

# Alternative Energy Profile

»» *A Profile & Value Proposition for NW  
Ohio & SE Michigan*

March 2009

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# The Energy Problem

- ▶ **Rising Aggregate Demand**

Our aggregate energy needs, here and worldwide, only continue to increase

- ▶ **Rising Prices**

Energy comes at a high price to consumers—over \$1 trillion of U.S. GDP

- ▶ **U.S. Foreign Policy**

Greater domestic energy production in transportation fuels is a priority

- ▶ **Externalities**

These are unintended consequences, such as pollution, human health detriment, and resource depletion

- ▶ **Low-Impact Solutions**

U.S. energy needs are equivalent to one cubic mile of oil, which equals:

- 4.2 billion solar rooftops, or

- 3 million wind turbines, or

- 2,500 nuclear plants

# Opportunity

## ▶ Market Opportunity

- Rising aggregate demand: There's room in the market for innovations and new technologies
- Rising prices: Those with lower-cost solutions have potential
- U.S. Foreign Policy: Standards and incentives for domestic production and R&D
- Externalities: In 2008, we have technologies for better management of energy production
- Technology: An emerging industry that requires great innovations for higher-impact solutions

## ▶ Regional Growth Partnership

- We are technology-neutral
- We hold a realistic and pragmatic view of means for energy production
- Both alternative and “traditional” energy can employ “revolutionary” technologies

# Energy

- ▶ Energy is the ability to do work
- ▶ The energy released from almost all energy sources is converted into electricity or made into fuels that create heat or motion
- ▶ Where does energy come from?
- ▶ What forms does energy take?
  - Fuel
  - Power
  - Heat
  - Light

# Energy Sources

	Traditional Sources	Alternative Sources	Renewable Sources
F U E L	<b>Fossil Fuel</b>		
	Petroleum		
	Other Hydrocarbons		
	Coal		
	<b>Biomass Fuel</b>	<b>Biomass Fuel</b>	<b>Biomass Fuel</b>
	Wood		Wood
	Peat		Peat
		Biofuel	Biofuel
		Water	Water
		Hydrogen	Hydrogen
		Nuclear	
P O W E R		<b>Wind Power</b>	<b>Wind Power</b>
		<b>Water Power</b>	<b>Water Power</b>
		Hydro	Hydro
		Tidal	Tidal
		Wave	Wave
L I G H T		<b>Solar Light</b>	<b>Solar Light</b>
		Solar Photovoltaic	Solar Photovoltaic
		Solar Thermal	Solar Thermal
H E A T		<b>Heat</b>	<b>Heat</b>
		Geothermal	Geothermal

# Cost & Externalities

	<u>Cost</u>	<u>Externalities</u>
Coal	Low	Pollution
Petroleum	Increasing; highly price-volatile	Pollution; depletion of the finite supply
Biofuels	High; getting closer to petroleum	Pollution; nutrient depletion
Natural Gas	Increasing; highly price-volatile	Limited pollution
Nuclear	Low; but very high capital cost	Risks; depletion of the finite enriched uranium
Water	Low; siting is the major issue	Ecological destruction
Wind	Moderate; only works when windy	Unsightly and noisy
Solar	High; equipment	Nearly none; least of all energies
Hydrogen	High	Production of energy to make the hydrogen

# Specific Regional Opportunities

## ▶ Here's how to “get in the game”:

- **Production**      Alternative energy production      (wind farms, power plants, fuels)
- **Infrastructure**    Construction, installation, maint.      (solar, wind farms)
- **Equipment**      Manufacturing energy equipment      (wind turbines, biodigesters, solar panels)
- **R&D**              R&D of energy technologies      (ethanol technologies, solar technologies)

## ▶ Here's where we can “get in the game”:

### 1. Biomass

Biofuels production

### 2. Wind Power

Wind turbine equipment

### 3. Solar

Solar module equipment

Solar technology research and development

# Biomass



## ► Definition

Biomass: An organic material, taking the form of plant or animal life

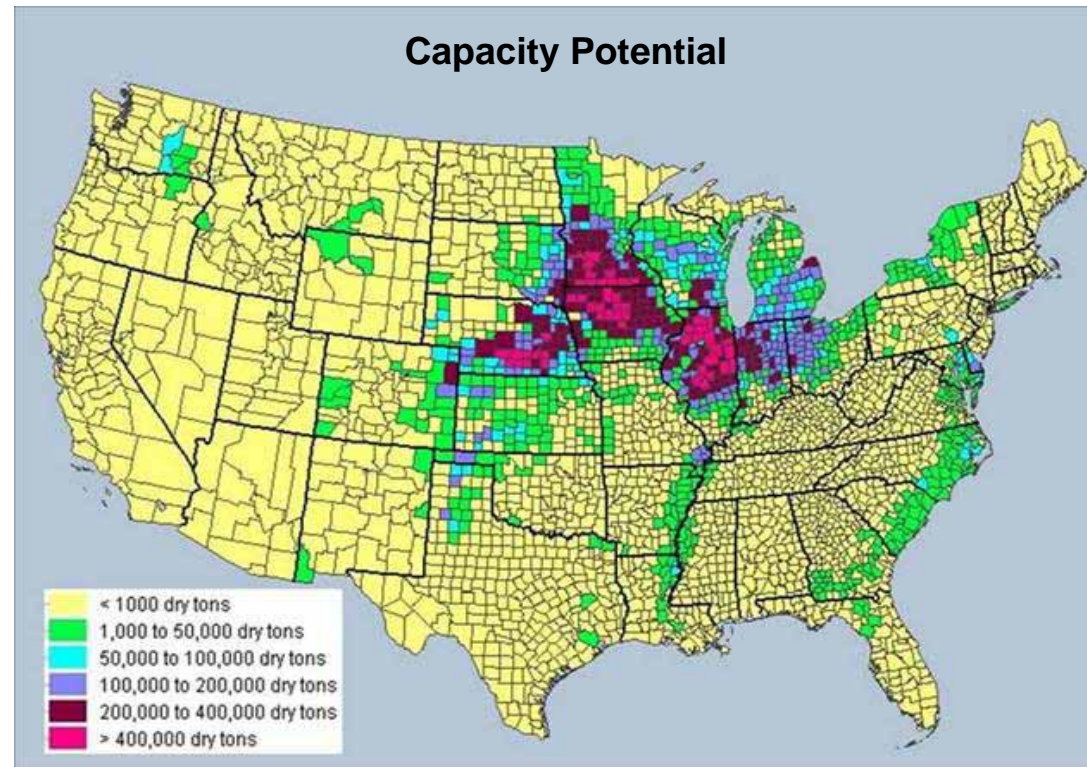
Biomass Fuel: An organic material containing stored energy from the sun that is burned directly or refined into combustible gas or liquid fuels

## ► Statistics

4.5% of U.S. energy production;  
1.3% of U.S. electricity production

84% of biomass-derived energy is used by the logging and milling industry to create steam and electricity for its own purposes

**\$179,263,000** (2008) Congressional funding request for research



Map credit of Iowa State University, Robert C. Brown, 2006

# Biomass

## ▶ Strengths

- Great abundance, low cost
- Can be used directly (burning of wood or solid waste) or refined into various fuels
- Can be a substitute or additive to fossil fuels
- Can support self-sufficient rural electrification (on large farms)

## ▶ Weaknesses

- Transportation cost—not near harvest locations
- Only marginal environmental relief
- Only feasible where very large amounts exist

## ▶ Market Opportunities

- Energy Act of 2005—ethanol and cellulosic ethanol production
- Biodiesel fuels—high diesel prices
- large farm self-sufficient electricity

## ▶ Regional Opportunity: Biofuels Production

- Abundant biomass resources—agriculture and food processing industry byproduct
- Landfills to create biogas (methane)
- An emerging industry presence in biofuels: American Ag Fuels, The Andersons Marathon Ethanol, PEC Biofuels, POET Biorefining, etc.

# Wind



## ► Definition

Wind: An air current produced by the differential heating of the atmosphere by the sun, rotation of the planet, and planet surface irregularities

Wind Power: The harnessing of air currents to produce motion that drives electrical generators

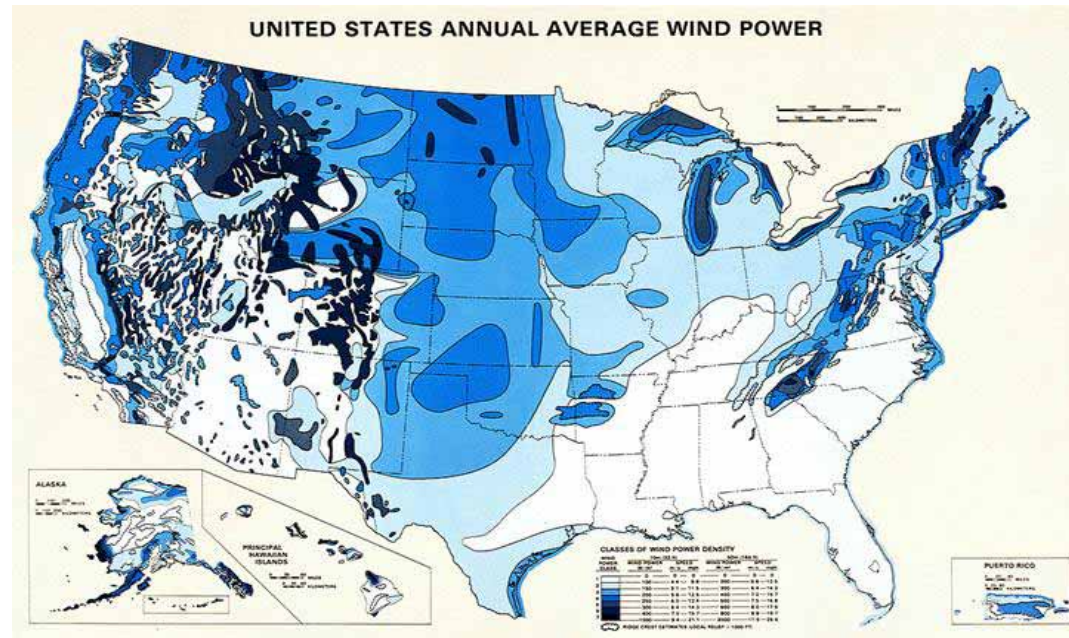
## ► Statistics

0.44% of U.S. electricity production

**\$40,069,000** (2008) Congressional funding request for research

The U.S. is among the top four countries in the world for wind power capacity and has set a goal of producing 20% of the nation's electricity from wind power within the next 20 years

## Wind Power Potential



# Wind

## ▶ Strengths

- Emission-free
- The higher the capacity utilization, the more efficient and less expensive it becomes


## ▶ Weaknesses

- Siting is essential
- Noise and unsightliness (“Not in my yard”), including zoning and siting regulations
- Prone to damage from severe weather
- Turbine availability
- Wind areas are mostly in remote locations—access to power grid and infrastructure needs

## ▶ Market Opportunities

- Farm, commercial, and small industrial off-grid (50% growth in 15 years)
- Wind diesel for rural communities (26% growth)
- Small-scale community wind projects (23% growth)
- Residential on-grid (22% growth)

## ▶ Regional Opportunity: Wind Turbine Equipment

- Ideal location for manufacturing and shipping
  - A well-suited workforce
  - Materials development nearby
  - A great Ohio supply chain for wind components
- 

# Solar

## ► Definition

Solar Light: Photon particles from the sun

Solar Power: The harnessing of light particles (photons) to excite electrons in a photovoltaic material for producing electricity or to generate heat for space heating or to drive electrical generation equipment



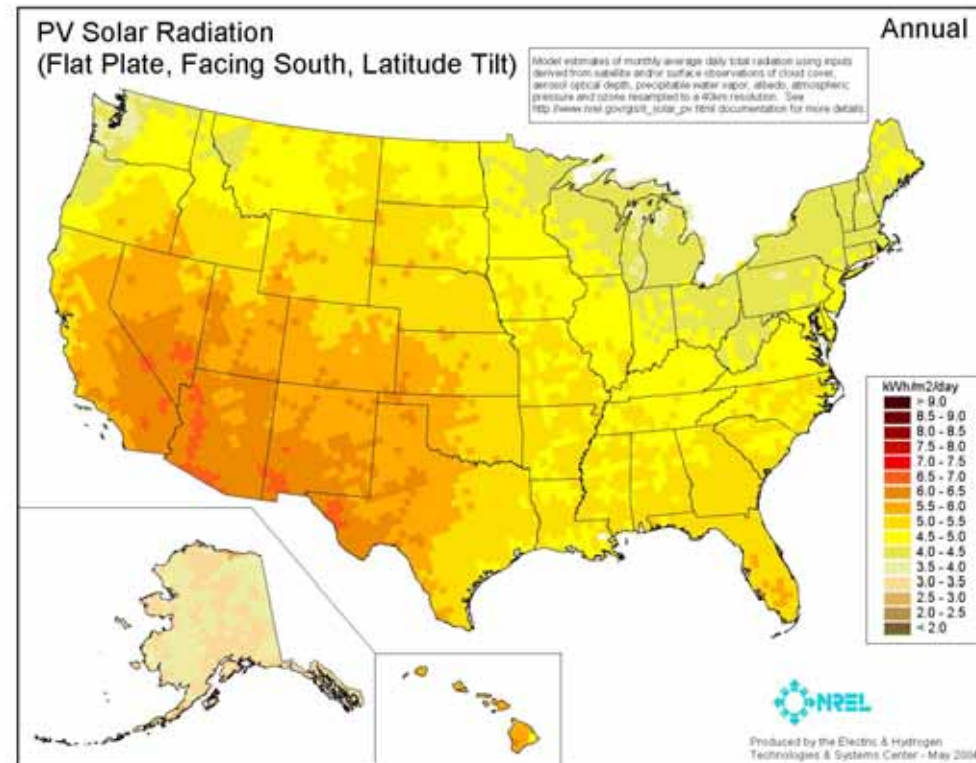
## ► Statistics

0.01% of U.S. electricity production

**\$148,304,000** (2008) Congressional funding request for research

Global sales for photovoltaic solar have been increasing about 25% every year since 2003

## Solar Power Potential



# Types of Solar

## ▶ Solar Photovoltaic

- Coatings are applied to various substrates (rigid or flexible) to generate electricity
- Two types of coatings:

### 1. Crystalline

- Rely on silicon and have the highest energy conversion efficiencies (tested up to 25% efficiency)
- 3 kinds: polycrystalline, monocrystalline, and ribbon silicon
- Account for 93% of market share

### 2. Thin-Film

- Amorphous silicon (tested up to 12% efficiency)
- Cadmium telluride (tested up to 12% efficiency)
- Account for 7% of market share

## ▶ Solar Thermal

- Panels absorb infrared light to create heat that can drive electrical generation equipment, air turbines, etc.

## ▶ Major Players

- Japan and Europe are the major suppliers of solar modules (76% of market)
- By demand, in 2006 Europe purchased 51% of solar modules, Japan 22%, and the U.S. 11%

## ▶ Leading Solar Manufacturers by Market Share

Sharp: 22%   Q-Cells: 12%   Kyocera: 9%   ...and locally, First Solar: 3%

# Solar

## ▶ Strengths

- Emission-free
- Government incentives and subsidies
- Can be used for commercial and residential, and grid-tied and off-grid

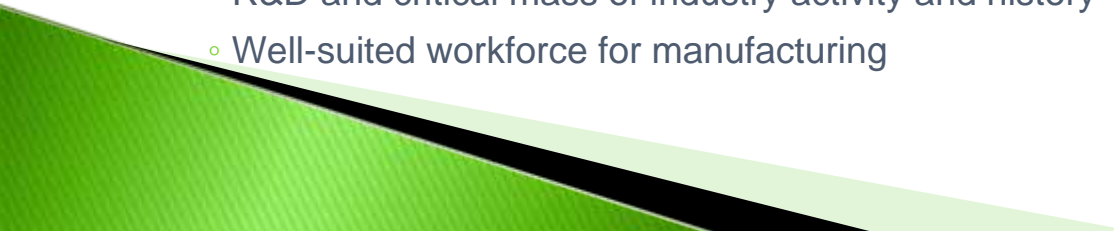
## ▶ Weaknesses

- Poor capacity utilization in cloudy areas; Especially in the Great Lakes and Northeast U.S.
- Inadequate battery technologies—for remote electrical storage (off-grid)
- Thermal solar does create a minor net heat gain for the planet
- Total system cost remains very high
- Proper installation and system engineering is still a challenge

## ▶ Market Opportunities

- Remote industrial
- Remote habitation
- Grid-connected (86% of installations)

## ▶ Regional Opportunity: Solar Equipment and R&D

- Research and development capability—private sector and University of Toledo
  - Location
  - R&D and critical mass of industry activity and history
  - Well-suited workforce for manufacturing
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# Ohio Alternative Energy Portfolio Standards

Detailed in Ohio Senate Bill 221, calling for a 2025 energy production benchmark of:

- ▶ 12.5% for Advanced Energy (e.g., clean coal, nuclear, fuel cells, etc.)
- ▶ 12.5% for Renewable Energy
- ▶ 0.5% exclusively for Solar

As well, the bill mandates that utilities must produce at Ohio plants at least half of the alternative energy-derived electricity, gases, and other fuels mandated by these Ohio alternative energy standards...the remainder can be produced in other states and delivered by the utilities to Ohio customers.

# Value Proposition

## Alternative energy sources

- (1) will become increasingly cost-effective,
- (2) have fewer and diminished externalities,
- (3) require industry growth, and
- (4) will benefit from assets and innovative efforts in Northwest Ohio and Southeast Michigan for biomass, solar, and wind.

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