



**EPRI**

ELECTRIC POWER  
RESEARCH INSTITUTE

## Wrap-up: Enabling Storage

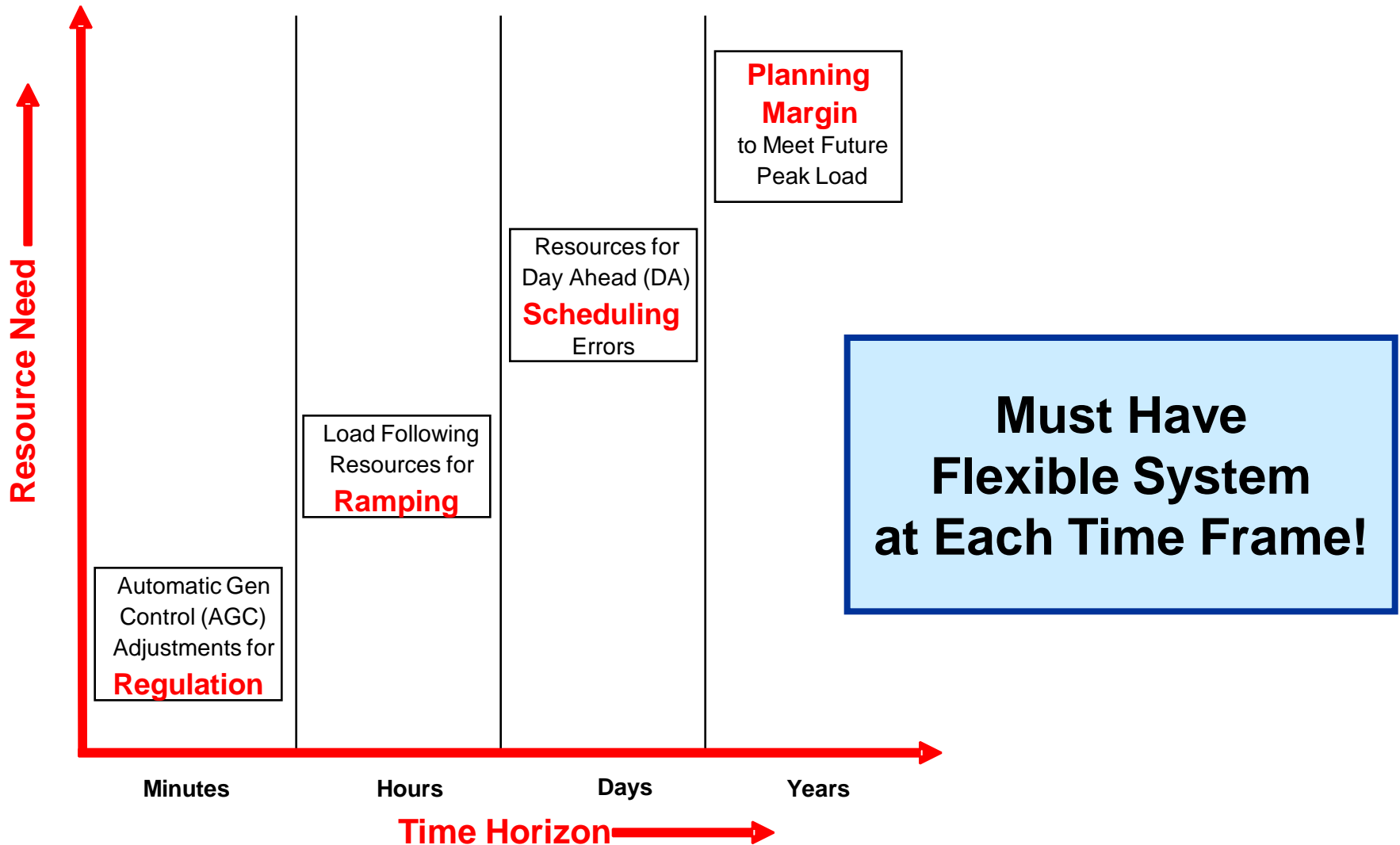
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Vice President, Power Delivery & Utilization

**PJM-EPRI Energy Storage Summit**

April 20, 2010 | Valley Forge, PA

# Variable Generation (VG) Increases the Need for Balancing Resources



# Storage – Will Have to Compete with Other Flexible Resources

Traditional Low VG System

1.15 – 1.20

Assumed Values for  
Illustration Only

Spain Same System + High VG

1.8 – 1.9

Denmark + Available Transmission

1.5 – 1.6

+ Liquid Markets

1.4 – 1.5

+ Energy Storage

1.3 – 1.4

ERCOT + Demand Response

1.2 – 1.3

1.0 1.25 1.5 1.75 2.0  
Planning Margin

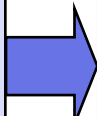
**Must evaluate economics and reliability of various flexibility options to obtain optimal mix of resource!**

# Enabling Energy Storage

**Innovative  
Regulation and  
Rates**



**Reliable &  
Low Cost  
Technology**



**Enable  
Renewable  
Penetration**

**Smart Grid  
Integration**

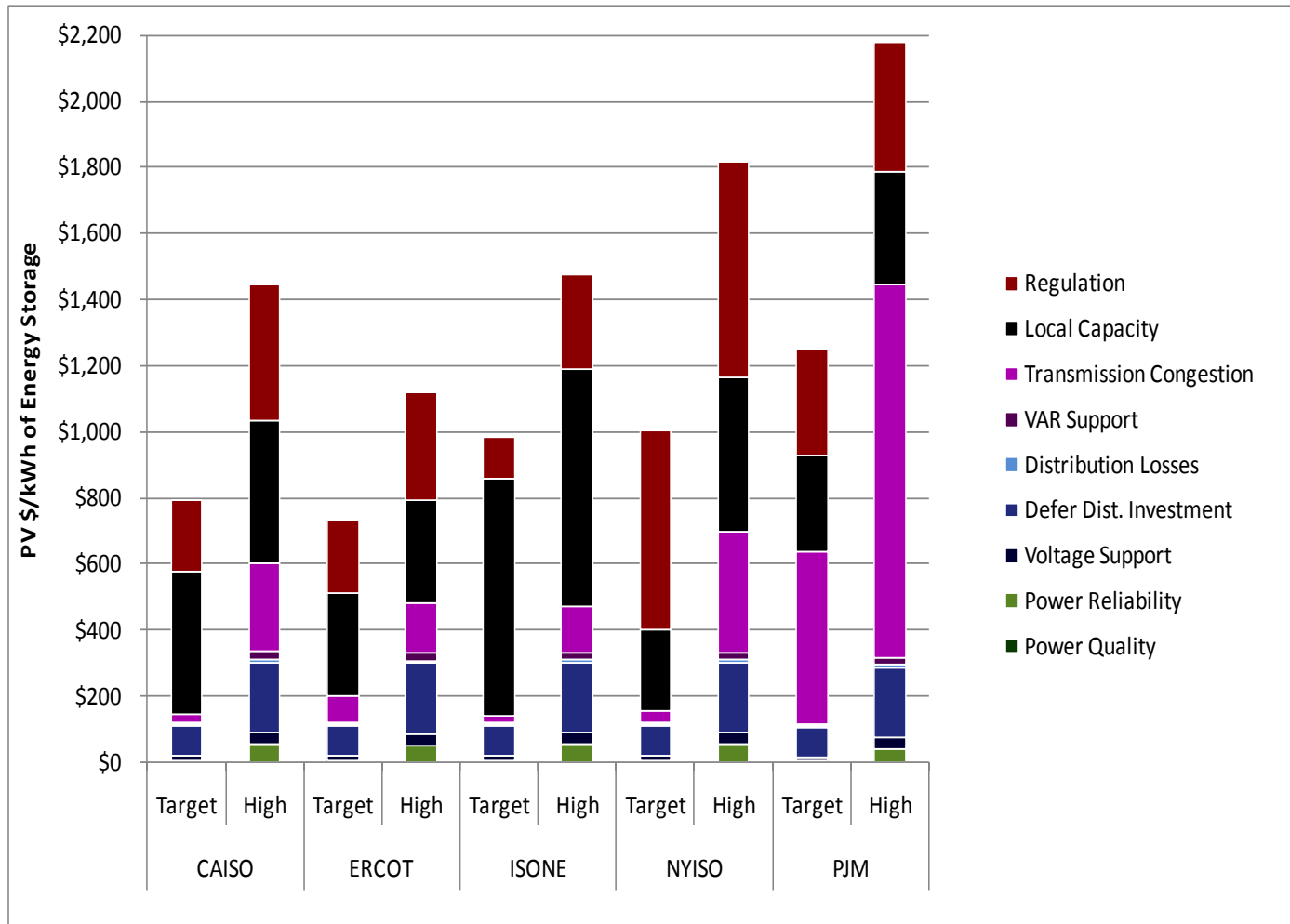


**Need Both Policy and Technology to  
Successfully Deploy Energy Storage**

# Policy: Innovative Markets

- **Realizing multiple value streams from energy storage technologies**
- **Energy storage technologies coupled with grid operations and transmission systems**
- **New markets for frequency regulation (e.g., NYISO, PJM, etc.)**
- **Enabling renewables – incentives for storage (PTC/ITC/REC)**

# Realizing Multiple Value Streams



# Technology Gaps

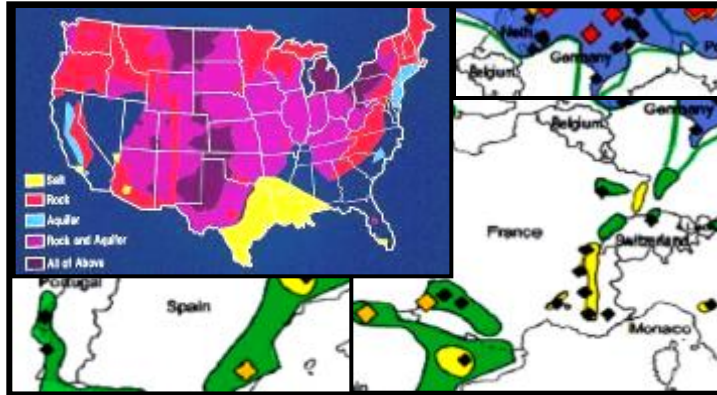
- **Technology Gaps for near term deployment**

- – Verifiable data on real life performance, reliability and cost
- – Standard language for “smart” grid communications to enable storage at the transmission and distributed levels
- – Industry guidelines for planning, designing, operating and life cycle management of energy storage technologies
- – Manufacturability to reduce cost of storage and balance of plant

- • **Continued RD&D to reduce cost of advanced storage technologies**

# Ongoing EPRI's Advanced Compressed Air Energy Storage (CAES) Demonstration Project

## *Belowground Geologic Opportunities*

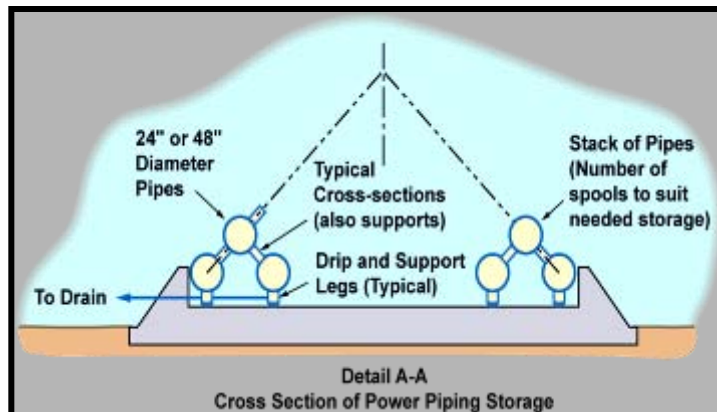


Demonstrate advanced CAES design and assess its performance when using under/above ground air store

## **Belowground CAES**

- Plant Size: ~ 300 MW with 10 hr. store
- Assess and Demonstrate Adv. CAES Using Salt, Porous Rock/Aquifer or Hard Rock Air Storage Systems

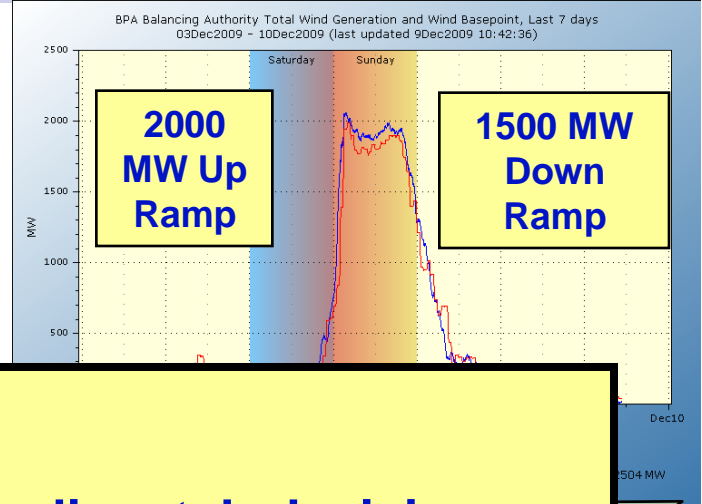
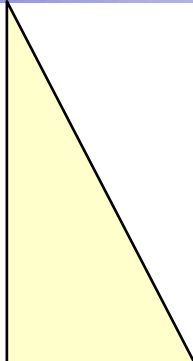
## *Aboveground Air Piping Opportunities*



## **Aboveground CAES**

- Plant Size: ~ 15 MW with 2 hr. store
- Assess and Demonstrate Adv. CAES using Pipe and/or Vessel-Based Aboveground Air Storage System
- Assess corrosion impact on vessel/pipe air store due to cycling temperature and pressure

# New EPRI Research: Operator Decision Tool for Variable Generation



## EPRI Role

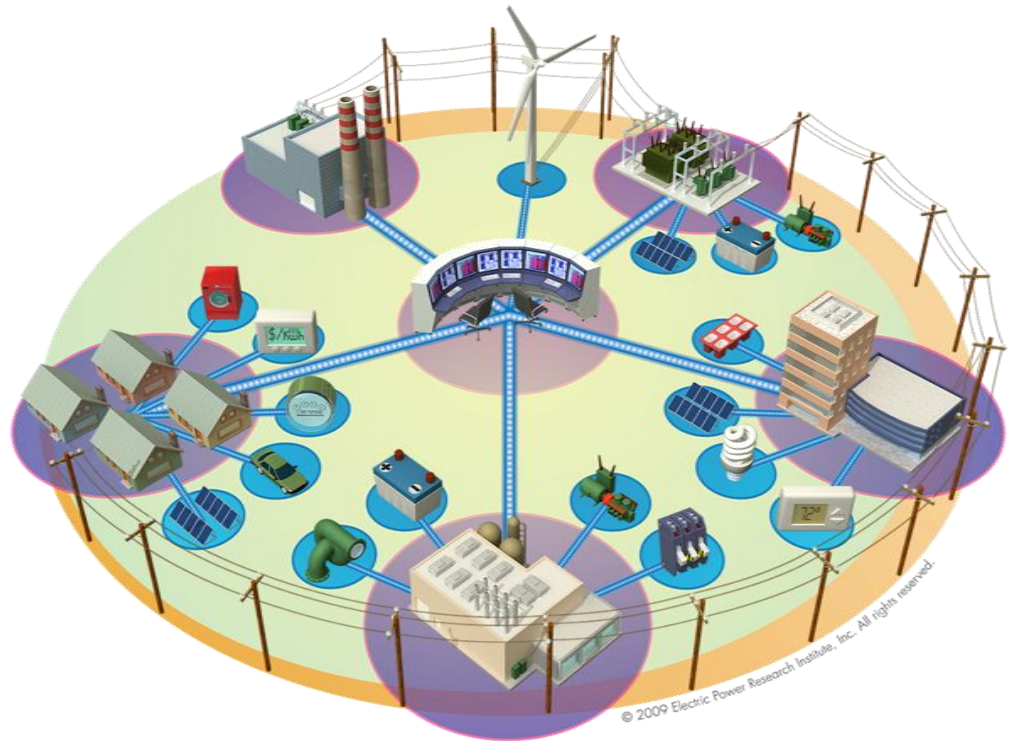
- functional requirements for operator dispatch decision-making tool
- Work with vendors for prototyping
- Prototype demonstration and validation



Source: [www.newenglandfutures.com](http://www.newenglandfutures.com)

# On-Going EPRI Research Smart(er) Grid Demonstrations: Tying All Together

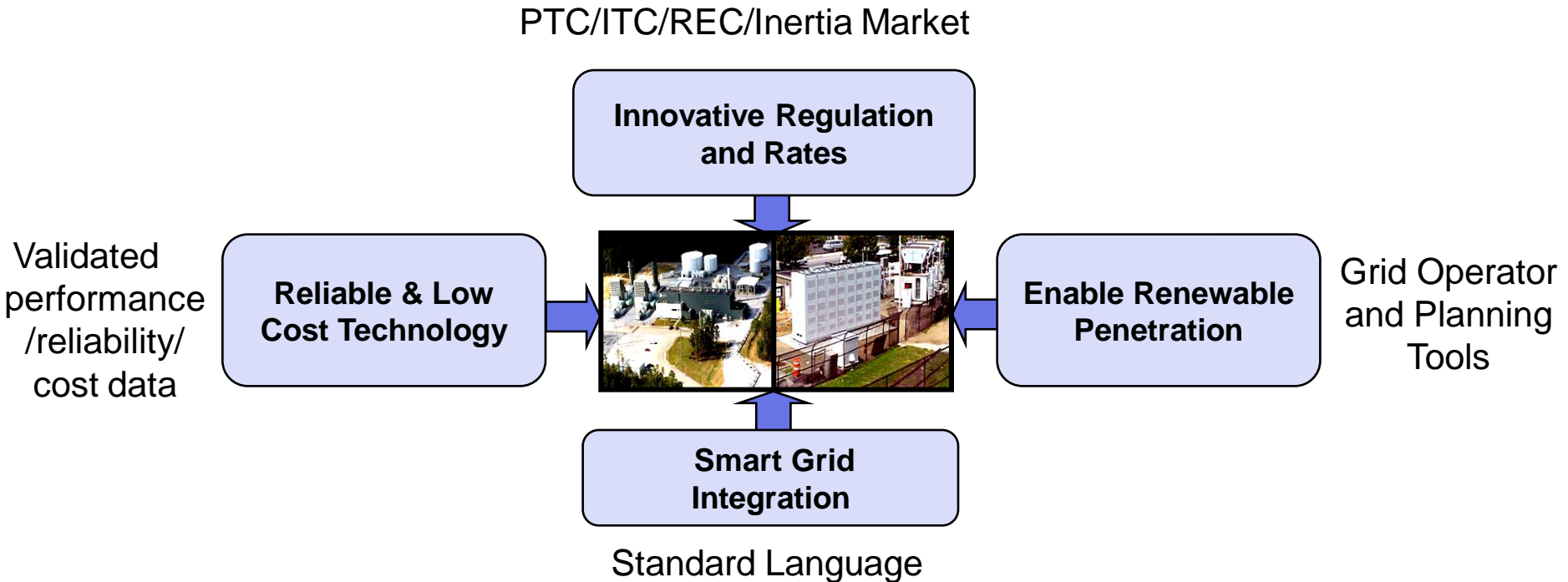
- Demonstrate Integration and Interoperability
- Leverage information & Communication Technologies
- Integration of Multiple Types of Distributed Energy Resources (DER)



Consolidated Edison	FirstEnergy	PNM Resources	AEP	ESB Ireland	EDF	KCP&L	Exelon
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**8 Host Sites to Demonstrate Integration of Distributed Resources including Energy Storage**

# Defining Success for the Summit



**Need Both Policy and Technology to Successfully Deploy Energy Storage**