

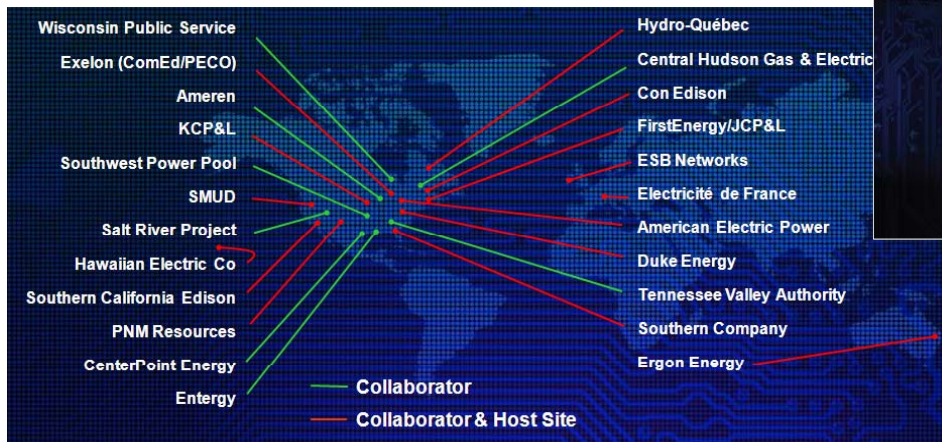


Costs and Benefits of the Smart Grid

EU-US
Smart Grid Assessment Methodologies
November 7, 2011

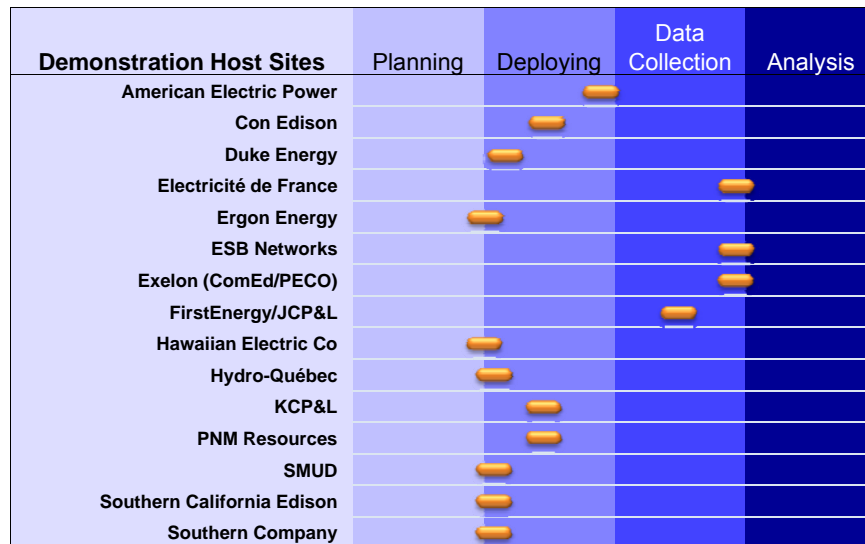
Jeffrey D. Roark
Sr Project Manager
Smart Grid Demonstrations

EPRI Smart Grid Demonstration Initiative



Publicly Available:
Product ID 1023411

Status of Host-Site Demonstrations



Cost-Benefit Analysis Guiding Documents

- **“Methodological Approach,” published Jan, 2010**

- Jointly funded by DOE and EPRI
- Provides framework for estimating benefits & costs
- Provides definitions, concepts and data sources
- Publicly available: Product ID 1020342

Methodological Approach for Estimating the Benefits and Costs of Smart Grid Demonstration Projects

1020342
Final Report, January 2010



- **“CBA Guidebook, Volume 1: Measuring Impacts,” published May, 2011**

- provides a manual for practical application with step by step instruction
- provides guidance for documenting the project in detail and approach to perform a CBA,
- includes templates for working through the process.
- Publicly available: Product ID 1021423

Goal of the CBA Process: Maximizing Learning

- **Maximize *learning* from Smart Grid projects by**

- Advancing understanding of where, how, and why Smart Grid technologies perform as they do
- Promoting transferability of results

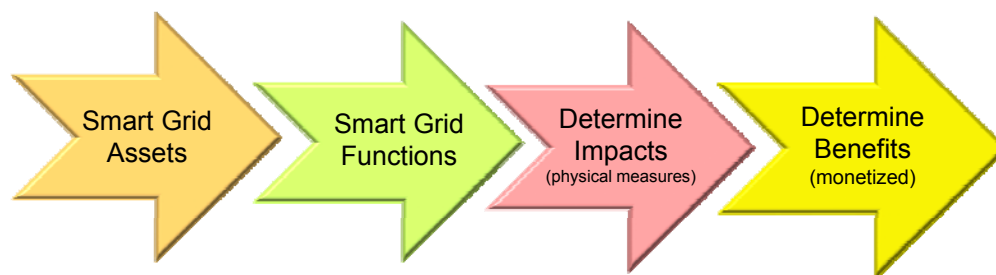
- **For *learning* to be maximized:**

- Methodologies must be credible
- Results must be verifiable by others

**We address these goals
by applying the Scientific Method:**

**Formulating, testing, and modifying hypotheses through
experimentation, observation, and measurement.**

Overview of Smart Grid Evaluation Process



- List Technologies, Devices, & Systems

Examples:

- AMI/Smart meters
- Distribution Automation
- 2-way communication
- Smart Appliances
- Intelligent Electronic Devices (IEDs)

- Describe Systems' Intended Functions

Examples:

- Volt/VAR control
- Dynamic Capability Rating
- Flow control
- Intelligent line switching
- Real-time load management

- Compare project performance to baseline case

Example measures:

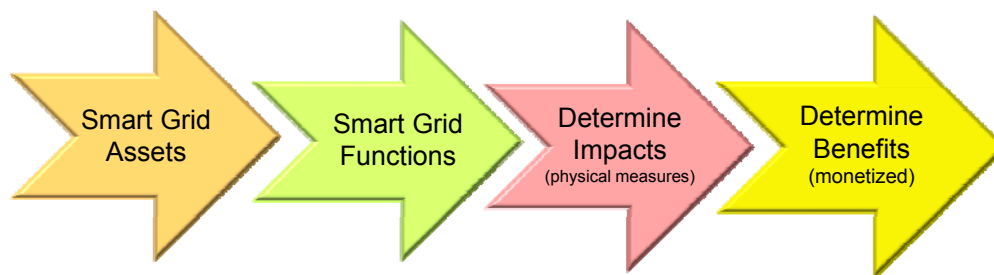
- kWh reduction
- Peak kW reduction
- Loss reductions
- Outage reductions
- Improved asset utilization

- Monetize physical measures

Example metrics:

- Fuel savings
- Capacity savings
- Reduced outage costs
- Customer bill reductions
- Reductions in CO₂, Hg, etc.

Overview of Smart Grid Evaluation Process

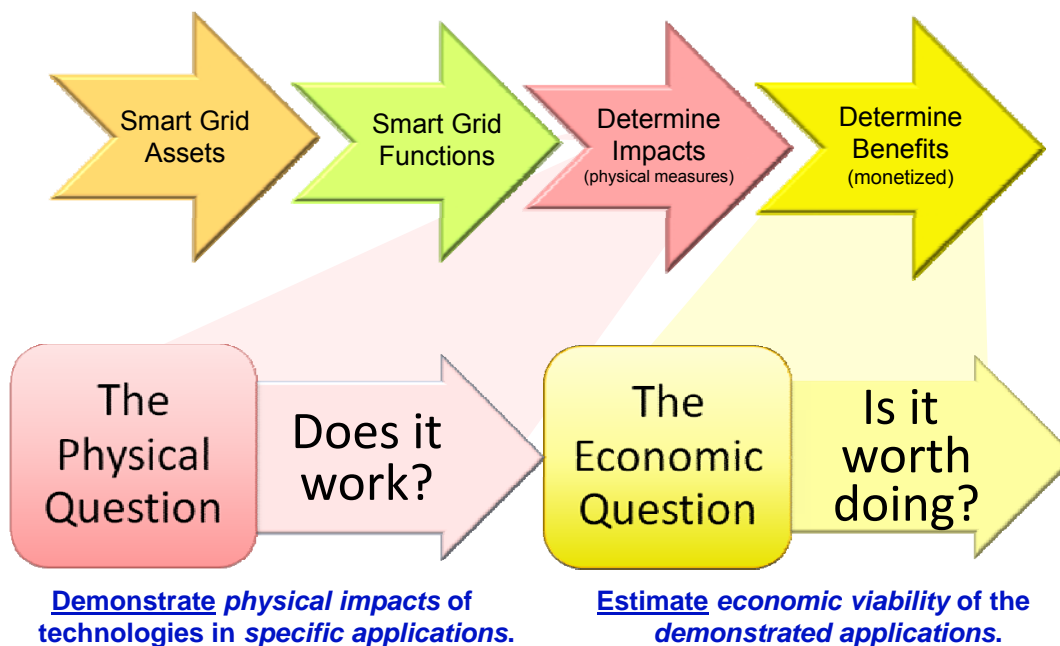


SG Assets		Functions				
		Transmission	Distribution	Substation	Control	Protection
Asset Name	Asset Type					
Asset Description	Asset Location					
Asset Status	Asset Age					
Asset Cost	Asset Value					
Asset Lifetime	Asset Efficiency					
Asset Reliability	Asset Security					
Asset Environmental Impact	Asset Social Impact					
Asset Regulatory Compliance	Asset Market Compliance					
Asset Interoperability	Asset Scalability					
Asset Flexibility	Asset Resilience					
Asset Sustainability	Asset Innovation					
Asset Transparency	Asset Accountability					
Asset Inclusiveness	Asset Empowerment					
Asset Collaboration	Asset Partnership					
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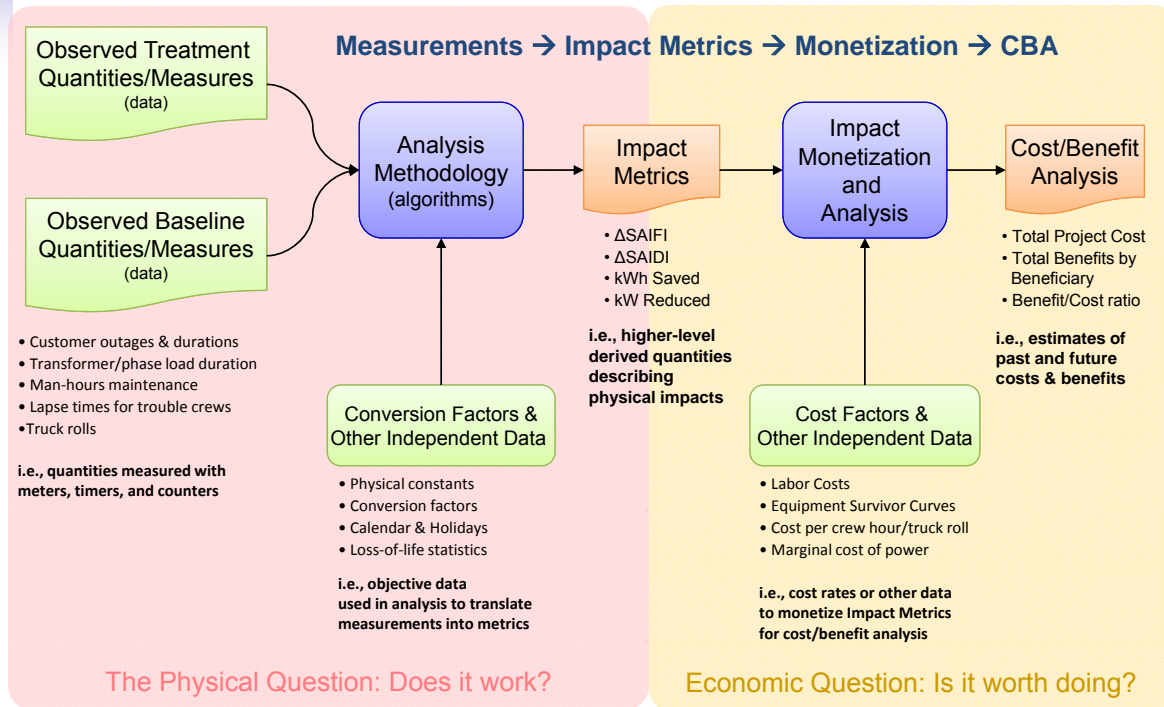
Benefits		Functions				
		Transmission	Distribution	Substation	Control	Protection
Benefit Name	Benefit Type					
Benefit Description	Benefit Location					
Benefit Status	Benefit Age					
Benefit Cost	Benefit Value					
Benefit Lifetime	Benefit Efficiency					
Benefit Reliability	Benefit Security					
Benefit Environmental Impact	Benefit Social Impact					
Benefit Regulatory Compliance	Benefit Market Compliance					
Benefit Interoperability	Benefit Scalability					
Benefit Flexibility	Benefit Resilience					
Benefit Sustainability	Benefit Innovation					
Benefit Transparency	Benefit Accountability					
Benefit Inclusiveness	Benefit Empowerment					
Benefit Collaboration	Benefit Partnership					
Benefit Integration	Benefit Synergy					

Tables 4-4 and 4-8 in "Methodological Approach" and Tables 5-1 and 5-2 in "CBA Guidebook"

Cost/Benefit Analysis Guidebook for SG Demos Overview of Smart Grid Evaluation Process

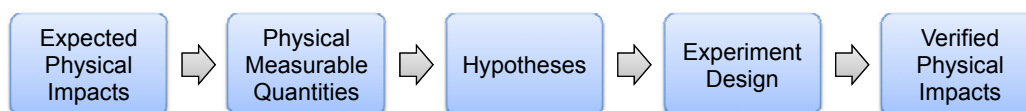


Completing the Cost/Benefit Analysis



Hypotheses Drive Experiment Design

- Some benefits occur far from site of deployment.
- Prior to experimentation and measurement, impacts and benefits must be traced back to physical, measurable quantities local to the project.
- Hypotheses for experimentation are developed to drive experimental design, to expose measurable quantities.



Issues

- Monetizing Benefits
- Timing of Costs and Benefits
- Hard and Soft Benefits
- Who pays, and who benefits?
- Marginal rates and marginal costs (the “Lost Revenue” problem)

	Beneficiaries		
	Utilities	Customers	Society
Economic			
Environmental			
Reliability & Power Quality			
Security & Safety			

QUESTIONS?



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