Natural Resources: Local Economic Impacts Using Local Renewable Energy

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Our Mission

Provide the best possible technical and economic advice and services in assisting Indian mineral owners to achieve economic self-sufficiency by creating sustainable economies through the environmentally sound development of their energy and mineral resources.

What We Do

Division of Energy and Mineral Development

Minerals
- Construction aggregate projects
- Precious metals
- Coal

Renewable Energy
- Biomass
- Wind
- Solar
- Hydro

Geothermal & Conventional Energy
- Geothermal
- Oil & Gas
- Coal

Business Development
- Tribal Business Structures
- Financial Analysis
- Good Governance Practices

Our Staff: Geologists, GIS Analysts, Engineers, MBA, Financial Analysts, and Policy Analysts

IEED Business Model

RESULT:

Tribal Jobs and Income

Why is Local Renewable Energy Important for Tribes?

- Primary reasons behind a Tribe's desire to develop renewable energy projects includes:
  - Sovereignty
  - Energy Independence, Security, and Diversification
  - Environmental Benefits and Sustainability
  - Economic Impact
  - Dissatisfaction with the current electricity supplier
- One project often cannot address all of these topics – so tribe must either assess resource opportunities and match to goals, or prioritize goals and assess resource opportunities that align with top goals.

Positive Local Economic Impacts Using Local Renewable Resources

- Jobs on Reservation
- Income from sale of products/by-products
- Local energy cost savings/reduced electricity/heating bills
- Renewable Energy projects improve tribal sovereignty
  - Creation of jobs for band members
  - Increased knowledge on the reservation
  - Building relationships in the energy community
  - Long-term environmental sustainability
  - Reaching tribal energy goals

Electricity Market and Emergency Preparedness

- Short-Term
  - Important to have full/partial access to electricity when grid shuts down during emergency
  - Many Tribes are first ones off last ones on
- Long-Term
  - Electricity prices rising, and will continue to rise, due to:
    - Gas pipeline constraints
    - Grid mix changes
    - Inflation
    - Cold weather events

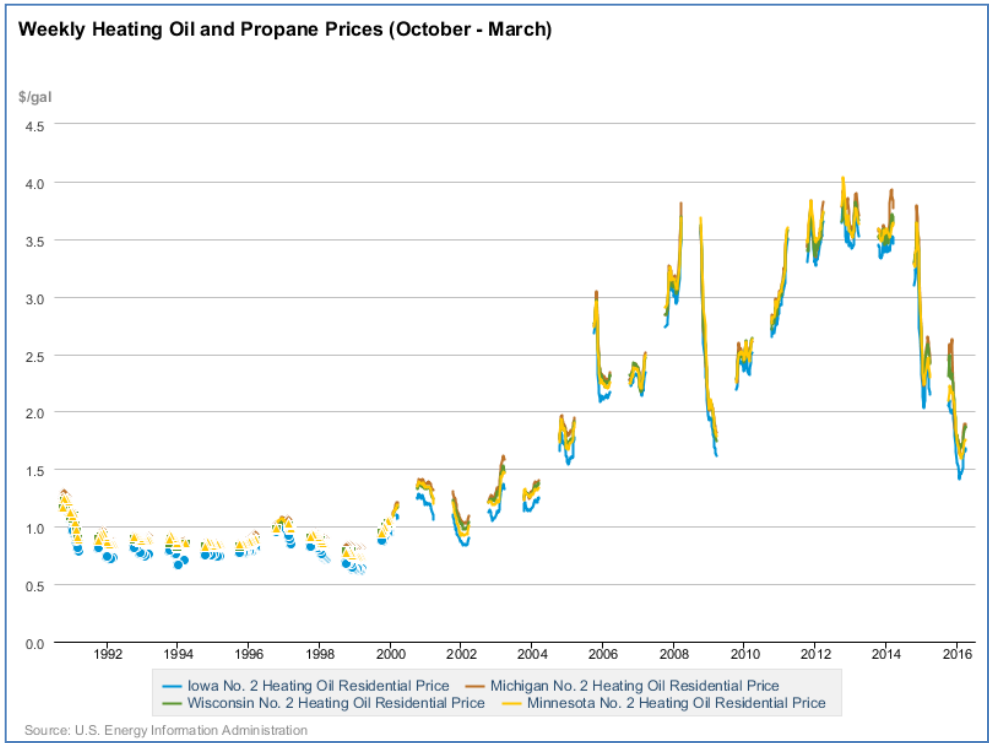
Average Residential Electricity Rates		
	April 2015 (cent/ kWh)	**April 2016 (cent/ kWh)**
US	12.61	12.68
Minnesota	11.53	12.23
Wisconsin	13.96	14.23
Michigan	13.81	14.83
Iowa	10.87	11.50

Source: US Energy Information Administration

Heating Market and Emergency Preparedness

Rising/Unstable Fuel Prices

- Need to be able to heat homes/hospitals/schools in emergency
- Infrastructure closures during cold-weather emergencies can lead to supply issues of heating oil/propane
- Heating oil and propane prices fluctuate due to supply and demand, weather events, taxes, politics, and the economy
    - This can hinder financial/supply planning for emergencies



Source: US Energy Information Administration

Renewable Energy Prices

Renewable Energy can provide security during disaster, and may sometimes even be cheaper than conventional energy!

The **Levelized Energy Cost (LEC)** represents the total cost to build and operate a new power plant over its life divided by the total electricity generation

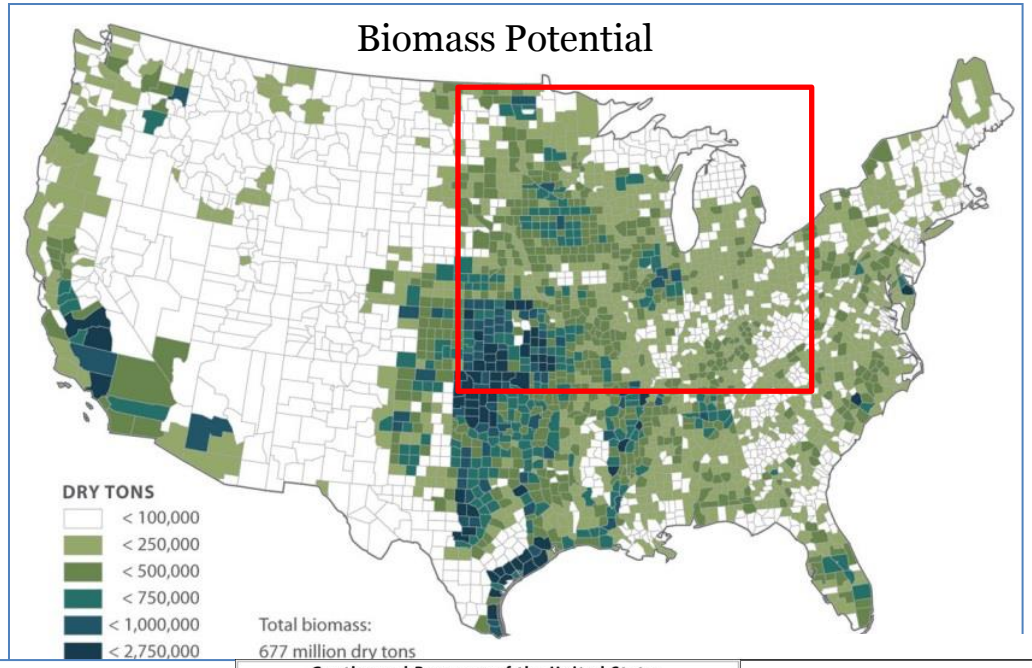
It is important to consider:

- High initial investment
- Medium to low operating/maintenance costs
- Other feasibility considerations (renewable potential, competition, market for product, plant location, infrastructure, legal regulations, incentives)

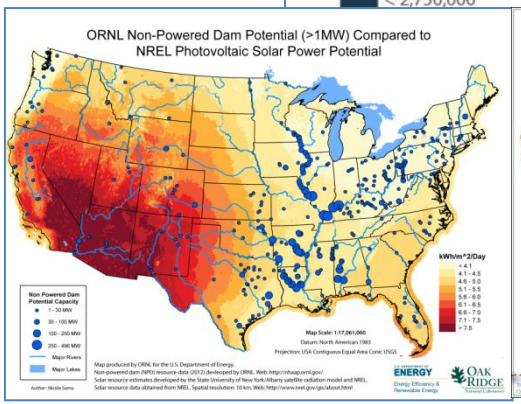
Renewable Energy Prices	
Technology	**Levelized Energy Cost (LEC) (cent/kWh)**
Conventional Electricity	12.68
Biomass	10
Natural Gas	7-14
Solar	12-25
Hydro	8
Geothermal	5
Wind	7-20

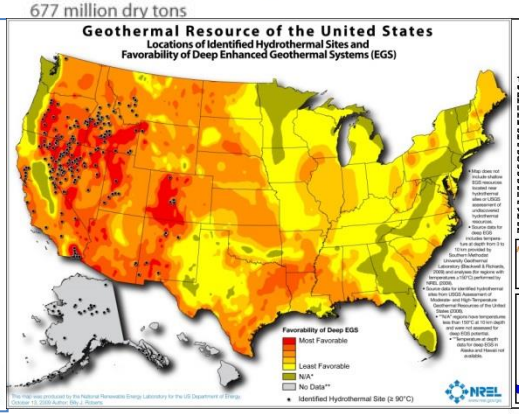
Source: http://www.renewable-energysources.com/

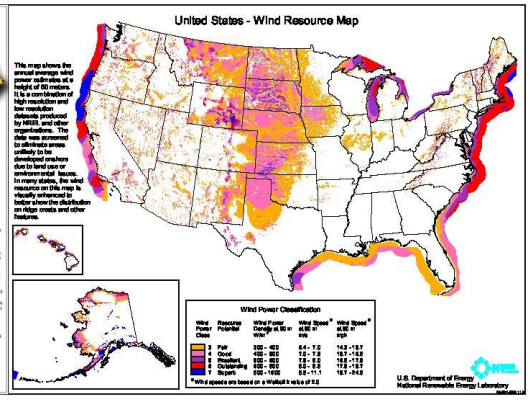
Renewable Potential Maps



Source: National Renewable Energy Lab (NREL) and Oak Ridge National Lab







Biomass as a Renewable Energy Resource for Emergency Preparedness

- **Options**
  - Woody Biomass
  - Waste to Energy (WTE)
  - Combined heat and power (CHP)
- **Technologies**
  - Pyrolysis
  - Gasification
  - Incineration/Combustion
  - Anaerobic Digestion/Fermentation
- **Feasibility Considerations**
  - Existing building energy systems
  - Detailed resource/feedstock assessment
  - Existing regulatory and business infrastructure
  - Complimentary to forest management and farming

Pictures: Fond du Lac Woody Biomass

Case Study – Blue Lake Rancheria

- Tribal goals: become leader in greenhouse gas reductions, improve community resiliency, curb health and economic costs
- Rural reservation is susceptible to earthquakes, tsunamis, storms, winds, floods, landslides, and wildfire
- Tribal energy plan includes energy efficiency and renewable energy – reduced overall consumption by 35%
  - Biomass gasification to syngas for CHP (DEMD funded feasibility study)
  - Solar
  - Fuel cells
  - Grid battery storage/microgrid
- Microgrid allows for reservation to have access to power during outages and natural disasters
- Selected as a 2015-2016 Climate Action Champion by the Obama Administration for exceptional work in response to climate change
  - Served as evacuation site for Fukushima in 2001
  - Served as evacuation site for local school district during natural gas leak
  - Certified Red Cross Shelter

Source: https://toolkit.climate.gov/taking-action/blue-lake-rancheria-tribe-undertakes-innovative-action-reduce-causes-climate-change

Current DEMD Renewable Energy Projects in the Midwestern Region

DEMD Midwest Biomass Projects	
Bad River	Regulatory and infrastructure to build biomass facility
Bad River	CHP for Casino and community
Fond du Lac	Woody biomass (chip and pellet)
Fond du Lac	Engineering for 1 MW ground mount near casino
Forest County Potawatomi	Community scale biomass fuel production facility
Ho-Chunk	Anaerobic Digestion
Ho-Chunk	Waste Gasification
Menominee	CHP for MTE sawmill and lumber drying operation

Case Study – Fond du Lac

- Tribal goals: reduce energy costs to tribe, improve tribal sovereignty
- Fond du Lac Band of Lake Superior Chippewa
  - Reservation uses ~3000 kWh electricity per year
  - Signed up for Kyoto Protocol
    - Goal: 20% renewable by 2020
    - Actual: On track for 20% by end of 2016, 50% by 2025
- Projects funded by DEMD
  - Woody biomass feasibility study
  - Solar photovoltaic (PV) panels feasibility study

Picture: Fond du Lac solar site

Fond du Lac – Woody Biomass

- DEMD funded feasibility study
- 500 kWh and 1000 kWh pellet and chip systems project
  - **System will provide heat to school, tribal center, clinic, head start, resort/casino**
    - Important to keep these buildings heated locally during emergencies
    - 1% of total Fond du Lac energy usage
  - Reduce Carbon Footprint by 18,500 tons (CO2-eq)
- Local Economic Benefits
  - Total system decreases energy costs by $14,000 per year, while still creating jobs for band members, keeping the money in the community, and diversifying the economy
  - Jobs created for band members:
    - Forestry/Firefighting: **5 band members** full time
    - Operations/Facility Management: **2 band members** full time
    - Facility Supervisor: **1 band member** full time

Fond du Lac – Solar PV

- DEMD funded feasibility study
- 1 MW Solar PV installation project
  - 5% total Fond du Lac energy usage, 50% casino usage
  - Credit on electricity bill
- Local Economic Benefits
  - System saves Fond du Lac $100,000 per year (not accounting for escalating cost of electricity)
  - Jobs created for band members:
    - Excavation/Stormwater treatment: **2 band members**, full time/temporary
    - Solar Installation: **3 band members**, full time/temporary
    - Maintenance: **1 band member**, part time

Picture: Fond du Lac solar site

Emergency Preparedness

Emergency Response Plan Components:

1. Mitigation
2. Preparedness
3. Response
4. Recovery

Update yearly

Standard practice for every government: quick response

Tribal Emergency Preparedness Plan

- What roads and buildings are at risk?
  - Which infrastructure is in the floodplain?
- What are the repair priorities during an emergency?
- Identify exacerbating factors
- Material quantity estimates

DEMD Assistance

Engineers and geologists provide:

- Free technical assistance
- Resource assessments
- Feasibility studies
- Project planning

Energy and Mineral Development Program (EMDP)

- **Purpose:** Provides financial assistance and free in-house technical support to Tribes for performing data collection and investigations of their energy and mineral potential
- An annual program using a competitive evaluation process to select proposed projects from tribes
- Tribes use this information to:
  - plan where they want development to occur
  - promote their lands to industry partners
  - negotiate the best economically beneficial agreement with partners
  - develop the resource themselves

Find out more:
www.bit.ly/demdemdp

Tribal Energy Development Capacity Program (TEDC)

Find out more: www.bit.ly/tedcprogram

- **Purpose:** to provide financial and free technical assistance in order to develop tribal managerial, organizational and technical capacity needed to maximize the economic impact of energy resource development on Indian land
- An annual program using a competitive evaluation process to select proposed projects from tribes
- Provides financial assistance for tribes to:
  - Establish business entity structures and/or organizational structures related to energy resource development
  - Develop or enhance key regulatory activities

Incentives

Database of State Incentives for Renewables & Efficiency (DSIRE):

- Comprehensive source of information for
  - State incentives
  - Local incentives
  - Utility incentives
  - Federal incentives
  - Policies that promote renewable energy and efficiency

Find out more:
http://programs.dsireusa.org/system/program

Name	State/ Territory	Category	Policy/Incentive Type
Solar Heating Contractor Licensing	MI	Regulatory Policy	Solar/Wind Contractor Licensing
Fuel Mix and Emissions Disclosure	MI	Regulatory Policy	Generation Disclosure
Residential Energy Conservation Subsidy Exclusion (Personal)	US	Financial Incentive	Personal Tax Exemption
Residential Energy Conservation Subsidy Exclusion (Corporate)	US	Financial Incentive	Corporate Tax Exemption
Renewable Electricity Production Tax Credit (PTC)	US	Financial Incentive	Corporate Tax Credit
Business Energy Investment Tax Credit (ITC)	US	Financial Incentive	Corporate Tax Credit
Modified Accelerated Cost-Recovery System (MACRS)	US	Financial Incentive	Corporate Depreciation

FEMA Funds

- FEMA may require matching funds for emergency recovery
- Tribe's sand and gravel resources can be used in place of that match
- Large savings for Tribes

Additional Resources

- FEMA is updating flood hazard maps throughout the country: https://msc.fema.gov/portal
- Free Floodplain Management Training is offered by the Minnesota Department of Natural Resources
- The Rural Domestic Preparedness Consortium offers classes such as “Disaster Recovery – Rural Communities.” https://www.ruraltraining.org
- Other States coordinate with FEMA and Homeland Security to provide free and low cost training for local community officials and citizens.

Contact Us!

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Website:

http://www.bia.gov/WhoWeAre/AS-IA/IEED/DEMD/

Fond du Lac – Future and Overall Energy Goals

Bruno Zagar: Environmental Specialist and Energy Projects Manager

- Speaking in the Emergency Preparedness Session
- Worked with the Reservation Business Committee and legal staff to draft a Kyoto accord to reduce the use of fossil fuels by the Fond du Lac Band of Lake Superior Chippewa by 20% by 2020
- Drafted strategic energy plan for the Band and works with staff to accomplish energy efficiency and renewable energy generation goals

Picture: www.fdlrez.com

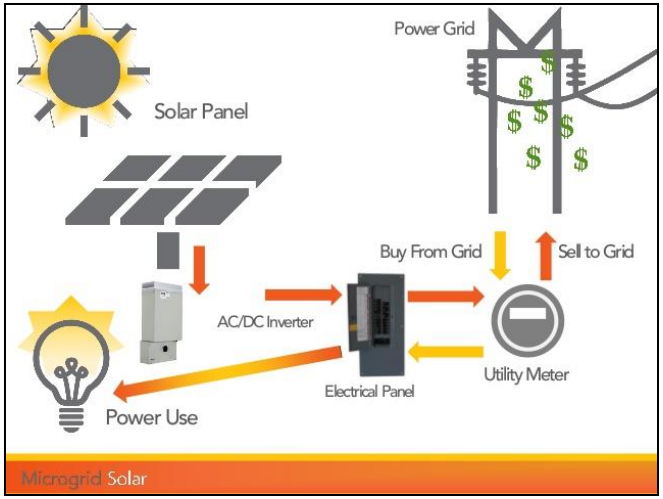
Appendix
(For Reference Only)

Solar

- **Technology**
  - Photovoltaics (PV)
  - Solar thermal heating

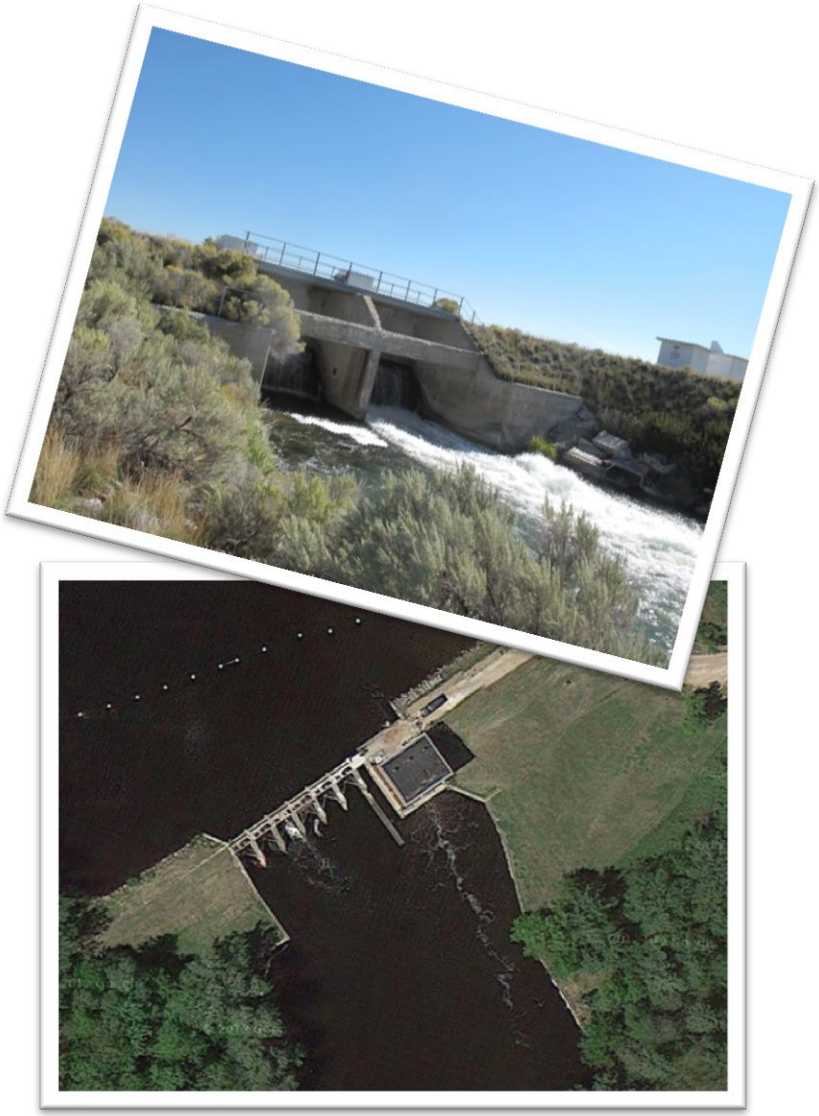
DEMD Midwest Solar Project	
Fond du Lac	Engineering for 1 MW ground mount near casino

- **Feasibility Considerations**
  - Return on investment – enough solar coverage?
    - Technology becoming cheaper
  - Access to transmission lines
  - ***Microgrid*** can be complicated and expensive
    - Tribal Energy Development Capacity (TEDC) group at DEMD can help with options planning



Hydro

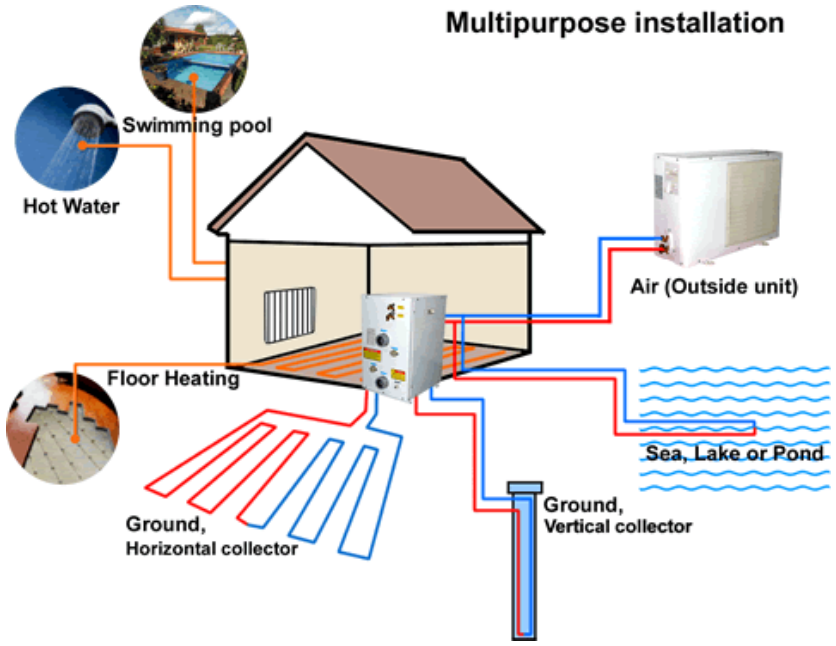
- **Technology**
  - Retrofit existing dams or irrigation systems
- **Feasibility Considerations**
  - Prohibitively high cost to build
  - High cost to retro-fit
  - Dam safety upgrades
  - Access to transmission lines



Geothermal

- **Technology**
  - Direct use
  - Requires additional electricity

- **Feasibility Considerations**
  - Geology
  - Energy and Mineral Development Program (EMDP) at DEMD can support feasibility work



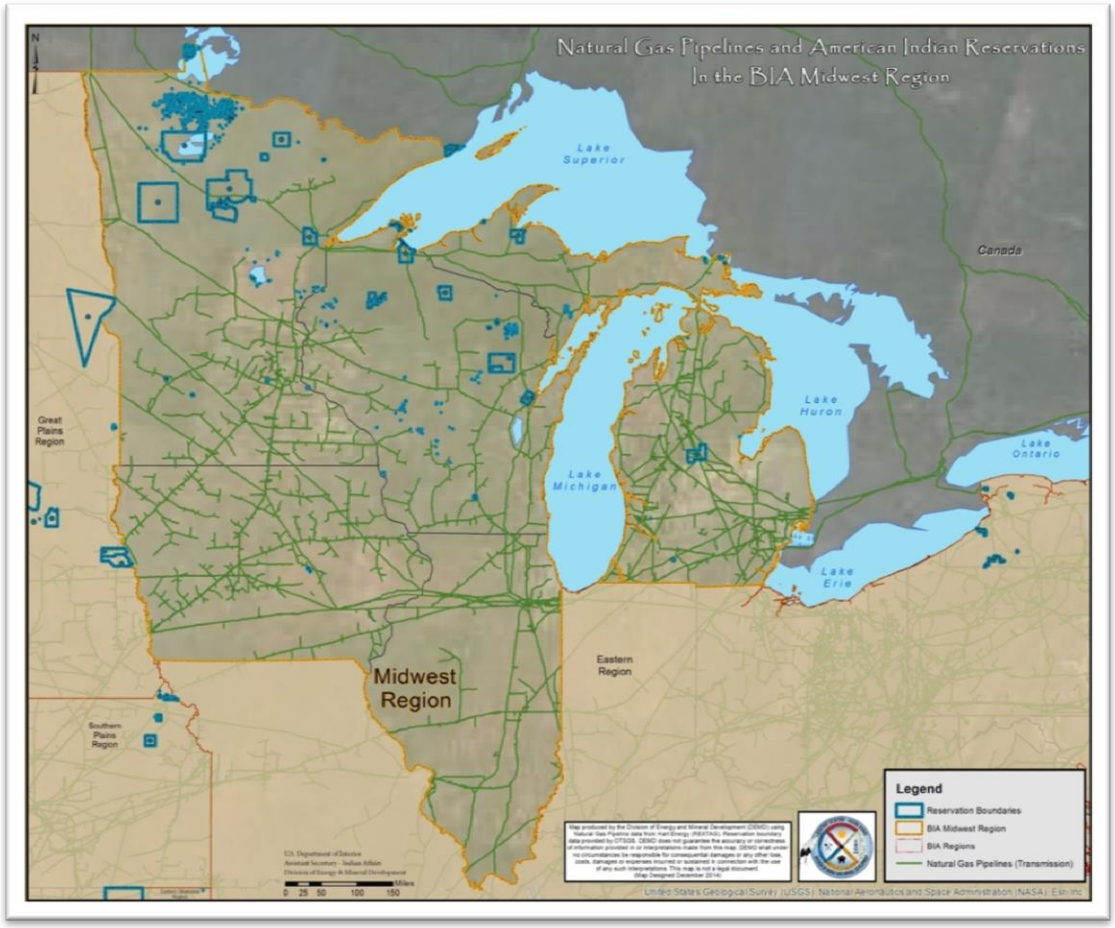
Wind

- **Technology**
  - Horizontal Axis (most common)
  - Vertical Axis

- **Feasibility Considerations**
  - Historical challenges with O&M
  - Net metering rules
  - Return on investment
  - Access to transmission lines

Natural Gas

- **Technology**
  - Home heating
  - Combined heat and power
- **Feasibility Considerations**
  - Access to pipeline infrastructure



Cost/Land Comparison

Renewable Energy Fact Sheet

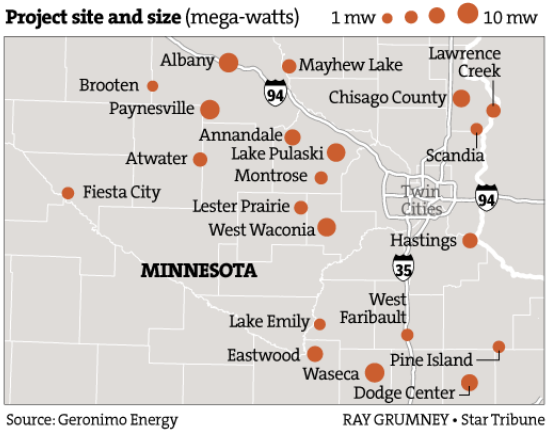
Technology	Levelized Energy Costs (LEC) Cent/kWh	Cost to implement technology	Land Needed (Acres/MW)
Biomass	4-29	$2M-$5/MW for >5 MW	150-700 (varies)
Solar	12-25	$1-3M/MW	5-7
Hydro	8	$1.6M-$4M/MW	1-2000 (varies)
Geothermal	5	$3-4M/MW	1-8
Wind	5-20	$1.3M-$2.2M per MW, one turbine is ~2MW	55-130 per turbine (to work properly)
Natural Gas	7-20	$1M/MW - Combined-cycle gas-fired generation costs roughly $1 million per MW	0.04

Non-Tribal Midwest RE Projects

- Minnesota Ground Mount Solar (100 MW)
  - $250 Million implementation over 21 sites
  - Sell electricity to Xcel

- Michigan Utilities
  - Public Act 295 of 2008 set 10% RE goal
  - Exceeded 10% renewable energy production goal
  - Increased capacity by 1500 MW-wind power
  - Hydroelectric 15%
  - Landfill gas 6%
  - MSW 3%
  - Solar 1%

- Wisconsin



2015 Utility-Sponsored Community Solar Projects in Wisconsin

Electric Provider	*Location*	*Installation Contractor*	*Project Size (in kW DC)*
Eau Claire Energy Cooperative	Fall River	Able Energy	865
River Falls Utilities and WPPI Energy	River Falls	H&H Solar	250
New Richmond Utilities and WPPI Energy	New Richmond	H&H Solar	250
Taylor Electric Cooperative	Medford	Unknown	100
Clark Electric Cooperative	Greenwood	Unknown	53
Total Capacity		**1,518 kW**	

Biomass Technology Types

- **Pyrolysis: thermal decomposition of the volatile components of an organic substance**
  - Temperature range of 400-1,400°F (200-760°C)
  - Absence of air/oxygen
  - Forming syngas and/or liquids
  - Mixture of un-reacted carbon char (the non-volatile components) and ash remains as a residual

- **Gasification: breaks apart feedstock molecules with heat to create syngas**
  - Temperature range of 900-3,000°F (480-1,650°C)
  - Contains some oxygen
  - Non-volatile carbon char that would remain from pyrolysis is converted to additional syngas
  - Steam may also be added to the gasifier to convert the carbon to syngas
  - Ash remains as a residual

- **Incineration/Combustion: burning of MSW to create steam**
  - Municipal Solid Waste (MSW) as fuel
  - Burned with high volume of air to form CO2 and heat
  - Hot gases make steam to generate electricity

- **Other processes include anaerobic digestion and fermentation**

Geothermal Technology Types

- **Dry Steam Geothermal – Direct Use**
  - Underground steam flows directly to a turbine that generates electricity
- **Flash Steam Geothermal – Requires Electricity**
  - Pump pushes hot fluid to a tank at the surface
  - As fluid cools in tank, it “flashes” (turns into vapor), which flows to the turbine to generate electricity
- **Binary Cycle Geothermal – Requires Electricity**
  - Hot fluid from underground heats separate surface fluid called “heat transfer fluid” in a heat exchanger
  - Fluid changes to vapor and flows to the turbine to generate electricity

Hydroelectric Technology Types

- **Run-of-river hydropower:**
  - channels flowing water from a river through a canal or penstock to spin a turbine
  - little or no storage facility
  - continuous supply of electricity with some flexibility of operation for daily fluctuations
- **Storage hydropower:**
  - large system that uses a dam to store water in a reservoir
  - electricity is produced by releasing water from the reservoir through a turbine
  - storage hydropower provides base load as well as the ability to be shut down and start up at short notice according the demands of the system
- **Pumped-storage hydropower:**
  - provides peak-load supply
  - harnesses water which is cycled between a lower and upper reservoir by pumps which use surplus energy from the system at times of low demand
  - when electricity demand is high, water is released back to the lower reservoir through turbines to produce electricity
- **Offshore hydropower:**
  - a less established but growing group of technologies that use tidal currents or the power of waves to generate electricity from seawater

Solar/Wind Technology Types

- **Wind Turbines:**
  - Horizontal axis and vertical axis
  - Horizontal axis is most commonly available commercially

Vertical Axis Wind Turbine (HAWT)

Horizontal Axis Wind Turbine (HAWT)

- **Solar:**
  - Photovoltaic technology directly converts sunlight into electricity
  - Solar thermal technology harnesses its heat

Renewable Energy Certificates (REC)

- Certificates reflecting environmental, social, and non-power qualities of renewable electricity
  - RECs give added value ($$) to renewable electricity
- 1 REC = 1 MWh generated renewable energy
  - One time sale (tracked with code)
- Bundled or unbundled with sale of electricity
  - If sold separate (unbundled), may gain larger profit than if sold bundled to utility
  - Some businesses purchase unbundled RECs for green image
- List of Green Power Markets: http://apps3.eere.energy.gov/greenpower/markets/certificates.shtml?page=2

Net Metering

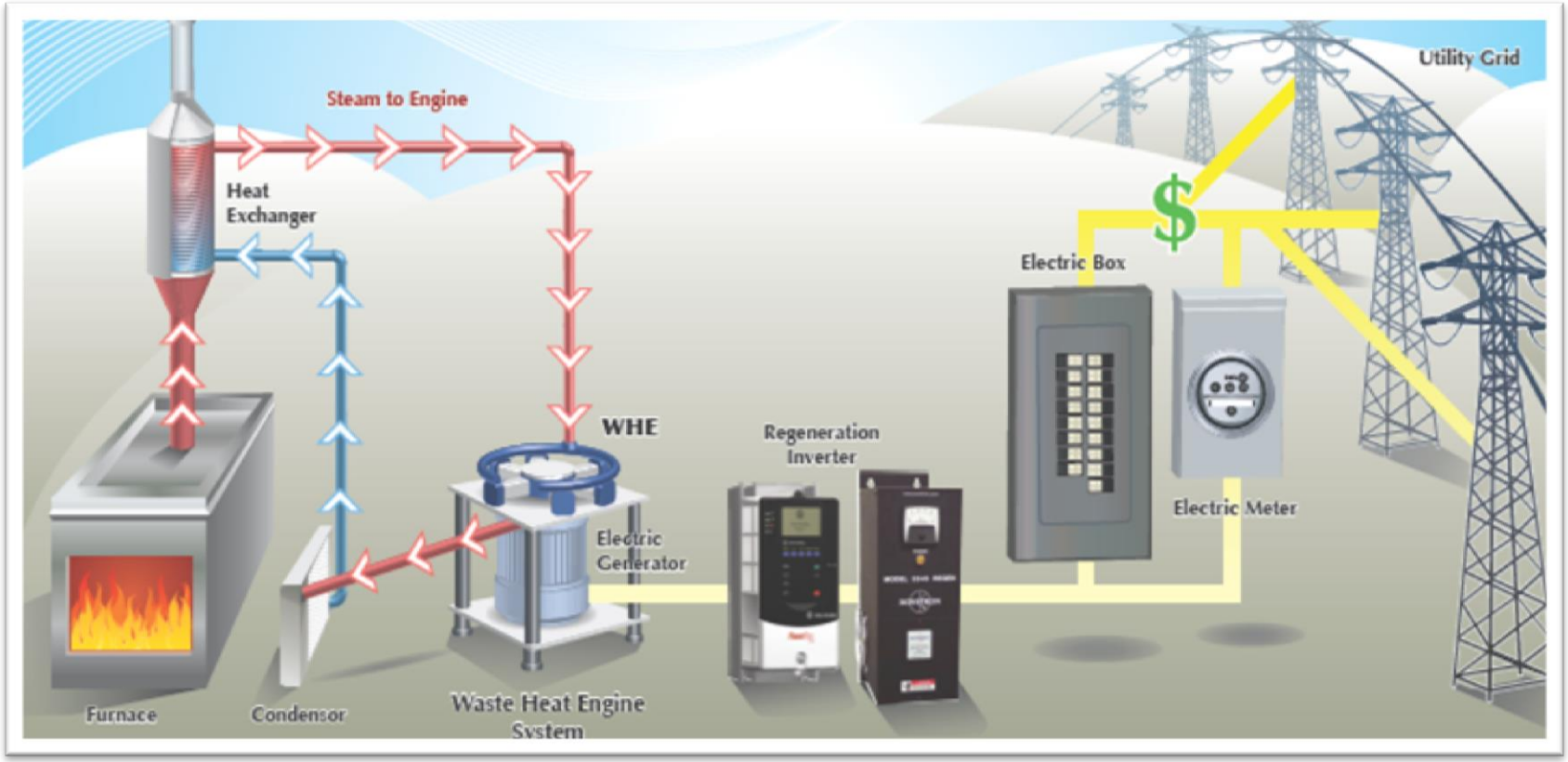
- Distributed generation connected to public utility grid
- Offsets generator's energy consumption and credits for excess generation
- REC's tend to go to utility when project is operational
- Net Metering systems less capital-intensive
- Utility credits excess electricity at avoided cost rate
- Limits:
  - The Minnesota Public Utilities Commission *may* limit cumulative net metering generation once generation has reached 4% of annual retail electricity sales

Net Metering Limits

- Minnesota
  - Net Metering Capacity Limit: 40 kW (individual system)
- Wisconsin
  - Net Metering Capacity Limit: 20 kW(individual system)
  - Net Metering Capacity Limit: 100 kW (investor owned utility)
- Michigan
  - Net Metering Capacity Limit: 150 kW (investor owned utility)
- Iowa
  - Net Metering Capacity Limit: 500 kW (investor owned utility)

Net Metering Diagram

Example Biomass Net Metering Setup



EMDP – Limiting Factors

- Project must be on tribal land held in trust or restricted fee by the Federal Government
- Multi-year projects
  - Cannot award multi-year funding, but can provide extensions
  - Submit each year
  - Funds not guaranteed
- Project tasks should be accomplishable in one year
- Funding Limitations:
  - Cannot purchase the equipment for the assessment of energy and mineral resources (e.g. anemometer towers)
  - Cannot purchase or lease the equipment for the development of energy and mineral resources (e.g. solar panels, wind turbine)