The George Washington University

Environmental Resource Policy Graduate Program

Capstone Project

Beneficial Reuse at Bodo Canyon Site

Feasibility and Community Support for Photovoltaic Array

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List of Acronyms

CEC	Clean Energy Collective
DOE	Department of Energy
DOE-LM	Department of Energy Office of Legacy Management
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FONSI	Finding of No Significant Impact
GPM	Gallons Per Minute
NRC	Nuclear Regulatory Commission
REC	Renewable Energy Credit
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
UMTRA	Uranium Mill Tailings Remedial Action

Executive Summary

I. Site History:

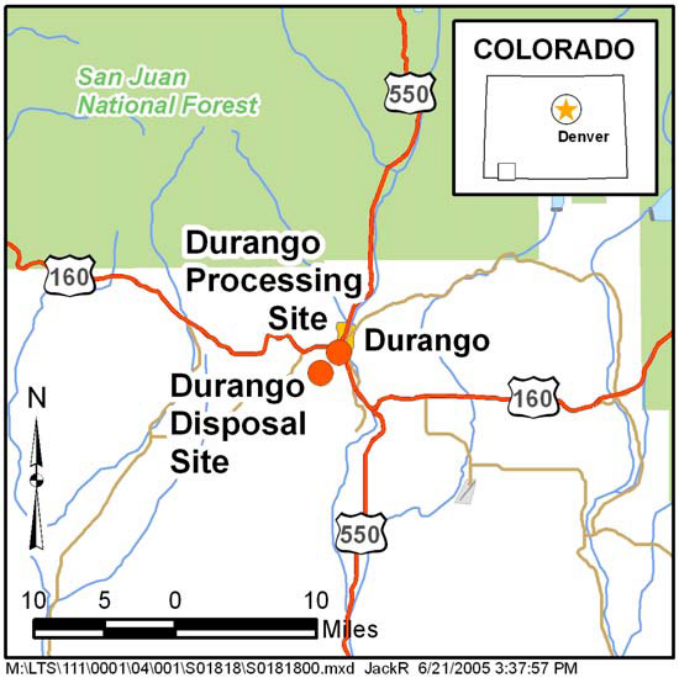


Figure 1: Locations of the Durango Processing and Disposal Sites

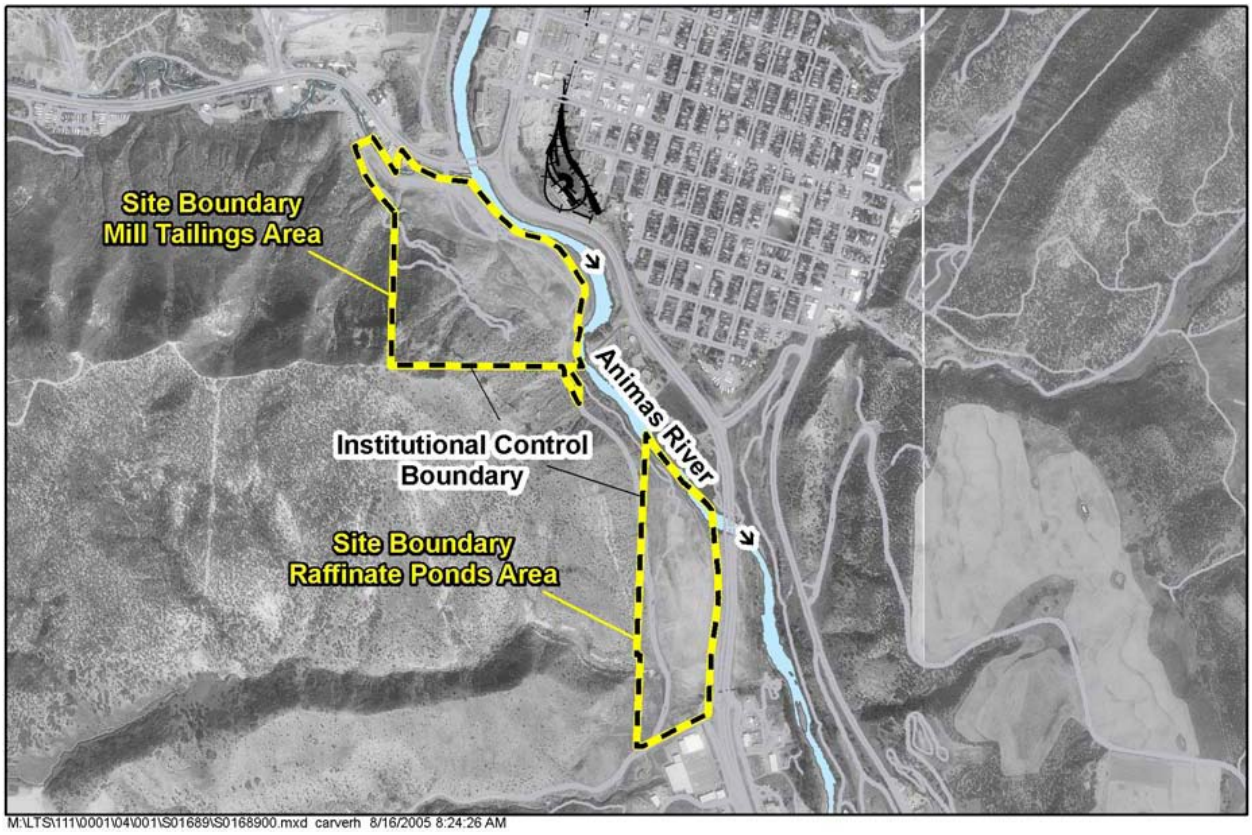
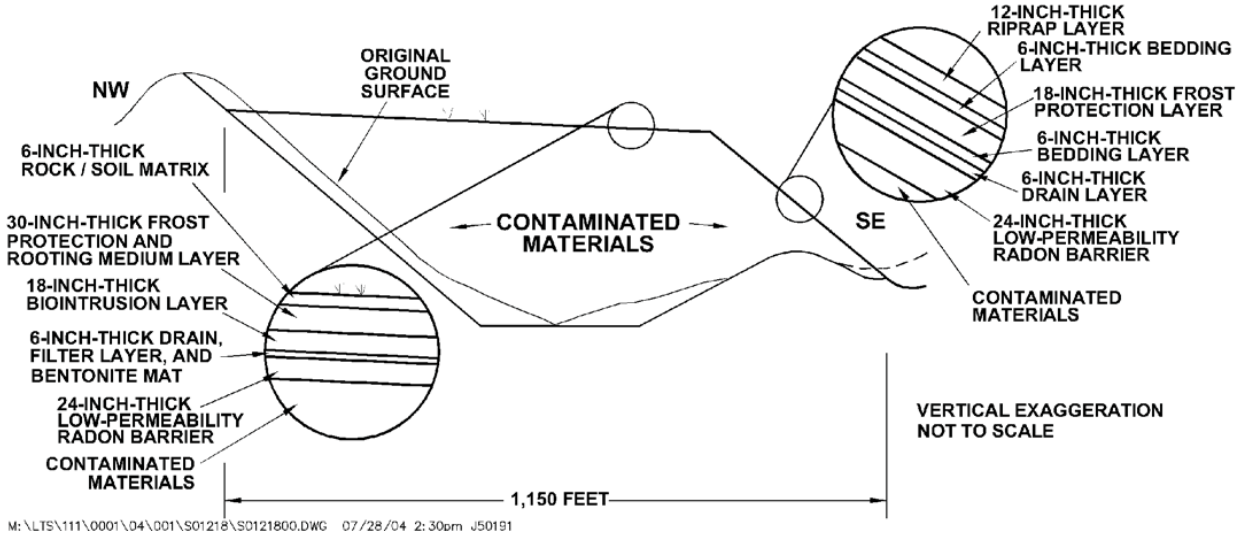


Figure 2: Institutional Control Boundaries at the Durango Sites

Bodo Canyon prior to disposal cell

The 120-acre disposal site was transferred from the State of Colorado to DOE in order to accommodate the contaminated soils and former mill tailings from two decommissioned processing sites just across the Animas River to the south of the town of Durango. The radioactive mill tailing were generated in the 1940's through the 1960's as part of uranium ore milling for the U.S. Government national defense programs. Vanadium Corporation of America also operated on the site in the 1940's. Just over three-fourths of the 40 acre mill tailings property was contaminated by the activities as well as 20 acres of raffinate pond area. The location of the processing site along the bank of the Animas River is now owned by the city of Durango and is used by locals as a dog park. The former raffinate pond area is owned by the Animas-La Plata Water Conservancy District. The areas have been re-sloped and vegetated with native grasses.

Construction of the disposal cell



The Bodo Canyon disposal site was created as a result of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). This act was designed "to provide for the disposal, long-term stabilization, and control of… mill tailings in a safe and environmentally sound manner and to minimize or eliminate radiation health hazards to the public (USNRC, fact sheet)."[1] Uranium mill tailings are an environmental health

[1] http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/mill-tailings.html

concern because of their long-lasting characteristics and the radon that is produced from radium, a component of the tailings.

While UMTRCA established two programs, the Title I program applies to the situation in Durango because the uranium mill tailings were accumulated prior to 1978 as a result of weapons programs. Title I is a joint federal and state program where the federal government owns the tailings and is regulated under the Nuclear Regulatory Commission (NRC) and the Department of Energy maintains the responsibility for remediating and cleaning up the sites. NRC oversees DOE to ensure that EPA's standards as established in 1983 are being met at all points in the cleanup process.

The Durango, Colorado disposal cell site in Bodo Canyon was completed in 1991 by the Department of Energy's Office of Legacy Management. The disposal cell contains uranium tailings and other debris that was relocated from a nearby uranium mill facility and other contaminated sites. The 120 acre site includes the 42 acres that comprise the cell. The slightly southern slope of the site and the area adjacent to the cell is ideal for a ballasted solar array system which could cover up to 21.5 acres, leaving the underground cell undisturbed.

The cell was designed to encapsulate and isolate the uranium contaminated materials. The irregularly shaped cell is roughly 2,400 feet by 1,300 feet. These measurements include the surrounding rock apron that will not be a usable surface for the ballasted solar array. The cell's cover layer has a _____(finish description of cell).

Site Monitoring

> "A total of 2.5 million yd^3 of uranium mill tailings were relocated to the Bodo Canyon disposal cell in the fall of 1990. Contaminated seeps developed along the downgradient slope of the disposal cell shortly after construction. The seep water was collected by a collection drain and piped to a retention pond, where it was regularly treated and discharged to a nearby wash."
> http://www.rtdf.org/public/permbarr/prbsumms/profile.cfm?mid=82

"Concentrations of uranium, selenium and molybdenum in seven monitoring wells are within bounds, the 2010 report said. A spike in the concentration of uranium in one well in 2009 has dropped as a result of remedial work, the report said. The 0.11 parts per million of uranium in November 2009 are now at 0.075 ppm, below the limit of 0.077 ppm. The limits for selenium and molybdenum are 0.042 ppm and 0.22 ppm, respectively. In 2010, the level of selenium was 0.0062 ppm and the level of molybdenum, less than 0.002 ppm.
http://www.durangoherald.com/article/20110301/NEWS01/703019966/Uraniumwastewithinlimits"

Site Development

DOE first issued an expression of interests for parties interested in installing and operating a solar photovoltaic electrical power generating system in August of 2011 upon suggestion by a member of the community. The initial plans to lease the site for 20 years with a 5 year option have been re-evaluated and DOE plans to release a new solicitation potentially with an option of a solar garden-type concept to improve the economic viability of the proposed project. DOE has conducted an environmental assessment (EA) and issued a finding of no significant impact (FONSI). The remaining expenses related to the solar array will be the full responsibility of the party with the winning proposal and may be subsidized by individuals and groups within the community that participate in the solar garden concept if that option is pursued by the developer. The developer will be responsible for all the site development except the construction of a roadway into the site. The developer will also be responsible for all compliance and monitoring and for restoring the site once the lease expires.

LM's mission of protecting human health and the environment while also managing legacy lands and assets are the most important objective for LM. The project goal is to meet the LM requirements and to take advantage of the potential reuse value of the site while encouraging public and private involvement in the project.

LM anticipates issuing a revised solicitation in the spring of 2012. The initial public scoping meeting was held on May 3, 2010. The final Environmental Assessment (EA) was completed by DOE in June, 2011 and a Finding of No Significant Impact (FONSI) was the conclusion of the assessment. This conclusion means that an Environmental Impact Statement (EIS) is not required. Any additional assessments will be the responsibility of the developer.

The site location at Durango is ideal for several reasons. The surrounding area is undeveloped so visual opposition is an unlikely concern. There is also an electrical transmission line running across one corner of the site and although an estimated $500,000 upgrade will be required for a 2MW array, helps make the site more desirable to a developer compared to more isolated sites that do not possess a feasible connection to the energy grid. The slight southern slope of the site is also ideal for a photovoltaic array's ability to capture maximum incoming solar energy.

Southwestern Colorado is an ideal location for solar arrays because of the location and weather. Durango, Colorado sits at 6,512 feet in elevation and experiences over 300 sunny days a year (http://www.worldatlas.com/webimage/countrys/namerica/usstates/codurango.htm).

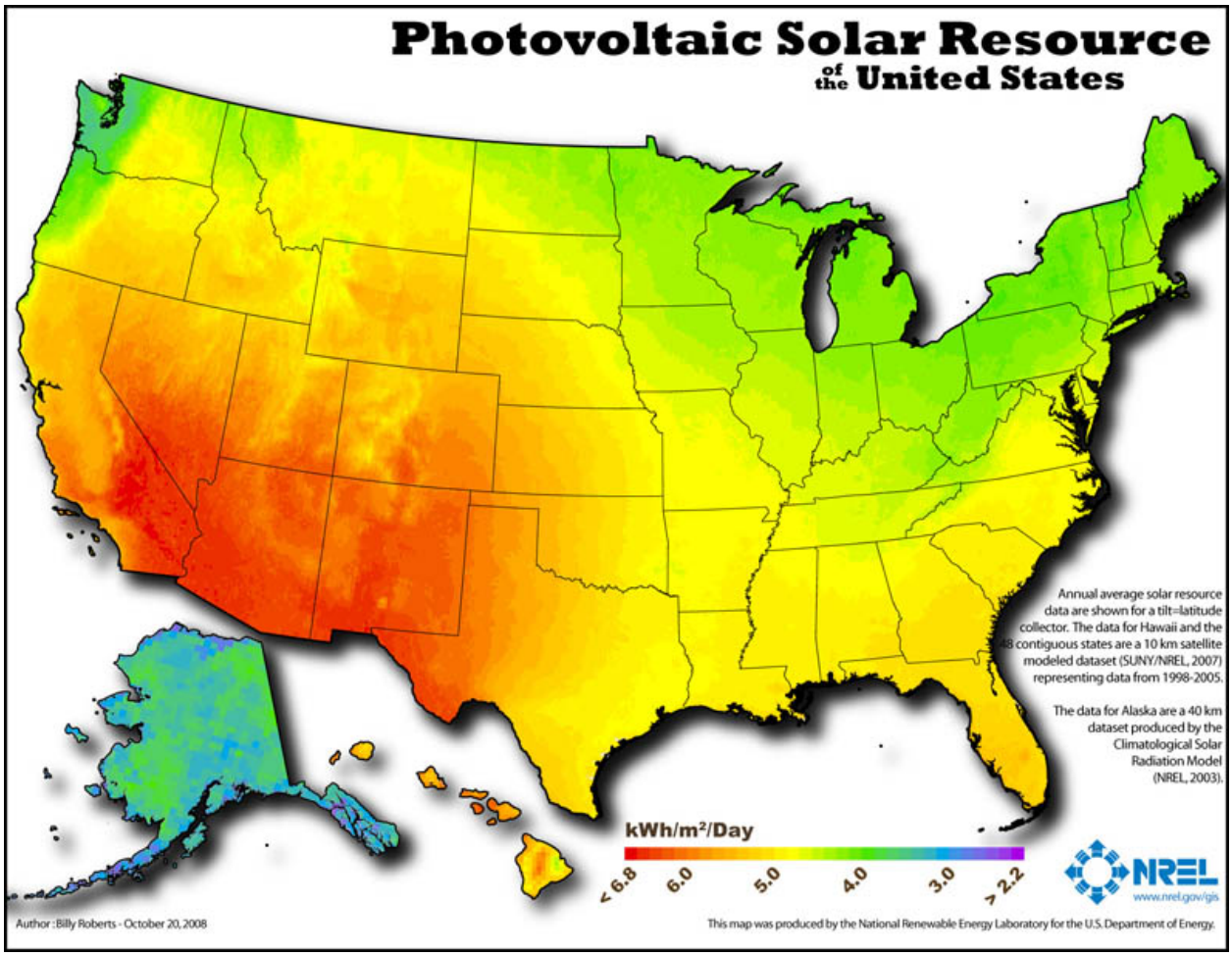


Figure 3: http://www.entecsolar.com/Services-SolarPowerApplicationAssessment.asp

II. Green Energy & Community Involvement: Ben Walsh

There are about 7,800 homes located in Durango, CO. Currently 81% of homes are heated through natural gas while 16% comes from electricity. The proposed site has a 40-acre uranium mill tailing disposal cell located on 120 acres. Up to 21 acres could be used to support a 4.5 megawatt photovoltaic (solar) system that can power approximately 1,000 homes. That means almost 13% of the homes can switch from traditional energy sources to renewable solar energy. The solar array can be connected directly to existing transmission lines; however an upgrade would be needed for systems larger than 1.6 MW.

Political Support

For this project to be successful, the site must be structurally, economically, and politically suitable. Without all three of these components, moving forward with a developer to build a PV system would be very difficult. Therefore, we designed a survey to gauge community support on both willingness to pay for green energy and support for a community solar garden. Our survey aims to find out 1) the level at which support for green energy falls off, and 2) the benefits the current proposed location for the solar array has over other locations in the Durango area. Respondents were contacted via phone between April 9 and 17th and directed to our website www.surveymonkey.com/s/solardurango to complete the survey. (add survey data here)

Percentage Green Power Usage

Research was conducted to aid DOE in selecting future sites for green energy projects. This research was conducted on multiple fronts including demographic data of

green cities and the optimum conditions for a PV system. The first set of data looks at demographics that are common to communities receptive to green projects. Through our research we have isolated a number of green communities to analyze. The Environmental Protection Agency is currently conducting a Green Power Challenge to increase the use of renewable energy in communities. The chart below (released March 26, 2012) indicates that our target city, Durango, is listed 9th in the country in percentage of green power used (11.1% of total electricity use).

Table 1: GPC Rankings Based on Percentage Green Power[2]

Community	Green Power %
1. Oak Park, IL	82.9 %
2. Brookeville, MD Community	45.7%
3. Hillsboro, OR Community	35.7%
4. Swarthmore, PA Community	27.9%
5. Corvallis, OR Community	21.2%
6. River Falls, WI Community	14.9%
7. Bellingham, WA Community	14.4%
8. Gresham, OR Community	11.5%
9. Durango, CO Community	11.1%
10. Lake Oswego, OR Community	9.4%

[2] http://www.epa.gov/greenpower/communities/gpcrankings.htm

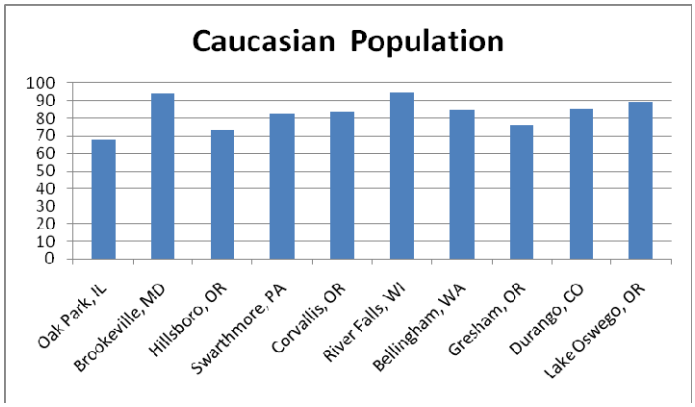


Figure 4

Looking at Table 2 we find demographic information about the cities listed above. All of the top 10 cities are mostly Caucasian with only two cities (Oak Park and Hillsboro) falling below 75% (Figure 1). Each city has over 60% of its population in the working age between 18 and 65. This puts the communities in line with the country as a whole which shows 63% of the population between 18 and 65. The lowest high school graduation rate is 85% although the college graduation rate is more diverse (Figure 2). All but one city on the list is above the national average in college graduation rates.

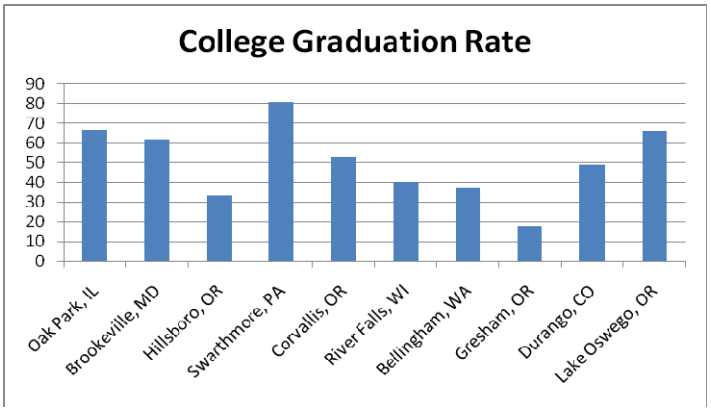


Figure 5

These demographic statistics suggest that cities with high populations of Caucasians, aged 18-65 and college graduates

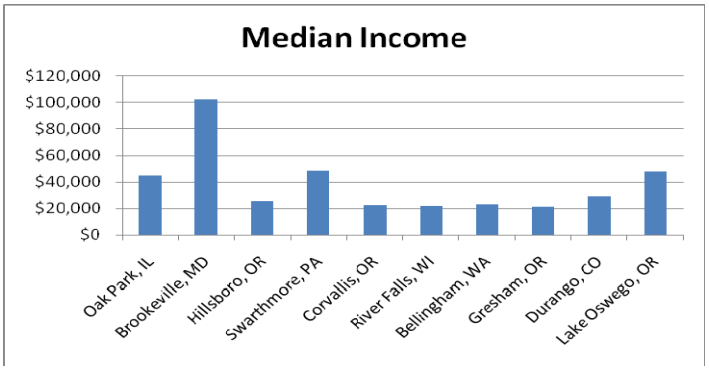


Figure 6

should be targeted by the DOE for future solar power array installations. In addition, it is a common perception that communities must be wealthy to enact green infrastructure such as solar power. The demographics show that half of the top 10 cities fall below the national median income of $27,000 (Figure 3), but four cities have poverty rates higher than the national average. So it is possible for cities to invest and promote green energy even if they are not the wealthiest communities.

Total Green Power Usage

Additionally, in Table 4 we looked at the highest total usage of green power according to the Green Power Challenge. These communities tend to be larger than the previous list which makes sense as larger cities use more energy, and would thus need more green energy than a smaller community. However, five cities do make both lists for total green power usage and percentage of green power used. As of March 26, 2012 Durango ranks 18th with 19,843,200 kWh. Durango would need to use almost 4 times the amount of green energy as it currently does to match a community listed in the top 10 cities in total usage of Green Power.

Table 2: Top 10 Cities by Percentage of Green Power

City	*Green Power %*	*Population*	*Male/Female*	*Under 18*	*Over 65*	*White*	*Black*	*Hispanic*	*Asian*	*Amer. Indian*	*HS Grad*	*College Grad*	*Median Income*	*Poverty Rate*
Oak Park, IL	82.9	51,878	46.4/53.6	24.1	10.7	67.7	21.7	6.8	4.8	0.2	96.2	66.9	$45,150	6.6
Brookeville, MD	45.7	134	45/55	n/a	n/a	94.1	0	5.9	0	0	93.2	61.6	102,156	n/a
Hillsboro, OR	35.7	91,611	50.2/49.8	26.8	7.8	73.3	2	0.4	8.6	1	86.4	33.2	$25,697	10.9
Swarthmore, PA	27.9	6,194	47.2/52.8	20.7	12.4	82.5	5	4.9	7.7	0.3	96.7	80.9	$48,350	4.2
Corvallis, OR	21.2	54,462	50.3/49.7	14.9	10.5	83.8	1.1	7.4	7.3	0.7	94	52.7	$22,837.00	26.8
River Falls, WI	14.9	15,000	46.8/53.2	17.2	8.2	94.8	1.2	1.8	1.5	0.4	92.6	40.4	$22,049	15.4
Bellingham, WA	14.4	80,885	48.8/51.2	15.6	12.8	84.9	1.3	7	5.1	1.3	91.7	37.4	$23,288	21.6
Gresham, OR	11.5	105,594	49/51	26.4	10.7	76	3.5	18.9	4.3	1.3	85	17.8	$21,609	16.1
Durango, CO	11.1	16,887	51/49	15.7	9.7	85.1	0.6	12.3	0.8	6.3	93.9	49.3	$28,925	13.2
Lake Oswego, OR	9.4	36,619	47.3/52.7	22.1	16.2	89.3	0.7	3.7	5.6	0.4	97.9	66.1	$47,704	6
USA		*308,745,538*	*49.2/50.8*	*24*	*13*	*72.4*	*12.6*	*16.3*	*4.8*	*0.9*	*85*	*27.9*	*$27,334*	*13.8*

Table 3: Top 10 Annual Green Power Cities

City	*Annual Green Power*	*Population*	*Male/Female*	*Under 18*	*Over 65*	*White*	*Black*	*Hispanic*	*Asian*	*Amer. Indian*	*HS Grad*	*College Grad*	*Median Income*	*Poverty Rate*
Washington, DC	772,324,379	601,723	47.2/52.8	16.8	11.4	38.5	50.7	9.1	3.5	0.3	86.5	49.2	$42,078	18.5
Hillsboro, OR	709,336,690	91,611	50.2/49.8	26.8	7.8	73.3	2	0.4	8.6	1	86.4	33.2	$25,697	10.9
Portland, OR	708,666,565	583,776	49.5/50.5	19.1	10.4	76.1	6.3	9.4	7.1	1	89.5	41.1	$29,797	16.3
Santa Clara, CA	233,138,672	116,468	50.5/49.5	21.3	10	45	2.7	19.4	37.7	0.5	90.9	48.8	$38,422	8.6
Oak Park, IL	191,000,000	51,878	46.4/53.6	24.1	10.7	67.7	21.7	6.8	4.8	0.2	96.2	66.9	$45,150	6.6
Corvallis, OR	126,735,822	54,462	50.3/49.7	14.9	10.5	83.8	1.1	7.4	7.3	0.7	94	52.7	$22,837.00	26.8
Gresham, OR	125,843,124	105,594	49/51	26.4	10.7	76	3.5	18.9	4.3	1.3	85	17.8	$21,609	16.1
Bellingham, WA	94,533,140	80,885	48.8/51.2	15.6	12.8	84.9	1.3	7	5.1	1.3	91.7	37.4	$23,288	21.6
Beaverton, OR	76,276,884	89,803	48.6/51.4	22.9	10.4	73	2.6	16.3	10.5	0.6	91.4	42.4	$30,526	9.9
Palo Alto, CA	73,209,780	64,403	48.9/51.1	23.4	17.1	64.2	1.9	6.2	27.1	0.2	97.6	79.3	$70,242	5.7
USA		*308,745,538*	*49.2/50.8*	*24*	*13*	*72.4*	*12.6*	*16.3*	*4.8*	*0.9*	*85*	*27.9*	*$27,334*	*13.8*

Table 4: GPC Rankings Based on Green Power Usage[3]

Community	Annual Green Power Usage (kWh)
1. Washington, DC Community	772,324,379
2. Hillsboro, OR Community	709,336,690
3. Portland, OR Community	708,666,565
4. Santa Clara, CA Community	233,138,672
5. Oak Park, IL Community	191,000,000
6. Corvallis, OR Community	126,735,822
7. Gresham, OR Community	125,843,124
8. Bellingham, WA Community	94,533,140
9. Beaverton, OR Community	76,276,884
10. Palo Alto, CA Community	73,209,780

With the larger users of green power we see more diversity in table 3. Each city in the table has at least 50,000 people and 4 of them are over 100,000 people. At least 60% is of working age between 18 and 65 putting them in line with the national average. However, 4 cities have white populations under the national average of 72.4%. The cities are still very educated with 85% still the lowest high school graduation rate and all but one city above the

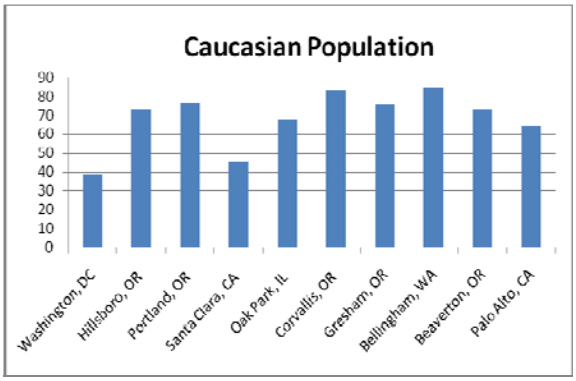


Figure 4

[3] http://www.epa.gov/greenpower/communities/gpcrankings.htm

national average in college graduation. Four cities fall below the median income (Figure 5) while half of the cities are below the national poverty rate of 13.8% (Figure 6).

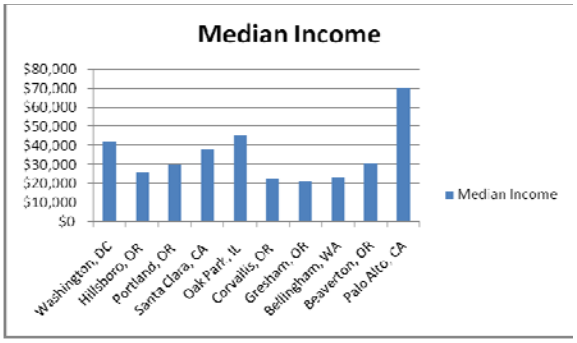


Figure 5

Therefore, ideal large users of green energy would have cities with over 50,000 people and over 60% of its population between 18 and 65. These stats show the racial make up of the community can be more diverse but more educated areas continue to favor and support green energy. While these cities are more wealthy then the first list, it still shows that they do not need to be wealthy communities for green energy initiatives succeed.

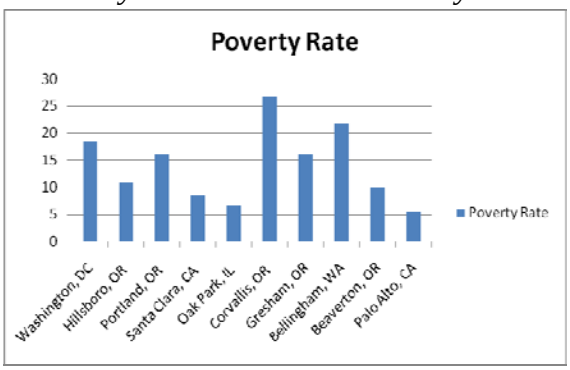


Figure 7

This demographic information provides a good basis for the DOE to start a search for supporting cities. Identifying these communities with similar demographics to Durango, CO, will be helpful in selecting other locations to implement solar arrays. This is of course only one part of the equation. Just because a community is receptive to solar energy projects does not mean that project will be a success. The selected area must also meet the conditions for proper solar generation and it must be economically feasible.

Structural and Environmental Attributes

Analysis was also done on the attributes that make a site like Durango favorable to PV projects. Combining our research on demographics and physical attributes will enable DOE to match receptive communities with suitable sites for future projects.

One of the chief concerns at Bodo Canyon is preserving the integrity of the disposal site. However, no drilling is needed as a ground-mounted PV system, similar to the figure 7, will be deployed to ensure the site is not punctured.

Figure 7 Ballasted PV Panels

Before any solar project is implemented a number of factors should be examined both structural and economical. We much first establish the structural feasibility otherwise it would not be effective to build in such a site. Considerations include:

1. Shading analysis (identification of obstructions that might shade the array location)
2. Available square footage for a solar system
3. Preliminary estimate of the system's size
4. Utility interconnection issues
5. Incline/Slope
6. Weather analysis

The Bodo Canyon area is an ephemeral drainage basin of about 4.5 square miles. The Durango Disposal Site is a 120 acres property located 3.5 road miles southwest of the city of Durango in southwestern Colorado at an elevation of 7,100 feet (Figure 8).

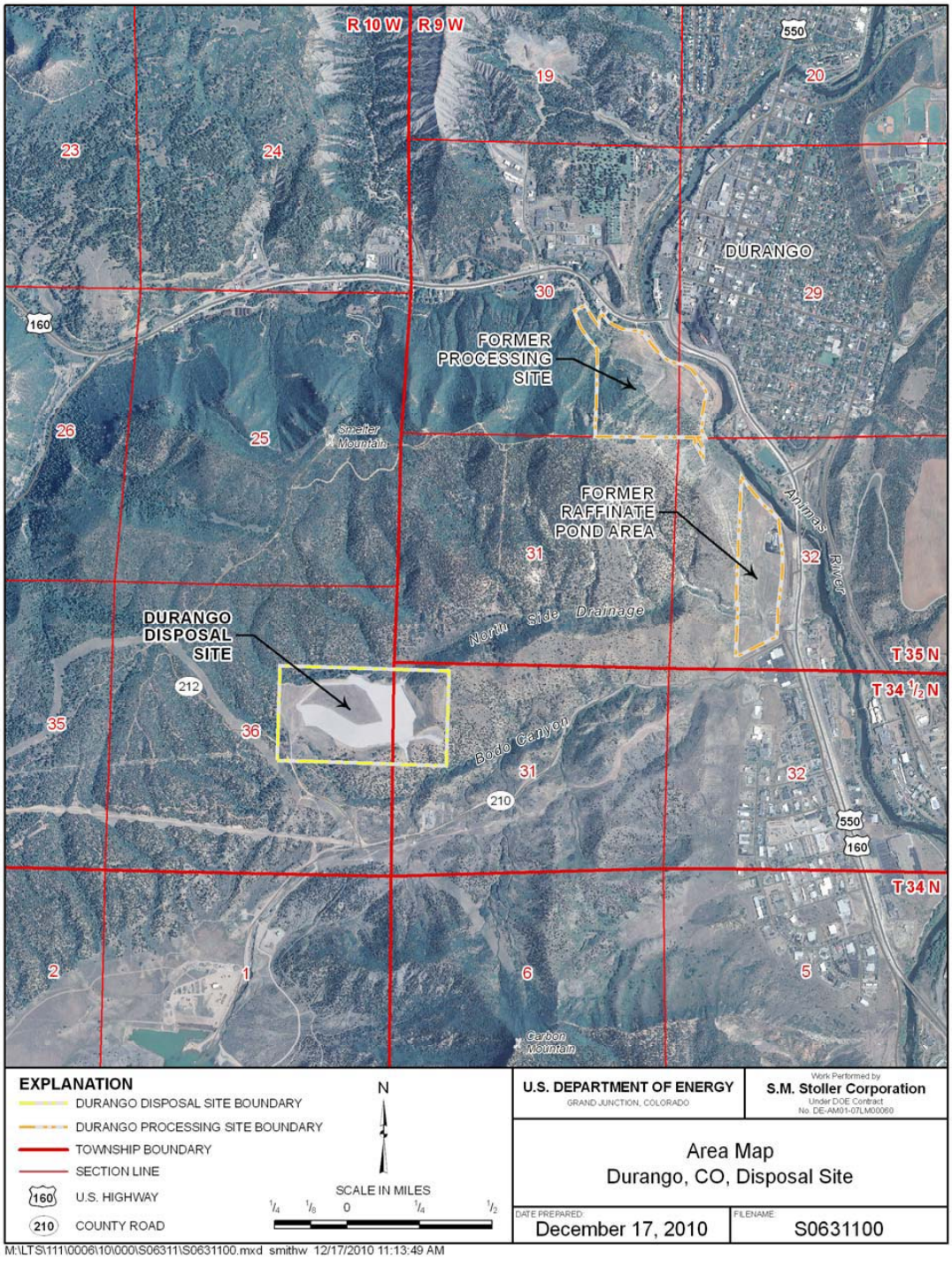


Figure 8 Map of Durango Disposal Site

Of the 120 acres, 42 acres comprise the tailings cover. Out of the tailings cover, approximately 21 acres could be used to install a 4.5mW solar installation (Figure 9). The entire site is located on an exposed plateau with no trees, shrubs or other large shading implements. Additionally, several transmission lines owned by Tri-State Generation and Transmission Association and La Plata Electric Association (LPEA) cross the site. These lines could be upgraded to allow the PV system to tap into the system.

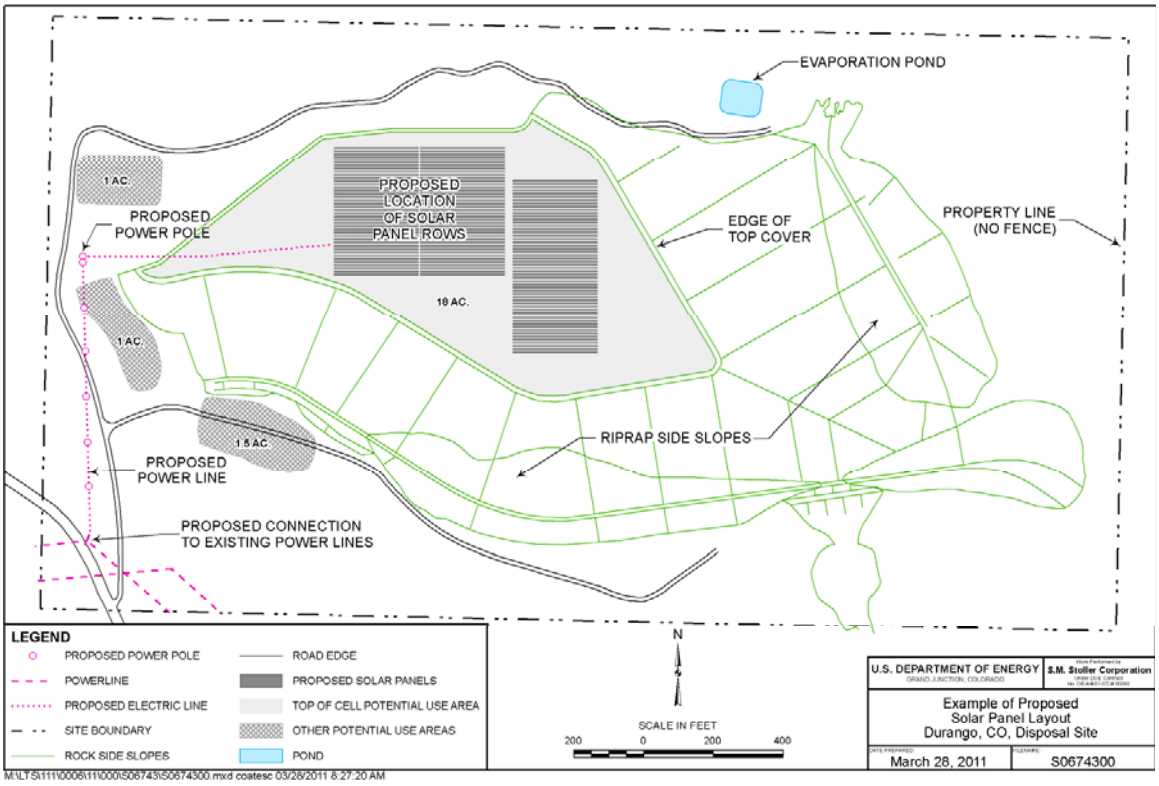


Figure 9 Proposed Connection to Existing Lines

Environmental Assessment Photovoltaic Solar Project at the Durango, Colorado, Disposal Site

Solar installers prefer a range of 1 to 2 percent for ease and cost of installation. The cover of the cell at this site was constructed with a slope between 1.5 and 2 percent. No

additional grading will be needed and therefore there would be limited risk of disturbing the site.

Additionally, ideal sites should be south facing, have cool but sunny weather, and be surrounded by public lands. Bodo Canyon also meets all of these requirements. The site is bordered to the south by the US Bureau of Reclamation and is surrounded to the north, east, and west by lands owned by the Colorado Division of Wildlife. There are no housing developments in the immediate area and only one road that passes with a quarter mile of the site (Figure 3). The hill is southern facing and has 70-86% sunny days for each month of the year (Table 5).

Table 5: Sunshine in Durango[4]

Month	% Sunny	Clear Days	Partly Cloudy	Cloudy
January	74.19%	13	10	8
February	75.00%	11	10	7
March	70.00%	10	11	9
April	74.19%	10	13	8
May	74.19%	9	14	8
June	86.67%	14	12	4
July	81.25%	9	17	6
August	80.65%	11	14	6
September	83.33%	15	10	5
October	80.65%	17	8	6
November	76.67%	14	9	7
December	77.42%	14	10	7

The temperature also ranges from an average low of 11°F to an average high of 80°F over the course of the year (Table 6).

[4] http://www.homefacts.com/weather/Colorado/La-Plata-County/Durango.html

Table 6: Durango Weather[5]

Month	Avg. High	Avg. Low	Mean	Avg. Precip	Record High	Record Low
January	35°F	11°F	23°F	1.52 in.	60°F (1953)	-35°F (1963)
February	39°F	15°F	27°F	1.48 in.	60°F (1986)	-25°F (1951)
March	46°F	22°F	34°F	1.48 in.	71°F (1966)	-15°F (1966)
April	56°F	28°F	42°F	1.12 in.	77°F (2000)	-4°F (1953)
May	65°F	35°F	50°F	0.98 in.	91°F (2002)	11°F (1977)
June	75°F	42°F	59°F	0.67 in.	99°F (1974)	16°F (1954)
July	80°F	50°F	65°F	2.11 in.	102°F (1973)	29°F (1995)
August	77°F	50°F	64°F	2.29 in.	93°F (2002)	26°F (1968)
September	70°F	42°F	56°F	2.15 in.	88°F (1995)	17°F (1970)
October	58°F	31°F	45°F	1.57 in.	80°F (1979)	3°F (1971)
November	45°F	21°F	33°F	1.58 in.	70°F (1999)	-15°F (1952)
December	36°F	13°F	25°F	1.26 in.	59°F (1995)	-24°F (1990)

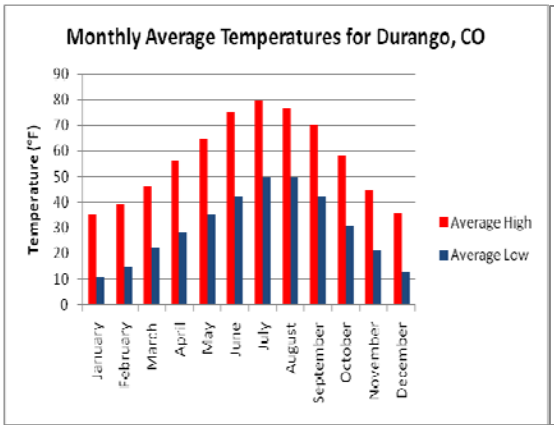


Figure 10 Durango Monthly Temperatures

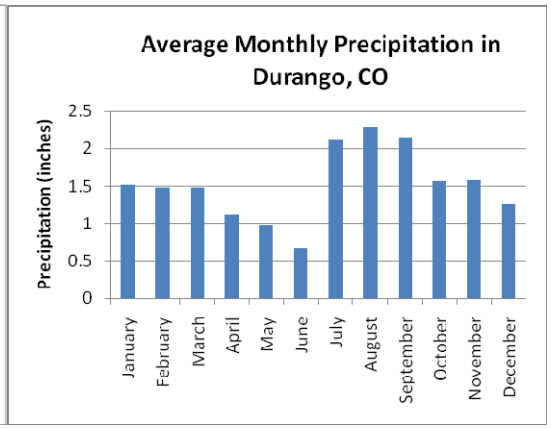


Figure 11 Durango Monthly Precipitation

The National Renewable Energy Laboratory has mapped the amount of solar energy that could be generated in various parts of the US (Figure 12). Durango is located in southwest Colorado in an area with one of the highest solar potential. Looking

[5] http://www.weather.com/weather/wxclimatology/monthly/81301

at all of these factors, Bodo Canyon does appear structurally and environmentally to be an ideal location for a PV installation.

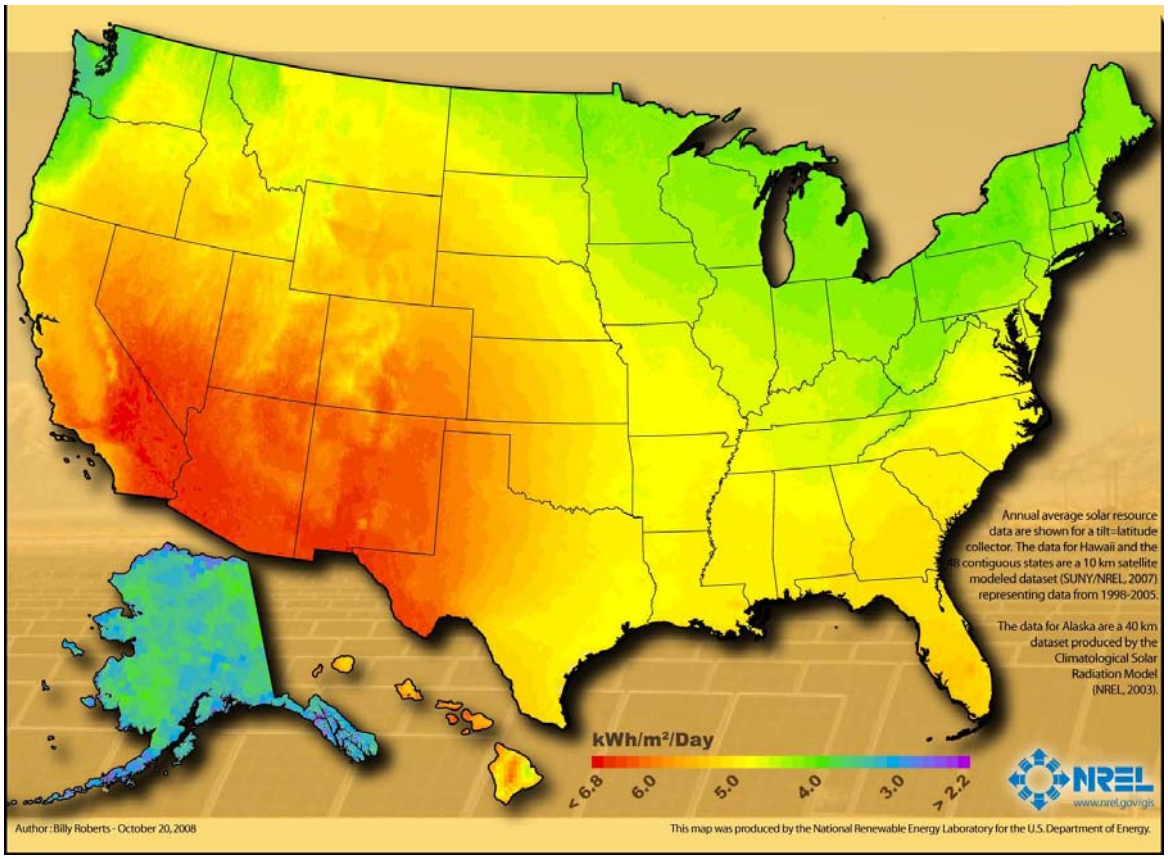


Figure 12 Annual Average Solar Resource

National Renewable Energy Laboratory http://www.nrel.gov/gis/solar.html

Economic Attributes

While a site may be ideal physically it must also make sense economically to build and support such a project. Economic considerations include:

1. Cost of energy at a site, plus any details of rate schedules that could favor or penalize solar
2. Estimated annual energy production
3. Incentives (federal, state, local, utility, RECs) and their time sensitivities

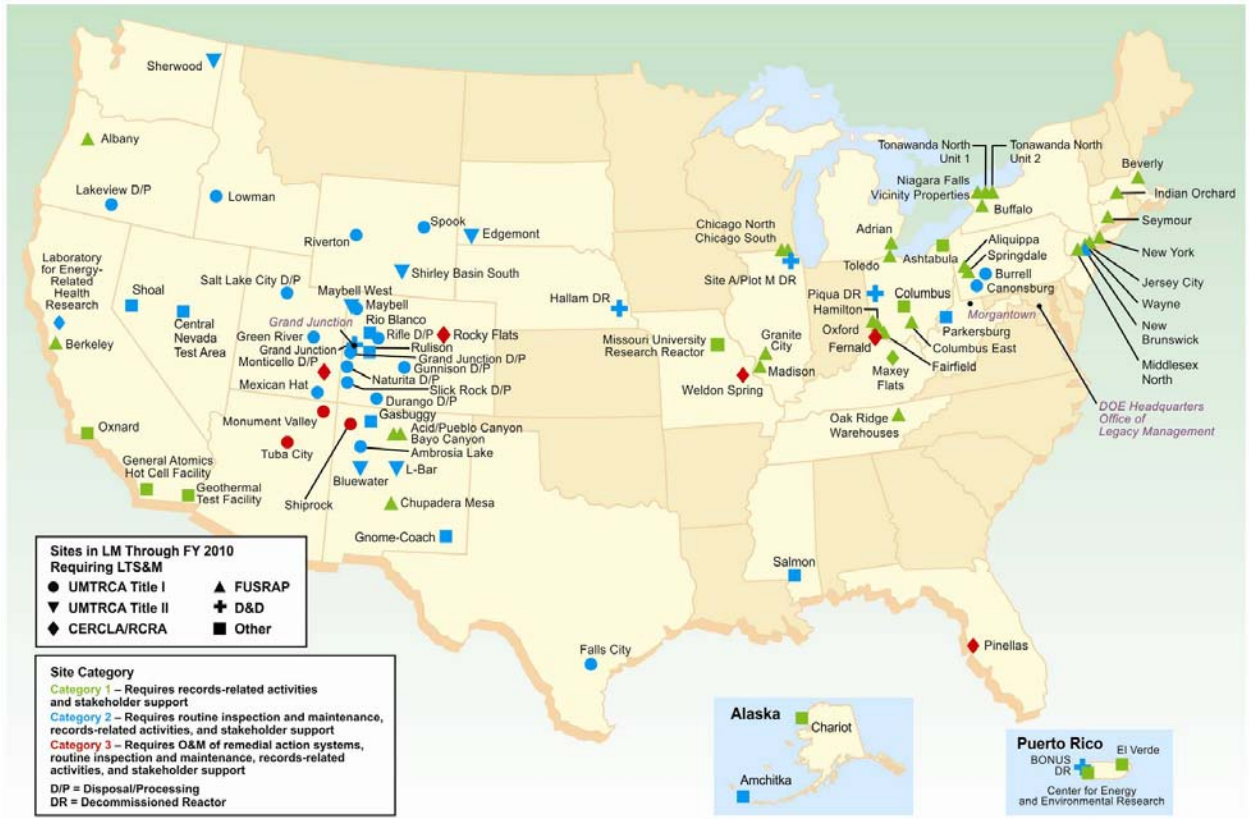
Consumers currently pay $0.03 per renewable energy credit to the La Plata Electric Association and it is projected to go down in the future. LPEA currently charges about $0.105 per kWh projected to increase at 5% per year. LPEA offered contract rates of $0.07 per kWh, so the total would be $0.10 per kwh including RECs right now. Indications are that $0.12 - $0.14 per kWh are needed for the project to become economically viable on the basis of power generation alone. So an increase of $0.03 - $0.04 in the contract rate would make the project at least fiscally possible.

LPEA/Tri-State has a 10% renewables portfolio standard (RPS) versus 20% for investor owned utilities in Colorado by 2020 (currently at 3%). These can be bought from anywhere, resulting in the low price for RECs. The only incentive to speak of, other than net metering by the utility, is a 30% federal tax credit for solar panels, which is set to expire in 2016. It would be advisable for a private contractor to begin construction before 2016 to take advantage of this credit.

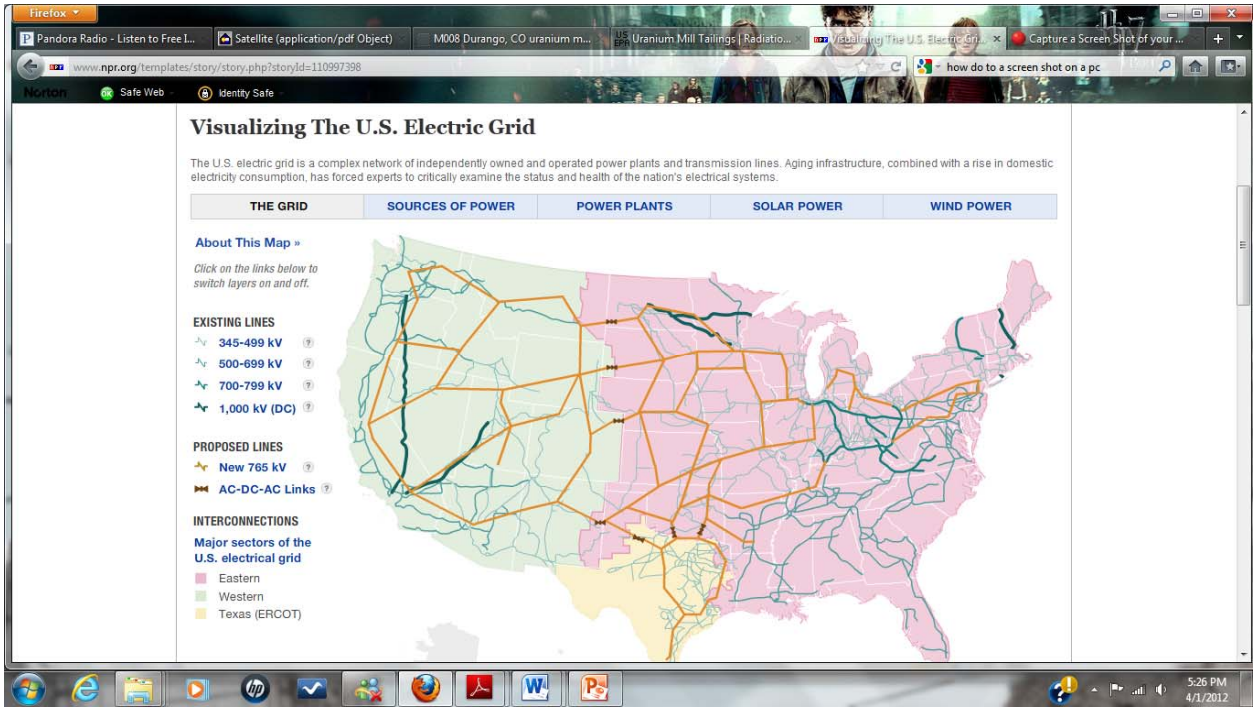
The site has the potential for 4.5MW, but other than that the annual energy production cannot be estimated as it would be commensurate with whatever is actually built. It is important to note that the $500k LPEA estimated would bring a 2MW line to the site, while LPEA has stated that beyond 2MW would require a $1.5 million project.

III. Uranium Mine Tailings Act- (See Appendix B)

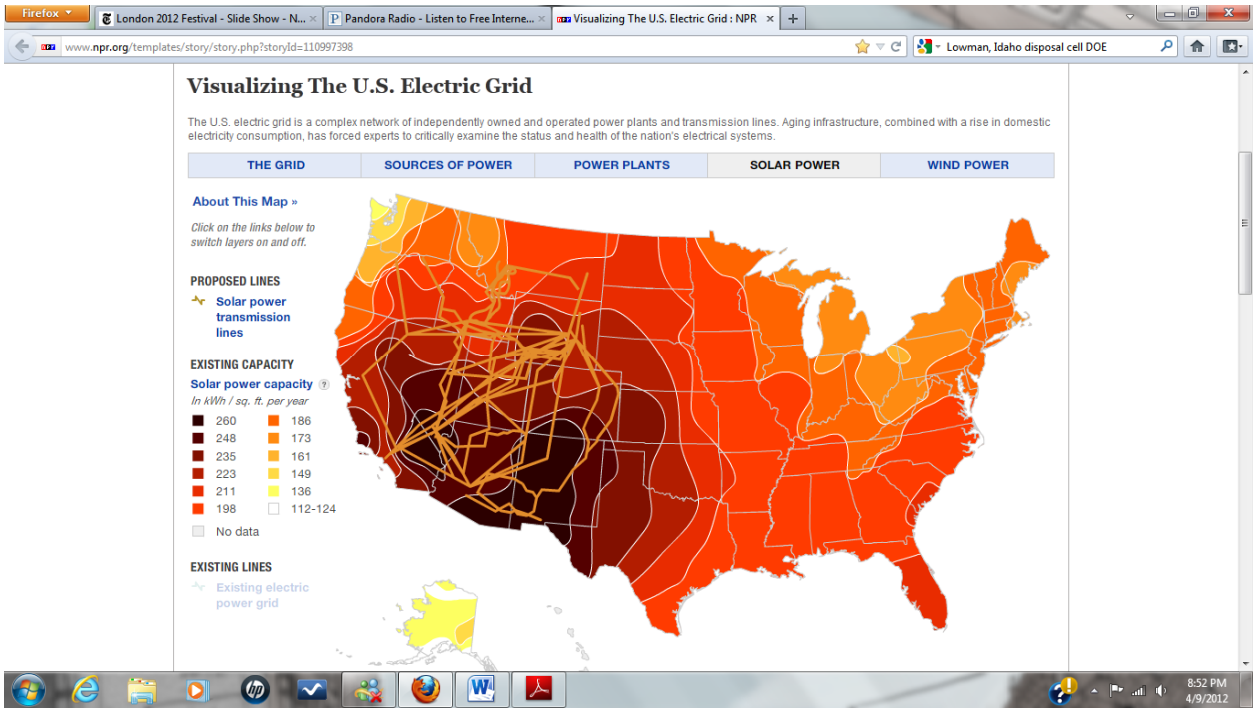
Comparable Sites



DOE sites

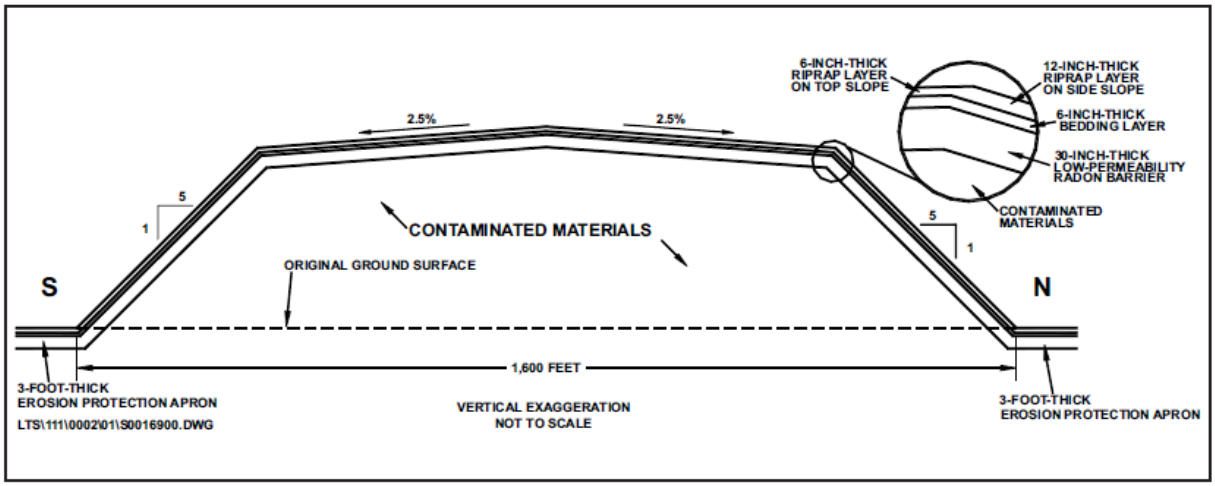


http://www.npr.org/templates/story/story.php?storyId=110997398



Sites brought under general NRC license by the Uranium Mill Tailings Remedial Action (UMTRA) Project.

Ambrosia Lake, New Mexico[6]



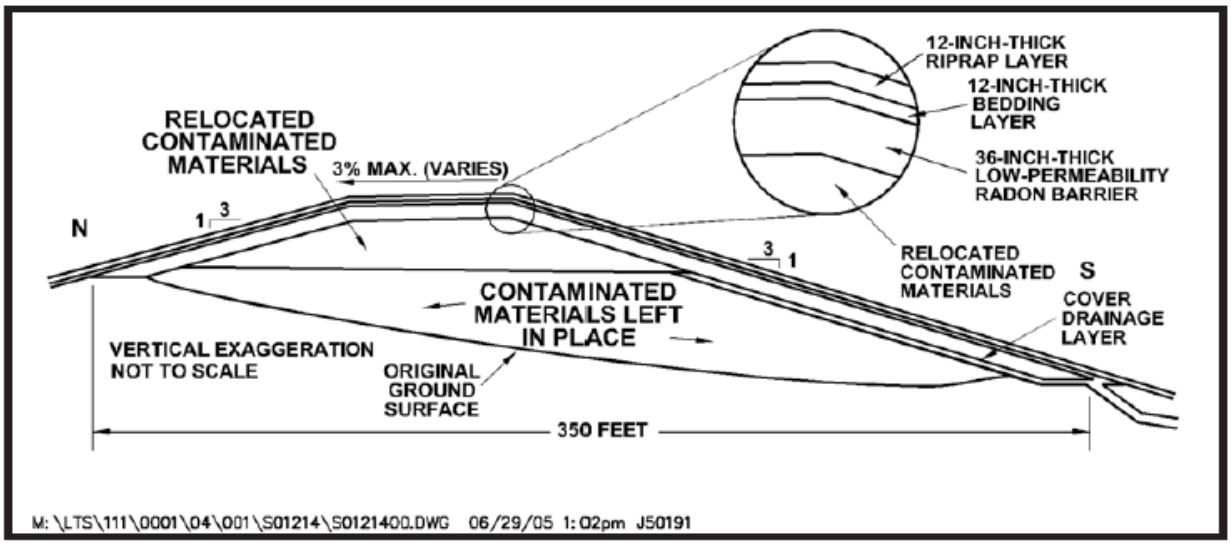
South-North Cross Section of Ambrosia Lake Disposal Cell

The property is located about 25 miles to the north of Grant, NM. This site has a large disposal cell surface area amounting to 91 acres of the 290 acre site. Because of the north and south divided surface slope, only about one-half of the cell would have the

[6] Ambrosia Lake Fact Sheet - DOE

ideally-preferred, slightly-southern exposure. The top of the cell surface slope is maximum 4 percent grade, however, so it may be possible that with slight modifications to the top soil cover or the method of installation for a potential solar array that more of the surface could be useful. The location of the cell is ideal for two reasons. It is in a remote part of New Mexico thereby minimizing any concern that neighbors might find a solar array to be unsightly. Secondly, the groundwater in the area is part of an aquifer that is not drawn for human consumption which lessens concerns for litigation should an installation link at some point in the future to a toxic leak. There are also several large transmission lines that run through the Northwestern corner of NM near to the Ambrosia Lake site.

Burrell, Pennsylvania[7]



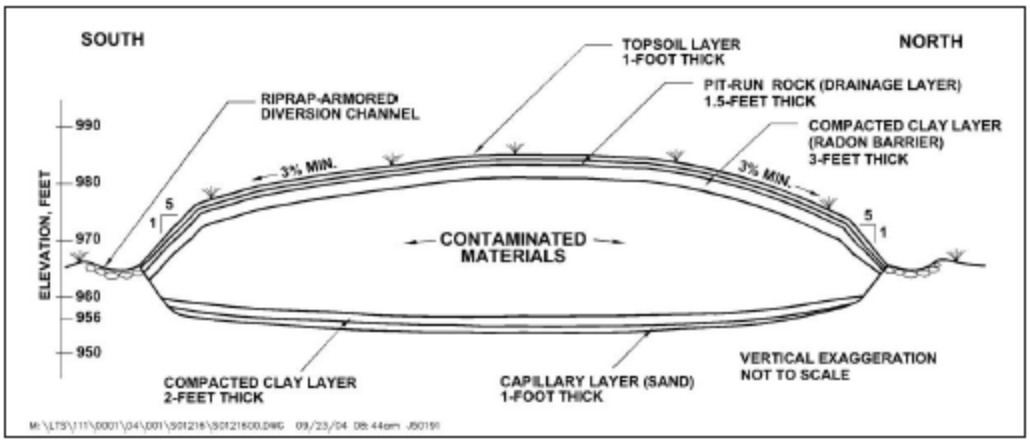
North-South Cross Section of the Burrell Disposal Cell

The property is located in Southwestern Pennsylvania, one mile from the borough of Blairsville. Originally a landfill for the railroad, Uranium waste from a nearby Canonsburg processing site was relocated in an effort by DOE to consolidate waste. The disposal cell is 4 acres of the 72 acre site. Groundwater samples from eight wells and two seeps at the site have been consistently below required standards and are monitored every 5 years. Although the site is small, the southern facing slope dominates the cell and is ideal for sun exposure. Compared to sites in the southwestern U.S. where solar

[7] Burrell Fact Sheet - DOE

energy is about 6 kWh/m^2/day, incoming solar energy in Pennsylvania is only 4 kWh/m^2/day. This means that funding put toward solar investments would be more efficient if located in areas with higher incoming solar energy (assuming connections to transmission lines and state incentives are equal).

Canonsburg, Pennsylvania[8]

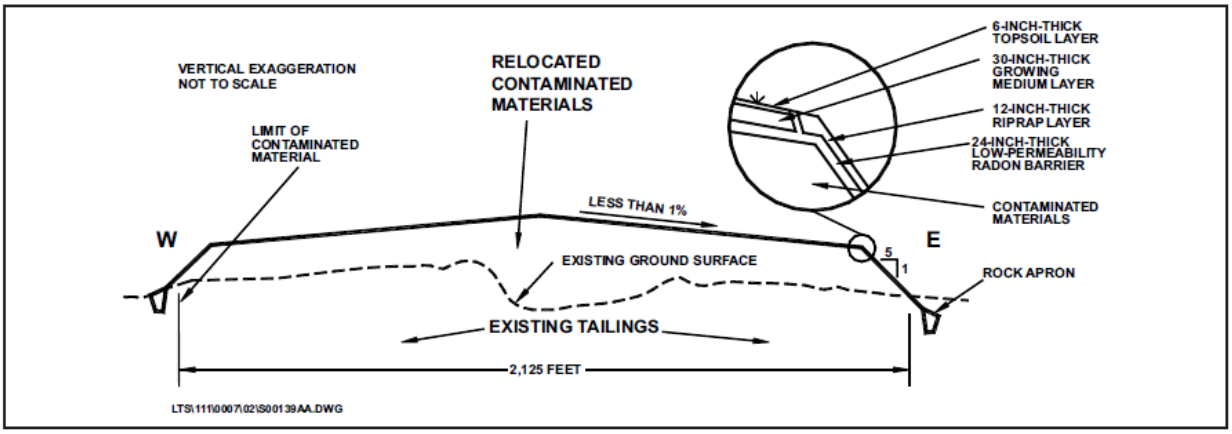


South-North Cross Section of Canonsburg Disposal Cell

The property is less than 10 acres, 3 of which have already been sold to a private owner. There are plans in the future for more of the property to be sold once it is approved by the NRC. The disposal cell was re-vegetated with grasses and was designed to minimize infiltration and encourage rapid runoff. For these reasons, and the location in an area of the country with lower incoming solar energy, this site is not ideal for reuse as a solar array.

Falls City, Texas[9]

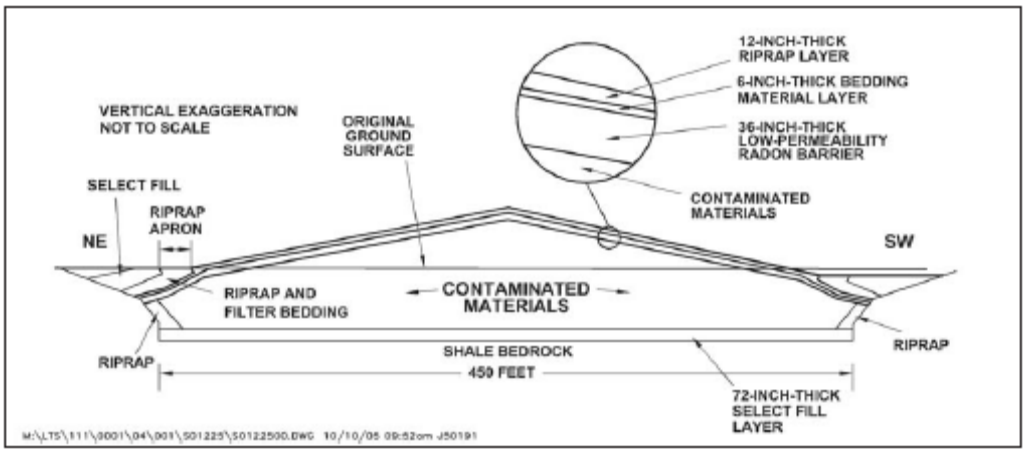
[8] Canonsburg Fact Sheet - DOE
[9] Falls City Fact Sheet - DOE



West-East Cross Section of Falls City Disposal Cell

Generated in the 1960's to 1980's the uranium mill tailings were encapsulated by DOE in an engineered disposal cell in 1994. The site is 40 miles southeast of San Antonio, Texas in an area where incoming solar energy is 5 kWh/m^2/day. Although the grass vegetation atop the cell was part of the design to increase evapotranspiration and decrease infiltration, the groundwater in the area is not used for human or agricultural consumption which lessens any concern that reuse of the site could change historically diminishing contamination levels. The site occupies 127 acres and is already surrounded by a fence thus minimizing concern for how wildlife could be affected should a solar array be built at the site. Texas also has an extensive network of transmission lines in the eastern half of the state.

Green River, Utah[10]

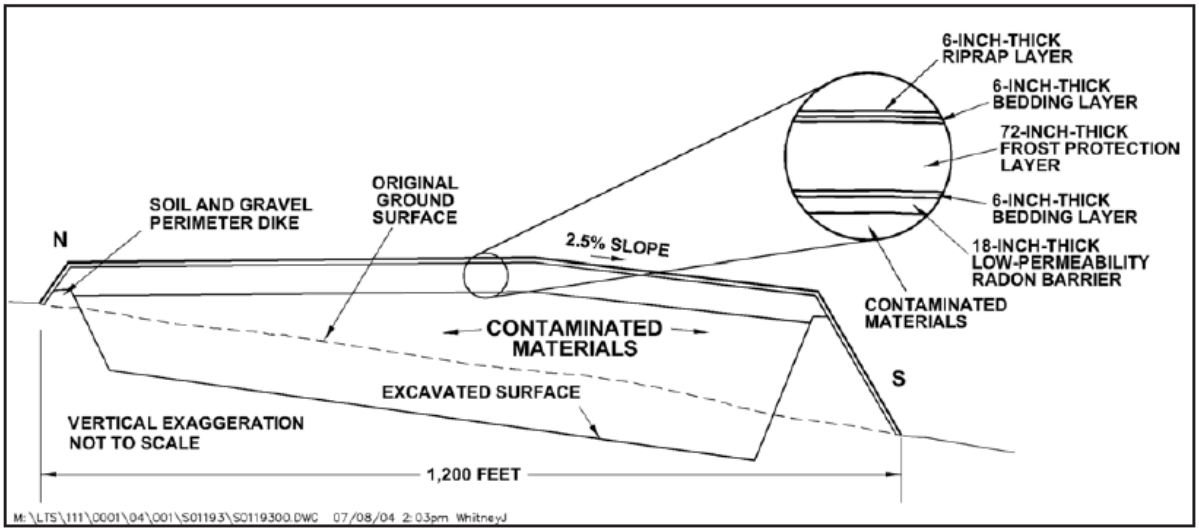


Northeast-Southwest Cross-Section of the Green River Disposal Cell

[10] Green River Fact Sheet - DOE

The site is only 21.5 acres with the disposal cell accounting for a mere 6 acres. This small size creates extremely limited options and could make the financial payback of a solar array system economically prohibitive. With only one major transmission line crossing the eastern half of Utah, the options for connecting a potential solar array to the power grid are scarce.

Gunnison, Colorado[11]

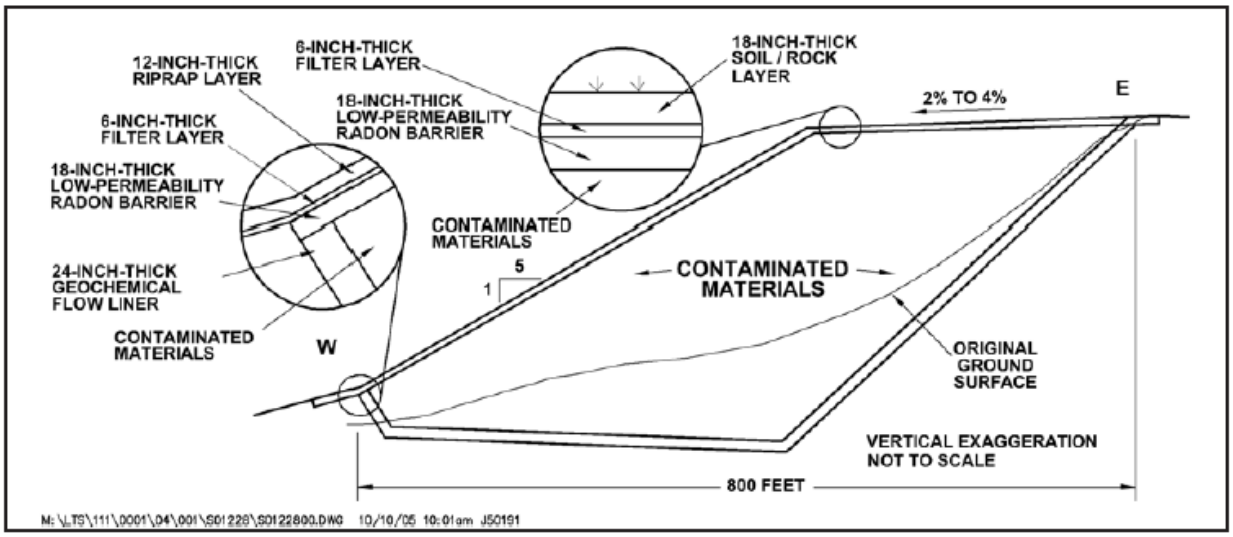


North-South Cross Section of Gunnison Disposal Cell

Located in southwestern Colorado, the Gunnison site is ideal for solar energy generation. Completed by DOE in 1995, the disposal cell is 29 acres of the 115 acre site. The size of this site and the contents of the disposal cell are very comparable to that of Durango's Bodo Canyon site. The areas groundwater was initially contaminated by the uranium ore but it is thought that with time the level of contamination will continue to decline naturally within the 100 year allowable time frame. The surface slope of the site is also conducive for a southern facing solar array.

Lakeview, Oregon[12]

[11] Gunnison Fact Sheet - DOE
[12] Lakeview Fact Sheet - DOE



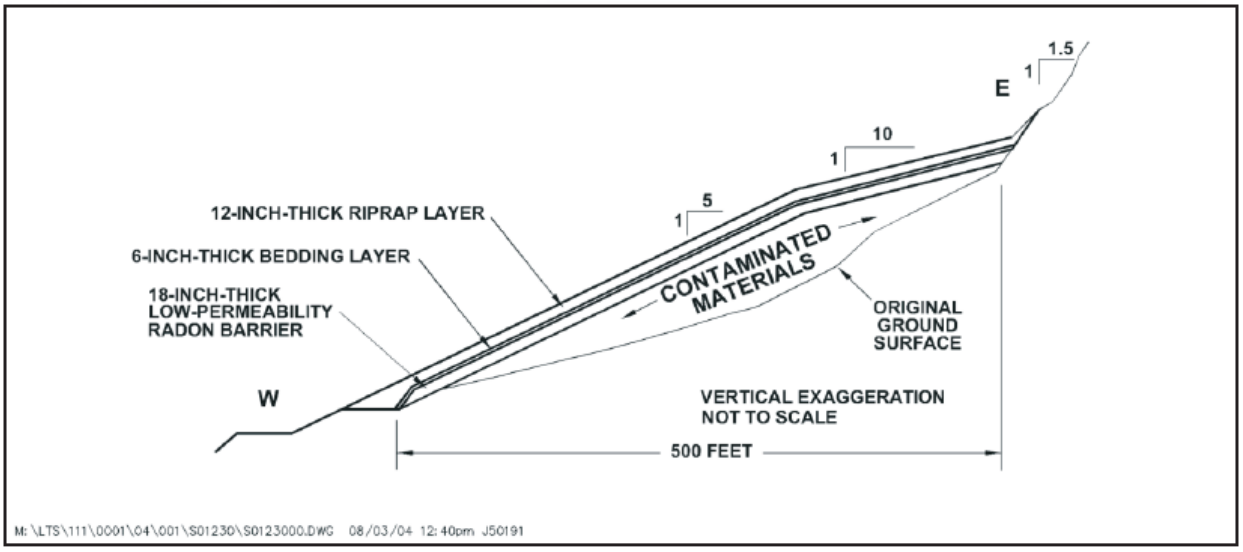
West-East Cross Section of the Lakeview Disposal Cell

This site is along the southern border just 16 miles north of California and in the middle of the state. This location is near to an existing 700-799 kV transmission line. There is an aquifer on the site that contains hydraulically connected sediments that are partly separated by claylike sediments. Groundwater crosses the western edge of the site as it flows from the northeast to the southwest. Geothermal activity is also prevalent onsite. Several raffinate ponds occupied 69 acres of the total 258 acre parcel. The tailings pile occupied 30 acres and in the late 1980's was removed from the site and transferred to a disposal cell 7 miles northwest of the town of Lakeview. According to the DOE fact sheet, "elevated concentrations of manganese and sulfate in ground water beneath and just downgradient of the site are probably at least partially attributable to uranium-milling operations." Because of these concerns DOE continues to monitor the groundwater contaminants and water from the area is classified as limited use as human treatment methods cannot adequately guarantee drinking quality standards. Extra precautions have been taken to extend the western boundary of the site and to require hookups to a domestic water supply and greater minimum depths for wells. The Oregon Water Resources Department requires that all new wells be at least 250 feet below ground surface. All of these requirements are an effort to secure human and environmental health.

The disposal cell site is located in an area known as Collins Ranch. It is sparsely populated and primarily used for grazing. It is at the northern end of a flat mountain

valley and is at an elevation of 4,950 feet. Groundwater in the area is just 100 feet below the surface. Of the site's 40 acres, the disposal cell is 16 acres and is surrounded by a wire fence. Excavation was used to lower the original level of the soil so more contaminants could fit at the site which is lined with low-permeability, clay soil. The top of the cell was sloped to encourage runoff and is also vegetated with native grass species. The site grade is 20 percent to the north and west. This is not ideal for solar arrays since incoming solar energy is best captured by southern exposures.

Lowman, Idaho[13]



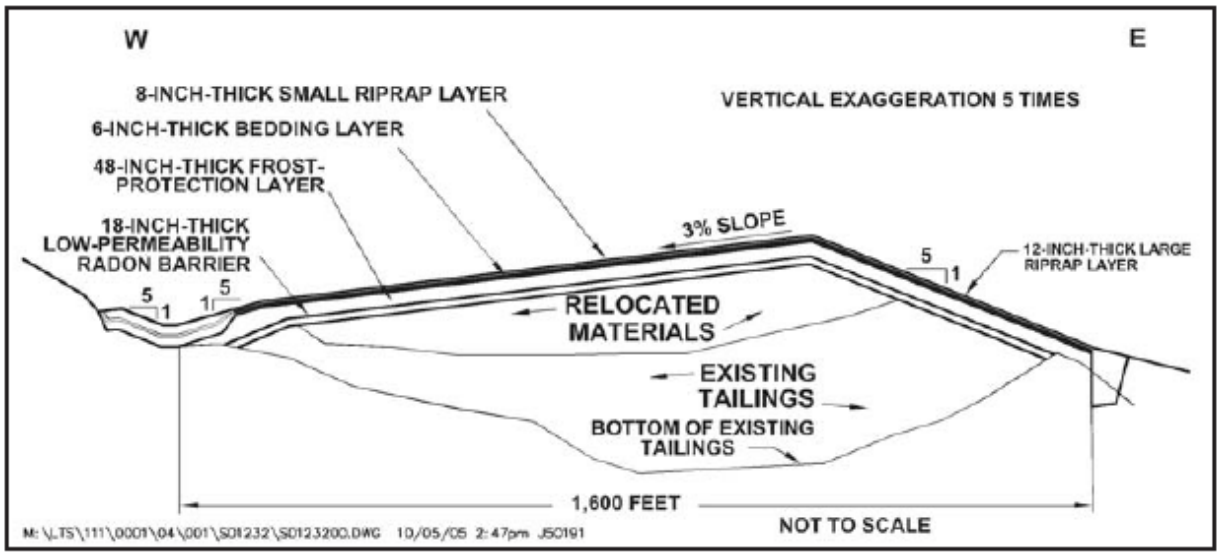
West-East Cross Section of Lowman Disposal Cell

Bordered on the south by State Highway 21, the site is mountainous and the surrounding area is used for recreation, grazing, logging and mining. The disposal cell was completed in 1992 and groundwater in the area is between 27 and 78 feet below the surface. To date there has been no contamination of ground water from the contaminants store in the disposal cell. The Lowman site is unique to UMTRCA sites because the milling was completely mechanical instead of chemical so no harmful toxins related to the process were produced. This has meant that there was no contamination of the groundwater or surrounding soil. The bottom of the cell is the original sandy soil layer. Vegetation, including ponderosa pines, has grown around and even onto the cell and are helping to slow the movement of water in the cell cover and actually helping to reduce infiltration.

[13] Lowman Fact Sheet - DOE

The proximity of the site to Boise, Idaho also means that it would be relatively close to an existing transmission line and also to energy consumers.

Maybell, Colorado[14]

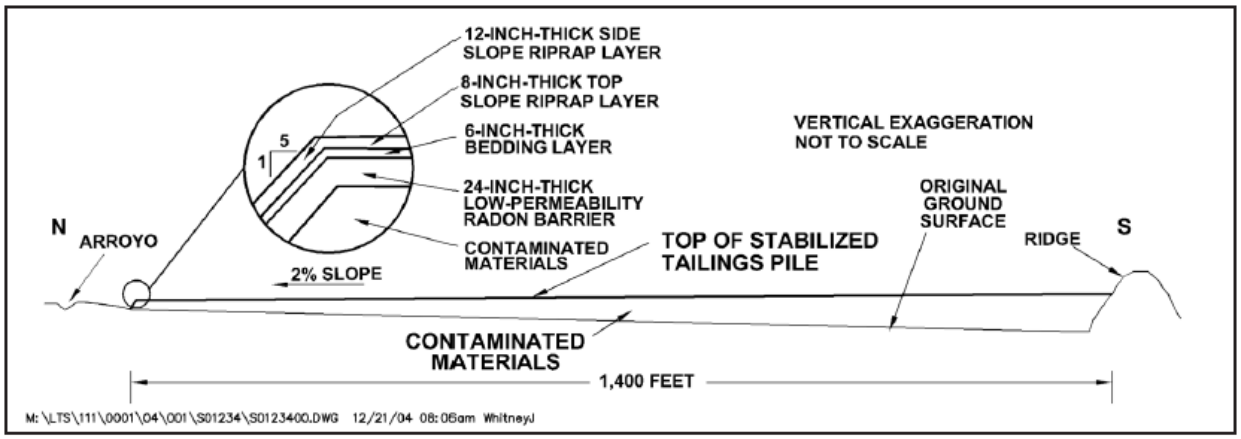


West-East Cross Section of the Maybell Disposal Cell

The northwest corner of Colorado is transected by three major transmission lines helping to increase the purchasing options for any energy generated at the site as part of beneficial reuse for DOE. Monitoring of ground wells was discontinued in 2006 after measurement taken yearly from 2000-2004 showed no interaction between disposal cell leachate and local ground water. Unfortunately, the 66 acre disposal cell on the 250 acre site is located in a small valley which would decrease the daily sun exposure to reach a potential solar array. Abandoned uranium mines are prevalent in the area and have resulted in elevated levels of arsenic, cadmium, lead, molybdenum, selenium, and uranium in the areas ground water. This could complicate monitoring of future Maybell disposal cell disturbance and leachate should any construction activities take place on the site.

Mexican Hat, Utah[15]

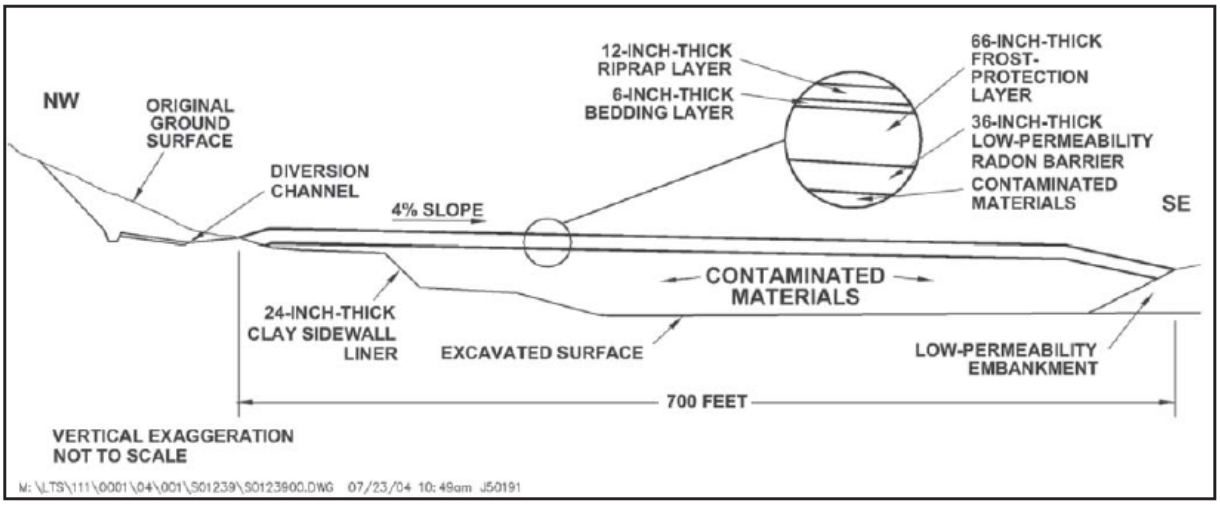
[14] Maybell Fact Sheet - DOE
[15] Mexican Hat Fact Sheet - DOE



North-South Cross Section of the Mexican Hat Disposal Cell

Located on the Navajo Nation Reservation in the southeastern corner of Utah, the Mexican Hat disposal cell is on the site of a former uranium-ore processing mill that operated in 1950's and 1960's. A sulfuric acid manufacturing plant continued operations at the site until 1970. Remedial surface actions were completed by DOE in 1995. The San Juan River lies 1 mile to the north and receives surface drainage from the site and surrounding lands creating the need to closely monitor contaminated leachate. Of the 119 acre site, the disposal cell occupies 68 acres. The site is nearly flat and does have a minor downward slope toward the north and east which decreases the suitability for a solar array system.

Naturita, Colorado[16]

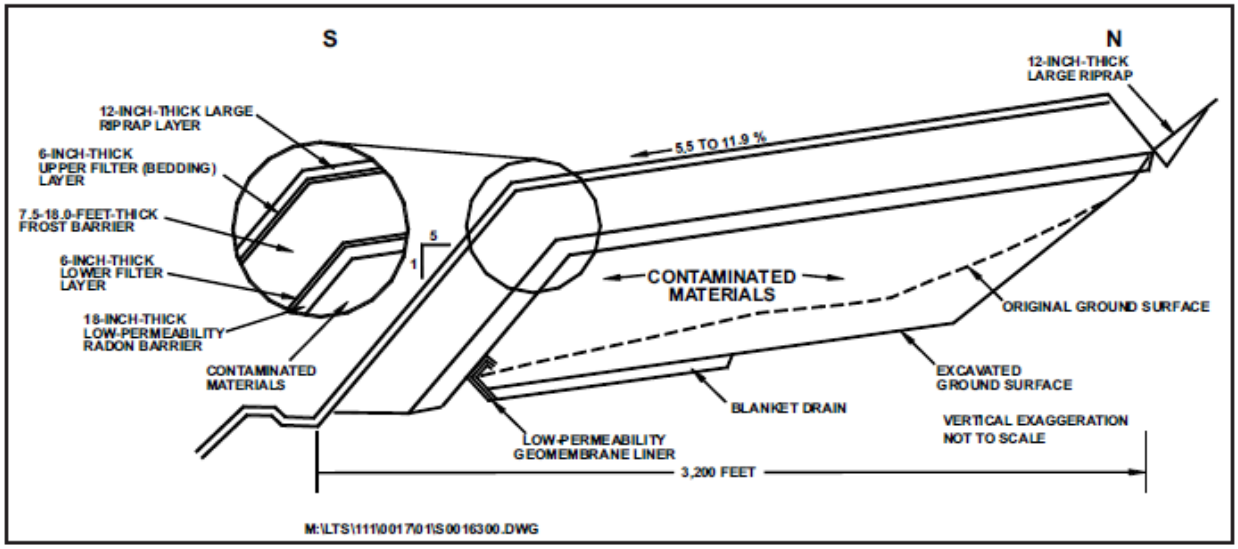


Northwest-Southeast Cross Section of the Naturita Disposal Cell

[16] Naturita Fact Sheet - DOE

This site, like Durango's Bodo Canyon, is located in the southwestern corner of the state and is therefore in an excellent location to for capturing of incoming solar energy. The 79 acre processing site is constrained by the San Miguel River on the east and State Highway 141 and high-voltage power poles on the west. Both Uranium and Vanadium ores were processed at the site at some point during its operations in the 1930's to late 1950's. The disposal cell is 15 miles northeast and was owned by Umetco Minerals Corporation until DOE assumed responsibility in 1997. The disposal cell has a 4 percent slope from the NW to the SE and is relatively small, comprising just 10 acres of the 27 acre site. The location of the site so near the western border of Colorado means that the nearest major transmission line may actually be across the border in eastern Utah. Depending on different energy policies in the two states the purchasing agreements of for generated power could be complicated.

Rifle, Colorado[17]



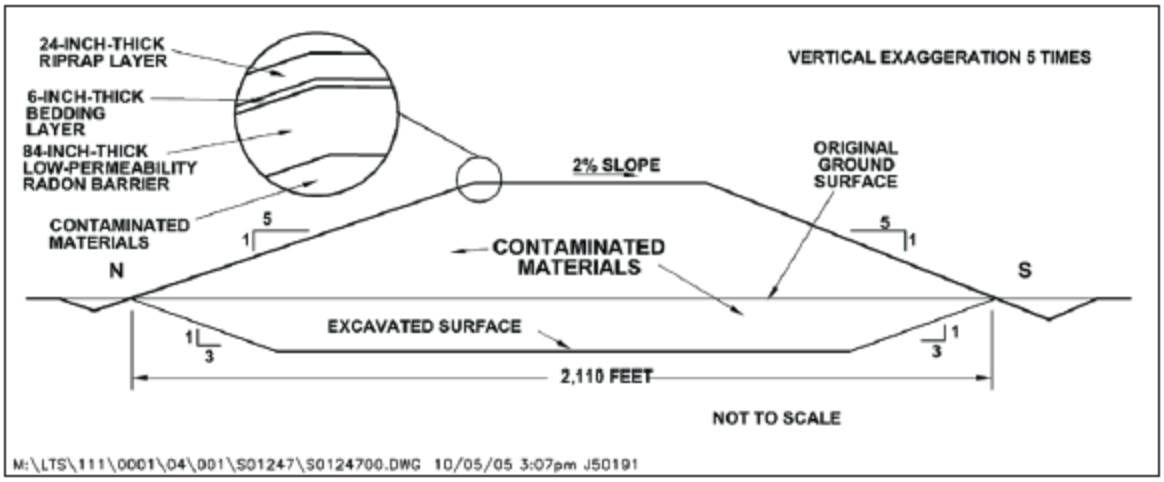
South-North Cross Section of Rifle Disposal Cell

In 1991 the 205 acre Estes Gulch site, which contains tailing from both Old Rifle and New Rifle processing sites, was transferred from the U.S. Bureau of Land Management to DOE. The southern facing and moderately sloped 71 acre disposal cell surface is ideal for collecting solar energy with a photovoltaic array. The disposal cell sits atop the

[17] Rifle Fact Sheet - DOE

Wasatch Formation, a poor-yielding and poor-quality aquitard and its stored groundwater is unlikely to be consumed. There is also a leachate collection system at the toe of the cell which will be decommissioned once all the seepage has halted. If an installed solar system were to unsettle contaminants this collection system could easily contain and deal with small increases in leachate.

Salt Lake City, Utah[18]

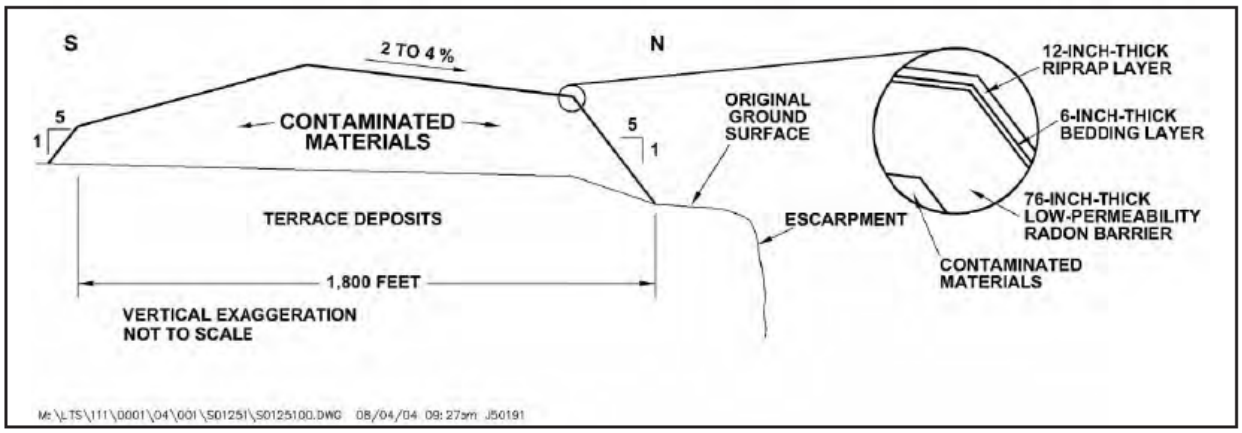


North-South Cross Section of the Salt Lake City Disposal Cell

Although only 81 miles West of Salt Lake City, the Salt Lake City disposal site is 15 miles away from the nearest residents providing an ideally isolated location but still within a manageable distance to transmission lines and energy consumers. Groundwater monitoring is not a requirement at the site because the tailings are stabilized and are not impacting any potentially useful aquifer. Vegetation in the semiarid location is sparse so any site construction could have a minimal impact on the surrounding environment. The disposal cell is 54 acres of the 99 acre site, similar to the proportions at Bodo Canyon.

Shiprock, New Mexico[19]

[18] Salt Lake City Fact Sheet - DOE
[19] Shiprock Fact Sheet - DOE

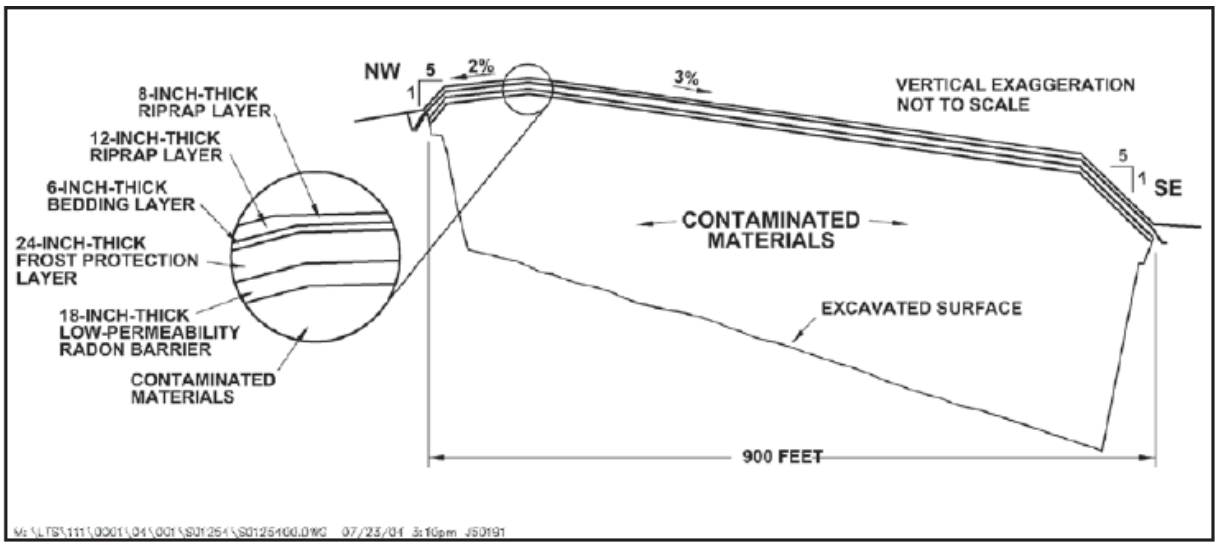


South-North Cross Section of the Shiprock Disposal Cell

In 1983 DOE and the Navajo Nation partnered in an effort to begin clean up at the 230 acre site that produced Uranium and Vanadium from 1954 to 1968. Of the 105 acre site, the 77 acre disposal cell comprised of the consolidated contaminants was built on top of the former tailing piles and completed in 1986. Groundwater and contaminated leachate have the potential for coming into contact both in the Bob Lee Wash and the San Juan River, which runs to the east of the disposal cell. The collected water discharging from the site is stored in an evaporation pond to the south of the disposal cell. Rates of discharge have been nearly one half of what was predicted (4 gpm versus 7.5 gpm). Monitoring contaminant levels is complicated by the natural geologic strata where the prevalence of Mancos Shale is a contributor of selenium, sulfate, and uranium. The proximity of the site to residential and commercial development is both positive and negative. It is useful to have energy consumers so close by to mitigate wheeling costs, but there may be complaints from residents who can see the site and do not like the aesthetics of a solar array.

Slick Rock, Colorado[20]

[20] Slick Rock Fact Sheet - DOE

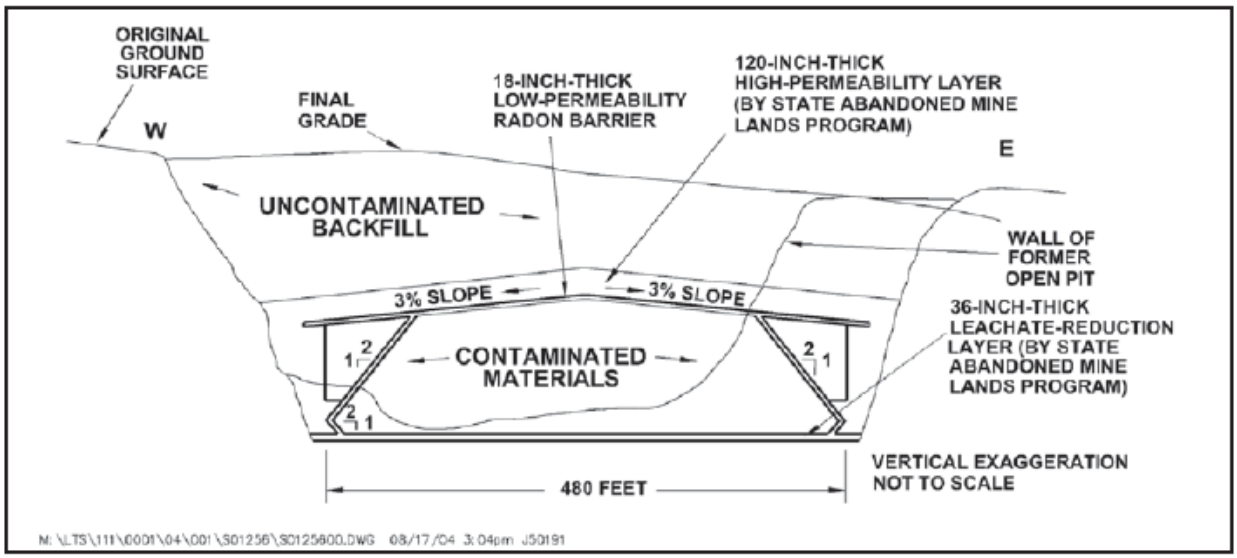


Northwest-Southeast Cross Section of the Slick Rock Disposal Cell

Located adjacent to the Dolores River in southwest Colorado, the 12 acre Slick Rock disposal cell is part of the 62 acre site and is composed of tailing from two former uranium- and vanadium-ore processing facilities. Both of these facilities were located above geologic formations that inhibited downward migration of water. Excavation of 7-20 feet was necessary to construct the disposal cell in an effort to place the contaminated materials beneath the permeable Dakota Sandstone layer. The disposal cell is mostly southern sloping, but the proximity to the Dolores river and concerns about contaminants in from the two tailings piles a recommended use for this site would require more comprehensive site testing.

Spook, Wyoming[21]

[21] Spook Fact Sheet - DOE

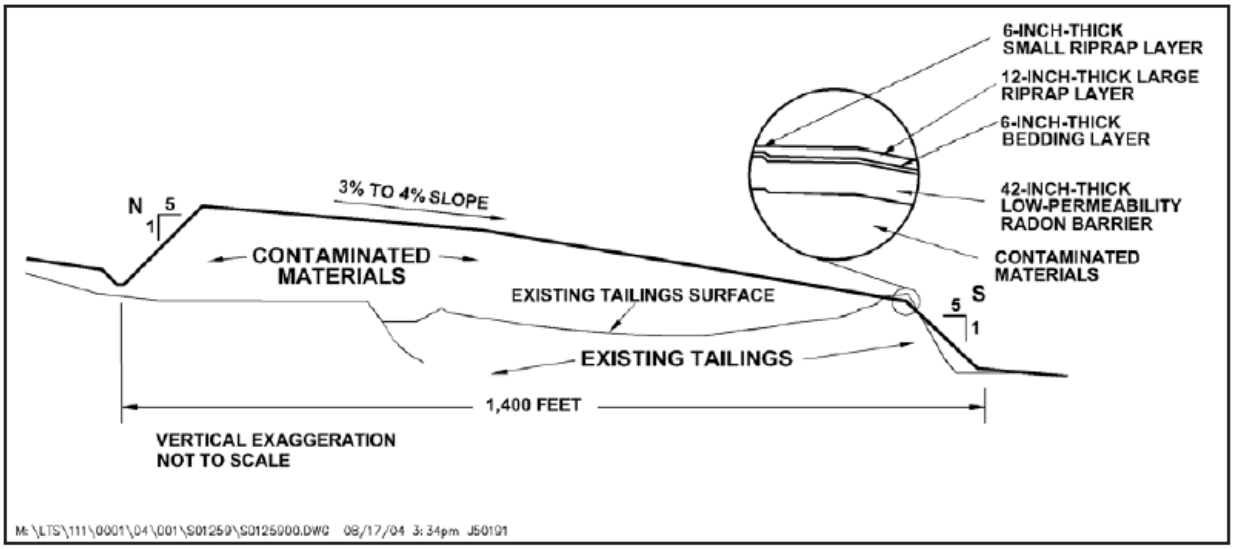


West-East Cross Section of the Spook Disposal Cell

This disposal cell is unique for DOE LM UMTRCA sites because it is the only cell that is completely buried. The above diagram illustrates how the contaminated materials are beneath a significant layer of uncontaminated backfill. There are two aquifers at the site. While the upper aquifer has been contaminated naturally and by the milling activities it has poor yields and is therefore an unlikely potential drinking water source. The lower aquifer is completely separate, has shown no indication of contamination, and several wells tap into the groundwater for human consumption. Large transmission power lines do not currently exist in this part of Wyoming although American Electric Power does have plans to build five 765 kV transmission lines for wind energy that would all intersect approximately at Spook, WY potentially making tie-in available.[22] Compared to sites in the southwestern U.S. where solar energy is about 6 kWh/m^2/day, incoming solar energy in Wyoming is about 5 kWh/m^2/day.

Tuba City, Arizona[23]

[22] http://www.npr.org/templates/story/story.php?storyId=110997398
[23] Tuba City Fact Sheet - DOE



North-South Cross Section of the Tuba City Disposal Cell

The site is in north-central Arizona and is located on Navajo Nation lands. Clean-up was completed in 1990, when DOE consolidated contaminated materials from 33.5 acres of evaporation ponds and 250 acres that had been impacted by wind-blown wastes. Although the areas surround the site are used for light grazing and irrigation the area groundwater is not use for human consumption, farming or manufacturing purposes. No contamination seepage has been found to affect the nearby Moenkopi wash which the Navajo draw from for irrigation and water storage. The disposal cell is 50 acres of a 145 acre site and its location in the state is near two large transmission lines. Recent articles indicate that Navajo are becoming increasingly interested in adding solar energy to their energy investment portfolio and may therefore support for working with DOE to install a solar array at the site will likely be growing in the future .[24]

IV. Primary Stakeholders

Bodo Canyon stakeholders can be qualified into four main components: decision makers, impacted parties, interested parties. The stakeholders represent business, science, education, national security, public health and environmental interests. Some stakeholders have legislated authority and responsibility to determine the future of the site, while others capitalize on public influence to be recognized. Balancing the interests of so many stakeholders when planning future operations at Bodo Canyon will not be a simple task. It is

[24] http://www.durangoherald.com/article/20120402/NEWS01/704029947/Hope-for-a-bright-future

critical to examine and reconcile all stakeholder perspective regardless of their economic or political influence to determine the best future use for the Bodo Canyon disposal cell site.

V. Path Forward

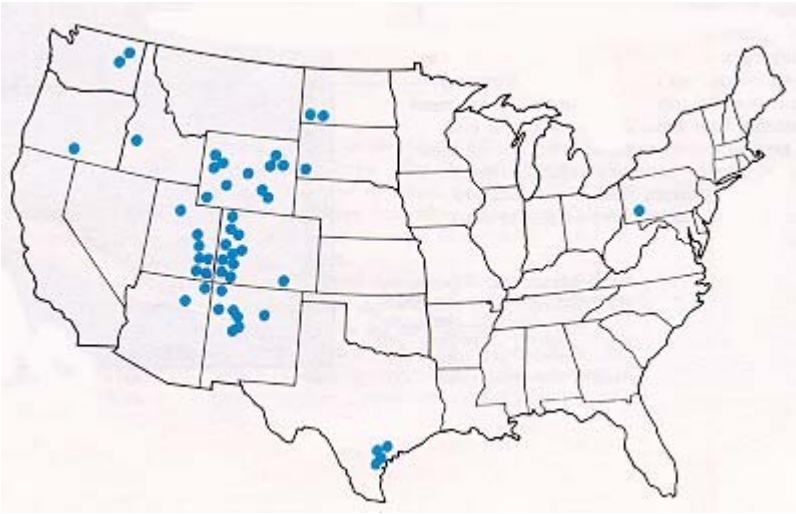


Figure 8: Uranium Mill Tailings Piles

Similar federal programs- EPA

The U.S. Environmental Protection Agency's RE-Powering America's Land initiative promotes the siting of renewable energy at potentially contaminated sites and landfills. Brownfields and Superfund sites often already have some available infrastructure which makes the sites more appealing for developers. Investing in renewable projects at previously abandoned and contaminated sites has many benefits. The development provides economic stimulus to the community and the potential for job creation. Revitalized communities that are healthier economically as well as improved environmental conditions from a greater reliance on renewables are an ultimate goal.

> "The EPA is teaming with its colleagues at the U.S. Department of Energy's National Renewable Energy Laboratory in the project, which is called "Re-Powering America's Land" or RE-PAL. In addition to its potential to benefit landowners and renewable energy developers, the project has also been touted as a way to generate jobs in the down economy and to fix blighted properties located in depressed communities. The EPA also notes that many of these sites are

already connected to readily-useable transmission lines — yet another hurdle renewable power generators often face." [25]

VI. Comparable Renewable Energy Projects

Finding comparable sites to Bodo Canyon is challenging. Each site has unique sitting considerations, how the generated energy will be consumed, and how the projects are funded. That being said, looking at several case studies and identifying specific aspects with similarities to Bodo Canyon could be useful in making recommendations for development of the site moving forward.

Fort Carson, Colorado:[26]

Although this former landfill site is on a US Army base where the energy generated goes directly to powering homes on the property the 2 MW solar array and the Colorado location provide a useful comparison for Bodo Canyon.

The site was developed in 2007 and cost $13 million. The solid wastes in the landfill were first caped by two feet of soil, the site was graded to improve drainage, and native vegetation was establishing. Of the 15-acre site, 12-acres comprise the ground-mounted photovoltaic system. The array will generate 3,200 megawatt-hours (MWh) of power annually. It is predicted that the flat-plate, thin-film solar technology used on the site will effectively generate energy for 40 years.

According to the EPA's fact sheet, "through a power purchase agreement with Fort Carson, Colorado Springs Utilities builds and maintains the solar PV facility and provides the Fort with lower-cost electricity in return for leasing the site." There were seven public and private parties involved in the development at the site. DOE wrote contracts to allow the Army to purchase power at a low fixed cost for 20 years. The project was financed, designed, and installed by three private companies. The local power provider has the responsibility for maintaining and

[25] http://environmentallawblog.greenbergglusker.com/2010/02/whither_superfund_brownfield_s.html
[26] Fort Carson Fact Sheet - EPA

monitoring the PV system. This is an excellent example of how the Bodo Canyon site will require coordination and team-work between DOE, LPEA or an alternate energy buyer, and the developer for the site.

A major recommendation is increased flexibility in the leasing options will contribute greatly to the economic forecast for an installation at Bodo Canyon. Using Fort Carson as a baseline, the 20-year least plus 5 year option suggested at Bodo Canyon is 15 years too short to accommodate the 40 year expected lifetime of the current standard solar panel technology. Another concern to note is the generation and value of Renewable Energy Credits (RECs). At Fort Carson, one of the developers sells the RECs to Denver's utility company which then uses the RECs to meet the state's renewable energy portfolio standards (RPS) which require 10% of a utilities electricity to come from renewable sources by 2015, and 20% by 2020. The difference at Bodo Canyon is that LPEA has already met its 5% limit for locally generate energy, set by its overarching utility TriState. This means that LPEA has little interest or monetary incentive to acquire RECs from the proposed solar array at Bodo Canyon.

Steel Winds, Lackawanna, NY: [27]

This site generates renewable energy from wind turbines rather than solar panels but is a successful project with notable comparisons to Durango. The 30-acre heavy metal and mine acid drainage contaminated superfund site sat abandoned for several decades before it was repurposed as a local clean energy generation site. A main goal of the project was to help spur economic growth in a town that had suffered greatly when the steel mill that had operated on the site for 80 years closed and local unemployment rates climbed.

Environmental concerns were taken into account when constructing the wind turbines. Disturbance of the contaminated soil was avoided by constructing windmill foundations, service roads, and green spaces as a cover without needing to excavate the site.

[27] Steel Winds Fact Sheet – EPA : http://www.epa.gov/oswercpa/docs/success_steelwinds_ny.pdf

Similar to Bodo Canyon, the site was ideal for renewable energy because transmission lines and roads already existed on the property. In teaming with local utilities, the Lackawanna site is able to generate enough energy to 9,000 local homes.

The chosen turbines were manufactured in Iowa thereby increasing the positive economic benefits to other areas in the United States rather than buying equipment from foreign companies. The specific turbines were the most efficient available and were also considered to be easy to repair. Forty construction jobs were temporarily created within two local construction companies that were selected for the installation of the turbines. An additional 5 permanent jobs have been created at the site. The initial funding to study the potential of the site was provided by EPA late in the spring of 2002. Construction of the eight turbines was complete in the early summer of 2007, thus making the complete project timeline about five years. It is eventually planned that ten more turbines will be added to the site, bringing the total energy generation up to 45 MW.

There are several takeaways from the Lackawanna site. REC's generated from the site are valuable and are being sold to Constellation NewEnergy in order to meet the renewable portfolio standards requirements for the State of New York. The city has also been flexible about tax incentives. BQ Energy has promised to pay $100,000 a year for the next 15 years in lieu of property taxes. Finally, the funding for construction involved cooperation between private investors, the electric utility, local government, and the EPA. This extensive partnership is a commonality among reuse sites because so many stakeholders are involved and the support of several parties is required to make such a unique project successful.

Ship Rock, Colorado:

VII. Political Feasibility

Durango is located in the Southwestern corner of Colorado and is the county seat for La Plata County. [28] The city is a typical democratic core surrounded by more conservative rural areas. The town is also home to Fort Lewis College so the town has a youthful relaxed feel. Local businesses are known for their environmental concern with a prevalent Green Business Roundtable sponsored by the San Juan Citizens Alliance that hosts monthly lunch meetings. While the downtown area is predominantly liberal, the outlying areas are home to rural ranchers who are more typically conservative.

The town's mayor is a sitting member of the five-person city council and is appointed by the other members for a one year term beginning in April of each year. The current Mayor is Doug Lyon. [29] While the mayor presides at every meeting, he or she has no veto power or regular administrative duties.

According to the Sustainability page of Durango's official website, "The City of Durango is committed to improving public health and reducing the impact of its operations on our community and the environment."[30] It has several areas of improvement such as energy and water efficiency, eliminating wastes and pollutants, and sustainable developments.

In visiting Durango, interviewing local leaders and attending the March Green Business Roundtable about localizing energy it became apparent that there are some significant political tensions that may influence the developement of a solar array at the Bodo Canyon site. [31] There is clear disagreement regarding the expansion of local renewable energy among the board members of the local utility LPEA.

The LPEA board of directors has 12 seats, three for each of the four districts. The current board members are:

[28] http://www.durangogov.org/discover/aboutgovt.cfm
[29] http://www.durangogov.org/council/councilor4.cfm
[30] http://www.durangogov.org/environmental.cfm
[31] http://www.sanjuancitizens.org/green-business/greenbusiness.shtml

Jerry L. McCaw (President- district 2), **Thomas L. (Tom) Compton, (Vice President- district 2), Jeffrey A. Berman (district 3), Harry Goff (district 3), Robert A. (Bobby) Lieb, Jr.(district 3), Herbert C. (Herb) Brodsky (district 4), Pam Patton (district 4), Joe Wheeling (treasurer, district 4), Bob Formwalt (district 1), Ken Fox (district 1), Lindon Stewart (district 1), and Davin Montoya (district 2).**

This cycle "incumbent directors are Bob Formwalt (District 1 - Archuleta County), Jerry McCaw (District 2 - south and west La Plata County), Bobby Lieb (District 3 - City of Durango) and Herb Brodsky (District 4 - north and east La Plata County). " Each year one seat in each district is up for election. The current election cycle has already begun with election packets becoming available on March 5, 2012. [32] Persons interested in running for a seat must complete their petition and submit it to either of LPEA's offices by 1pm on March 28th, 2012. Four interested persons have joined together to run for each of the four seats up for election in an effort to have a more significant impact as board members. Under the premise of "renewable energy candidates are Kirsten Skeehan for District 1, Archuleta County; Bruce Baizel for District 2, western La Plata County; Britt Bassset for District 3, City of Durango; and Heather Erb, for District 4, northern La Plata County. "As per LPEA bylaws, candidates for the board of directors are required to be permanent residents of the district they seek to represent, and be members-in-good-standing of the cooperative throughout their term in office. Completed election petitions must contain 15 or more signatures from co-op members in a candidate's district." "Ballots will be mailed to the membership on Friday, April 20th and must be returned by May 11th so that results, tallied by an independent third party, can be announced at LPEA's Annual Meeting set for Saturday, May 12, 2012, at Sky Ute Resort and Casino, Ignacio."

Jeff Berman, a current board member not facing re-election this cycle, published a letter to the editor opinion piece title "Blowing Smoke" in the Durango Herald on April 7th. He states "It is thus with reluctance I begin publicly describing how I am witnessing

[32] http://www.durangodowntown.com/news/la-plata-electric-board-candidate-election-packets-available-march-5

LPEA greenwash its environmental record."[33] He has also started a personal blog, jbonlpea.blogspot.com, where he reveals issues he sees as problematic for the current LPEA board regarding renewable energy. He plans to "demonstrate how LPEA's rate policies undermine the conservation and renewables policies it professes to support, how LPEA generated a windfall through Colorado's renewable-energy law and used it in a way that actually undermines conservation and renewables, describe LPEA's prerogative to address climate change and its locally expanding impacts." These contentious disagreements have increased recently. According to Berman, "especially in the last year, many of LPEA's policy decisions have moved farther and farther out of line with the environmental and related fiscal concerns of its membership. In sum, LPEA is woefully short on substantive pro-conservation and renewable-energy policy, yet nonetheless, long on the marketing of it."

A citizen of Colorado since 1966, Marilyn Nagler responded in support of Mr. Berman and expressed concern about the deterioration of local air quality.[34] Local residents are not the only people who have noticed declining air quality as a result of nearby coal-fired plants.

At Mesa Verde National Park decreased visibility has been noted. The National Parks Service has a separate webpage addressing air quality in the park. "Most people who visit national parks expect clean air and clear views. However, Mesa Verde National Park (NP), Colorado, well known for its archeological remains of the Anasazi, lies downwind of polluted air from coal-fired power plants in the Four Corners region, nearby mining, and urban and industrial pollutants from the Southwest U.S., California, and Mexico. Pollutants emitted from these sources can harm the park's natural and scenic resources such as vegetation, surface waters, and visibility."[35]

[33] http://durangoherald.com/article/20120408/OPINION02/704089964/0/SEARCH/Blowing-smoke#
[34] http://durangoherald.com/article/20120416/OPINION03/704169938/-1/opinion03
[35] http://www.nature.nps.gov/air/permits/aris/meve/index.cfm

Another letter to the editor written April 19th encourages Durango voters to "elect new leaders to the LPEA board."[36] The article emphasizes that LPEA has been raising base rates, an action which does not encourage energy conservation. Just one day prior, another article referenced the four-candidate block running on the basis of renewable energy. Julie Ward believes the energy future of Durando is riding on the LPEA board election; "There is no comparison between these four great candidates and their incumbent opponents when it comes to renewable-energy knowledge and experience."[37]

More evidence of growing political tensions in Durango is the recent controversy regarding the renewal of a 20-year franchise fee agreement with LPEA which, if passed, would have continued adding $900,000 a year to the city budget. [38] Voters did not pass the franchise extension and the implications of the smaller city budget will become more apparent over the next fiscal year.

These political tensions must be considered if the proposed solar project at Bodo Canyon is to be a success. Without more support from LPEA board members is seems unlikely that rates or REC's for local renewable energy will change anytime soon. After the ballots are tallied on May 12th and the winners announced it will be easier to predict whether or not LPEA board meetings will include discussions about renewables in the future.

VIII Consistent Support for Solar Energy

Sustainable Energy: [39]

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[36] http://durangoherald.com/article/20120420/OPINION03/704209943/-1/opinion03

[37] http://durangoherald.com/article/20120419/OPINION03/704199977/-1/opinion03

[38] http://durangoherald.com/article/20120418/OPINION03/704189926/-1/opinion03

[39] http://www.seia.org/cs/news_detail?pressrelease.id=1710

A November, 2011 poll conducted by Kelton Research in conjunction with the Solar Energy Industries Association (SEIA) found that for the fourth consecutive year 9 out of 10 Americans support solar energy. Regardless of political affiliation, the vast majority of all American's support the advancement and utilization of solar energy.

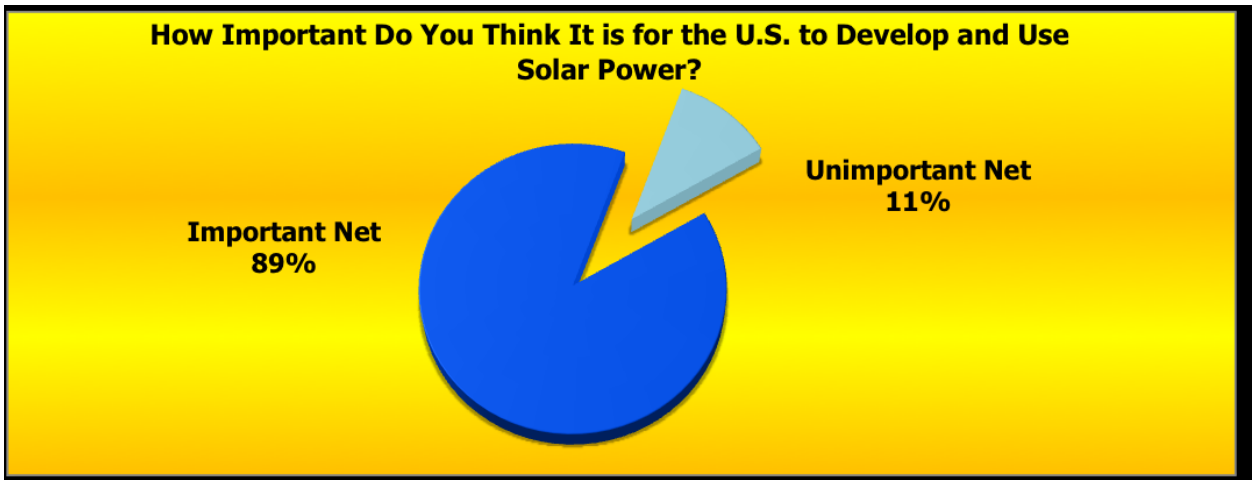

Figure 9: Importance of Developing & Using Solar Power[40]

Solar As a Top Energy Pick:

Some political disparity is evident when survey respondents were asked if they would give monetary support to solar energy if they were in charge of the United States' energy plan. 43% of Democrats compared to just 26% of Republicans support the government giving money to solar, although those numbers are both higher than support for more traditional methods like natural gas, nuclear, or coal.

[40] http://www.seia.org/galleries/pdf/SCHOTT_Solar_Barometer_2011.pdf

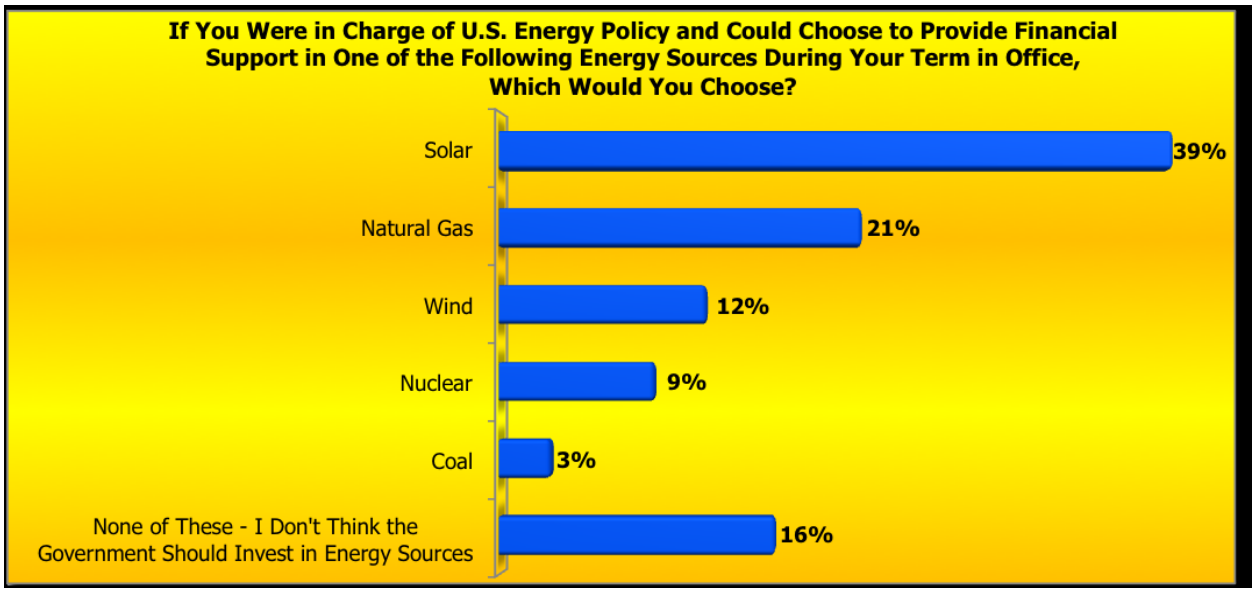

Figure 10: Policy Changes[41]

Solar Energy as a Marketing Tool:

There is evidence that green energy can affect consumer purchasing behaviors. A majority of Americans (51%) would be more likely to buy a product if they knew it was made using solar energy. Only a small fraction (7%) would be less likely to purchase a product produced with renewable solar energy.

[41] http://www.seia.org/galleries/pdf/SCHOTT_Solar_Barometer_2011.pdf

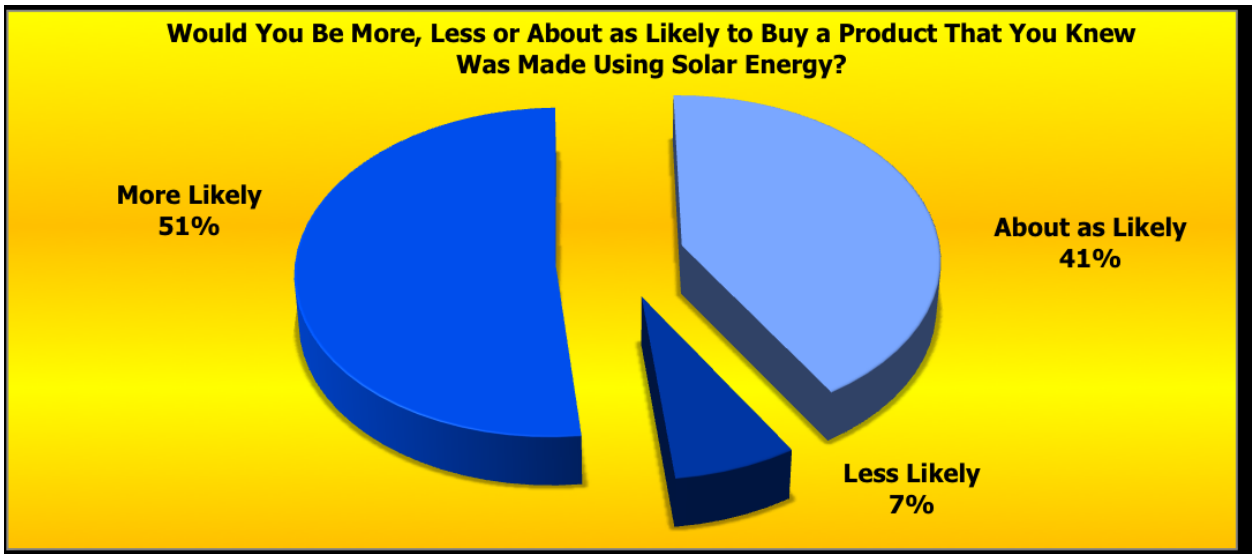

Figure 11: Effect on Consumption of Products [42]

The SEIA also recognized that the results of the polling have uncovered some important issues to consider. Of those surveyed who had concerns cost was the most important issue (55%), with reliability a distant second (29%), and uncertainty of benefits (11%) and aesthetics (4%) being minor concerns.

IX. Concluding Recommendations:

Lease flexibility:
Start date.
Length of lease.

Liability concerns:
Although the disposal cell at Bodo Canyon is stable with no monitored wells indicating any notable leakages of uranium, developers and local citizens have concerns about the risks of building on the site. Potential solar installers would have more incentive to place bids for the project if they were given liability protection should contamination unrelated to the solar panels occur in the future. According to The Revitalization of Contaminated Sites published by the EPA "historically, under the liability schemes found in both Superfund and RCRA, developers faced enforcement and liability concerns if they purchased or operated contaminated land for redevelopment. To some extent, these concerns were addressed, at least for Superfund sites, by the 2002 Brownfields Amendments. ER3 was designed to provide extra relief as an enforcement incentive not only to develop, but to

[42] http://www.seia.org/galleries/pdf/SCHOTT_Solar_Barometer_2011.pdf

develop in a sustainable manner. [43]" ER3 could be used as a model for DOE reuse sites. It encourages sustainable development of reuse sites while lessening liabilities for businesses. It also helped to create a network of specialists to help with expertise in sustainability and to improve education and outreach.

Economics & RECs

State Support: [44]

"(a) Local communities can benefit from the further development of renewable energy, energy efficiency, conservation, and environmental improvement projects, and the general assembly hereby encourages electric utilities to establish community energy funds for the development of such projects;
(b) IT IS IN THE PUBLIC INTEREST THAT BROADER PARTICIPATION IN SOLAR ELECTRIC GENERATION BY COLORADO RESIDENTS AND COMMERCIAL ENTITIES BE ENCOURAGED BY THE DEVELOPMENT AND DEPLOYMENT OF DISTRIBUTED SOLAR ELECTRIC GENERATING FACILITIES KNOWN AS COMMUNITY SOLAR GARDENS, IN ORDER TO:
(I) PROVIDE COLORADO RESIDENTS AND COMMERCIAL ENTITIES WITH THE OPPORTUNITY TO PARTICIPATE IN SOLAR GENERATION IN ADDITION TO THE OPPORTUNITIES AVAILABLE FOR ROOFTOP SOLAR GENERATION ON HOMES AND BUSINESSES;
(II) ALLOW RENTERS, LOW-INCOME UTILITY CUSTOMERS, AND AGRICULTURAL PRODUCERS TO OWN INTERESTS IN SOLAR GENERATION FACILITIES;
(III) ALLOW INTERESTS IN SOLAR GENERATION FACILITIES TO BE PORTABLE AND TRANSFERRABLE; AND
(IV) LEVERAGE COLORADO'S SOLAR GENERATING CAPACITY THROUGH ECONOMIES OF SCALE.

Definition: (I) (A) "COMMUNITY SOLAR GARDEN" MEANS A SOLAR ELECTRIC GENERATION FACILITY WITH A NAMEPLATE RATING OF TWO MEGAWATTS OR LESS THAT IS LOCATED IN OR NEAR A COMMUNITY SERVED BY A QUALIFYING RETAIL UTILITY WHERE THE BENEFICIAL USE OF THE ELECTRICITY

[43] www.tn.gov/environment/dor/toolbox/pdf/RevitalizingContaminatedSitesAddressingLiabilityConc.pdf

[44] http://www.colorado.gov/cs/Satellite?blobcol=urldata&blobheadername1=Content-Disposition&blobheadername2=Content-Type&blobheadervalue1=inline%3B+filename%3D%22Solar+Gardens.pdf%22&blobheadervalue2=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1251749683359&ssbinary=true

GENERATED BY THE FACILITY BELONGS TO THE SUBSCRIBERS TO THE COMMUNITY SOLAR GARDEN. THERE SHALL BE AT LEAST TEN SUBSCRIBERS. THE OWNER OF THE COMMUNITY SOLAR GARDEN MAY BE THE QUALIFYING RETAIL UTILITY OR ANY OTHER FOR-PROFIT OR NONPROFIT ENTITY OR ORGANIZATION, INCLUDING A SUBSCRIBER ORGANIZATION ORGANIZED UNDER THIS SECTION, THAT CONTRACTS TO SELL THE OUTPUT FROM THE COMMUNITY SOLAR GARDEN TO THE QUALIFYING RETAIL UTILITY. A COMMUNITY SOLAR GARDEN SHALL BE DEEMED TO BE "LOCATED ON THE SITE OF CUSTOMER FACILITIES".

(II) "SUBSCRIBER" MEANS A RETAIL CUSTOMER OF A QUALIFYING RETAIL UTILITY WHO OWNS A SUBSCRIPTION AND WHO HAS IDENTIFIED ONE OR MORE PHYSICAL LOCATIONS TO WHICH THE SUBSCRIPTION SHALL BE ATTRIBUTED. SUCH PHYSICAL LOCATIONS SHALL BE WITHIN EITHER THE SAME MUNICIPALITY OR THE SAME COUNTY AS THE COMMUNITY SOLAR GARDEN; EXCEPT THAT, IF THE SUBSCRIBER LIVES IN A COUNTY WITH A POPULATION OF LESS THAN TWENTY THOUSAND, ACCORDING TO THE MOST RECENT AVAILABLE CENSUS FIGURES, SUCH PHYSICAL LOCATIONS MAY BE IN ANOTHER COUNTY, ALSO WITH A POPULATION OF LESS THAN TWENTY THOUSAND, WITHIN THE SERVICE TERRITORY OF THE SAME QUALIFYING RETAIL UTILITY AND ALSO ADJACENT TO THAT OF THE COMMUNITY SOLAR GARDEN. THE SUBSCRIBER MAY CHANGE FROM TIME TO TIME THE PREMISES TO WHICH THE COMMUNITY SOLAR GARDEN ELECTRICITY GENERATION SHALL BE ATTRIBUTED, SO LONG AS THE PREMISES ARE WITHIN THE GEOGRAPHICAL LIMITS ALLOWED FOR A SUBSCRIBER.

(III) "SUBSCRIPTION" MEANS A PROPORTIONAL INTEREST IN SOLAR ELECTRIC GENERATION FACILITIES INSTALLED AT A COMMUNITY SOLAR GARDEN, TOGETHER WITH THE RENEWABLE ENERGY CREDITS ASSOCIATED WITH OR ATTRIBUTABLE TO SUCH FACILITIES UNDER SECTION 40-2-124. EACH SUBSCRIPTION SHALL BE SIZED TO REPRESENT AT LEAST ONE KILOWATT OF THE COMMUNITY SOLAR GARDEN'S GENERATING CAPACITY AND TO SUPPLY NO MORE THAN ONE HUNDRED TWENTY PERCENT OF THE AVERAGE ANNUAL CONSUMPTION OF ELECTRICITY BY EACH SUBSCRIBER AT THE PREMISES TO WHICH THE SUBSCRIPTION IS ATTRIBUTED, WITH A DEDUCTION FOR THE AMOUNT OF ANY EXISTING SOLAR FACILITIES AT SUCH PREMISES. SUBSCRIPTIONS IN A COMMUNITY SOLAR GARDEN MAY BE TRANSFERRED OR ASSIGNED TO A SUBSCRIBER ORGANIZATION OR TO ANY PERSON OR ENTITY WHO QUALIFIES TO BE A SUBSCRIBER UNDER THIS SECTION.

(7) Applicability to cooperative electric associations and municipally owned utilities. THIS SECTION SHALL NOT APPLY TO COOPERATIVE ELECTRIC ASSOCIATIONS OR TO MUNICIPALLY OWNED UTILITIES.

Opposing Groups

Rural residents concerned that increasing renewable portfolio will reduce their income from drilling fees on their lands. (cattle ranchers) Carole King mentioned this at the Green Business Roundtable meeting.

Political Supporters

Local Businesses

The Bodo Canyon disposal cell site is conveniently located near electric transmission lines owned by The La Plata Electric Association (LPEA). As a rural coop, LPEA is not mandated to meet the same regulations as urban electric companies in the rest of Colorado. Because of this exemption, the proposed Bodo Canyon site has less appeal than if it were in a domain under stricter mandates for renewable energy generation.

Green credentials:

Green Leadership

At the 2010 Green Power Leadership Awards ceremony held in Portland, Ore., the U.S. Department of Energy (DOE) honored LPEA as one of six organizations in the nation to receive the Green Power Leadership Award for its commitment to supporting electricity generated from a renewable resource. LPEA was the only rural electric cooperative to receive the honor.

The DOE annually singles out those organizations that distinguish themselves among U.S. green power market participants. LPEA has been actively involved in promoting voluntary Green Power purchase for more than a decade, and in 2009-2010 launched its successful “Just One Block” program to encourage

purchase of 100-kWh blocks of Green Power. “We’re tremendously honored to receive this national award,” says Greg Munro, CEO. “Credit for LPEA’s success in our Green Power program goes
to our creative and enthusiastic LPEA staff and board, which have all worked hard to get the word out to our communities about the benefits of supporting renewable energy, as well as how easy it is for everyone to do their small part. In turn, our communities deserve praise for stepping up and
voluntarily paying a premium for electricity from a renewable resource.”
http://www.lpea.coop/pdf/annual_report/AnnualReport10.pdf

Appendices:

Appendix A:
Key Survey Findings: (http://www.seia.org/cs/news_detail?pressrelease.id=1710)

http://seia.us/sERklb

Question 1: If you were in charge of U.S. energy policy and could choose to provide financial support in one of the following energy sources during your term in office, which would you choose?

X. Thirty-nine percent chose solar, compared to 21 percent for natural gas, 12 percent for wind, 9 percent for nuclear and 3 percent for coal. Among Independents, solar is more than twice as popular as any other energy source (43 percent to 20 percent for natural gas).
XI. Among Independents, solar is more than twice as popular as any other energy source (43 percent to 20 percent for natural gas).

Question 2: How important do you think it is for the U.S. to develop and use solar power?

- Nine out of 10 Americans (89 percent) think it is "extremely important" or "somewhat important."
- Eighty percent of Republicans, 90 percent of Independents, and 94 percent of Democrats agree with this statement.

Question 3: How important do you think it is for the federal government to support U.S. solar manufacturing right now?

- Eight out of 10 Americans (82 percent) think it is "extremely important" or "somewhat important."
- A majority of Independent voters (51 percent) think it is "extremely important."

Question 4: Would you be more, less or about as likely to buy a product that you knew was made using solar energy?

- A majority of Americans (51 percent) would be more likely to buy products produced with solar energy.
- Sixty-one percent of consumers in the key age demographic of 18 to 44 years old would be more likely.

Question 5: Which of the following best describes the biggest concern you would have with choosing solar energy?

- Cost was the most common concern (48 percent), followed by reliability (25 percent), uncertainty about the benefits (9 percent) and aesthetics (3 percent).

Question 6: The federal government currently gives subsidies, such as federal tax credits and grants, to traditional sources of energy, such as oil, natural gas and coal. How likely would you be to support similar subsidies for solar energy?

- More than eight out of 10 Americans (82 percent) would be "extremely likely" or "somewhat likely" to support federal investments in solar. Seventy-two percent of Republicans support federal investments, as well as 87 percent of Democrats and 82 percent of Independents.
- Seventy-one percent of Republicans support federal incentives, as well as 82 percent of Independents, and 87 percent of Democrats.

Appendix B

Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA)

This Act established two programs to protect the public and the environment from uranium mill tailings.

The UMTRCA Title I program established a joint Federal/State-funded program for remedial action at abandoned mill tailings sites where tailings resulted largely from production of uranium for the weapons program. Now there is Federal ownership of the tailings disposal sites under general license from the Nuclear Regulatory Commission (NRC). Under Title I, the Department of Energy (DOE) is responsible for cleanup and remediation of these abandoned sites. The NRC is required to evaluate DOE's design and implementation and, after remediation, concur that the sites meet standards set by the Environmental Protection Agency (EPA).

The UMTRCA Title II program is directed toward uranium mill sites licensed by the NRC or Agreement States in or after 1978. Title II of the Act provides -

- NRC authority to control radiological and non-radiological hazards.
- EPA authority to set generally applicable standards for both radiological and non-radiological hazards.
- Eventual State or Federal ownership of the disposal sites, under general license from NRC.