Federal Regulatory Energy Storage Policy

DOE-ESTAP Webinar

Hosted by Clean Energy States Alliance

January 25, 2012

Housekeeping

- All participants will be in listen-only mode throughout the broadcast.
- You can connect to the audio portion of the webinar using your computer's speakers or a headset. You can also connect by telephone.
- You can enter questions for today's event by typing them into the "Question Box" on the webinar console. I will ask your questions, as time allows, following the presentations.
- This webinar is being recorded and will be made available after the call on the CESA website at:

  www.cleanenergystates.org/projects/energy-storage-technology-advancement-partnership/

CleanEnergy States Alliance

DOE-CESA Energy Storage Technology Advancement Partnership (ESTAP)

Purpose: Create new DOE-state energy storage partnerships and advance energy storage

Focus: Distributed electrical energy storage technologies (batteries, flywheels, supercapacitors, site-anywhere compressed air, micro pumped hydro)

Outcome: Near-term and ongoing project deployments across the U.S. with co-funding from states, project partners, and DOE

Activities:

- State and stakeholder listservs (ongoing)
- Surveys and interviews (ongoing)
- Webinars
- RFI (next few weeks!) in conjunction with Sandia National Laboratories
- RFI #2>RFQ
- MOU

http://www.cleanenergystates.org/projects/energy-storage-technology-advancement-partnership/

Anne Margolis, Project Director (anne@cleanegroup.org)

CleanEnergy States Alliance

Today's Webinar:
Federal Regulatory Energy Storage Policy

Presenters:

- Dr. Imre Gyuk, Manager, DOE Energy Storage Systems Program
- Dr. Bob Hellrich-Dawson, Economist, FERC
- Ruston Ogburn, Sr. Lead Engineer, PJM Interconnection
- Eric Hsieh, Regulatory Affairs Manager, A123 Systems
- Praveen Kathpal, VP of Market and Regulatory Affairs, AES Energy Storage

www.cleanenergystates.org/projects/energy-storage-technology-advancement-partnership/

CleanEnergy States Alliance

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Grid Energy Storage Issues and Challenges

IMRE GYUK, PROGRAM MANAGER
ENERGY STORAGE RESEARCH, DOE

Grid Energy Storage Issues and Challenges

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Energy Storage provides Energy

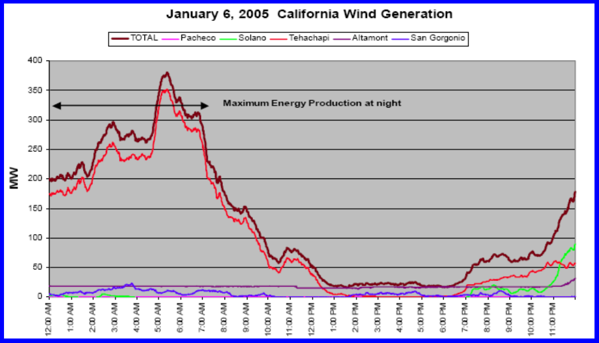
when it is needed

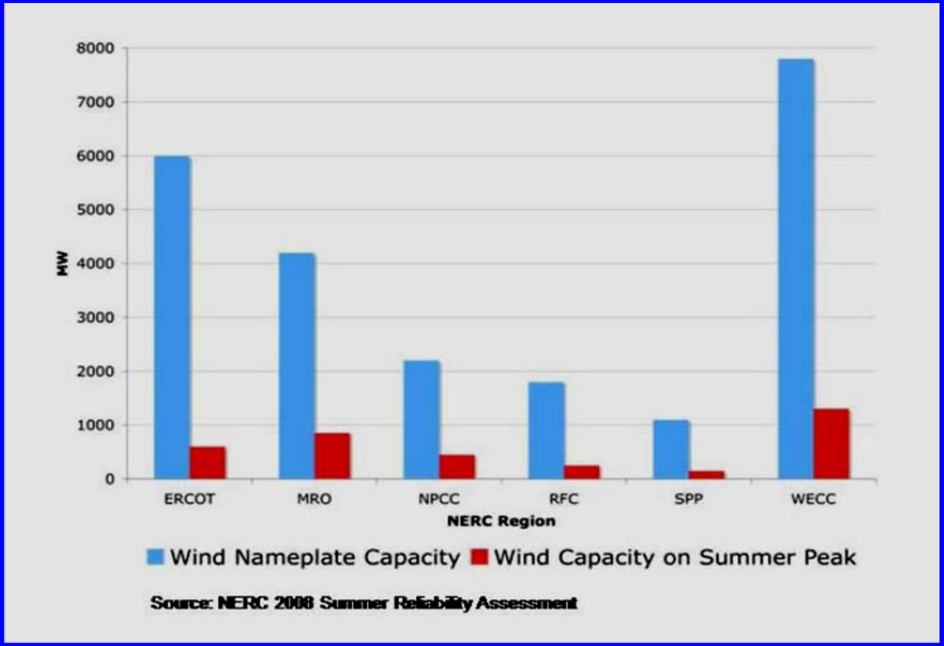
just as Transmission provides Energy

where it is needed

29 States have Renewable Portfolio Standards (RPS) Requiring 10-40% Renewables

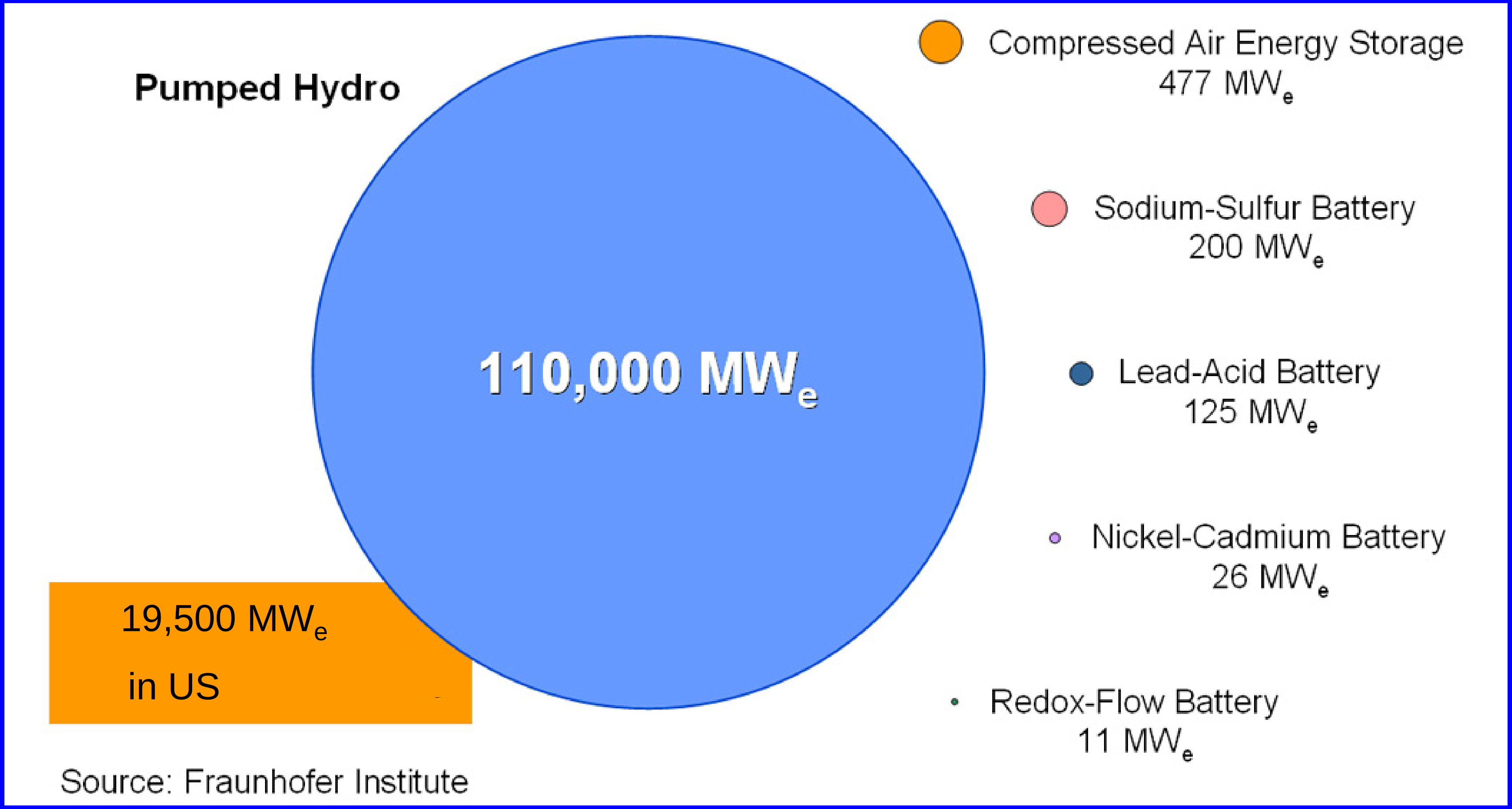
On Peak Wind - the Reality!





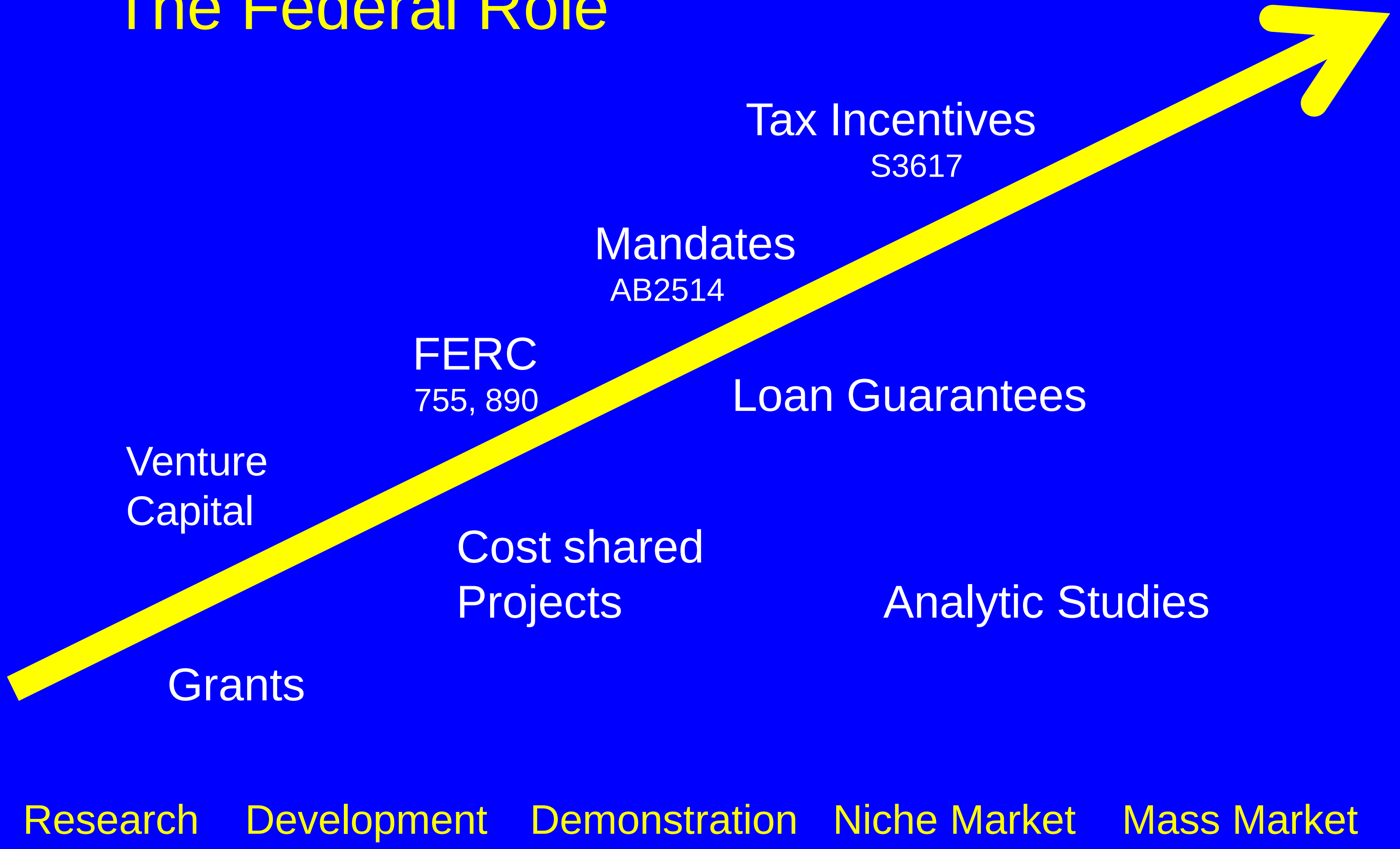
Cost effective Energy Storage yields better Asset Utilization

Worldwide installed storage capacity for electrical energy



Note: Pumped hydro represents 2.5 percent of U.S. electrical baseload capacity.

The Federal Role



Technology Track:

Devices	Cost, Cycle Life, Safety, Reliability, Ramp Speed
Applications	Regulation, PV Ramping Load Shifting, Micro-grids
Field Tests	Scaling, Systems, Standards

Will it work? Is it better?

Applications Track:

Frequency Regulation (Wind fluctuations)

Ramping (PV – fast, Wind – slow)

Load Shifting

Transmission Congestion

Multiple Benefit Streams!

What are the benefits? What is the volume?

Financial Track:

Grants	National Laboratories SBIR, Solicitations
V. Cap.	High Risk – High Return
Cost Shares	Work with Utilities, States

Equity, Loan Guarantees

Is it Cost Competitive? Is it Bankable?

Regulatory / Policy Track:

Federal	FERC Rules → 755, 890 Tax Rebates → S3617
States	State Mandates → AB2513 RPM Consequences
PUC	Rate Cases: SDGE, HI, TX

Can it be Rate Based?

An Emerging Policy Framework

Layers of Legislation/Policy Supporting Storage

Federal Layer	FERC		DOE	EPA	CONGRESS
	NOPR Frequency Regulation Compensation in the Organized Wholesale Power Markets		- ARRA Demo Funds ~ $200 M ARPA - E Funding (12% devoted to storage or $49 M)	- Carbon Reduction - Emissions Rules on Peaking GTs? - Investment Tax Credit for Storage	- Potential Clean - Energy Standard Clean Energy - Development Bank (under discussion)
	Electric Energy Storage Request for Comments	Variable Energy Resources Notice of Proposed Rule Making			

National Layer	NERC	Eastern Interconnect Planning Collaborative
	- Issued Report from Variable Generation Task Force - Annual Long-term Reliability Assessment	Modeling Studies Include Bulk Storage

ISO/RTO Layer	NY-ISO	PJM	MISO	CAISO	ERCOT	WECC	SPP	
	FERC Approved Energy Storage Tariffs for Day-ahead and Real-Time Regulation Service Markets (15 min. intervals)	- Ancillary Service - Frequency Regulation	- Ancillary Services Tariffs - Developing Ramping Product	- Approved Tariffs for Ancillary Services from Non-generators Developing Ramping Product - Modeling Storage in Production & Forecasts	- Day-ahead Ancillary Services Tariffs and Market - Texas Nodal Market Beginning 2011	- Modeling Storage	Variable Energy Generation Policy Initiatives	

State Layer	NEW YORK	OHIO	CALIFORNIA	TEXAS	UTAH	KANSAS	OTHERS
	- Storage R&D Program	- Storage Included in the PUCs Alternative Energy Portfolio Standard	- AB2514 Possible Storage Procurement Mandates - Storage Included in Integrated Resource Plan - SDGE Storage Rate Case	- Bill 1421 Utilities Code Amendment Energy Storage Equipment or Facilities - Proposed PUC Rulemaking on Legislative Target of 500 MW of Non-wind Renewable Energy	- Storage RPS - Proposed Renewable Energy Zones Include Storage	- Regulations to implement legislation supporting CAES	- 24 states currently have RPS policies

Recent Projects:

DOE Loan Guarantee – Beacon:
20MW Flywheel Storage for Frequency Regulation in NY-ISO
20MW commissioned July 2011

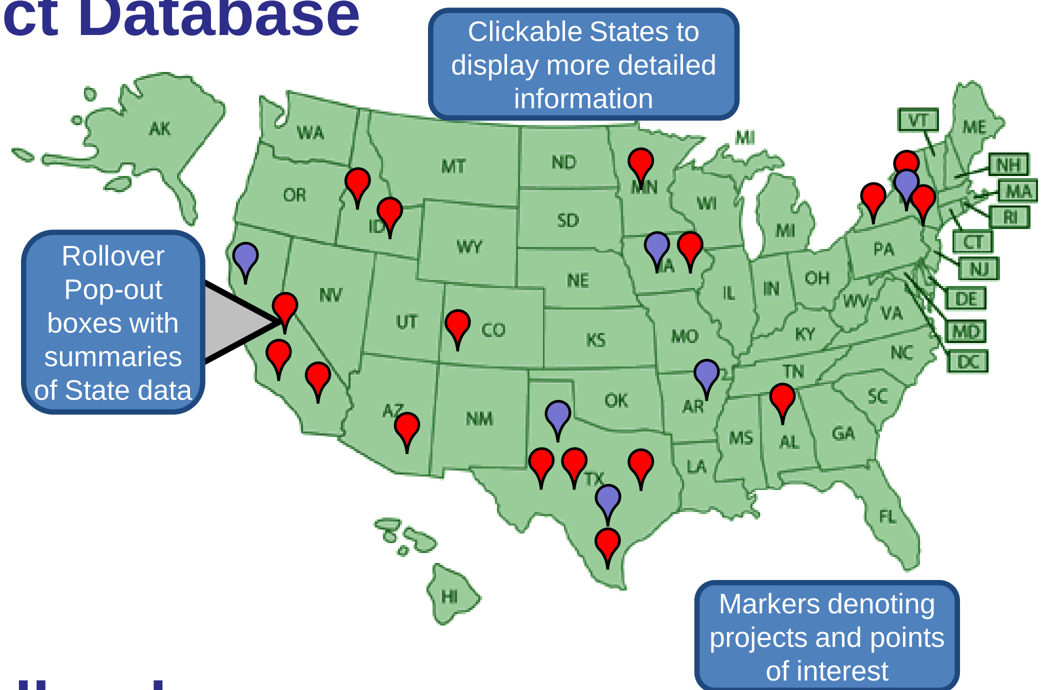
FERC – Pay for Performance 755

ARRA – Public Service NM:
500kW, 2.5MWh for smoothing of 500kW PV installation; Using EastPenn Lead-Carbon Technology
Commissioned Sep. 2011

Equal Renewable Tax Benefits?

Energy Storage Project Database

A publicly accessible database of energy storage projects world-wide, as well as state and federal legislation/policies.



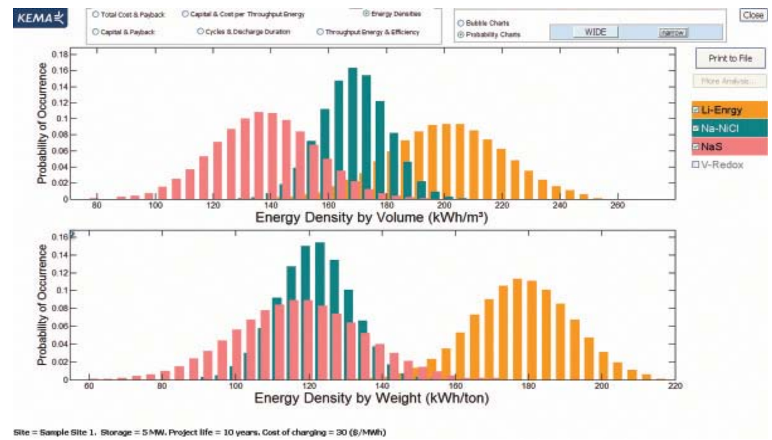
Energy Storage Handbook

Partnership with EPRI and NRECA to develop a definitive energy storage handbook:

- Details the current state of commercially available energy storage technologies.
- Matches applications to technologies
- Info on sizing, siting, interconnecting
- Includes a cost database

ES-Select: Energy Storage Selection Tool

- A tool for high-level decision makers to facilitate planning for ESS infrastructure:
  - High-level technical and economic review of storage technologies
  - Determine and size applicable energy storage resources
  - Develop a preliminary business case
- Educate potential owners, electric system stakeholders and the general public on energy storage technologies
- Developed by KEMA



Storage Guidebook for Regulatory Officials

- Inform regulators about Storage benefits
- Provide information on technical aspects of Energy Storage Systems
- Identify regulatory challenges to increased Storage System deployment
- Suggest possible responses/solutions to challenges
- Develop model PUC submissions requesting approval of rate base addition
- Advisory Committee comprised of industry and government experts

Storage-Related FERC Rate Policies

Clean Energy States Alliance webinar
Jan. 25, 2012

Bob Hellrich-Dawson

bob.hellrich-dawson@ferc.gov

FERC Energy Storage Policy

- Standard disclaimer

The views expressed herein do not necessarily represent those of the Chairman, Commissioners, or FERC staff.

FERC Energy Storage Policy

- Existing RTO/ISO Rules and Policies
  - Participation in markets
  - Charge state management
- Order No. 755
  - Applicability
  - Findings
  - Remedies/Requirements
  - What the Commission *did not* do
- Notice of Inquiry (RM11-24) on Bilateral Ancillary Service Sales and Financial Reporting for Storage

Existing RTO/ISO Rules and Policies

- Special category of seller: NYISO and MISO
  - Qualification to provide frequency regulation but not energy
- Charge state management – MISO, NYISO, CAISO
- Size limits for participation in markets
  - smaller MW capacity limits means participation by wider range of resources

Order No. 755

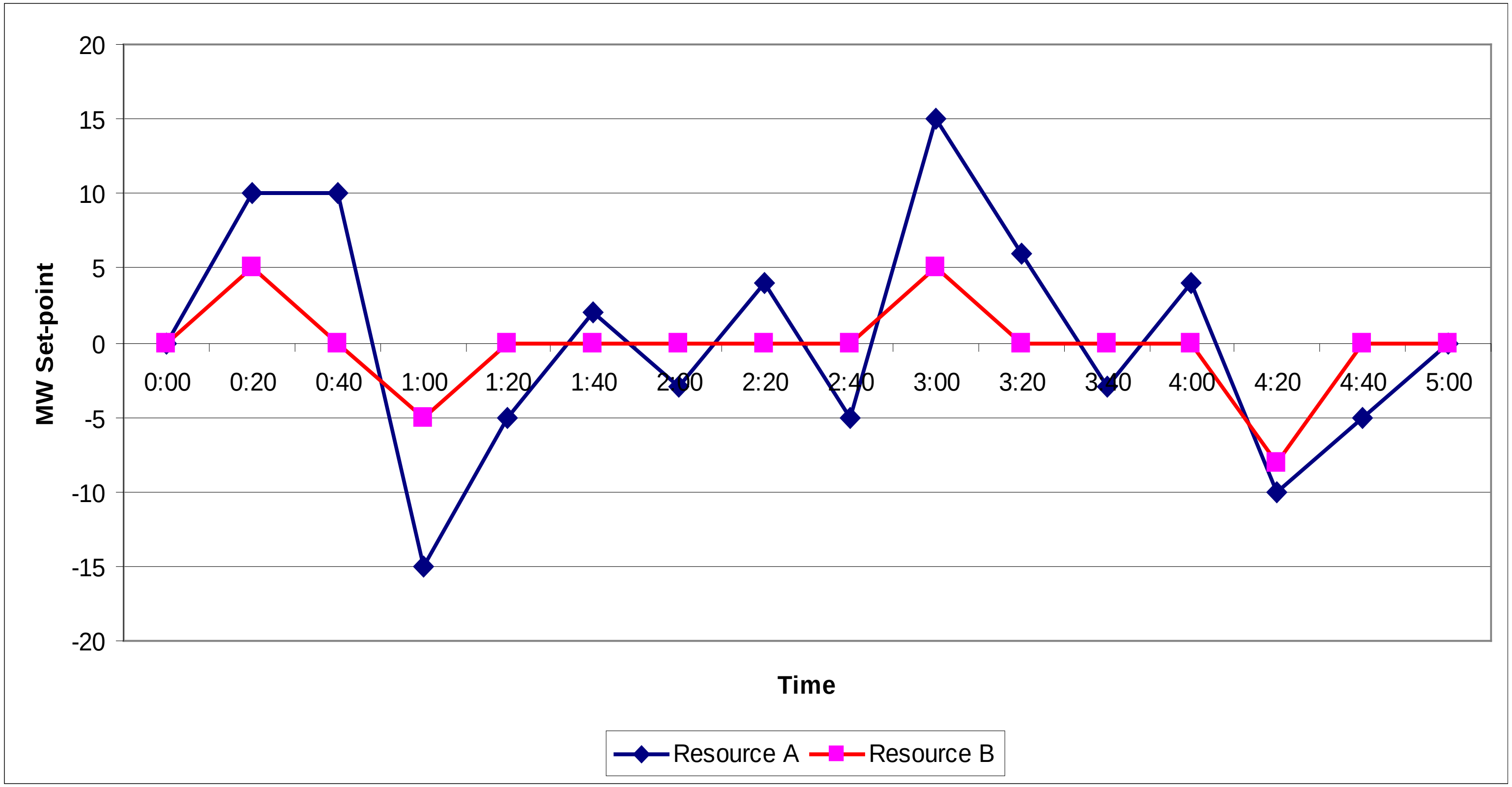
- The Final Rule
  - Applicability
    - RTOs and ISOs with centrally-procured frequency regulation service – does not apply outside these regions (non-RTO/ISO regions or SPP for now)
  - Finding #1
    - Current practices are unduly discriminatory.
    - Reason: performance is not reflected in compensation.

Order No. 755

- An Example: Should these resources receive the same compensation?
  - Resources A and B clear the same amount of frequency regulation capacity (i.e. the amount of capacity set aside to provide the service and not provide energy).
  - In real-time they are both dispatched, but Resource A is dispatched more than B.

Order No. 755

- Real-time dispatch for frequency regulation service. Graph shows movement away from a previously-established set-point in response to the dispatch signal.



Order No. 755

- Settlement—how much do they get paid?
  - Resource A = $(Cap_A$*MCP) + $(MWh_A$*LMP)
  - Resource B = $(Cap_B$*MCP) + $(MWh_B$*LMP)

  - $Cap_A = Cap_B$
  - $MWh_A = MWh_B = 0$ (approx.) (netting)
  - They receive the same payment
  - Did they do the same amount of work or provide the same amount of frequency regulation service?

Order No. 755

- The Final Rule
  - Finding #2 – Price signals are inefficient and there are potential market efficiency gains to be had if price signals were efficient. Prices must reflect all costs and be uniform to all cleared resources.
    - The faster your fleet the less capacity you need to meet NERC standards ➔ Procure less and pay less. ISO-NE and NYISO as examples.
    - Will new entrants have lower costs all around?
    - More efficient heat rates for displaced “reluctant regulators” if new entry by specialized resources.

Order No. 755 – Remedies/Requirements

- Capacity payment (option payment)
  - Uniform clearing price
  - Market-based
  - Opportunity costs
    - Cross-product opportunity costs
    - Inter-temporal opportunity costs
- Performance Payment
  - Market-based
  - Differentiate between different levels of work
  - Must account for accuracy

Order No. 755

- What the Commission *did not do*
  - Many aspects of implementation left for the RTOs and ISOs to propose.
  - What resources qualify as frequency regulation resources?
  - How are resources dispatched?
  - Different classes of resources (i.e. “fast” response versus “slow” response)?

NOI on Bilateral Ancillary Service Sales and Financial Reporting for Storage

- 3 Areas of Inquiry
  - Possibility of extending the principles of Order No. 755 to the areas outside the RTOs and ISOs
  - The *Avista* restriction (transmission providers may not procure AS from a third party at market-based rates)
  - Accounting and financial reporting requirements for storage

NOI on Bilateral Ancillary Service Sales and Financial Reporting for Storage

- Extending the principles of Order No. 755 beyond the RTOs and ISOs
  - Commission proposed a scenario: if a transmission customer self-supplies frequency regulation using “faster ramping” resources, should it be allowed to provide less capacity than is required under the transmission provider’s tariff?
  - Few comments received; mixed bag.

NOI on Bilateral Ancillary Service Sales and Financial Reporting for Storage

- The *Avista* restriction (the gist of it)
  - No market-based AS sales to a transmission provider in order to meet its tariff obligation to provide AS to its transmission customers.
  - No market-based AS sales between affiliates (transmission customer and AS seller cannot be affiliated)
  - No market-based AS sales to a transmission customer when transmission service is from a transmission provider affiliated with the AS seller.

FERC Energy Storage Policy

Questions?

Impact of Regulatory Policy on Energy Storage in RTOs

Capturing the Value to System Control through Competitive Markets

Clean Energy States Alliance Webinar

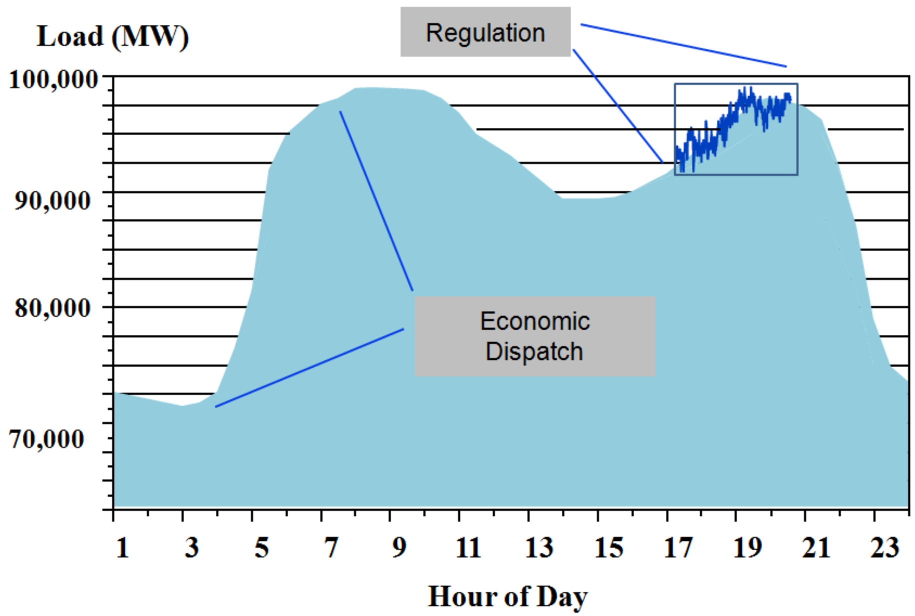
January 25, 2012

Ruston Ogburn

PJM Interconnection

- "Regulation" is an ancillary service used to correct short term deviations between supply and demand (measured as "ACE")

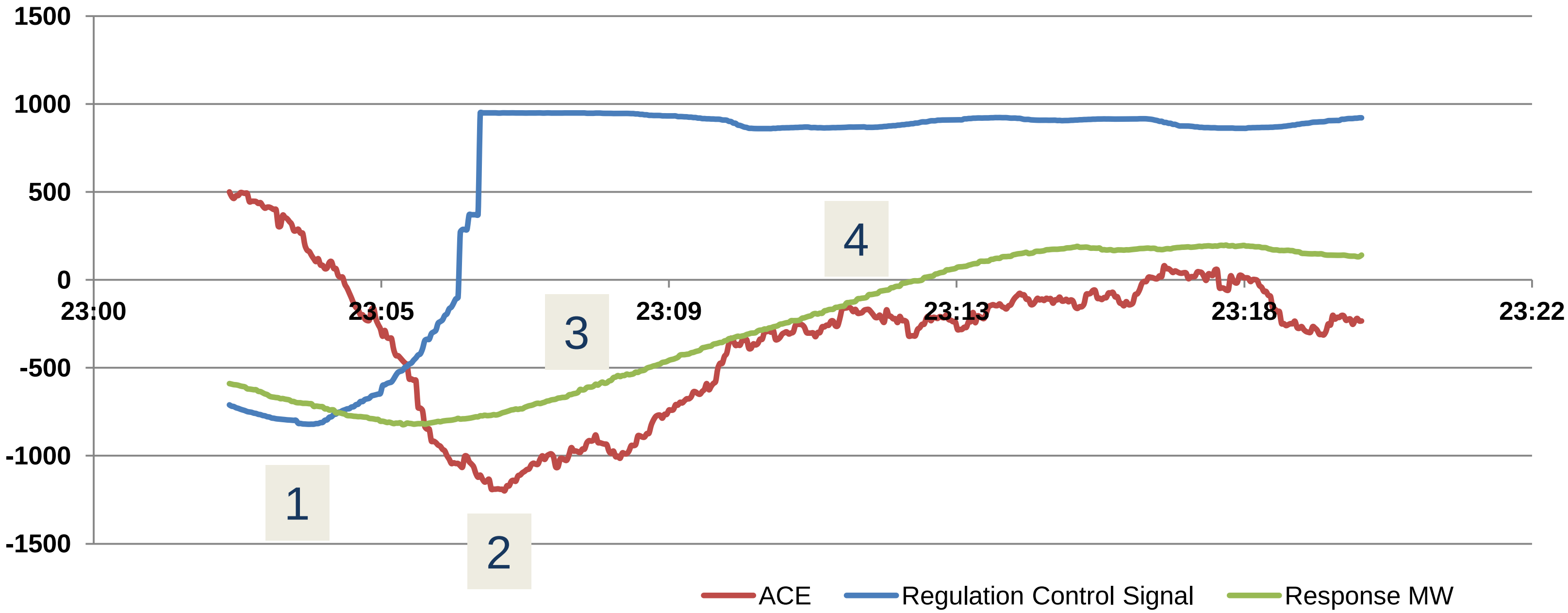
- Various Regulation Market rules have been in place for many years across the RTOs
- Total billing of $250 million annually within PJM



Key Questions to Consider

- Does energy storage have value providing regulation?
- Can we capture that value in a market?

What problem are we addressing?

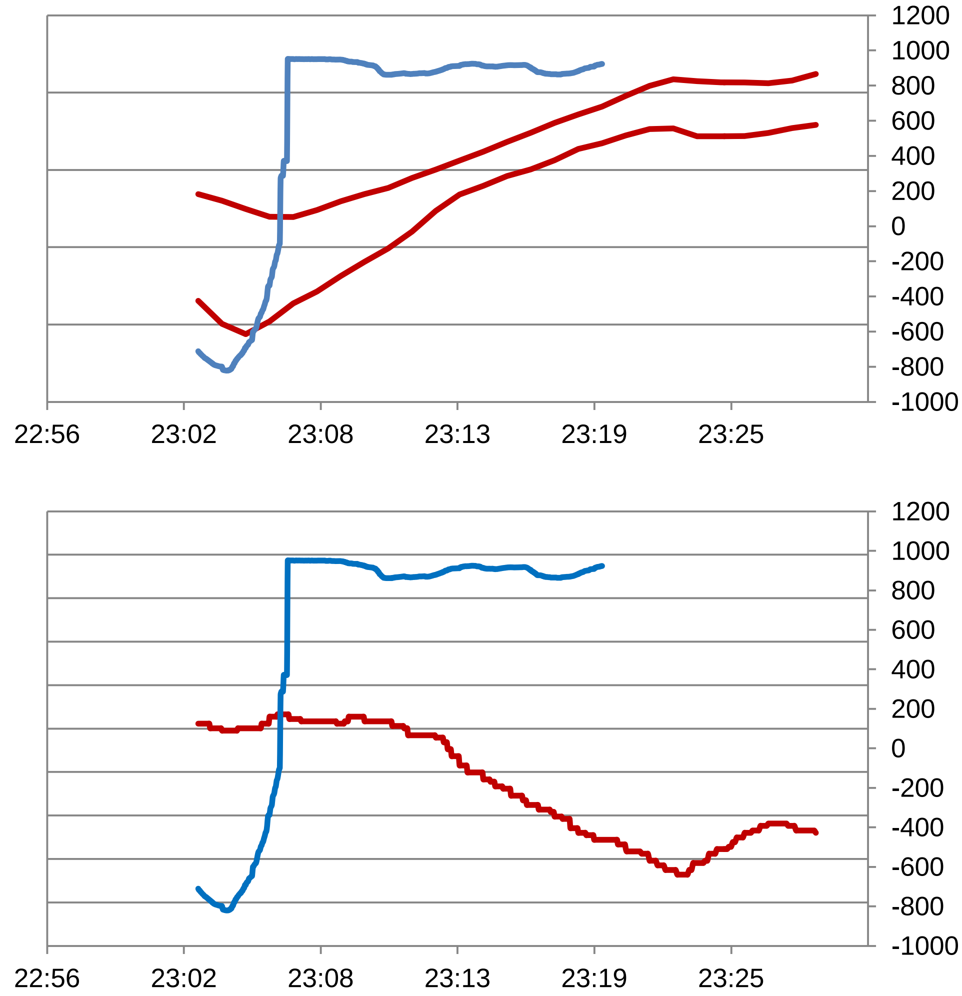


Point on the Curve	MW Response	Expected MW Response
1 - Regulation signal turn-around	---	---
2 - Generation turn-around (94 seconds)	-116	---
3 - Five minutes after regulation signal turn-around	188	1009
4 - Ten minutes after regulation signal turn-around	796	~ 1700

Actual response in this example is less than 50% of expected response. Today, we are paying on the expectation; we need to pay on the response.

What problem are we addressing for individual units?

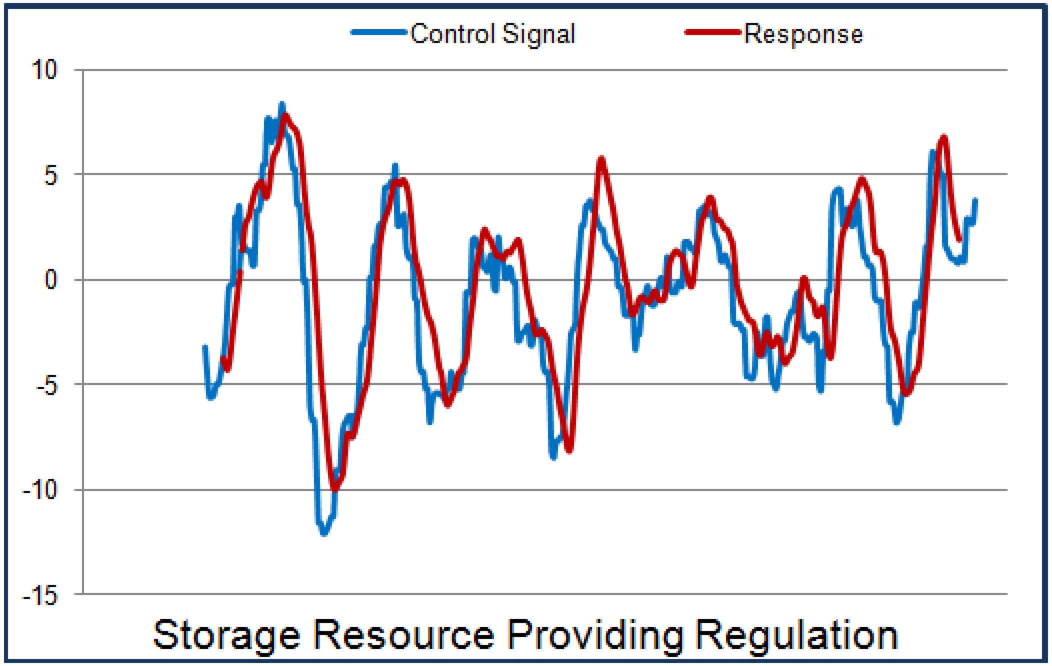
- Good vs. poor response from units regulating on previous slide.
- Despite the significant differences in resource response, all get paid the same amount for each assigned MW.



Performance-based compensation aligns the compensation with the benefits each resource provides to system control.

Incenting New Technology

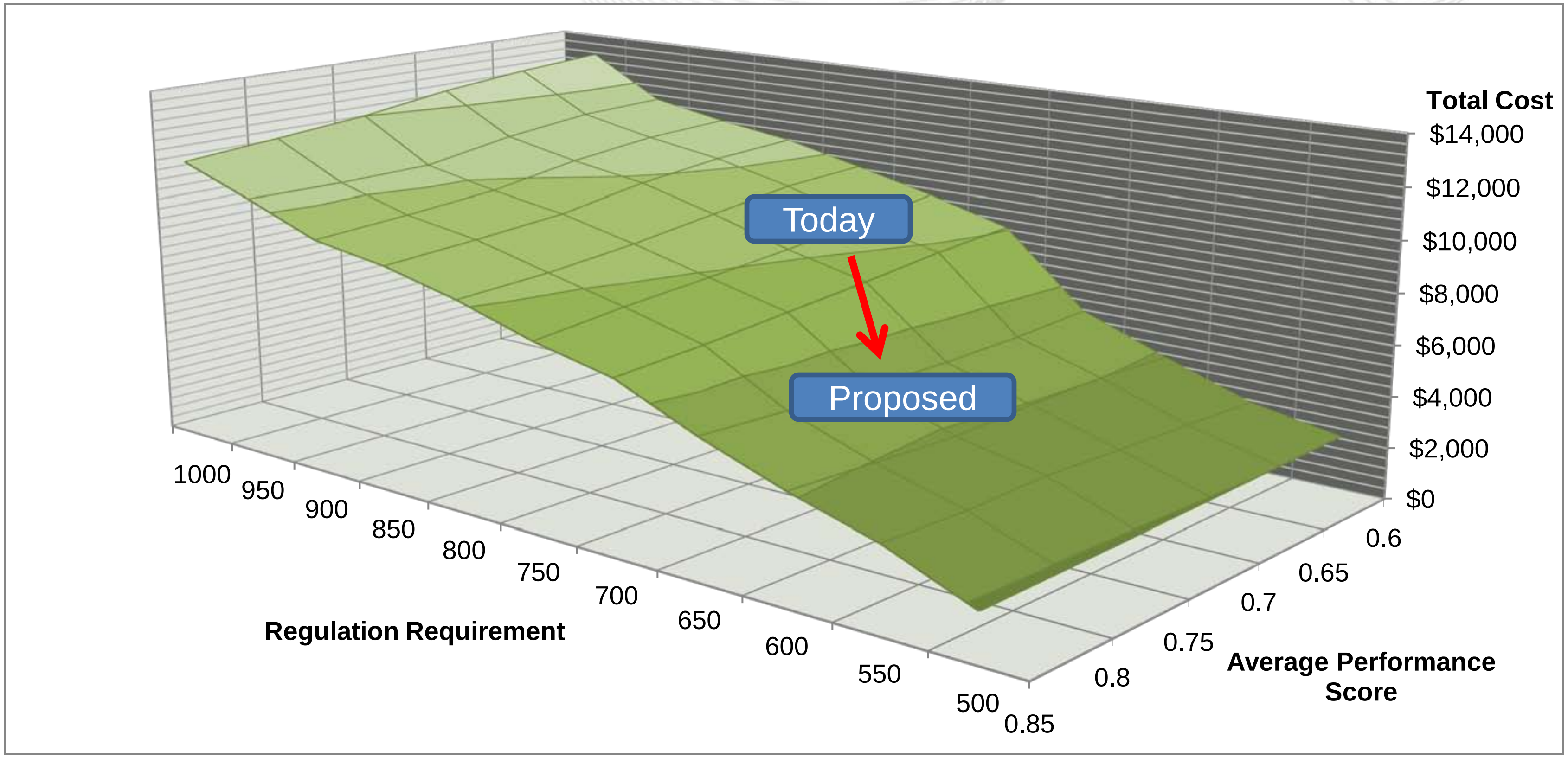
- Significant interest from new technologies to enter this market
  - Stationary batteries
  - Demand response
  - Flywheels
  - Vehicle batteries
  - Heaters/Coolers
- Good results from these resources during their short time in the market
- Control system changes help to align our signals to the capabilities of the resources



PJM's Proposed Market Design

- Shifts market clearing mechanism and compensation to focus on performance
  - Continuous scoring of resources
  - Near real-time feedback to owners
- Focuses on achieving the lowest total cost of the regulation service, and
- Gives the highest performing resources a larger share of the regulation compensation

Total Cost of Regulation



- This surface shows the total cost of regulation with different MW requirements and varying levels of average resource performance.
- Lower requirements lead to lower total cost. (left to right)
- Proposal in PJM creates structure where better average performance also leads to lower total cost. (back to front)

- Recognizes the valuable aspects of providing regulation service and requires uniform application
  - Performance - MW movement requested of each resource
    - With consideration of accuracy relative to the RTO control signal
  - Capability - Cost of reserving a resource to provide regulation
- Allows some flexibility in the implementation to account for different control systems and operational realities

Does energy storage have value?

Can we capture that value through markets?

- Storage helps system control.
  - Value comes from high “controlability” - flexibility and accuracy
  - In the regulation market, higher performance leads to lower total cost for regulation and high performers get more compensation
- Regulatory policies and market designs that allow this value to be captured help to foster more reliable system operation and more competitive markets.

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Storage: Policy and Design

Eric Hsieh

January 25, 2012

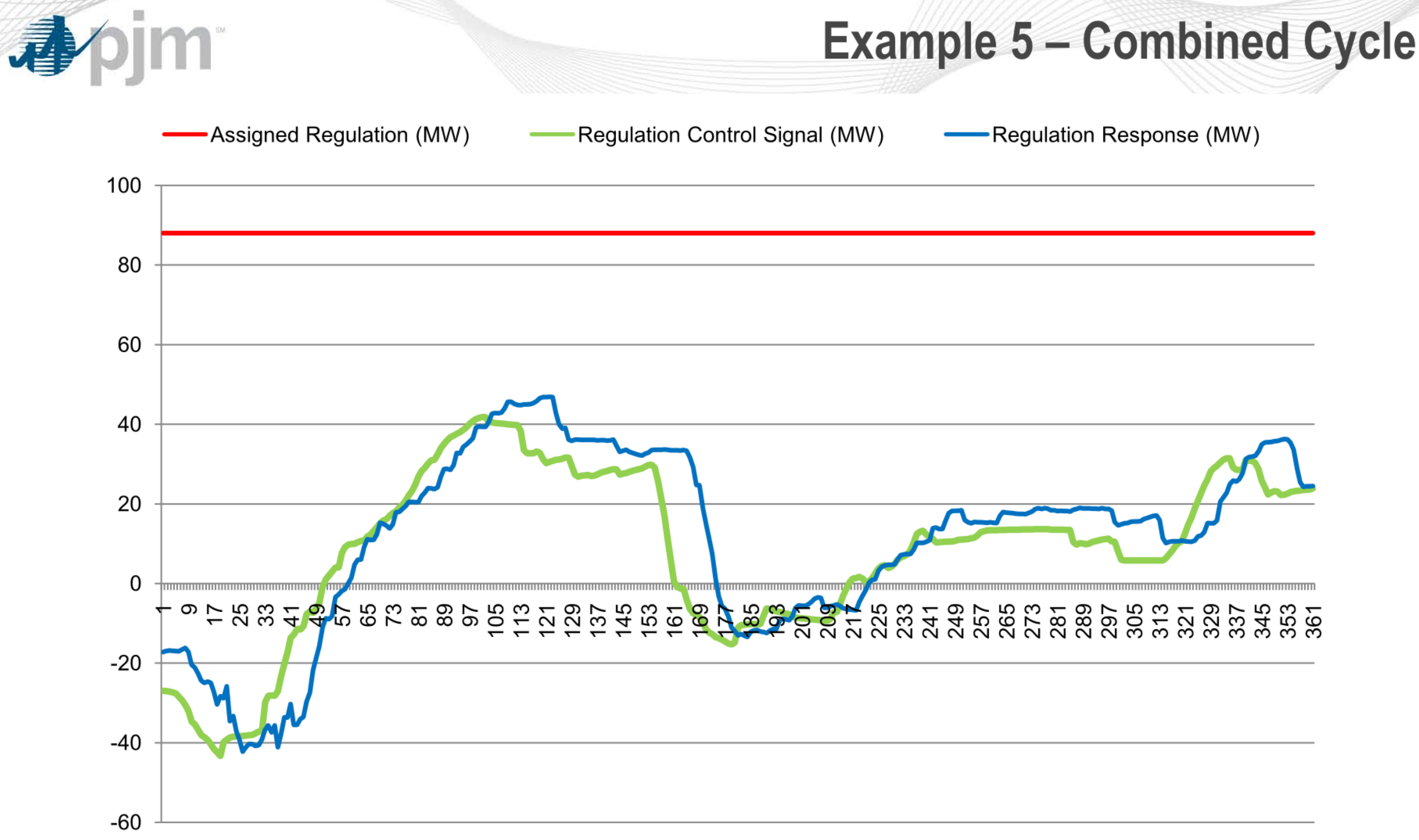
Clean Energy States Alliance Webinar

Storage Policy Development

New rules will shape storage architectures

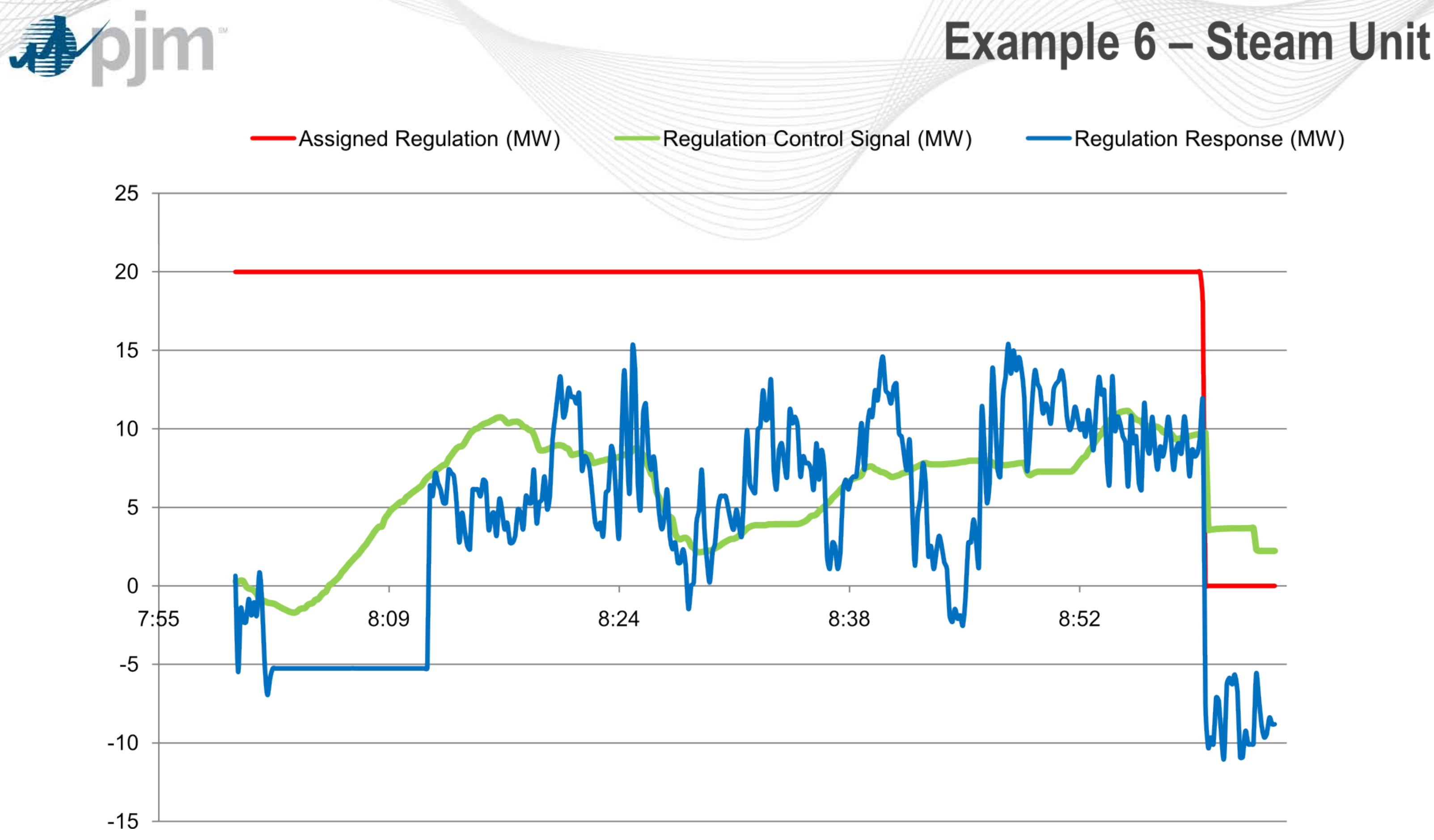
- Short Duration: Power Resources
  - FERC Order 755: Pay-for-Performance
- Medium Duration: Renewable Integration
  - Hawaii PPAs
- Long-Duration: Capacity Replacement
  - EPA Cross-State Air Pollution Rule and Others

Pop Quiz: Unit A



Source: PJM, "RPSTF Performance Metrics Formulas and Examples," August 10, 2011

Pop Quiz: Unit B



Source: PJM, "RPSTF Performance Metrics Formulas and Examples," August 10, 2011

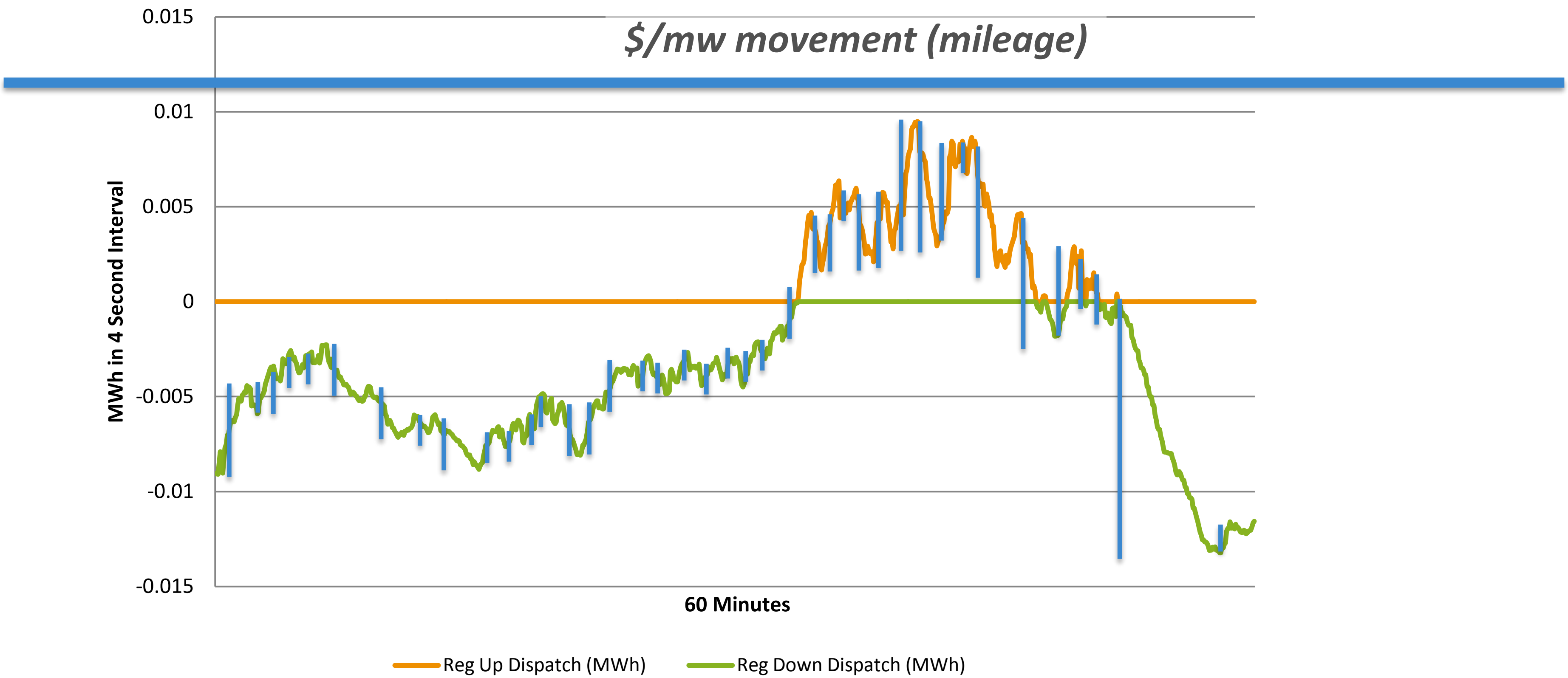
Short Duration: Pay-For-Performance

Fair Compensation for Frequency Regulation

- Barrier: lack of pay-for-performance leads to inefficiency
  - Unit A provides more value to the grid than Unit B
  - Current rules do not reward A or penalize B
  - Paying A the same price as B neither reasonable nor just
- Solution: FERC Order 755
  - Provides bonus for speed and accuracy (storage strengths)
  - CAISO and PJM: eventual disqualification of poor resources
  - Storage enabled by Order 890 (non-generation resources)

FERC Order 755: Performance Example

Sum of all vertical (mw) movements as directed by the ISO



Short Duration: Laurel Mountain

32MW/8MWh Online Oct. 2011

Photo Credit: AES

Storage Policy Development

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Case Study: Hawaii

A123 SYSTEMS

Performance Standards in State-Approved Renewable PPAs

c. Ramp Rate

The Seller shall ensure that the ramp rate of the Seller's Facility are less than the following limits for all conditions including start up, normal operations, and shut down for the following periods. Note that time periods are subject to seasonal variations and typical times of day/night are provided for general planning purposes only.

Wind farm projects less than 50 MW in capacity

- Maximum Ramp Rate Upward of 2.0 MW/minute for all periods except during Early Morning Low-Load Periods (typically Midnight to 4:00 am) where Maximum Ramp Rate Upward is 1 MW/minute.
- Maximum Ramp Rate Downward of 2.0 MW/minute for all periods except during Evening Periods (typically 4:00 pm to 8:00 pm)where Maximum Ramp Rate Downward is 1 MW/minute.

http://www.heco.com/vcmcontent/GenerationBid/Files/ModelRenewableFirmCapacityPPA.pdf

Time-Shifting Wind Output

Economic In Comparison to Alternatives

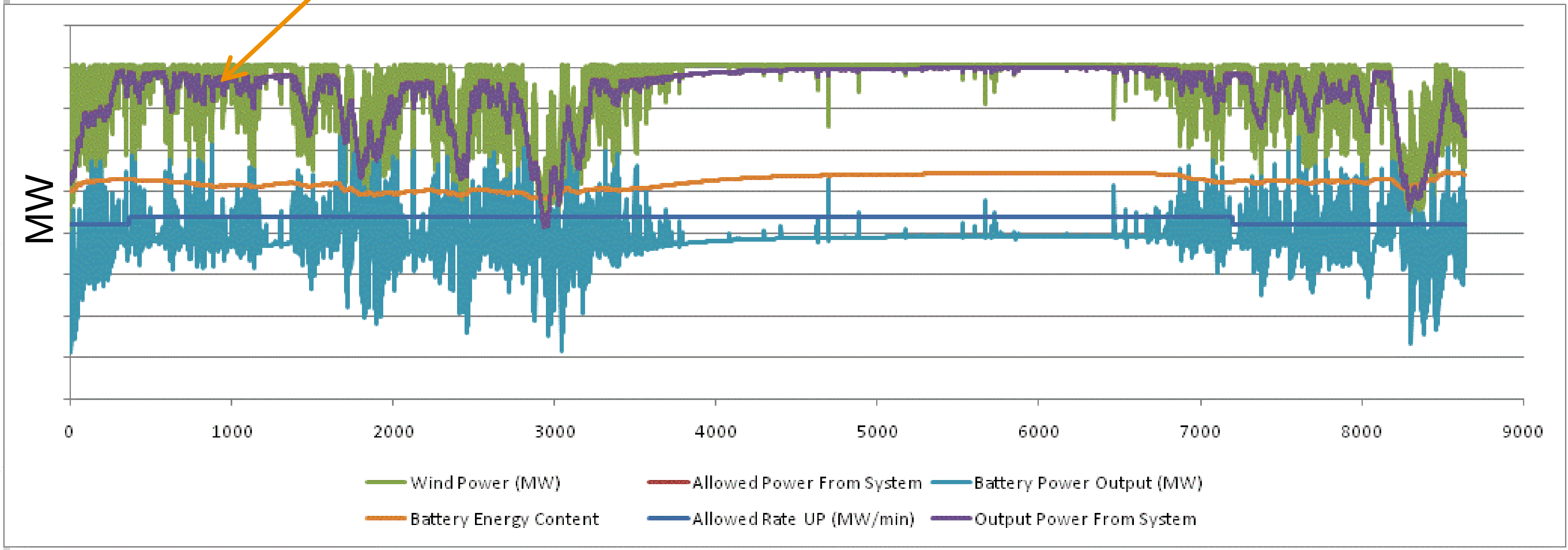
- Constraint: PPA performance standards
- Potential Solutions
  - Fossil-based backup generator: expensive since HI imports all fuels
  - Curtail wind output: significant cost from lost generation
  - Battery storage: no fuel cost, maximizes wind production
- Levelized storage cost ~ $25/MWh of system output
  - Generically: $1,200/kW capital, $10/MWh O&M, 95% storage system capacity factor, 10% carrying charge rate, 20 year life
- Why advanced energy storage is cost effective
  - High Cycle Life, low replacement cost under high utilization
  - High Efficiency, low losses under high utilization
  - Flexible Operation, can follow a variable output-driving control signal

From "Grid Code Compliance beyond simple LVRT", Tobias Gehlhaar et al, Hamburg Germany

Case Study: Auwahi Wind (Maui, Hawaii)

11MW/4MWh Online Late 2012

Net power delivered to grid **meets performance requirements**



Storage Policy Development

New rules will shape storage architectures

- Short Duration: Power Resources

  FERC Order 755: Pay-for-Performance

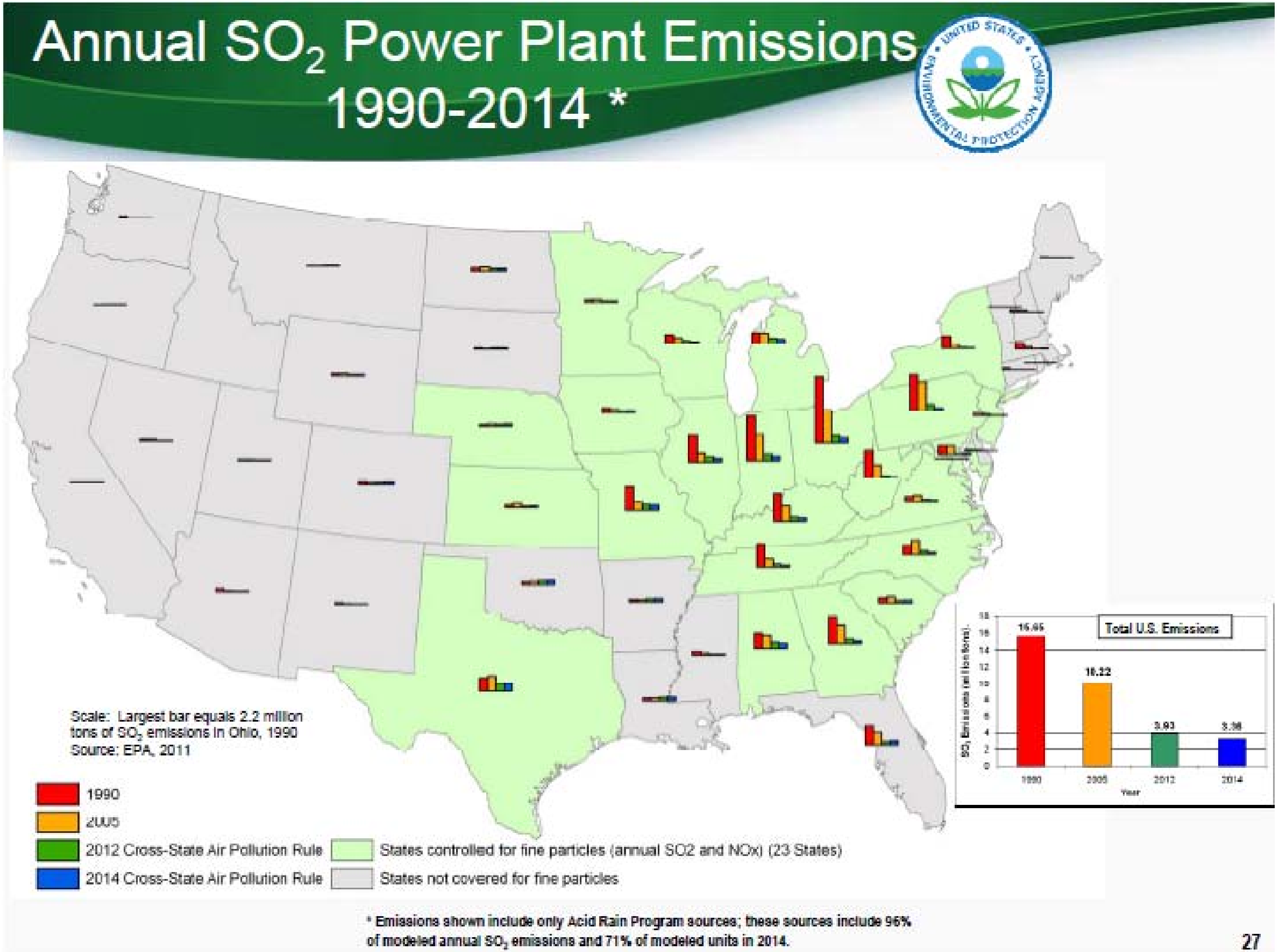
- Medium Duration: Renewable Integration

  Hawaii PPAs

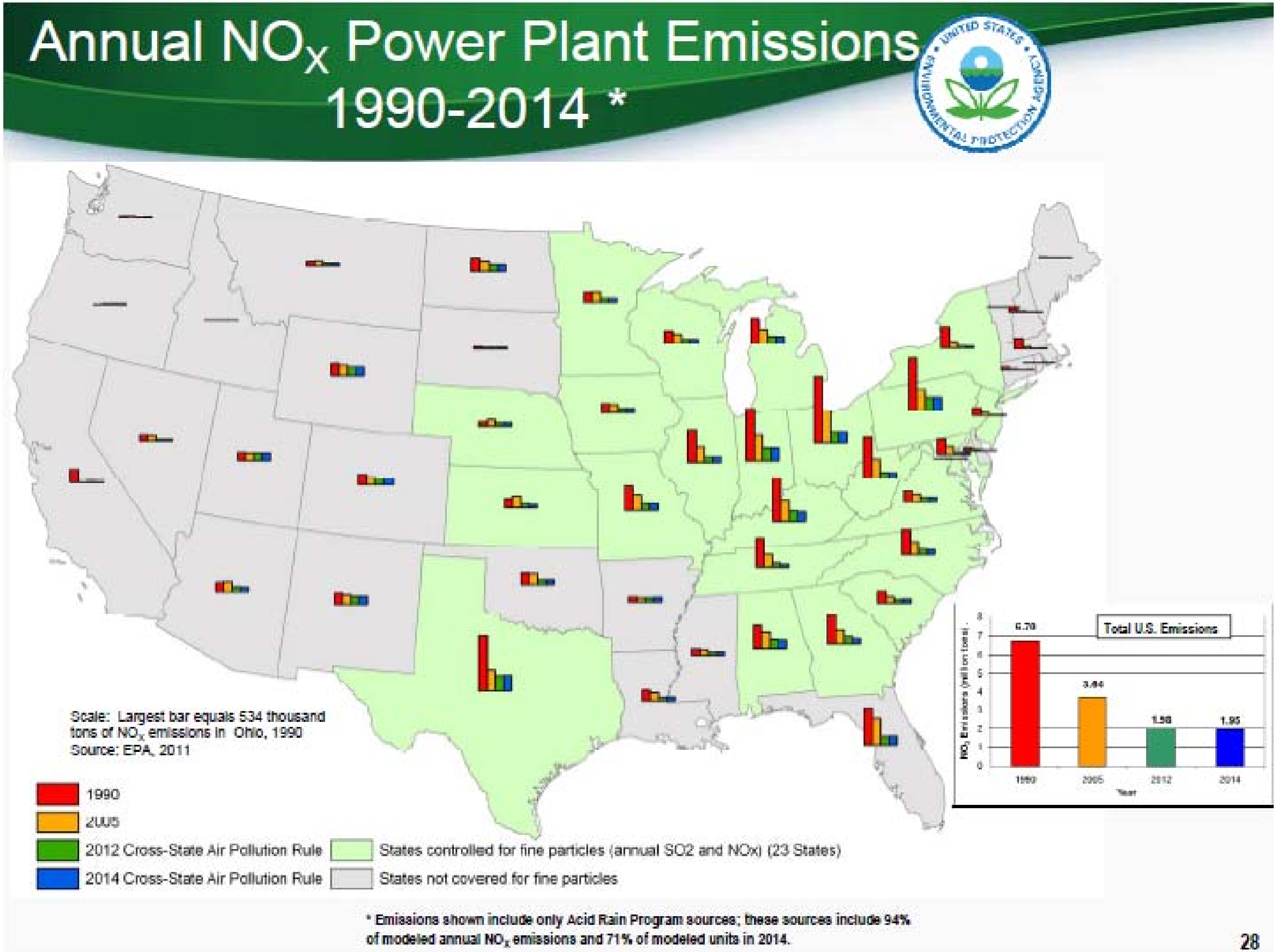
- Long-Duration: Capacity Replacement

  EPA Cross-State Air Pollution Rule and Others

EPA CSAPR Emissions Reductions



EPA CSAPR Emissions Reductions



Generation Fuel Changes due to EPA Rules

Also Once-Through Cooling, MACT, etc.

- Retirements primarily of old, inefficient coal plants
- New plants and technologies will replace coal
  - Natural Gas – economic due to shale gas (but difficult to site)
  - Renewables – mandated by many states
  - Demand Response – qualifies as capacity in most RTOs
  - Storage – comparatively less expensive than fossil fuels when considering all externalities, more reliable than demand response

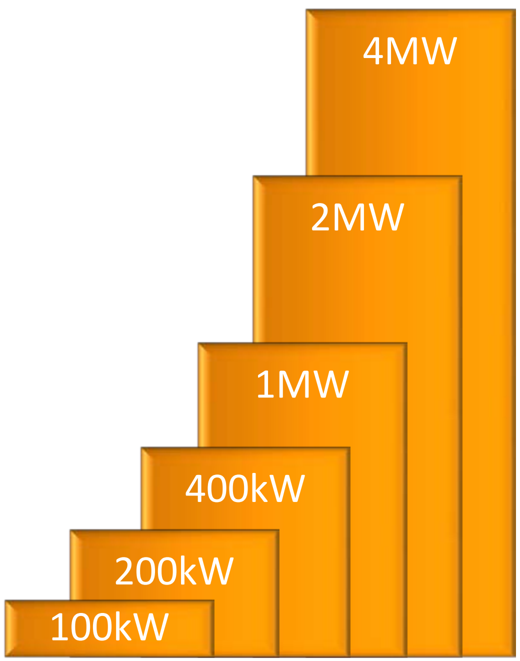
Long Duration: Tehachapi Storage Project

8MW/32MWh Online in 2012

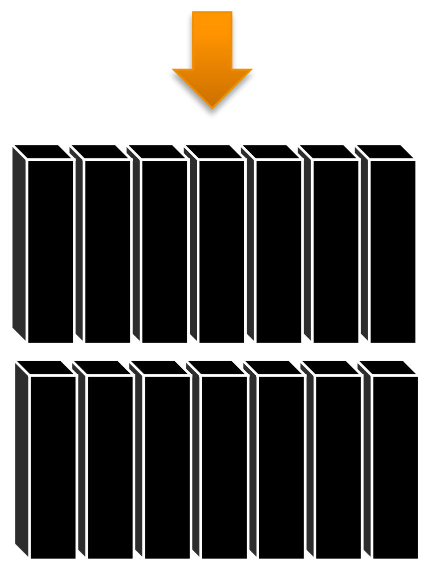
Flexible Product Architectures…

More Power:	More Energy:	Scalability:
Choose Inverter Size	Select Number of Racks	Add Containers

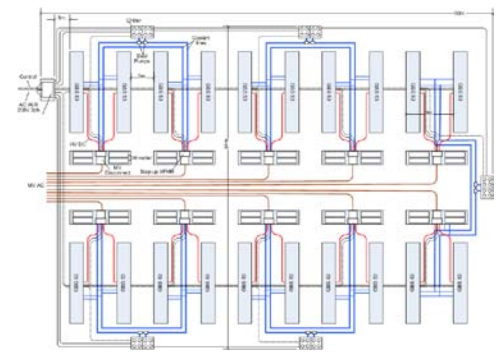
Choose Inverter Size



Select Number of Racks

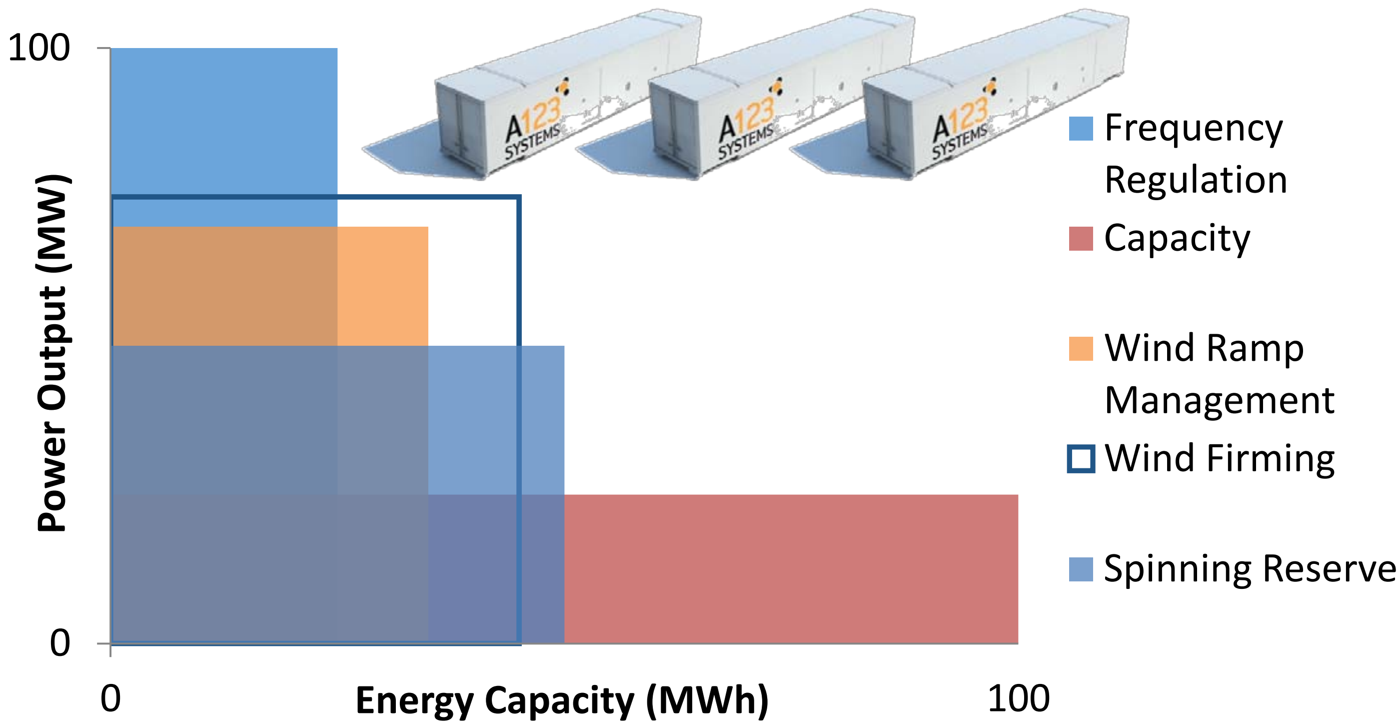


Add Containers



…For Diverse System Needs

System Sizing



Conclusion

Overall energy policies will drive demand and design

- Valuation of Fast Storage Services

  FERC Order 755 pays for speed and accuracy

- Demand for Highly Dispatchable Resources

  Hawaii PPA requirements for renewable integration

- Fewer MWs Supplied by Traditional Generators

  New clean capacity technology from EPA rules

Eric Hsieh

AES
Energy Storage

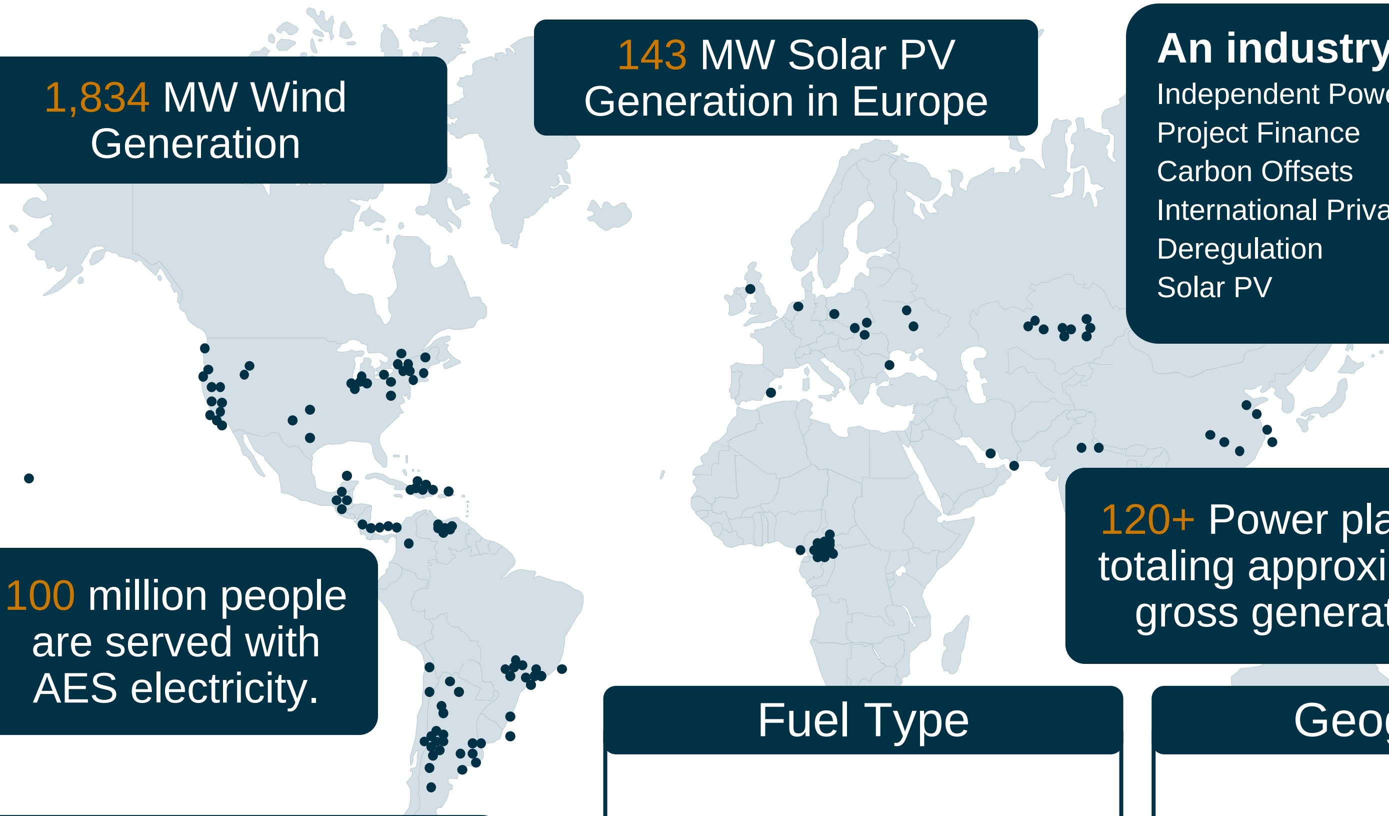
Energy Storage for Flexible Peaking Capacity

Clean Energy States Alliance
25 January 2012

www.aesenergystorage.com

AES has been supplying capacity to utilities for over 30 years.

AES Energy Storage



1,834 MW Wind Generation

143 MW Solar PV Generation in Europe

An industry leader in…

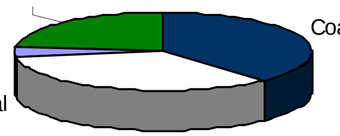
- Independent Power Production
- Project Finance
- Carbon Offsets
- International Privatizations
- Deregulation
- Solar PV

100 million people are served with AES electricity.

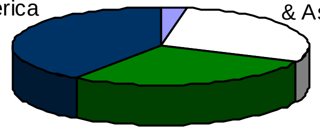
120+ Power plants worldwide totaling approximately 46 GW gross generation capacity

13 Utilities worldwide, serving 11 million customers, with sales of 93,000 GWh

Fuel Type



Geography



Note: As of November 2011

FERC Order No. 755 identified speed and accuracy as attributes that make a resource good at frequency regulation and determined that just & reasonable rates must compensate this superior performance.

137 FERC ¶ 61,064
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

18 CFR Part 35

[Docket Nos. RM11-7-000 and AD10-11-000; Order No. 755]

Frequency Regulation Compensation in the Organized Wholesale Power Markets — Docket Nos. RM11-7-000, AD10-11-000

and ISOs deploy a variety of resources to meet frequency regulation needs; these resources differ in both their ramping ability, which is their ability to increase or decrease their provision of frequency regulation service, and the accuracy with which they can respond to the system operator's dispatch signal.

and ISO markets fail to acknowledge the inherently greater amount of frequency regulation service being provided by faster-ramping resources. In addition, certain

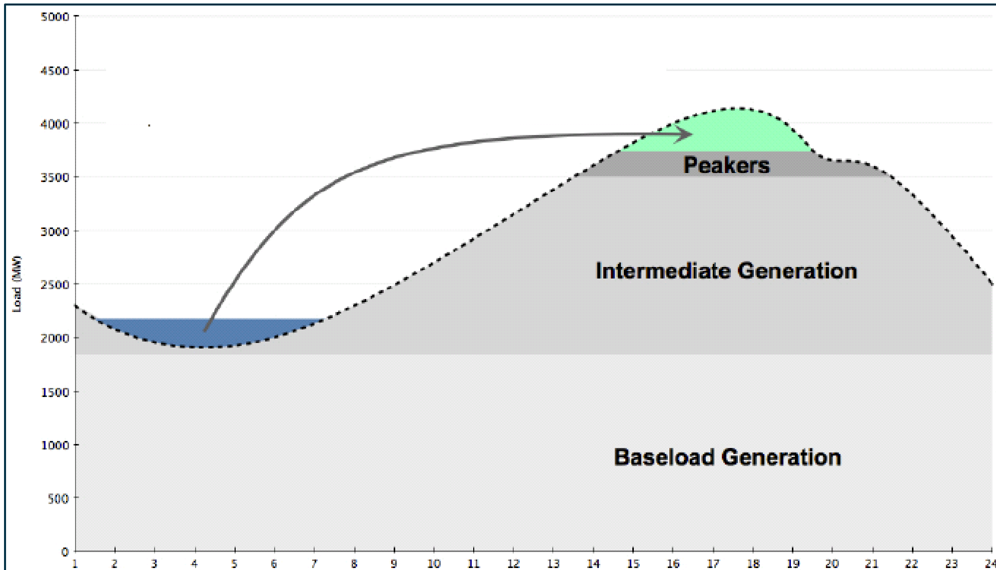
By remedying these issues, the Commission is removing unduly discriminatory and preferential practices from RTO and ISO tariffs and requiring the setting of just and reasonable rates. Specifically, this Final Rule requires RTOs and ISOs to compensate

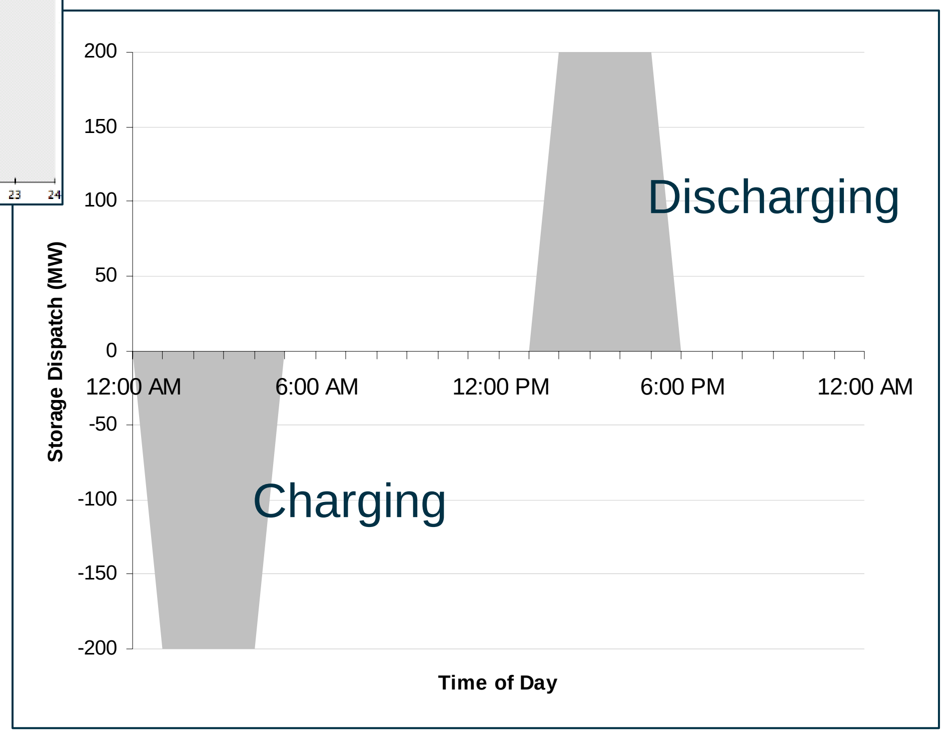
The playbook:

Identify superior performance.

Recognize its value.

The job: Provide power at peak.





Job #1: Peaking capacity.

Batteries can do this. AES is proposing flexible peaking capacity to utilities using battery-based energy storage under long-term contracts.

AES Energy Storage

REQUEST FOR PROPOSALS

TO PROVIDE
ELECTRIC CAPACITY, ENERGY, & ANCILLARY SERVICES
TO THE LONG ISLAND POWER AUTHORITY

AMENDED DECEMBER 17, 2010
ORIGINALLY ISSUED AUGUST 20, 2010

Prepared by
Long Island Power Authority

LIPA
Long Island Power Authority

Figure 1. July 2010 Projection of Need for New Capacity

Long Island BusinessNEWS

SEPT. 23-29, 2011 | VOL. 58 | NO. 42 | $2.00 | libn.com

LIPA eyes world's biggest battery

400-megawatt proposal would store energy for peak usage

By CLAUDE SOLNIK

Energy storage facility in Johnson City, N.Y.

As it reviews proposals for up to 2,500 megawatts of electricity, including wind,

"I think utility grid storage makes sense. It's part of the equation we have to look at," said Robert Catell, former KeySpan chairman and now chairman of the Advanced Energy Research and

erator needs to ramp up. "If we need to produce power, we can produce power nearly instantaneously," Perusse said.

Although lithium ion batteries are the most likely candidates, Kathpal said various innovations could allow large-scale projects.

Perusse said the latest generation of batteries is safer, more durable and more efficient than in the past, able to return about 90 percent of the power that's stored.

"There's a variety of technologies," Kathpal said. "Massive improvements have been made in battery technology in recent years."

While AES didn't say how much the project would cost, Kathpal said the company believes "our overall value and net

PUGET SOUND ENERGY
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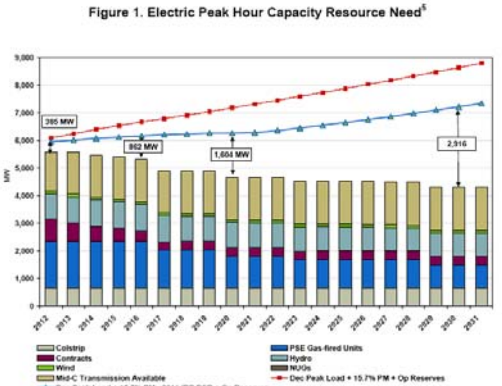
PSE PUGET SOUND ENERGY

Figure 1. Electric Peak Hour Capacity Resource Need[5]



platts www.platts.com

Megawatt Daily

Tuesday, December 20, 2011

AES proposes storage system for power RFP

AES Energy Storage responded to a recent Puget Sound Energy request for proposals with a 200-MW battery storage system to play a role similar to a natural gas-fired peaking unit.

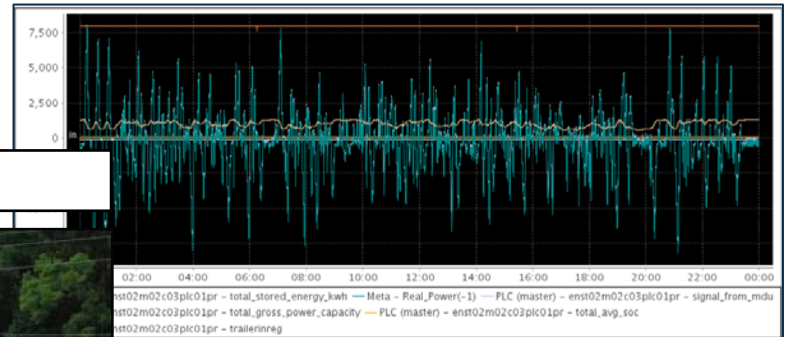
What makes a resource good at peaking?

AES Energy Storage

Less fuel	➢ Replaces the output of inefficient thermal peakers with cleaner units. ➢ Storage can provide the min load efficient units need to stay on.
Fewer emissions	➢ Can be charged off-peak: wind, hydro, gas CCs in many places.
Right amount	➢ Added incrementally as peak needs grow year-to-year.
Right location	➢ Sited close to load, avoiding transmission costs. ➢ Customer benefit of avoided transmission can be shared with IOUs.
Greater reliability	➢ Modular systems reduce risk of losing a large turbine. ➢ Sourcing from AES, a trusted supplier of capacity to utilities.

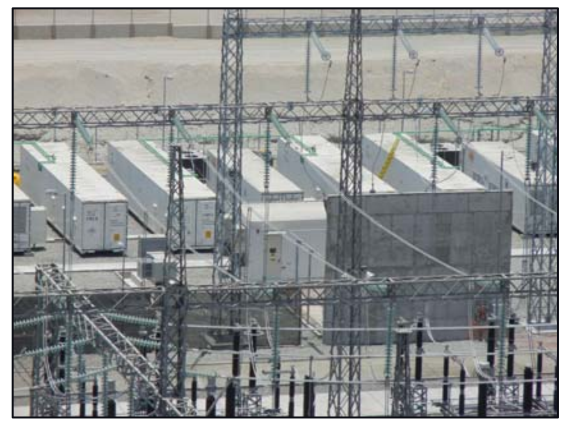
The job: respond to system needs for different power levels. Again, batteries can do this.

2009: Los Andes, Chile (12MW)



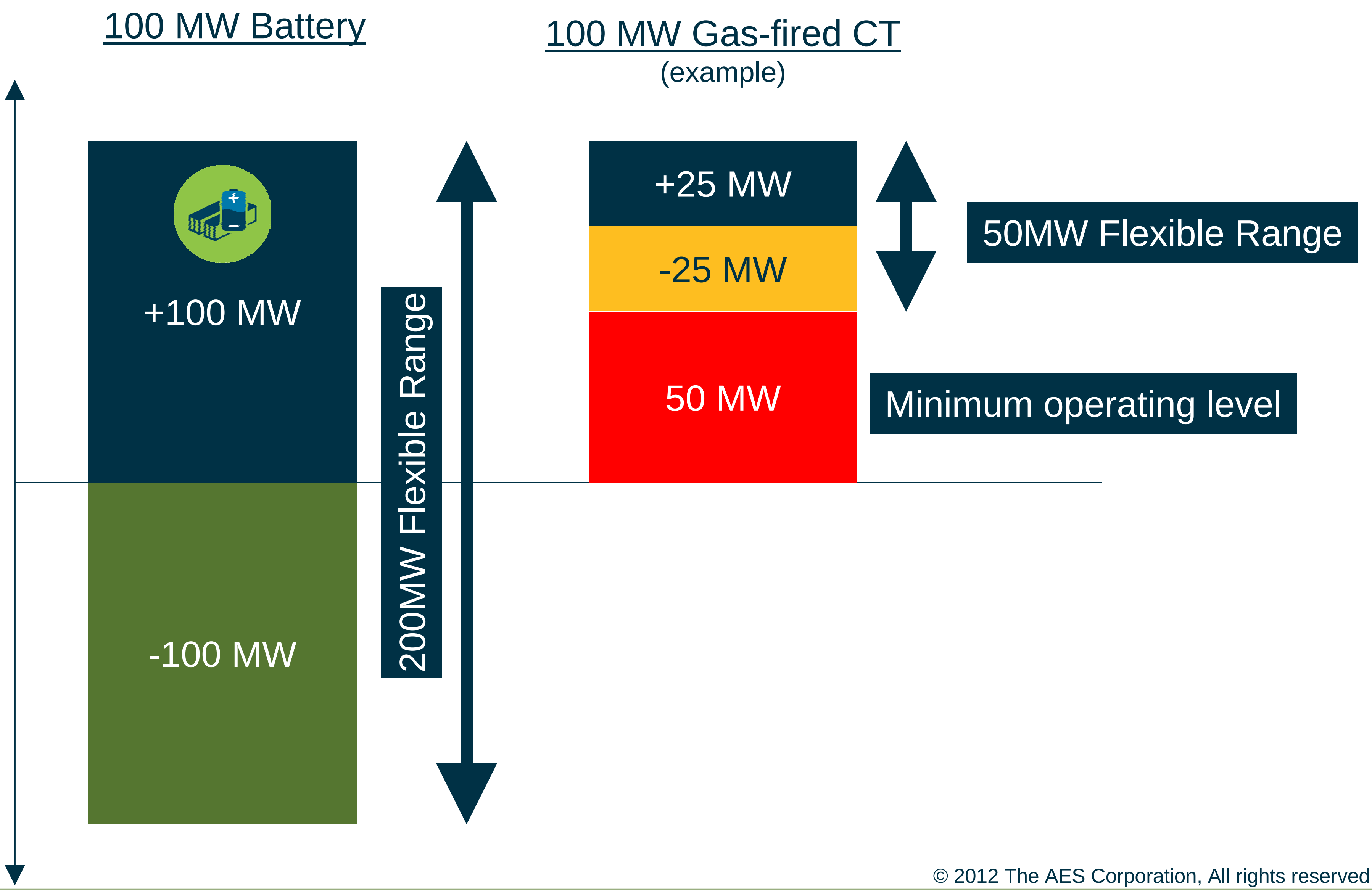
2010: Johnson City, NY (8MW)

2011: Laurel Mountain, WV (32MW) and Angamos, Chile (20MW)



Job #2: Flexibility.

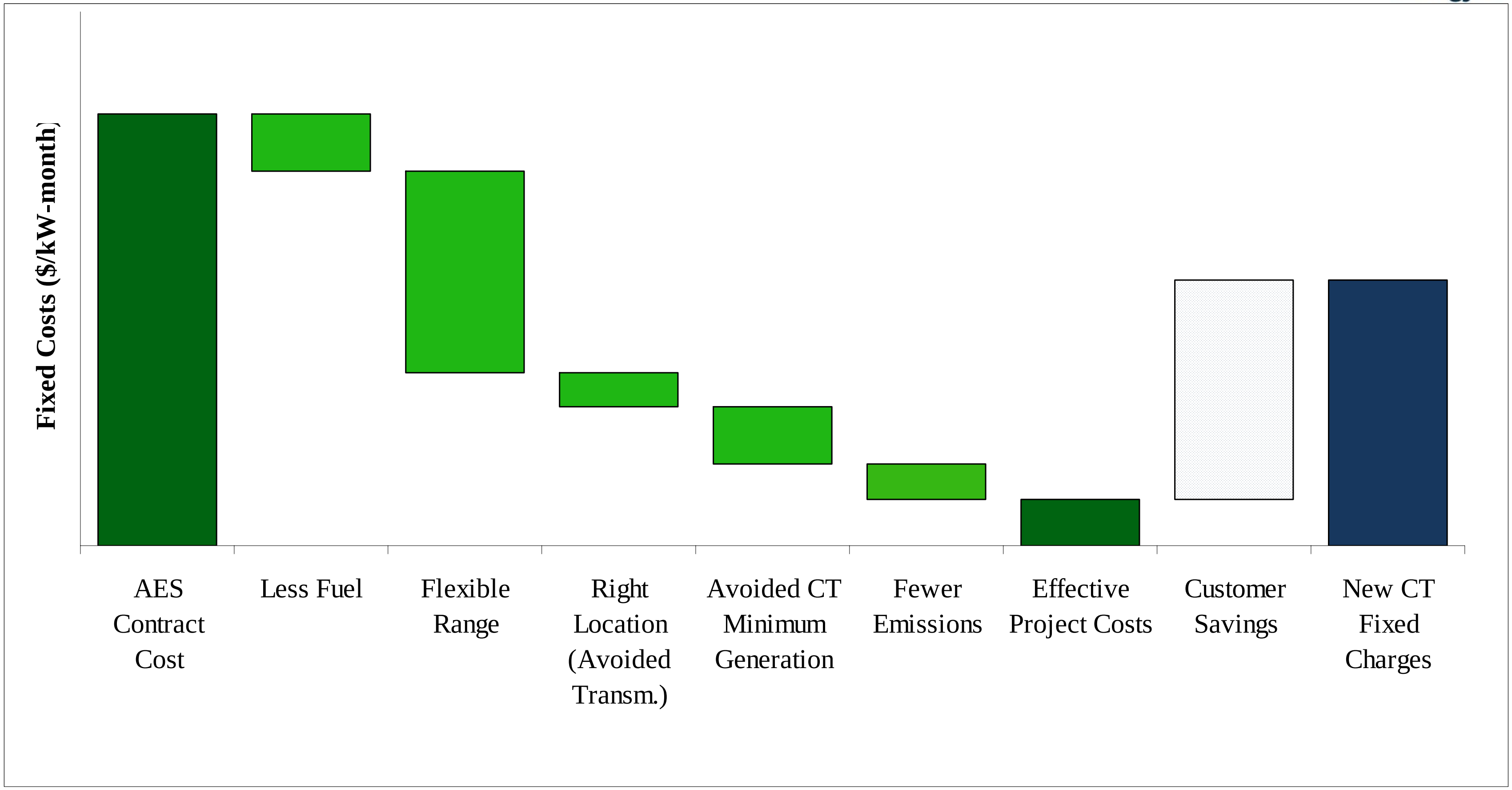
What makes a resource good at flexibility? One major driver is the flexible range offered with no minimum output level required.



What makes a resource good at flexibility?

Flexible range	➢ Batteries have 2.5x-4x the flexible range of CTs.
Avoided Min Gen	➢ Avoids requirement to take high cost energy which can limit opportunity for cleaner alternatives.
Availability	➢ Synchronized to the grid 24/7, ready to respond.
Speed	➢ Can provide full swing (e.g. -100MW to +100MW) in < 1 sec.
Accuracy	➢ *Exactly* how many megawatts do you want to inc/dec output?

Energy storage is good at peaking and flexibility. How good is it?



Each of the benefits can be measured and stacked up vs a CT.

Can we really add peaking generation in areas that have not considered storage in planning and procurement?

Safe Harbor Disclosure

Certain statements in the following presentation regarding AES's business operations may constitute "forward-looking statements." Such forward-looking statements include, but are not limited to, those related to future earnings growth and financial and operating performance. Forward-looking statements are not intended to be a guarantee of future results, but instead constitute AES's current expectations based on reasonable assumptions. Forecasted financial information is based on certain material assumptions. These assumptions include, but are not limited to accurate projections of future interest rates, commodity prices and foreign currency pricing, continued normal or better levels of operating performance and electricity demand at our distribution companies and operational performance at our generation businesses consistent with historical levels, as well as achievements of planned productivity improvements and incremental growth from investments at investment levels and rates of return consistent with prior experience. For additional assumptions see the Appendix to this presentation. Actual results could differ materially from those projected in our forward-looking statements due to risks, uncertainties and other factors. Important factors that could affect actual results are discussed in AES's filings with the Securities and Exchange Commission including but not limited to the risks discussed under Item 1A "Risk Factors" in the Company's Annual Report on Form 10-K for the year ended December 31, 2008, as well as our other SEC filings. AES undertakes no obligation to update or revise any forward-looking statements, whether as a result of new information, future events or otherwise.