

Modernizing Electricity Infrastructure and the Integration of Smart Grid Technology

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Problem Statement:

1. Multiple barriers prevent smart grid technologies from being utilized
2. Existing measures of progress have limited usefulness

Research Questions:

1. To what extent are specific SGTs underutilized within ERCOT due to barriers of implementation?
2. How can electric grid modernization progress, or lack thereof, be better collected and communicated to decision-makers?

Working Hypothesis:

Transition to a smart grid is a challenging long term process that is unlikely to achieve the full theoretical concept, however, identifying and measuring the gaps between theory and reality may help prioritize funding and better direct implementation roadmaps

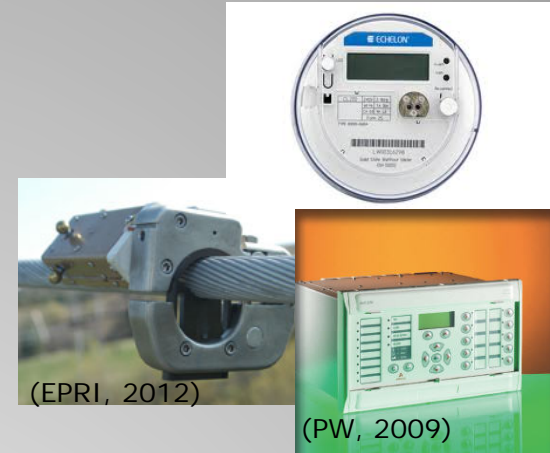
Goals:

1. Demonstrate the gap between smart grid technology (SGT) concepts and their on the ground utilization within ERCOT
2. Refine and create measures of progress that can be used to evaluate electric modernization within ERCOT over time

Research Focus

Proposed Methodology:

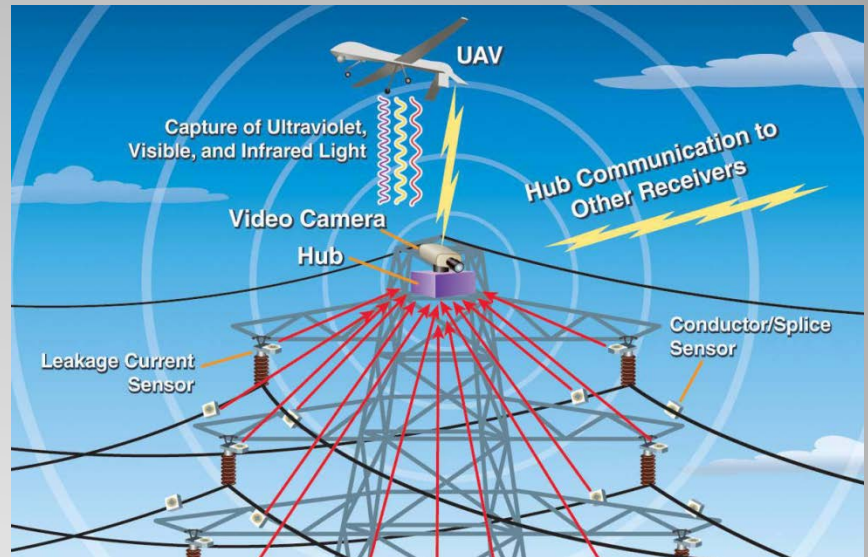
- Mixed methods (quantitative & qualitative)
- Dependent Variables (Smart grid technology utilization/ integration)
- Independent Variables (Funding, Infrastructure, Workforce, Regulation)
- Purposive sample strategy
 - Identify precise barriers
 - Pilot test of all 75 utilities in ERCOT
 - Study each barrier w/ n = 3-10 utilities
 - Possible cluster sampling (utility size, location, ownership, volume)
- Fieldwork: Utility & Engineering surveys



Method	Barrier Centric	Smart Grid Technology Centric
Description	<ul style="list-style-type: none"> • Narrow in on three specific barriers • Choose utilities with a range of SGT utilization • Evaluate how these barriers impact each utility 	<ul style="list-style-type: none"> • Narrow in on three specific SGTs • Choose barriers specific to these SGTs • Evaluate how these barriers impact each utility's use of the SGTs
Advantage	<ul style="list-style-type: none"> • Highlights the potential that could be utilized if a specific barrier is reduced 	<ul style="list-style-type: none"> • Easier to identify and communicate barriers to specific SGTs • Reduces error in aggregating energy savings of a broad range of SGTs
Disadvantage	<ul style="list-style-type: none"> • Full story of the barriers to implementation would not be conveyed • May reduce the interdisciplinary contribution of the study 	<ul style="list-style-type: none"> • Results are narrow and may underemphasize the significance of barriers to the overall modernization effort

Research Design Methods

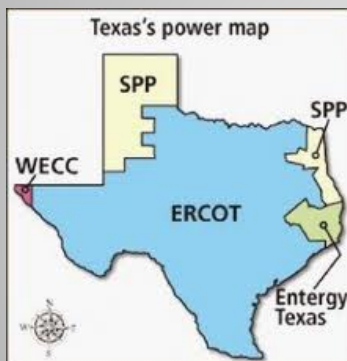
- Infrastructure barriers may be circular, i.e. SGT can be considered infrastructure
- Subjective measure of technology capability, widespread utilization & usefulness
- Utility survey results reflecting perspective of company specific strategies



Source: EPRI, "Estimating the Costs and Benefits of the Smart Grid, pg 5-7"

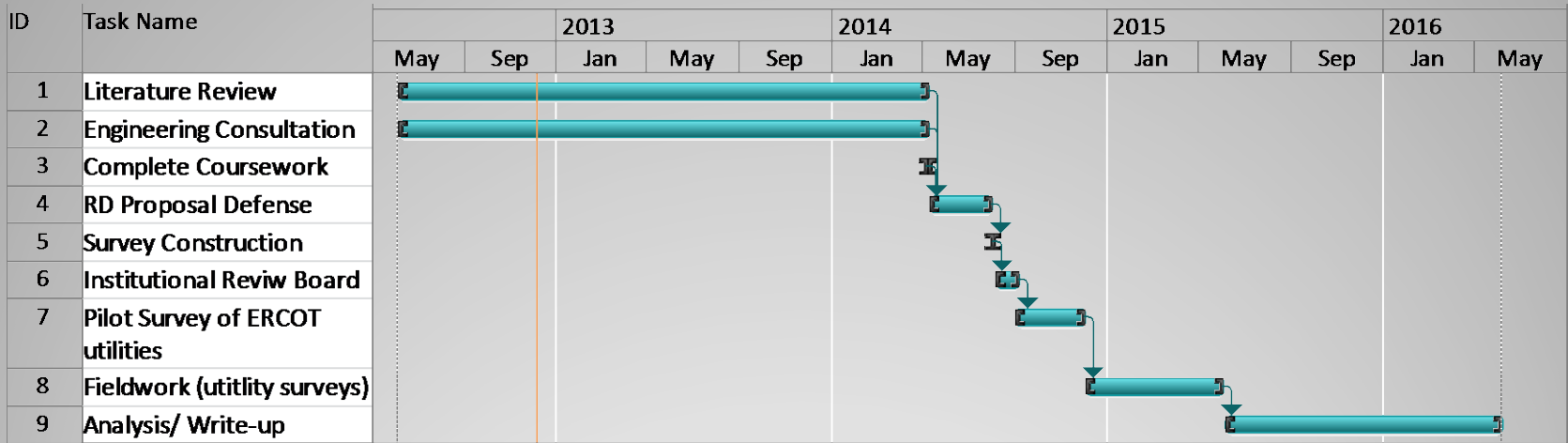
Threats to Validity & Reliability

- Assist decision-making for prioritized funding and investment incentives
- Encourage debate in academic community
- Support smart grid engagement by smaller utilities



Anticipated Contributions

Back-Up



Research Steps & Schedule

- Public Utility Commissions, ERCOT & Utilities
- U.S. Government Sources
 - U.S. Department of Energy
 - Smart Grid Information Clearinghouse
 - Federal Energy Regulatory Commission
 - North American Electric Reliability Corporation
 - U.S. Energy Information Administration
 - Smart Grid Advisory Committee
 - Smart Grid.gov
 - Science & Technology Council
 - National Science Foundation
- Academic & Private Research Institutions
 - Edison Electric Institute
 - Electric Power Research Institute
 - IEEE Power & Energy Magazine
 - American Society of Civil Engineers
 - Black & Veatch
 - Brattle Group
- On-line publications/ Blogs
 - Smartgridnews.com
 - Shedthelight.org

*Stakeholder
Positions*

*Identification of
gov projects,
challenges &
goals*

*National &
international
conversations in
smart grid efforts*

*Information
sharing*

Literature Review_Sources

- Ethical Concerns
 - Privacy of utility survey results
 - Data storage/ access
 - Potential future employers

Ethical Concerns/ IRB

Project Title	Address	City	State	zip	Project Type	Lead Organization
AEP Texas gridSMART initiative	539 North Carancahua Street	Corpus Christi	Texas	78478-0044	Advanced Metering Infrastructure	AEP Texas
Austin Energy Smart Grid 1.0 and 2.0	721 Barton Springs Road	Austin	Texas	78704-1145	Advanced Metering Infrastructure	Austin Energy
Bluebonnet Electric Cooperative Smart Grid Project	650 Highway 21	Bastrop	Texas	78602	Customer Systems	Bluebonnet Electric Cooperative
CCET - Technology Solutions for Wind Integration	816 Congress Avenue, Ste. 1260	Austin	Texas	78701	Regional Demonstration	Center for the Commercialization of Electric Technologies
CenterPoint Energy Smart Grid Project	1111 Louisiana Street	Houston	Texas	77002	Advanced Metering Infrastructure	CenterPoint Energy
CPS Energy Smart Grid Project	7000 San Pedro Ave	San Antonio	Texas	78216	Advanced Metering Infrastructure	CPS Energy
Denton County Electric Cooperative d/b/a CoServ Electric Smart Grid Project	7701 South Stemmons Freeway	Corinth	Texas	76210-1842	Advanced Metering Infrastructure	Denton County Electric Cooperative d/b/a CoServ Electric
El Paso Electric Smart Grid Project	100 N. Stanton	El Paso	Texas	79901	Distribution Systems	El Paso Electric
Golden Spread Electric Cooperative, Inc. Smart Grid Project	905 South Filmore, Suite 220	Amarillo	Texas	79101-3541	Integrated Systems	Golden Spread Electric Cooperative, Inc.
Lyntegar Electric Coop AMI Project	1807 Main St	Tahoka	Texas	79373	Advanced Metering Infrastructure	Lyntegar Electric Coop
Oncor Electric Delivery Company, LLC Smart Grid Regional Demonstration Project	1601 Bryan Street	Dallas	Texas	75201	Regional Demonstration	Oncor Electric Delivery
Oncor Smart Texas - Rethinking Energy	Rodgers Fwy, Suite 6C-006	Dallas	Texas	75202-1234	Advanced Metering Infrastructure	Oncor (Dallas area pka TXU)
Pecan Street Project, Inc. Smart Grid Regional Demonstration Project	3925 West Braker Lane	Austin	Texas	78759	Regional Demonstration	Pecan Street Project, Inc.
Pedernales Electric Cooperative AMI Project	201 South Avenue	Johnson City	Texas	78636-0001	Advanced Metering Infrastructure	Pedernales Electric Cooperative
Reliant Energy Retail Services, LLC Smart Grid Project	1000 Main Street	Houston	Texas	77002-6336		Reliant Energy Retail Services
South Plains Electric Cooperative AMI Project	P.O. Box 1830	Lubbock	Texas	79408	Advanced Metering Infrastructure	South Plains Electric Cooperative
TXU Energy AMI Project	6555 Sierra Drive	Irving	Texas	75039	Advanced Metering Infrastructure	TXU Energy
United Cooperative Services AMI Project	3309 North Main Street	Cleburne	Texas	76033	Advanced Metering Infrastructure	United Cooperative Services

TX Smart Grid Projects

Project	States	Award Amount	Total Project Value
*Austin Community College	Texas	\$44,959	\$132,169
CCET (Technology Solutions for Wind Integration)	Texas	\$13,516,546	\$27,075,457
CenterPoint Energy (Smart Grid Project)	Texas	\$200,000,000	\$639,187,435
Denton County Electric Cooperative d/b/a CoServ Electric (Smart Grid Project)	Texas	\$17,205,844	\$40,966,296
El Paso Electric (Smart Grid Project)	New Mexico, Texas	\$1,014,414	\$2,196,187
**Entergy Services, Inc. (Smart Grid Project)	Arkansas, Louisiana, Mississippi, Texas	\$4,611,201	\$10,466,358
Golden Spread Electric Cooperative, Inc. (Smart Grid Project)	Texas	\$17,263,115	\$43,157,788
Oncor Electric Delivery Company	Texas	\$188,748	\$431,937
Oncor Electric Delivery Company (Dynamic Line Rating)	Texas	\$3,471,681	\$7,279,166
Pecan Street Project Inc (Energy Internet Demonstration)	Texas	\$10,403,570	\$24,657,078
Reliant Energy Retail Services, LLC (Smart Grid Enabled Consumer Participation)	Texas	\$19,839,689	\$63,696,548
**Western Electricity Coordinating Council (Western Interconnection Synchrophasor Program)	Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Texas, Washington	\$53,890,000	\$107,780,000

*The scope of the first project listed is limited to workforce training and is not considered in the project list from the Smart Grid Information Clearinghouse used to conduct this study

**Two multi-state projects are not based out of Texas and are not allocated to Texas in the project list from the Smart Grid Information Clearinghouse used to conduct this study

Recovery Act Awards