



Wind Energy and Society

Hard Bop and Cool Jazz

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Wind Energy and Society: Hard Bop and Cool Jazz

Bonnie Ram

Guest Scholar and Senior Researcher

**Roskilde, Denmark. DTU Wind Energy Department
June 25, 2014**

OUTLINE

- ✦ **My education & work experience**
- ✦ **Lessons learned from wind energy (2001-present)**
- ✦ **Recent research topics**
- ✦ **What I hope to accomplish at DTU?**

Bonnie Ram

- Family Roots in Montreal, Canada and Miami, FL
- Clark University, M.A.
- Groundwater contamination & legal frameworks (thesis)
- Development & natural resources, Energy planning
- Beijer Institute (Swedish Academy of Sciences) – Zimbabwe (book series)
- WRI – Policy & environmental research on sub-Saharan Africa
- FAS Fellowship – campaign to stop plutonium production for weapons
- Moved to consulting world: federal government agencies- Department of Energy
 - EIA and consent processes
 - Nuclear waste management
 - Public engagement

Bonnie Ram

- Consulting firms 20+ yrs.
- 2001-2010. NREL & the DOE's Office of Wind & Hydropower Technologies
- Environmental and social sciences & regulatory frameworks related to land-based and offshore wind energy, wave & tidal power
- NREL's Large Scale Offshore Wind Power in the U.S.: Assessment of Opportunities and Barriers (with W. Musial)
- DOE's 20 Percent Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply (co-manager)
- An Integrated Risk Framework for Gigawatt Scale Deployment of Renewable Energy (author)
- IEA Offshore Wind Annex (2004)

Bonnie Ram

- University of Delaware – Sr. Research Scientist
- Associate Director, Center for Carbon-free Power Integration
- 4 winning DOE grants (offshore wind)
- Won National Science Foundation grant - Risk and uncertainty analyses for offshore wind siting
- Ram Power, L.L.C.
- Formed new Mid-Atlantic stakeholder wind coalition
- Strategic planning for regional marine spatial planning
- Chair of AWEA R&D Subcommittee on Offshore Wind
- Co-authored 2 articles – energy transformation

What have I learned?



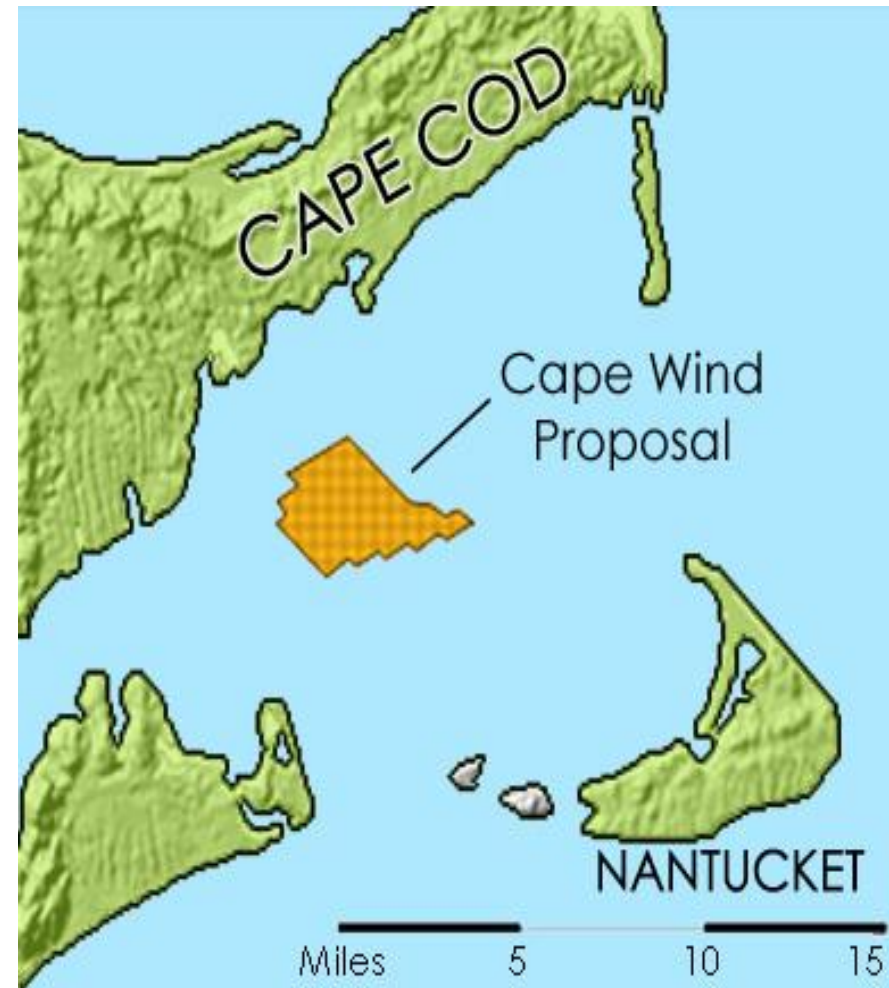
- Importance of mentors & colleagues
- Broad learning leads to interdisciplinary views
- Decisions are local ultimately
- DC is an amazing laboratory for national policy making
- We work too many hours in Washington, DC
- One horse town!
- Great jazz clubs!
www.twinsjazz.com
- <http://www.bohemiancaverns.com>

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- ✦ My education & work experience
- ✦ **Lessons learned from wind energy, wave/tidal power (2001-present)**
- ✦ Recent research topics
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How it all began.....Cape Wind Nantucket Sound

- First permit filed (2001)
- 130 turbines – about 468 MW
- About 24 square miles
- MET tower installed (2002)
- Draft EIS - Nov. 2004
- Well-funded and high profile opposition



Cape Wind Lessons Learned

- Institutional changes with regulatory agencies
- Need third party, credible scientific information
 - Incorporate EU findings
- More information does not create public support or trust
 - Public opinion is evolving
 - Discuss in public forum before siting decisions are made
- Collaborative siting process is needed

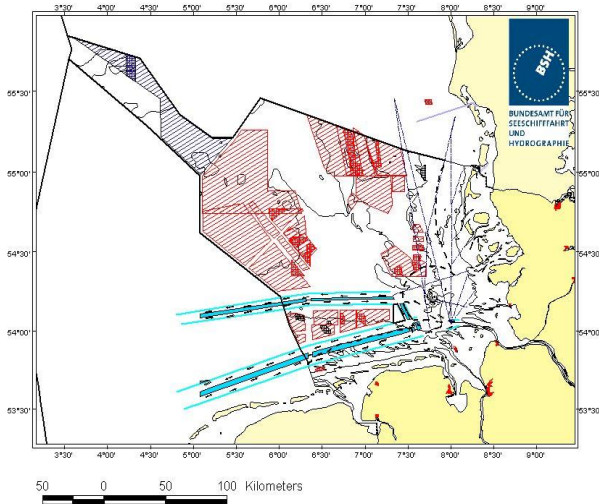


**179 feet installed at
Horseshoe Shoal**

Europeans are Planning on a National Scale

Germany

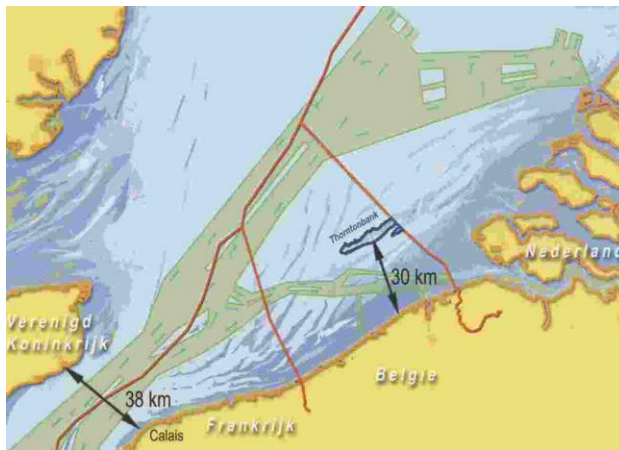
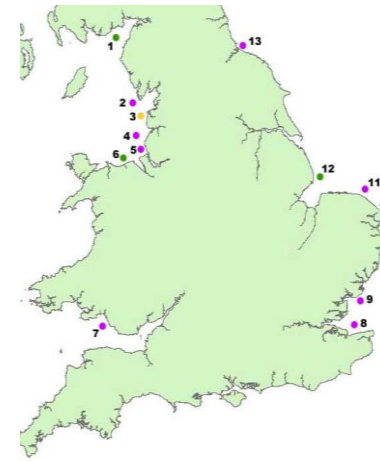
Nordsee - Offshore-Windparks



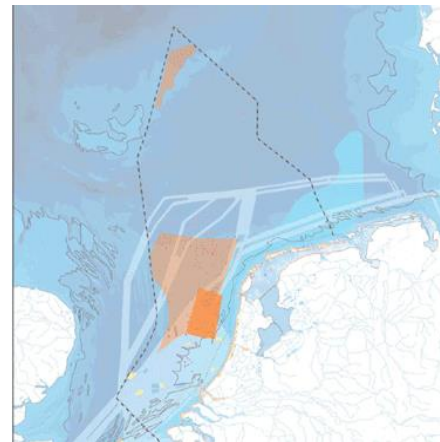
Denmark



Great Britain



Belgium



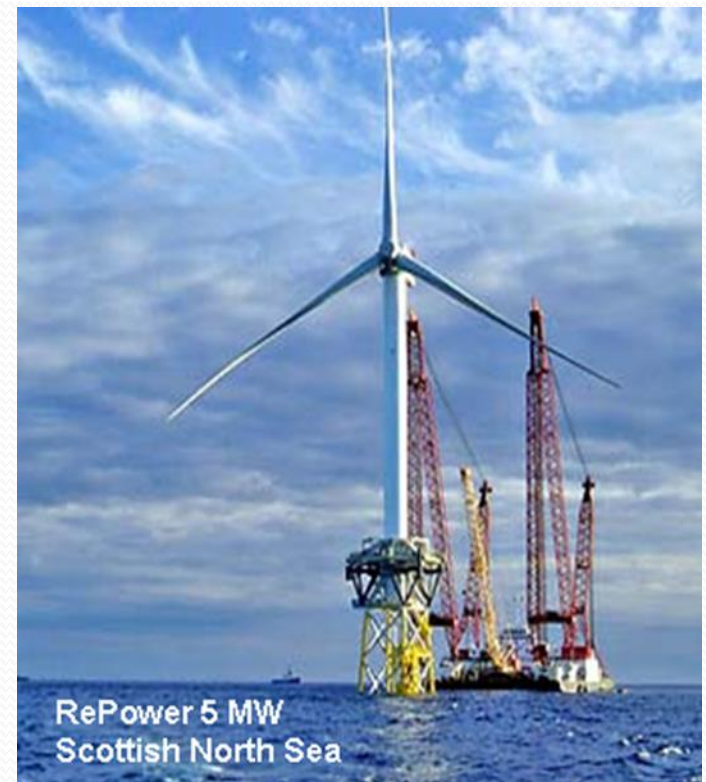
Netherlands

Environmental Risks & Benefits (physical/biological)

- Seabed sediments
- Scour pits
- Riparian and coastal processes
- Seabed contamination
- Water and air quality
- Protected sites and species
- Benthic ecology
- Fish and shellfish/
Fisheries
- Birds
- Marine mammals and bats
- Cables and pipelines
- Military activities
- Disposal areas
- Electronic and magnetic fields
- Onshore grid connection
- Noise and vibrations
- Cumulative risks
- Climate change
- Decommissioning

Human Risks & Benefits

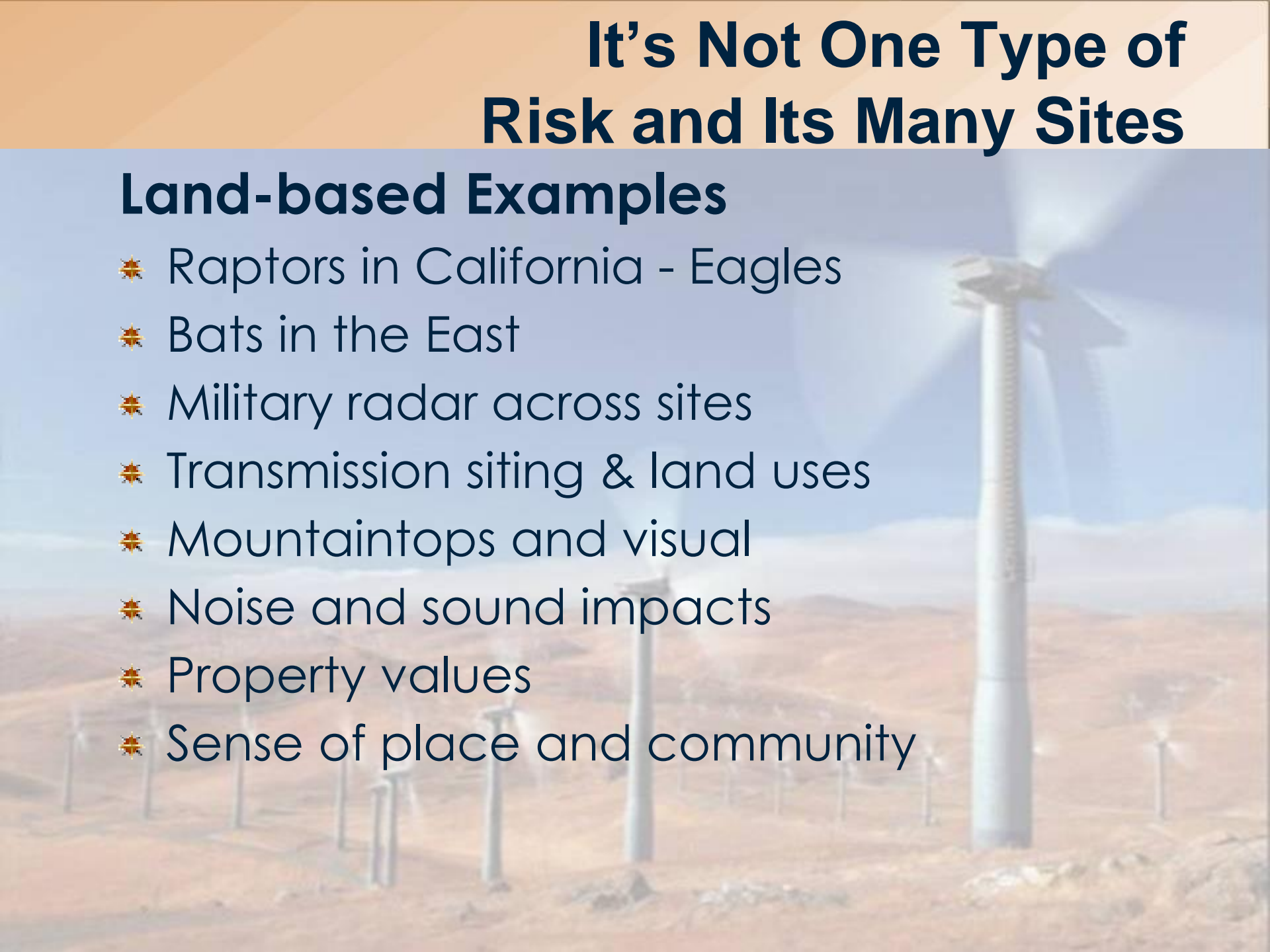
- Worker health and safety
- Integrity of shoreline communities
- Tourism and recreation
- Aesthetics
- Cultural/historic views
- Property values
- Conflicting uses/accidents
- Shipping and navigation
- Noise
- Radar/radio disturbances (military/commercial uses)
- Transmission lines
- Electromagnetic fields
- Marine archaeology
- Cumulative risks (e.g., air quality)



It's Not One Type of Risk and Its Many Sites

Land-based Examples

- ✦ Raptors in California - Eagles
- ✦ Bats in the East
- ✦ Military radar across sites
- ✦ Transmission siting & land uses
- ✦ Mountaintops and visual
- ✦ Noise and sound impacts
- ✦ Property values
- ✦ Sense of place and community



It's Not One Type of Risk and It's Many Sites

Offshore Wind Examples

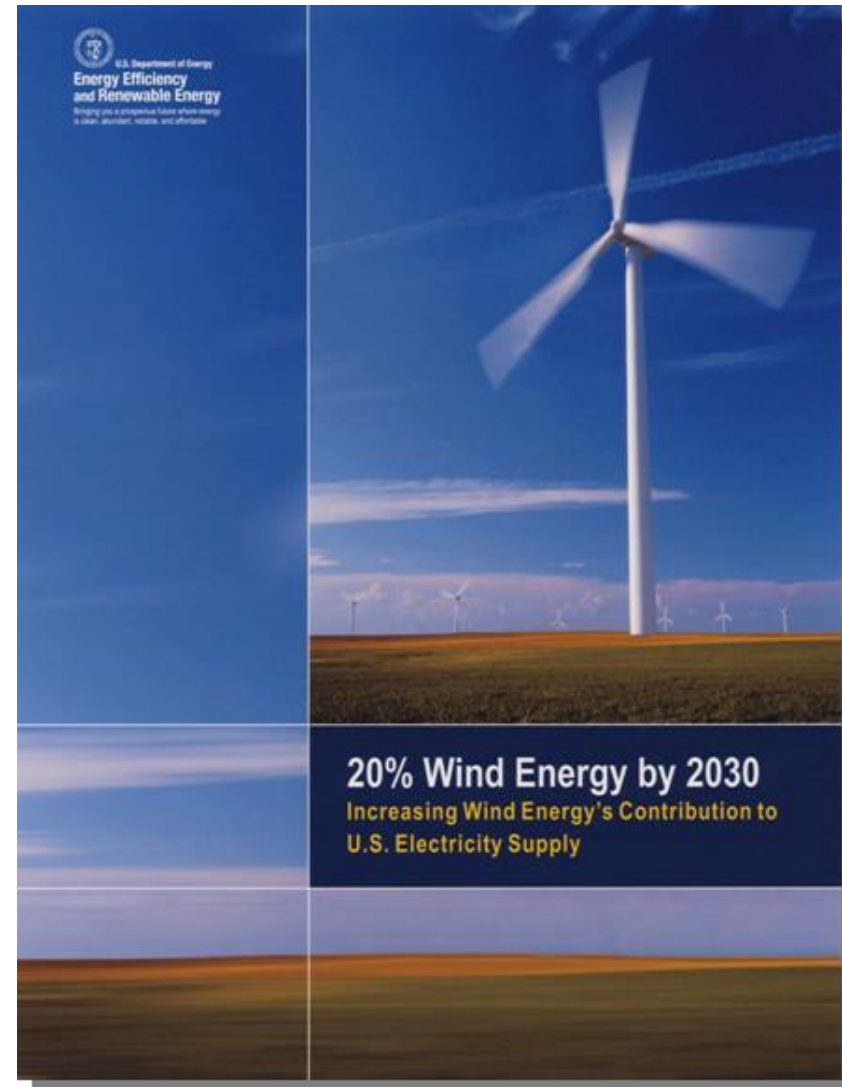
- ✦ East Coasts – recreation & beach tourism
- ✦ Eastern shore – migratory birds
- ✦ Endangered species – turtles, fish,
- ✦ SE to NE regions – right whale migration
- ✦ Viewshed across all sites
- ✦ EMFs from subsea cables
- ✦ Marine spatial planning & tourism
- ✦ Fishing restrictions – commercial/recreational
- ✦ Ship collisions

Technology/ Risks/Effects	Public Concerns/ Values	Coastal/ Land Uses (compatibility/ conflict)	Visibility & Aesthetics	Habitat/ Wildlife	Regulatory Framework (consents/EIAs)
Ocean, wave, tidal	X	X	X	X	X
Wind	X	X	X	X	
Solar-CSP		X	X	X	
Biomass	X	X	X	X	X

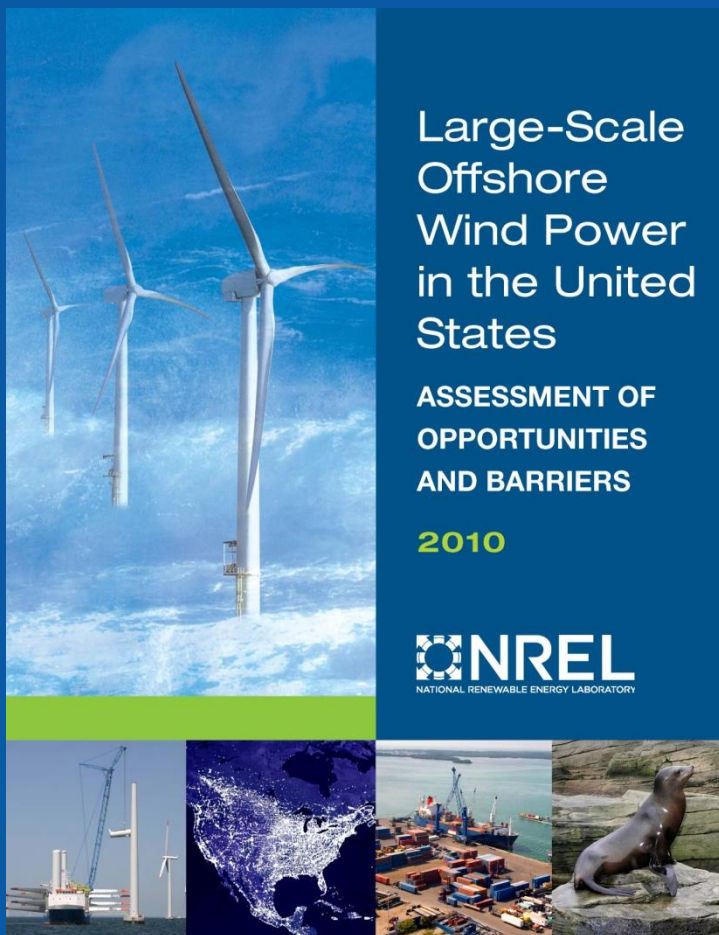


20% Report – 300 GW by 2030

- ✓ 20% wind electricity would require about 300 GW of wind generation
- ✓ Affordable & available across the country
- ✓ Cost to integrate wind modest
- ✓ Emissions reductions and water savings
- ✓ Transmission a challenge



Large Scale Offshore Wind Power in the United States: Assessment of Opportunities and Barriers



<http://www.nrel.gov/docs/fy10osti/40745.pdf> (PDF 7.1 MB)

Authors: Walter Musial (NREL) and Bonnie Ram (Energetics)

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Are we asking the right questions about fish and wildlife?

- Assuming specific sectoral “impacts” (e.g., fish & wildlife) are most important in a complex decision making problem across many sites

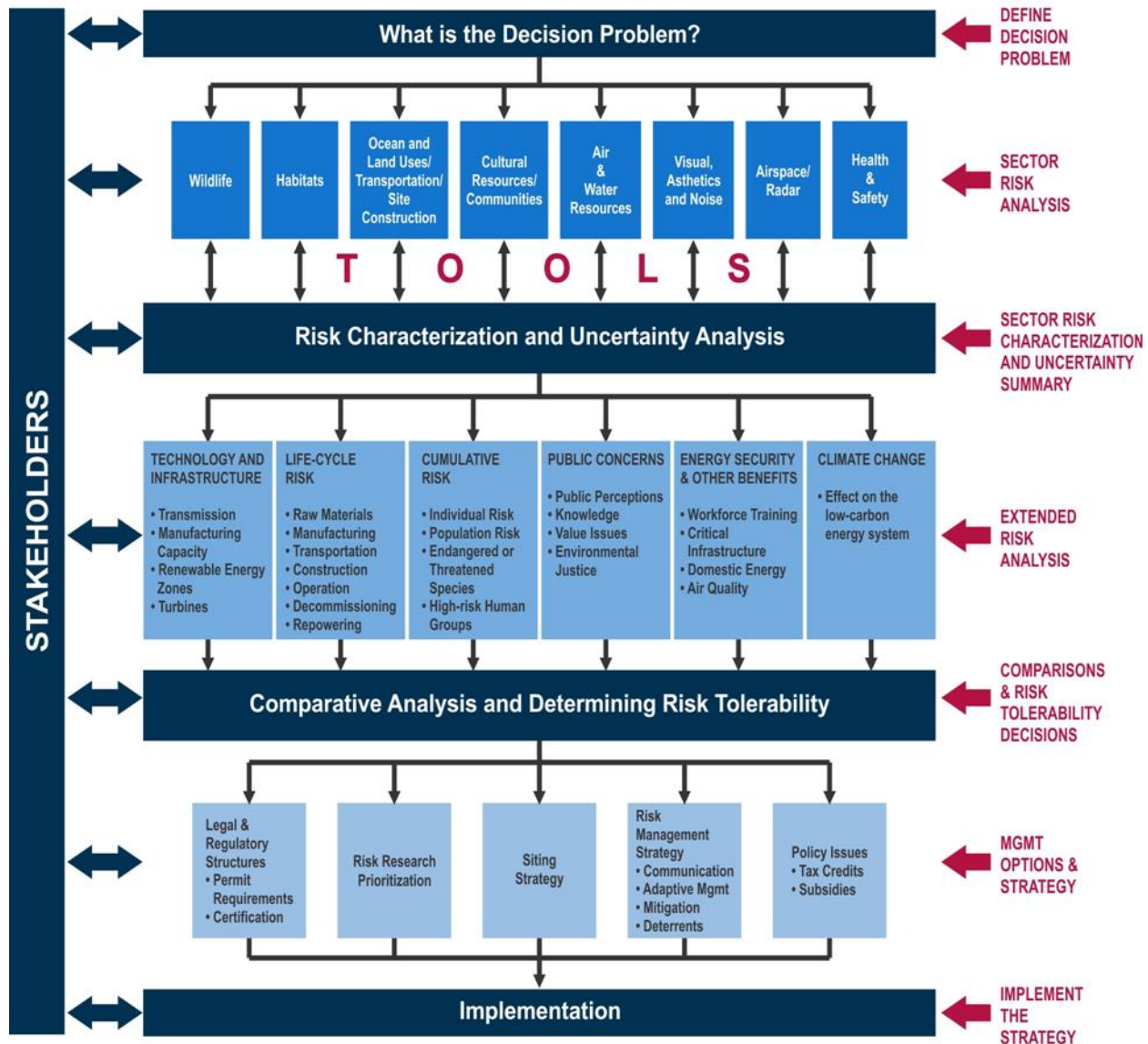
IMPACTS \neq RISKS



What have we learned in 20 yrs?

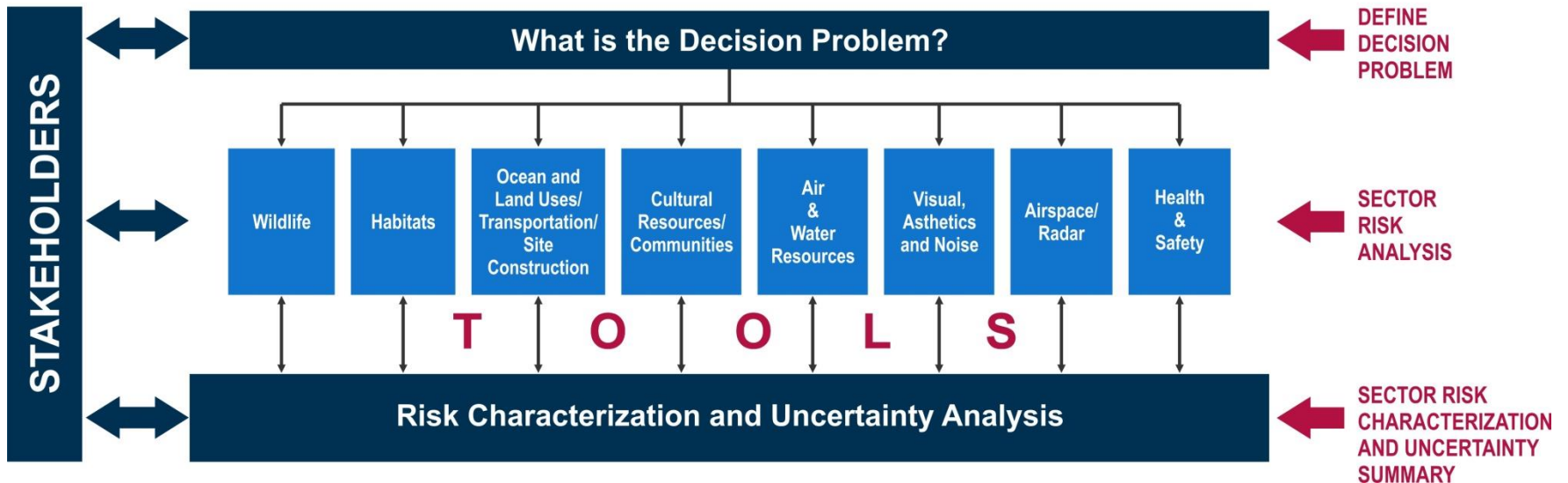


Gigawatts–Scale Wind Energy Deployments: A Framework for Integrated Risk Analysis



Risk Characterization (top)

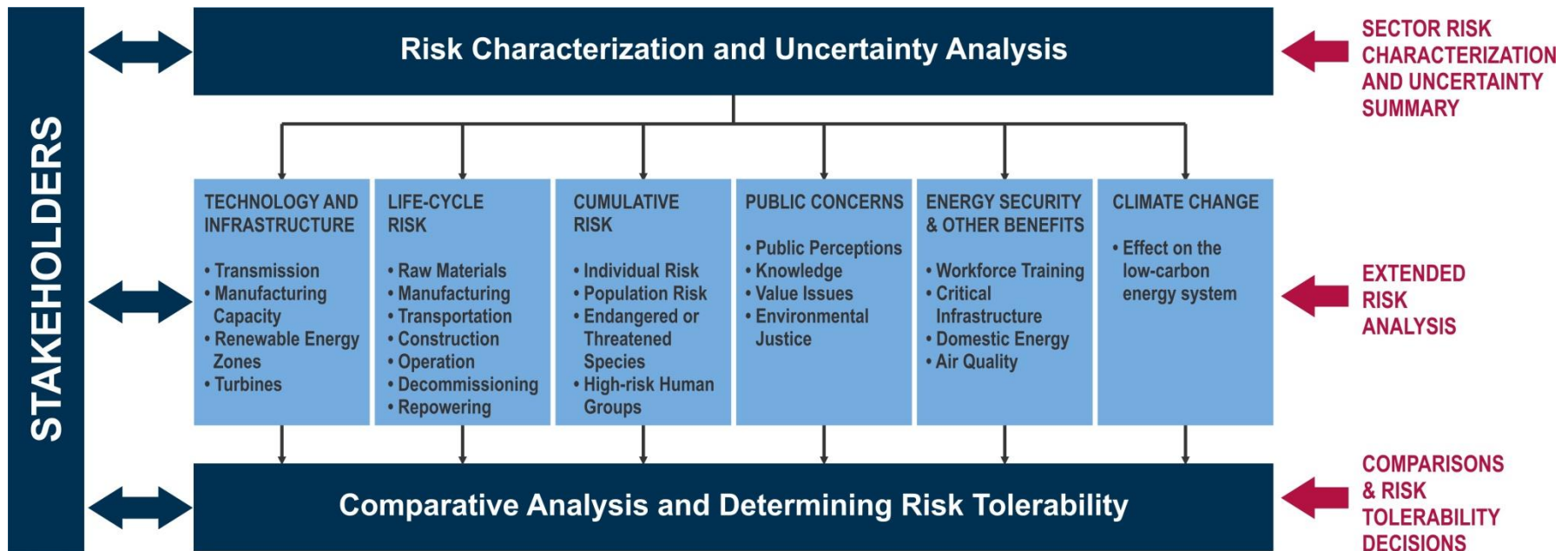
Gigawatt–Scale Wind Energy Deployments: A Framework for Integrated Risk Analysis



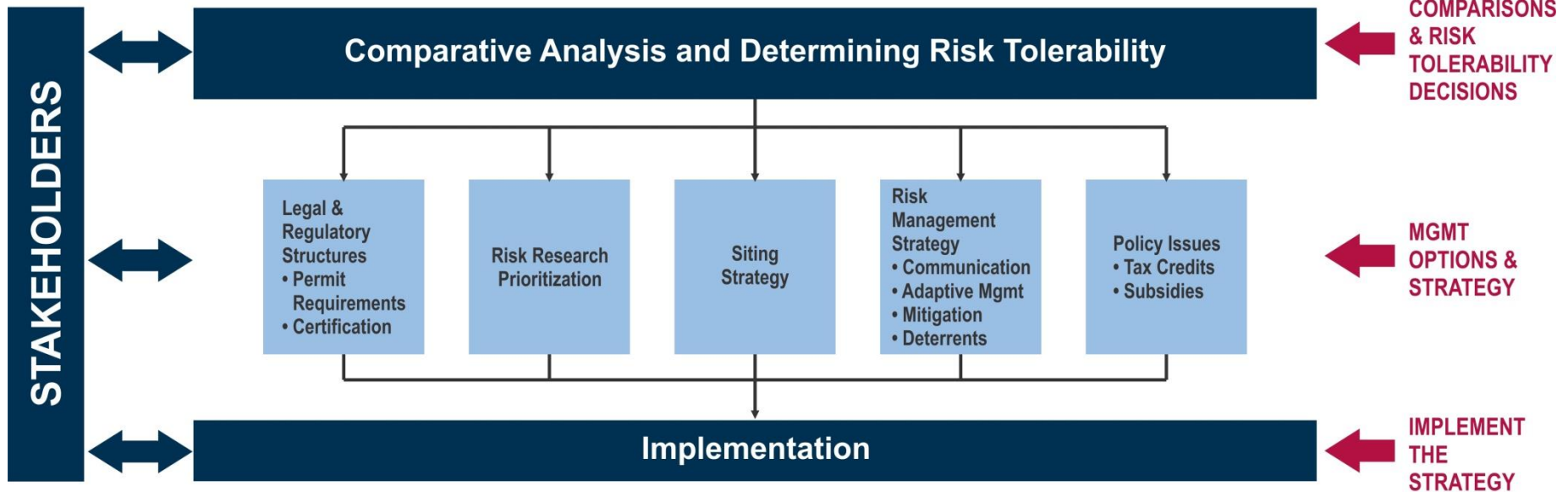
Reference citations: “An Integrated Risk Framework for Gigawatt Scale Deployment of Renewable Energy: The Wind Energy Case Study,” April 2010. NREL Subcontractor Report (2009). NREL/SR-500-47129.

<http://www.nrel.gov/docs/fy10osti/47129.pdf>

Determining Risk Tolerability (middle)



Management Options (bottom)



Energy Transformation: “Systemic” Approach, not Piecemeal

- ✦ *Technology Innovation*
- ✦ *Cost of Energy*
- ✦ *Biological & Physical Effects*
- ✦ *Transmission Planning*
- ✦ **Social – Technical System
(what gets left out)**
 - ✦ **Political = Institutions and Governance**
 - ✦ **Cultural Beliefs and Public Values (Context)**
 - ✦ **Human Behaviors**
 - ✦ **Energy Policies**
 - ✦ **Ecosystem Services and Natural Capital**
 - ✦ **Macroeconomics and Subsidy Systems**

Major Impediments to Transformation

- ✦ Lock-in Infrastructure
- ✦ Life Cycle Costs & Subsidies
- ✦ Public Values
- ✦ Social Trust & Social Capital
- ✦ Short-term Political Goals



Aerial Image of Kingston Ash Slide 03/20/2009



**Aerial Image of Kingston Coal Ash Slide:
5.4 cubic yards of toxic sludge in 2009**



0 500 1,000 1,500 2,000
feet

Tennessee Valley Authority
CESR - ERS
Geographic Information & Engineering

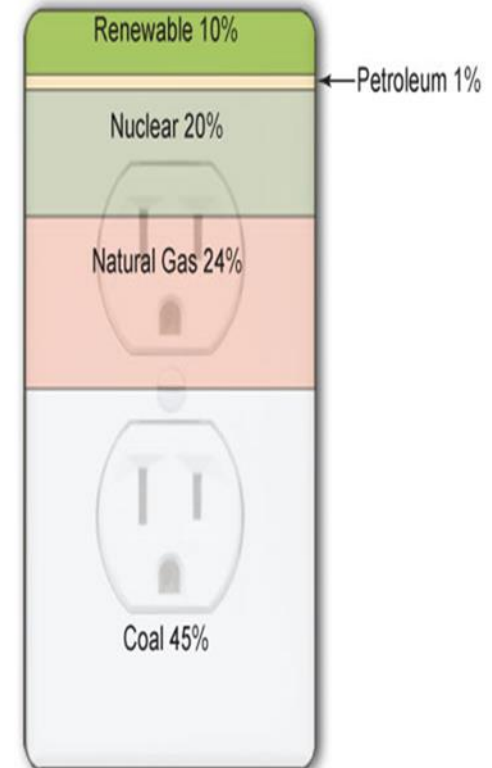
OUTLINE

- ✦ My education & work experience
- ✦ Lessons learned from wind energy (2001-present)
- ✦ Recent research topics
- ✦ **My wind energy & society footprint at DTU?**

The Argument

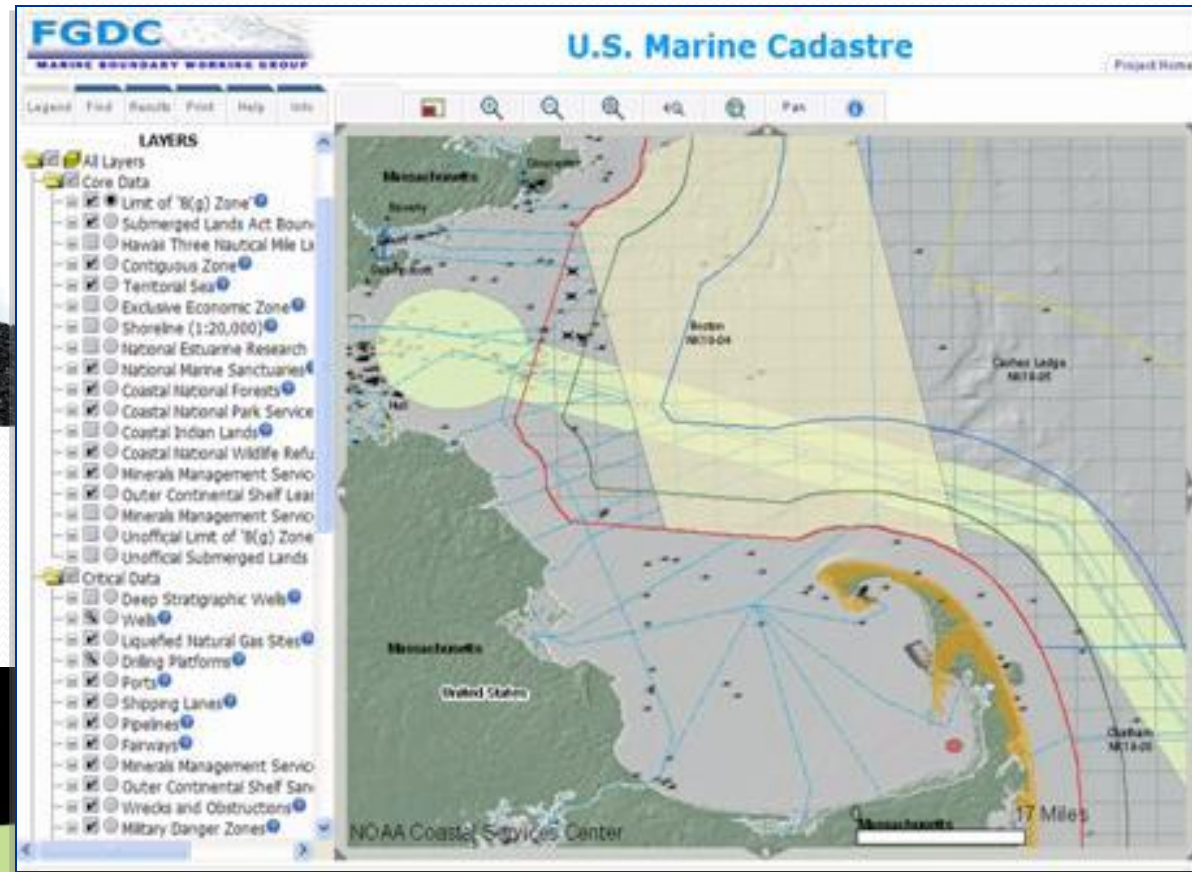
- Rapid & sustained energy transformation with large-scale wind requires a new paradigm
- Success will depend on:
 - Systemic thinking
 - Training an interdisciplinary generation
 - Prepare for surprises
 - Process issues early on with stakeholders

Sources of
U.S. Electricity Generation, 2010



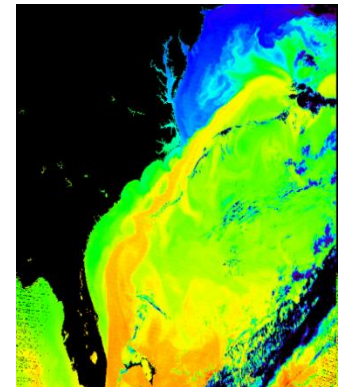
Source: U.S. Energy Information Administration, *Monthly Energy Review* (June 2011). Percentages based on Table 7.2a, preliminary 2010 data.

Grand Challenges are “Process Issues” = Social Sciences



Process Issues: Public Values

- ✧ **Distribution of benefits and risks**
 - ✧ **Transmission lines!**
- ✧ **Value issues**
- ✧ **Visibility and aesthetics; Spirituality**
- ✧ **Habitat/community modifications**
- ✧ **Cost to ratepayers**
- ✧ **Social distrust of institutions and science**
- ✧ **Significant remaining risks and uncertainties**

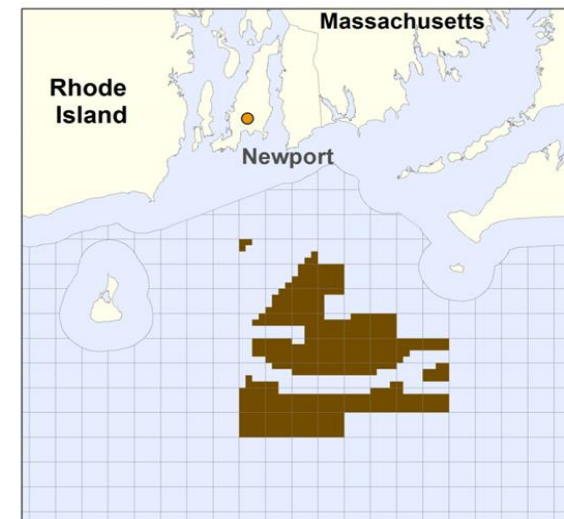


What is Social Science Research?

- ✦ **Siting strategies**
- ✦ **Decision making – individuals and institutional**
- ✦ **Public perceptions**
- ✦ **Stakeholder engagement strategies**
- ✦ **Risk and uncertainty analyses**
- ✦ **Risk communication**
- ✦ **Public trust**
- ✦ **Equity and ethics**
- ✦ **Cultural context**
- ✦ **Sense of place, values, landscapes, seascapes, etc.**

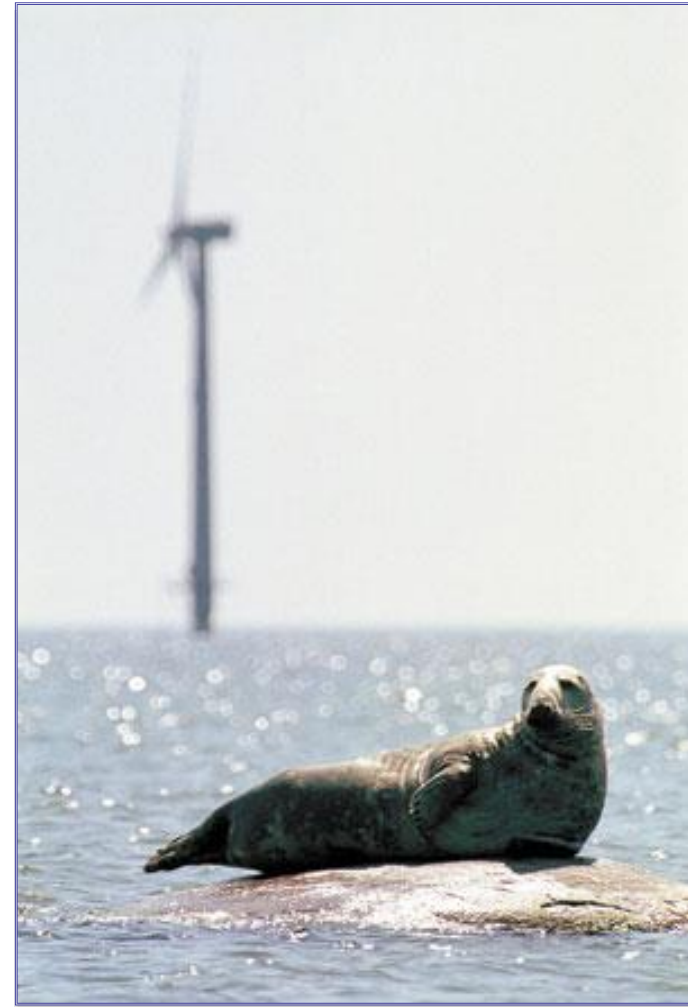
Why Integrating Social & Environmental Sciences is Needed

- **Building human capacity with interdisciplinary perspectives is essential for scaling wind (e.g., Erasmus Mundus)**
 - **Now focus is mostly on technology/ engineering/scientific challenges, & cost reductions**
 - **New lexicon**
- **Tap into extensive social science knowledge in the US/EU (not much focus on wind to date)**
 - **Stop talking about “NIMBY”**
 - **“Educate them & they will believe”**
- **Couple economic & cost analyses with an understanding of winners & losers**



Why Integrating Social & Environmental Sciences is Needed

- Recognize risks are very local and site specific
 - “Risk du jour” approach
- More environmental monitoring due to regulatory requirements and mitigation strategies
- Public perception research may clarify true risks from perceived, e.g., wind turbine syndrome
- ★ Little multiple-stressor or comparative perspectives



Conundrums

- **Greater stakeholder participation does not always lead to better decision making**
- **Socio-technical approach is sorely needed for climate change scalability and regional deployments**
- **Beware - Length of time needed to explore social and environmental sciences**
- **Cultural divide or opportunities? Context is important**
- **Without this integrated, system pathway, we are certain to slow down or fail to scale up**

DISCUSSION QUESTION:

*WHAT DOES WIND
ENERGY AND SOCIETY
MEAN TO YOU?*

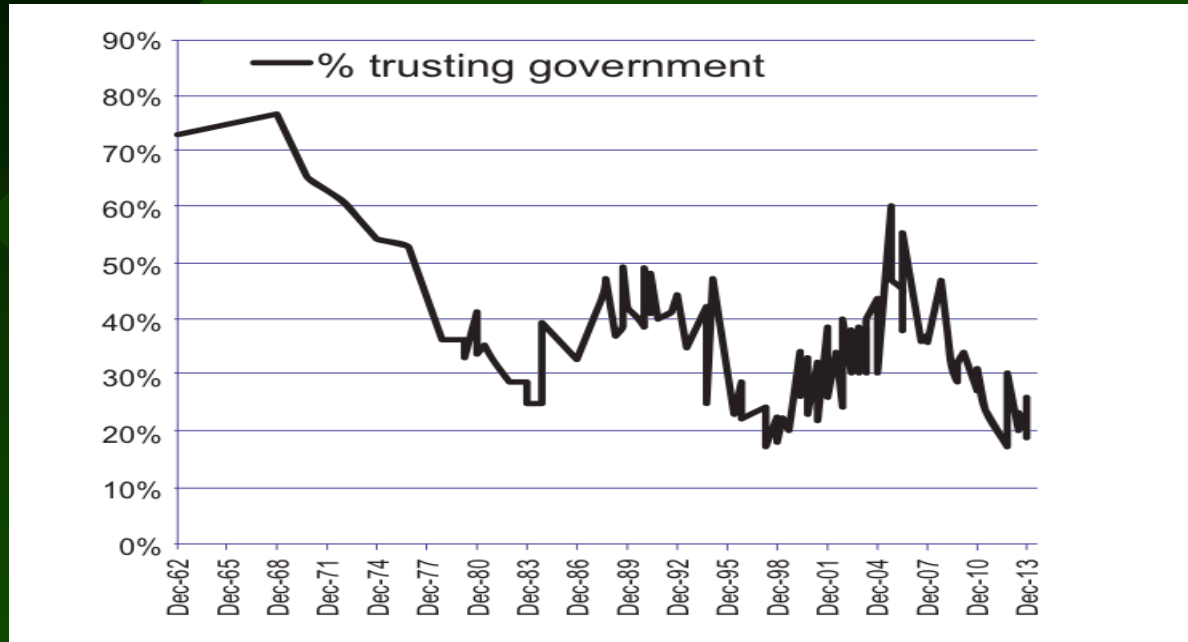
EXTRA SLIDES

ARGUMENTS AGAINST-



Jo Heller © 2011 GREEN ANTI TOSS GAZETTE

How much of the time do you think you can trust the government in Washington to do what is right?



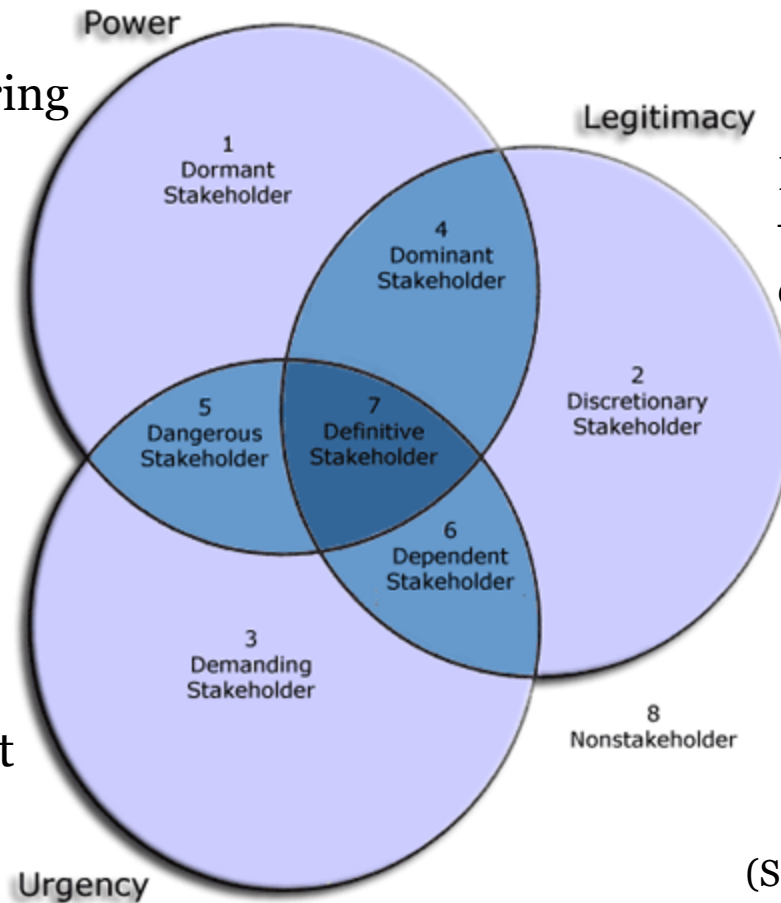
• **Trend in Percentages** shown for summed values of “just about always” and “most of the time” (other categories: “some of the time,” “never,” “don’t know” or “refused”). Chart from: <http://people-press.org/trust/>. Data compiled by: Pew Research Center, National Election Studies, Gallup, ABC/Washington Post, CBS/New York Times, and CNN Polls. From 1976-2010 the trend line represents a three-survey moving average.

• **Note:** See BRC Technical Report. Tuler, Seth and Roger E. Kasperson (2010) SOCIAL DISTRUST: IMPLICATIONS AND RECOMMENDATION FOR SPENT NUCLEAR FUEL AND HIGH LEVEL RADIOACTIVE WASTE MANAGEMENT (BRC 29 January, 2010) http://cybercemetery.unt.edu/archive/brc/20120620221531/http://www.brc.gov/sites/default/files/documents/brc.social_trust.17feb11.pdf

• http://science.house.gov/sites/repUBLICans.science.house.gov/files/documents/hearings/102711_Kasperson.pdf

One popular framework for Stakeholder Assessment: Identifying key actors

POWER = The ability to bring about desired outcomes despite resistance



LEGITIMACY = Claims that are socially accepted or expected

URGENCY = Claims that are time-sensitive and of critical importance

(Source: Mitchell et al. 1997)

A wind example

- Siting a community wind farm

- Power:

- Who has power over relevant decisions?
 - Who has power to block them?

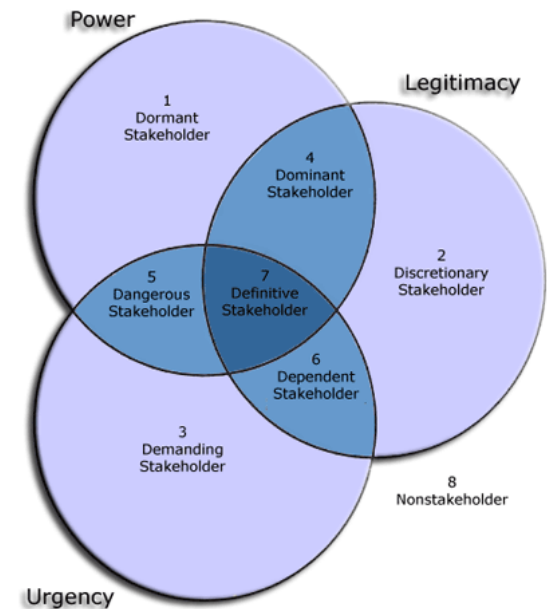
- Legitimacy:

- Who has a legitimate claim/stake in siting community wind?
 - Pro wind/opposing wind

- Urgency:

- In every step of the process, who is most important to it?
 - Whose needs, decisions are first, immediate, pending etc.?

- Prioritization for engagement would be the result of overlapping criteria (P+L, P+U, L+U, P+L+U)



Defining Transformation: Four Major Components

Social transformation processes involve:

(1) Structural changes to society

- ***Technology R&D***
- ***Smarter electrical grid***
- ***Institutions***

(2) Long term processes that cover at least one generation

- ***Supporting public values***
- ***National energy policies – flexible & durable***

Social transformation processes involve four major components (cont.)

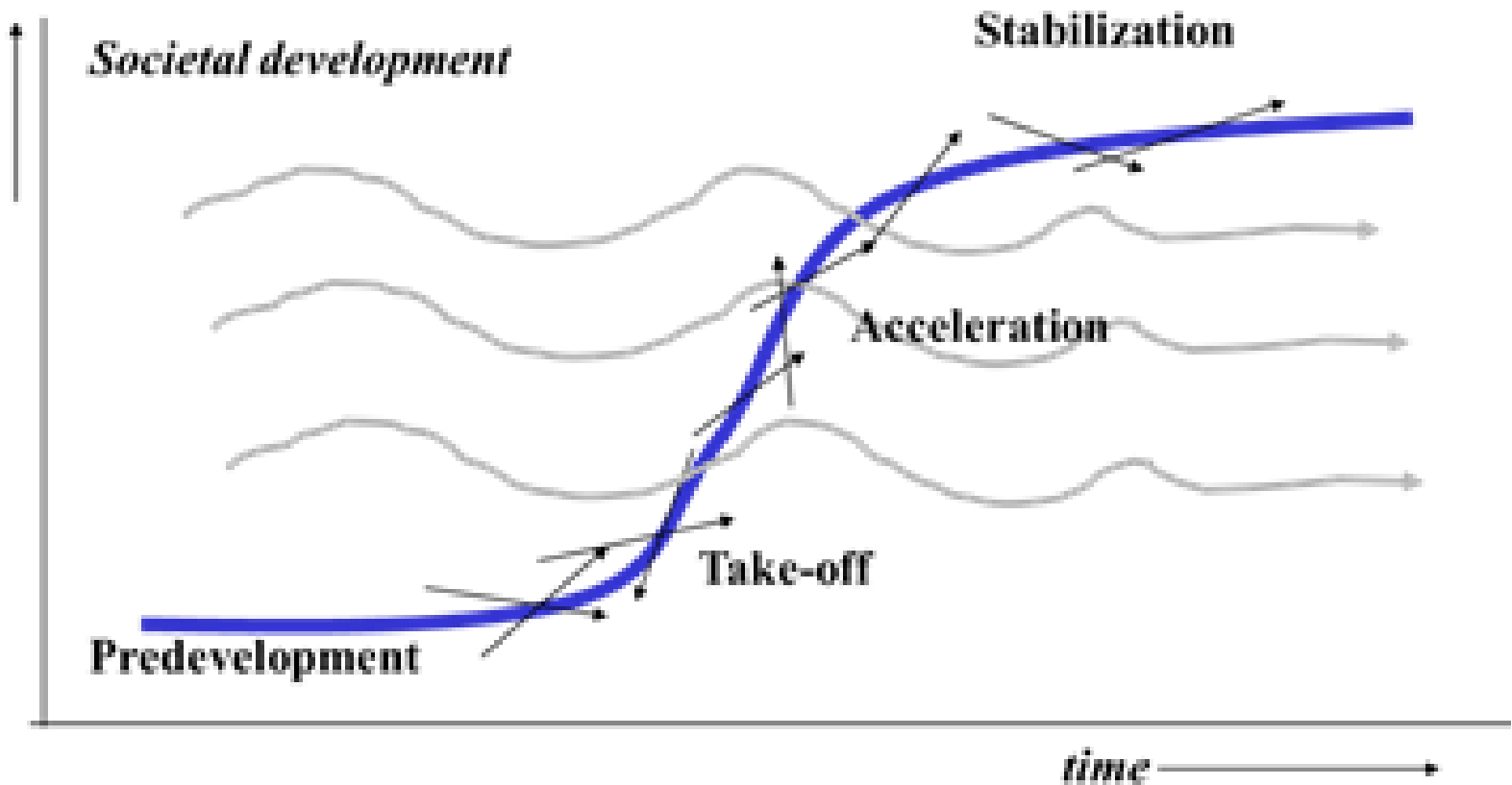
3) Large scale technological, economic, ecological, social-cultural, and institutional developments that influence and strengthen each other

- ***Subsidies***
- ***Life-cycle cost calculus***

4) Interactions between developments at different scale levels

- ***Environmental and Social risks & benefits***
- ***Risk Communication***

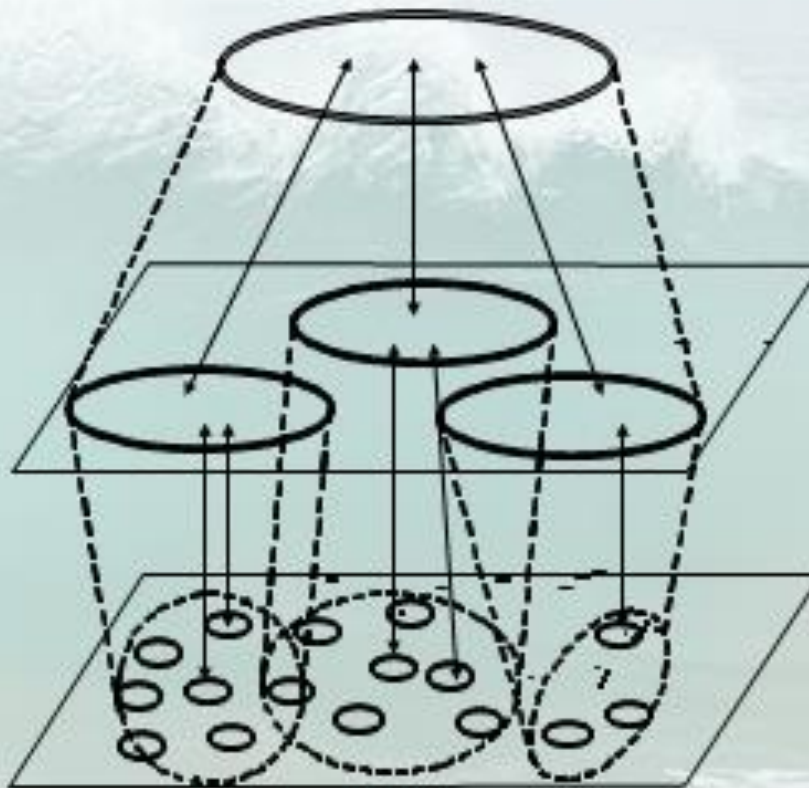
Transitions: Multi-phased



After Rotmans (2002) See <http://www.transitionsnetwork.org/about>
www.drift.eur.nl and <http://www.rsm.nl/people/jan-rotmans/publications>

Transitions: Multi-Level

Transition levels



Macro-level: landscape
autonomous trends, paradigms,
slow changes

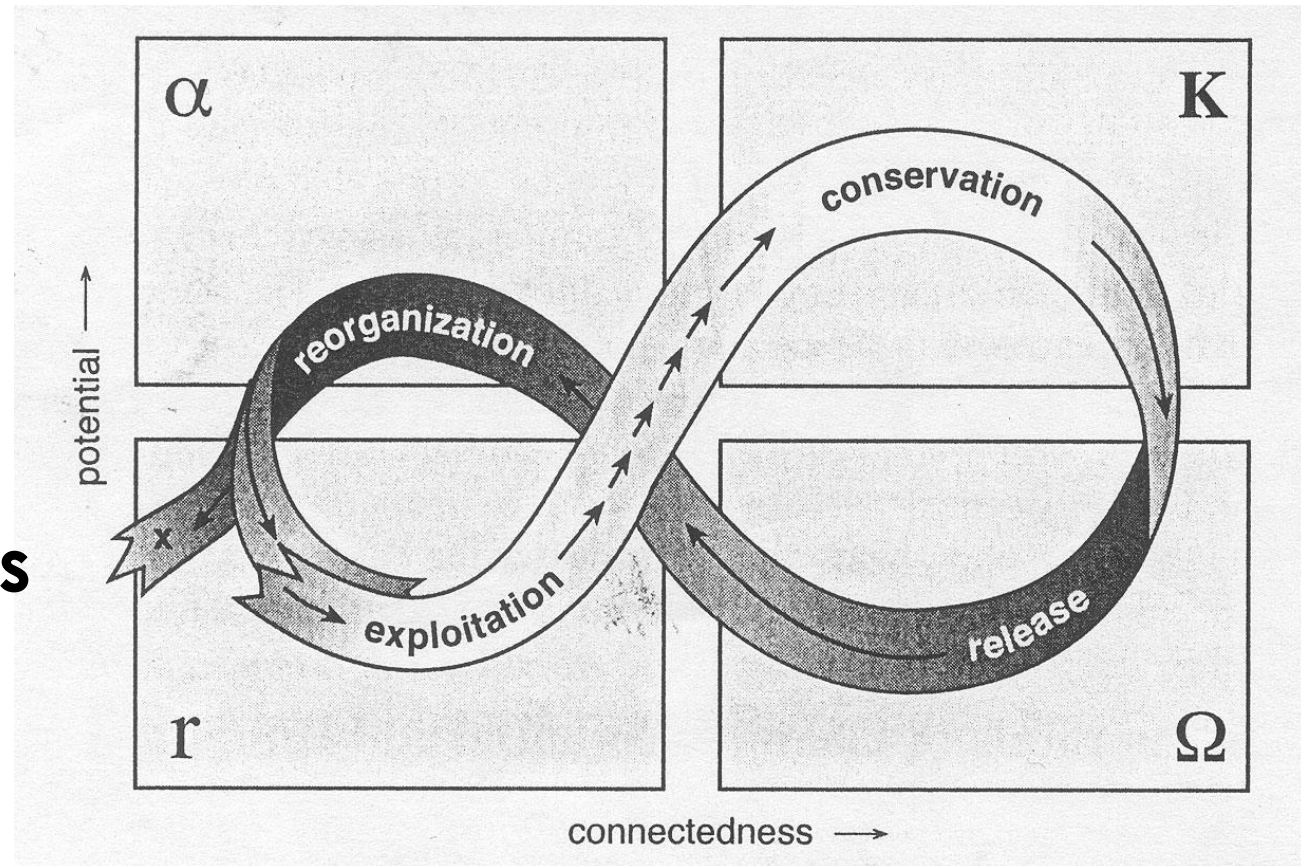
Meso-level: regime
Dominant structure, culture
and practices

Micro-level: niches
innovative ideas, projects,
technologies, niche actors

Based on Geels and Kemp, 2001

Multi-change Concepts

**Innovation
experiments
with high
uncertainty**



L. H. Gunderson and C.K. Holling
(ed.) Panarchy

Selected Current Research: USA

Universities/NGOs (selected examples)

- ✦ **Mail survey work to understand public concerns, values, and attitudes, (Kempton and Firestone, University of DE)**
- ✦ **Decision making, risk communication, and values in energy (J. Arvai and R. Gregory)**
- ✦ **Policy alternatives & publics (Carnegie Mellon, G. Morgan)**
- ✦ **Behavioral economics and individual choices (Columbia, E. Weber)**
- ✦ **Smart grid and energy transformations (Clark University, J. Stevens)**