcel located very near water courses eligible for designation? (refer to Forest Plan Amendment No. 2, p.)	no GIS	Consider whether a special lease notice or stipulation is needed.	Required IDT
OTHER CONCERNS Are there any other concerns or possible cumulative effects not mentioned above?	no GIS	Consider whether a special lease notice or stipulation is needed.	Requires IDT

ADMINISTRATIVE NO SURFACE OCCUPANCY STIPULATION AREAS - GIS MAP 1 <anso> (Continued)

ITEM OF CONCERN	GIS FILE	MITIGATING MEASURES	ACTION
DFC 9AAND DFC 9B Is any portion of the parcel within DFC 9A or DFC 9B, except in MA's 41 and 73? (p. 224, 229, 277, and 289)	nsodfc.t	These areas require a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect campgrounds, other developed recreational sites, special use recreation areas, and administrative sites.	
MA 22 Is any portion of the parcel within the DFC 2B area located along the Hoback River? (p. 275)	nso3.t	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to maintain the quality of recreation experiences.	
MA's 33 AND 34 Is any portion of the parcel within DFC 4, except the DFC 4 area surrounding Periodic Springs? (p. 181, 301,)	nsodfc4.t	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect quality water quality.	
MA 72 Is any portion of the parcel within the DFC 2B, DFC 9A, or DFC 9B areas near New Fork Lakes, that are not within 1000 feet of the shorelines? (p. 287, Appendix B p. 7)	nsolakes.t	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to maintain the quality of recreation experiences and protect developed sites.	
MA 73 Is any portion of the parcel within: the DFC 2A area near Fremont Lakes, that is not within 1000 feet of the shoreline; the DFC 2B areas near Fremont and Boulder Lakes, that are not within 1000 feet of the shorelines; or the DFC 9A and DFC 9B areas near Half Moon and Burnt Lakes, that are not within 1000 feet of the shorelines (p. 289, Appendix B, p. 7)?	No GIS	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to maintain the quality of recreation experiences and protect developed sites.	
MA 75 Is any portion of the parcel within the DFC 2A area located west of Pool Creek? (P. 293)	nso3.t	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to maintain the quality of recreation experiences.	
IDENTIFIED CRUCIAL WINTER RANGES Is any portion of the parcel located within: **MA 12** - Crucial elk winter range on Absaroka Ridge, west of Mahogany Ridge (p. 317); <map1cw12> or **MA 33** - Crucial winter ranges along the Afton Front (p. 301); <map1cwaf> or **MA 34** - Crucial winter ranges along the Afton Front (p. 303); <map1cwaf> or **MA 41** - Crucial elk, deer, and moose winter ranges along the Snake and Hoback Rivers (p. 277); <mat1cw41> or **MA 47** - Crucial winter ranges (p. 281); <map1cw47> or **MA 48** - Crucial elk, deer, and moose winter ranges along the Snake and Hoback Rivers; or in a designated area surrounding a bald eagle nesting territory (p. 283)? <map1cw48>	map1cwr	This area requires a No Surface Occupancy Stipulation, which prohibits surface occupancy, in order to protect crucial big game winter ranges.	

Manti-La Sal Calibration Area Stipulations

SUMMARY OF OIL AND GAS LEASING DIRECTION
LAND AND RESOURCE MANAGEMENT PLAN
MANTI-LA SAL NATIONAL FOREST
MARCH 22, 2000

The following is a description of Forest Plan direction for oil and gas leasing on National Forest System lands administered by the Manti-La Sal National Forest. The Record of Decision (ROD), dated January 1994, based on the Final Environmental Impact Statement for Oil and Gas Leasing on Lands Administered by the Manti-La Sal National Forest, amended the Forest Plan establishing current direction for oil and gas leasing.

The oil and gas estates within the exterior boundaries of the Forest are divided into four different categories regarding availability for leasing as follows:

- Areas where the oil and gas estate is not under Federal ownership and is not available for leasing by the Bureau of Land Management (BLM).

- Areas that have been legislatively closed to leasing by specific Acts of Congress. These areas are identified in the Forest Plan as "not legally open to leasing (NOL)".

- Areas where conflicting resource objectives cannot be adequately mitigated and have been determined to not be available for leasing by administrative decision. These areas are identified in the Forest Plan as "not administratively available for leasing (NAL)".

- Areas open to leasing.

Non-Federal oil and gas estates and the Dark Canyon Wilderness Area (approximately 47,000 acres) designated under the Wilderness Act of 1984 are not legally open to leasing (NOL).

The following description identifies areas not administratively available for leasing (NAL) and those areas available for leasing with a description the Forestwide and Site-Specific lease stipulations that would be incorporated into the leases. These stipulations are in addition to the standard terms and conditions on BLM Oil and Gas Lease Form 3100-11. Criteria for which exceptions, modifications, and waivers of stipulations would be considered are included in italics. The total area of the Forest legally open to leasing is approximately 1,291,555 acres. Of this area, approximately 1,173,376 acres (91%) are administratively available for leasing. Approximately 57% of the area administratively available for leasing is available for surface occupancy after considering the No Surface Occupancy Stipulations for slopes greater than 35% and sensitive resource areas.

MINERALS MANAGEMENT LEASABLES (GO2 to 07), 01, Page 111-35 of Amended Forest Plan

a. Any lease, license or permit may be denied or limited by standard or other stipulations where proposed activities could result in irreparable damage, may preclude existing uses or be contrary to management direction. The following areas would not be administratively available for oil and gas leasing (Plate 3, Oil and Gas Leasing Map, Alternative III (Modified Forest Plan)).

(1) The Peavine Corridor SPR Management Unit.

(2) The La Sal Peaks Oil and Gas Analysis Area.

(3) The major peaks and passes of the Abajo Mountains.

(4) That portion of the Sinbad Ridge/Sewemup Mesa area that extends north of Salt Creek and Garvey Gulch adjacent to the Sewemup Wilderness Study Area.

(5) High density/low disturbance cultural resource areas in the San Juan Analysis Area.

(6) Research Natural Areas (RNA).

b. Stipulations (Uniform Format for Oil and Gas Lease Stipulations, Rocky Mountain Regional Coordinating Committee, March 1989) will be used in oil and gas leases as appropriate (ROD, Page A-5). Plate 3 (Alternative III Stipulation Map) shows stipulations and where they would be applied. Criteria under which waivers, exceptions, or modifications could be considered are identified in italics. Where no criteria are identified the stipulations would be considered to be rigid.

The following stipulations will be applied to each lease on a Forest wide basis:

(1) Stipulation for Lands of the National Forest System Under Jurisdiction of the Department of Agriculture

(2) The following No Surface Occupancy (NSO) Stipulation would be applied to all oil and gas leases:

- Slope is greater than 35%. *Could be excepted if it is determined that erosion and sediment yield can be controlled, reclamation would be consistent with Forest Plan goals, land instability would not be induced, and visual quality objectives could be met. This would*

- Geologic or erosion hazard rating is high. *Could be excepted if it is demonstrated that operations would not cause instability or the site can be stabilized.*

- Within 200 ft. from arterial and collector roads. *Could be excepted if it can be demonstrated that operations would adequately provide for public safety, would not damage or interfere with the Forest Transportation System, and would be consistent with visual quality objectives.*

- Within 200 feet of riparian areas. It is not intended to prohibit perpendicular crossings of riparian areas by roads if it is determined that riparian areas can be replaced after completion of operations. *Could be excepted if it is determined that riparian areas can be replaced upon reclamation and disturbance would be consistent with other Forest Plan goals.*

- Within Retention and Preservation Visual Quality Objective Areas. *Could be excepted if it is determined that operations could be adequately screened from view and would meet the visual quality objective.*

- Sage Grouse Leks, Nesting, and Brooding Areas.

(3) This Timing Limitation Stipulation (TL2) is used on all leases to prevent surface occupancy for construction of facilities and drilling from May 1 to July 5. The purpose of this stipulation is to protect elk during the calving season and protected raptors/migratory birds during the nesting season. This stipulation can be adjusted by up to 7 days at each end of the season without a lease modification. *Could be excepted if it is determined that the project area is not a traditional elk calving area or is not being used due to seasonal variations.*

SITE-SPECIFIC DIRECTION/STIPULATIONS

Stipulations would be applied to leases in specific areas to protect resources or mitigate impacts. Site-specific stipulations are used on areas available for leasing as follows:

(1) No Surface Occupancy Stipulation in the following areas:

- DRS (Developed Recreation Sites) Management Units

- Huntington Canyon UDM (Undeveloped Motorized Recreation) Management Unit. This stipulation would not prohibit project roads from being constructed from State Highway 31 to adjacent areas.

- Sage Grouse Leks, Nesting, and Brooding Areas.

- SPR (Semiprimitive Recreation) Management Units High-Use Areas (see Oil and Gas Leasing EIS, Plate 3).

- SLD (Special Land Designation) Management Units. Could be excepted if operations would not conflict with administration.

- RPI (Research Protection and Interpretation) Management Units. Would be waived if RPI areas are studied and are not designated as Research Natural Areas (RNA).

- MWS (Municipal Water Supply) Management Units.

- WPE (Watershed Protection and Improvement) Management Units within MWS Management Units.

- Retention and Preservation Visual Quality Objective Areas. Could be excepted if it is determined that operations could be adequately screened from view and would meet the visual quality objective.

(2) Timing Limitation Stipulation (TL1) would be used to prevent surface occupancy for construction of facilities and drilling in the following areas:

- GWR (General Big Game Winter Range) and KWR (Key Winter Range) Management Units. Surface occupancy for construction of facilities and drilling would not be allowed from December 1 to April 15 to protect elk and deer in their general winter habitat. These dates can be adjusted by up to 7 days at each end without lease modification. Could be excepted if winter range is not being used.

(3) Controlled Surface Use Stipulation (CSU) would be applied to the following areas as described below:

- GWR (General Big Game Winter Range) Management Units. Surface disturbance (including animal behavioral avoidance) is limited to 10% of any GWR unit (CSU2). Could be excepted if adjacent habitat is enhanced, increasing GWR or KWR habitat in or adjacent to the unit disturbed.

- KWR (Key Big Game Winter Range) Management Units. Surface disturbance (including animal behavioral avoidance) is limited to 1% of any KWR unit (CSU2). Could be excepted if adjacent habitat is enhanced, increasing KWR habitat in the unit being disturbed.

- SPR (Semiprimitive Recreation) Management Units, Low-Use Areas (see Plate 3). Only essential facilities allowed (CSU1).

(4) All Other Areas - Standard Terms and Forestwide Stipulations Only. Standard terms would allow moving sites up to 200 meters (660 feet) and delaying operations up to 60 days in any lease year. All operations would be required to be consistent with non-discretionary laws.

Uinta Calibration Area Stipulations

APPENDIX A
STANDARD LEASE TERMS (BLM FORM 3100-11) AND LEASE STIPULATIONS

INTRODUCTION

The following information pertaining to lease stipulations is taken from the booklet, "Uniform Format For oil And Gas Lease Stipulation," prepared by the Rocky Mountain (in Regional Coordinating Committee in March 1989. These guidelines were developed by the Bureau of Land Management (BLM) and the Forest Service.

Stipulations are conditions, promises, or demands to be part of a lease only when the environmental and planning record demonstrates the necessity for the stipulations. Stipulations, as such, axe neither "standard" nor "special", but rather a necessary modification of the terms of the lease. The forms, given at the end of this appendix, provide for standardized structure, wording, and usage. In order to accommodate the variety of resources encountered on Federal lands, these stipulations are categorized as to how the stipulation modifies the lease rights, not by the resource(s) to be protected. What, why, and how this mitigation/protection is to be accomplished is determined by the land management agency through land use planning and National Environmental Policy Act (NEPA) analysis.

IMPLEMENTATION

If upon weighing the relative resource values, uses, and/or users identified that conflict with oil and gas operations and cannot be adequately managed and/or accommodated on other lands, a lease stipulation is necessary. Land use plans serve as the primary vehicle for determining the necessity for lease stipulations (BLM Manual 1624). Documentation of the necessity for a stipulation is disclosed in planning documents or through site-specific analysis. Land use plans and/or NEPA documents also establish the guidelines by which future waivers, exceptions, or modifications may be granted. Substantial modification or waiver subsequent to lease issuance is subject to public review for at least a 30-day period in accordance with Section 5102.f of the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (FOOGLRA).

Stipulations may be necessary if the authority to control the activity on the lease does not already exist under laws, regulations, or orders. It is important to recognize that the authorized officer has the authority to modify the site location and design of facilities, control the rate of development and timing of activities as well as require other mitigation under Sections 2 and 6 of the standard lease terms (BLM Form 3 100-11, Attachment A-1) and 43 CFR 3101.1-2.

The necessity for individual lease stipulations is documented in the lease-file record with reference to the appropriate land use plan or other leasing analysis document The necessity for exceptions, waivers, or modifications also will be documented in the lease-file record through reference to the appropriate plan or other analysis. The uniform format for stipulations should be implemented when amendments or revisions of land use plans are prepared or by other appropriate means.

The uniform format for stipulations is designed to accommodate most existing stipulations by providing space to record the local mitigation objectives. The stipulations have been developed for the categories of':

- no surface occupancy,

- timing or seasonal restriction, and

- controlled surface use.

This guidance also includes the use of lease notices. Also, there is provision for special or unique stipulations, such as those required by prior agreements between agencies when the standardized forms are not appropriate. In all cases, use of the uniform forms for stipulations require identification of specific resource values to be protected and description of specific geographical area covered. Stipulations attached to non-competitive leases require the applicant's acceptance and signature.

DEFINITIONS

Conditions of Approval (COA). Conditions or provisions (requirements) under which an Application for a Permit to Drill or a Sundry Notice is approved.

Controlled Surface Use (CSU). Use and occupancy is allowed (unless restricted by another stipulation), but identified resource values require special operational constraints that may modify the lease rights. CSU is used for operating guidance, not as a substitute for the NSO or timing stipulations.

Exception. Case-by-case exemption from a lease stipulation. The stipulation continues to apply to all other sites within the leasehold to which the restrictive criteria apply.

Lease Notice. Provides more detailed information concerning limitations that already exist in law, lease terms, regulations, or operational orders. A Lease Notice also addresses special item the lessee should consider when planning operations, but does not impose new or additional restrictions. Lease Notices attached to leases should not be confused with Notices to Lessees (NTL). (See 43 CFR 3160.0-5)

Modification. Fundamental change to the provisions of a lease stipulation, either temporarily or for the term of the tease. Therefore, a modification may include an exemption from or alteration to a stipulated requirement. Depending on the specific modification, the stipulation may or may not apply to all other sites within the leasehold to which the restrictive criteria apply.

No Surface Occupancy (NSO). Use or occupancy of the land surface for fluid mineral exploration or development is prohibited to protect identified resource values. The NSO stipulation includes stipulations that may have been worded as "No Surface Use/Occupancy," 'No surface Disturbance," "Conditional NSO," and "Surface Disturbance or Surface Occupancy Restriction (by location)."

Notice to Lessees (NTL). The NTL is a written notice issued by the authorized officer. NTLs implement regulations and operating orders, and serve as instructions on specific item(s) of importance within a State, District, or Area.

Stipulation. A provision that modifies standard least fights and is attached to and made a part of the lease.

Timing Limitation (Seasonal restriction). Prohibits surface use during specified time periods to protect identified resource values. This stipulation does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation and that less stringent, project-specific mitigation measures would be insufficient.

Waiver. Permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.

NO SURFACE OCCUPANCY STIPULATION GUIDANCE

The No Surface Occupancy (NSO) stipulation is intended for use only when the stipulations are determined insufficient to adequately protect the public interest. The land use plan/NEPA document prepared for leasing must show that less restrictive stipulations were considered and determined by the authorized officer to be insufficient. The planning/NEPA record must also show that consideration was given to a no-lease alternative when applying an NSO stipulation. An NSO stipulation is not needed if the desired protection would not require relocation of proposed operations by more that 200 meters (43 CFR 3101.1-2).

The legal subdivision, distance, location, or geographic feature and resource value of concern must be identified in the stipulation and be tied to a land use plan and/or NEPA document. Land description may be stated as: the "Entire Lease", distance from resources and facilities such as rivers, trails, campgrounds, etc.; legal description; geographic feature such as a 100-year floodplain, municipal watershed, percent of slope, etc.; special area with identified boundaries—area of critical environmental concern, wild and scenic river, etc.; or other description that specifies the boundaries of the lands affected. The estimated percent of the total lease area affected by the restriction must be given if no legal or geographic description of the location of the restriction is given. In other cases the estimated percent is optional. (See Example A-1.)

Land use plans and/or NEPA documents should identify the specific conditions for providing waivers, exceptions, or modifications to lease stipulations. Waivers, exceptions, or modifications must be supported by appropriate environmental analysis

and documentation, and subject to the same test used to initially justify the imposition of this stipulation. Language may be added to the NSO stipulation form to provide the lessee with information or circumstances under which waivers, exceptions, or modifications would be considered. A waiver, exception, or modification may be approved if the record shows that circumstances or relative resource values have changed or that the lessee can demonstrate that operations can be conducted without causing unacceptable impacts, and that less restrictive stipulations will protect the public interest. Waivers, exceptions, or modification can only be granted by the authorized officer. If the waiver, exception, or modification is inconsistent with the land use planning document, that document must be amended as necessary, or the change disallowed.

If the authorized officer determines, prior to lease issuance, that a stipulation involves an issue of major concern, modification or waiver of the stipulation will be subject to public review (43 CFR 3101.1-4). The land use plan also may identify other cases when a public review is required for a waiver, exception, or modification. In such cases, wording such as the following should be added to the stipulation form to inform the lessee of the required public review: "A 30-day public notice period is required prior to modification or waiver of this stipulation."

TIMING LIMITATION STIPULATION GUIDANCE

The Timing Limitation Stipulation (often called seasonal) prohibits fluid mineral exploration and development activities for time periods less than yearlong. When using this stipulation, assure that date(s) and location(s) are as specific as possible. A limitation involves the prohibition of new surface-disturbing operations for periods of less that 60 days (43 CFR 3101.1-2).

The land use plan/NEPA document prepared for leasing must show that less restrictive stipulations were considered to be insufficient. The environmental effects of exploration, development, and production activities may differ markedly from each in scope and intensity. If the effects of reasonably foreseeable production activities necessitate timing limitation requirements, this need should be clearly documented in the record. The record also should show that less stringent, project-specific mitigation may be insufficient. In such cases the stipulation language should be modified on a case-by-case basis to clearly document that the timing limitation applies to all stages of activity.

The legal subdivision, distance, location, or geographic feature, and resource value of concern must be identified in the stipulation and be tied to a land use planning and/or NEPA document The timing limitations for separate purposes may be written an separate forms or as combined stipulation. (See Example A-2.) During the review and decision-making process for Application for Permit to Drill (APD) and Sundry Notices, the date(s) and locations(s) should be refined based on current information.

EXAMPLE A-1

Serial Number _____

NO SURFACE OCCUPANCY STIPULATION

No surface occupancy or use is allowed on lands described below (legal subdivision or other description).

a. T2N, R10E SLM
Section 26, NE1/4 SWI/4

b. T2N, R14E
Section 30, W1/2

For the purpose of:

a. Avoidance of steep slopes exceeding 35 percent to avoid mass slope-failure and erosion Western Uinta Basin Oil and Gas Leasing EIS

b. Protection of riparian area as discussed in Forest Plan (page ___) and EIS (page __).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or Forest Service Manual 1950 and 2820.)

Form #/Date

EXAMPLE A-2

Serial Number _____

TIMING LIMITATION STIPULATION

No surface use is allowed during the following time period(s); this stipulation does not apply to operation and maintenance of production facilities.

a. May 1 to June 30

b. November 15 to April 30

On the lands described below:

a. T3N, R14E, Section 3, E1/2

b. T2N, R17E, Section 2: All

For the purpose of:

a. protect elk calving area; Forest Plan (page ___) and EIS (page ___).

b. protect elk winter range. This does not apply to operation and maintenance of production facilities; Western Uinta Basin Oil and Gas Leasing EIS (page ___).

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or Forest Service Manual 1950 and 2820.)

Form #/Date

Land use plans and/or NEPA documents should identify the specific conditions for providing waivers, exceptions, or modifications to lease stipulations. Waivers, exceptions, or modifications of this stipulation, such as continuing drilling operations into a restricted time period, must be supported with appropriate environmental analysis and documentation, and would be subject to the same test used to initially justify the imposition of this stipulation. Language may be added to the stipulation form to provide the lessee with information or circumstances under which waiver, exception, or modification would be considered. The need for one-time, case-by-case exceptions of timing limitation stipulation may arise from complications or emergencies during the drilling program. The need for timely review and decision malting is great in such cases. For this reason, it is desirable that land use plans/NEPA documents clarify what review procedures and other requirements, if any, would apply in such cases.

A waiver, exception, or modification may be approved if the record shows that circumstances or relative resource values have changed or that the lessee can demonstrate that operations can be conducted without causing unacceptable impacts, and that less restrictive stipulations would protect the public interest. Waivers, exceptions or modifications can only be granted by the authorized officer. If the waiver, exception or modification is inconsistent with the land use planning document, and that document does not disclose the conditions under which such changes would be allowed, the plan or NEPA document must be amended as necessary, or the change disallowed.

If the authorized officer determines, prior to lease issuance, that a stipulation involves an issue of major concern, modification or waiver of the stipulation would be subject to public review (e.g., 43 CFR 3101.1-4). The land use plan also may identify other cam when a public review is required for waiver, exception, or modification. In such cases, wording such as the Mowing should be added to the stipulation form to inform the lessee of the required public review: "A 30-day public notice period is required prior to modification or waiver of this stipulation."

CONTROLLED SURFACE USE STIMULATION GUIDANCE

The Controlled Surface Use (CSU) stipulation is intended to be used when fluid mineral occupancy and use are generally allowed on all or portions of the lease area year-round, but because of special values, or resource concerns, lease activities must be strictly controlled. This stipulation replaces stipulations commonly referred to as limited Surface Use stipulations. The CSU stipulation is used to identify constraints on surface use or operations that may otherwise exceed the mitigation provided by Section 6 of the standard lease terms and the regulations and operating orders. The CSU stipulation is less restrictive than the NSO (No Surface Occupancy) or Timing Limitation stipulations, which prohibit all occupancy and use on all or portions of a lease for all or portions of a year. The CSU stipulation should not be used in lien of an NSO or Timing Limitation stipulation. The use of this stipulation should be limited to areas where restrictions or controls are necessary for specific types of activities rather than all activity.

The stipulation should explicitly describe the activity that is to be restricted or controlled or the operation constraints required, and must identify the applicable area and the reason for the requirement. The record must show that less restrictive stipulations were considered and determined to be insufficient. The legal subdivision, distance, location, or geographic feature, and resource value of concern must be identified in the stipulation and be tied to a land use plan and/or NEPA document. (See Example A-3.)

Land use plans and/or NEPA documents should identify the specific conditions providing waives, exceptions, or modifications to lease stipulations. Waivers, exceptions, or modifications of this stipulation must be supported with appropriate environmental analysis and documentation, and will be subject to the same test used to initially justify the imposition of this stipulation. Language may be added to the stipulation form to provide the lessee with information or circumstances under which waiver, exception, or modification would be considered. A waiver, exception, or modification may be approved if the record shows that circumstances or relative resource value have changed or that the lessee can demonstrate that operations can be conducted without causing unacceptable impact, and that less restrictive stipulations would protect the public interest. Waivers, exceptions, or modifications can only be granted by the authorized officer. If the waiver, exception, or modification is inconsistent with the land use planning document, that document must be amended as necessary or die change disallowed,

If the authorized officer determines, prior to lease issuance, that a stipulation involves an issue of major concern, modification or waiver of the stipulation would be subject to public review (e.g., 43 CFR 3101.1-4). The land use plan also may identify other cases when a public review is required for waiver, exception, or modification. In such cases, wording such as the following should be added to the stipulation form to inform the lessee of the required public review. "A 30-day public notice period is required prior to modification or waiver of this stipulation."

SPECIAL ADMINISTRATION STIPULATION GUIDANCE

There is no required or suggested uniform format for these stipulations. They are usually provided by another agency or organization. However, other agencies are to be encouraged to use the uniform stipulation format.

Special Administration stipulations are used in situations where the three uniform stipulation forms or lease notices do not adequately address the concern. Special Administration stipulation should be used only when special external conditions, such as preexisting agreements with other agencies, require use of a one-of-a-kind stipulation that is not used in any other area or situation. The resource use or value, location, and specific restrictions must be clearly identified. In addition, the external agency, agreement, or preexisting use, which dictates the special restrictions, must be identified. The stipulation should state if and under what circumstances a waiver, exception, or modification may be allowed.

EXAMPLE A-3

Serial Number _____

CONTROLLED SURFACE USE STIPULATION

Surface occupancy or use is subject to the following special operating constraints.

a. Any operations within this lease must be designed or located to enable the visual quality objective of partial retention to be met within one year of commencing operations.

On the lands described below:

a. The entire lease.

For the purpose of:

a. To meet visual quality objectives; Western Uinta Basin Oil and Gas Leasing EIS.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101, Forest Service Oil and Gas Regulations, 36 CFR, Sec. 228.104)

Form #/Date

Examples of Special Administration stipulations are contained in the document, "Uniform Format For Oil And Gas Lease Stipulations," through the Forest Service or BLM.

LEASE NOTICE GUIDANCE

Lease Notices are attached to leases to transmit information at the time of lease issuance to assist the lessee in submitting acceptable plans of operation or to assist in administration of leases. Lease Notices are attached to leases in the same manner as stipulations; however, there is an important distinction between Lease Notices and Stipulations. Lease Notices do not involve new restrictions or requirements. Any requirements contained in a Lease Notice must be fully supported in either a law, regulation, standard lease terms, or onshore oil and gas orders. A Lease Notice is not signed by the lessee. Guidance in the use of Lease Notices is found in BLM Manual 3101 and 43 CFR 3101.1-3.

A lease notice should contain the following elements:

- the resource/use/value;
- the lands affected, if applicable;
- the reason(s);
- the effect on lease operations or what may be required; and
- a reference to the lease term, regulation, law, or order from which enforcement authority is derived.

If a situation or condition is known to exist that could affect lease operations, there should be full disclosure at the time of lease issuance via a Lease Notice. If a lessee may be prevented from extracting oil and gas through a prohibition mandated by a specific nondiscretionary statute, such as the Endangered Species Act, then a stipulation may be used even though a Lease Notice would be sufficient. It is at the discretion of the authorized officer whether a situation is sufficiently sensitive to warrant the use of a lease stipulation. Example A-4 illustrates a Lease Notice.

The following section lists the stipulations that will be applied (by resource, by stipulation type, by site-specific resource area), and a short explanation of the reasons for the stipulation. This is mandated by section 102(c)(1)(ii) of the oil and gas regulations found in 36 CFR Part 228 Subpart E - Oil and Gas Resources, where it states: "As part of the analysis, the authorized Forest Officer shall identify on maps those arm that will be open to development but subject to constraints that will require the use of lease stipulations such as those prohibiting surface use on area larger than 40 acres or such other standards as may be developed in the plan for stipulation use." Section 102(e)(2) also reiterates this direction in its discussion of leasing decisions for specific lands. Forest Service policy states (FSM 2822.42) that the stipulations should be "hold to, a minimum consistent with those purposes," meaning that the least restrictive stipulation should be applied which protects the target resource. This section will also discuss guidelines by which future waivers, exceptions, or modifications may be granted.

EXAMPLE A-4

Serial Number _____

LEASE NOTICE

This lease was issued based on limited information regarding the water resources that may be affected by oil and gas operations. No activities can be approved that would violate the Clean Water Amendments Act of 1972 as amended and the associated Federal and State regulations. In order to assure compliance with the applicable laws and regulations regarding the protection and non-degradation of water quality, the lessee may be required to collect flow and quality baseline information for any surface and subsurface waters that could be adversely affected, prior to approval of proposed operations. The lessee will be required to establish a monitoring program capable of identifying and measuring any affects to water flow and quality that may occur as a result of operations.

Requirements for baseline data collection and water monitoring will be determined on a site-specific basis.

Form #/Date

RESOURCE: **Geologic Hazards/Unstable Soils**

Stipulation: No Surface Occupancy

Objective: To preclude surface disturbing activities on areas that are unstable, have a high erosion hazard and would be difficult to reclaim

Waiver: None

Exception: An exception may be granted if the operator can demonstrate in a surface use Plan of operations that adverse effects can be minimized and activities safely conducted.

Modification: A modification may be granted if an on site inspection demonstrates that geologic hazards and unstable do not exist on the specific site.

RESOURCE: **Geologic Hazards/Unstable Soils**

Stipulation: Controlled Surface Use

Objective: To require that activities be located and/or designed to avoid or minimize the potential for adverse effects to unstable areas and to ensure that the area can be reclaimed.

Waiver: None

Exception: An exception may be granted if an on site inspection demonstrates that geologic hazards and unstable soils do not exist on the specific site.

Modification: A modification may be granted if an on site inspection demonstrates that geologic hazards and unstable soils do not exist on the specific site.

RESOURCE: **Steep Slopes**

Stipulation: No Surface Occupancy

Objective: To preclude construction of well sites and related facilities such as tank batteries on slopes over 35% which would involve relatively large cut and fill slopes and would be difficult to rehabilitate.

Waiver: None

Exception: An exception may be granted if the operator can demonstrate in a surface use plan of operations that adverse effects can be minimized and activities safely conducted.

Modification: A modification may be granted if an on-the-ground review of a proposed well site or facility shows that an area of less than 35% slope exists or that engineering design of the site can mitigate erosion and reclamation concerns.

RESOURCE: Steep Slopes

Stipulation: Controlled Surface Use

Objective: To require that facilities such as well sites be located and/or designed to minimize construction on steep slopes and large cut and fill slopes that would be difficult to rehabilitate.

Waiver: None

Exception: An exception may be granted if the operator can demonstrate in a surface use plan of operations that adverse effects can be minimized and activities safely conducted.

Modification: A modification may be granted if an on-the-ground review of a proposed well site or facility shows that an area of less than 35% slope exists or that engineering design of the site can mitigate erosion and reclamation concerns.

RESOURCE: Wetland/Riparian Areas (greater than 40 acres)

Stipulation: No Surface Occupancy

Objective: To preclude surface disturbing activities and protect wetland and riparian areas.

Waiver: None

Exception: An exception may be granted if the operator can demonstrate in a surface use plan of operations that adverse effects can be minimized, that there are no practicable alternatives, that a 404 permit can be obtained, and the area reclaimed.

Modification: A modification may be granted if an on-the-ground inspection shows that the area of the proposed activity is not wetland or riparian.

RESOURCE: Wetland/Riparian Areas (greater than 40 acres)

Stipulation: Controlled Surface Use

Objective: To require that surface disturbing activities in riparian areas and jurisdictional wetlands be located and/or designed to minimize adverse effects.

Waiver: None

Exception: An exception may be granted if the operator can demonstrate in a surface use plan of operations that adverse effects can be minimized, there are no practicable alternatives, and a 404 permit can be obtained.

Modification: The area affected by this stipulation may be modified if an on-the-ground survey concludes that riparian areas and wetlands do not cover the entire arm

RESOURCE: Critical Sage Grouse Habitat

Stipulation: No Surface Occupancy

Objective: To protect critical sage grouse habitat.

Waiver: A waiver may be granted if new field studies in coordination with the applicable State wildlife agency concludes that no leks or important nesting habitat is present within two miles.

Exception: An exception may be granted if field studies show that there are no currently active leks within two miles.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area does not contain habitat features critical to sage grouse.

RESOURCE: Critical Sage Grouse Habitat

Stipulation: Timing Limitation

Objective: To preclude new surface disturbance within critical sage grouse habitat which could interfere with breeding and nesting activities during the reproductive period (April 1 to May 31).

Waiver: A waiver may be granted if new field studies in coordination with the applicable State wildlife agency concludes that no leks or important nesting habitat is present within two miles.

Exception: An exception may be granted if field studies show that there are no currently active leks within two miles.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area does not contain habitat features critical to sage grouse.

RESOURCE: Critical Elk Winter Range

Stipulation: Timing Limitation

Objective: To preclude new surface disturbing activities within elk critical winter range which would cause increased stress and/or displacement of animals during the critical time period (November 15 to April 30).

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as a winter range.

Exception: An exception may be granted if seasonal conditions are such (i.e., an early spring and snowmelt) that the elk have moved out of and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the arm is not used as a winter range.

RESOURCE: Critical Deer Winter Range

Stipulation: Timing Limitation

Objective: To preclude new surface disturbance within critical mule deer winter range, which could cause increased stress and displacement of animals during the critical winter period (November 15 to April 30)

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as a winter range.

Exception: An exception may be granted if seasonal conditions are such (i.e., an early spring and snowmelt) that the deer have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as deer winter range.

RESOURCE: Critical Deer Winter Range

Stipulation: Controlled Surface Use

Objective: To limit the amount of disturbance within critical mule deer winter range, which could cause increased stress and displacement of animals during the critical winter periods.

Waiver: A waiver my be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as mule deer winter range.

Exception: An exception may be granted if seasonal conditions are such (i.e., an early spring and snowmelt) that the mule deer have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as deer critical winter range.

RESOURCE: Critical Elk Summer Range

Stipulation: Controlled Surface Use

Objective: To limit the amount of disturbance within critical elk summer range, which could cause increased stress and displacement of animals.

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the am affected by this stipulation is no longer used as elk critical summer range.

Exception: An exception may be granted if seasonal conditions are such that the elk have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as elk critical summer range.

RESOURCE: Critical Deer Summer Range

Stipulation: Controlled Surface Use

Objective: To limit the amount of disturbance within critical deer summer range, which could cause increased stress and displacement of animals and adverse effects on fawning.

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as mule deer critical summer range.

Exception: An exception may be granted if seasonal conditions are such that the mule deer have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as deer critical summer range.

RESOURCE: Critical Deer Summer Range

Stipulation: Timing Limitation

Objective: To preclude new surface disturbance within critical mule deer summer range, which could cause increased stress, displacement of animals and reduced reproductive success during the summer fawning period (April 15 to May 15).

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as a summer range.

Exception: An exception may be granted if seasonal conditions are such that the deer have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as deer summer range.

RESOURCE: Critical Elk Yearlong Range

Stipulation: No Surface Occupancy

Objective: To limit the amount of disturbance within critical elk yearlong range, which could cause increased stress, displacement and reduced reproduction of animals from disturbance during the critical winter and calving periods (November 15 to June 30).

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as elk critical yearlong range.

Exception: An exception may be granted if seasonal conditions are such (i.e., an early spring and snowmelt) that the elk have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as elk critical yearlong range.

RESOURCE: Critical Elk Calving Range

Stipulation: Timing Limitation

Objective: To preclude new surface disturbing activities within elk calving areas which could cause increased stress, displacement and reduced reproductive success during the critical time period (May I to June 30).

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as a calving area.

Exception: An exception may be granted if seasonal conditions are such that the elk have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as a calving area.

RESOURCE: Critical Elk Yearlong Range

Stipulation: Timing Limitation

Objective: To preclude new surface disturbance within critical elk yearlong range, which could cause increased stress and displacement of animals during the critical winter and calving periods (November 15 to June 30).

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as elk critical yearlong range.

Exception: An exception may be granted if seasonal conditions are such (i.e., an early spring and snowmelt) that the elk have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as deer critical yearlong range.

RESOURCE: Critical Elk Yearlong Range

Stipulation: Controlled Surface Use

Objective: To limit the amount of disturbance within critical elk yearlong range, which could cause increased stress and displacement of animals during the critical winter and calving periods.

Waiver: A waiver may be granted if new habitat studies in coordination with the applicable State wildlife agency concludes that the area affected by this stipulation is no longer used as elk critical yearlong range.

Exception: An exception may be granted if seasonal conditions are such (i.e., an early spring and snowmelt) that the elk have moved out and are not using the general area during the particular year.

Modification: A modification of the stipulation may be granted if new habitat studies show that a portion of the area is not used as elk critical yearlong range.

RESOURCE: Sensitive Plant and Animal Species

Stipulation: Controlled Surface Use – an on-the-ground survey would be required prior to surface disturbing activities to determine the possible presence of any sensitive plant or animal species. Facilities and operations would be designed or located so as to not adversely affect the viability of any sensitive species.

Objective: To ensure that proposed activities do not adversely affect the viability of a sensitive species.

Waiver: A waiver may be granted if surveys and research shows that potential habitat for sensitive species does not exist within the area.

Exception: Same

Modification: Same

RESOURCE: Research Natural Areas

Stipulation: No Surface Occupancy

Objective: To preclude surface occupancy and new surface disturbing activities within research natural areas.

Waiver: A waiver may be granted if the research natural area designation is removed.

Exception: None.

Modification: None.

RESOURCE: Roadless Areas

Stipulation: No Surface Occupancy

Objective: To protect and maintain the roadless character of the area, which includes such elements as natural integrity, natural appearance, opportunity for solitude, manageability of boundaries and special features (ecological, geological, scenic, cultural features).

Waiver: A waiver may be granted if upon future review during the forest planning process the area is determined to not possess roadless attributes or character.

Exception: None

Modification: None

RESOURCE: Roadless Areas

Stipulation: Controlled Surface Use

Objective: To protect and minimize impacts to the roadless character of the area, which includes such elements as natural integrity, natural appearance, opportunity for solitude, manageability of boundaries and special features (ecological, geological, scenic, cultural features).

Waiver: A waiver may be granted if upon future review during the forest planning process the area is determined to not posses roadless attributes or character.

Exception: None

Modification: None

RESOURCE: Developed Campgrounds

Stipulation: No Surface Occupancy

Objective: To preclude surface occupancy and new surface disturbing activities within developed campgrounds.

Waiver: A waiver may be granted if the campground is moved or eliminated.

Exception: None

Modification: None

RESOURCE: Semi-Primitive Non-Motorized

Stipulation: Controlled Surface Use

Objective: To minimize the effects of activities within Semi-Primitive Non-Motorized areas by requiring that activities be located, designed, and reclaimed in a manner that would minimize effects to the semi-primitive character of the land.

Waiver: None

Exception: None

Modification: None

RESOURCE: Retention VQO

Stipulation: No Surface Occupancy

Objective: To protect the high quality scenic resources present on forest lands within the study area.

Waiver: None

Exception: An exception may be granted if an operator can present a surface plan of operations that would demonstrate that the management objectives for Retention would be met and that the proposed action would not lower the scenic quality of the affected area. This decision must be approved by the forest officer responsible for scenery management.

Modification: None

RESOURCE: Retention VQO

Stipulation: Controlled Surface Use

Objective: To protect the high scenic quality of forest lands present within the study area by requiring proposed activities to be located and designed to meet the Retention objectives within one year from project startup.

Waiver: None

Exception: None

Modification: None

RESOURCE: **Partial Retention VQO**

Stipulation: Controlled Surface Use

Objective: To protect the scenic quality of forest lands within the study area by requiring proposed activities to be located and designed to meet the Partial Retention objectives within one year from project startup.

Waiver: None

Exception: None

Modification: None

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Pinedale Calibration Area Stipulations

TIMING LIMITATION STIPULATIONS

TLS (1) Nov 15 to Apr 30; (2) as mapped on the Pinedale RMP oil and Gas Lease Stipulation Overlay #1; (3) protecting big game crucial winter range.

TLS (1) May 1 to Jun 30; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #1; (3) protecting big game parturition areas.

TLS (1) Feb 1 to Jul 31 ; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2;, (3) protecting sage grouse nesting habitat.

NO SURFACE OCCUPANCY STIPULATIONS

NSO (1) *list legal description* (2) protecting *(list which feedground)* elk feedground.

NSO (1) *list legal description* (2) protecting HUD designated Zone A (100 year) flood hazard area on perennial water courses.

NSO (1) Within the boundaries of *(list which campground)* Campground in list legal description; (2) protecting campground facilities and associated recreation values.

NSO (1) *list legal description;* (2) protecting National Register Cultural Resource Site *(list site reference number).*

CONTROLLED SURFACE USE STIPULATIONS

CSU (1) Surface occupancy or use within 1/4 mile of the *(list which campground)* will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2 ; (3) protecting campground and associated recreation values.

CSU (1) Surface occupancy or use within 1,000 feet of Beaver Creek or on slopes greater than 25 percent in the Beaver Creek ACEC will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2; (3) protecting class A Colorado River cutthroat trout habitat.

CSU (1) Surface occupancy or use within the Cora Stock Driveway will be restricted or prohibited from June 1 through June 30 and from Oct 1 through Oct 31 unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2; (3) protecting cattle movement along the stock driveway.

CSU (1) Surface occupancy or use, including snow removal and vehicle operations (over-the-snow vehicles excepted), will not be allowed on the Continental Divide Snowmachine Trail (CDST) from December 1 to April 30, unless the operator and the surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped an the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2; (3) protecting recreational use on the CDST.

CSU (1) Surface occupancy or use within HUD designated Zone A (100 Year) flood hazard areas not protected by NSO will be restricted or prohibited unless the operator and surface man aging agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RMP Flood Hazard Overlay; (3) protecting riparian, water quality and floodplain values.

CSU (1) Surface occupancy or use within the Sublette County Landfill at *(list landfill)* will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts. This may include development, operations and maintenance of facilities; (2) *(list legal description.)*; (3) public safety and preventing ground water contamination.

CSU (1) Surface occupancy or use within the Upper Green River Special Recreation Management Area and Wild & Scenic River Study Area will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated-impacts; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2; (3) protecting recreation and Wild & Scenic River values.

CSU (1) Surface occupancy or use within 1/4 mile of a sage grouse strutting ground will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts. Surface use and human activity will not be allowed within a 1/2 mile radius of active elks between midnight and 9:00 AM from March 1 through May 15. These restrictions may apply to the operation and maintenance of production facilities, as well as development activities; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2; (3) protecting sage grouse breeding habitat.

CSU (1) Surface occupancy or use between Feb 1 and July 31 within a radius of up to 1 mile of occupied or active raptor nest sites will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2, or as determined by a pre-disturbance raptor survey; (3) protecting raptor nesting habitat.

CSU (1) Surface occupancy or use within the Soaphole Basin will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2; (3) to reduce sediment and salinity deposition in the Green River/Colorado River system.

CSU (1) Surface occupancy or use within 1/4 mile or the visual horizon (whichever is closer) of contributing segments of the Lander Cutoff of the Oregon Trail will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RMP Oil and Gas Lease Stipulation Overlay #2; (3) protecting contributing segments of the National Historic Trails System

CSU (1) Surface occupancy or use will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts; (2) as mapped on the Pinedale RKP Visual Resource Management Overlay (preferred alternative); (3) protecting Class I and II Visual Resource Management Areas.

2.7.42	In order to protect deer winter range, exploration, drilling, and other development activity will be allowed only during the period from May 16 to October 31. This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically approved in writing by the authorized officer of the Bureau of Land Management. The BLM is authorized to waive, modify, or have mitigation measures enforced by the authorized officer of the Bureau of Land Management.
	Now is the time to implement the stipulations that have been in full.
2.7.43	In order to protect deer winter range, exploration, drilling, and other development activity will be allowed only during the period from May 16 to November 14. This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically approved in writing by the authorized officer of the Bureau of Land Management.
2.7.47	In order to protect deer winter range/elk high priority range, exploration, drilling, and other development activity will be allowed only during the period from May 16 to October 31. This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically approved in writing by the authorized officer of the Bureau of Land Management.
2.7.48	In order to protect deer/moose habitat area, exploration, drilling, and other development activity will be allowed only during the period from May 16 to October 31. This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically approved in writing by the authorized officer of the Bureau of Land Management.
2.7.64	In order to protect elk winter range, exploration, drilling, and other development activity will be allowed only during the period from May 16 to October 31. This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically approved in writing by the authorized officer of the Bureau of Land Management.
2.7.68	In order to protect moose winter range, exploration, drilling, and other development activity will be allowed only during the period from May 16 to October 31. This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically approved in writing by the authorized officer of the Bureau of Land Management.
2.7.88	In order to protect sage grouse habitat, exploration, drilling, and other development activity will be allowed only during the period from June 16 to March 30. This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically approved in writing by the authorized officer of the Bureau of Land Management.
3.0.1	No occupancy or other activity on the surface is allowed under this lease.
3.0.2	A portion of the lease area is within the Cleveland-Lloyd Dinosaur Quarry Buffer Zone. Any surface use or occupancy within these areas will be strictly controlled through close scrutiny of any surface use plan filed to protect paleontological values and the enjoyment of visitors to the quarry. Options held by the federal government include relocation of proposed wells and access road coring of the upper portion of the drill hole or other measures deemed necessary by the authorized officer of the Bureau of Land Management.
4.0.1	Closed To Leasing

Rock Springs Calibration Area Stipulations

AREAS OF OIL AND GAS LEASE RESTRICTIONS BY HYDROCARBON POTENTIAL
(Approximate Acres)[1]

Category	Surface Ownership: Federal Acres	Hydrocarbon Potential (Federal Surface and Subsurface Acres): High	Moderate	Low	Total
No Leasing					
Greater Red Creek ACEC (Red Creek Drainage) X203	*55,880*	*20,810*	*12,230*	*26,430*	*59,470*
Wind River Front (Eastern Portion)	*88,510*	*0*	*0*	*92,990*	*92,990*
Total No Leasing	*144,390*	*20,810*	*12,230*	*119,420*	*152,460*
No Surface Occupancy (NSO) [2]					
14-Mile Recreation Area MBH	*20*	*20*	*0*	*0*	*20*
Big Sandy River and 1/4-mile buffer (1.5 miles) MBH	*240*	*0*	*0*	*240*	*240*
Boars Tusk	*90*	*90*	*0*	*0*	*90*
Cedar Canyon, LaBarge, Sugarloaf, Tolar, CONF and White Mountain Petroglyphs + 1/2-mile vista	*1,600*	*770*	*480*	*350*	*1,600*
Crookston Ranch	*40*	*40*	*0*	*0*	*40*
Cottonwood Canyon MBH	*160*	*0*	*160*	*0*	*160*
Current Creek Drainage X601A	*23,740*	*0*	*2,820*	*21,200*	*24,020*
Dry Sandy Swales HISTRAILS	*20*	*0*	*0*	*20*	*20*
Emmons Cone MBH	*60*	*60*	*0*	*0*	*60*
Greater Sand Dunes ACEC (developed recreation sites and ORV parking lot)	*50*	*50*	*0*	*0*	*50*
LaClede and Dug Springs Stage Stations CONF	*20*	*20*	*0*	*0*	*20*
Native American Burials CONF	*2*	*2*	*0*	*0*	*2*
Natural Corrals ACEC X232	*1,115*	*1,270*	*0*	*0*	*1,270*
North and South Table Mountains MBH	*1,280*	*1,280*	*0*	*0*	*1,280*
Oregon Buttes ACEC X228	*3,450*	*0*	*0*	*3,450*	*3,450*
Pilot Butte MBH	*120*	*0*	*0*	*120*	*120*
Pine Butte MBH	*320*	*320*	*0*	*0*	*320*
Pine Springs ACEC X600, X600A, X600B	*6,030*	*0*	*0*	*6,030*	*6,030*
Prehistoric Quarry CONF	*160*	*0*	*0*	*160*	*160*
Raptor nesting (occupied nests, cliffs, bluffs, roosts, outcrops, and pinnacles)	*835*	*600*	*120*	*125*	*845*
South Pass Historic Landscape (area visible within 1-mile buffer of Lander Cutoff and area visible within 3-mile buffer of Oregon Trail)	*33,700*	*0*	*760*	*34,630*	*35,390*
Special status plant species habitat [3] *A**	*3,610*	*2,600*	*100*	*920*	*3,620*
Sweetwater River and 1/4-mile buffer XEROX MAP (Wild & Scenic part, 5.8 miles)	*1,860*	*0*	*0*	*1,860*	*1,860*
Tri-Territory Marker MBH	*10*	*10*	*0*	*0*	*10*
Wild horse herd viewing area + 1/2-mile buffer MBH	*500*	*0*	*500*	*0*	*500*
Total No Surface Occupancy	*79,120*	*7,130*	*4,938*	*69,193*	*81,261*
Seasonal Restrictions [2]					
Crucial Antelope Winter Range	*817,640*	*268,740*	*335,370*	*241,780*	*845,890*
Crucial Deer Winter Range	*676,830*	*330,630*	*74,590*	*300,690*	*705,910*
Crucial Elk Winter Range	*345,590*	*182,870*	*40,280*	*128,000*	*351,150*
Crucial Moose Winter Range	*33,270*	*8,770*	*6,500*	*23,080*	*38,350*
Elk Calving Areas	*85,830*	*55,610*	*6,130*	*26,330*	*88,070*
Game Fish Spawning Areas (miles) DNM	*210*	*30*	*80*	*140*	*250*
Moose Parturition Areas	*410*	*0*	*0*	*410*	*410*
Mule Deer Parturition Areas	*40,880*	*21,690*	*0*	*19,010*	*40,700*
Raptor Habitat	*361,330*	*263,780*	*47,750*	*57,480*	*369,010*
Sage Grouse Nesting Areas (1 3/4 mile from lek)	*447,170*	*110,740*	*218,770*	*131,840*	*461,350*
Total Seasonal Restrictions	*1,954,560*	*934,400*	*483,870*	*622,190*	*2,040,460*

Controlled Surface Use Restrictions [2]					
Continental Divide Snowmobile Trail (1/4-mile buffer)	2,330	0	0	2,330	2,330
Floodplains, wetlands, and riparian areas (within 50 feet of 100-year floodplains and waters) [4]	153,320	33,370	65,700	58,250	157,320
Highly erodible soils	158,110	62,390	34,390	63,100	159,880
Historic Trails (1/4 mile or visual horizon) [5]	64,910	34,430	25,400	23,740	83,570
Monument Valley X604	69,940	69,940	0	0	69,940
Pine Mountain and Sugarloaf Basin (X601B - X203)	150,080	64,400	60	88,040	152,500
Recreation sites + 1/4 mile buffer	930	330	130	470	930
Riparian Areas	8,730	2,780	1,718	4,940	9,438
Sage Creek Watershed X601C	52,270	6,660	32,450	13,850	52,960
Sage Grouse Leks and 1/4-mile buffer	8,170	1,420	4,410	2,660	8,490
Slopes greater than 25%	188,090	84,440	29,730	83,700	197,870
South Pass Historic Landscape (area not visible within 1-mile buffer of Lander Cutoff and area not visible within 3-mile buffer of Oregon Trail)	20,080	0	460	20,640	21,100
Special status plant species potential habitat [6] P*	39,870	7,090	16,890	19,690	43,670
Steamboat Mountain Crucial Overlap [7]	27,000	77,000	0	0	27,000
Superior Recharge (modified) [8]	7,120	8,180	0	0	8,180
View from Fontenelle Reservoir DNM	120	220	0	0	220
VRM Class II Lands	681,560	278,300	66,200	387,140	731,640
Within 100 feet of inner gorge of intermittent/ephemeral streams	7,170	4,130	920	2,500	7,550
Within 1/4-mile of Sweetwater River XEROX MAP (Recreational part 3.4 miles)	1,090	0	0	1,090	1,090
Total Controlled Surface Use Restrictions	1,189,340	541,320	180,250	533,850	1,255,420
Special Management					
Steamboat Mountain ACEC [7] DEFERRED	43,270	44,190	0	0	44,190
Greater Sand Dunes ACEC [7] DEFERRED	70,850	58,600	13,190	0	71,790
Rock Springs-Green River Expansion area [9]	26,600	13,860	6,570	10,510	30,940
Wind River Front (Western Portion) [10] CSU	172,630	0	29,350	143,390	172,740
Total Special Management	313,350	116,650	49,110	153,900	319,660

1. Lease parcels are designed on aliquot parts. The actual acreage for the lease may vary.
2. Refer to Appendix 2. These requirements apply to all surface disturbing activities.
3. This refers to the populations of those plants designated in the Special Status Plant ACEC. As new populations are identified, their locations will be added to this total.
4. Surface disturbing activities that could adversely affect water quality and wetland and riparian habitat will avoid the area within 500 feet of or on 100-year floodplains, wetlands, or perennial streams. The 100-year floodplains, wetlands, and riparian areas will be closed to any new permanent facilities. Activities could be allowed if a site-specific analysis determines that no adverse Impacts would occur (see the Watershed Management section).
5. All activity will conform with requirements of Class II visual values.
6. This includes the actual plant sites and potential habitat. Acres will change as floristic inventories Identify actual areas with potential. Searches will be required prior to surface disturbance activities.
7. To be determined with completion of a comprehensive and detailed site-specific activity or implementation plan encompassing the combined Steamboat Mountain and Greater Sand Dunes areas.
8. The Ericson Formation recharge area, for the town of Superior sole source aquifer and overlong formations, will be protected through the use of mitigation.
9. Leasing will allow for consultation with local communities, and provide direction to protect pubic health and safety.
10. Surface disturbing activities will be limited through controlled surface use requirements or closing areas where maximum resource protection is necessary.

For the CSU stipulation dealing with the floodplains, wetlands, and riparian areas (within 500 feet of 100-year floodplains and waters) [4] **AND** Within 100 feet of inner gorge of intermittent/ephemeral streams

plot digstreams on bottom in BLACK; add waters in RED by selecting a "P" in the place of the 10 digit attribute; plot floodplain in RED on top. Anything in RED gets buffered by 500 feet. Anything in BLACK gets buffered by 100 feet.

MSH – Map by hand from paper maps sent
CONF – Confidential data No mapping permitted
XEROX MAP – Map from xerox map sent
DNM – Do not map

ACCESSIBILITY TO THE GAS SUPPLY ON BUREAU OF LAND MANAGEMENT AND FOREST SERVICE LANDS IN EASTERN UTAH AND WESTERN WYOMING

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Accessibility to the Natural Gas Supply

on

Bureau of Land Management and Forest Service Lands

In Eastern Utah and Western Wyoming

Executive Summary

Introduction and Overview

With the occurrence of changes in legislative, regulatory and public policy over the federal lands in the last two decades, access to minerals has steadily declined. This decline has prompted an update of a 1992 Natural Gas Study assessing the supply of the natural gas resource. Access to federal lands is the foundation for economic health of the oil and gas industry and consequently has great impact on the financial well-being of western states and the counties in which the resources are located. Counties are not adequately compensated through PILT payments for the land taken out of production. The national economy is impacted as are federal government shares in royalty revenues which are derived from mineral production.

This micro-study is specifically focused on the supply side of natural gas. Public lands in Eastern Utah and Western Wyoming were visited and examined for the purpose of determining accessibility to natural gas reserves, specifically addressing the geographic relationship between federal lands restricted from development and areas of known mineral deposits where development could occur. Environmental laws affecting access decisions by federal agencies and federal personnel are also included in the overall study.

The natural gas resource base is abundant, is capable of expansion of production with large reserves in the West, and can be sold at a price that will ensure continued development. Natural gas is an environmentally desirable source of energy for its clean burning quality. However, the natural gas industry faces significant challenges, both discretionary and non-discretionary, with access ranking high among issues demanding immediate consideration if the industry is to continue to supply the nation's needs into the next millennium. There is great irony in having large supplies of natural gas in the West, a preferred energy source, that is impacted by an ever

growing number of environmental issues which cumulatively, act as barriers to exploration and production.

To understand the numerous road blocks to exploration and production on federal lands it is necessary to assess legislative and regulatory changes, lands under lease, lands available for lease, reasons for withdrawals of acreage from leasing, both discretionary and non-discretionary, split estate, monitoring and agency accountability.

English historian Lord Macauly, long ago noted that the true test of American institutions would come when the free public domain was exhausted and an increased population competed for ownership of the land and its depleting resources. (Coggins, xix) We have arrived at that juncture in time, and fierce competition over who is given access to the federal lands continues to escalate. A long history of changing regulations, punctuated with lawsuits filed to prevent exploration and/or production, has worked to suppress the number of new wells going on line. Preservation and recreation have come to the forefront of actions on the public lands. For legal minds it is a uniquely fascinating body of law. For those whose lives and livelihoods are tied to federal natural resources it is excruciating and costly. And, for the vast uninformed American public, it is not yet an issue and will not be until their lifestyle or their economic position is threatened.

Federal Actions

Nearly one-third of the land in the United States is owned by the federal government (One Third of the Nation's Land pps 327-334) and public land law provides for multiple use of those lands. (see Laws 1.6 & 1.14) Beginning in 1964 with the Wilderness Preservation System, Congress has enacted 88 laws designating new wilderness areas or adding to existing ones. Wilderness acreage totals nearly 104 million acres. (CRS) These lands, as well as proposed Wilderness Areas, have been permanently taken out of potential production. In 1976 Congress passed the Federal Land Policy Management Act (FLPMA) and the National Forest Management Act (NFMA) and established an overall multiple use-sustained-yield management policy for both the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). However, during the same period, Congress enacted a number of laws targeted to address specific issues including the Endangered Species Act (ESA), the National Historical Preservation Act (NHPA) and the National Environmental Policy Act (NEPA) providing kindling for a conflict of laws.

Congress also passed legislation related to Wild and Scenic Rivers, National Trails, the Clean Water Act and Clean Air Act as well as many other laws, all of which place restrictions on the use of public lands for production purposes. Early years saw a gradual creep of environmental laws. Today there is a flood of laws, amendments to laws, extensive regulations and policies which effectively blanket the West and render exploration and production of minerals with a proverbial "broken wing" syndrome—the inability to work to capacity.

In the past, dominant use of federal lands has been toward commodity outputs such as timber, oil and gas, and grazing. Today, despite Congress' voice in 1960 and again in 1976, mandating multiple use on BLM and Forest Service lands, use of those lands has changed, although the seminal multiple use laws have not. With this inherent conflict between multiple use management and single purpose management, agencies have had to prioritize their management emphasis. Industry analysts believe that the change in priorities has come from discretionary decision making on the part of federal land managers. (Delta) (Laitos) (Smith)

Both the BLM and the USFS are giving priority to the management of special species at the expense of other resource values. What has been missing is an overall assessment of the impacts of the various laws, regulations and discretion of federal land managers on the expressed multiple-use sustained-yield management direction for these agencies. Over the years it appears that a major policy shift has developed "defacto" and has significantly changed federal land management without public and congressional discussion.

Preservation and recreation have increased in importance to take the alpha position, dominating the value of public land use. (Laitos) Signs of a change in thought about the public domain were becoming evident in the sixties and seventies. By the early eighties that direction obviously had enough energy behind the concept that it was taught at major institutions of learning. In a 1981 edition of *Federal Public Land and Resources Law*, a textbook used in law schools across the U. S., Chapter 11 is devoted to the preservation resource. The chapter begins, *"It may seem incongruous to categorize preservation as a resource. Limited use or non-use of a land area, however, has all of the elements of exclusivity that characterize the more traditional resources. A pristine ecosystem is a finite entity that is nonrenewable, at least for generations, if its wilderness qualities are destroyed. While the "outputs" or values of preservation are less susceptible of measurement in economic terms, it is certainly not the least in terms of the value or worth attached to it by contemporary society."* (Coggins, p. 724)

Federal land is distributed unevenly throughout the nation. One third of the landmass of the nation belongs to the Federal Government, and ninety-five percent of all the federal lands are located in the Western area of the United States. Oil and gas deposits with potential for production ranking "very high" are located on the federal lands of the West. (Barlow & Haun, p 12) The two states studied, Utah and Wyoming, are

respectively 67.9% and 49% federally owned and are therefore heavily dependent upon the federal lands for economic survival. A recent study of Payment in Lieu of Taxes (PILT) directed by Congress to the US Department of Interior shows that the overall tax liability on Federal lands is almost three times the Federal payments. A survey of county executive officers indicates that the direct fiscal costs or benefits to county governments from Federal lands and programs are modest. (Schuster, et al USDA FS)

Natural gas production is more important to Wyoming, per capita, than any other major U.S. gas producing state, (Barlow & Haun, Inc. p 2). If the nation's needs for a projected 19 to 31 Tcf per year of natural gas is to be reached by 2010, there will necessarily need to be a rethinking of access to federal lands for exploration and production. (GRI, p 4) Today's production of natural gas is 22 Tcf per year. (WY Oil & Gas Commission) In 1994, 18 Tcf/yr was consumed in the U.S. and by 1996 the nation was consuming 20 Tcf/yr. (GRI) Between 1994 and 1996, natural gas production increased 2 Tcf, and between 1996 and 1999 production raised only 3 Tcf.

With the occurrence of changes in legislative, regulatory and public policy over the federal lands, access to minerals has declined. An example is the demand for more preservation in the form of wilderness. Utah's federal land estate, locked-up to exploration and production due to permanent wilderness designation, could grow by another 2.6 million acres in the near future. BLM is currently conducting the planning process to evaluate the potential for new wilderness areas in Colorado, Montana and Utah.

The United States is the greatest-consuming nation in the world; and yet, ongoing decisions are made to limit, greatly reduce and in many cases eliminate the extraction and production of raw materials with consumption never being discussed.

There can be no completion of the puzzle as long as some of the pieces are missing. It is imperative that we look ahead and plan for the future by careful scrutiny of what the road blocks to exploration and production are, and how, with natural gas becoming the preferred domestic energy supply based on its abundance, economy, ease of transport, and clean burning characteristics, (GRI p 1) the number of allowed exploratory wells and total acreage open to production are not increasing to meet projections for the year 2010.

Scope and Methodology

The scope of this paper is to supply data from BLM Field Office Areas and Forest Service lands in Eastern Utah and Western Wyoming to be utilized in an update to the study, *The Potential for Natural Gas In the United States: Source and Supply,* by the National Petroleum Council, 1992, which addressed the availability of federal lands

for natural gas exploration and development. The time frame and scope of the this study did not allow an in depth examination of Resource Management Plans or Forest Plans. Perusal of those documents from each office visited clearly shows the individualism within each of the offices. There is a lack of consistency in the interpretation of NEPA and other laws under which the agencies operate.

On-Site Visits:

On-site visits were conducted in May, 1999, by a three person team consisting of a BLM fluid minerals representative, an industry consultant and the individual selected to write the narrative for the report. Visits were made to the following Bureau of Land Management Offices: Rock Springs Field Office, Rock Springs, Wyoming (Pinedale Field Office personnel traveled to Rock Springs with their data for the meeting); and, Price Field Office, Price, Utah. Forest Service Offices represented: Bridger-Teton in Wyoming; and Manti-La Sal and Uinta forests in Utah.

Conclusions drawn in this study-update are derived from information obtained from federal land management agencies in the form of Resource Management Plans and Forest Plans with corresponding maps, oil and gas statistics, reports, letters to federal agencies from lessees and personal interviews with geologists and landmen and from Advanced Resources International, Inc. Agency personnel were cooperative, but time-limited also. From the date of the visits until the mapping data was completed there was a lull of three months.

Time Limitations:

Time constraint is a limitation in this study-update. The ability to verify statistics and to ascertain both sides of the picture was limited in the time allotted. Some pertinent material is not utilized as responses were not received in time for this report.

Categorical Groupings:

Forty sub-categories of discretionary and non-discretionary categories were synthesized into six large groupings that corresponded to those used by both the BLM and Forest Service within the study area. The six categories include: No Leasing

(NA), No Surface Occupancy (NSO), Controlled Surface Use (CSU), Timing Limitations (TL), a combination of CSUs and TLs, and Standard Lease Terms (SLT). Sub-categories are discussed later in this report.

Looking at Draft and Final Resource Management Plans, Forest Plans and other documents made available, it is evident that the discretion available to agency personnel makes each document a unique creation. There is a movement in BLM to decentralize and empower managers and give front-line personnel decision making authority, whereas the Forest Service is more closely aligned with traditional government in coordinating, directing and controlling from a centralized location. The Forest Service's tightly held standards, coupled with the recent 18-month road moratorium, show the tenor of an ever-more stringent "off-limits" attitude toward gas exploration and production. It is not possible to unify statistics from one BLM Field Office to another or between the BLM and Forest Service. To gain a clear picture, in addition to federal information, it is necessary to look to industry statistics, employment statistics and to mineral revenues associated with the federal lands.

Future Expectations

There are many indications or markers of a continued decline in accessibility to federal BLM and Forest Service lands for exploration and production. (Kiplinger Newsletter) The following are attestations to the mounting problems that either confront mineral companies or will do so in the future as they wrestle the issue of access.

- Hundreds of potential new listings under the Endangered Species Act such as the sage grouse, mountain plover and black tailed prairie dog.

- Proposed Congressional legislation HR 701 and S 25 or other similar legislation which provide for a billion dollar trust fund with which the federal government can purchase private lands. Many ranches in the West with mineral deposits are for sale due to consecutive bad years of harvest. The convergence of these two events could be the catalyst for an unprecedented movement of private lands into the hands of the federal government.

  The biggest play in coal bed methane in the nation is in the Powder River Basin of Wyoming and most of the wells being drilled are on private land. If the private lands were to be purchased by the federal government under provisions of

HR 701 and S 25, there would be much less action in the Powder River Basin today and it would be more costly to producers. The distribution of wells is 15 percent federal, 15 percent state and 70 percent private.

The Wyoming State BLM director, in a recent speech to the Petroleum Association of Wyoming stated that the Wyodak EIS on gas development in the Basin might be outdated within a few months of its release later this fall. (Pierson) A moratorium on drilling permit applications for coal bed methane in the Powder River Basin has slowed the development of federal mineral rights, but business is escalating on state and private lands. The Wyoming Oil and Gas Conservation Commission is issuing as many as 20 permits a day. The preferred alternative allows for a total of 3,890 wells in the project area, but it appears the alternative that permits 5,000 wells will be more likely. It was supposed that it would take three to five years to reach the maximum, but in truth the maximum will be reached in six to nine months. Adequate pipeline infrastructure also affects activity.

- Maximum pollution levels for waterways—rivers (and tributaries), lakes and bays are being mandated. States are mandated by EPA to set limits for each waterway. Now the President, through EPA, is directing the Departments of Agriculture and Interior to develop a policy for watershed control rather than the current stream by stream approach to management of federal lands and resources. This new policy of assessing, protecting and restoring watersheds will have great impact on the oil and gas industry as the federal land agencies move toward improvements in water quality and watershed condition. (http://www.fs.fed.us/clean/unified/ufpint2.html)

- Regional haze rules are taking on new importance. EPA is mandating that states control pollution in remote areas if dust and soot cloud national parks' air. With major national parks located in the West, adverse impact to production can be expected.

- Higher impact fees from states and counties are to be used to curb growth AND to raise money for government to buy green space such as parks and untouched areas which may reduce recreation pressure on federal lands.

- A continued moratorium on Forest Service roads makes the affected forest lands defacto wilderness areas. A major confrontation with the State of Wyoming on the Medicine Bow National Forest over a state section on the forest is occurring as the state prepares to harvest timber on their property. A federal court issued a preliminary injunction on Friday, August 20th, 1999, blocking the use of the road to the state section even though state officials are exempt from the closure. Thus, the federal government dictates what can occur on state lands. Frontiers of Freedom

and the timber industry in Wyoming have filed a lawsuit over closed roads based on the language in the federal legislation designating wilderness in Wyoming which states that there will be no buffers to the wilderness.

- Expansion of Wilderness Areas by designation and defacto designation.

- Expansion of Wild and Scenic Rivers.

- Expansion of Areas of Critical Environmental Concern (ACEC)

- U.S. Forest Service announced on March 28, 1999, that conservation biology will be its first priority in the future. The new directive is a continuation and renewal of the old policy of Ecosystem Management, but with a stronger bite. One of the first projects to affect the West under this directive is the Forest Service's *Gravelly Landscape Analysis Documentation* in Southwest Montana, just North of Yellowstone Park. It takes in almost two million acres with over half of the acreage in private and state ownership. Private lands are about 40% of the Forest Service's several hundred page plan that shows mineral development is moderate to low, and "scenic integrity" is high to moderate.

  The *Gravelly Landscape Analysis Documentation* resembles the old "Vision" document prepared for the Greater Yellowstone Area South of Yellowstone Park a decade ago by the U.S. Park Service and U.S. Forest Service. Although over 50% of all lands in the Gravelly Landscape Analysis belong to other than the federal government, the counties do not have cooperator status, leaving them on an uneven playing field with the federal government.

- The above situations dictate increased costs, uncertainty and delays to an operator who produces minerals on federal lands. If provided a choice mineral companies would operate on private lands where the impediments to exploration and production are far less formidable.

It is expected that the Gulf Coast and Canada will be the major players in gas production in the future, not Wyoming, Utah and the Rockies. A best guess is that the Gulf Coast will produce 48%, Canada 37% and Wyoming and the Rockies only 15% of the total through the year 2002. According to Vello Kuuskraa, President, Advanced Resources International, Wyoming alone could easily produce an additional 500 MMcf/d to 1 Bcf/d (approximately 17-35% over current production) by year 2002 based on the volume and economic attractiveness of the states' gas supply. (Barlow & Haun p 29)

Downward employment trends in the oil and gas industry are significant. There has been a loss of nearly 22,000 jobs in Wyoming over the last 17 years (WY Facts & Figures) which equates to just about 1,300 jobs lost per year in the mineral industry. The highest level of employment was recorded in 1981 at 38,500 jobs in the four major mining industries. Drastic fluctuations in employment in the minerals industry have occurred since the early eighties. With growing levels of discretion for mineral leasing and development, it is indicated that broad areas of the federal lands are off limits to private industry development. Additionally, other than coal bed methane produced gas, current permitted wells are greatly reduced from request levels in Western Wyoming. Recently, potential natural gas well permits in western Wyoming have gone from 2,000 to 750 or even down to possibly 500 wells. (Inteview with Ultra personnel 8-13-99)

Summary and Conclusions

Although economic analysis is not a part of this study-update it is apparent that an evaluation of foregone economic opportunities should be undertaken to see a complete picture of the impact not only to specific states, but also to the entire nation. Present and future consequences of public policy decisions leading to reduced or no access for exploration and production of oil and gas impacts the U. S. balance of trade as well as the well-being of the nation's citizens. Within the western states with significant federal lands, production of minerals from the federal lands corresponds directly to the money available for the education of children as well as social services.

The federal government and private industry are partners in establishing a supply of energy to the American public. If one partner, the federal government, is reluctant to fulfill its partnership role, the other, private industry, is prevented from fulfilling its role as expressed in the Mining and Minerals Policy Act of 1970.

The Mining and Minerals Policy Act of 1970 is very clear in stating that the intent of the Federal Government is to encourage (not prohibit or severely restrict) private enterprise in developing the mineral resource, including natural gas. The Act states that *"The Congress declares that it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security and environmental needs. . . ."*.

The mineral industry is experiencing increased costs of discovery, development and operation. There is a marked difference in operations on private land and federal land. Federal land operations face numerous uncertainties expressed in the single purpose laws such as the Endangered Species Act, Clean Air and Clean Water as well as the abundant delays associated with such laws, in addition to subjective discretionary decisions of land-based federal agencies. It is good business to invest a company's resources, fiscal and human, where the best return is realized. Operating costs escalate where time delays and uncertainties predominate, placing Wyoming and other western states with a predominance of public lands at a clear disadvantage to private land states such as Texas.

Companies that operate on both BLM and Forest Service lands note a marked difference in the agencies' interpretation of regulatory and statutory mandates and application of both discretionary and non-discretionary stipulations. There are differences between the agencies, but also between and among the BLM Field Offices without any additional laws or regulations to warrant such a change. Since Field Office borders are arbitrary and man-made and since minerals do not respect these borders, companies necessarily must deal with inconsistent restrictions in their operating activities. Those differences can equate to significant costs to a company from one Field Office to another within one state, or from one time to another within the same Field Office for the same activity. (Jonah Gas Gathering Company letter; pp 53-55 this report)

Findings in the 1992 study have not changed in the following areas:

- No comprehensive inventory of acreage linked to mineral access status exists within BLM or the Forest Service.

- Stark inconsistencies within and between the Forest Service and the BLM regarding the interpretation of regulatory and statutory requests and application of discretionary and non-discretionary stipulations still exist.

- Since 1983 access to mineral reserves in the western states has declined.

- Mineral leasing is still a less allowed activity in BLM Wilderness Study Areas as compared to other allowed uses such as recreation, grazing and mining.

- Designated Wilderness is still growing. There are proposals in Colorado, Montana and Utah at this time that will add several million more acres to wilderness if Congress acts in the affirmative.

- Over 10 percent of the BLM oil and gas mineral estate is restricted because of Areas of Critical Environmental Concern, and more areas are being considered.

- Industry employment in the petroleum industry is still dropping; however, there is a change from the late 80's and early 90's -- employment in the natural gas industry is on the rise. This change is mainly due to the coal bed methane play. Leases are in progress, wells are being drilled; however, gas production in Wyoming is on hold on many new wells until the issue of produced water is solved.

- There has been some change in closing the gap in the difference between the Forest Service and the BLM regarding attitude toward development of minerals. Environmental pressures on the BLM are mounting, making them more inclined to make decisions that preclude exploration and drilling where known reserves are located. The Pinedale Anticline requests to drill have gone from 2,000 wells down to two alternatives, either 700 or 500 producing wells due to such access issues as crucial deer winter range, sensitive view shed and sage grouse leks.

As mineral exploration has been thwarted in the Rocky Mountain States there has been no parallel program to decrease our nation's reliance on oil and gas. Even with this blatant dichotomy present, various government and industry groups have projected at least a doubling and up to three times the current rate of natural gas demand and deliverability from the Greater Green River Basin (GGRB) by the year 2010. (GRI) The BLM is the only source that projected a decline in natural gas production in the GGRB. BLM projected a 15% decline in their Green River Resource Management Plan. (GRI, p 16) Reasons for the BLM's stand-alone position remain unclear. The agency's analysis could be based upon knowledge of the trending toward curtailed business on federal lands or a lesser belief in what is possible than the mineral industry itself.

The pendulum has swung from production of commodities to preservation and recreation in the short period of less than two decades. (Laitos) The trending of public policy decisions of federal land closure to mineral exploration and development in the face of rising consumption is unreasonable and may have adverse repercussions for the American public in the future. As the world's population doubles and technology increases in our children's lifetime there will be a corresponding doubling or tripling

of global demand for natural resources. It appears that without a turn-around in agency philosophy and discretion, as older oil and gas fields go off line, there will not be a comparable number of new production wells to off-set the decline. (WY O&G Commission)

Recommendations

The aforementioned issues impacting the natural gas industry today are staggering and the angst this situation has triggered in the industry is noteworthy. It is imperative that a solid, unwavering visionary approach is undertaken at this time. The following suggestions are offered in the hope they may act as a catalyst for positive change in opening access for exploration and production of natural gas in the West to meet the expected need in the next century.

Recommendation 1:

A consortium of oil and gas industry representatives must meet with Western States Governors, appropriate Congressional Representatives and Federal Land Agency Secretaries in the year 1999 to find an answer to the current trend of preservation and recreation closing the federal lands to exploration and production without a balancing of mineral laws. This group must address the future well-being of the citizens of the United States and the possibility of the nation's citizens being dependent upon foreign energy as well as the responsibility of the Forest Service under the 1990 Resource Planning Act which says the Forest Service must assess multiple-use management and their contribution to rural development in addition to mixed ownership management. It clearly directs that the agency look at how the mineral resource affects the economic well-being of communities and the strategic defense of the Nation.

Additionally, other industries affected by lack of access and discretionary decision making by federal agencies should be brought into the discussions, especially timber and livestock agriculture.

Federal land and environmental laws are man-made and can be altered or dispensed with as credible science and monitoring are applied, and time provides a picture of the laws' adverse effects. Regulations and policies that interpret the laws have great weight in how the laws are carried out on a day-by-day basis by federal agencies. And, discretion is heavily weighted in favor of those whose lives are not person-

ally affected by federal land-based decisions. Monitoring must become commonplace for federal land management agencies. Until monitoring accompanies each project there can be no scientific basis for decision-making.

Industry at all levels must coalesce; becoming a living, breathing single entity that impresses Congress, state legislatures and governors, federal agencies and citizens with their extensive knowledge of all natural resources and their ability to extract minerals with the latest in technology that ensures protection of flora and fauna.

Turning perception around is difficult, but not impossible. To do so will mean initiating communication and coordination with other industries that utilize the public domain. In recent years those who speak for preservation and some segments of recreation have slowly helped drive a wedge between the extractive industry and other industries that utilize renewable resources found on federal lands. All commodities that operate on federal lands have traditionally lobbied Congress as separate entities, mostly unknowledgeable of the other industries' issues. There are many major and minor areas where all industries can come together to join forces for the benefit of all.

Recommendation 2:

In federal environmental law a mechanism has been provided for delegating programs to the states to protect the common air and water resources; therefore, it should be possible to do the same with federal lands. States also have primacy over the wildlife and by law are suppose to also have primacy over water on the federal estate although there is debate about who is in control of the water.

Congress can provide a mechanism for the delegation of management responsibilities for federal forests and Bureau of Land Management lands to the states under a trust arrangement achieving both environmental and economic goals for the federal lands that are mired in continual controversy. Drs. Jon Souder and Sally Fairfax, professors at Northern Arizona and the University of California respectively, wrote in their book *The State Trust Lands, A guide to Their Management and Use,* that states manage their trust lands more sensitively and productively than does the federal government manage Federal lands. (Fairfax)

State trust lands are worthy of comparison simply because of their size. In round numbers for example, the U.S. Forest Service manages about 192 million acres. State trust lands total about 153 million acres if the severed mineral estate is included. Funds produced by state trust land resources totaled over $27 billion in the mid-90's according to the Fairfax study, with about $3 billion distributed to the beneficiaries on

an annual basis. An additional $1.5 billion in revenues were distributed to the beneficiaries of the state trust lands on an annual basis as well. Thus, on about two thirds of the acreage, the state trust lands produce over four and one-half times the annual returns that the Forest Service is providing.

Even though there is enough evidence to show that the vitality of the West is tied to federal lands in states that share ownership of lands with the federal government, there is a trend for more public ownership of land with more restrictive use of the lands. As stated earlier, the two states involved in this study, Utah and Wyoming have respectively 67.9% and 49% of their lands in federal ownership. Individual counties within the two states have up to 98% of the their land base controlled by the federal government with economic growth, development and sustainability of these counties, and the states, being highly dependent upon economic production of those lands.

Recommendation 3:

To commence a process of state involvement with land management decision making at a less ambitious level than managing federal lands on a trustee basis, and until such a trustee relationship can be actualized, each state should develop a formalized land plan policy for federal lands within that state. Without a state vision, plan or goals upon which industry and others can ascertain what is expected to be attained from the federal lands within that state's boundary, the federal government will continue to march to their own drum beat set by environmental lawsuits and threat of environmental lawsuits.

The State of Wyoming, under leadership of Governor Jim Geringer, has forged a new relationship with the BLM and Forest Service and has designated the state as a cooperating agency with both federal agencies. Under 40 C.F.R. 15-1.6 (b)(5) *the benefits of being granted cooperating agency status include disclosure of relevant information early in the analytical process, receipt of technical expertise and staff support, avoidance of duplication with state, tribal and local procedures, and establishment of a mechanism for addressing intergovernmental issues. If a non-federal agency agrees to become a cooperating agency, agencies are encouraged to document (e.g., in a memorandum of agreement) their specific expectations, roles and responsibilities, including such issues as preparation of analysis, schedules, availability of pre-decisional information and other issues. Cooperating agencies are normally expected to use their own funds for routine activities, but to the extent available funds permit, the lead agency should fund or include in its budget requests funding for major activities or analyses that it requests from cooperating agencies.*

Wyoming will act as an equal partner with the Forest Service in the Medicine Bow Forest Plan, and is a partner with the BLM on the Pinedale Anticline EIS and coal bed methane development in the Powder River Basin. Other western states could follow

Wyoming's lead and form a partnership with the federal agencies in helping to define the issues and developing the solutions for future health of the industries that depend upon the federal lands for their business and for local and state government as well.

George Frampton, Acting Chair of the CEQ, in a July 28, 1999 Memorandum to the heads of federal agencies said, *"The Purpose of this Memorandum is to urge agencies to more actively solicit in the future the participation of state, tribal and local governments as "cooperating agencies" in implementing the environmental impact statement process under the National Environmental Policy act (NEPA)."* The memo goes on to say that non-federal entities should, under most circumstances, not have to pay for the exercise. *"....to the extent available funds permit, the lead agency should fund or include in its budget requests funding for major activities or analysis that it requests from cooperating agencies."*

Counties, too, can become cooperating agencies as demonstrated with the Yellowstone Winter Use EIS. Counties in states surrounding Yellowstone Park joined together as cooperating agencies, hired a consultant and have worked with Park representatives to ascertain recreation activity levels within the Park.

Recommendation 4:

There must be serious monitoring taking place on federal lands in relation to mineral development and production. A through discussion of monitoring was published by the Keystone Group of Colorado in the spring of 1999, pp 39-40. (See pp 57-58 this document). Federal land agencies and industry as partners should develop a monitoring document that will be used by agency personnel in the field.

Recommendation 5:

Eco-Royalty Relief could provide a royalty offset for the cost of NEPA documentation, related studies and mitigation and monitoring that exceed lease and regulatory requirements. This action would address the increasing cost of operating on federal lands as compared to operating on private lands. In addition to mineral companies finding help with current agency practices that raise costs and cause time delays it would also be a positive action for improving and enhancing the environment and the landscape.

Recommendation 6:

Lastly, the Wilderness Act can be amended by Congress to encompass a time certain from proposed status to designation. After that time period, the land would automatically revert to the status it had prior to the proposed designation. Numerous

proposed Wilderness Areas have not been acted upon by Congress for a decade or more, precluding exploration and production in areas totaling many millions of acres in the West.

The Endangered Species Act gives the USFWS two years to determine if a species should be listed from the time it is proposed and the Wild and Scenic Rivers Act has a time certain that a designation must be made or the section of the water body and the surrounding land reverts to its original designation. The number of years an area could remain in proposed status would be debated, but two to three years is ample time for Congress to investigate a specific area and vote on the proposal. By today's standards, the time from recommendation status to analysis and designation is avoidably protracted. During the entire process the land within the proposed site is administered as if the designation had been made by Congress. Such defacto set aside classification is unnecessarily locking up potential natural gas areas.

There are no silver bullets and the problems are diverse, regionalized, localized, and too complex for a "one-size-fits-all" solution. Any change in the availability or management of the federal estate upon which the natural gas industry is dependent can directly impact the viability and activity level of the industry with corresponding economic impacts to the counties, the states and the nation. States and local governments should have a leadership role as partners in determining how the public lands within their boundaries are managed.

Accessibility to the Natural Gas Supply

on

Bureau of Land Management and Forest Service Lands

In Eastern Utah and Western Wyoming

Report of Findings

1.0 Federal Laws Affecting Natural Gas Production

The federal government owns and manages a vast, resource-rich land and resource base. A solid partnership between the federal land agencies and the private mineral sector is needed to explore and produce the natural gas resource for the benefit of the nation, the states and the counties in which the resource is located. Industry, under the Mining and Minerals Policy Act of 1970, is fulfilling its role as half of the partnership when it drills for gas on the federal lands.

The following review of laws which direct mineral development is provided to give a broad picture of the defining perimeters in the exploration and development of natural gas on federal lands. The intent of Congress in passing laws regulating how leasing and related gas activities are to be managed, is clearly that the resource is to be developed and that discretion in leasing, exploration and development on federal lands is limited. The changes that relate to how the resource is leased have occurred over the years are based mostly on new technology and economic changes in the industry.

None of the statutory authorities relevant to natural gas prohibit leasing, exploration or development on federal lands, except special status lands such as National Parks, Wilderness and National Monuments. Environmental laws passed by Congress compete with statutes granting authority for mineral exploration and development. With this conflict of laws, federal land management agencies have taken discretionary authority in managing for single purposes on millions of acres under their jurisdiction. There has been no thorough national debate, nor Congressional analysis of impacts and conflict of laws.

An overall assessment and an analysis of the multiple use-sustained yield laws and regulations in tandem with special purpose laws is necessary at this time to understand the direction BLM and the Forest Service have taken in management of special species as a priority of purpose.

Listed below are major laws affecting access to federal lands for mineral production:

1.1 1872 Mining Law 30 U.S.C.A. 22-54 (later amended by the 1920 Mineral Leasing Act)

Originally, oil and gas were subject to the 1872 Mining Law, and rights to the mineral deposits were gained by the same process as hard rock mining claims are today. This law known as the General Mining Law of 1872 preceded the Organic Act, establishment of the National Forest Service and the Bureau of Land Management. In today's world a well is surveyed or located, but in the beginning a well was "staked" just as a mining claim is staked. Under the 1872 Mining Law there was no discretion by the government to allow or not allow oil and gas activity.

1.2 Organic Act of 1897 16 U.S.C.A. 473-81

The Organic Act established the system of Forest Reserves, which later became the National Forest System. This law outlines the purposes for which the National Forests are to be managed. When the Bankhead Jones lands (Bankhead-Jones Farm Tenant Act of 1937, 7 U.S.C.A. 1010-1012) were returned to the federal government they were placed under the management of the Forest Service. These were submarginal grasslands that had been farmed. When the tenants could not sustain them the lands were returned to the federal government.

The Act provides in part that *". . . it is not the purpose or intent of these provisions, or of said section, to authorize the inclusion therein of lands more valuable for the mineral therein, or for agricultural purposes"* Authority for regulations providing access for locating and developing minerals is found in 16 U.S.C.A. 478. **This and other mineral leasing laws have survived because the public in every generation has seen mineral development as a necessary activity for national protection and growth.** (emphasis added)

1.3 Migratory Bird Treaty Act of 1918 16 U.S.C.A. 703-11

This Act forbids the killing of migratory birds *"by any means in any manner."* Although the MBTA has long been considered a hunting law, it is interpreted in an additional substantive way in the production of natural gas. Courts have found mineral companies guilty of criminal offenses under the Act for dead birds found in water and sludge ponds. Such findings come under the heading of "public welfare" offenses. The number of ways human beings can accidentally cause the death of birds is limitless, and so is the potential extent of criminal liability if the Justice Department decides to prosecute.

1.4 Mineral Leasing Act of 1920 30 U.S.C.A. 181 et seq.

The Mineral Leasing Act of 1920 continues as a cornerstone of natural resource law today. It ended the federal government policy of outright sale or grant of fluid minerals. In essence this Act requires competitive bidding for leases of lands with mineral reserves. The change from locatable to leasable occurred because the fluid mineral industry was beginning to grow up and recognized the vast areas or "reservoirs" of resources covered miles, not just the few acres hard-rock minerals took up. The Act states, *"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that deposits of coal, phosphate, sodium, oil, oil shale, or gas and lands containing such deposits owned by the United States, including those in national forests, . . . shall be subject to disposition in the form and manner provided by this Act to citizens of the United States . . . ."*

This language clearly demonstrates the intent of Congress to promote mineral development on federal lands, with limited, if any discretion. Lease proceeds go to the states, the federal treasury and the Reclamation Fund. When access is curtailed, the states and the people of the United States are shortchanged. All new money in the system comes from the ground, be it a blade of grass, a drop of oil or an mcf of gas.

1.5 Mineral Leasing Act Revision of 1960 (see 1.4)

Under this law lands became available for leasing through competitive bidding on Known Geologic Structures or KGS, and non-competitive leasing (simultaneous filing or lottery-type system and over-the-counter leases). This change in the leasing process was made to ensure that the federal government received a "fair market value" for leases in areas of known oil and gas resources. Prior to this change, industry

competition generated "bonus bids" for leases on non-federal lands while federal minerals were leased at a set rate of $.50 per acre.

Department of Interior, BLM, implementing regulations of the Mineral Leasing Act 43 CFR 3100.0-3 states that oil and gas in public domain lands are subject to lease. Exceptions to this direction, or lands not subject to leasing, are specifically listed and include areas or sites as National Parks, Indian Reservations, incorporated areas, petroleum and oil shale reserves, Wilderness Areas, and others specifically described.

1.6 Multiple-Use Sustained-Yield Act of 1960 (MUSY) 16 U.S.C.A.528

The Act specifically states *"Nothing herein shall be construed so as to affect the use or administration of the mineral resources of national forest lands. . . ."* This Act does not alter or restrict the wording in the Mineral Leasing Act of 1920, which states that minerals *"shall be subject to disposition in the form and manner provided by this Act to citizens of the United States . . ."* This Act extends the purposes for which lands in the National Forest System can be managed. In essence the Act makes it clear that the lands are to be managed for multiple uses and not for individual uses in specific places. Multiple use has become a chief source of conflict between users of the federal lands and the agencies that manage the lands. As one conflict is resolved another arises.

1.7 Wilderness Act of 1964 16 U.S.C.A. 1131-36

The Wilderness Act turned 35 years old on September 3, 1999. The Act has created more than 104 million acres in the National Wilderness Preservation System. The Forest Service at first opposed wilderness bills, arguing that statutory wilderness was contrary to multiple-use, sustained-yield management. Upon passage, the Forest Service had "instant wilderness" of 9.1 million acres as there were 54 areas that they had designated as "wilderness" "wild" or "canoe" prior to 1964.

Passage of the Wilderness Act brought forward one of the most idealistic pieces of federal legislation ever enacted. The first sentence in the Act doesn't even read like legislation. It states, *"A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."*

Wyoming's Wilderness Act of 1984 passed by Congress provides that there will be no buffer zones around the wilderness in Wyoming, that forestland not classified as wilderness would be maintained on a multiple-use basis. Based on that language a lawsuit has been filed against the Forest Service challenging the validity of the recent road moratorium rule which suspended permanent and temporary road construction in roadless areas of the national forest for a period of 18 months.

The federal agencies, including the National Park Service, the Bureau of Land Management, the US Forest Service and the US Fish and Wildlife Service each manage those lands under their jurisdiction that have been designated as part of the National Wilderness Preservation System. BLM was not authorized to manage designate wilderness areas by the Act. When FLPMA was passed in 1976 it required BLM to identify Wilderness Areas. Currently BLM manages 622 Wilderness Study Areas encompassing 17 million acres, and 136 designated Wilderness Areas totaling 5.3 million acres. Wilderness Study Areas become Wilderness Areas only when Congress acts. Although there are 42 Wilderness Study Areas within the jurisdiction of the BLM in Wyoming none have been designated as wilderness by Congress.

Over a third of the US Forest Service lands are now Wilderness Areas. With the new mandate of road closures by the USFS, more acres are off limits to exploration and drilling for natural gas in the form of defacto wilderness.

The designation of a "Wilderness Study Area" has repercussions for the mineral industry. The lands that have been designated are treated differently than if there is no proposal for wilderness. The 600,000 acres in Wilderness Study Areas are more closely scrutinized by the BLM than if there was no designation. For example, in Jack Morrow Hills, the Wyoming State BLM director ruled to withdraw leases for sale and to put up no more for sale.

The BLM has designated part of the Jack Morrow Hills area as elk habitat and off limits to leasing. There are no native elk to the area. The desert elk herd was brought into the area in 1959 with the approval of the Rock Spring Grazing Association (RSGA), a private group organized since 1912. The RSGA owns every other section in the area, commonly known as the "checkerboard", an area in excess of two million acres of privately owned land. In 1959 a private trucking company from Big Piney hauled in the elk and it was agreed between the RSGA and the Wyoming Game and Fish that there would be no more than 300 head of elk ever allowed in the area. That number has escalated to over 600 head and is now a factor in the mineral industry being precluded from new leases in Jack Morrow Hills. Although the Wyoming Game and Fish control wildlife, the BLM controls the habitat. It is the role of the BLM to look to all sources of environmental degradation, administratively taking steps in correcting the source of the problem.

Although there has been little action to approve Wilderness Areas in the last two sessions of Congress, proposals are on the table to add new Wilderness Areas in several western states. If the proposed areas in Colorado, Montana and Utah do become designated as wilderness, several million more acres will be off limits to access for the natural gas industry.

Wilderness, as with Wild and Scenic Rivers and Endangered/Threatened/Sensitive species are treated as if Congress or the US Fish and Wildlife Service had spoken in the affirmative from the day of submission of the proposal even though it might be years before the actual designation is made. This situation deserves serious consideration for change.

1.8 National Historic Preservation Act of 1966 16 U.S.C.A. 470

This Act allowed the establishment of a program for preserving historic and cultural buildings, objects and antiquities thought to be of national significance and for other purposes. The language "for other purposes" is very broad and has the potential of prohibiting access in areas not deemed as cultural. A federal agency is required in its undertakings to consider the effects of the action on cultural resources eligible for, or listed on, the National Register of Historic Places.

Private lands owners in the checkerboard BLM areas and abutting Section 15 BLM lands are being bombarded with requests for cultural and endangered/threatened/sensitive species searches on their private lands even though the minerals may be private. (Although Section 15 lands are commonly called "isolated tracts" by agency personnel the nomenclature does not adequately depict their geography.) Additionally, if a mineral company finds it necessary to gain access through private lands to a mineral lease on federal lands, the request is also that a cultural and endangered/threatened/sensitive species search be conducted on private lands. Several landowners have revealed that they will not submit to such searches and thus private mineral companies may be precluded from access to federal minerals which appear to be leaseable by agency plans and maps.

1.9 Wild and Scenic Rivers Act of 1968 16 U.S.C.A 1271-87

The Act created a system of sections of eight rivers initially, five are located in the West, flowing across lands that are in federal, state and private ownership. At passage another 27 rivers were designated for further study. Scenic easements can be

taken under the Act, which prohibit mining in areas where a river has been designated as "wild". The federal government has ample discretion to control the number of users and types of uses allowed in each of three river categories under this law, thus classification of a river can be an administrative decision of great economic importance to the mineral industry.

1.10 National Environmental Policy Act of 1969 (NEPA) 42U.S.C.A. 4321-43

This law colors all actions of federal agencies and is at the root of much debate over the issue of access. NEPA is the nation's central environmental statute.

President Nixon was prophetic as he proclaimed NEPA as the heralding in of a new environmental era. NEPA has been ingrained into the fabric of administrative decision making and has become by far the most important procedural public land management statute because it requires every agencies to comply with its process in all situations where major actions are contemplated. It requires that all federal agencies give consideration to the environmental aspects of their programs in the form of an environmental analysis. Over the years "environment" came to mean only the physical environment. In the last five to six years conservatives have demanded that federal agencies adhere to the meaning in the law which addresses both the physical environment and the human environment. Socioeconomic impacts are now considered in all EISs and EAs.

Both BLM and the FS have developed manuals for utilizing NEPA in their land planning process and conduct classes for personnel although those who are attempting to gain access for a project on federal lands find that the two agencies apply NEPA in different ways. Mitigation varies from project to project with public interest and controversy often determining the standards in the decision making process. It may have been instructive in the past to look at which lands have the most scenic and aesthetic values to ascertain and correlate which have the most acres off limits to exploration and production; however, today each EA or EIS is heavily monitored and debated and/or appealed by specific interest groups. Such groups are aided by the numerous environmental laws, rules and regulations, policies and guidelines brought forth and placed into action since the early 1970's.

Federal agencies necessarily utilize every avenue afforded by NEPA to substantiate their environmental analysis. Decision making based on NEPA many times costs project developers time and money beyond reasonable limits. Even with such extensive analysis and proper procedures, the number of appeals continue to escalate, which in turn amplifies the uncertainty with which operators must tolerate and the cost of production escalates. This situation is costly to the American taxpayer as well as those whose livelihoods are dependent upon reasonable access to the resource.

The Jack Morrow Hills area in the BLM Rock Springs Office area is an example of the extensive self-required time frame by an agency in analysis of environmental concerns. A Resource Management Plan was written for the entire Rock Springs Office Area, but the area known as Jack Morrow Hills consisting of about 622,000 acres was excluded for further analysis, leaving the lease holders in limbo beyond the time when the RMP was issued.

An Environmental Impact Statement or Environmental Assessment must be drafted, subjected to public comment by a lead agency team and reviewed by other agencies in connection with all major actions. As NEPA gained momentum and complexity of interpretation over the years, many projects went from what would have had the status of an EA in early years, to an EIS today, with public hearings on the issue and the process taking 24 to 36 months to complete. This lengthy process costs private companies millions of dollars, and rather than waiting for the federal agency to commence the work, pay a third party contractor to complete the necessary work for an EA or EIS. The designated federal agency remains in control of the process even though the private company pays for the analysis. Streamlining the NEPA process is essential. Streamlining the process will cut costs to both the federal government and industry.

Each NEPA document must have developed alternatives to the proposed (preferred) action and can include a "no action" alternative. Impacts are classified as direct, indirect, and cumulative. This aspect of the law allows for economic impacts to counties and states to be considered, in addition to impacts on resources.

According to the Gas Research Institute in a 1994 publication, it cost between $60,000 and $250,000 to complete a large scale EA or EIS in a new field. The cumulative costs associated with access in the NEPA process can add $9,500 to $21,000 on a per well basis, or $.005 to $.01 per Mcf for the average gas well. (GRI, p 41) A survey updating the 1994 data is recommended as it is estimated to cost from between $150,000 to $1.5 million today for oil and gas projects and take up to 2 1/2 years to complete, and if a major pipeline is involved the project, it takes longer and is more expensive. Today air quality is a significant issue in the costs of projects and time delays.

NEPA is essentially a procedural law and many lawsuits have been commenced over its language. In spite of the many NEPA decisions, much of the interpretation of its broad and cryptic commands continue to be debated between and among the federal government, environmental groups and industry. Many questions go unanswered after two decades.

Recently, in 1999, the State of Wyoming has initiated becoming a part of the NEPA process prior to the issuance of the Draft and Final documents with both the BLM and FS. Results of this new development are yet to be determined; however, it is

a welcomed change and is expected to reap positive results. Part of this change is the expectation that monitoring will be included in the long-term process. It is essential that agencies include monitoring to confirm their predictions of impacts and to ensure that mitigation measures are effective. Only three of the five major producers of environmental analyses---the U. S. Army, the Department of Energy and the BLM---include monitoring in their NEPA guidelines. (NEPA, p 31) Although in the agencies' guidelines it does not guarantee that monitoring is accomplished.

1.11 Mining and Minerals Policy Act of 1970 30 U.S.C.A.

This law states that *"The Congress declares that it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metal and mineral reclamation industries, (2) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security and environmental needs . . . for the purposes of this Act "minerals" shall include all minerals and mineral fuels including oil, gas, coal, oil shale and uranium,"* The Act also provides that it is the Secretary of Interior whose responsibility it is to carry out policy in leasing public domain minerals for oil and gas, including minerals on forest lands. This Act is very clear that the intent of the federal government is to encourage, (not prohibit or severely restrict) private enterprise in developing mineral resources, including oil and gas.

1.12 Wild Free Roaming Horses and Burros Act of 1971 16 U.S.C.A. 1331-40

Several herds of these feral animals (meaning they descended from domestic animals that escaped long ago) occupy the federal lands of the West. Their well-being prompted the Rock Springs Field Office to write into the preferred alternative of an EA for a pipeline that only 400 yards of trench could be open at any one time, creating an impossible situation for construction. This law as been exceedingly successful in that there are excess numbers of wild horses and burros necessitating the sale of each at public sale each year.

According to Bud Cribley, BLM senior wild horse and burro specialist in Washington, D.C., reproduction rate for wild horses is about 19 percent a year and herds can double their population in three to four years. The US has a wild horse population of about 39,470 animals in 10 western states a 1998 BLM report says, and the agency estimates that the land can support about 22,778 head. Roughly 16,500 animals are classified as "excess". Nevada has the largest number of wild horses of any state.

1.13 Endangered Species Act of 1973 (ESA) 16 U.S.C.A. 1531 et seq.

The Endangered Species Act is a formidable constraint on uses of both private and public lands. It generally commands all agencies of the federal government to "conserve" listed species. "Conserve" is broadly interpreted and applied. The US Fish and Wildlife Service is responsible for this Act. It also prohibits "taking" any listed species and "takings", too, is broadly applied. When any federal agency proposes a plan of action that "may" affect in any way the existence of an identified species then a consultation with the USFWS must take place to determine if and how the species will be affected. The law was passed in December, 1973, and it was indeed a Christmas present to the environmental community. Any one can petition to list a species without scientific reasons. The Act, over the years, has precluded all federal agencies from carrying out other laws if it is determined the action may "jeopardize" an endangered or threatened species. Habitat for the species is also protected. The far-reaching effects of Section 7 have cost many natural gas projects time and money, and has precluded development of the resource. (see sections on Utah and Wyoming for specifics on numbers of endangered/threatened/sensitive species)

Although Section 7 is notorious for its far reaching arm among natural resource based industries, interpretation of the ESA on land use has the potential to go beyond monetary liability. If enough political pressure arises and incites the Justice Department to prosecute for "environmental modification", which is a normal incident to any large-scale project, any activity could be shut down in perpetuity regardless of the volume of natural gas that was determined to be involved. The theoretical basis for this, and the organizations and individuals willing to assert that the environment has been modified, are numerous in this age of litigation.

1.14 Federal Land Policy and Management Act of 1976 (FLPMA) 43 U.S.C.A. 1700 et. Seq.

FLPMA is the Act that gives BLM permanent authority to manage its lands for multiple use and sustained yield unless otherwise specified by law. It explicitly establishes the balance inherent in the concept of multiple use and recognizes the nation's need for domestic sources of minerals, food, timber, and fiber from the public lands. This Act directs the Secretary of the Interior to develop, maintain, and when appropriate, revise Land Use Plans which provide for the use of public lands.

1.15 Energy Security Act of 1980 42 U.S.C.A.

The Energy Security Act states that *"It is the intent of the Congress that the Secretary of Agriculture shall process applications for leases of National Forest System lands, notwithstanding the current status of any plan."* In another section of the Act when addressing the timber resource it uses language of "may" when speaking of making the timber resource available for sale. Congress used "shall" when talking about processing applications for leases, again clearly pointing out the preference for mineral development, regardless of the status of the Forest Plans. In Mountain States Legal Foundation v. Hodel (1986) the court held that the Bridger-Teton National Forest had violated the Energy Security Act when they decided to use their discretion not to lease until completion of the Forest Plan.

1.16 Federal Onshore Oil and Gas Leasing Reform Act of 1987

Motivation for this law came from cases such as the *"Amos Draw situation"* in Wyoming, where leases were issued non-competitively during the time gap between the completion of a very productive well on adjacent lands and the filing of the completion report with the BLM, an individual acquired leases non-competitively and the next day sold them for roughly 100 times what they had paid the federal government. This was said to preclude the government from receiving "fair market value" as intended under the Mineral Leasing Act Revision of 1960. Due to the state receiving 50% of lease bonuses, the failure to maximize those bonus bids became a hot political issue which lead to this Act. Lottery-style, non-competitive leasing was eliminated.

The Act also grants the Forest Service and BLM specific authority over both leasing and related surface-disturbing activities on National Forest and BLM lands. It provides that the Secretary of the Interior may not issue any lease on National Forest System lands reserved from the public domain over the objection of the Secretary of Agriculture, giving the Forest Service authority over regulating mineral leases, and it implies that objection to issuing leases on the NFS lands will be the exception rather than the rule. Under the Administrative Procedures Act federal agencies are required to be objective and not arbitrary and capricious in decision making which includes mineral leasing decisions.

1.17 Clean Air Act of 1970 as amended 42 U.S.C.A. 7401 et. Seq.

This Act provides that each state is responsible for ensuring achievement and maintenance of air quality standards within its jurisdictional border so long as its standards are as stringent as federal standards as established by the U. S. Environmental Protection Agency (EPA). This Act is directly involved in deciding the number of wells drilled in an area due to cumulative emissions and air quality that may or may not come from the well site.

The cooperative group called the Green River Basin Advisory Council (GRBAC) was appointed by the Secretary of Interior to address the perceived conflict between gas development in Southwest Wyoming and Northwest Colorado and environmental concerns. Mineral companies faced with escalating delays and associated costs agreed to work to balance the issues of wildlife management and air quality with their own to come to a place in time where each side could win. Support for the GRBAC recommendation was given by industry, environmental groups, local government, the state, federal agencies and private landowners. Two of the agreed upon recommendations are of great significance: (1) NEPA Streamlining, and (2) Eco-Royalty Relief.

Wherever the Act is sited it has total control of an area. Because air moves, as do water and wildlife---air, water and wildlife have the capacity of adding time delays, substantial added costs and outright preclusion of development of natural gas wells and pipelines locally and regionally. More monitoring of air quality is expected to take place in future years with the customary escalation of regulation creep over time. As an example each state is now expected to establish reasonable progress toward improving visibility in Class I areas. This haze index measurement has arrived with its own new language called "deciview".

1.18 Clean Water Act and amendments 33 U.S.C.A. 1251 et. Seq.

National standards are mandated by this Act which restore and maintain chemical, physical and biological integrity of the Nation's waters. As with the Clean Air Act, states are empowered to enforce water quality standards as long as they are at least as stringent as federal standards established by the EPA. The State of Wyoming has, for example, established standards more rigorous than Federal standards for clean water and has thus caused a slow down in the coal bed methane play in the Powder River Basin. Until the issue is resolved the state and county are foregoing $200,000 per day in income.

Recently the federal government has established, without Congress acting, to manage water on federal lands by watershed rather than waterway by waterway. This action has the potential of closing off access to many more acres than if each waterway or water body is considered individually. Prior to the watershed directive, a directive was issued in 1994 entitled "Ecosystem Management" directing agency personnel to emphasize ecological integrity and biological diversity of public lands rather than emphasizing commercial use and production of natural gas and other commodities from the lands. Watershed planning and administration furthers the goals of placing environment and biological diversity before production.

Watershed and ecosystem management appear to be a signal that the federal government has established another priority in their decision making process. Ecosystem management does not rest on a firm scientific foundation. No one can ascertain where one ecosystem ends and another begins. For a flea it is the back of a dog. Man has decided what an ecosystem is, not nature, and therefore discretion by federal employees is heightened. Watershed management will only be defensible scientifically in relation to quality if credible, measurable science is attached to waterway designations.

1.19 Resource Planning Act of 1990

The Resource Planning Act (RPA) sets national policy for oil and gas development on federal lands based on a fifty-year future projection. Multiple-use management, contribution to rural development and management in mixed ownership are important points in the RPA. The document addresses development of minerals: *"The mineral resources within the National Forest System significantly affect the economic well-being of local communities and the strategic defense of the Nation. The Public is concerned about the effects on minerals development on other resource values and on the environment."*

1.20 Energy Policy Act of 1992

This Act changes the term of competitive mineral leases from five years to ten years which assists companies in today's world of competing laws and regulations. It takes longer to permit a well today than it did even a decade ago. Lending institutions are more willing to become a part of the mineral-leasing scene when a longer term is offered.

2.0 States of Utah and Wyoming

2.1 Utah

Sixty-seven percent of the total acreage in Utah, 52,696,960 acres, is federally owned. Nearly 35 million acres are federal lands, and 17.8 million acres are private and state owned. Some counties are as high as 98% federally owned, burdening local governments to provide services on a greatly reduced tax base.

The BLM manages 22.9 million acres of surface land and 32.5 million acres of subsurface mineral estate in Utah. BLM lands extend the length and breadth of Utah.

In an era when land exchanges are at a premium, Congress passed legislation in October, 1998, sealing an historic land exchange agreement between Utah Governor Mike Leavitt and Secretary of the Interior Bruce Babbit, sealing the fate of 376,739 surface and subsurface acres of Utah school trust lands, including 176,699 acres in the Grand Staircase-Escalante National Monument.

The Grand Staircase-Escalante National Monument would be a prime area of land for the State of Utah to manage under a trust agreement with the federal government.

A proposed Wilderness Area within the state of Utah will take another two million acres out of consideration for mineral production should Congress make the designation.

2.2 Wyoming

Wyoming is comprised of 62,343,040 acres of land with 453,588 residents as of the 1990 census, making it the least inhabited state in the nation. Wyoming has only one city reaching a population of 50,000. Some of Wyoming's 23 counties are moderately populated, others are extremely rural and have less than one person per square mile. Sixty-five percent of Wyoming's population live in cities or towns of less than 2,500 people. This rural state is dependent upon minerals as its economic base. Wyoming has nearly 10 million more total acres than does Utah.

In Wyoming, the BLM manages 18.4 million surface acres which are concentrated primarily in the western two-thirds of the state, and manage 30 million acres of surface and subsurface mineral estate, leaving Wyoming very dependent upon BLM lands for all commodities. Scattered tracts of BLM, Section 15 lands, are found in other parts of Wyoming.

The checkerboard lands of Southwestern Wyoming continue to be a pivotal point of controversy as federal, state and private land intermingle every other section for twenty miles on each side of the railroad in Southwest Wyoming. Because of Wyoming's dependency upon mineral extraction, the recent NEPA cooperator status agreement the Governor of Wyoming has made with both the Forest Service on the Medicine Bow National Forest and two BLM Field Office sites is paramount for the state's future.

Wyoming and Utah, as well as other western states, feel the impact of federal land management agencies' decisions the fullest. For example, more controversial endangered species causing access problems to federal lands reside in the West than in other states. Many of the nation's water bodies have their beginnings in the mountains of the West. Wyoming and Utah each have well over 100 species either designated as Endangered or are candidates for petitioning as mammals, birds, fish, amphibians, reptiles or plants under the Endangered Species Act. For specific designations contact the state of Utah's Division of Wildlife and the Wyoming Game and Fish Department.

3.0 Mineral Production in Utah and Wyoming

Utah has been producing natural gas since 1889, and oil since 1907. Wyoming has been drilling and producing fluid minerals for over 115 years, with the first producing oil well drilled in 1884 and natural gas wells shortly thereafter.

There was substantial gain in drilling activity in Utah in 1995 at 308.6 billion cubic feet of gas (BCF), spurred on by coal bed gas development. 1996 saw a small decline to 281.8 BCF.

Both Utah and Wyoming experienced a gradual climb in production of oil and gas from the 70's into the mid-eighties when oil production declined. Natural gas production has continued to climb in Utah and Wyoming, due primarily to coal bed methane production.

1997 was the peak year for gas production in Wyoming. That year there were 271 companies/operators producing natural gas, with 5,160 producing wells at 530 Mcf per day for a total of 997,424,673 Mcf, up 9.85% from 1996. Due to the Powder River Basin coal bed methane development, production levels will continue to climb in the future. 1981 was the all-time peak year for rig activity in Wyoming, with an average of 192 units working monthly. Today there are on average 38 rigs active per month. 1995 was the all time low of 23 rigs averaged per month, the lowest since WW II.

In Wyoming, beginning in 1997 numerous wells were shut in. That year there were 1,130 wells drilled and 3,488 wells shut in. The next year in 1998, 1,333 wells were drilled and 4,646 shut in. (Wy Oil & Gas) If the number of wells drilled are to exceed those being shut in, access to exploration and production must become more friendly to mineral companies. *Note: All above information is taken from either Utah or Wyoming's FACTS & FIGURES of the respective state association publications.*

Income to Utah from royalties, rents, and bonuses totaled $32,621,000 in 1998, down from 1994 totals of $66,457,000. Utah received $9,477,000 in Payment in Lieu of Taxes (PILT) in 1998, up from $8.8 million in 1994 PILT payments. (Interior) The counties exhibiting a large percent of their land base in federal land do not recoup the needed money to run county government from PILT payments according to County Commissioners. (Liston-Utah, Johnstone-Wyoming)

Energy revenues from the public lands are significant to Wyoming's economic stability. In 1998, the state received over $237 million in mineral royalties, rents and bonuses from federal minerals managed by the BLM. That amount is down from 1994 receipts for mineral royalties, rents and bonuses which totaled $508 million. Counties received $8 million in Payment in Lieu of Taxes (PILT) in 1998. (Interior) Wyoming is a leader among states in payments from the federal government for its minerals. Looking at this fact from another view, the nation's population, via the federal government, receives more royalty monies from Wyoming than any other state.

4.0 Bureau of Land Management and National Forest Service

The Bureau of Land management managed about 60% of the federally owned lands in the United States, or more than 465 million acres, in 1970. (One Third the Nation's Land) Today, the Bureau manages about 481 million acres, acquiring over 17 million more acres to manage. The National Forest Service system manages about a fourth of all Federal lands in the US, with most of the public domain under its control located in the West. The Forest Service manages 232,740,643 acres nationwide. About 90% of Federal lands located outside Alaska are in the 11 western states. (One Third the Nation's Lands P. 22, and National statistics from Congressional Research Service)

The BLM and Forest Service maintain greater control over access to oil and gas minerals than other federal land management agencies with BLM being the dominate land resource manager.

In addition to NEPA, for lands managed by the BLM, the Federal Land Policy and Management Act (FLPMA) is the authority having the greatest impact on the oil and gas industry's ability or inability to access federal minerals. The Forest Service manages access under the National Forest Management Act, and it too must adhere to NEPA mandates. The Reform Act of 1987 (see p. 30 this document) expanded the authority of the Forest Service to deny leasing of minerals within the boundaries of each forest. In addition, the Reform Act of 1987 amended the 1920 Mineral Leasing Act in defining which lands are to be with held from oil and gas leasing such as potential Wilderness and Wilderness Study Areas.

This Act necessitates the need for effective communication, coordination and cooperation between BLM and the Forest Service. Industry is essentially caught between the two agencies as evidenced by the Christmas Meadows situation on the Uinta Forest. (see pp 55-57 this document)

4.1 Land Access Stipulation Categories

A federal gas lease is in essence a contract between the federal government and an individual or corporation (lessee) which allows the lessee to extract gas from the federal mineral estate for a percentage (royalty) of the gross value. The federal government determines what is leaseable on the lands under their jurisdiction, stipulating the terms and conditions of the lease for protection of the resource. Stipulations, or restraints on surface and subsurface disturbance, are categorized as mandatory through laws, rules, regulations and executive orders, or discretionary by local federal land agency personnel.

The leasing of federal lands for natural gas exploration and production is a complex process which can involve multiple agencies, millions of dollars, and several years of footwork. Companies must have more than a working knowledge of all laws and regulations. An in-depth understanding of not only the laws, but the process is mandatory, for it is labyrinthine and a miss-step could cost a company many millions of dollars and years of time. Once a lease is made continual communication with the federal land agencies is imperative for favorable results. Negotiations are on-going during the life of an EA or EIS process, and communication continues on through the life of a producing well.

Land access stipulations in this study are listed in six broad categories:

CATEGORIES

1. No Leasing (NA)
2. No Surface Occupancy (NSO)
3. Controlled Surface Use (CSU)
4. Timing Limitations (TL)
5. A Combination of CSU & TL (CSU/TL)
6. Standard Lease Terms (SLT)

No Leasing and No Surface Occupancy generally have the same meaning as both preclude drilling. These non-discretionary categories include: *(Please note that some categories are listed both in the NA/NSO categories and also CSU as they are treated both ways, depending upon the specific situation.)*

- Wilderness
- Proposed Wilderness or Wilderness Study Areas
- Roadless Areas
- Wild and Scenic Rivers
- Cultural Resource Sites, Historic Sites, Historic Trails with 3 mile buffers
- Recreation Areas and Campgrounds
- Areas of Critical Environmental Concern (ACEC)
- National Wildlife Refuges and Wildlife Refuges
- Research Natural Areas
- Class I View Sheds
- Steep Slopes of 25% or more
- Incorporated Cities
- Endangered/Threatened/Sensitive Species and their Habitat
- Elk Feed Grounds
- Wetlands/Riparian Areas
- Flood Hazard Areas
- Quality of Recreational Experience
- Bighorn Sheep/Grizzly Bear Habitat

Controlled Surface Use includes:

Generally drilling is permitted, but there are special values or resource concerns that are strictly controlled for specific reasons.

- Highly erodible soils
- Slopes of 35% or more
- Visual impacts of Class I and II
- Raptor nest sites buffer, sage grouse leks buffer
- Flood hazard areas
- Stock driveways
- Trails with up to 3 mile buffers
- Watersheds, water bodies including intermittent/ephemeral streams
- ACECs
- Lands in competition with other minerals such as coal or trona
- Semi-primitive/ Non motorized

Timing Limitations (seasonal) include:

Stipulations preclude drilling activity during certain times of the year, generally for less than 6 months a year.

- Big game crucial winter or summer range
- Big game calving area
- Game fish spawning area
- Raptor/bird habitat
- Wildlife corridors
- Sage grouse nesting areas
- Wildlife parturition areas
- Stock Driveways
- Snow Machine Trails

Decisions made using discretionary restrictions to leasing are often arbitrary and subjective according to leasees. Discretionary decision making can affect the acres of BLM and Forest Service lands designated as Standard Lease Terms as well as other categories. The best example of this issue with stipulations as portrayed in writing not necessarily matching the practice on the land, is the Bridger Teton Forest which has 15% of the forest under Standard Lease Terms and yet less than 5% of the forest is

in mineral development with 88 mineral leases pending, some of which have been pending since 1996. (BLM, Wyoming)

Discussion between industry and federal agencies' teams determined that timing limitations of less than 3 months were considered to have no impact on resource development and restrictions causing lack of access for 9 months or more means that access is not available. A gray area exists for timing limits restricted for more than 3 months and less than 9 months, the group agreed. It is this writer's opinion that restrictions of 6 months or more is not a gray area, but clearly means that access is not available where skilled workers have to leave their families behind. The only time that it could be considered available is if there was considerable mineral activity near by where competent, skilled workers could find work.

Workers may be available; however, *skilled* workers will not wait around for a job every six months when there is not fieldwork near by to move to as a job diminishes. Their livelihoods and lives are greatly affected by arbitrary decisions of federal land agencies–decisions that when challenged can be changed.

When the 1994 Natrona County Wyoming, Cave Gulch-Bull Frog gas EIS was in process, the BLM's preferred action included a six month activity period only, based on raptor nests, of which most had been empty for years. Only three nest were active. The local community, gas field workers, school personnel, county commissioners, legislators and the county treasurer joined with the three mineral companies that had leases in the gas field, successfully protesting that alternative. The County Treasurer and County Commissioners, utilizing actual economics and work force statistics, school personnel addressing their income from the tax base, legislators addressing the royalty issue and many families talking about their personal lives and the hardship of trying to keep a family together with the breadwinner working for six months and then trying to find a job away from the family for the other six months, all created the framework for consideration of a less limited time frame. And the birds were well protected.

Additionally, it was agreed by the Team that trails would not be included in areas considered off limits to exploration and drilling as directional drilling could be accomplished. Most preclusions are within 1/4 to 1/2 mile of a designated trail. There are exceptions to this determination. In the Rock Springs and Pinedale Field Offices there are areas not open for leasing that are within three miles on each side of an historic trail.

The recreation resource has been recognized by both BLM and Forest Service as a stipulation under NSO, CSU and TL, impacting access for the mineral industry. Substantiating the Laitos study that establishes the twin dominant uses on public lands of recreation and preservation, the BLMs annual publication, *Public Rewards from Public Lands* revealed that in 1994 there were 1,428,000 recreation days in Wyoming on BLM lands and 2,701,000 recreation days in 1998. Utah had 3,149,250 recreation days in 1994 and 4,864,000 recreation days in 1998. The budget appropriation for recreation

within the BLM on a national basis rose from $48,277,000 in FY97 to $50,075,000 in FY99 and is projected to be $51,403,000 in FY00.

4.2 Conditions of Approval (COA)

In addition to stipulations, an additional discretionary burden is placed on extractive companies in the form of Conditions of Approval (COA). COAs are not mandated by any law that Congress has passed, but have been developed by the BLM over a number of years as mitigation for surface disturbing activities. There is no standard means of identifying a COA by a potential lessee. Some COAs can be identified in an RMP as Best Management Practices and others are merely included in a request for authorization approval. COAs are included in BLM initiated projects as well as those initiated by the mineral industry.

Monitoring is intended to occur when COAs are used as mitigation of a project, but there is no ongoing evidence that monitoring is linked to effectiveness of the COA. A list of nearly two hundred COAs address surface disturbing activities for any user of the BLM lands. Natural gas companies specifically must concentrate on the following:

- road construction and maintenance
- tanks and pits for fluid storage
- oil and gas exploration, drilling, and well plugging
- pipeline and power line construction
- geophysical exploration
- protection of archeological and paleontological sites
- wildfire suppression
- hazardous substances
- protection of wildlife habitat
- management of noxious weeds
- reclamation

It is impossible to ascertain the number of acres in COAs without going to each local agency office. There is no procedure to gather and analyze such information. COAs and stipulations overlap and there is no accurate record to classify these land use discretionary withdrawals, be they temporary and time limited or consistent and long term. This study, or any study will not have accurate land use designations until an accurate research process is designed that reflects this status of discretionary mandates.

4.3 Three Bureau of Land Management Field Offices in Eastern Utah and Western Wyoming

A. BLM Price Field Office, Price, Utah:

Categories defined in Acres and Percent		
Total Acres Price BLM	2,887,939	100.0%
SLT	1,823,845	63.1
TL	117,885	4.0
CSU	161,884	5.6
CSU/TL	630,511	21.8
NA	261,285	9.0

The Price Field Office area in Utah has 261,285 acres or 9% totally off limits to mineral development and another 31.4% in stipulations of controlled surface use and timing. COAs are not listed separately. Price is similar to Rock Springs in Wyoming in percent of lands involved in discretion of the Field Office. Pinedale has more discretion in percentage than either Price or Rock Springs, but far less in number of acres involved in discretionary terms.

There is coal bed methane development within the Price BLM in which the water is brackish and undergoes the costly process of reinjection. Companies were given the choice of reinjection or other options which included purification processes such as reverse osmosis. The companies chose reinjection.

Price, in their 1993 land use plan, addressed critical winter range of more than 10 surface acres as being significant. Any mineral company that impacts 10 surface acres or more of critical winter range must mitigate off site to compensate for the impact. Since the 1993 plan about 30 projects have applied the mitigation impact. BLM has designed the off site mitigation projects and the companies have supplied the funding.

A unique process and plan have been developed with the National Fish and Wildlife Foundation (NFWF) in Washington, D.C. in which the companies send the

$1,250 per well mitigation money directly to the NFWF and the Foundation invests it in a Federally protected investment. NFWF receives 5% of the interest earned and in turn invests new money received by the Foundation into the Utah mitigation program.

The Price BLM is never involved with the money and the mineral companies' comments are taken into consideration by the BLM when the projects are being considered. A typical project is a prescribed burn for habitat enhancement for deer and elk. (David Mills, Price BLM)

Price BLM Field Office has worked with the issue of Coal Bed Methane successfully over the years. Where known coal is found, methane leasing takes a backseat to the coal, with competition between fluid and hard rock minerals less a problem in the Price area than in other areas.

B. BLM Pinedale Field Office, Pinedale, Wyoming:

Categories defined in Acres and Percent		
Total Acres Pinedale BLM	1,575,812	100.0%
SLT	850,829	53.9
TL	653,663	41.4
CSU	000.000	0.0
CSU/TL	000,000	0.0
NA	72,121	4.6

The Pinedale Field Office area is currently developing the Pinedale Anticline EIS. This area has great potential for natural gas. 41 wells have been drilled since the 1930's, ten of which are producing today, all from an area along the crest of the anticline. There is sensitivity of the human environment, resource values and because of the uncertainty as to the likely level of production, two levels of activity are being considered. One with 700 producing wells, and one with 500 producing wells.

Mitigation considerations are Pad (directional) Drilling in sensitive deer crucial winter range, sensitive viewshed, raptor nest areas and areas known for sage grouse leks; Centralized Production Facilities (CPF) are used for sensitive deer crucial winter

range and sensitive view shed, etc. This is being analyzed in two ways—one CPF per 8 to 16 wells or 1 per mile, and one CPF per 32 to 64 wells or 1 per 4 square miles. Although the BLM has no authority or jurisdiction on private or state lands, it is required to assess the cumulative impacts of actions it authorizes on federal lands with concurrent and similar actions on private or state lands. This requirement is by the CEQ regulations which implement NEPA.

Nearly one half of the Pinedale Field Office area is managed for timing limitations, with another 4.6% of the area not available for leasing. The Pinedale area is beginning to become a destination for out-of-state and wealthy owners who prize open lands and scenic beauty. Development of the anticline will have some political overtones caused by the makeup of landowners, especially viewshed considerations.

C. Rock Springs Field Office, Rock Springs, Wyoming:

Categories defined in Acres and Percent		
Total Acres Rk SPS BLM	5,356,233	100.0%
SLT	2,927,614	54.7
TL	1,440,115	26.9
CSU	314,034	5.9
CSU/TL	265,086	5.0
NA	409,381	7.6

The Rock Springs Field Office manages the largest of the BLM Field Offices and National Forests studied. The land area comprises over 5 million surface acres. Management of the area is complicated by the checkerboard land ownership and the Union Pacific Rail Road lands stretching across southern Wyoming. Although a private association of grazing lessees own over 2 million intermingled acres in the Rock Springs BLM area there are few conflicts with the private land owners and the mineral industry.

The area is home to one of the wild horse herds in Wyoming and also a desert elk herd.

Jack Morrow Hills in Rock Springs BLM

BLM controls about 92.3% of the Jack Morrow Hills area within the Rock Springs Field Office, or 574,680 acres of which 123,440 acres are in a Wilderness Study Area and are off limits to new mineral leasing. About 267,840 acres are currently leased, leaving 306,840 acres in question. Leaseholders state that the range of alternatives for JMH are not adequate and will preclude development on areas that could be productive.

JMH is an example of the extensive discretionary, self-required time frame and analysis by a federal land agency in doing their due diligence in order to restrain appeals, when addressing environmental concerns. The desert elk herd that frequents the area is not native, and when transplanted into the desert were to be contained at 300 head. Over time the herd has grown to over 600 head and personnel within the BLM have changed. Agreements made years ago with the private sector have been long forgotten by the agency which in turn impacts today's decisions in favor of the wildlife resource.

Although only 7.6% of the Rock Springs Field Office area is in the No Lease (NA) category, the acres affected are 409,381--twice that of the no lease acreage in the Price Field Office, and over five and a half times the land area designated in NA in the Pinedale Field Office area. With air quality issues heavily impacting development in the Rock Springs Field Office area, the amount of discretion the Rock Springs BLM Area Manager controls is immeasurable.

Today, the checks and balances in weighing commodity outputs, including some forms of recreation, and environmental concerns are addressed when conflicts occur or at the time of an EA or EIS process. It is apparent that Congress should define a management philosophy for the federal lands giving statutory guidance to values now expressed administratively.

D. Summary

BLM RESTRICTED ACRES SUMMARY

Categories	Pinedale	Price	Rock Springs
Total Acres	1,575,812	2,887,939	5,356,233
SLT	850,829	1,823,845	2,927,614
NA	72,121	261,285	409,381
CSU	----------	161,884	314,034
CSU/TL	----------	630,511	265,086
TL	653,663	117,885	1,440,115
Total Acres Restricted	725,784	1,171,565	2,428,616
Percent of Acres Restricted	46.01%	40.56%	45.34%
Percent of Acres in Discretionary Restricted Status	41.48%	31.52%	37.69%

Collectively over forty-five percent of all BLM lands in this study are restricted in some way, with seven percent in no leasing restrictions, lands that are totally off limits for mineral leasing by actions of Congress. Total land in the NA category for the three BLM Field Offices is substantial at nearly three-quarters of a million acres.

Price BLM has the greatest percent of discretion in deciding which lands are to be leased and which stipulations and COAs to apply with 41.4% of total restricted acres in the discretionary category. Price and Rock Springs are equal in percent of

restricted acres that are completely precluded from leasing; however, comparing acreage, Rock Springs has over two times the total acres in the non-discretionary category than does Price and over five times the number of wells that could potentially be drilled. Rock Springs BLM has the greatest number of discretionary acres of all districts studied.

Pinedale Field Office area is dominated by bird and big game discretionary areas. Sage grouse, various species of hawks and crucial winter habitat for elk, moose, deer and antelope prevail as consideration for discretionary decision making. The area also has two Wilderness Study Areas, two ACECs, a Wildlife Study Area and numerous designated cultural sites that are no lease areas. There is a dedicated stock driveway trail that is NA also.

Viewshed restrictions are mostly Class II and there are air quality considerations also which overlap the above restrictions, attesting to the cumulative impact barrier to mineral development which haunts the mineral industry.

Lastly, there is a three-mile buffer along both sides of the Lander Trail totaling six miles across. This is outside the limits of the 1/4 to 1/2 mile area that the Team ascertained would be leasable with directional drilling.

4.4 Three National Forests in Eastern Utah and Western Wyoming

The late 19th Century marked a shift in Federal land management priorities. Congress created the first National Forests which were located in the Pacific Northwest. By withdrawing the forest lands, Yellowstone Park (the first National Park) and lands for Wildlife Refuges from settlement, Congress signaled a shift in policy goals served by the federal lands. In the early 20th century Congress further defined the nation's direction by passing the Mineral Leasing act of 1920, ensuring that the government would gain control over assets within the federal land boundaries.

A failing of the Forest Service today is lack of coordination in leasing activity with the BLM (see Bridger-Teton p. 38 and Christmas Meadows on Uinta pp. 55-57). Secondly, there seems to be a lack of effort in administering lands for oil and gas leasing even though there is a plethora of lands in the category of Standard Lease Terms—15.5% on the Bridger-Teton National Forest, 75.2% on the Manti La Sal National Forest, and 33.8% on the

Uinta National Forest. The agencies' interpretation of available acreage open to leasing is substantially inflated according to the number of acres in Standard Lease Terms and the number of wells permitted. The Uinta boasts 3 Wilderness Areas and a National Monument on only 320,613 acres with 40.0% in absolute restricted status.

According to a 1997 study by Delta environmental consultants, comparing mineral leasing on federal lands in 1983 with 1996, Utah went from 24,474,572 acres under lease in 1983 to only 3,381,091 acres under lease in 1996. Wyoming, in 1983 had 22,669,549 acres under lease and dropped to 12,150,269 in 1996. Across the West there was a 72% decrease in 13 years. (Delta, p 24)

The time element in relation to this study precluded a thorough research history on a year by year basis to ascertain the decline rate in mineral activity and the number of acres open for lease.

A. Bridger-Teton National Forest, Jackson, Wyoming:

Categories defined in Acres and Percent		
Total Acres B-T Forest	3,272,642	100%
SLT	507,953	15.5
TL	93,340	2.9
CSU	00,000	0.0
CSU/TL	8,191	0.3
NA	2,663,158	81.4

The Bridger-Teton National Forest comprises 3,272,642 acres, with only 15.5% of the forest under standard lease stipulations. This is less than half that of the Uinta National Forest. In comparison to the Bridger-Teton, the Manti La Sal, has five times more land in standard lease terms.

There are only 12 oil and gas leases in the Bridger-Teton, involving 71,975 acres, or a mere 2% of the forest. Another 88 leases have been nominated with a total acreage of 166,399.39 acres. Many of these 88 leases have been pending since 1996 indicating a reluctance to lease by Forest Service personnel.

2,663,158 acres, 81.4% of the Bridger-Teton Forest is designated as non-leasable. This is a significantly high percent of land not open for lease. It is higher than any of the other forests studied. The B-T hosts two major Wilderness Areas, the Gros Ventre and the Teton. The Bridger-Teton Forest abuts two National Parks: Yellowstone National Park and Grand Teton National Park and also abuts the elk feed grounds at Jackson, Wyoming. Consideration is given for the few leasable acres in the B-T as it is a showcase forest with view shed values, home to numerous wildlife species including the grizzly bear and wolf, and wilderness designations.

B. Manti La Sal National Forest, Price, Utah:

Categories defined in Acres and Percent		
Total Acres in Manti LS	1,418,905	100%
SLT	1,066,744	75.2
TL	204,464	14.4
CSU	122,939	8.7
CSU/TL	00,000	0.0
NA	24,758	1.7

The Manti La Sal National Forest comprises 1,418,905 acres with three fourths of the forest in standard lease terms and only 1.7% not available for leasing. The Bridger-Teton land area is twice as large as the Manti La Sal, but the Manti La Sal has twice the number of acres in SLT. This forest is the most open to leasing of the three forests studied. Although not a part of this study the total mineral activity on the Manti La Sal should be compared to the other forests to ascertain if the percent of activity equals the percent of acres open to leasing under all categories except NA.

Roads built by mineral companies on the Manti La Sal are required to be graveled and of a standard to accommodate recreation which will meet Forest objectives for the Forest Development Road System.

According to the Final EIS on the Manti La Sal National Forest, under the heading of Forestwide Cumulative Impacts (page IV-164) for oil and gas leasing, there are well below the number of wells predicted to be drilled. An example of the expected impacts is that there were to be 9 wells per year which had been the trend throughout

the early and mid 80's. The reality, between 1986 and 1991, was that only two wells were drilled per year. The question remains, what caused the decline in the number of wells drilled from 1986 until the early 90's? A follow up to this data would reveal if the trend of decline continued into the late 90's.

C. Uinta National Forest:

Categories defined in Acres and Percent

Total Acres Uinta Forest	320,613	100.0%
SLT	108,441	33.8
TL	14,802	4.6
CSU	50,060	15.6
CSU/TL	18,931	5.9
NA	128,379	40.0

The Uinta National Forest is the smallest of the three forests studied encompassing only 320,613 acres. The Uinta lies just south of the Wyoming border in the state of Utah. One third of the forest is designated as Standard Lease which is equal to 108,441 acres. Just over 40% of the forest is totally off limits to mineral activity, and another 26% is in the discretionary category. The entire forest is less than the number of acres that the Bridger-Teton has in SLT. The Manti La Sal has three times the number of acres in SLT than the total acreage of the Uinta National Forest.

D. Summary

NATIONAL FOREST RESTRICTED ACRES SUMMARY

Categories	Bridger-Teton	Manti La Sal	Uinta
Total Acres	3,272,642	1,418,905	320,613
SLT	507,953	1,066,744	108,441
NA	2,663,158	24,758	128,379
CSU	----------	122,939	50,060
CSU/TL	8,191	----------	18,931
TL	93,340	204,464	14,802
Total Acres Restricted	2,764,689	352,161	212,172
Percent of Acres Restricted	84.47%	24.31%	66.17%
Percent of Acres in Discretionary Restriction Status	3.10%	23.07%	26.13%

The Bridger-Teton Forest has the greatest number of acres of the three forests studied, and also has the largest percent of restricted acres, but the Forest Supervisor has the least amount of discretion percentage wise, with only 3.1% of the restricted acres, just a little over a million acres, available for individual decision making . The B-T also has the fewest percent of acres in the category of Standard Lease Terms, but percentages can be deceiving, as the B-T has more actual acres in SLT than is in the entire Uinta Forest. The Bridger-Teton Forest lies adjacent to the Crown Jewel of National Parks, the Yellowstone, and is heavily scrutinized by the public; consequently, 81.37% of the Bridger-Teton's acreage is strictly off limits to mineral activity. This

equals over 2.5 million acres, more land mass than the Manti La Sal and Uinta Forest combined.

Although the Uinta National Forest has the least number of total acres, the Uinta ranks second in percent of acres that are restricted. Just a little less than a third of the restricted acres lie in the discretionary category, but looking at the Christmas Meadows situation (see pp 55-57 this document) there is room for doubt that all acres counted in the discretionary category are available for lease. About one third of the forest is open under Standard Lease Terms.

Manti La Sal National Forest in Utah has the least percent of acres in restricted status as well as fewer actual acres that are totally restricted on the Manti La Sal than on the Uinta, which has fewer total forest acres. The Uinta has almost 5 times the number of acres restricted than does the Manti La Sal and it is only a quarter as great in total acres.

The three forests studied have a total of just over 5 million total acres with 3.3 million categorized as restricted, indicating that over 60% of the land base has restrictions that potentially preclude natural gas development. 2.8 million acres, or 40.5% of the total acres are completely non-attainable for leasing.

5.0 Commodity Competition on Federal Lands

The future of the West is obligatorily intertwined with the federal lands in the western states and with continued use of the resources on those lands. It follows therefore, that access to the resource is intrinsically wed to the economic viability of each industry associated with a specific commodity. Potential collisions between commodities is inevitable as natural resources such as gas, oil, coal, trona and coal bed methane exist simultaneously within and upon the federal lands.

- When coal is produced it is possible to destroy the coal bed methane. Coal companies do not own the coal bed methane and are therefore not intent upon preserving the methane gas. A recent U.S. Supreme Court decision clarified who owns the rights to coal bed methane, but did not resolve potential conflicts between the coal companies and companies extracting the methane. The Southern Ute American Indian tribe unsuccessfully sued Amoco, claiming that ownership of the methane came with the tribe's existing possession of the coal. The court decision essentially allows coal companies to mine as usual, without

carrying responsibility for collecting the gases that are automatically lost when the coal is extracted.

- A similar issue has arisen in the Pinedale BLM district with a dispute between gas and helium during the processing of gas. Sublette County Wyoming is seeking compensation from Exxon for lost helium, a gas that was discharged as part of the company's normal operation at the LaBarge Field gas processing plant. These examples of conflict between commodities may broaden the concept of "takings" law.

- Conflicts between trona and fluid mineral production in Southwest Wyoming will impact about 6% of the undeveloped natural gas resource. (GRI, p. 2 and 4) Wyoming produces about 90% of the nation's need for trona, and about 30% of worldwide demand. A Joint Interagency Committee was established in Wyoming to address the conflict between trona mining and oil & gas drilling operations on just over 800,000 acres in Southwest Wyoming in the Rock Springs BLM Field Office area. All alternatives placed mine safety as the number one issue. Findings of the Committee, based on numerous engineering studies, have been recommended to the Wyoming State BLM Director. The Committee recommended that petroleum leasing be delayed until trona mining is completed (it is estimated that there is a 2,500 year supply, 20 times the life expectancy of the estimated natural gas resource), and where leases already exist, the BLM will find compensation alternatives that may include an outright cash settlement.

- Elsewhere in the West, a conflict between potash and oil and gas exists in New Mexico which has bearing on the trona/oil and gas conflict. They are similar as both potash and trona are salt-based minerals. Potash and fluid minerals are better able to coexist than trona/oil and gas as the potash can be drilled through without harm whereas the trona cannot. The mineral producer in New Mexico became involved with the Interagency Committee for trona/oil and gas knowing that the findings and decision in Wyoming would impact his case that is currently before the IBLA. It is not known if the Wyoming State BLM Director will issue a decision prior to IBLA's decision, which is not expected for at least a year.

6.0 Illustrations of Roadblocks to Access on BLM & Forest Service Lands

Interviews conducted with industry representatives disclosed that there continues to be a lack of environmental analysis as required by NEPA in some instances in

decision making (using credible science), adherence to multiple use mandates set by Congress are not respected, the application of land use requirements is excessive, monitoring appears to take a back seat to other functions within the agencies, and in many instances companies are held hostage due to time and cost limitations.

Although a plethora of laws and regulations exist setting the perimeters for access on federal land for exploration and production of natural gas, the reality persists that there is enough room for subjective actions by federal land managers, using single purpose laws, that access to the federal lands is greatly curtailed.

The following illustrate lack of access due to discretionary decision making which determines the viability of exploration and production on both BLM and Forest Service lands within the study areas. These examples are not rare. To do a through investigation of the many creative ways in which access has been curtailed or stopped would take a questionnaire mailed to every mineral lessee within the last decade, and a review of the numerous lawsuits filed by environmental groups with subsequent decisions by federal land managers. The question remains, does this country desire natural gas exploration and drilling on its federal lands, and if so to what degree and at what cost?

Examples:

1. The Jonah Gas Gathering Company Granger Pipeline, Opal Spur Pipeline, and Bird Canyon Compressor Environmental Assessment (EA) depicts several issues of significance relating to timing limitations, current federal land management agencies' practice of holding mineral companies hostage in moving forward with a project unless they pay for the EA/EIS, for an endangered species search and a recouping of federal government costs of ROW application and monitoring of pipeline construction.

   Only one of two legs of the pipeline has been built for a total of 52 miles. Application was made in June, 1998, and it was expected that an internal EA is all that would be needed for such a small project. On August 14, 1998, the company was told a formal EA with public comment was needed. If the company expected the federal agency to do the work the project would be put in the budget and it would be three years before the EA work would commence. The company, due to time limitations, paid $45,000 for the EA. In addition, the company was informed that under federal regulatory authority the federal agency could recover the cost

of the application, which was $54,000, to process the paperwork and monitor construction. At this point the company has paid nearly $100,000 to proceed with a small natural gas pipeline in an area that has become nationally known for the size of the play.

Two more instructive situations come to light with this project illustrating unreasonable roadblocks to mineral production and delivery on federal lands. First, the EA mandates that only 400 yards of pipeline trench can be exposed at any one time due to wildlife. This is an impossible situation which has the potential to escalate the costs of the project to impossible heights unless an agreement can be made to preclude this requirement.

Third, and the least understandable, is the mandate that a search for a specific endangered plant must be made. If the federal agency conducted the search, the project would be delayed another 12 months. The company has hired a botanist for approximately $12,000 to conduct the search of 20 miles up and down a river where the pipeline will cross. The pipeline is being laid in the same corridor where six utilities are currently laid, and at least two of the six has been laid since the plant was listed as endangered in 1992. One of the two utilities conducted a survey due to the specific endangered plant in question and results showed that no plant and no habitat was found. Additionally, previous research has shown that the endangered plant is found at an elevation one thousand feet lower than the site of the pipeline corridor and never found in the area involved.

2. For convenience, the same pipeline will be used to illustrate discretionary decision making between different field offices of the same agency. In 1995 a draft EIS was released in August and a Final EIS in February 1996, and the ROD was signed on April 4, 1996, for a major pipeline running 515 miles from Canada to Wyoming. It received all the necessary permits in just 8 months even though the pipeline crossed 43 perennial rivers and streams including the Clark's Fork which is #1 on the endangered rivers list and the Missouri River which is home to the "Pallid Sturgeon", a listed endangered species.

Other endangered or threatened species identified along the pipeline route included: Black-Footed Ferret (an aerial search was conducted and none were found), White-Tailed Prairie Dog, Bald Eagle, Peregrine Falcon, Whooping Crane, Piping Plover, Mountain Plover and ten sensitive plant species.

The pipeline crossed the Bridger Trail and under Alternative #1 (Modified Action) which the ROD endorsed, the Draft EIS states: "The route would be moved to an area where the visual integrity of the trail has been compromised." (Page S-18, Draft EIS)

The EPA recommended "pipe within a pipe" regarding the river crossings, but the federal agency disagreed. All of the rivers were open-trenched except the Missouri and the Yellowstone. The federal agency stated " it did not warrant the increased complexity and expense of directional drilling." (FEIS, response to EPA comments)

In contrast, the Jonah pipeline is only 52 miles long, crosses only two BLM districts and it has taken over a year to move on that project even though there are six other utilities that are in the same corridor. The 515-mile pipeline forged a new corridor and crossed rivers and waterways where none had gone before. It took over two months per mile for McMurry to build a small pipeline, but Express was able to build a pipeline from Canada through two states in record time. It took, on average, only 6 days per mile of pipeline for Express.

The 52-mile ROW is located within two BLM districts. No restrictions were encountered while crossing one BLM district, but numerous roadblocks occurred in the other. Three roadblocks occurred in one BLM district: a mandate to search for the nonexistent endangered plant, a timing delay when a red-tailed hawk was spotted and the trenching of the ROW was stopped until the birds were gone and lastly, the need to open only a minuscule part of the trench at any one time due to a wild horse herd. Cost of the delays are not available at this time.

3. This illustration involves both the Forest Service and the BLM, a split estate issue, and shows how exploration of our nation's natural resources can be restricted by withholding key lands from leasing although they appear to be leasable. It is not an isolated situation, and it illuminates how the federal government appears as if they have offered a very large percentage of the federal lands for lease and have only withheld leasing on a small portion of the federal estate, when in real terms many acres are off limits to mineral producing companies. The timing delays and legal costs companies incur are prohibitive to mineral development in some areas.

The issue of split estate further complicates a process that can be labyrinthine when only one agency is involved. It has the potential to induce costly delays

due to communication between the agencies and, in the following illustration, also necessitated a legal process.

The mineral lease in question known as the Table Top Unit (Christmas Meadows) is located in the Northeastern Utah Overthrust Area in Summit County, Utah on the Uinta National Forest. Leases were first made in the late 70's. The Unit was formed March 30, 1989 and encompasses 23,000 acres of leases with one 400-acre tract unleased but expected to be leased in the near future. The Unit was organized to develop a very large geological structure 14,000 feet below the surface of the earth which by Overthrust standards could have a potential to yield the equivalent of about 6 trillion cubic feet of natural gas, with a market value exceeding $10 billion.

Many miles of seismic were done, a drill site was chosen and an EIS was completed in January, 1992. The APD was received July 5, 1995. A road was constructed to within one-quarter mile of the proposed location in October, 1995. All this was accomplished with the 400-acre tract sitting like a donut hole still unleased.

Knowing that the unleased tract could affect the development of the rest of the leases, the Unit operator requested a suspension of terms on the leases within the Unit on April 1, 1996, citing its inability to adequately develop the Unit with the 400-acre tract still unavailable for lease. Utah BLM rejected the Operator's suspension request citing there was no hindrance to exploration because of the small unleased tract. The case went before the Interior Board of Land Appeals (IBLA) on July 11, 1996. Almost 3 years later, on March 17, 1999, the IBLA decided in favor of the Unit Operator and remanded the case back to BLM, which then granted the suspension on April 1, 1999.

In this case the Forest Service and Interior officials can continue telling the public that 98.3% of this particular Unit is available for exploration and that only 1.7% (the 400-acre tract) is unavailable. The public will find this percentage very acceptable, and makes the mineral company look as if they will never be satisfied until they have the entire forest leased. However, the IBLA ruling clearly identified the unleased tract as a hindrance to exploration efforts in the Unit. The Unit Operator has recently contacted the Forest Service with three alternatives, but to date has not received a reply.

This situation illustrates the time and money a company can incur in their quest for exploration and development. Additionally, this particular case highlights

the need for a potential new category of NSO lands. Perhaps a buffer area of 10 miles should be established around all federal lands not available for leasing because, by their unavailability, they make the acreage surrounding them equally unattractive for leasing, and therefore should be properly documented and not count as available lands for mineral exploration and production.

7.0 Monitoring

Changes in management occur on federal lands with each process that is undertaken by the agencies. Decisions are made to accomplish specific goals under federal laws such as NEPA or FLPMA and the myriad of other laws agencies follow, without the benefit of monitoring as a tool with which to make those changes.

According to a 1999 regional survey of oil and gas companies in 13 western states, a new management directive has taken place within federal agencies, one that matches the paradigm shift from commodity use to preservation. (Smith, IPAMS)

"Reinventing Government", a movement that was commenced by Vice President Al Gore's National Performance Review of 1993, includes a management directive to improve customer service for all users of public lands. Customer service is addressed in the fields of cultural, structural, procedural, ethical and environmental. The natural gas industry is a customer of federal government land-management agencies and the study by the Independent Petroleum Association of Mountain States (IPAMS) shows that the BLM's response to its natural gas customer base has been disappointing to that industry. Only 29% indicated they were satisfied, and frequency of interaction with the BLM was negatively correlated with satisfaction. This is instructive because companies with the greatest frequency of interaction with the agency are the ones in the exploration and development stages of the business.

A significant issue in customer satisfaction is monitoring and communication. The reinvention process lacked a monitoring component that is impacting the natural gas industry today. Issues that were addressed as important in 1995 have worsened and others have emerged according to the study.

Serious postmortem debate must take place in discussion of monitoring on the federal lands in relation to mineral development and production. A report by the

Keystone Group of Colorado was issued in April 1999 on the issue of biological diversity on the public lands. The published report includes a section on monitoring, recommending that federal land management agencies should strengthen their monitoring programs by taking the following actions: 1) Develop a system for tracking monitoring efforts that is coordinated both within and among agencies. 2) Provide an adequate and stable funding commitment to continuous monitoring efforts to ensure that management objectives are being met: ensure that monitoring is conducted on schedule in all types of land classification; and ensure the incorporation of the monitoring efforts into the land management plan of each management unit. 3) Develop a quality control and assurance process for their monitoring programs to ensure that: a) resource management objectives are stated explicitly in ways that are measurable and thus able to be monitored; b) monitoring activities are compatible across agency boundaries. 4) Incorporate monitoring programs and their results into compatible GIS and other information transfer systems. (selected goals taken from Keystone study page 39-40)

The Council on Environmental Quality (CEQ) in January, 1997, issued their examination study of NEPAs effectiveness, asking the question of whether the process could be streamlined for efficiency and how effectively was the integration of social, environmental and economic factors as called for by the Act. The study states that agencies should conduct monitoring to confirm predictions of impacts. (CEQ p.31) Presently agencies do not collect long-term data on environmental impacts of projects, nor is data collected and compiled by any entity on long-term impacts to business, local communities and states on lost opportunity.

8.0 Cumulative Impacts

"Cumulative impacts" has a double meaning. Assessment of cumulative impacts in the common understanding of the phrase means concern by environmental and public interest groups that not enough emphasis is given to the overall impacts of multiple projects over time. The GRBAC group in Southwest Wyoming addressed the need to evaluate environmental effects of energy development. If region-wide EISs become necessary due to concern about cumulative impacts, new production will become very costly and delayed. The time value of money to an operator could be on average $10 million the first year when delays occur. (Based on presentation by Ultra, August 1999, in relation to the Pinedale Anticline)

Cumulative impacts to the mineral industry, counties and states where the mineral resource is located is the second meaning of the phrase "cumulative impacts." Layers of impacts that preclude exploration and drilling for the natural gas industry

are substantial. NEPA process time delays and costs, no access, overlapping commodities competing for the same land area, surface disturbance, wilderness, endangered species, clean water, clean air, ecosystem management, timing limitations, prices, increased development costs--these and a myriad of others are the staggering issues that the natural gas industry faces today. These not only create time delays and uncertainty, but an increase in operating costs on federal lands as well.

As the mineral industry is over burdened with these cumulative concerns, so too, are the local and state governments that depend upon the income from minerals for economic stability. As production costs rise to meet the needs of the cumulative pressures and delays occur, states are finding their needs for income mounting. To meet the needs of the state's residents, the tendency to raise taxes on the mineral industry is increased. This situation is a downward spiral for the mineral industry, the states, the federal government and the nation.

This study is timely and responsive to the needs of the mineral industry, the states and the nation.

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Appendix K

Old Field Reserve Appreciation

Ultimate Recovery Appreciation – Methodology and Assessment

Ultimate recovery appreciation, also called old field reserve appreciation or reserve growth, has been assessed in two major ways. One approach solely depends on time, under the assumption that over time more is known about a field and more resources are converted to proved reserves as development proceeds. Time becomes a simple yardstick for knowledge growth and continued access to more gas resources through recompletions, workovers, and new wells. On the other hand, it is recognized that the number of completions can also be a yardstick by which to measure reserve growth as a field is developed. The number of completions is typically not uniform over time. Completion activity is concentrated in the early years of field development and then generally tapers off. However, recognition of undrained natural gas usually leads to cycles of infill drilling and recompletions, especially for low-permeability (tight) reservoirs where low matrix permeability necessitates hydraulic fracturing or other well stimulation treatments to achieve economic production rates. These cycles are affected by market prices and regulations related to well spacing.

Both time and well completions can be related to reported reserve increases by field. An ultimate recovery factor, representing a multiple of the initially reported reserves, can be calculated and grows over time, ultimately approaching an asymptotic value. The approach chosen for this assessment by the Reserves and Production Division, Energy Information Administration (EIA), was to utilize both the number of completions over time and time itself for each vintage of natural gas fields (fields grouped by year of discovery). Actual well data were available beginning in 1967 to 1971, depending on the region, and reserve volumes were available by field for the period 1977 to 1996. Thus, the modeling procedure adopted had to both backcast data, such as well data prior to 1967, and model future drilling and reserve additions. The modeling approach is briefly summarized here and an overview of the procedure is provided. Results for each area assessed by resource type (shallow <10,000 feet, deep, tight, and Gulf of Mexico shelf) are provided in Table K-1.

Modeling Overview

In the EIA approach, ultimate recovery appreciation is correlated to time and effort. While there are many factors that contribute to ultimate recovery appreciation, the details and/or data are not always available for specific modeling efforts. EIA chose to use surrogate parameters with influences that would effectively communicate and contribute the influences of the unavailable parameters. Most appreciation comes from some effort or activity at the well, reservoir, or field level. Well completions were used as the indicator of effort. Well completions consist of new wells and recompletions in existing wells, and are a surrogate for other activities and effort applied in a field to increase recovery. Some appreciation occurs over time with little or no

effort applied as more knowledge is gained about a field. Experience and knowledge gained over time, combined with the inherent conservative nature of reserve estimating also contribute to the appreciation. In the EIA model, well completions have the most influence while time has a minor contribution.

Data Preparation

Since 1977, EIA has collected field reserves and production data from operators. Ultimate recovery is defined as proved reserves plus cumulative production. This 20-year history of proved ultimate recovery by field was sorted or grouped by vintages (year of field discovery). The change in ultimate recovery for each vintage group of fields was used as the standard to be modeled. The earliest vintage used was 1900. The available 20 years of history for very old vintages represents appreciation some 70 years after discovery. For more recent vintages, the 20-year history represents appreciation during initial development. So nearly 100 years of appreciation can be modeled from EIA's 20-year history of actual ultimate recovery data.

Well completion data were grouped by vintages in the same way as the ultimate recovery data. Dwight's data was used to get a count of well completions for the vintaged groups of fields. Approximately 25 to 30 years of recent history is available. The available 25 to 30 years of history for very old vintages represents the level of effort some 60 years after discovery. For more recent vintages, the history represents the effort during initial development. So nearly 100 years of effort can be modeled from 25 to 30 years of actual well completion data.

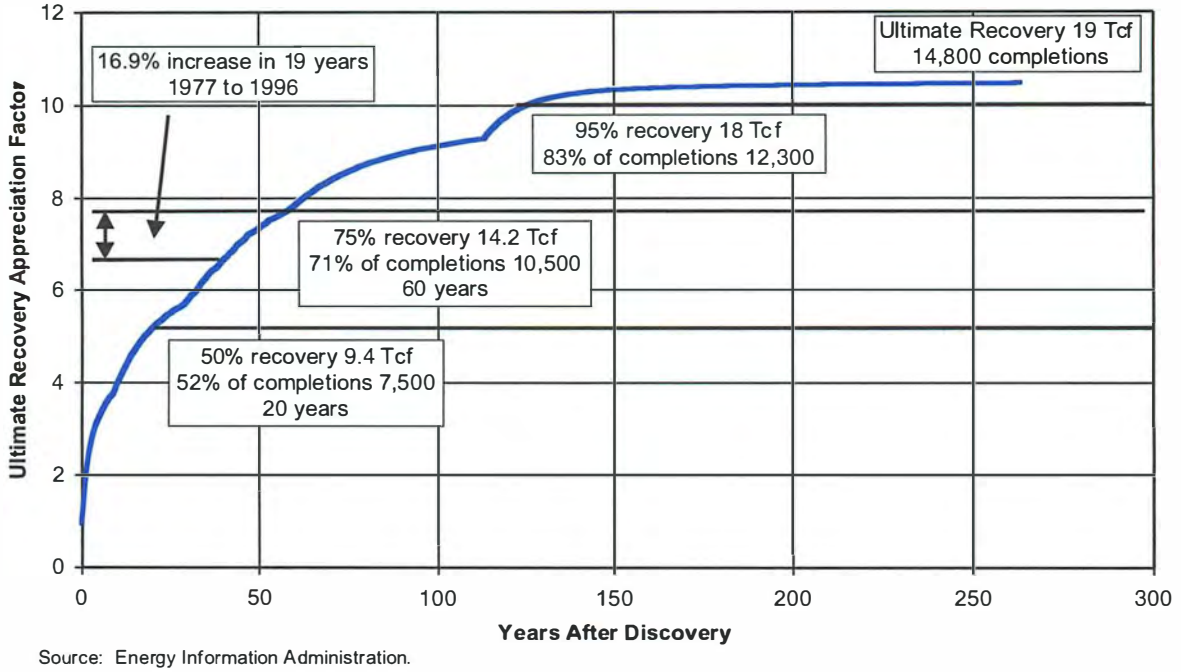
Modeling

Because well completion data are the major input into the ultimate recovery appreciation model, the well completion history for very old vintages must be estimated. A model of a hyperbolic nature based only on time was derived to forecast future well completions and to estimate history. The model yields faster growth in the beginning, slowing as it approaches its asymptotic value. All vintages are fit to the available history simultaneously with the same model (same fit parameters) using a least squares fit with an additional condition that the median ratio of the first and second year completions has to match. The estimated historical well completions are adjusted for general magnitude in the ultimate recovery appreciation model. Projected well completions are spliced to a three-year average of the actual well completions.

The ultimate recovery appreciation model uses well completions, and to a lesser extent time, as input data to match and project ultimate recovery appreciation factors. Ultimate recovery appreciation factors are expressed as multiples of the initial or discovery year's ultimate recovery. The factor for the initial year for any vintage is always 1. The model is hyperbolic in nature and has two parts. The first part models the early time where growth is fastest. The second part starts in year 10 and models the long-term slower growth. Because large fields grow more than small fields, the model includes a size factor so vintages that include large fields have the capability for more appreciation. A preliminary ultimate recovery appreciation model based solely on time is fit using a least squares method with an additional condition of matching total volumes for all vintages. The ultimate recovery from this preliminary model is used in the size factor calculation in the main model. The main ultimate recovery appreciation model uses seven fit parameters for a least squares fit of ultimate recovery factors (all vintages at once) with additional conditions to match volumes for four groups of vintages (typically 1900–36, 1937–56, 1957–76, and 1977–96) plus the total volume and the median ratio of the second to first-year recovery factors. Ultimate recovery appreciation factors are projected for each vintage.

As an example of model output, the change in ultimate recovery appreciation factor over time is shown for a group of 1937 vintage fields found at <10,000 foot depths in the onshore Gulf Coast (Figure K-1). Note that 60 years after discovery, more than two-thirds of the well completions have been realized and that three-quarters of the ultimate recovery has been attained. Nonetheless, actual data used to calibrate the model show almost a 17% increase in recovery over a 19-year period, 1977–96. One hundred years after discovery 87% of estimated ultimate recovery in this vintage group, 16.5 TCF of gas, has been

Figure K-1. 1937 Vintage Fields, Onshore Gulf Coast N A Gas Ultimate Recovery Appreciation



Source: Energy Information Administration.

The increase in slope occuring at about 115 years is due to accelerating the well completions forecast to shorten the time to the asymptotic value.

recovered and the rate of increase in the ultimate recovery appreciation factor has notably slowed as the ultimate recovery asymptote is approached.

Projected ultimate recovery appreciation factors along with current estimates of ultimate recovery are used along with the projected well completions in an economic model to determine the remaining economic volume target from appreciation. The economic model applied economic production cut-offs to the various categories of fields considered (Table K-1). For shallow and tight fields the economic cut-off used was 300 MMCF/completion. For deep fields (below 10,000 feet) 600 MMCF/completion was used. For the offshore Gulf of Mexico 1,000 MMCF/completion was used as the economic cut-off. These cut-offs are meant to be an average between economic volumes required to drill new wells and the much smaller economic volumes required to recomplete wells. These cutoffs could be varied to conduct sensitivity tests. Using these cut-offs in the regions investigated yielded a remaining economic target of about 351 TCF of non-associated natural gas. A variety of other economic cut-offs were considered, as listed in Table K-1.

Note that for some resource categories in Table K-1 where the proved ultimate recoveries as of end-1996 were small in several regions, a volume of ultimate recovery appreciation at a given economic cut-off was calculated using ratios. The sum of the volumes for a given cutoff was divided by the sum of the 1996 ultimate recovery volumes in a particular category (deep, tight) to create a ratio. The 1996 ultimate recovery volume for a region that was not modeled (deep, region 4; and tight, regions 3 and 4) was multiplied by that ratio for the same category of resource to yield the ultimate recovery appreciation economic target for the region.

TABLE K-1

Ultimate Recovery Appreciation Economic Targets, NA Gas MMCF

SHALLOW	Region 2 Gulf Coast Onshore	Region 3 Midcontinent	Region 4 Permian Basin	Region 5 Rocky Mtns	Region 1 Appalachia	Region 6 West Coast	U.S. TOTAL
PULT 1996	232,887,226	157,285,334	66,562,614	33,144,565			489,879,739
URAss	307,126,136	208,343,794	93,088,707	69,929,801			678,488,438
URAssRem	74,277,650	56,563,853	26,962,310	36,975,243			194,779,056
Econ5000	0	978,555	4,961,352	4,203,779			10,143,686
Econ3000	986,971	3,568,527	7,759,401	8,438,234			20,753,133
Econ2000	3,665,736	8,450,097	9,886,348	11,746,666			33,748,848
Econ1500	6,584,067	11,299,160	11,753,027	14,062,793			43,699,047
Econ1000	13,736,728	17,884,934	14,064,725	16,955,218			62,641,605
Econ750	20,993,785	22,143,607	15,870,768	19,117,242			78,125,402
Econ500	33,462,131	28,563,365	18,217,336	21,914,728			102,157,560
Econ300	**48,247,094**	**33,702,983**	**20,644,941**	**24,992,190**			**127,587,208**
Econ100	66,426,522	38,174,995	21,576,524	29,333,397			155,511,438

DEEP	Region 2	Region 3	Region 4	Region 5	Region 1	Region 6	U.S. TOTAL
PULT 1996	57,294,330	11,343,707	3,095,423	894,389			72,627,849
URAss	96,912,177	23,603,812		1,839,525			122,355,514
URAssRem	40,240,461	13,996,982		945,136			55,182,579
Econ5000	2,905,432	2,670,835		164,091			5,740,358
Econ3000	3,770,251	4,709,648		383,004			8,862,903
Econ2000	4,702,003	5,467,354		522,026			10,691,383
Econ1500	6,137,164	5,610,510		599,269			12,346,943
Econ1000	9,560,690	5,831,930		684,291			16,076,911
Econ750	12,663,173	6,111,139		727,091			19,501,403
Econ600	**15,218,463**	**6,246,546**	**989,128**	**753,754**			**23,207,891**
Econ500	17,401,854	6,613,101		772,823			24,787,778
Econ300	23,279,349	8,386,116		812,455			32,477,920
Econ100	32,660,888	10,715,428		824,091			44,200,407

TIGHT	Region 2	Region 3	Region 4	Region 5	Region 1	Region 6	U.S. TOTAL
PULT 1996	35,660,496	6,604,685	8,232,872	67,545,742			118,043,795
URAss	92,623,118			159,959,452			252,582,570
URAssRem	58,681,686			95,600,763			154,282,449
Econ5000	18,803,086			2,496,888			21,299,974
Econ3000	23,902,140			6,197,742			30,099,882
Econ2000	27,828,375			16,900,516			44,728,891
Econ1500	33,230,495			26,663,129			59,893,624
Econ1000	36,279,943			40,613,721			76,893,664
Econ750	39,628,859			47,912,140			87,540,999
Econ500	42,183,379			57,759,682			99,943,061
Econ300	**45,775,520**	**7,229,738**	**9,012,014**	**67,197,939**			**129,215,211**
Econ100	50,637,442			80,559,984			131,197,426

GULF	GULF
PULT 1996	163,205,881
URAss	267,478,022
URAssRem	104,910,287
Econ5000	6,690,823
Econ3000	25,391,881
Econ2000	44,554,532
Econ1500	56,968,781
Econ1000	**71,230,180**
Econ750	78,777,752
Econ500	86,657,620
Econ300	88,337,103
Econ100	88,980,176

Selected Economic URA Target
351,240,490

Appendix L

Technology

Part 1: Collaboration in the Technology Sector

In 1995, the National Petroleum Council published an extensive review regarding research and development, entitled *Research Development and Demonstration Needs of the Oil and Gas Industry.* The report noted a significant increase in the willingness of the industry to collaborate and form many types of technology alliances. Examples include alliances between producers, service companies and vendors, research consortiums, Department of Energy, national laboratories, and universities. The 1995 survey respondents indicated a relatively high willingness to collaborate and noted that the measure of success was that the collaborations must be focused on user driven technology development.

A survey was run in June 1999 to investigate collaborative trends, seeking responses from a select group of major and independent producers, service companies, and the DOE. Results indicated that the trend of collaboration is increasing and has become an important driver in the technology arena *(see Research and Development Survey for details).* Research, development, and technology implementation are increasingly critical factors in achieving corporate goals, which are primarily focused upon cost reductions and efficiency of systems, activities and processes. In light of decreasing research and development funding, reduction in technical professionals and facilities, collaborative relationships have become a requirement in meeting business goals.

Figures L-1, L-2, L-3, and L-4 are graphical summaries of collaboration trends by industry sector. As exhibited in the graphs, each industry segment shows increasingly stronger interest in collaborative activities. Comments from respondents indicate a number of additional sources of collaboration and technology sourcing. These include:

- Technology transfer directly from partner energy companies
- Cooperation with foreign and international energy companies based upon a variety of new business arrangements
- Application of synergistic ideas from industries outside the energy industry (space, military, chemical, medical, information technology, etc.)
- Entrepreneurial ventures and new corporations formed to capture niche markets.

In the future, it is expected that increased opportunities will exist with the Department of Energy and the National Laboratories. There are a number of business styles available, which are detailed in the 1995 NPC report (partnerships, Cooperative Research and Development Agreements, consultancies, sub-contracting, etc.). Issues of funding, ease in working with governmental agencies (paper work, etc.), and a continued depth of understanding of the manner in which government

Figure L-1. Collaboration – Majors

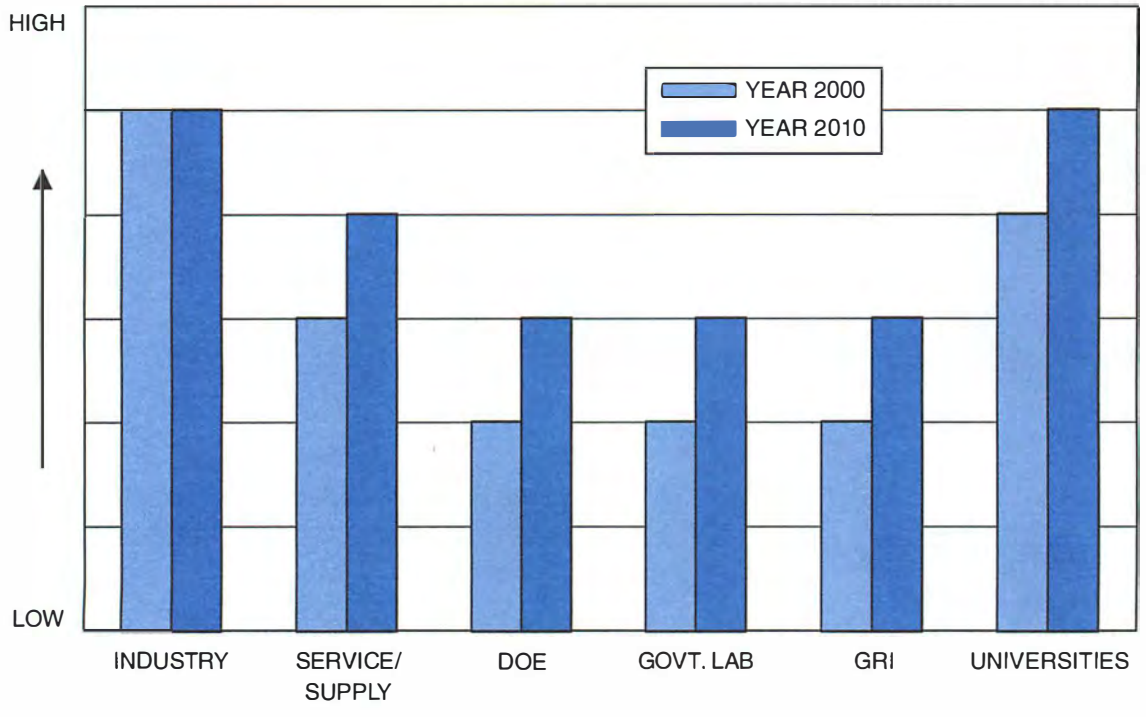


Figure L-2. Collaboration – Independents

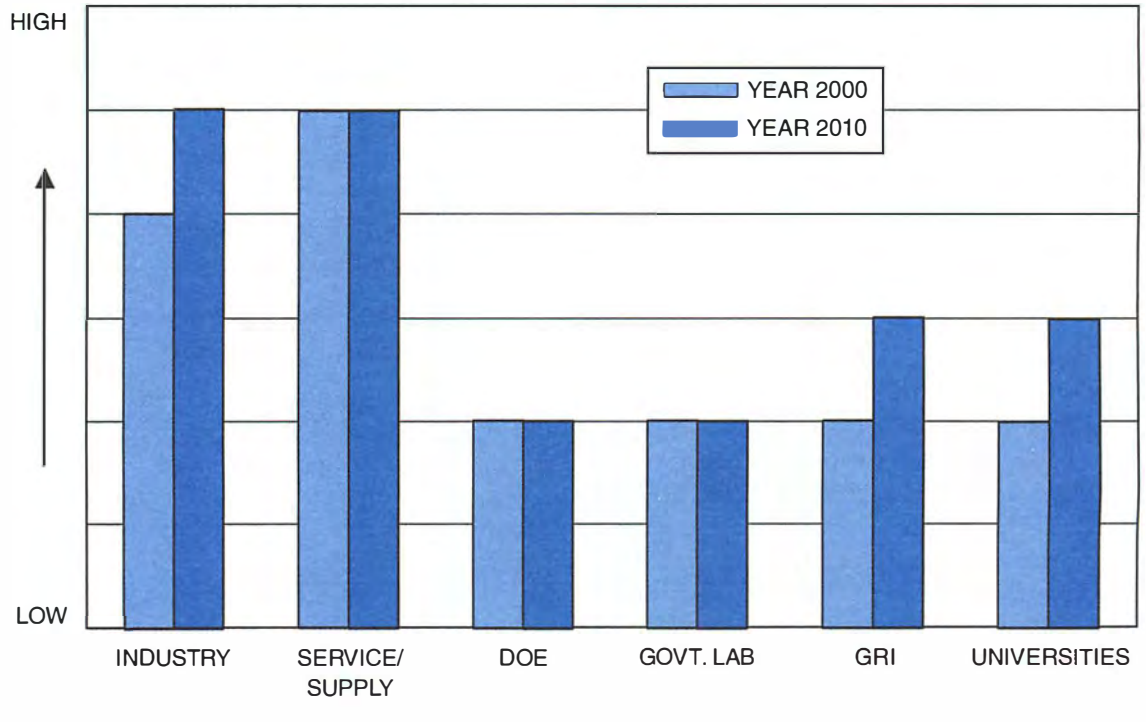


Figure L-3. Collaboration – DOE Office of Fossil Energy, Gas Supply Program

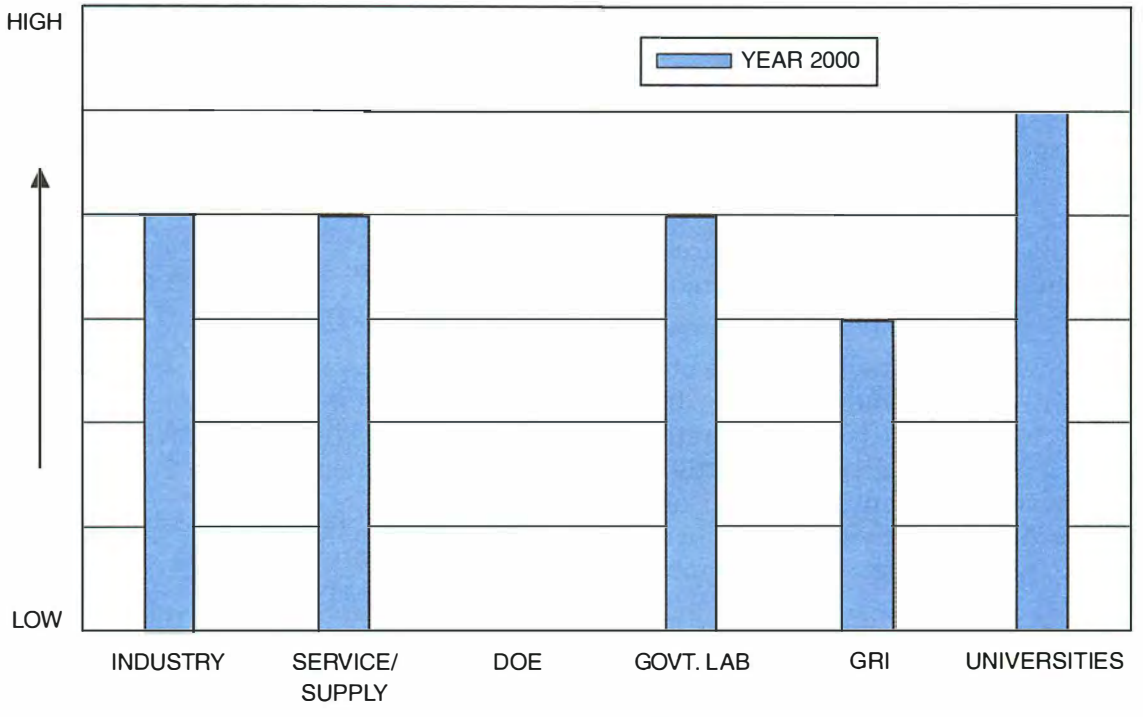
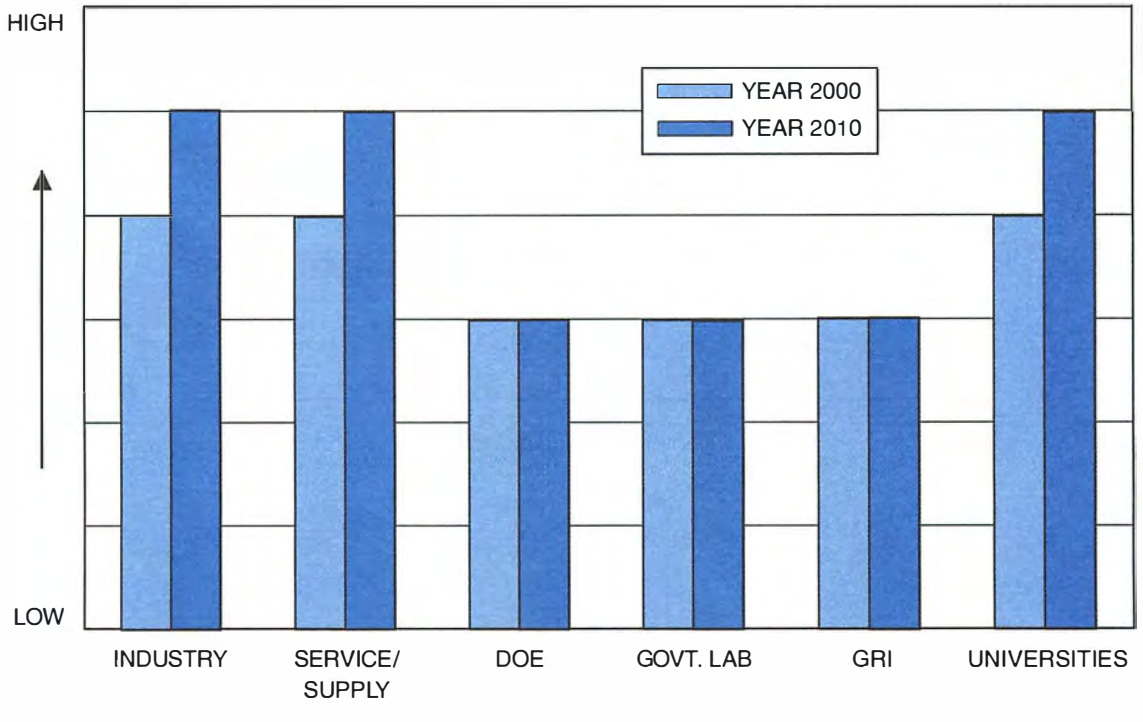


Figure L-4. Collaboration – Service/Supply



agencies and industry can best work together in an expedient and cost-effective manner will continue to be resolved.

Another "new" source of technology relationships is the rapidly growing entrepreneurial sector. These are generally groups that can bring high levels of expertise based upon experience in the energy industry or those bringing innovative ideas from other industries. An interesting example of this approach is to utilize expertise from the entertainment industry in the growing applications of visualization in geoscientific interpretation and whole earth model representation.

The following list shows examples of several collaborative efforts and technology transfer sources currently active in the industry. This gives a flavor of the diversity of activities, but by no means gives any indication of the vast number of cooperative projects that are taking place in the industry and not publicly announced.

Consortia

Completion Engineering Association (CEA)

Deep Star

Deep Look

Deepwater Well Control Taskforce

Drilling Engineering Association

Energy Research Clearinghouse

Gas Research Institute

Petroleum Open Software Corporation (POSC)

The Mounds Drill Cuttings Injection Project

Ziff Energy's Reducing Field Operating Costs/Best Practices (RFOC)

Government Technical Transfer

Advanced Research program – Natural Gas and Oil Technology

National Gas and Oil Technical Partnership

National Petroleum Technology Office

Petroleum Technical Transfer Council

Various state agencies in energy producing areas

Universities

Colorado School of Mines – Production Enhancement Research Forum

Louisiana State University – Petroleum Engineering Research and Technical Transfer Lab

Oklahoma University – Well Construction Technical Center

Stanford University – Stanford University Research Institute

Texas A&M University – Global Petroleum Research Institute

University of Texas – Center for Petroleum and Geosystems Engineering

University of Tulsa – TUDRP (drilling) and other projects

University of Utah – Energy and Geoscience Institute

University of Wyoming – Institute for Energy Research

Part 2: Research and Development

Research and development is a key component in the development and application of technology relating to increased natural gas supplies. The 1995 NPC report *Research, Development, and Demonstration Needs of the Oil and Gas Industry* reviewed the status of technology as a whole and the focus of research and development in depth. During the intervening years, there have been dramatic changes in the industry and substantial shifts in the business style of the manner in which research and development is funded, aligned and utilized. All indications point to these changes continuing into the future.

An excellent overview of the changes taking place in the research and development segment is a 1997 article by David M. Clementz of Chevron Petroleum Technology. Dr. Clementz notes:

> Company R&D can add value if we can define our expectations for it and for the measures of that value. The industry still needs R&D but is demanding it in a new form. Company R&D has a future if it can adapt and change.

Focus on the bottom line has become critical, and relates directly to the changing business styles of the parent companies, i.e., focus on the bottom line and shareholder/stakeholder value. Business and asset level drivers must be clearly defined and metrics determined to show appropriate value. He further defines metrics in two categories:

> The process metrics are to deliver in operational timeframes, to link and integrate external technology and add strategic value with competitive capabilities.
>
> Expected impact business metrics are to improve capital and exploratory effectiveness, to increase asset performance, to increase operating efficiency, and to improve strategic positioning.
>
> Source: Clementz, David M., "Company R&D: Does It Add Value to the Bottom Line?", *Journal of Petroleum Technology*, February 1997, p.144-148.

New strategies for the R&D function are being formulated and applied throughout the industry, often referred to in the literature as the "new R&D paradigm." This includes business styles and drivers as described above as well as changes in funding structure, staffing, collaborative efforts, outsourcing, and general process focus. The approaches would be expected to vary considerably from company to company as well as the segment of the industry represented (majors, independents, and service companies). However, the future technology and R&D approach will likely follow the same general strategic path.

In April 1999, the Society of Petroleum Engineers sponsored the Third Technology Summit in which an international group of high-level technology executives met to discuss and predict the needs for technology, research and education for the next 4 to 5 years. Discussions were framed around $10-12/bbl U.S. oil prices and the manner in which the technology segment could align and provide value. The findings of this meeting were not available at the time of this writing, however, it is anticipated that they will provide additional significant insight into the future path and challenges to be faced.

The Technology Oversight Group conducted a survey in July 1999 regarding R&D issues. It should be noted that this is intended to demonstrate general trends in the research and development sector. Data is based upon a small sample of major energy corporations, large independents and major service companies. Most operate on a global scale and are involved in a mix of oil and gas production, thus the trends represented do not specifically represent a unique North America gas focus. The following information intended as an update to the 1995 study, which should be referred to for comparison purposes. Comments are taken directly from individual responses.

R&D Business Model – Today

Majors

- Shift toward outsourcing non-core and in some cases basic technologies to vendors/contractors
- Retained R&D focused toward specific, carefully aligned with business portfolio

- Deliberate spread of short-, medium-, and long-term activity
- Joint industry programs for cost leveraging were appropriate
- Proven value and cycle time is imperative
- Operating company focused on short term (1-3 years). Corporate R&D seeking long-term, major breakthroughs and efficiency/cycle time step changes

Independents (do not as a rule have internal R&D groups)

- Highly focused on near-term improvements in well construction and completion costs
- General change in focus from long-term to just-in-time delivery
- Specific answers to specific problems
- Utilizing best technologies available from consortia, majors, universities, government, and service companies for long-term and specific case R&D

Service Companies

- Business strategy driven and focus on core competencies
- Predominantly short term with links to >3 year business and technical strategies
- Balanced portfolio of short/long term and low/high risk projects
- Applied research to develop more efficient, greener products and systems that lower overall system cost

Department of Energy

- DOE conducts R&D that will enhance U.S. energy security, promote effective environmental protection, and enhance global competitiveness. These goals are not measurable in traditional return on investment calculations. The major R&D focus is on developing knowledge, tools, and technologies that will aid Independent producers. Research focuses on the development of technologies that will be available 5 to 10 years in the future. Thus the program does little long-term, fundamental research and does not provide short-term, technology services.
- Since 1993, the Government Performance and Results Act has required that government programs tie their budgets to specific accomplishments that are monitored.

R&D Business Model – In Year 2010

Majors

- Risk-sharing alliances expected to become more commonplace
- Greater focus on fewer programs, but each program having greater significance
- Strategic shift from component optimization to business/strategy based system optimization
- R&D driven by new technologies such as fuel cells and hydrocarbon upgrading and conversion mechanisms
- Leverage a wide range of technologies from a wide range of sources. This integration will be equally valued with technical skills
- Proprietary ownership of technology will be less important than skill in deploying quickly and realizing a valuable return.

Independents

- Essentially the same model as today
- Tie to operational economics, measured in economic value terms to compete for funding
- Potential of increased R&D from international sources

Service Companies

- Increased levels of collaboration and outsourcing
- Role redefinition if service companies become principal technology developers
- Increased market pull to satisfy customer technology needs
- Enhanced integration across disciplines

Department of Energy

- We believe that the government will have a role in gas supply R&D in 2010 but that role may be different from today, as the government responds to changing industry and national needs. We project that DOE gas R&D will increase as domestic and world gas demand increases, and greater emphasis will be placed on technologies to improve recovery of unconventional resources. Partnerships with industry will continue to be very important. Increased emphasis on developing U.S. technology leadership and exports for International gas resources is expected. DOE may integrate R&D for transportation, delivery, and gas infrastructure with its gas supply R&D activities in the future.

Barriers in Providing Technology to Meet Long-Term U.S. Natural Gas Needs

Majors

- R&D expenditures enhancing U.S. gas production must compete economically with capital investment opportunities in the global arena
- U.S. sources will be skewed towards expensive offshore/deep offshore, which compete for funding with lower cost/higher return international opportunities
- Reluctance of the industry to think "outside the box" as exemplified by other high technology industrial sectors
- Limited availability of skilled personnel
- Potential impact of future industry consolidations
- Transportation/transportation efficiency in delivering remote/stranded gas
- Reducing costs of finding and developing marginal and tight gas reservoirs.

Independents

- Economics – cost of R&D can affect overall profitability if not properly managed
- Low level of awareness of the emerging gap between supply and demand
- Short-term focus on results without regard to long-term contribution
- Technical personnel choosing other high technology industries for careers.

Service Companies

- Ability of maintain equilibrium during boom and bust business cycles
- Business cycles create aversion to risk taking
- Decrease in knowledgeable/experience personnel in all segments will slow down technology implementation.

Department of Energy

- Declining R&D expenditures
- Short-term focus of industry R&D
- Data preservation and access
- Declining (aging) skilled employee pool
- Variations in regulatory requirements and data standards among companies and government agencies.

Potential Solutions to Overcome Some of the Barriers

Majors

- Establish the necessity for significant, continual investment in R&D as a requirement for profitability and growth in the eyes of the investment community
- Government incentives could provide additional mechanisms to develop technologies at a faster pace, for example tax credits and reduced royalties
- Increased industry collaboration and effectiveness
- Establishment of cost-effective environmental regulations
- Industry recognition of the "true universe" of technologies, most of which are well outside of the current E&P world

- Improved reservoir imaging to allow better-placed drainage conduits for improved recovery
- Distributed in-reservoir monitors to improve production/recovery.

Independents

- Balance between lower E&P costs and increased technology investment
- Low-cost transportation technologies are key
- Incentives to provide continued R&D development during periods of weaker economic results driven by product prices
- Bold vision!

Service Companies

- Gas price stability and above $2/MCF in current dollars
- Personnel issues – hire, train, and hold core talent
- Industry focus group regarding availability and development of future engineers and scientists. Consider incentives to universities and industry companies.

Department of Energy

- Increased emphasis on industry consortia, government-industry partnerships, and other forms of cooperative R&D
- Increased involvement of smaller companies in R&D
- Intern and mentoring programs for young workers
- Inter-government partnerships.

Note that input from government laboratories, universities, and independent research organizations such as GRI were not included in this review due to time and resource constraints. However, each will play and continuing and ever-increasing role in the viability of research and development as a supporter of enhanced natural gas supply in the future.

Part 3: Information Technologies

The energy industry in general and the technology segment in specific are in the midst of an unprecedented evolution driven by a relentless need to operate and prosper in low cost/affordable growth and high efficiency environment. A fundamental driver and enabler of this quest is the application and development of information technology (IT) as an integral part of doing business. While certainly a key component in the results and predictions of the 1992 NPC report, the intervening years have seen an exponential growth in the significance and criticality of IT and will have an unprecedented effect on the future of the industry.

There is not a single segment of the industry that is not touched by these advancements. It is not the intention of this report to delve deeply into IT in the industry, but rather highlight several areas of significant and attempt to indicate a vision of the future.

The Changing Environment

Overall, one of the greatest advents in IT is ubiquitous connectivity, a woven world in which interconnectivity is the key. This concept relates to the ability of the industry to transport data, utilize it effectively by the correct people and processes, and utilize the outcome in making real time decisions. Integration is a key component and is well described by Robert Peebler, President and CEO of Landmark Graphics:

> Integration to me, primarily has been about data. The process has been to move data from function to function, but we really haven't begun to truly integrate. There are four levels of integration: connecting individuals to the data, looping teams around groups of activities with a process perspective (workflows), networking these groups together to perform tasks (operational processes) and allocating resources.
>
> Source: Peebler, Robert, "Oil Industry at a Technological Turning Point," *Oil and Gas Journal*, July 12, 1999, p.27-8.

Costs of IT systems are high, integration difficult, and adaptation of personnel and operations are great challenges. However, viewing the successes of the recent past and envisioning potential for the future are highly encouraging with respect to the industries potential and capacity to meet natural gas demands in the future.

Today

The technology segment of the industry is currently making great strides in IT utilization. Processing power is growing and allowing applications to be moved from mainframes to high efficiency workstations. The advent of object based and data storage technologies have allowed greater access to data and allows a high level of access in user friendly interfaces. Connectivity has been enhanced by use of high capacity networks, fiber and satellite com links and the Internet (intranets, extranets, etc.). More importantly, these types of system advances support new paradigms of multi-disciplinary teaming.

One consideration in this constantly changing environment and workstyle is the manner in which people can adapt, modify work processes and comfortably utilize these tools. These present change management issues which must be understood to ensure that the people/systems interfaces grow concurrently.

CURRENT EXAMPLES

Linkage of Geoscience and Engineering—Current technologies allow for cross platform applications, which allow connectivity between the Unix based seismic and geologic world and the PC base of the reservoir and design engineers. Allows much greater data transfer and interdisciplinary team activities.

Visualization—Allows explorationists and engineers the capability of viewing and manipulating massive amounts of 3D and other seismic and geologic data in a collaborative environment. Utilization of viewable data and highly sophisticated data management techniques is especially important in obtaining reliable information regarding the geology of subsalt deepwater plays in the Gulf of Mexico.

Integrated Visualization—A further enhancement of visualization technology is the

integration of seismic/geologic information and well planning capabilities. This allows specialists to plan and visualize 3D well paths directly in the 3D seismic volume. Using multiple scenarios and by monitoring real time well activities, tremendous cycle time reductions are possible. This concept is also applied to design of both integrated systems and mechanical devices/structures using CAD/CAM and other similar tools, which allow multiple scenario investigation and ultimately less costly, enhanced fit for purpose facilities.

Connectivity—Utilizing the Internet, e-mail, desktop video, and other aids, companies can new stay in personal a data link communication with operations anywhere at any time. This allows for collaborative planning and operations regardless of location and can expedite problem solving and concurrent modeling of activities. Connectivity also promotes better availability and utilization of highly experienced personnel, in that they need not necessarily be at the well site or distant office to provide immediate/critical input and expertise.

Remote Control—Computer and sensor systems are currently being integrated into a host of unique and hostile environment applications. The advent of downhole production controls, "smart" tools, store and forward data systems, and remote direction of on location activities are becoming more commonplace.

Future

Moore's Law, the prediction that Gordon Moore, cofounder of Intel, made in 1965, indicates that computing capacity doubles every eighteen months. Assuming that this has been reasonably accurate over the last decade, the future of information and it's effect on the industry provides an interesting scenario. Tremendous challenges and opportunities will exist throughout the industry. In the immediate future, enhanced application of currently available software and hardware is likely to prevail as industry learns to apply and integrate systems for maximum viability. Some examples of future expectations may include some of the following.

EXAMPLES

"Projected Presence"—The full capability to utilize remote operation to effectively control remote operations. For example, unmanned platforms utilizing smart wells and SCADA control. This includes a wide range of enhanced robotics for sensing and operating in hostile environments, saving time, cost, and potential danger to personnel.

Smart Drilling Systems—Imbedded or linked intelligence to allow real time high volume bit face data and capability to effect true geo-steering.

Whole Earth Models—In which geologic and engineering data are integrated and updated by real time operational data. Of greater consequence is the linking of financial models and the ability to run what-if scenarios during the planning, construction, and production stages of the wells or assets economic life.

Reservoir Management Optimization—Includes the capability to manage the reservoir effectively from reservoir pore to end user. Full understanding of reservoir status and functionality at any given time and the ability to maximize economic value based on market/demand conditions. This would allow a more holistic management technique where multiple assets can be quickly analyzed and allocated for highest rate of return.

Data Management and Utilization—Utilizing collaborative filtering, neural networks, fuzzy logic, data mining, agents and avitars and data warehousing.

Knowledge Management—Is a very broad topic but in the technology context has very direct application. In light of the demographics relating to technical personnel in the industry today, there is reason for concern as the highly knowledgeable "baby boomers" leave the industry. This knowledge and experience has the potential of being lost forever without application of knowledge management processes. In a broader sense, storage and utilization of knowledge, experience, and best practices can greatly affect the time spent is data searching, and can potentially delay and add risk to the decision process. It is apparent that the success of companies in the future will be in part based on their ability to utilize the technology and processes to gather, integrate, validate, and make available their experiences and best practices.

TRANSMISSION & DISTRIBUTION TASK GROUP APPENDIX

Appendix M

Natural Gas Storage

Storage Capacity

According to the American Gas Association (AGA), total underground storage field capacity, including base gas, has grown from 4.1 TCF in 1965 to 8.0 TCF in 1996. The total number of storage facilities increased from 293 in 1965 to 419 in 1983 before falling to 394 in 1996. During the same time period, maximum deliverability from storage increased to 74.6 BCF per day. Figure M-1 illustrates the growth in underground gas in storage during this time period.

The map shown in Figure M-2 shows the location of the different types of natural gas storage fields. As indicated in this figure, the majority of the existing storage fields are located in a few regions. Storage fields in the Midwest, primarily in Michigan, Illinois, and Ohio, account for about 30% of current storage capacity; storage fields in the Southwest, primarily Texas, Louisiana, and Oklahoma, account for about 26% of total capacity; and storage facilities in the Northeast, including Pennsylvania, Ohio, and New York, account for about 25% of capacity.

Costs and Potential of Announced Storage Expansion Projects

Of 95 storage field expansion and development projects tracked by the Energy Information Administration (EIA), 36 were new storage projects with a planned total of 296.5 BCF of working gas capacity and deliverability of 6.4 BCF per day. The majority of the proposed storage projects are in depleted fields. As of September 1998, there were 20 planned new depleted fields, with a total capacity of 244.7 BCF of working gas and 3,678 MMCF per day of deliverability in 20 different fields. There were also 41 announced depleted field expansion projects, with a total of 44.6 BCF of working gas and 1,305 MMCF per day of deliverability. Forty of the projects are located in the Northeast and Midwest. Seven new projects and one expansion are planned for the Southeast region and will add a total of 41.3 BCF of working gas capacity and 569 MMCF per day of deliverability.

Twenty-one salt cavern projects are currently planned. Five projects, including two new facilities, are planned in the Central region. These projects will add a total of 20.1 BCF of working gas capacity and 1,125 MMCF per day of deliverability. The majority of this capacity is from one project with 12.5 BCF of working gas capacity planned by Questar Pipeline. This project is currently on hold. There are 11 planned projects in the Southwest, ten of which are expansion projects, for a total of 16.2 BCF of working capacity and 1,050 MMCF per day of deliverability. There are four salt cavern projects planned in the Northeast for a total working gas capacity of 6.3 BCF and deliverability of 1,000 MMCF per day. One expansion project is planned in the Southeast.

Figure M-1. Natural Gas in Storage – End of Year

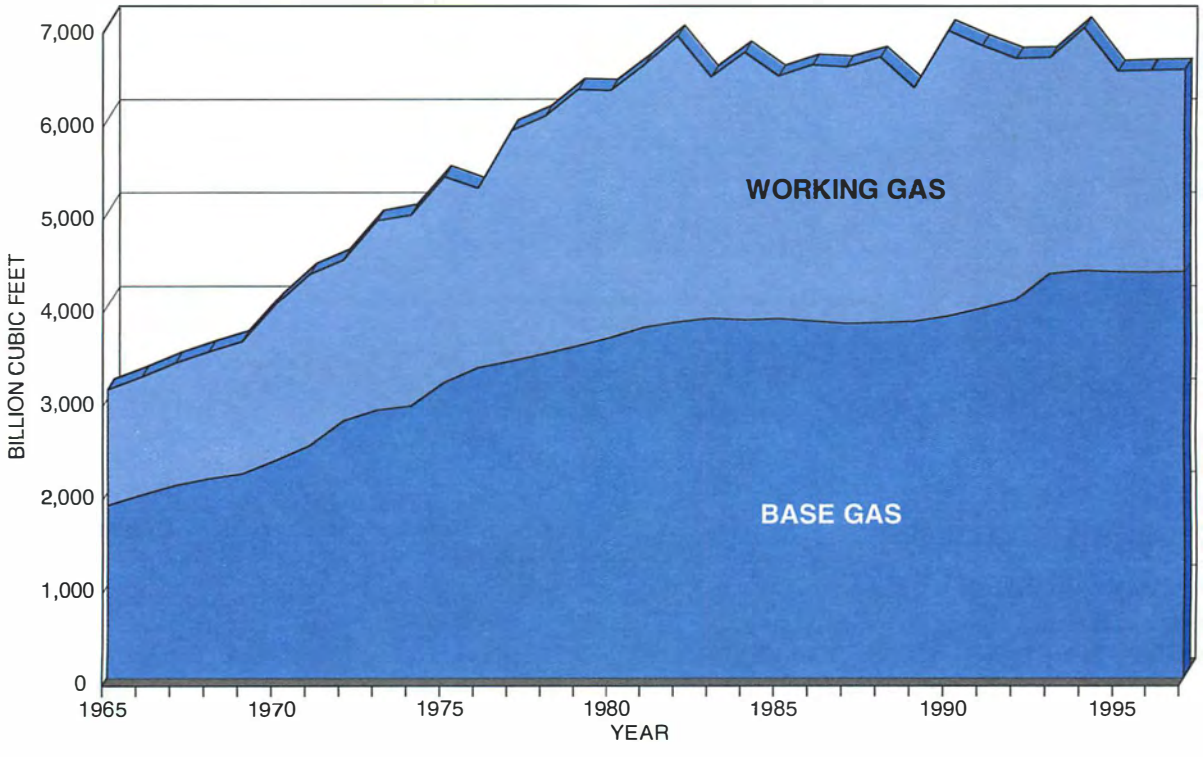
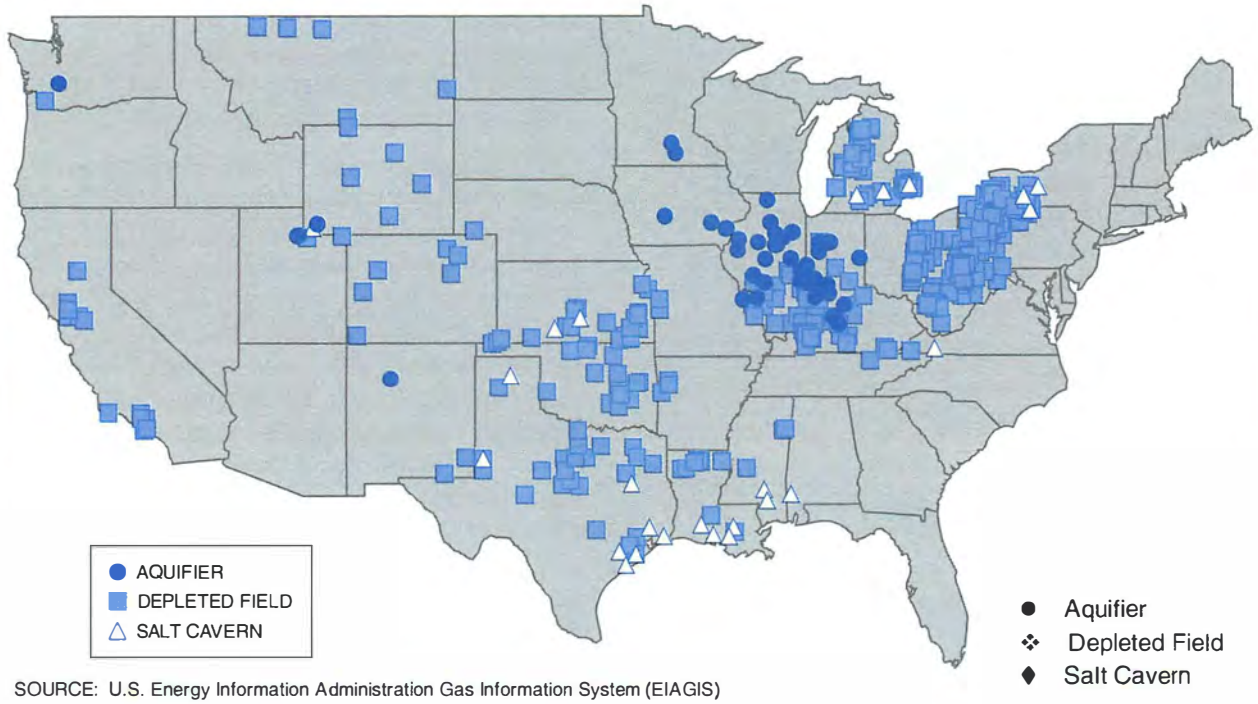


Figure M-2. U.S. Natural Gas Storage



SOURCE: U.S. Energy Information Administration Gas Information System (EIAGIS)

Figure M-3a. Cost of Working Gas Capacity Aquifer/Depleted Field Expansions

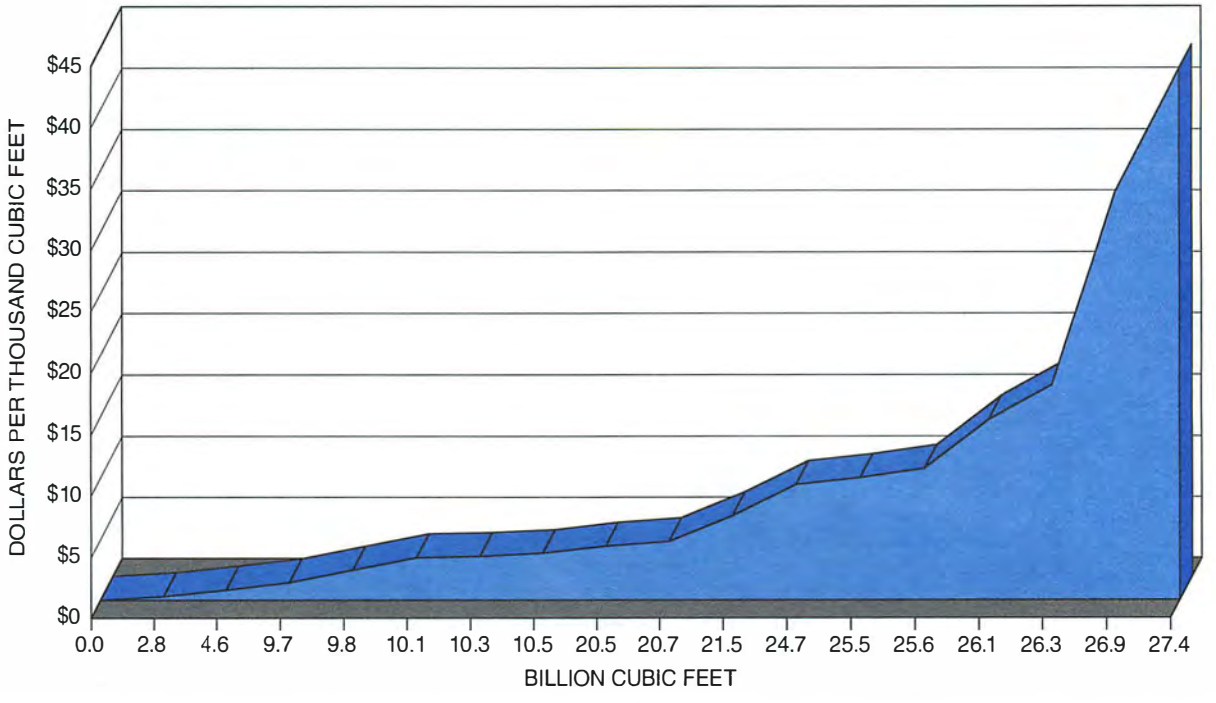


Figure M-3b. Cost of Working Gas Capacity New Aquifiers/Depleted Fields

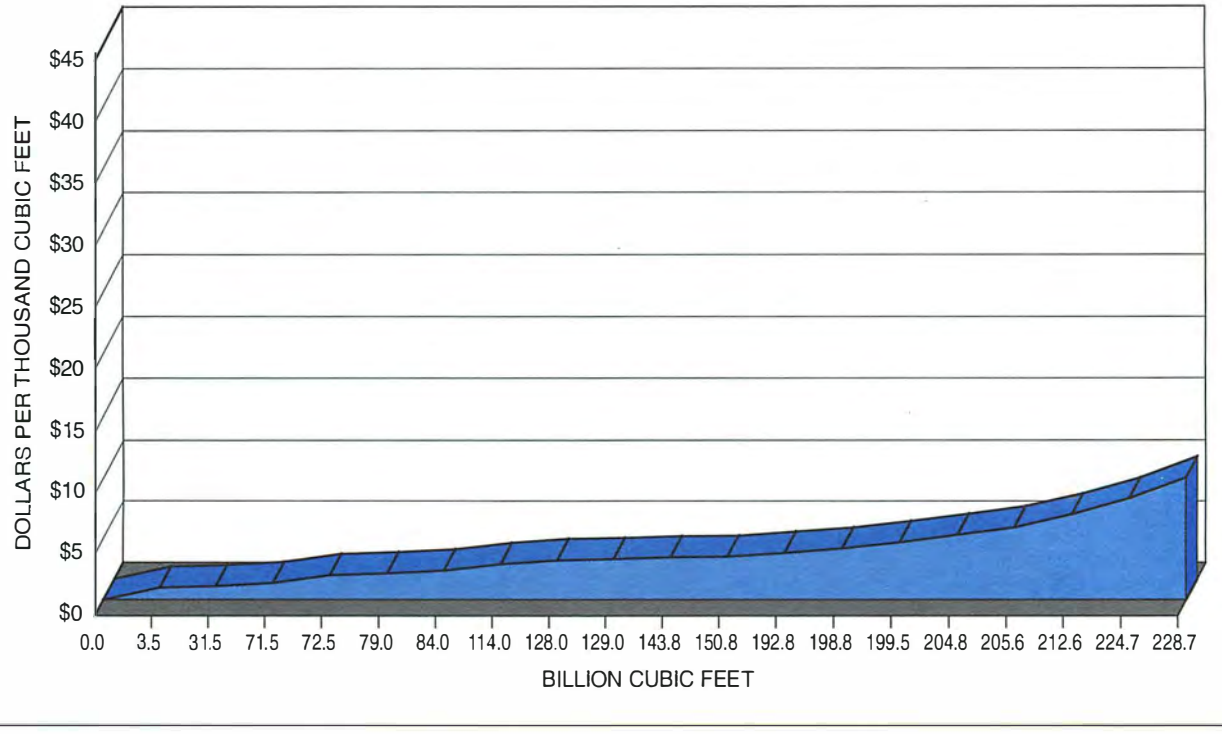


Figure M-4a. Cost of Deliverability
Salt Cavern Expansions

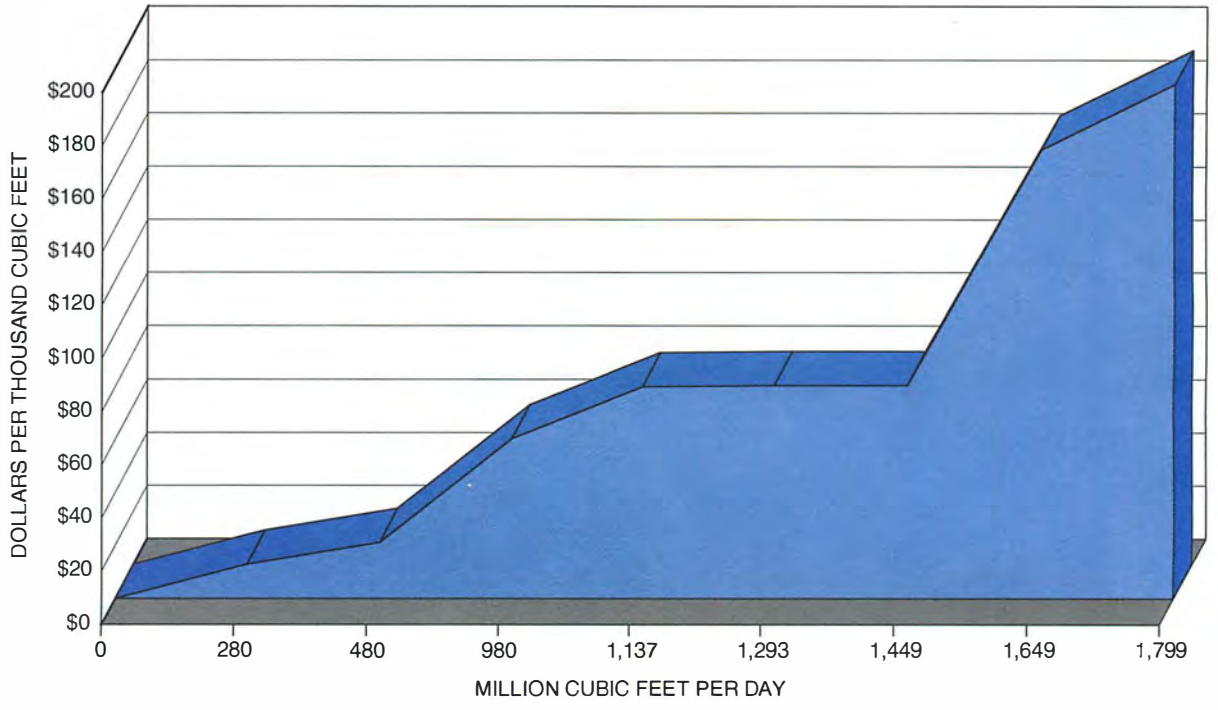


Figure M-4b. Cost of Deliverability
New Salt Caverns

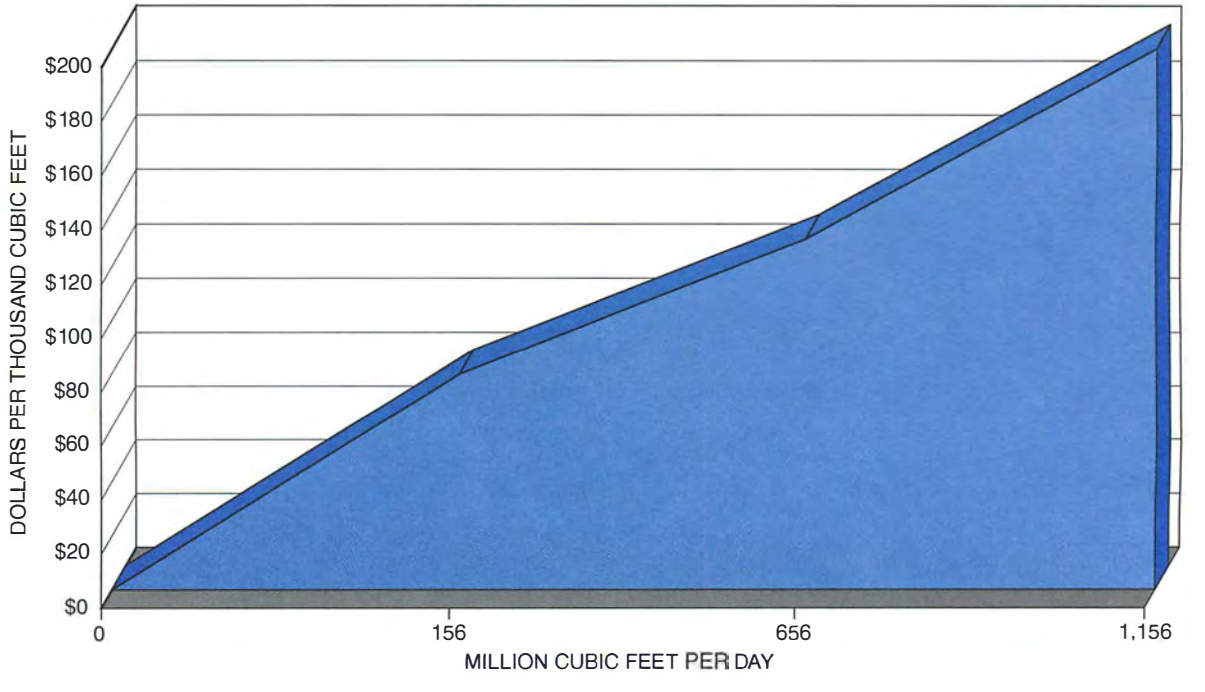
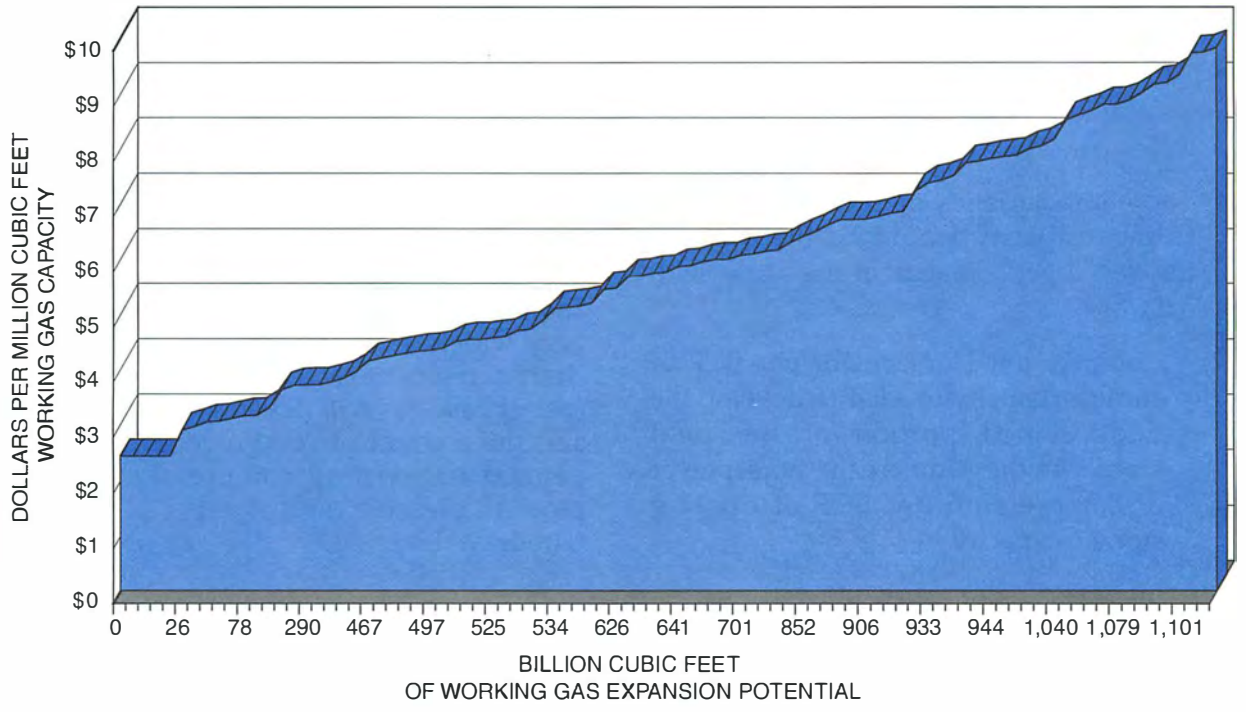


Figure M-5. Estimated Cost of Potential Storage Expansion in Existing Storage Fields



Source: Energy and Environmental Analysis, Inc.

There are four aquifer and eight LNG projects. Three new aquifer facilities are planned in the Midwest and Central region and one expansion is being developed in the West. The total planned new aquifer storage capacity is 25.2 BCF of working gas and 430 MMCF per day of deliverability. The LNG projects are all in the Northeast and Southeast regions and will add 11.9 BCF of working gas capacity and 1,643 MMCF per day of deliverability.

Many of these projects will not be built on the announced schedule. Of the 94 storage projects, 53 are currently in development and will add for 157 BCF of working gas capacity and 3.6 BCF of deliverability. Nineteen projects are listed as being "on hold" and may not be economic in the short term. These projects account for about one-third of the total proposed working gas and deliverability additions. The other 17 projects are in the planning or feasibility stages.

Where available, the costs of the proposed storage fields were aggregated to develop generic estimates of storage expansion costs per unit of working gas capacity and deliverability for the different types of fields. Figures M-3 and M-4 provide storage supply cost curves for capacity and deliverability generated from the project by project cost data. For each type of expansion project considered, the projects were sorted based on cost per unit of incremental capacity.

Costs of Future Unplanned Storage Capacity Expansion

In addition to EIA's list of proposed projects, AGA estimates the existence of a significant amount of expansion potential in existing fields based on field data provided by the operator. The 1996 AGA storage database identifies expansion potential of 2.3 TCF of total storage capacity, with an estimated 1.2 TCF of incremental working gas. Roughly half of this potential is located in existing aquifers, with the other half located in existing depleted field reservoirs. The estimated costs of achieving this expansion potential vary widely by field. Figure M-5 illustrates the potential capacity and deliverability expansions sorted by cost to provide a

national storage capacity expansion cost curve.

The cost curve was developed based on the following assumptions:

- All of the undeveloped storage capacity identified in the AGA database could be achieved.
- The characteristics of the undeveloped storage capacity would be the same as the developed capacity in the same field, e.g.,
  - Compression Horsepower per BCF of storage capacity needed to develop the undeveloped portion of the field would be the same as the horsepower of compression per BCF of existing storage capacity
  - Number of wells per BCF needed to develop the undeveloped portion of the field would be the same as the number of wells per BCF in the developed portion of the field.

These cost curves were developed using generic storage field cost expansion criteria developed from engineering data available from proposed expansion projects, which have been applied to field specific estimates of expansion requirements. The generic storage field expansion cost factors are shown in Table M-1. Actual field expansion costs will vary widely from field to field based on the characteristics of each field. For example, the cost of base gas will depend on field location, and the amount of compression needed will depend on existing compression capacity, pipeline pressure, and number of injection/withdrawal wells.

TABLE M-1

AVERAGE COST FACTORS FOR STORAGE FIELD EXPANSION PROJECTS

	Storage Cost Factor
1) Compression Cost Factors	
Compression ($/ Horsepower)	$1,600
2) Storage Field Pipeline Cost Factors	
Storage Field Pipe Cost ($/Mile)	$230,000
Miles of Storage Field Pipe Per New Well	0.2
Transmission Pipe Cost ($/Mile)	$850,000
Miles of Transmission Pipe Per BCF	0.8
3) Storage Field New Well Cost Factors	
New Well Drilling Cost ($/Foot)	$50
New Well Testing and Evaluation ($/Well)	$60,000
4) Existing Well Enhancement and Workover Cost Factors	
Percent of Total New Well Costs	67%
5) Overhead, Engineering, AFUDC, and Contingency Costs	
Percent of Total Facility Costs	26%
6) Base (Cushion) Gas	
Cost of Injected Base Gas ($/MMBtu)	$2.50
Cost of Base Gas Already in Place	$1.25
Percent Base Gas	50%

Source: Energy and Environmental Analysis, Inc.

Meeting the Challenges of the Nation's Growing Natural Gas Demand

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The CD-ROM located in the pocket opposite this page contains model output data and map files providing demand, supply, and transportation information on a regional basis. The CD also contains digitized maps, which were used in assessing a key critical factor—access to resources and rights-of-way. These maps provide a comprehensive inventory of acreage by land-use categories associated with related USGS gas plays for the several key Rocky Mountain resource areas analyzed in the 1999 NPC Study.

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The Resource Access Maps can be accessed by running the installation program setup.exe in the LAND ACCESS MAPS folder on the CD-ROM. This will install the SHAPE files and the MapView display program in the user's hard drive. The MapView program is designed to run on a PC with Win95, Win98, or WinNT. Minimum system requirements include a Pentium 100 with 32MB of RAM, video resolution of 1,024 x 768, and 50MB of free hard drive space. A Pentium II 266 with 64MB of RAM is recommended. The SHAPE files may also be manipulated in a GIS package such as ArcView, ArcExplorer, or MapInfo. Please refer to the readme.3.txt file located in the LAND ACCESS MAPS folder for more information.

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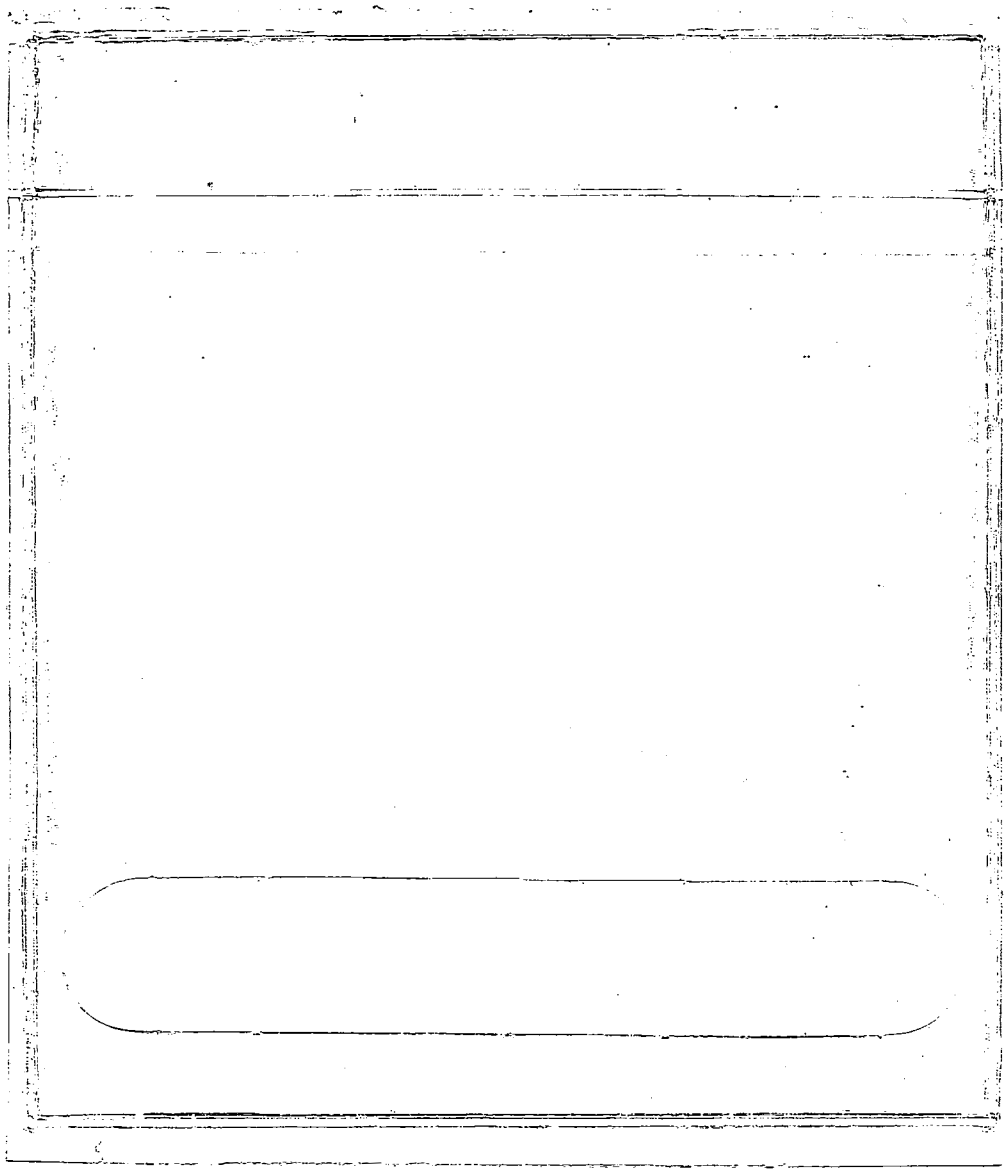
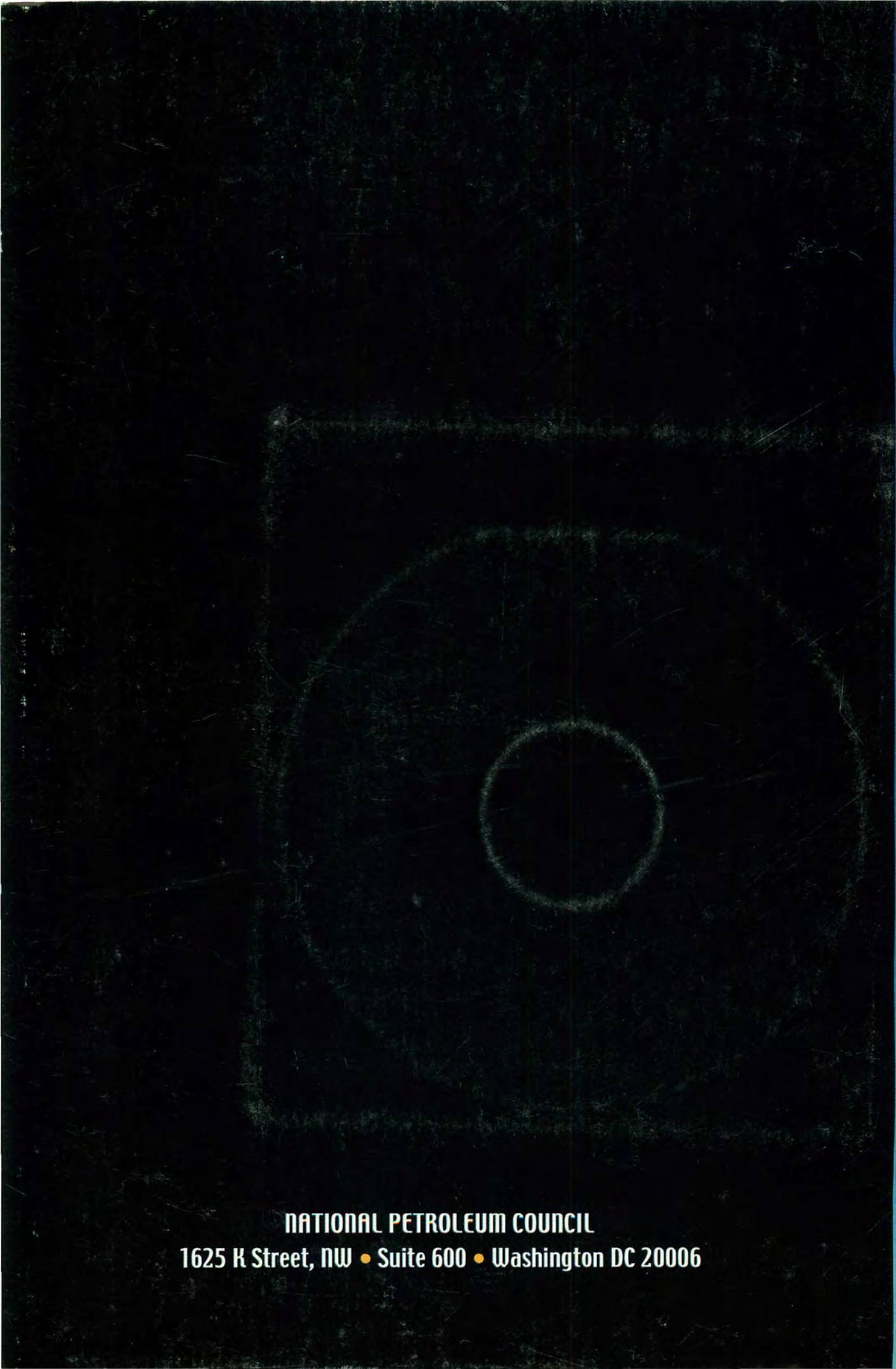
- Adobe® Acrobat® PDF Reader (included on the CD-ROM).
- Microsoft Excel 97, or other software capable of reading Excel 97 files.

SHAPE Files (PC)

- At least 50MB free hard drive space.
- Win95, Win98, or WinNT.
- Video resolution of at least 1,024 x 768
- Pentium 100 with 32MB of RAM.
- Pentium II 266 with 64MB of RAM recommended.





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