Climate Change Challenges and Opportunities:

Perspectives of a Regional Organization

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Great Lakes Commission

Impact of Climate Change on the Great Lakes Ecosystem – A NOAA Science Needs Assessment Workshop to Meet Emerging Challenges

July 29-31, 2008

Outline

- Energy
- Aquatic Invasive Species (AIS)
- Resiliency
- Role of NOAA in Informing Policy.

Clean energy in the Great Lakes region

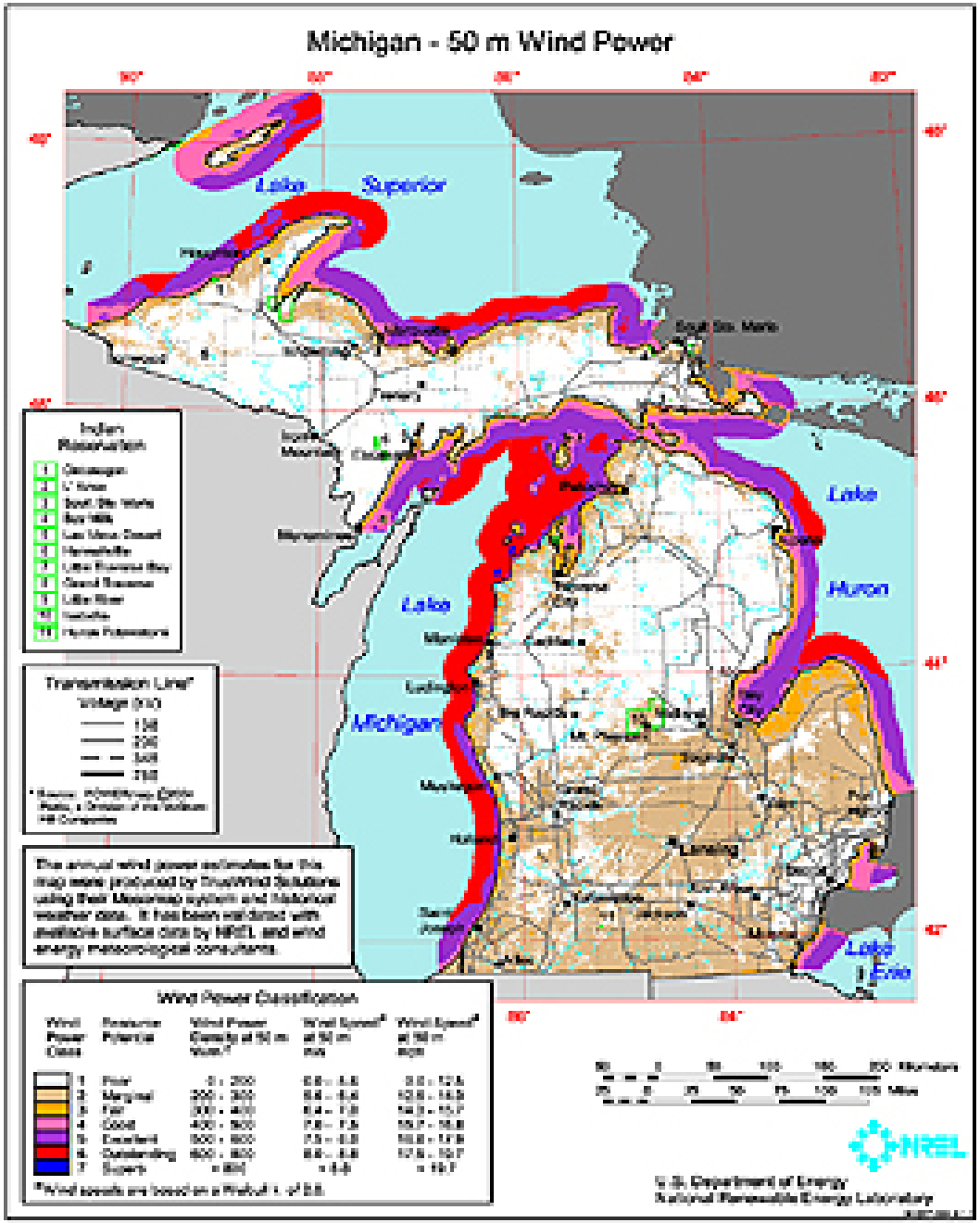
❖ Climate change creates an opportunity for clean ener

❖ Clean energy investment can spark an economic recovery in the region

- Manufacturing wind turbines
- Reducing oil and natural gas consumption
- Creating new high-profile jobs
- Cutting electricity use

❖ Benefits of clean energy:

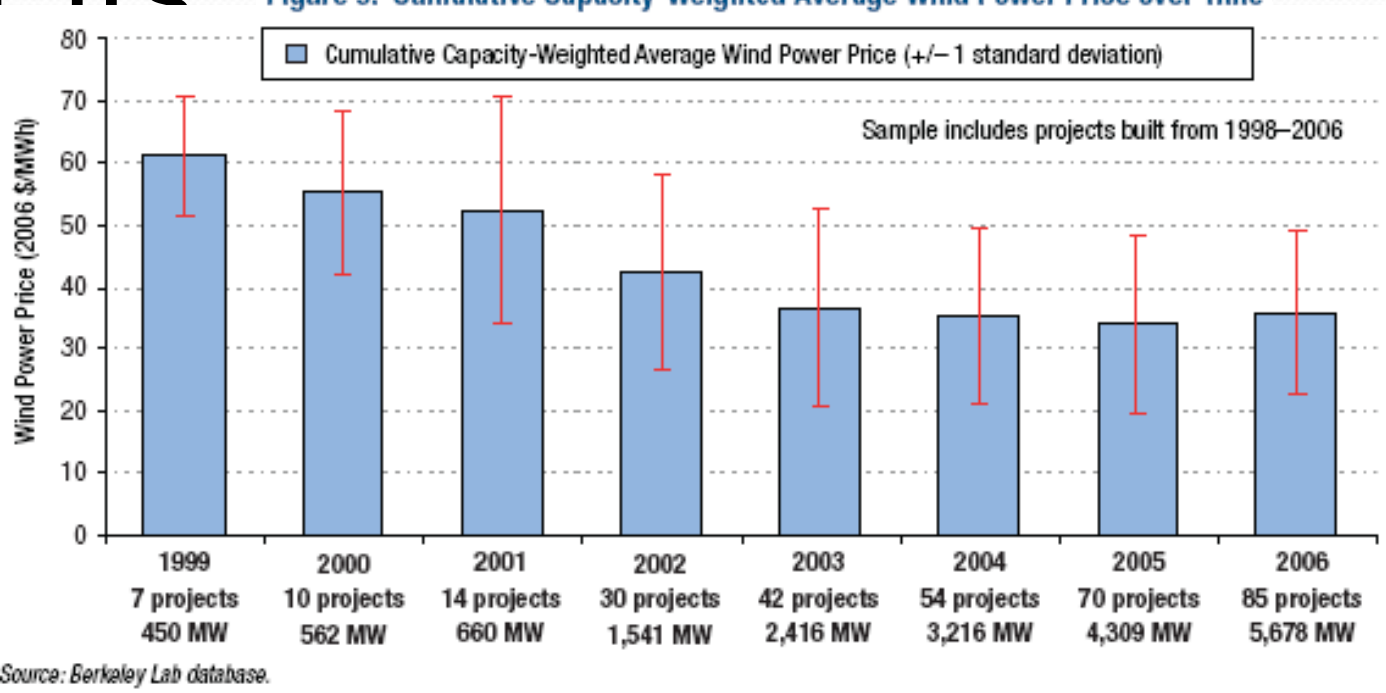
- Reduces CO_2
- Increases energy independence
- Improves energy


Michigan - 50 m Wind Power
Lake Superior
Lake Huron
Lake Michigan
Lake Erie
Indian Reservation
Transmission Line*
Voltage (kV)
Wind Power Classification
Wind Power Class
Resource Potential
Wind Power Density at 50 m W/m²
Wind Speed* at 50 m mph
Wind Speed* at 50 m m/s
Poor
Marginal
Fair
Good
Excellent
Outstanding
Superb
*Wind speeds are based on a Weibull k of 2.0.
This annual wind power estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.
Miles
Kilometers
NREL
U.S. Department of Energy
National Renewable Energy Laboratory

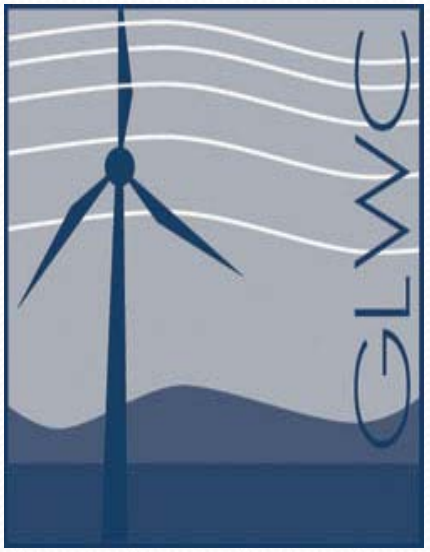
Energy

Wind energy is the **fastest growing source of energy in the U.S.**

Fuel	Costs cents/ kWh in 1996		
Coal	3.3 - 5.5	**Wind (without PTC)**	**4.0 - 6.0**
Gas	3.9 - 6.0	**Wind (with PTC)**	**3.3 - 5.5**
Hydro	5.0 - 11.3		
Biomas	5.8 - 11.6		



Great Lakes Wind Collaborative



- *Created in December 2007*

…to build consensus, identify and address issues affecting the planning, development, and operation of wind power facilities in the Great Lakes region.

- *All 8 Great Lakes States and Ontario and Quebec*
- *Facilitated by the Great Lakes Commission*
- *All major stakeholders: the wind industry, utilities, government, conservation NGOs, etc.*

- *Structure: Steering Committee > Advisory Committee > 5 workgroups:*
  - *Economic development, Environmental Planning, Siting and Permitting, Offshore Wind & Atlas, Transmission*

Research needs

Clean energy

• Large deployment of biogas, biomass, solar, wind, etc. will impact their surrounding environment.

NOAA`s role – help provide consistent & comparable data across the Great Lakes region

Wind

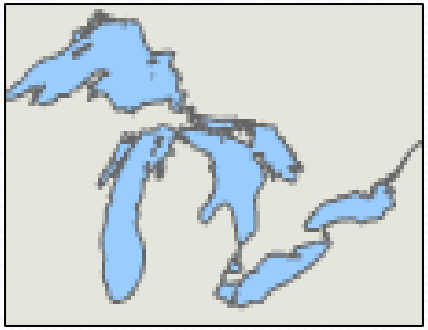
• *Siting, permitting and environmental planning issues*
• *Climate change impacts on future wind patterns and speed*

Underwater turbines

• *Riverine and tidal turbines impacts on the aquatic near-shore environment, lake levels, flows*

AIS

HOW CLIMATE CHANGE WILL INCREASE THE RISK OF INTRODUCTIONS, SPREAD AND ESTABLISHMENT OF NEW AND EXISTING AIS?

OTHER REGIONS → **AIS** → 

GREAT LAKES REGION

- **Overseas**
- **Southern regions**
- **Other US regions**

VECTORS

Recreational activities

Organisms in trade

Maritime Commerce

Aquaculture

Canals and waterways

Research needs on new AIS:

- Identify potential invasive species coming from regions with the same or a similar set of environmental characteristics:
  - Overseas (Baltic Sea, Caspian Sea, etc.)
  - Southern countries
  - Southern U.S. (Chesapeake Bay, Gulf of Mexico)
- Measure the probability of introduction and spread through different vectors caused by temperature increases, flooding, seasonal changes.
- Research efficient technologies and mechanisms to prevent the introduction/spread of new invasive species.

Research needs on new AIS: Focus on prevention

PREVENTION & ADAPTATION

OTHER REGIONS → **AIS** → **GREAT LAKES REGION**

- Identify new AIS donor regions
- Characterize those regions
- Identify vectors and pathways

- Identify new species
- Risk assessment frameworks
- Characterize vectors per species
- Measure the new frequency of invasions

What type of impacts new AIS will have on :

- Human health
- Receiving ecosystems
- Native species
- Commercial activities
- Recreational Activities

↑

NEW VECTORS

Aquaculture : Will flooding and extreme weather event will increase escapes probability?
Organisms in trade: Will new tropical species survive over winter?

Resilience and Adaptation

Resilience is the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. (UN/ISDR)

Adaptation is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. (IPCC TAR, 2001 a)

Expected climate change impacts:

- Increased temperature
- Water levels variation
- More extreme weather even
- Increased precipitation

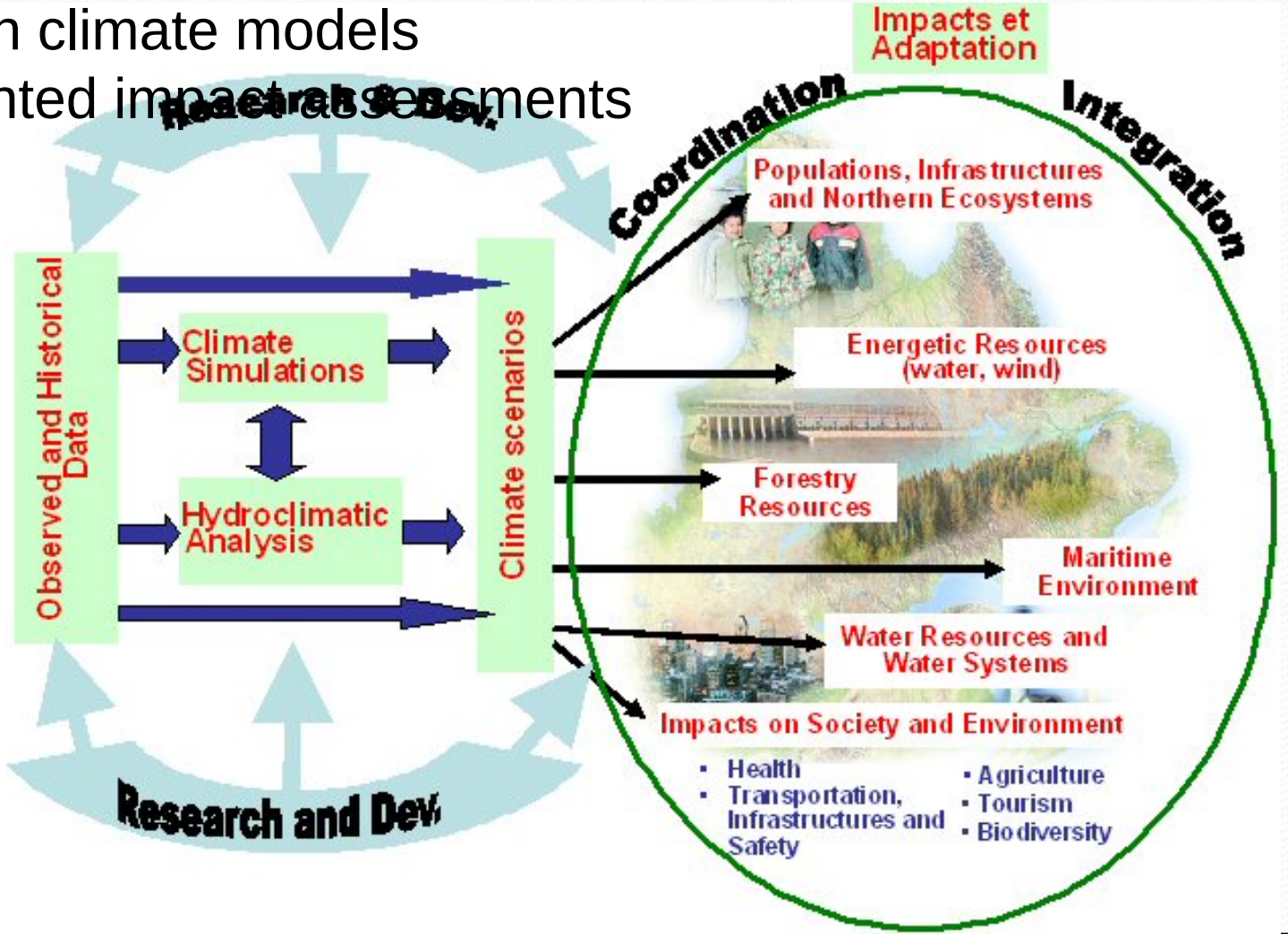
Indirect repercussions of climate changes:

- Coastal development and vulnerabilities
- Longer shipping seasons and increase risks of AIS introduction and spread.
- Longer touristic season and increase water demand
- Multiplied flooding and increased polluted runoff

Research needs:

- Understanding of direct *and* indirect impacts of climate change
- Scale-down climate models
- Sector-oriented impact assessments

Ouranos Consortium



Human Changes to Lakes Michigan-Huron Water Levels

Regime Change	Date	Estimated Effect on Lake Huron Water Level (inches)
20-foot Navigation Channel Dredging	1855 to 1906	-4.0 to -9.5
Removal of Shoal – St. Clair Flat	1906	-0.5
Sinking of Steamers Fontana and Martin	1900	+1.5
Sand and Gravel Mining	1908 to 1925	-3.5
Dredging 25-foot Navigation Channel	1930 to 1937	-2.0
Dredging 27-foot Navigation Channel	1960 to 1962	-5.0
NET EFFECT	**1855 to 1962**	**-13.0 to –18.0**

NOAA's role

Provide a relevant and sound science basis that will inform policy to build regional and local capacity for Resiliency, adaptation

NOAA could:

- Become a clearing house for climate change models
- Provide scaled-down regional and local climate information
- Provide sector-oriented impact assessments
- Conduct case studies of coastal adaptation and resiliency