Minnesota Tribal Coalition Tribal Utility Capacity Building Project

Grand Portage

White Earth

Leech Lake

The Grand Portage, Leech Lake and White Earth reservations seek to build a common foundation for strategic energy resource and utility planning capacity by banding together.

The effort will focus primarily on the following four inter-related areas:

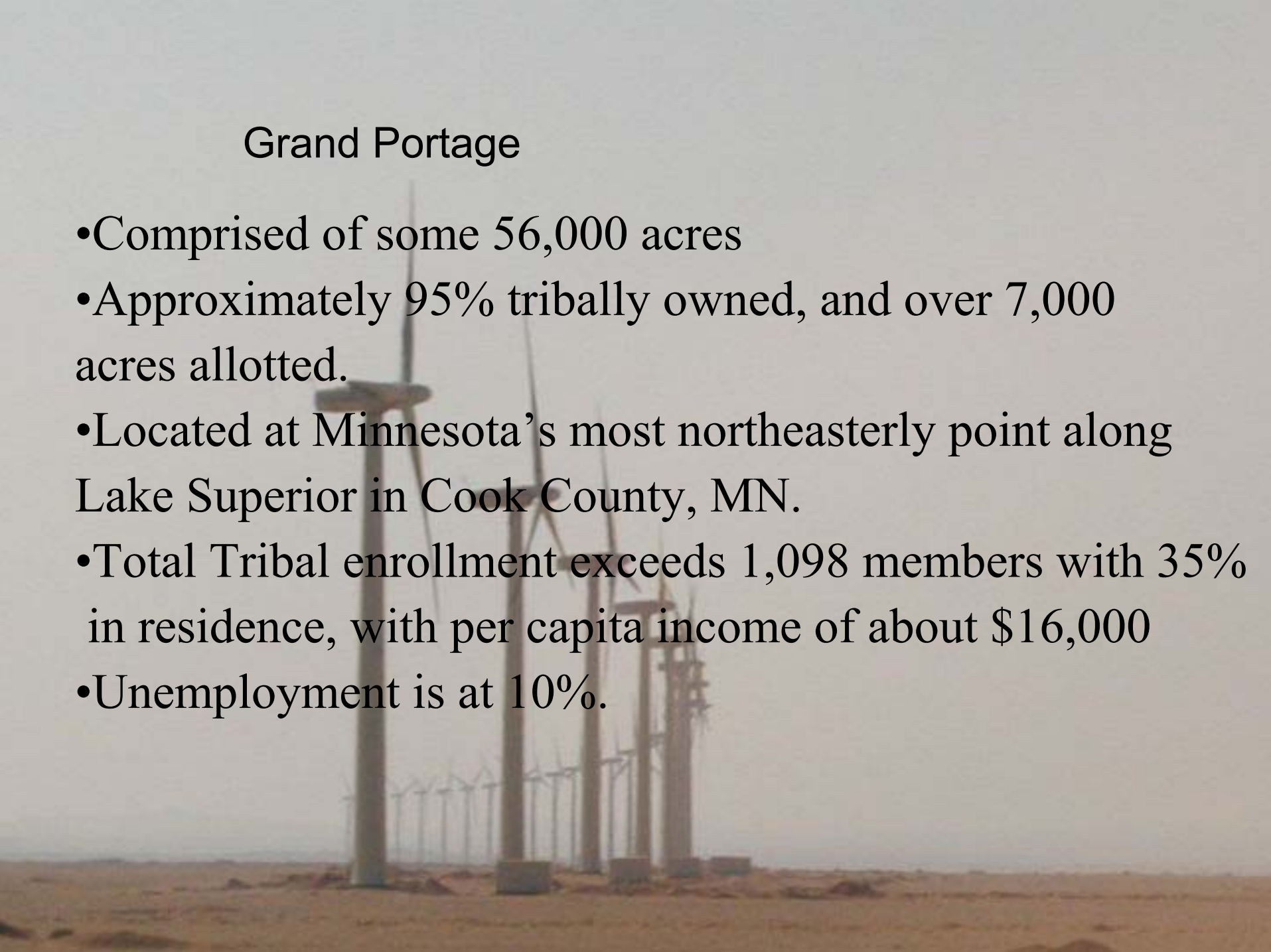
•**EDUCATION:** Raising community awareness about energy issues through the distribution of basic educational materials and focused outreach activities aimed at facility managers.

•**ASSESSMENT:** The identification and assessment of the basic on-reservation energy flow and consumption patterns, and the potential for energy policy development on issues of conservation, energy efficiency and application of renewable energy resources.

•**STRATEGIC PLAN:** The development of an overall tribal energy "vision" and outlining long-term strategic energy plans, including a statement, and goals and objectives, which may be tailored to the needs and resources of each reservation.

•**MODEL DOCUMENTS:** The development of model organizational documents, such as tribal codes and policies, to promote the formation of tribal utility institutions (offices, commissions, authorities) to better serve on-reservation loads and members.

Grand Portage

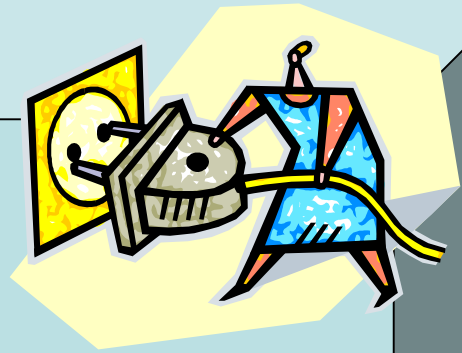


Grand Portage

- Comprised of some 56,000 acres
- Approximately 95% tribally owned, and over 7,000 acres allotted.
- Located at Minnesota's most northeasterly point along Lake Superior in Cook County, MN.
- Total Tribal enrollment exceeds 1,098 members with 35% in residence, with per capita income of about $16,000
- Unemployment is at 10%.

Grand Portage

Federally recognized by Cook County
Tribally owned: 37,679 acres
Allotted: 7,086 acres
Total labor force: 113
High school or higher graduate: 67.6%
Reservation population: 308
Total enrollment: 790
Total unemployment: 26.5%
Per capita income: $10,808
150 miles away from Duluth, MN.



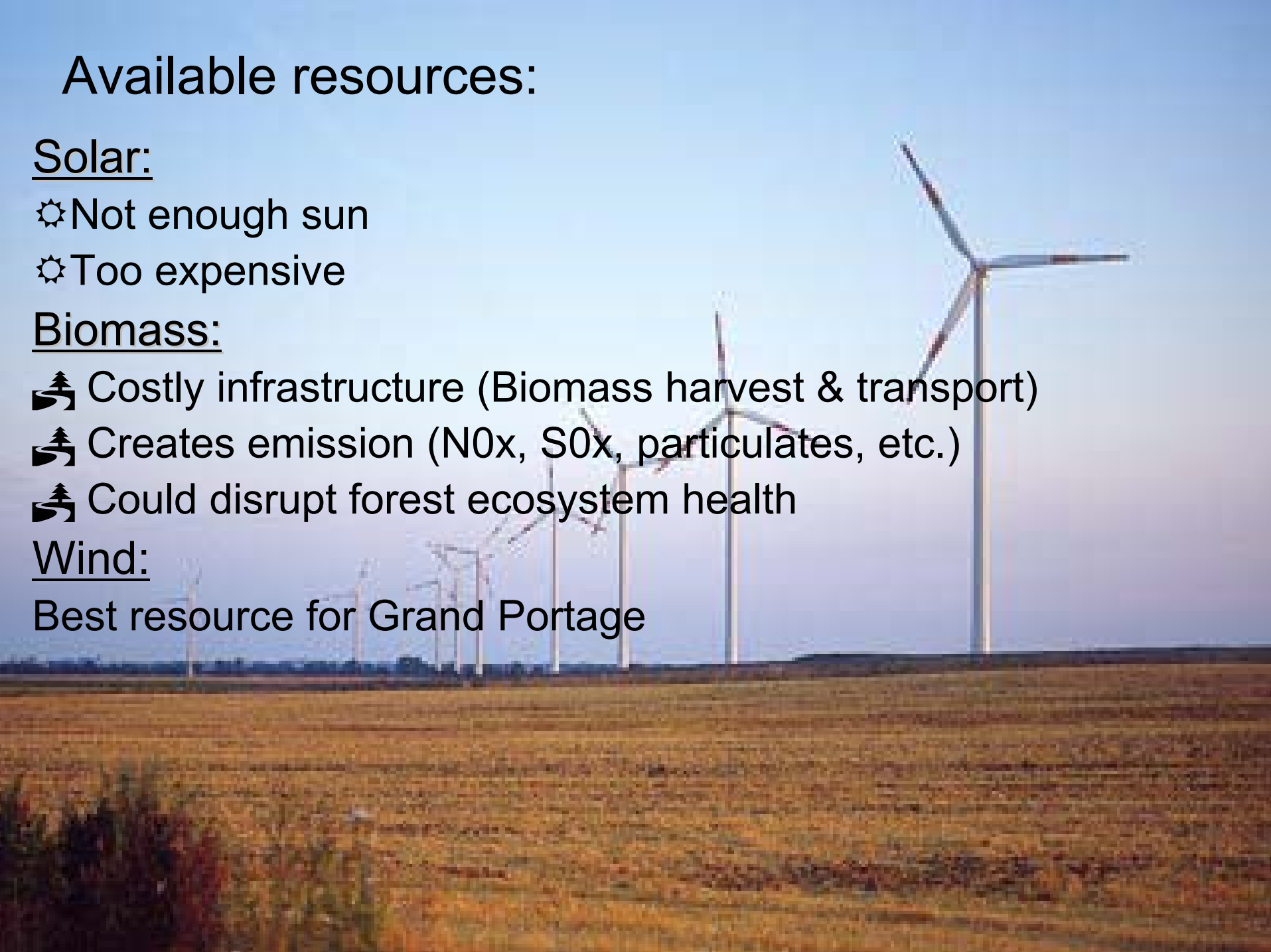
Total Electricity Consumption:

- Community Center- 840,000 kWh/yr
- Casino/Hotel- 2,200,000 kWh/yr
- Households- 1,440,000 kWh/yr
- Tribal Council Offices- 640,000 kWh/yr

Total Consumption: 5,120,000 kWh/yr

Annual Cost: $358,400.00

Available resources:



Solar:

- Not enough sun
- Too expensive

Biomass:

- Costly infrastructure (Biomass harvest & transport)
- Creates emission (N0x, S0x, particulates, etc.)
- Could disrupt forest ecosystem health

Wind:

Best resource for Grand Portage

Wind Resource:

Wind Production:

Turbine Site: Mt.Maud

Wind Data at 20m:
Class-5
Capacity Factor-.22

Wind Production:

Turbine Site: Mt.Maud

Wind Data at 60m:
Class-6
Capacity Factor-.58

(based on height extrapolated formula)

Storing Wind Generated Electricity With Hydrogen

Wind Turbine

H_20

ELECTROLYSIS

0_2

Heat

H_2

H_2

H_2 STORAGE

H_2

PEM FUEL CELL

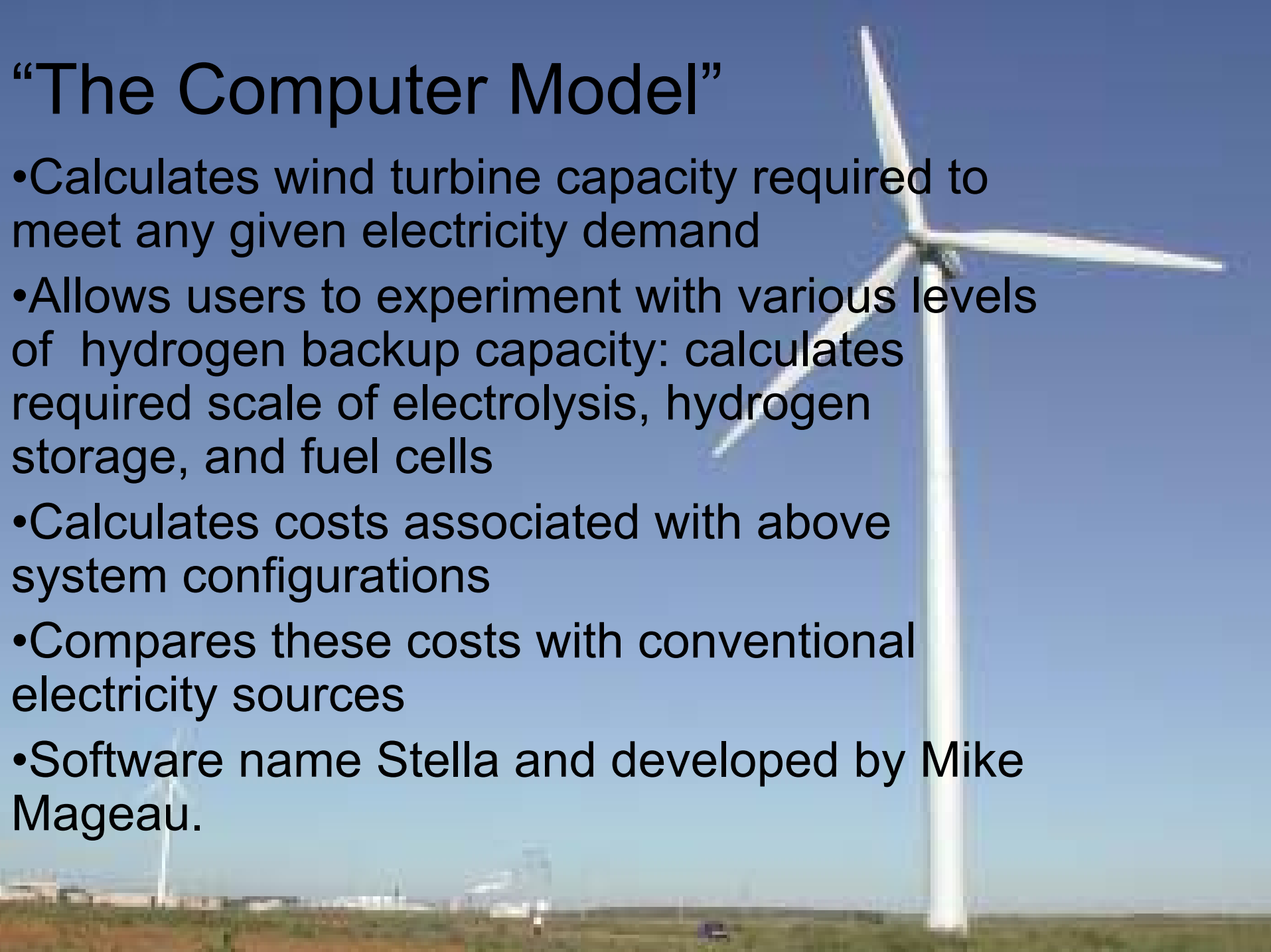
H_20

e-

Heat

Proposed Grand Portage Project

- Approximately 1MW of Wind to power community center and hotel/casino
- 20% Hydrogen backup (electrolysis, hydrogen storage, and fuel cell) located at community center
- All electricity production to be consumed by the reservation
- Community Education



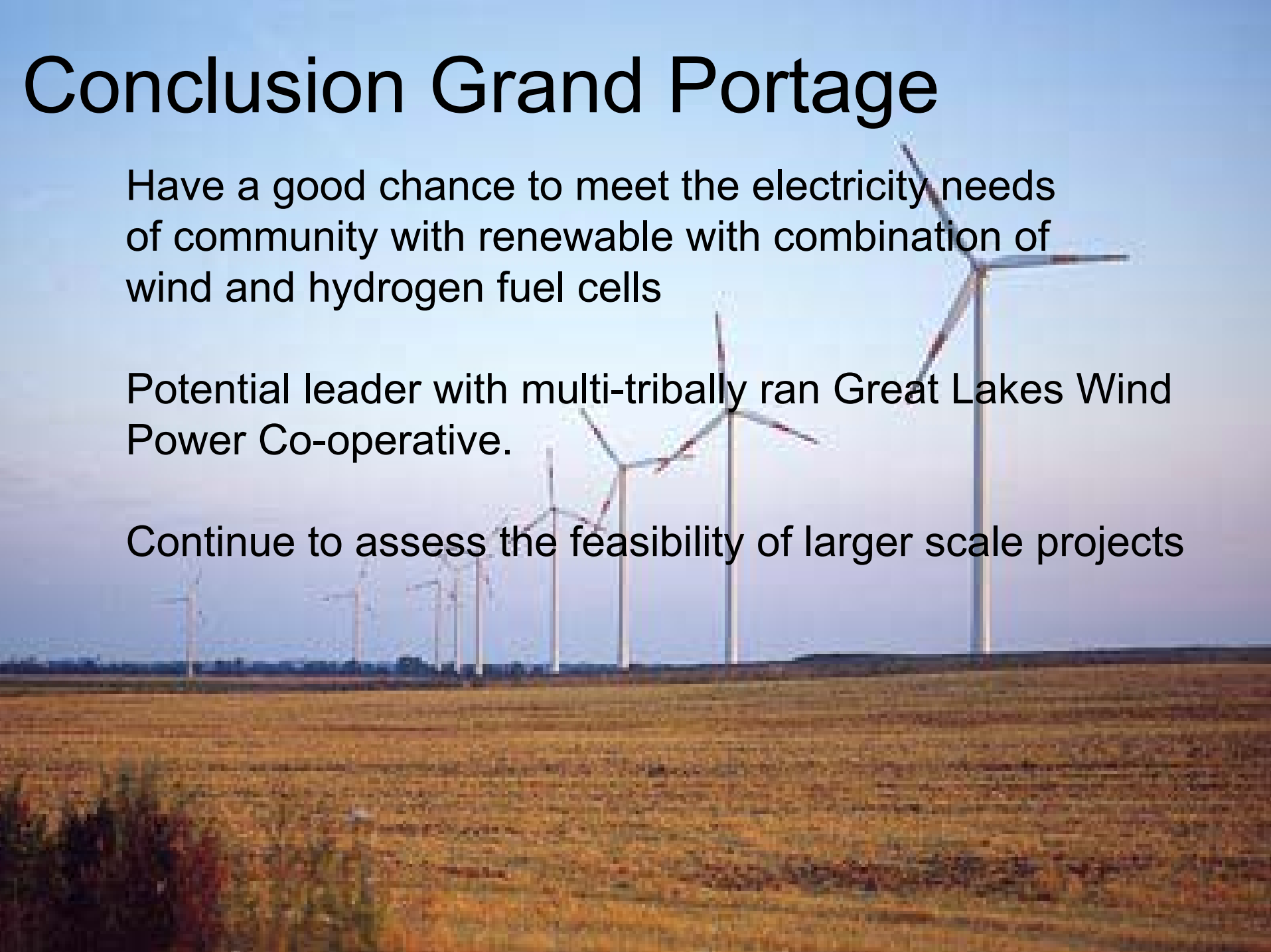
“The Computer Model”

- Calculates wind turbine capacity required to meet any given electricity demand
- Allows users to experiment with various levels of hydrogen backup capacity: calculates required scale of electrolysis, hydrogen storage, and fuel cells
- Calculates costs associated with above system configurations
- Compares these costs with conventional electricity sources
- Software name Stella and developed by Mike Mageau.

Grand Portage Model Output: 2 Scenarios

	No H2 Backup		20% H2 Backup	
	Capacity ☐	Cost	Capacity	Cost
Annual Production	2.08 million kwh		2.08 million kwh	
Wind Capacity	1000 kW	$946,959	1085 kW	$1,041,095
Electrolysis (H2)	0	$0	10.9 m3H2/hr	$173,950
Fuel Cell Capacity	0	$0	22.9 kW	$133,280
Total System Cost		$946,959		$1,348,326
Annual Cost		$66,287		$108,230
Cost per kwh		3.2 cents		5.2 cents
Annual Utility cost		$174,500		$174,000
Utility Cost per kwh		6.5 cents		6.5 cents

Conclusion Grand Portage



Have a good chance to meet the electricity needs of community with renewable with combination of wind and hydrogen fuel cells

Potential leader with multi-tribally ran Great Lakes Wind Power Co-operative.

Continue to assess the feasibility of larger scale projects

White Earth

White Earth

Gaa-Noodin-Oke

White Earth

•Over 837,000 acres of land located in northwestern Minnesota (Mahnomen, Becker and Clearwater counties) reserved under the 1867 treaty.

•Enrolled tribal membership is over 20,000.

•On-reservation unemployment rate is almost 25%, with per capita income of $5,000.

•The reservation was selected by our ancestors because it had the biodiversity and spiritual significance to provide for the future seven generations of our people.

•Today, 76,347 acres or about 9%, of the original land base is held by our people, as the White Earth Tribe.

White Earth Project Participants

Minnesota Tribal Coalition Tribal Utility Capacity Building Project :

White Earth Reservation Tribal Council

Grand Portage Reservation Tribal Council

Leech Lake Reservation Tribal Council

Intertribal Council On Utility Policy

White Earth Land Recovery Project

Center for Sustainable Community Development Duluth, MN

EPAC Fargo, ND

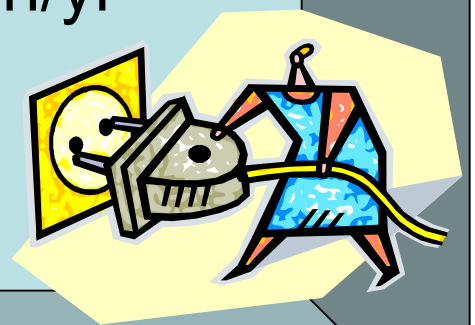
White Earth Land Recovery Project

- Largest reservation based non-profit organization in the state of Minnesota.
- Founded in 1989 with the mission of recovering the original land base of the White Earth Indian Reservation.
- Cultural preservation through language fluency and environmental and economic justice initiatives.
- Wind development work a product of this mission; recent successes include hoisting a Jacobs 20 kW tower on Diana King's property on White Earth Reservation.

Major Electricity Consumers:

- Tribal Council Building- 477,320 kWh/yr
- Circle of Life School- 464,000 kWh/yr
- Community Center- 300,000 kWh/yr
- Bingo Hall - 265,000 kWh/yr
- Casino - 14,982,000 kWh/yr
- Casino Sign - 87,000 kWh/yr
- Head Start - 36,000 kWh/yr
- Health Center - 1,700,000 kWh/yr

- Total: 18,311,320 kWh/yr
- Annual Cost: $732,453.00



Available Resources:

Solar:

- Not enough sun
- Too expensive

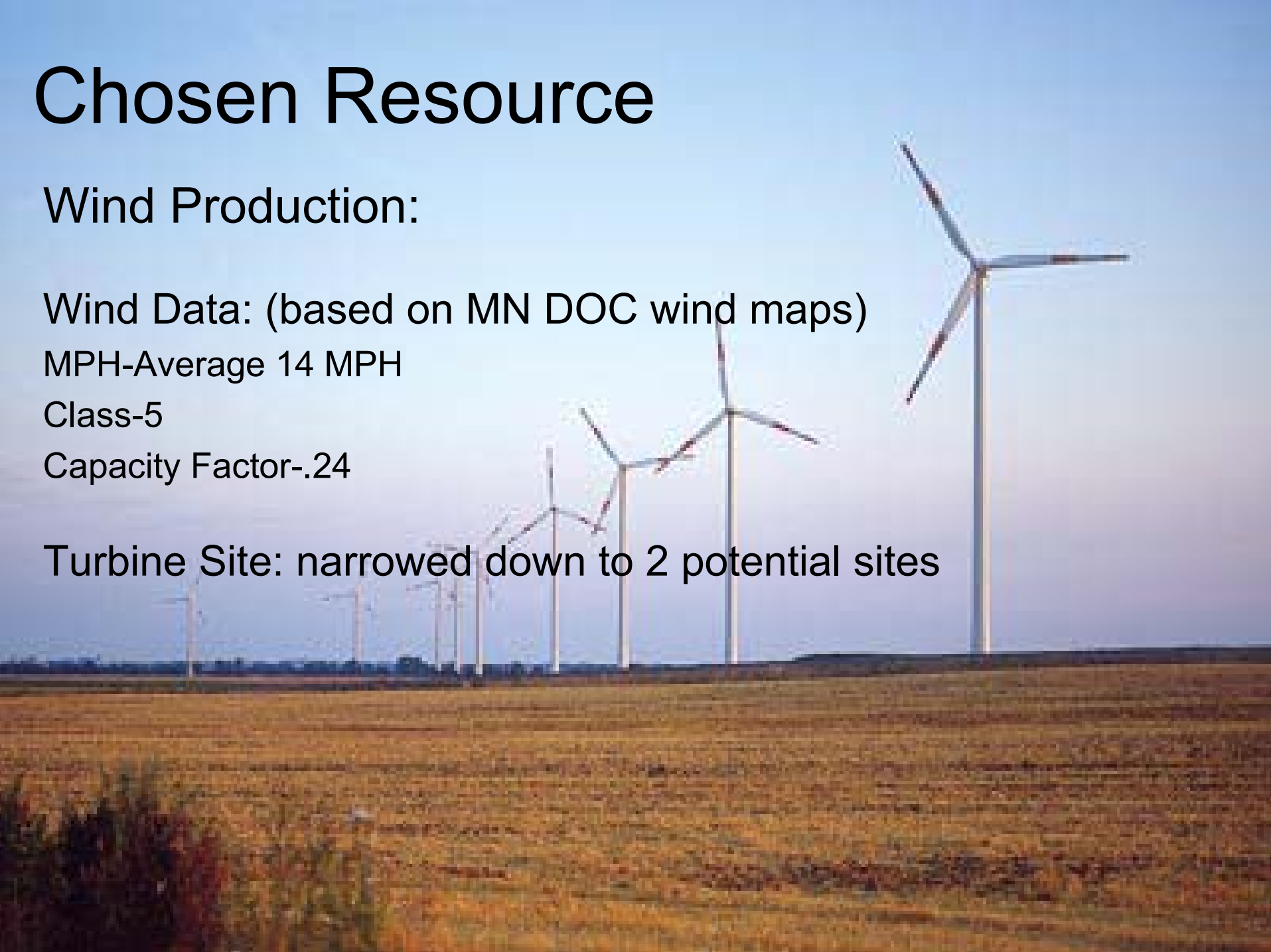
Biomass:

- Costly infrastructure (Transportation to Production)
- Creates emission (N0x, S0x, particulates, etc.)
- Could disrupt ecosystem health

Wind:

Several potential sites on tribal and non-tribal land.

Chosen Resource



Wind Production:

Wind Data: (based on MN DOC wind maps)

MPH-Average 14 MPH

Class-5

Capacity Factor-.24

Turbine Site: narrowed down to 2 potential sites

Proposed White Earth Project

- Approximately 600 kW of wind to power the new school, tribal offices, and new community center
- 20% hydrogen backup (electrolysis, hydrogen storage, and fuel cell)
- All electricity production to be consumed by the reservation
- Community Education and tribal college courses

“The Computer Model”

- Calculates wind turbine capacity required to meet any given electricity demand
- Allows users to experiment with various levels of hydrogen backup capacity: calculates required scale of electrolysis, hydrogen storage, and fuel cells
- Calculates costs associated with above system configurations
- Compares these costs with conventional electricity sources
- Software name Stella and developed by Mike Mageau from CFSCD Duluth, MN.

White Earth Model Output: 2 Scenarios

	No H2 Storage		20% H2 Storage	
	Capacity ☐	Cost	Capacity	Cost
Annual Production	1.52 million kwh		1.52 million kwh	
Wind Capacity	750 kW	$816,343	832 kW	$863,042
Electrolysis (H2)	0	$0	8.3 m3H2/hr	$132,202
Fuel Cell Capacity	0	$0	17.4 kw/hr	$102,475
Total System Cost		$816,343		$1,097,720
Annual Cost		$57,144		$87,518
Cost per kwh		3.8 cents		5.7 cents
Annual Utility cost		$73,720		$73,720
Utility Cost per kwh		4.6 cents		4.6 cents

Storing Wind Generated Electricity With Hydrogen

H_20

ELECTROLYSIS

0_2

Heat

H_2

H_2

H_2 STORAGE

H_2

PEM FUEL CELL

H_20

e-

Heat

Fuel Cell

Gen Core 5Kw fuel cell [Plug Power]

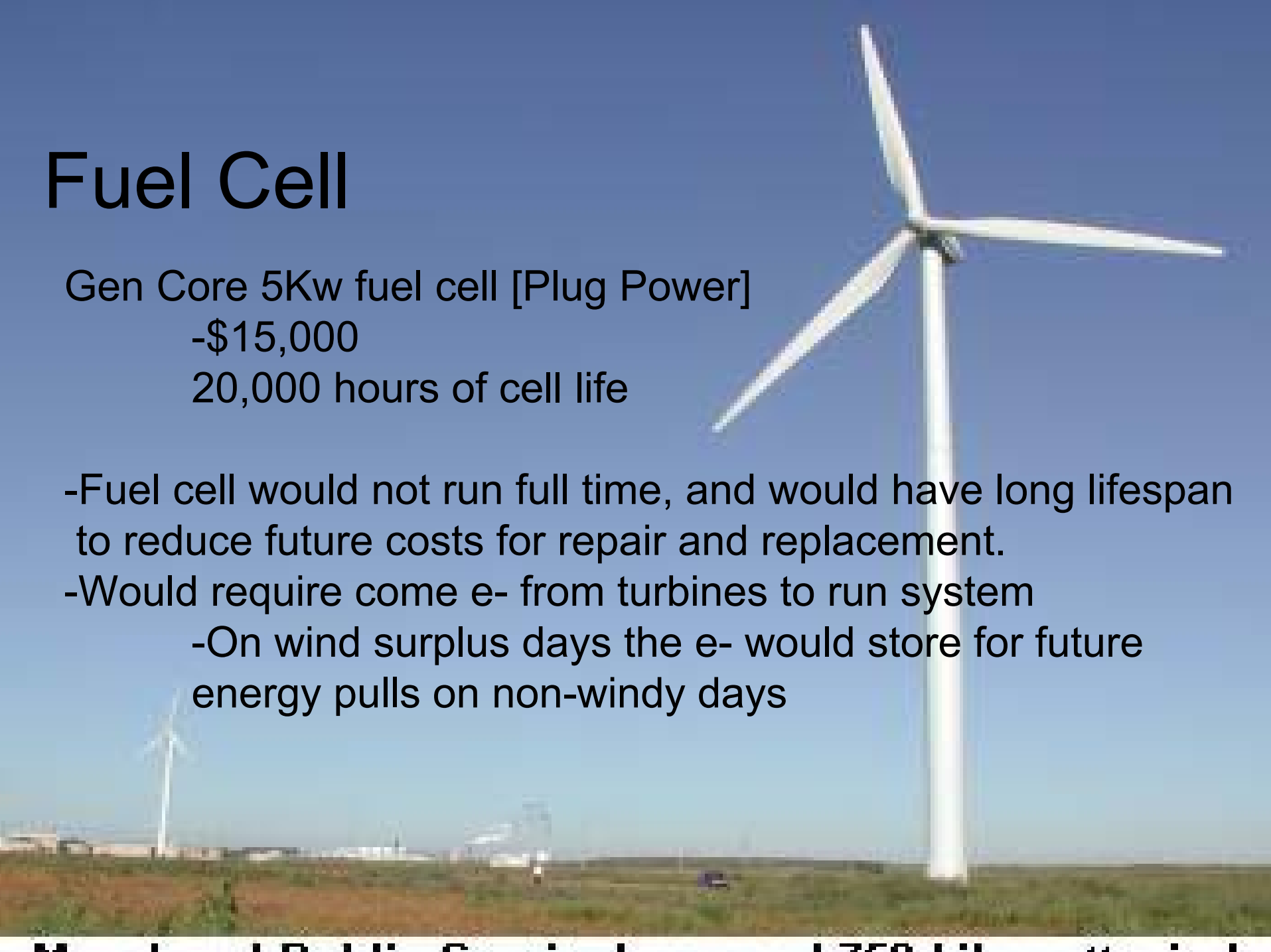
-$15,000

20,000 hours of cell life

-Fuel cell would not run full time, and would have long lifespan to reduce future costs for repair and replacement.

-Would require come e- from turbines to run system

-On wind surplus days the e- would store for future energy pulls on non-windy days



Fuel Cell

One problem with the fuel cell model is when the wind stops blowing, and we exceed the amount of energy stored in cell.

-Demand Charge could be a factor from local utility

-The charge might be 3 to 7 dollars X monthly charge

-For example a 660 Kw turbine at our casino

[our full capacity]

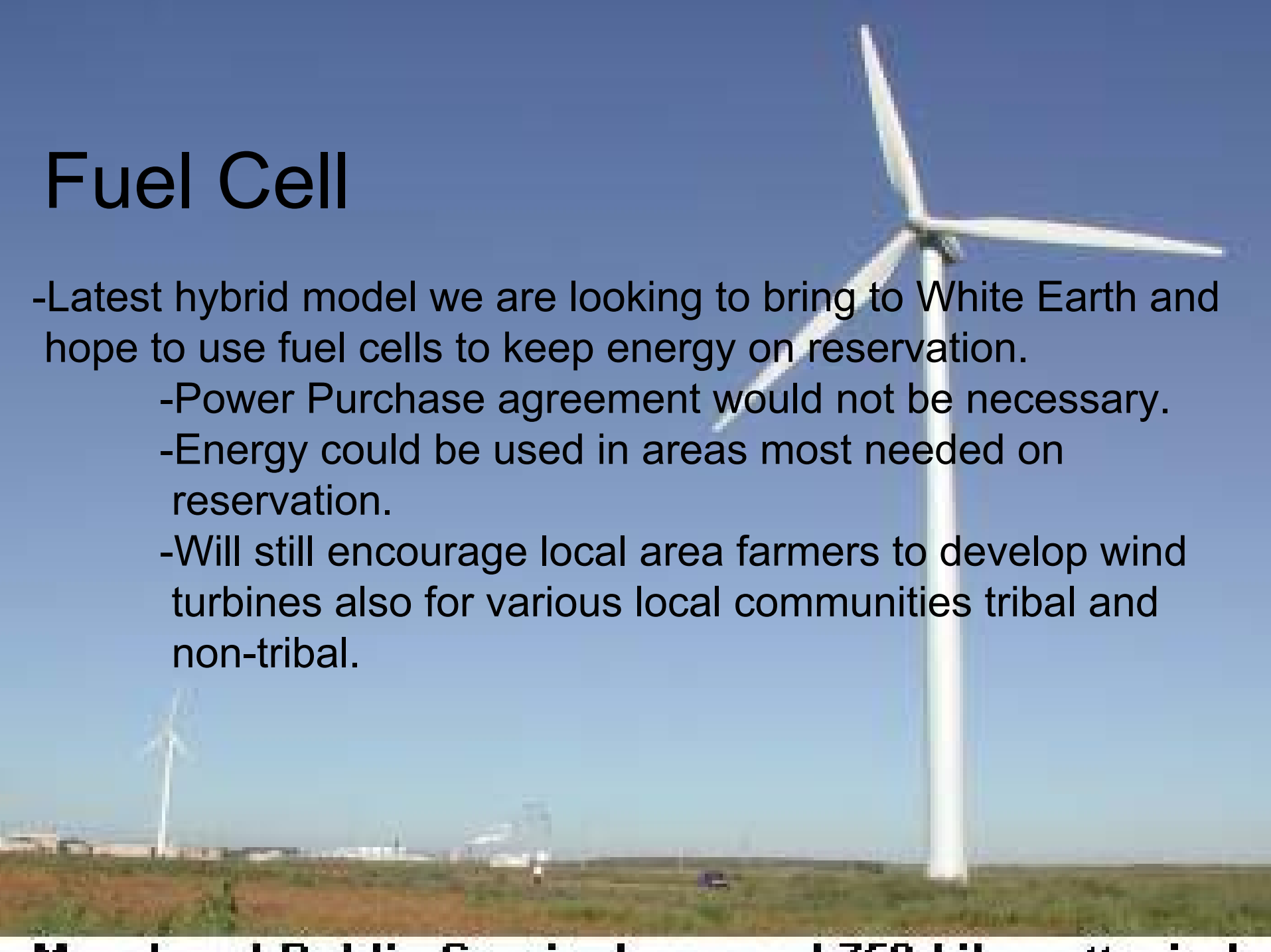
660 X 5 [estimated] = $3,300 on top of monthly bill

-Plan to develop H2 tanks and explore newest fuel cells for consumption on reservation.

Fuel Cell

-Latest hybrid model we are looking to bring to White Earth and hope to use fuel cells to keep energy on reservation.

- -Power Purchase agreement would not be necessary.
- -Energy could be used in areas most needed on reservation.
- -Will still encourage local area farmers to develop wind turbines also for various local communities tribal and non-tribal.



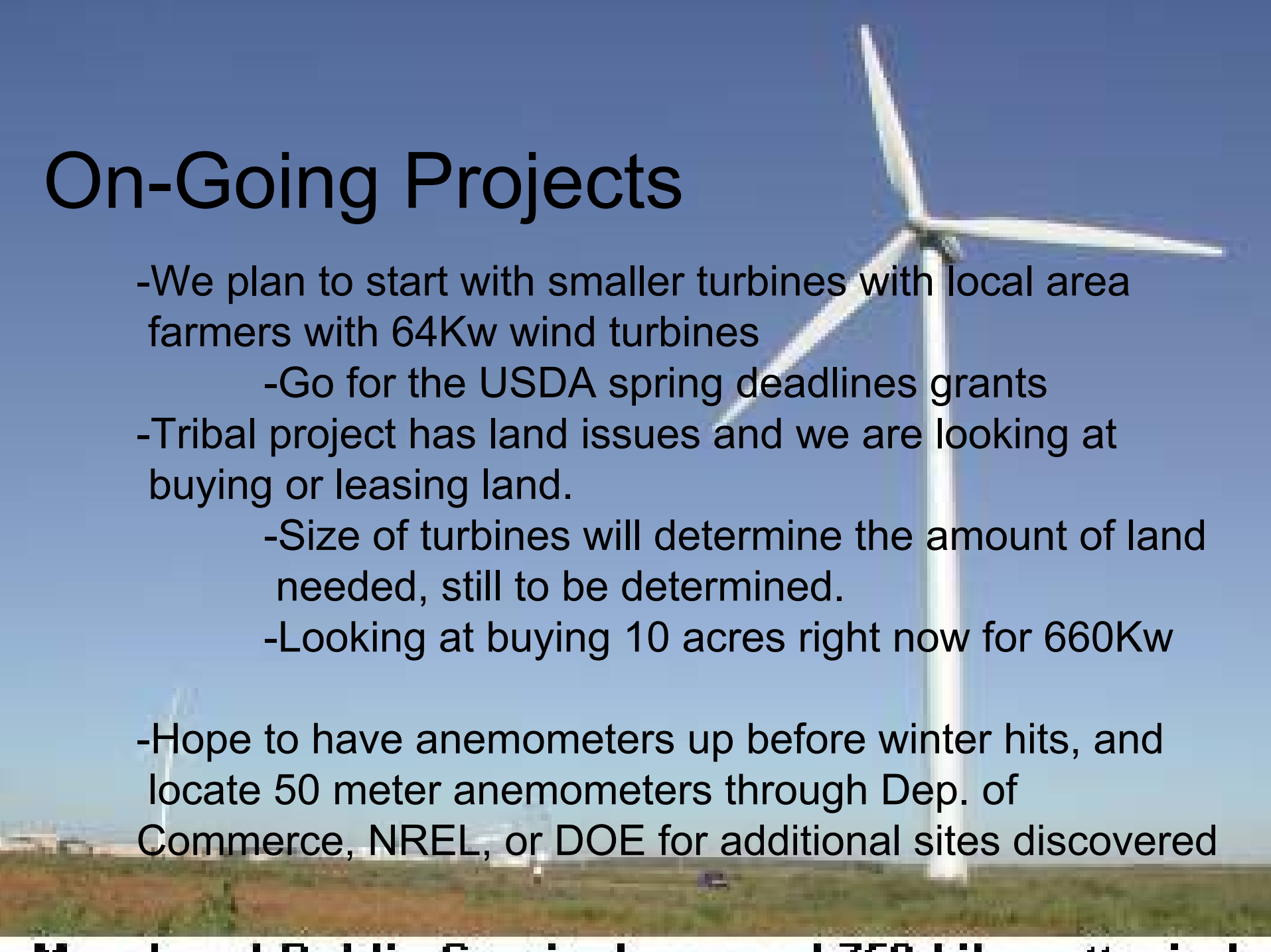
On-Going Projects

-Identified potential sites for net meters

-Jay Haley from EPAC in Fargo, ND will gather data to determine best location for resources from recent site visit.

-Planning workshops focusing in alternative energy awareness with both tribal and non-tribal members

-Community outreach to local farmers in area who own land within the reservation's borders with good sites.



On-Going Projects

-We plan to start with smaller turbines with local area farmers with 64Kw wind turbines

-Go for the USDA spring deadlines grants

-Tribal project has land issues and we are looking at buying or leasing land.

-Size of turbines will determine the amount of land needed, still to be determined.

-Looking at buying 10 acres right now for 660Kw

-Hope to have anemometers up before winter hits, and locate 50 meter anemometers through Dep. of Commerce, NREL, or DOE for additional sites discovered

On-Going Projects [solar]

-Homemade passive solar heaters for tribal elder hosing
    -White Earth Housing will supply lumber and materials
    -Teach area youth how to construct and place units

-Units - 4x10 feet, made out of 2x4, aluminum cans [black]
    -Heat will travel through a 6 inch duct work pipe with fan.
    -Can adjust heat with speed of fan.
-Cover or dismantle passive solar heaters during summer
-Very experimental at this point. Will not totally rely on these units for main source of heat.
-Very promising source of cheap winter heat.

Future Projects

-Bring a large scale tribal project to White Earth for tribal college or casino.

-On-going.

-Still doing resource assessments and education

-Once sites are selected, we will move into environmental and cultural assessments.

-Cheap energy prices make larger projects less feasible.

-Plan to consume all wind energy on reservation to skip the local energy providers on grid complications using a hybrid model with fuel cells.

Conclusion White Earth

Overall land issues and location for turbines remain to be biggest problems for developing wind turbines.

Going to start with further area farmers and community Education.

Hope to bring Tribal College energy programs to campuses

Site anemometers before winter

Leech Lake

Leech Lake

Federally recognized Beltrami, Cass, Hubbard and Itasca counties, Minnesota

Total area 602,889 acres; Tribally owned: 21,507acres

Allotted (members): 12,639 acres

State trust: 30,000 acres

Other: 507,750 acres

Total labor force: 1069

Total enrollment: 7173

Total reservation population: 3725

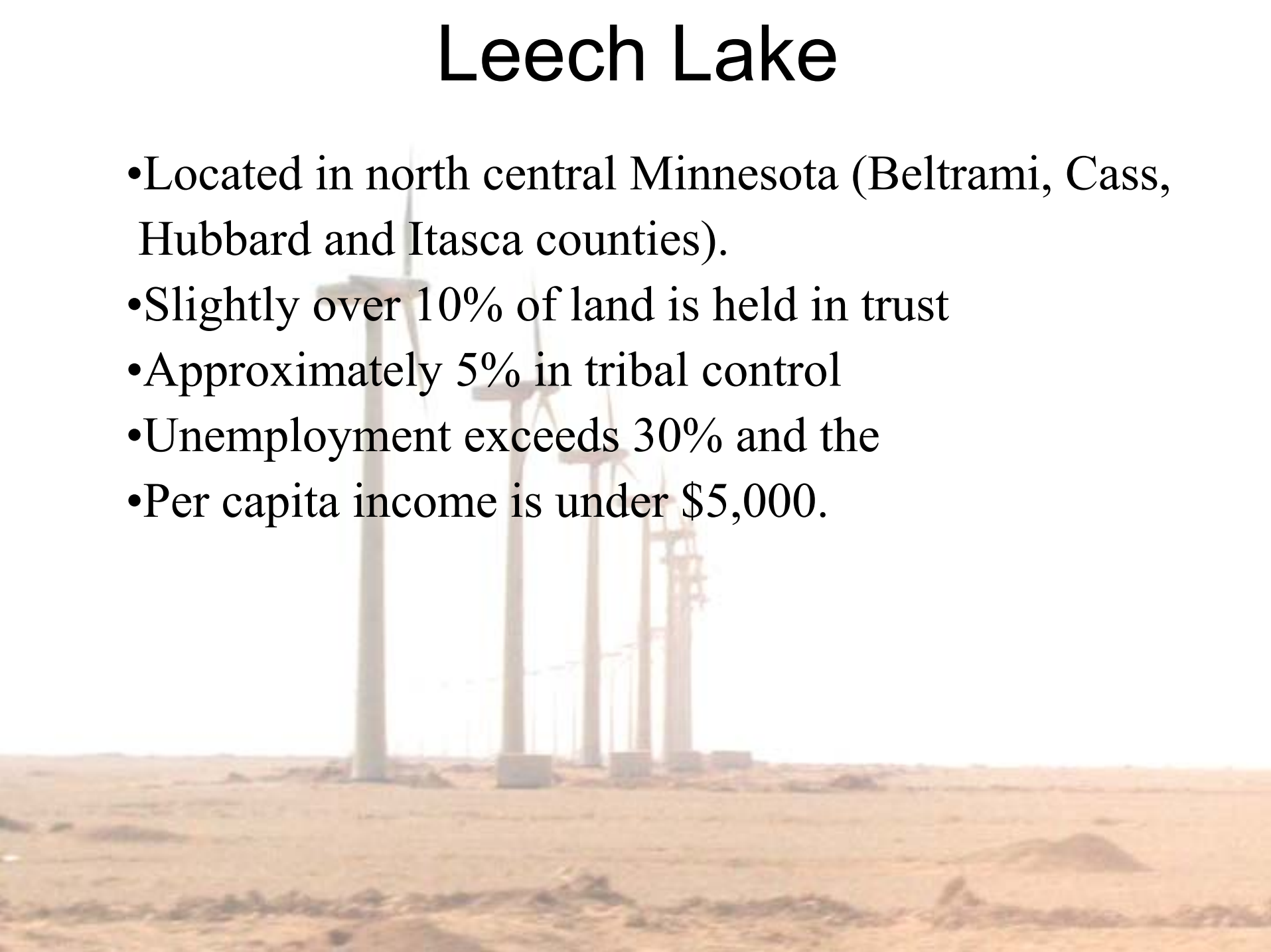
High school graduate or higher: 60.2%

Per capita income: $4705

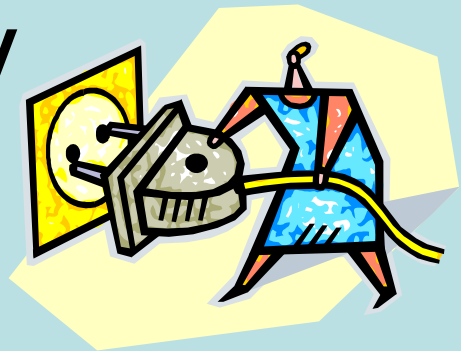
Total unemployment: 30.9%

Leech Lake

- Located in north central Minnesota (Beltrami, Cass, Hubbard and Itasca counties).
- Slightly over 10% of land is held in trust
- Approximately 5% in tribal control
- Unemployment exceeds 30% and the
- Per capita income is under $5,000.



Major Electricity Consumer:



Casino: 2002- 6,027,840 kW/H

2003- 6,427,320 kW/H

Annual Cost: $385,640.00

Available Resources:

Solar:

- Not enough sun
- Too expensive

Biomass:

- Costly infrastructure (Transportation to Production)
- Creates emission (N0x, S0x, particulates, etc.)
- Could disrupt ecosystem health

Wind:

Not yet determined

Wind Resource

Wind Production:

Wind Data:

MPH-10

Class-2

Capacity Factor-.08

Turbine Site: Several other potential sites to be explored

Storing Wind Generated Electricity With Hydrogen

H_20

ELECTROLYSIS

0_2

Heat

H_2

H_2

H_2 STORAGE

H_2

PEM FUEL CELL

H_20

e-

Heat

Proposed Project Leech Lake

- Approximately 1MW to power fraction of casino's demand
- Community Education

“The Computer Model”

- Calculates wind turbine capacity required to meet any given electricity demand
- Allows users to experiment with various levels of hydrogen backup capacity: calculates required scale of electrolysis, hydrogen storage, and fuel cells
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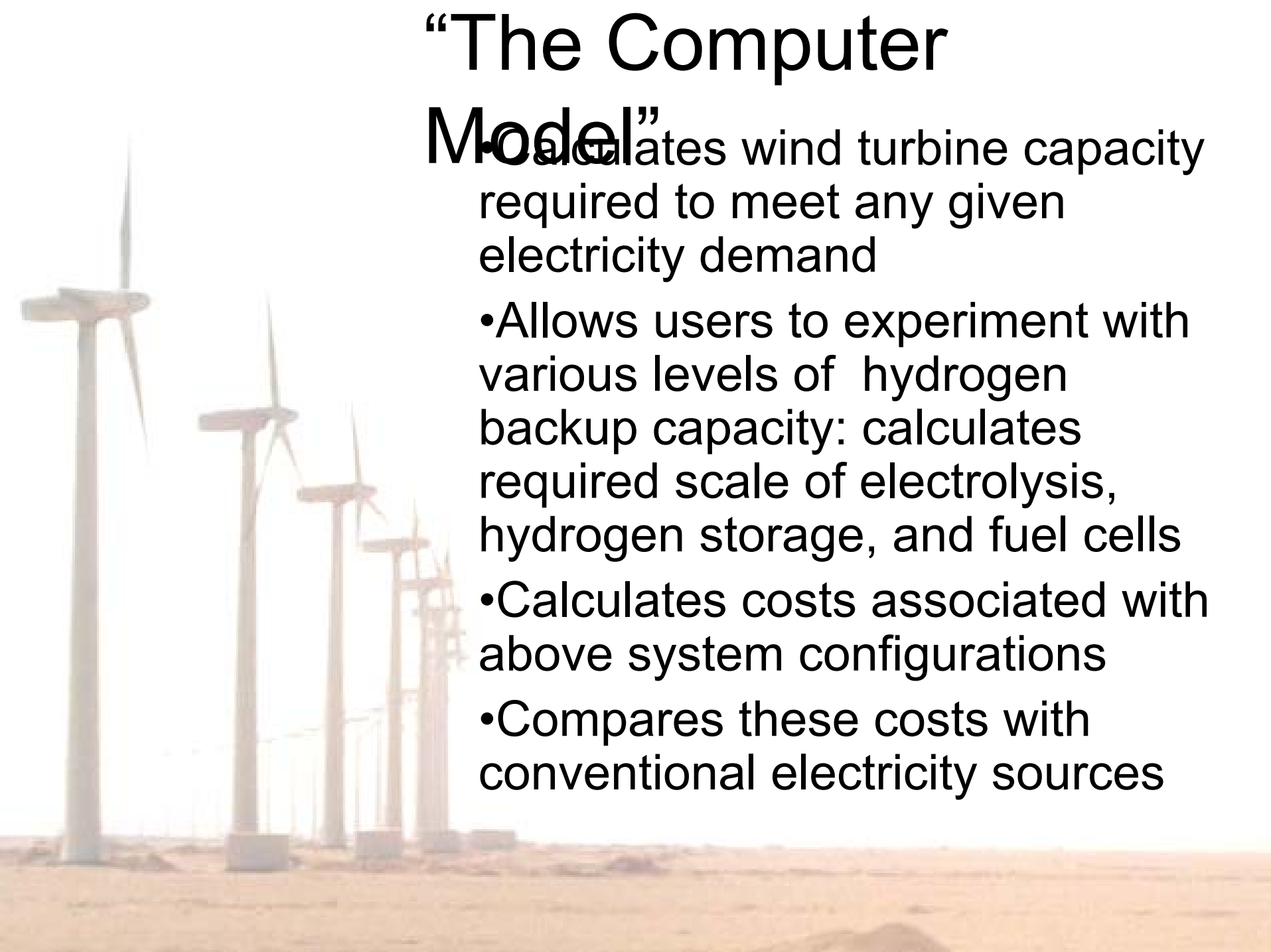
- Compares these costs with conventional electricity sources



Leech Lake Model Output

No Hydrogen Storage

	Capacity ☐	Cost
Total Annual Production	1.36 million kwh	
Wind Capacity	1000 kW	$951,959
Electrolysis Capacity	0	$0
Fuel Cell Capacity	0	$0
Total System Cost		$951,959
Annual System cost		$66,287
Cost per kwh		4.9 cents
Annual Utility cost		$82,200
Utility Cost per kwh		6 cents

Conclusion Leech Lake

-Research and look into the possibility of bringing BioMass operations to Leech Lake

-Not sure what wind options are at the present

-Early stages of assessing resource

-Hope to put up anemometer to assess wind resources

Closing Thoughts:

All three tribes are in the beginning stages for wind development.

-Next two years should see huge steps toward assessing potential sites for wind resource analyses.

-Wind sites already in our radar look to be very promising along with other alterative energies.

The co-operative vision is a great possibility for the three tribes, and we hope to bring this through extensive community outreach, education, and finally bring hybrid wind systems and bio-mass operations to Northern Minnesota communities.

Miigwitch