Approach for Calculating OE Benefits

Electricity Delivery and Energy Reliability

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Challenges

Analyzing the benefits of OE's portfolio requires overcoming several key challenges.

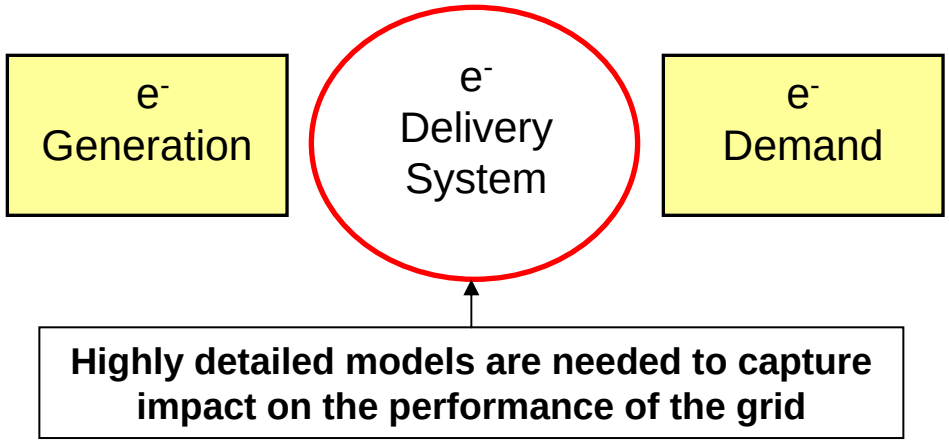
- Established benefits methodologies (e.g., NEMS and MARKAL) do not address some of the major benefits that OE's program will provide (e.g. reliability).
- Much of OE's program is about transforming the way the T&D infrastructure operates rather than replacing components:
  - Some technologies need a high penetration or must be deployed as an entire system to yield benefits (e.g. PMUs or Distribution Automation).
  - Some programs within OE are not developing "widgets" that can be easily counted.
  - OE is developing tools/methodologies or funding demonstrations that will enable and accelerate the deployment of new technologies.
  - OE is developing component technologies that will support new products (e.g. power electronics).
  - OE efforts will enable the enhanced utilization of renewable and distributed energy generation technologies.

Challenges

Analyzing the benefits of OE's portfolio requires overcoming several key challenges. (Continued)

- OE's portfolio leads to direct (T&D related) and enabling benefits. The enabling benefits may be substantially larger than the direct benefits.
- The buyer of OE's technology is likely to be regulated utilities, who have business models driven by utility regulatory economics with little reward allowed for taking technology risks.
- The large variance in physical, operations and market structures, especially at the distribution level, makes it difficult to simulate the impact of OE technologies using one grid simulation tool.
- A benefits estimation process will need to accommodate scenario analyses, e.g., examining the effects of varying fuel prices and changing GHG management strategies.
- A benefits estimation process will need to couple with other Departmental methods, and map into metrics associated with energy security, climate change concerns, and economics.

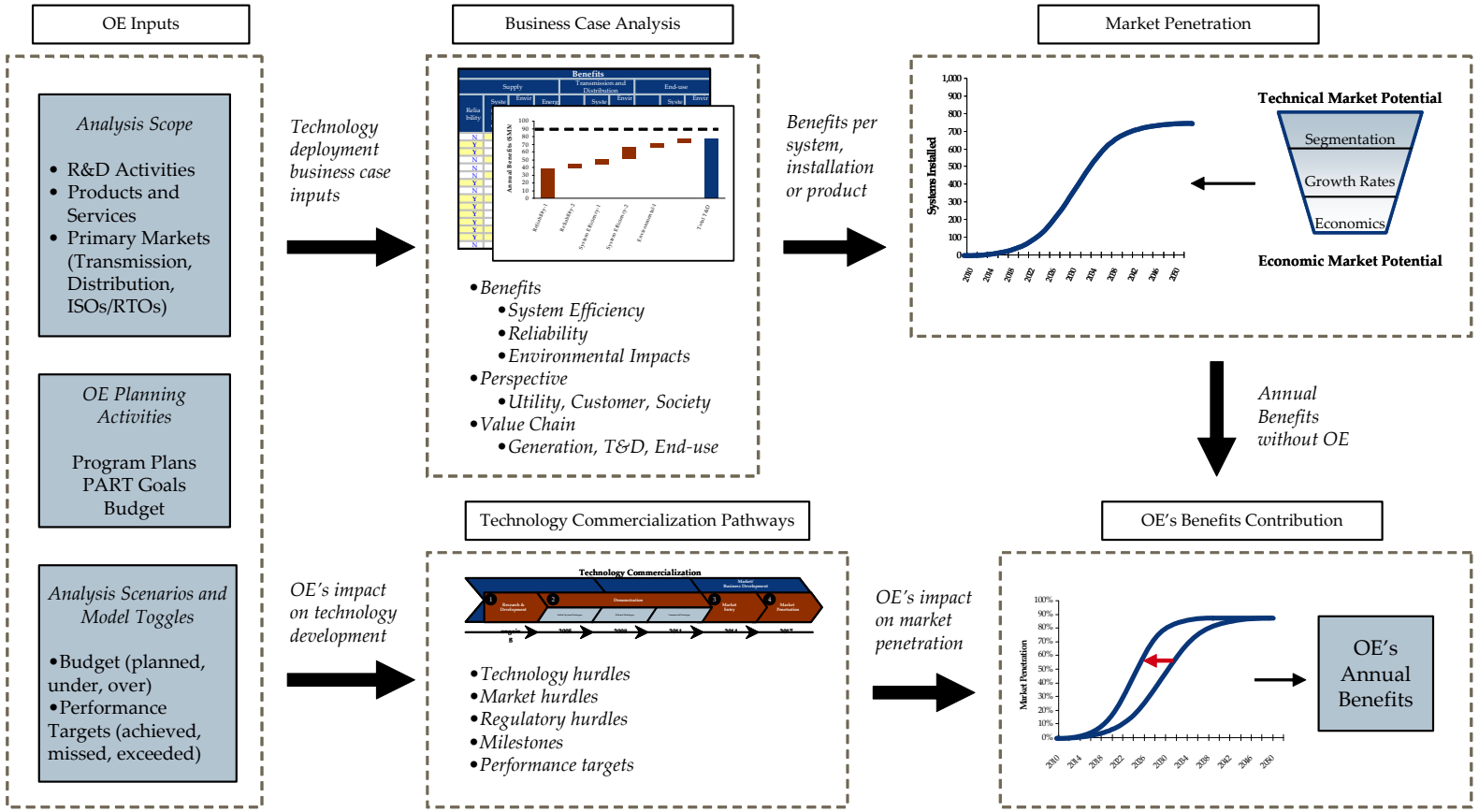
Issues with Grid Simulation Models (for GPRA Analysis)



- The large variance in physical, operations and market structures, especially at the distribution level, makes it difficult to simulate the application of OE technologies using one model.
- Different types of models are needed to represent the various OE technologies such as:
  - Dynamic power system model needed to see rapid grid stabilization by advanced power electronics (switching) technology
  - DC power flow model needed to examine impact of storage technology on reducing reserve requirements
- Utilities are in the best position to make technology investment decisions based upon their unique business and regulatory environments and DOE is not in the grid planning and operations business.
- There are too many variables to make rational inputs to grid simulation model on a national scale.

Conceptual Approach

The approach requires a business case, market analysis, and clear understanding of OE's role in technology and market development.



Application of Technology

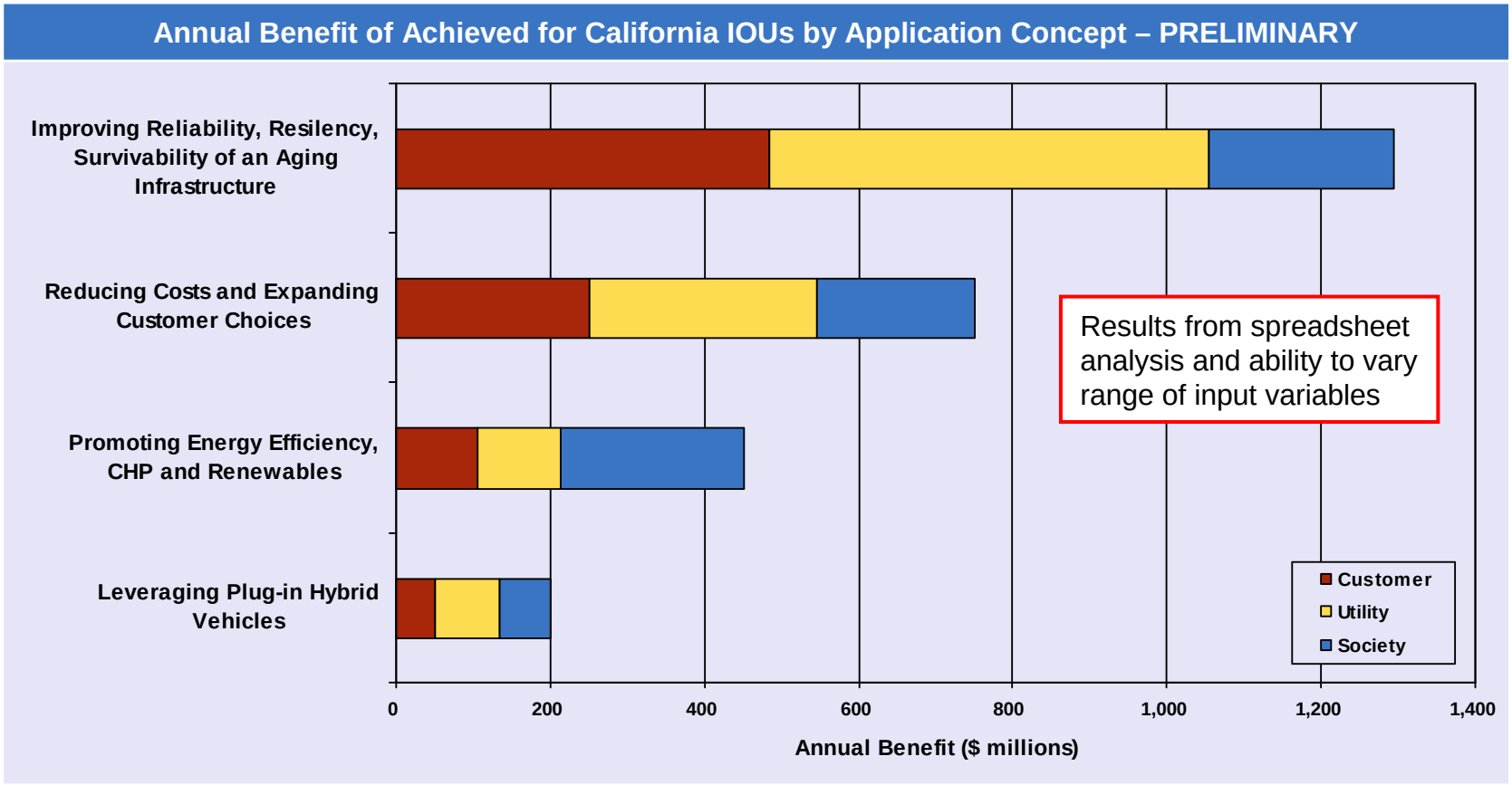
The first step will be to agree on the products and services, and the primary markets, that will result from OE's R&D activities.

R&D Program Activities →	Products and Services →	Primary Markets
Visualization and Controls	Phasor and other measurement devices	ISOs, RTOs, Control Centers
	Control system evaluations	SCADA owners/operators
	Visualization Tools	ISOs, RTOs, Control Centers
High Temperature Superconductivity	Cables	Transmission and/or Distribution Companies
	Transformers	Transmission and/or Distribution Companies
	Motors	Manufacturing and Process Industries
	Fault Current Limiters	Transmission Companies
Renewable and Distributed Systems Integration	DG strategies and concepts (generation, storage, demand response)	Distribution companies, consumers
	Distribution automation and AMI	Distribution companies
Energy Storage and Power Electronics	Storage devices (batteries, flywheels, ultra-capacitors)	Transmission and/or Distribution Companies
	Solid state switches	Transmission and/or Distribution Companies
	Solid state inverters	Transmission and/or Distribution Companies

Business Case

Based on variable user inputs, annual benefits will be estimated from a spreadsheet model as shown in the example below.

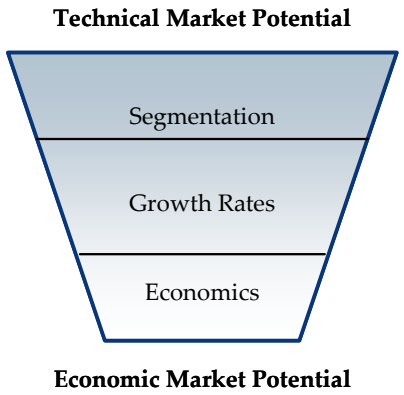
Illustrative



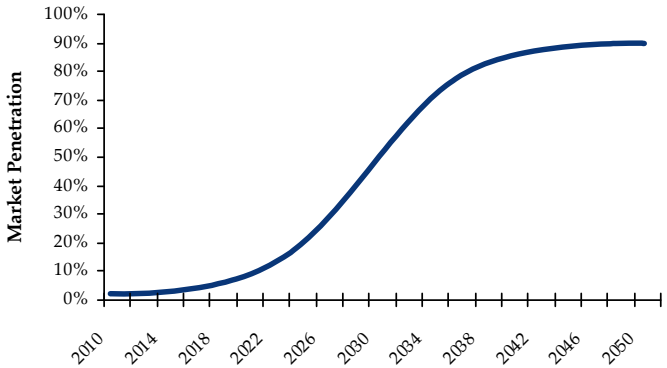
Source: NCI Analysis

Market Penetration

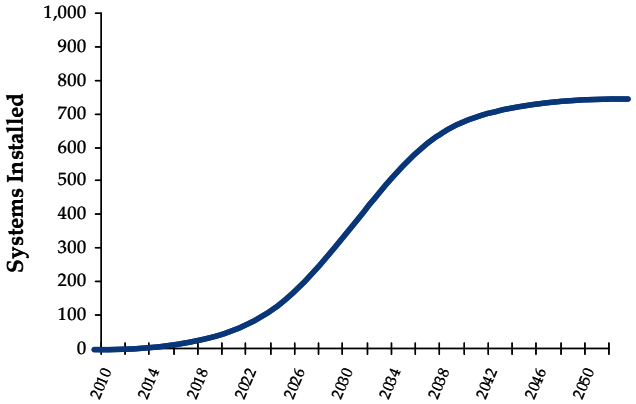
Market analysis will be performed to determine the number of systems or installations to be deployed with OE developed technology.



Historic and Projected Penetration

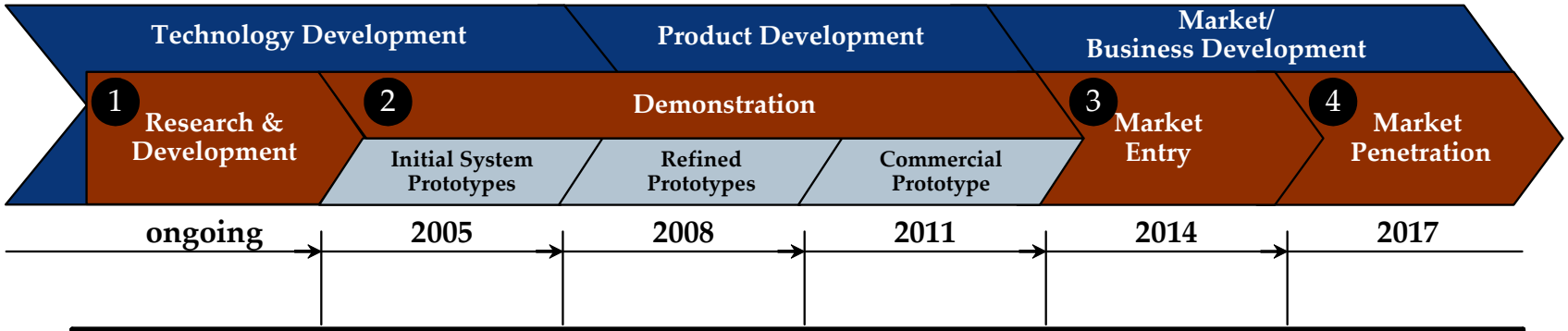


Systems Installed per Year



Commercialization Pathways

Commercialization pathways will be developed to determine how OE impacts technology and market development.

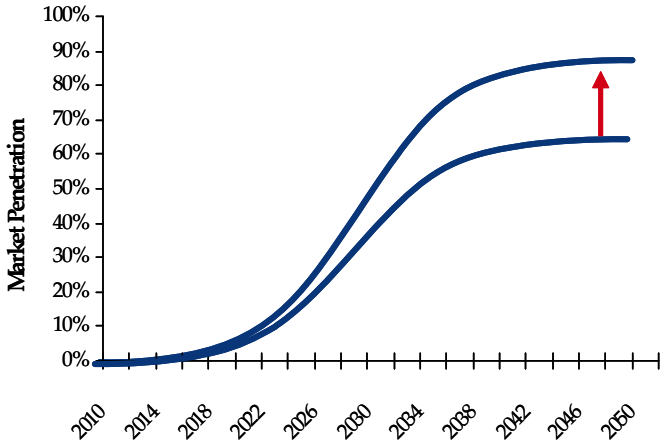


Technical Barriers					
Market Barriers					
Technology Performance Targets					
Milestones					

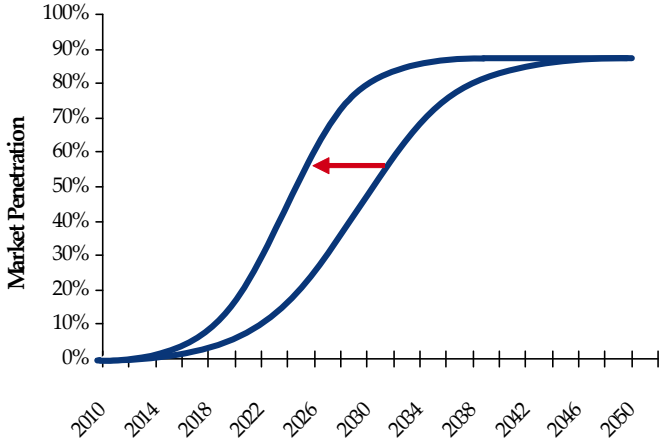
OE's Benefit Contribution

OE's benefit contribution will be determined by understanding how OE increases or accelerates market penetration.

Increasing Market Penetration



Accelerating Market Penetration



Plan

- Pilot methodology for:
  - Distributed Automation and Advanced Metering Infrastructure technology with final report due by end-March 2008.
  - Storage technology with final report by mid-September 2008
- Work with the Interoffice Working Group (IWG) to integrate the methodology into Departmental methodology throughout FY08
- Establish a set of peer reviewers to examine and comment on the methodology.