Renewable Energy in Indian Country

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NREL
National Renewable Energy Laboratory

• Only national laboratory *dedicated* to renewable energy and energy efficiency R&D
• Research spans fundamental *science* to *technology* solutions
• *Collaboration* with industry and university partners is a hallmark
• Research programs *linked* to market opportunities
Major NREL Technology Thrusts

Supply Side
- Wind Energy
- Solar Photovoltaics
- Concentrating Solar Power
- Solar Buildings
- Biomass Power
- Biofuels
- Geothermal Energy
- Hydrogen
- Superconductivity
- Distributed Power

Demand Side
- Hybrid Vehicles
- Fuels Utilization
- Buildings Energy Technology
- Federal Energy Management
- Advanced Industrial Technologies

Cross Cutting
- Basic Energy Science
- Analytical Studies
- International Programs
- Tribal Energy Program
Welcome to the Department of Energy’s Tribal Energy Program Web site. The Tribal Energy Program, under the Department of Energy’s (DOE) Office of Energy Efficiency and Renewable Energy, provides financial and technical assistance to tribes for feasibility studies and shares the cost of implementing sustainable renewable energy installations on tribal lands. This program promotes tribal energy self-sufficiency and fosters employment and economic development on America’s tribal lands.

This Web site provides information about Native American renewable energy and energy efficiency projects that have been funded by the Department of Energy. The site includes valuable information such as: business opportunities, including the latest tribal energy solicitation; case studies on renewable energy projects on tribal lands; reports and resources; and links to other relevant sites.

Tribal College – Teach the Teachers July 12-16, 2004
BIA/DOE/NREL Biomass Energy Workshop Sept 14-16, 2004
## Costs of Electricity with and without External Costs
### New Generation in $/kWh

<table>
<thead>
<tr>
<th>Electricity Source</th>
<th>Generating Costs</th>
<th>External Costs</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropower</td>
<td>2.4-7.7</td>
<td>0-1</td>
<td>2.4-8.7</td>
</tr>
<tr>
<td>Wind</td>
<td>4.0-6.0</td>
<td>0.05-0.25</td>
<td>4.05-6.25</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>3.4-5.0</td>
<td>1-4</td>
<td>4.4-9.0</td>
</tr>
<tr>
<td>Coal/lignite</td>
<td>4.3-4.8</td>
<td>2-15</td>
<td>6.3-19.9</td>
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<tr>
<td>Biomass</td>
<td>7-9</td>
<td>1-3</td>
<td>8-12</td>
</tr>
<tr>
<td>Nuclear</td>
<td>10-14</td>
<td>0.2-0.7</td>
<td>10.2-14.7</td>
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<tr>
<td>Photovoltaics</td>
<td>25-50</td>
<td>0.6</td>
<td>25.6-50.6</td>
</tr>
</tbody>
</table>

*Worldwatch: State of the World 2003*
New Energy Options

- Geothermal
- Biomass
- Solar
- Hydro
- Wind
NREL Native American Anemometer Loan Program Installation Sites
(22 Jan 04)

Legend
- Monitoring Completed
- Anemometer installed

Indian Reservation or
Alaska Native Village Area

Installation Year

2000
Bay Mills Indian Community - MI
Hopi - AZ
Rohnerville Rancheria - CA

2001
Houlton Maliseet - ME
Iowa Tribe of Oklahoma - OK
Robinson Rancheria - CA
Shakopee Mdewankan - MN
Shoshone-Bannock - ID
Ugashik Traditional Village - AK
Soboba Band of Luiseno Indians - CA
Tanana Village - AK
Walker River Paiute - NV
Winnebago Tribe of Nebraska - IA
Kaw Nation - OK
Flandreau Sioux - SD
Fort Peck - MT
Fort Yukon - AK
La Jolla - CA
Quinault - WA
Duck Valley - NV
Pine Ridge - SD
Otoe-Missouria - OK
Fort Belknap – MT
Fort Hall - ID

2002
Caddo Nation - OK
Sac & Fox - KS
Navajo - AZ
Sherwood Valley Rancheria - CA
Quileute - WA
Grand Portage - MN
Potawatomi - KS
Crow - MT
Table Bluff Reservation - CA
Stererts Point Rancheria - CA
Sisseton - SD

2003
Northern Cheyenne - MT
Cheyenne River - SD
White Mountain Apache - AZ
Las Coyotes Band of Indians - CA
Yaleta del Sur - TX
Augustine Band of Mission Indians - CA
Pascua Yaqui - AZ
YKHC - AK
Table B-36. Summary of results of hydropower resource assessment of Oklahoma.

<table>
<thead>
<tr>
<th>Annual Mean Power (MW)</th>
<th>Total</th>
<th>Developed</th>
<th>Excluded</th>
<th>Available$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL POWER</td>
<td>1,511</td>
<td>239</td>
<td>23</td>
<td>1,249</td>
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<tr>
<td>TOTAL HIGH POWER</td>
<td>725</td>
<td>239</td>
<td>5</td>
<td>481</td>
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<tr>
<td>High Head/High Power</td>
<td>323</td>
<td>239</td>
<td>1</td>
<td>83</td>
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<td>Low Head/High Power</td>
<td>402</td>
<td>0</td>
<td>4</td>
<td>398</td>
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<tr>
<td>TOTAL LOW POWER</td>
<td>786</td>
<td>0</td>
<td>18</td>
<td>768</td>
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<tr>
<td>High Head/Low Power</td>
<td>120</td>
<td>0</td>
<td>6</td>
<td>114</td>
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<tr>
<td>Low Head/Low Power</td>
<td>666</td>
<td>0</td>
<td>12</td>
<td>654</td>
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<tr>
<td>Conventional Turbine</td>
<td>286</td>
<td>0</td>
<td>4</td>
<td>282</td>
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<tr>
<td>Unconventional Systems</td>
<td>157</td>
<td>0</td>
<td>5</td>
<td>152</td>
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<tr>
<td>Microhydro</td>
<td>223</td>
<td>0</td>
<td>3</td>
<td>220</td>
</tr>
</tbody>
</table>

$^a$ No feasibility or availability assessments have been performed. “Available” only indicates net potential after subtracting developed and excluded potentials from total potential.
Tribal RE Resources

Solar

Potential Solar Generation from Tribal Lands

~4.5 times U.S. annual generation

Wind

Potential Wind Generation from Tribal Lands

14% of the U.S. annual generation
Biomass & Bioenergy Flows

Fiber
- pulp
- paper
- lumber
- plywood
- cotton

Crops, Animals
- stalks & straws
- harvest residues
- forest slash
- forest harvest for energy plantations

Process Residues
- black liquor
- sawdust
- bark

Process Residues
- dung
- bagasse

Biomass

Materials

Consumers
- MSW clean fraction
- yard trimmings
- constr. & demolition
- wood
- non-recyclable organics

Energy Services
- heat
- CHP
- electricity

Biofuels
- charcoal
- biogas
- ethanol

Food

Bioenergy

Services

Materials

Consumers

Energy Services

Biofuels

Food

Biomass

Fiber

Crops, Animals

Process Residues

Bioenergy

Materials

Consumers

Energy Services

Biofuels

Food
CO₂ over the Past 1000 Years

Globally Unprecedented Levels of CO₂
Warming Temperatures

Reducing Ice Pack

Possible Collapse of the Earth’s Circulatory System

Bleaching of Coral Reefs
Potential Water Supply Crises by 2025

(Areas where existing supplies are not adequate to meet water demands for people, for farms, and for the environment)
Stabilizing atmospheric concentrations of CO2 at 550 ppm (twice the pre-industrial concentration level) would require that 75% of electricity be generated from zero-emitting sources by 2100, and that carbon intensity (Carbon/$GDP) be no more than 10% of today’s value.
Mercury Contamination of Fish

Closely correlated with Power Plant Emissions

Estimated Percent Reductions in Air Deposition Load Necessary to Meet New Methylmercury Criterion in Watersheds with No Other Significant Mercury Sources
After a decade of low prices, natural gas prices are now more volatile at a higher level.

Net Metering By State

Map of the United States showing net metering policies by state.

Legend:
- Monthly Net Metering
- Annual Net Metering
- Varies by Utility or Unknown
- None
- Individual Utilities
- Investor-Owned Utilities Only, Not Rural Cooperatives
- Investor-Owned Utilities and Rural Cooperatives

Revised: 9 Jan 02
Energy Security & Sovereignty Through Local Self-Sufficiency

Interdependence

“We’re all in this together.”

National Grid
Oil Imports
Air Pollution
Water Contamination
Shrinking Planet
Agro-Industry

“He who has the gold, makes the rules.”

Independence

Self sufficiency

Local Community
Food (Earth)
Air
Energy (Fire)
Water

Community of Cooperation

“Share and share alike.”
The Tribal Energy Development Challenge

Tribal Council

Legal
- Sovereignty, Codes & Standards, Contracts, Legal Authority

Environment
- Earth, Air, Water, Sacred Sites, Wildlife & Plants

Financing
- Tribal Resources, RUS Loans, Federal Grants, “Green Tag” Sales

Tribal Energy Use & Growth
- Residential, Commercial, Casino & Industrial Loads

Technology
- Energy Resources, Technology Options

Power Markets
- On-Site Energy Displacement, Merchant Power Sales, “Green Tag” Sales

Strategic Plan

Projects

Tribal Champion Or Team
Progressive Partnerships
For Rural Economic Development and Local Self Sufficiency

Interdependence

- Information Sharing
- Business Development
- Economic & Financial Equity
- Quality of Life for All
- Survival of the Planet

Independence

- Tribal Capacity Building
- On-site Production
- Local Cultural Integration
- Local Quality of Life
- Local Pride
If Planet Earth... were the size of an Apple,

Then her life-giving atmosphere would be thinner than an Apple’s peel!