Post-Sandy Discourse on Energy System Vulnerability & Smart Grid

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Climate Change and America's Infrastructure: Engineering, Social and Policy Challenges

Panel on Policy and Governance Challenges and Strategies

ASU, Tempe Arizona

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Superstorm Sandy – Oct (28-30) 2012

$65.6 billion – estimated cost of devastation and disruption

NASA GEOS-13 View, October 28, 2012

Cover page. Bloomberg Businessweek. November 1, 2012.

- **Highlighted vulnerability of energy systems – a focusing event**
- **Reintroduced climate change into political discourse of the 2012 Presidential election – previously conspicuously absent**
- **Created new discursive linkages between energy infrastructure investments and climate change preparedness**

Climate-Energy Linkages

SuperStorm Sandy has expanded climate discourse - BOTH

- **MITIGATION**
- now also **ADAPTATION**

Energy System Vulnerability
Gasoline Shortages

Queens – People in cars and on foot line up for free gas on Nov 3, 2012 (Craig Ruttle/AP Photo)

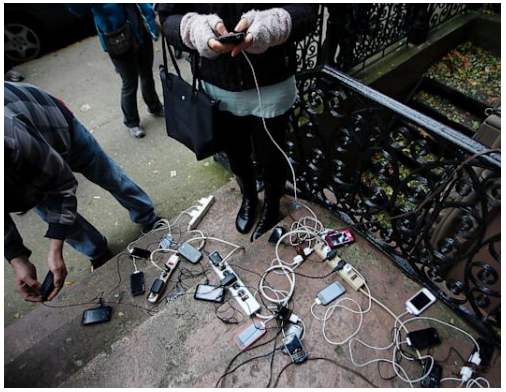
People line up to fill gas containers at the New Jersey Turnpike's Thomas A. Edison service area, Oct. 31, 2012, near Woodbridge, N.J. (Mel Evans/AP Photo)

Energy System Vulnerability
Power Outages

Electricity infrastructure damage
8.6 million customers lost power

Hopewell Township, NJ three days after the storm. The Trentonian, Jackie Schear/AP Photo.

Highlighted our increasing reliance on electricity for basic needs: communication, health, food, etc.



Hoboken, NJ. Charging electronic devices (Jeff Zelevansky/Getty Images)

NYU Medical Center Photo: Michael Heiman, Getty Images

Photo: TIMOTHY A. CLARY, AFP/Getty Images

Brooklyn, Food systems disrupted., Oct. 31, 2012 (John Minchillo/AP Photo)

Queens, NY, Rockaway Beach. Oct. 31, 2012 (Robert Nickelsberg/Getty Images)

New Research: Post-Sandy Energy Discourse

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Public Discourse

Media Analysis

- Mitigation vs. adaptation
- What energy technologies?
- What actors mentioned?
- Framing - Positive /negative
  - Technological, Economic, Cultural, Political, Health/safety, Envtl.

Energy Sector Discourse

Focus groups and Interviews

- Utilities
- Government
- Environmental advocates
- Consumer advocates
- Private sector

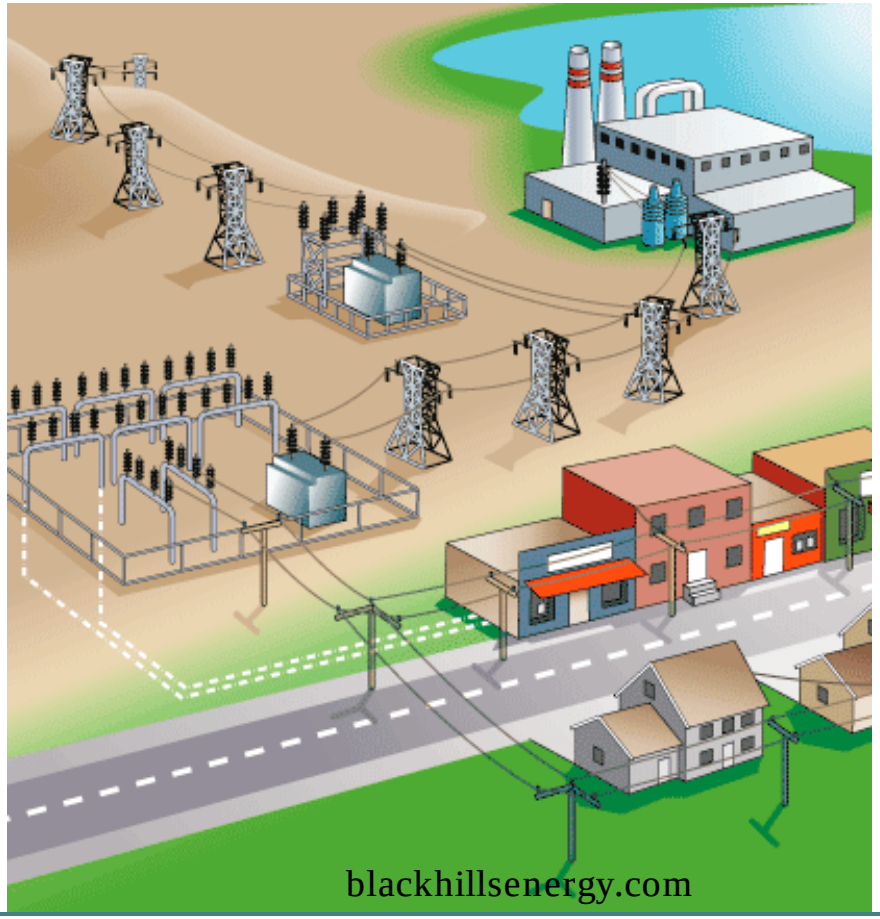
Regional Comparison

- New York/New Jersey – hardest-hit directly impacted
- Massachusetts - less severely hit but directly impacted
- Illinois - not directly affected
- Texas - vulnerable to hurricanes but not directly disrupted

FUNDING

NSF STS Program intends to fund this research thru the NSF RAPID program

Coupled with active research on Smart Grid: Regional Comparison of socio-political context for electricity system improvements



Generation

Transmission

Storage

Distribution

Consumption

METHODS

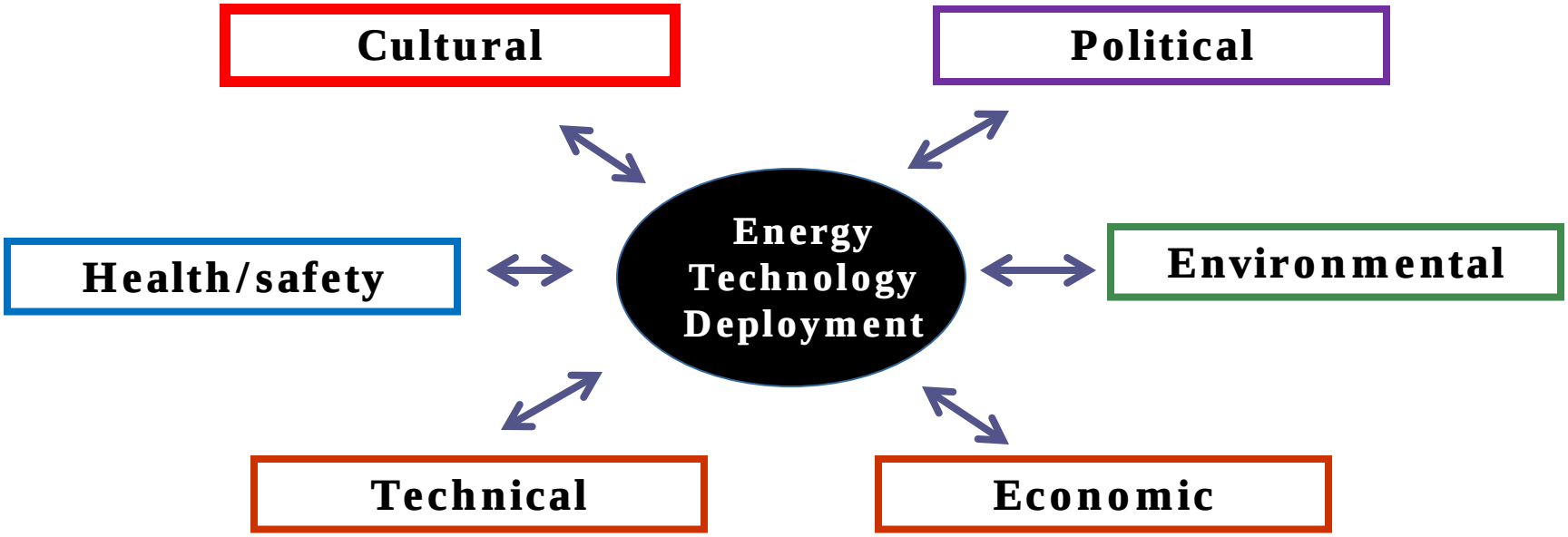
Focus Groups
Interviews
Media Analysis
Policy Analysis

The term "Smart Grid" incorporates multiple technologies and visions for change in the electricity system

Financial Support: NSF Science, Technology & Society Program NSF-SES1127697

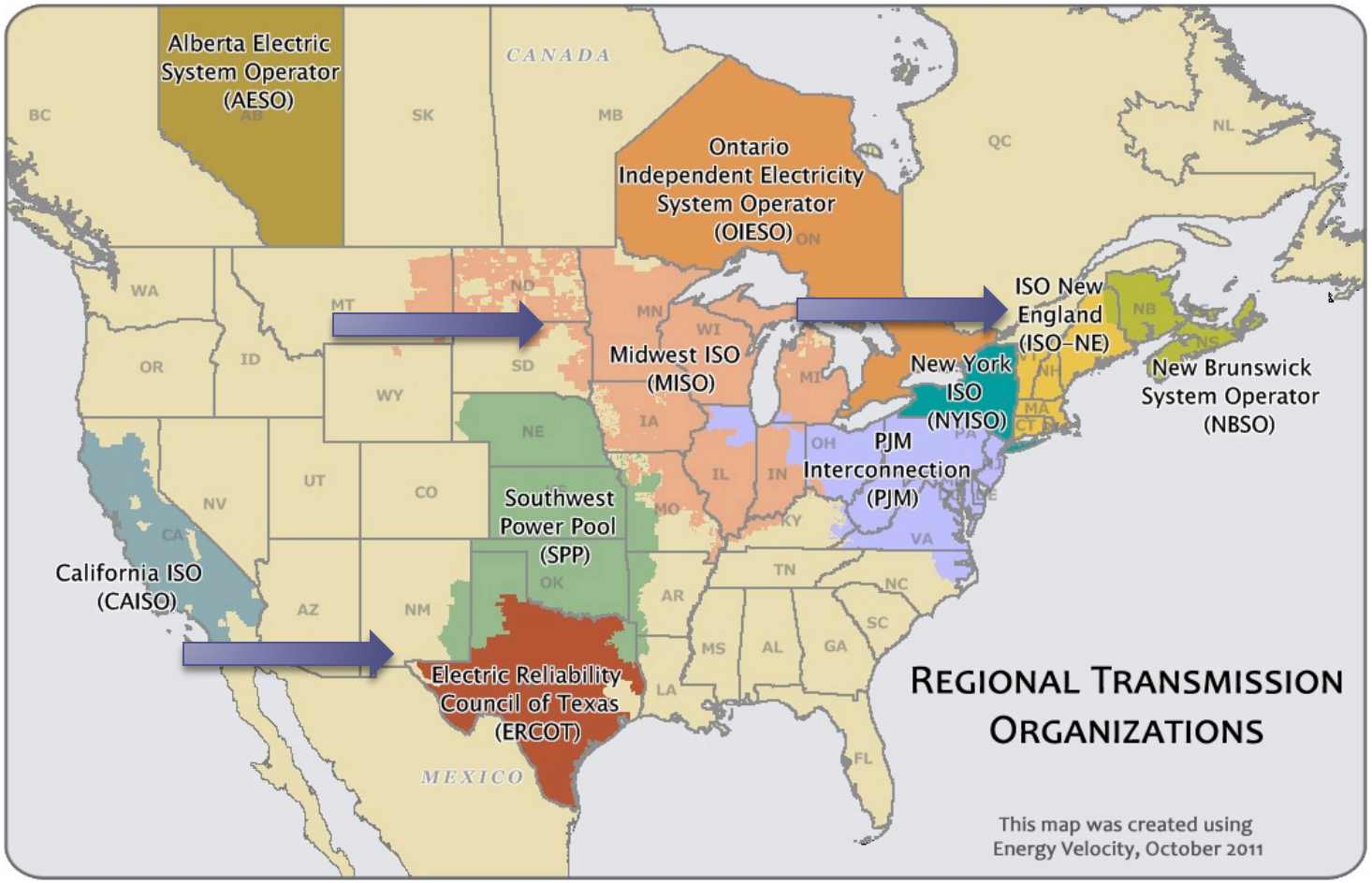
SPEED (Socio-Political Evaluation of Energy Deployment)

A framework to assess the complexity of perspectives influencing energy technology deployment: How is discourse of technologies framed?



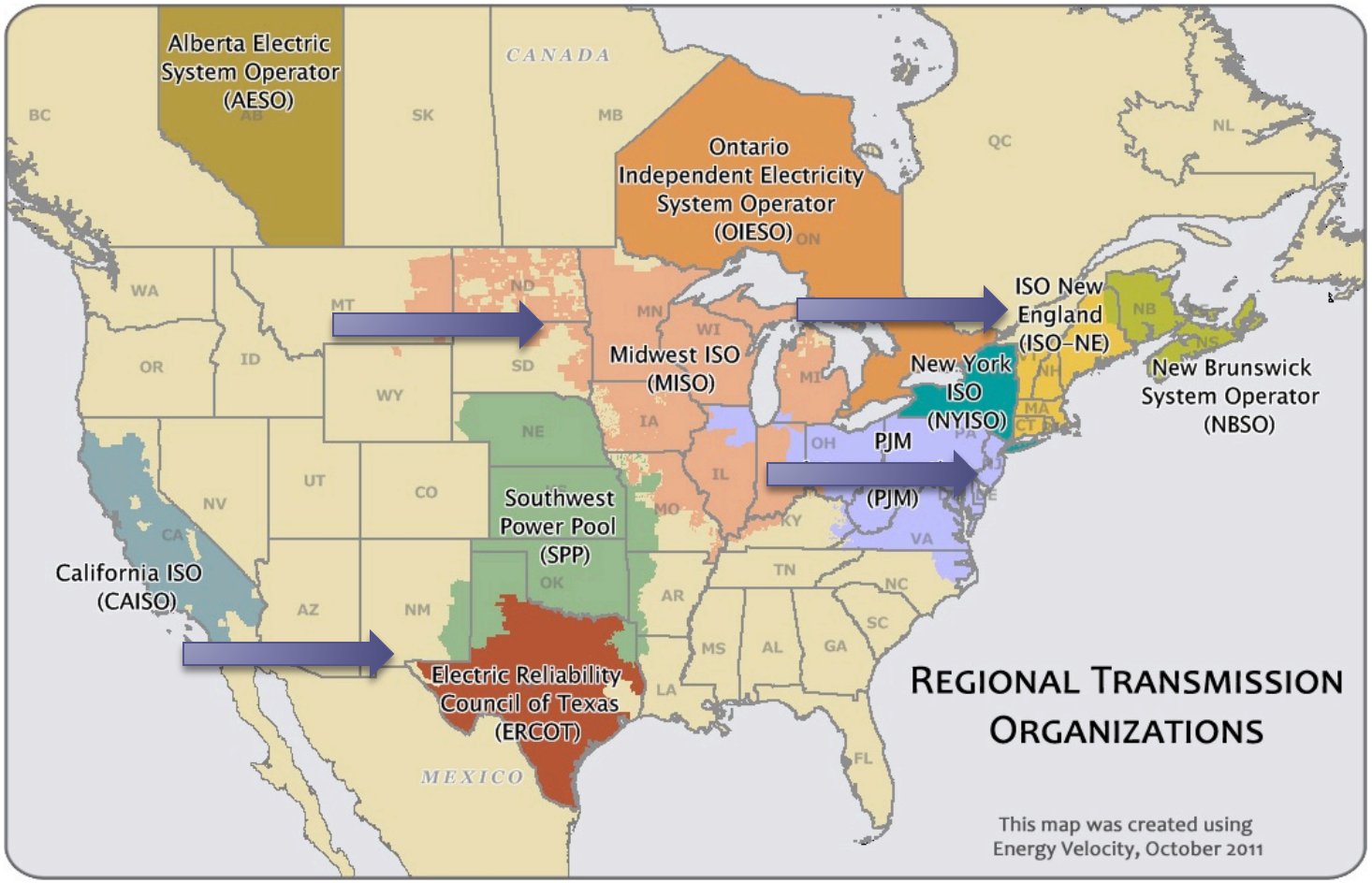
Stephens, J.C., E.J. Wilson, T.R. Peterson. 2008. "Socio-Political Evaluation of Energy Deployment (SPEED): An Integrated Research Framework Analyzing Energy Technology Deployment" ***Technological Forecasting and Social Change.*** 75: 1224–1246

Regional US Electricity System: Comparative Application of the SPEED Framework



Source: FERC, 2012

Post-Sandy Discourse: Added NY/NJ to Regional Comparison



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Themes: Initial Post-Sandy Media Analysis

Energy linkages with BOTH mitigation & adaptation

Although NY/NJ hit worst, influence on discourse nationwide

High costs of recovery and upgrading. Who will pay?

- Raising electricity rates.
- Uncertainty about role of federal relief

Technological improvements – stormproofing, hardening of equipment, undergrounding, elevating substations, self-healing grid, “islanding”, back-up generation

Cultural – High expectations for reliability, enhanced appreciation of reliance on electricity

Extensive Focus Groups Research In Progress

Post-Sandy Focus Groups Already Occurred

Shaded boxes represent focus groups planned – not yet occurred

	Minnesota/MISO	Texas/ERCOT	Mass/ISO-NE	Illinois/MISO	Vermont/ISO-NE	NY / NJ
Large Utilities	Xcel	Oncor	National Grid	Com-Ed, Ameren	Green Mountain	
Municipal/Coop Utilities	Great River Energy	Austin Energy, College Station Utilities	Shrewsbury Electric & Cable Operations		Burlington Electric COOP	
Regional Transmission Organizations	MISO	ERCOT	ISO-NE	MISO	ISO-NE	
State Regulators	MN State Energy Office	Public Utility Commission of Texas	MA Dept. of Public Utilities	State Office, Citizens Utility Board, IL State Geo Survey	VT Department of Public Service	
Consumer/Nonprofit			Mass Energy Consumer Alliance	Galvin Power, Building Owners & Managers Ass.	VT Public Interest Research Group	
Techies/Academics	UM EE Students	TAMU engineer students	Worcester Polytechnic Institute	Illinois Institute of Technology	U. of VT	
Environmental Groups	Great Plains Institute	Theodore Roosevelt Conservation Partnership	Conservation Law Foundation	Illinois Sierra Club	VT Energy Investment Corp., Conservation Law Foundation	

Initial Results from MA Focus Groups & Interviews

Utilities sensitive to criticism, but improved responsiveness from two previous big storms

- MA Dept.of Public Utilities finalized fine/penalty on utilities right before Superstorm Sandy, utility response rate and preparedness improved

Urgency of repairs results in re-investment in status quo technology. Tension with investments in new technology

- Although 8,000 NJ National Grid customers still not able to reconnect (may not be rebuilding)

Enhanced interest in micro-grids

- Tension between utilities and back-up generation – centralization vs. decentralization

Enhanced interest in Micro-Grids

- Princeton University "islanded" itself

- NYU Medical Center - 200 patients moved (20 babies from intensive care)
  - back-up generator in basement flooded (risk prevention measure post-9/11) so flooded

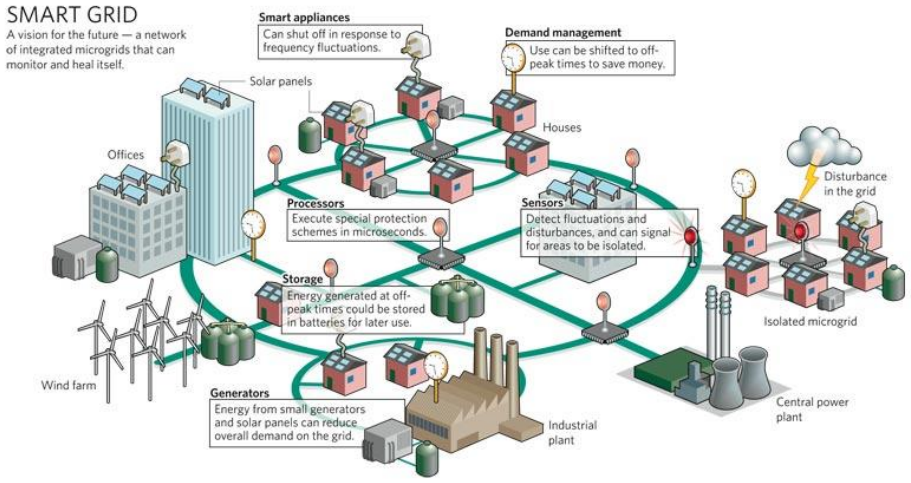
Photo: Ashley Gensler, October 30 2012

Photo: Michael Heiman, Getty Images

- Individual households demonstrate high willingness to pay for back-up generators – suggests value of electricity being realized.

Competing Visions of Smart Grid - Electricity System Improvement

- Revolution in efficiency and use
- Renewable generation and integrat
- Electrification of transport
- Decentralized and local systems
- The SuperGrid – long-distance transmission
- Secure grid with no informal/illegal connections



http://www.prism-magazine.org/jan11/feature_03.cfm

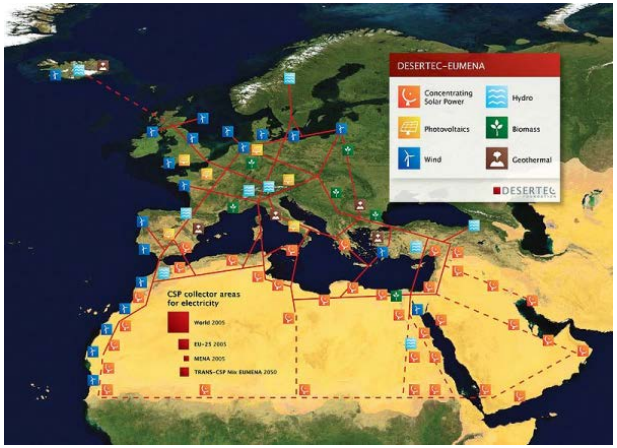
- Enhancing reliability and reducing power outages: storm-proofing, hardening , and self-healing

Fundamental Tension: Centralization vs. Decentralization

Decentralized Local Energy Systems

Communities control/manage energy systems
http://en.sap.info/smart-grid-enterprise-cloud-mobile-app-2/21376/6

Centralized – Supergrid with Long Distance Transmission



Desrtec http://www.getsolar.com/blog/solar-project-to-connect-europe-north-africa-in-next-five-years/8370/

Spectrum of perspectives on potential for change in electricity systems

Understanding discourse and the plurality of actors' perspectives provides insights that may facilitate change

Conclusions

- Superstorm Sandy heightened nation-wide awareness of the value of & dependence on electricity systems
- Multiple justifications/visions for electricity system improvements – stormproofing and reducing power outages only one of the many
- Electricity systems complex and dynamic – critical decision being made, more public attention, engagement, and transparency in decisions
- Emerging tensions
  - Utilities vs. customers interests
    - Who should pay for recovery and upgrades
  - Centralization vs. decentralization/micro-grids
  - Prioritizing management of multiple risks
  - Climate preparedness uncertain requirements

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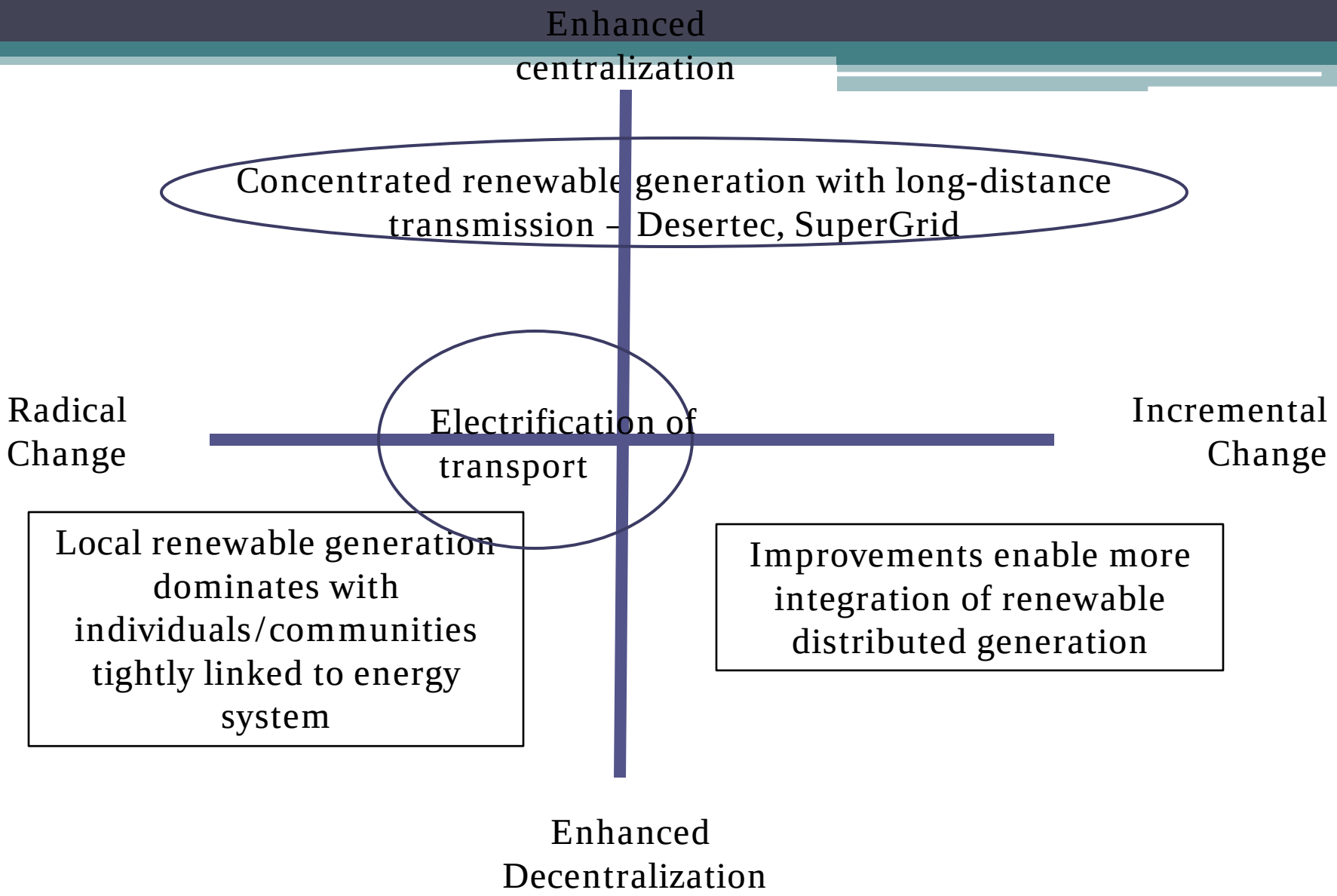

Figure 1. Actors' vision of the potential of Smart Grid can be characterized by perceptions of the possibility and need for radical versus incremental change and perceptions of a future with enhanced centralization or decentralization.

Huge burden on local governments

- Expectations for federal disaster relief decreasing
- Communities facing reduced property tax due to property destruction (Cowan, NYT, Jan 25, 2013)

Towns' Next Hit From Hurricane Is to Tax Revenue

By ALISON LEIGH COWAN

As a result of property damage, localities hit by Hurricane Sandy cannot expect to reap the same property taxes from homeowners.

Urgency of repair results in re-investment in status quo technology (8,000 NJ National Grid customers not accepting reconnect)

Utilities highly criticized – although improved performance from previous two storms (October 2012).

Enhanced interest in micro-grids