

“Electricity is really just organized lightning.”
– George Carlin

Challenges to Energy Assurance in the 21st Century

Power Shift

Matthew S. Sinn, Tennessee Valley Authority, April 2014

Why Am I Here?

“The nine most terrifying words in the English language are, 'I'm from the government and I'm here to help.'”
– Ronald Reagan

Problem

“We have to protect the CIKR. Distribution is part of the CIKR. How can DHS help?”



Solution

“Send Matt to ride around in big trucks.”



Outcome

Have data. Will travel.



"[New York] has a 100-year flood every two years now."
– NY Governor Andrew Cuomo, Oct. 2012

So What?

...or why I'm speaking to you today

Documents

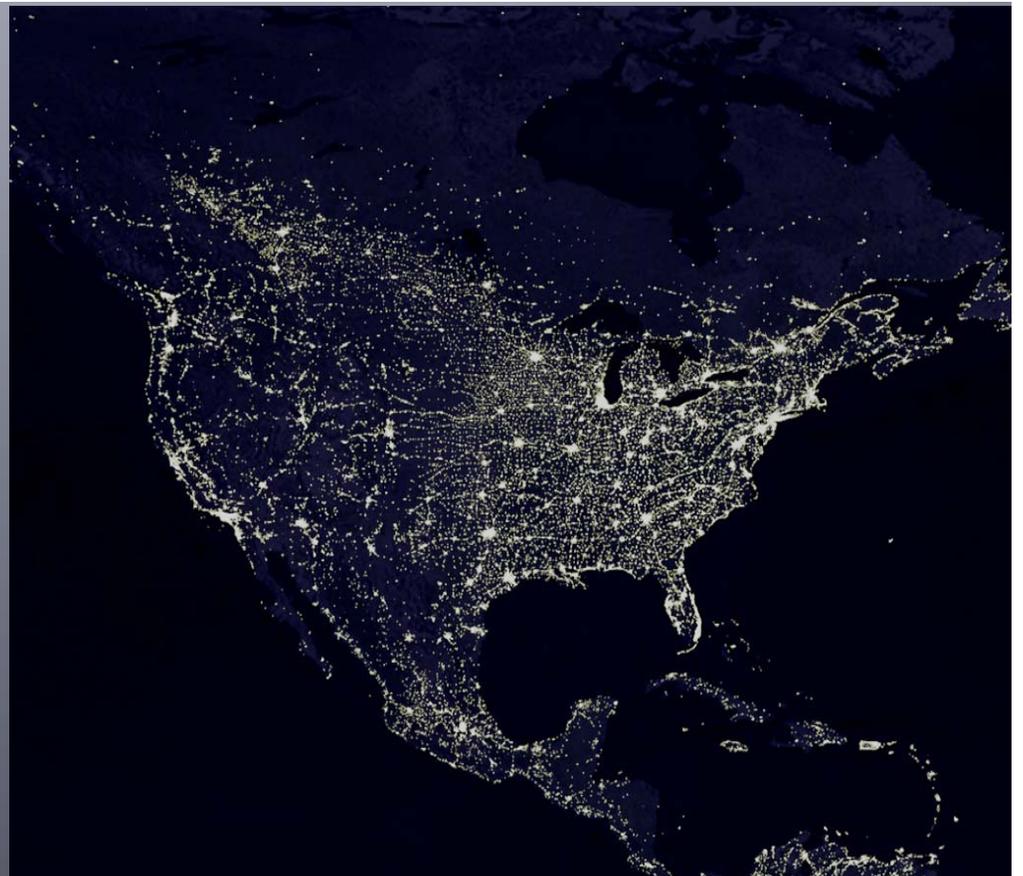
- 250+ sources

Interviews

- 200+ utility professionals
- 50+ different organizations
- nationwide coverage

Fieldwork

- 2 ridealongs
- 1 ops center visit



“Our Republican governor personally restored power to over 40,000 homes, armed with nothing but a pair of linemen’s pliers and some ordinary household bleach.”
 – A Virginia resident remembers the *derecho*

Reliability in Jeopardy

Guess what the number represents.

The Industry		The Value		Storm Data		Scary Stuff	
144,000,000	# of power customers in the U.S. (DOE)	\$80 billion	Total annual cost of power outages in US (low estimate)	8,511,251	Peak outages, Hurricane Sandy (DOE)	55,000	# of substations in U.S. (FERC)
68%	Percentage of customers served by IOUs (DOE)	\$18 billion	Total annual cost of storm outages in US (low estimate)	679	Storm outages affecting 50,000+, 2003-2012 (White House)	9	# of critical substations that, if lost, would kill the grid (FERC)
3,200	# of utilities in the U.S. (APPA)	\$21,000	Avg. cost of 24 hour outage to small business	11	# of billion-dollar weather events in 2012 (White House)	-2%/year	Reliability trend since 2002 (LBNL)
93.0/outage	SAIDI (U.S./CAN, 2012) (IEEE)	\$1,450,000	Avg. cost of 24 hour outage to large business	\$36 million	Cost to LIPA of staging for Hurricane Earl (2010)	0	# of national distribution reliability advocates
0.89/year	SAIFI (U.S./CAN, 2012) (IEEE)	\$48,700,000	Avg. cost of major storm for an IOU (2005)	61,000	Number of linemen in US (2012)	19	# of attackers on Sept. 11, 2001

“What's to be scared about? It's just a little hiccup in the power.”
– Alan Grant, *Jurassic Park*

Study Results

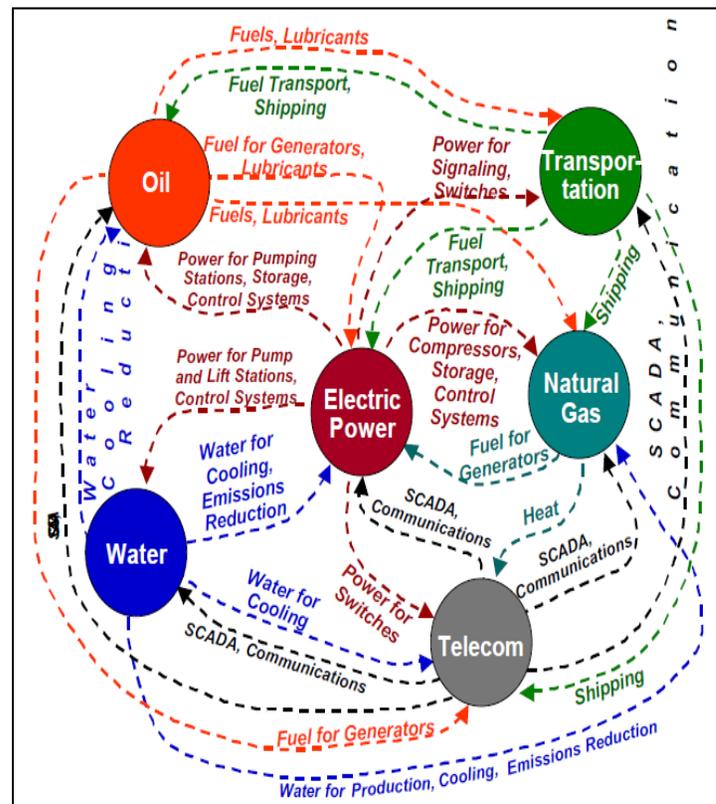
- Changing definition of reliability.
 - Risks, value rising; price and reliability falling.
- Current frames of reference invalid.
 - Utilities aren't selling what customers think they're buying.
- The solution is collaborative.
 - Key challenges are structural and cultural.



“The first night’s a holiday. The second night’s a riot.”
– Former NYS utility commissioner, on outages

The New Reliability

- Worth more in the digital era
- Declining as customer cost falls
- Risk perceptions are flawed, but risks increasing in number and severity
- Customer expectations rising
- 21st century threat environment



Resilience: Ability to resist, absorb, recover from or successfully adapt to adversity or a change in conditions. [DHS Risk Lexicon, 2008]

"We have nothing to do with this."

– @ILLUMINATI twitter response to 2013 Superbowl power outage

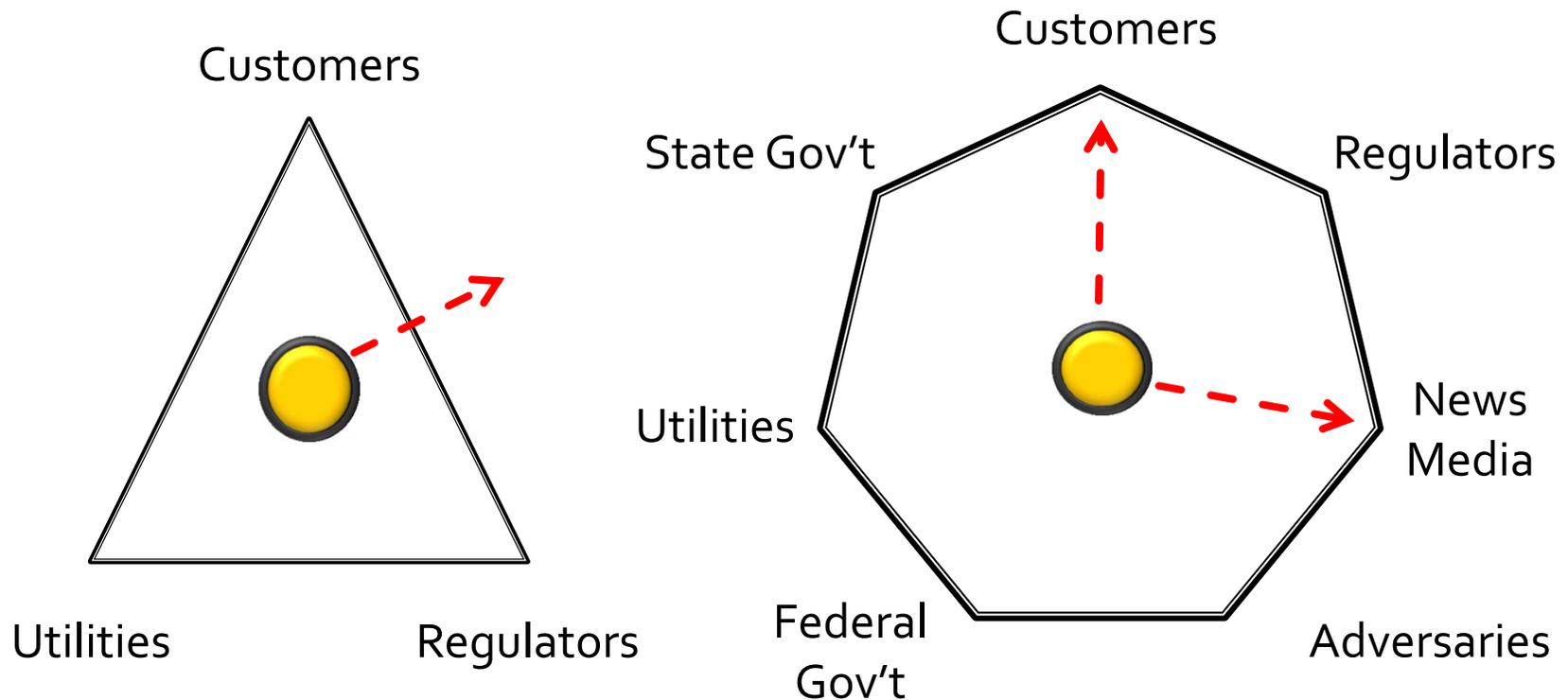
How Do We Think About Power?

1. Who are the stakeholders here?
2. Do we know how we're doing?
3. Do you help customers understand how utilities work?
4. What is the impact of public policy and the marketplace?



"I can't see the forest for the trees, Henderson. Have the trees cut down."
– Patrick Hardin (cartoonist)

21st Century Stakeholder Mapping



“Three days without power is difficult, five days is unbearable and nine days is simply unacceptable.”

– Sen. Chuck Schumer (D-NY), July 9, 2012

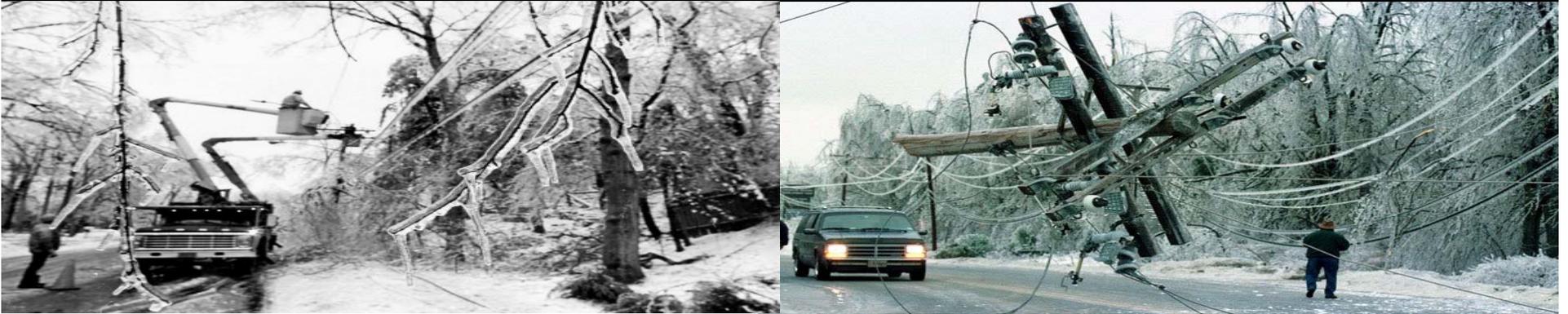
Case Studies

How Does It Come Together In Practice?



“There are known unknowns; that is to say, there are things that we now know we don’t know.”
– Donald Rumsfeld, poet

Breaking the Frames



- Is the system perfectly designed for failure? Do reliability and security compete?
- No industry, regulatory consensus on how to harden or recover. Many trade-offs.
- Utilities keep stringing lines in the air... while customers keep insisting they can't do without it for even a few days.
- But whose job is it, really, to keep us safe and warm?

"Switching to Downton Abbey where they still have electricity."
– Funniest Superbowl 2013 Tweets

What Do We Do Next?

- Overhaul federal and state assistance programs?
- Graceful degradation versus impregnability?
- Do we require standard measures of performance?
- Can we agree on a national "standard of care"?
- Will the Smart Grid help? At what cost?
- Mobile sub-stations and transformers?
- Is it ethical to use public money to benefit private industry?
- Can we make more money for distribution reliability by focusing on cheaper generation options?
- What about distributed generation? Will we outgrow utilities or learn to miss them?
- Energy storage? Microgrids?



"Power outages are like being grounded by God."
– Jimmy Kimmel, comedian

Wrap Up

- **The definition of reliability is changing**
 - For the industry (more precise)
 - For government (more vulnerable)
 - For society (more valuable)
- **Our frames of reference need attention**
 - We need to be comfortable challenging our own thinking
- **Our solutions must be collaborative**



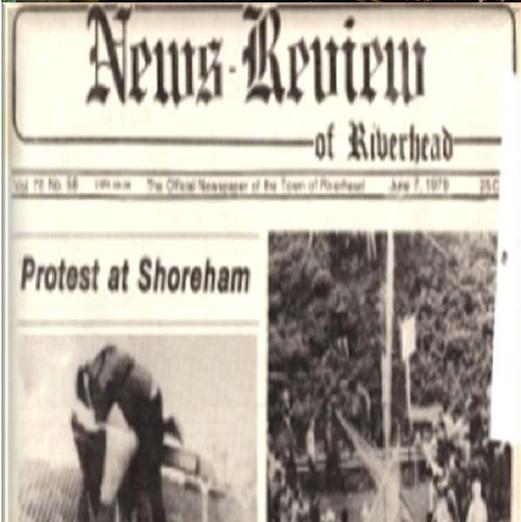
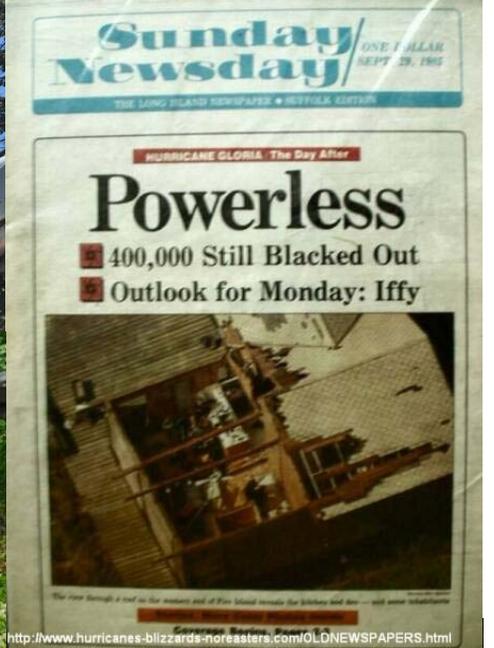
“With great power comes a huge electric bill.”
– Anon.

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The Focus

“Electricity can be dangerous! My nephew tried to stick a penny into a plug. Whoever said a penny doesn’t go far didn’t see him shoot across that floor.”

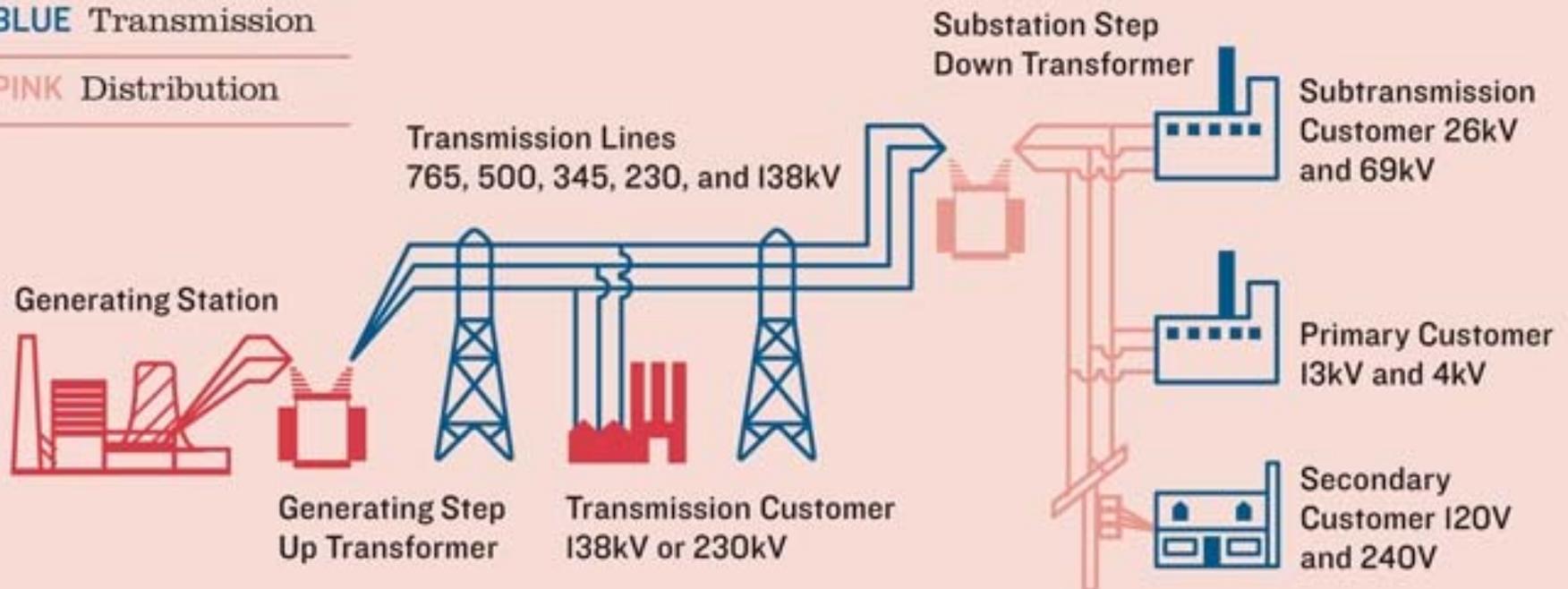
—Tim Allen

FIGURE 1 ★ Elements of Generation, Transmission, and Distribution Systems

RED Generation

BLUE Transmission

PINK Distribution



SOURCE Federal Energy Regulatory Commission, 2006.

Courtesy: American Society of Civil Engineers (ASCE)