State-Federal RPS Collaborative

Clean Energy States Alliance

America's Power Plan

Wholesale Market Design and Distributed Generation

Hosted by
Warren Leon, Director, CESA

October 2, 2013

Clean Energy States Alliance

CleanEnergyGroup
Innovation in Finance, Technology & Policy

Housekeeping

- All participants will be in listen-only mode throughout the broadcast.
- We suggest that you connect to the audio portion of the webinar using VOIP and your computer's speakers or USB-type headset. You can also connect by telephone. If by phone, please expand the Audio section of the webinar console to select "Telephone" to see and enter the PIN number shown on there onto your telephone keypad.
- You can enter questions for today's event by typing them into the "Question Box" on the webinar console. We will pose your questions, as time allows, following the presentation.
- This webinar is being recorded and will be made available after the event on the CESA website at

  www.cleanenergystates.org/events/

About CESA

Clean Energy States Alliance (CESA) is a national nonprofit organization working to implement smart clean energy policies, programs, technology innovation, and financing tools, primarily at the state level. At our core is a national network of public agencies that are individually and collectively working to advance clean energy.

State-Federal RPS Collaborative

- With funding from the Energy Foundation and the US Department of Energy, CESA facilitates the **Collaborative**.
- Includes **state RPS administrators**, **federal agency representatives**, and other stakeholders.
- Advances dialogue and learning about RPS programs by **examining the challenges and potential solutions** for successful implementation of state RPS programs, including **identification of best practices**.
- To sign up for the Collaborative listserve to get the **monthly newsletter** and announcements of **upcoming events**, see: www.cleanenergystates.org/projects/state-federal-rps-collaborative

Today's Webinar: America's Power Plan

- A project to propose a path to overcoming regulatory, legal, and economic barriers to cleaner more-efficient energy
- 150 top energy experts participated
- The premise: "We are at a pivotal point in America's energy history. Decisions and investments made in the next decade will shape the course of the power sector, the economy, national security and the climate for decades to come."
- An overview paper and seven focused papers
- "Together, these papers provide a policy toolbox to guide decision makers on utility business models, finance, market design, transmission and distribution policies, distributed energy resource integration and siting."
- Curated by the Energy Foundation in partnership with Energy Innovation, an energy and environmental policy firm

Two Webinars for CESA/RPS Collaborative

- Will cover four of the seven papers
  - September 30
    - Utility Business Models
    - Finance
  - Today
    - Wholesale Market Design
    - Distributed Generation

http://www.cleanenergystates.org/events/
http://americaspowerplan.com/

Today's Guest Speakers

- Michael Hogan, Senior Advisor, Regulatory Assistance Project

  "Aligning Power Markets to Deliver Value"

- Joseph Wiedman, Partner, Keyes Fox & Wiedman; Team Member, IREC

  "Distributed Generation's Role in Our Clean Energy Future"

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CleanEnergy States Alliance

RAP | Energy solutions for a changing world

America's Power Plan: Aligning Power Markets to Deliver Value

Matching the structure and operation of wholesale power markets to the needs of a modern power system

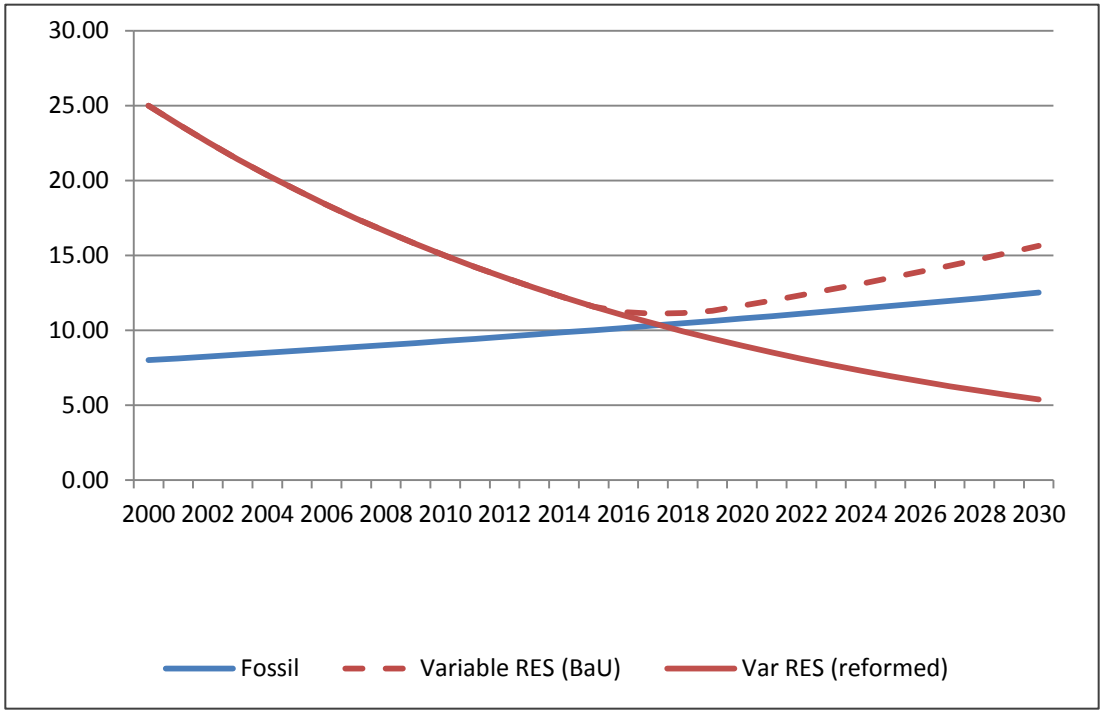
Michael Hogan
Senior Advisor

2 October 2013

The Regulatory Assistance Project
50 State Street, Suite 3
Montpelier, VT 05602
Phone: 802-223-8199
web: www.raponline.org

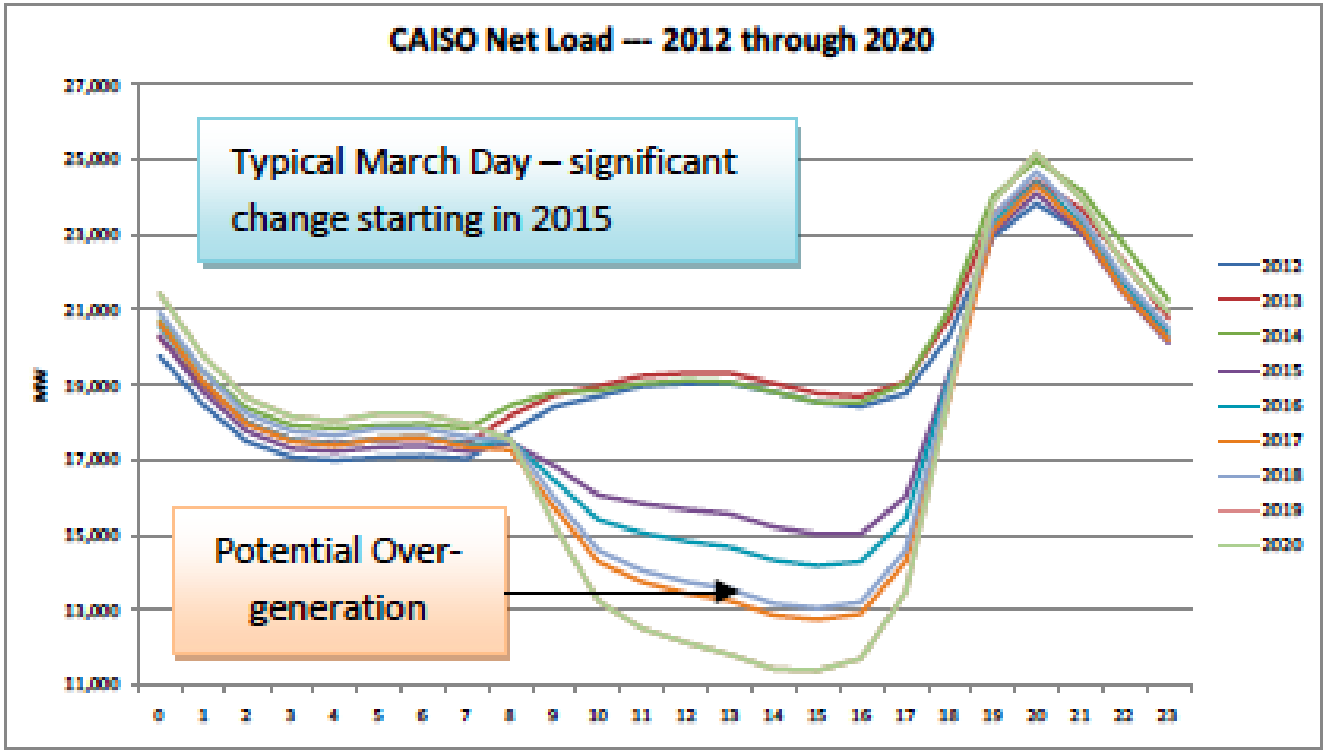
Success brings new risks, complexity

"System cost" of variable RES vs. average market price



Reaching "grid parity" will require more than just deployment

Challenges

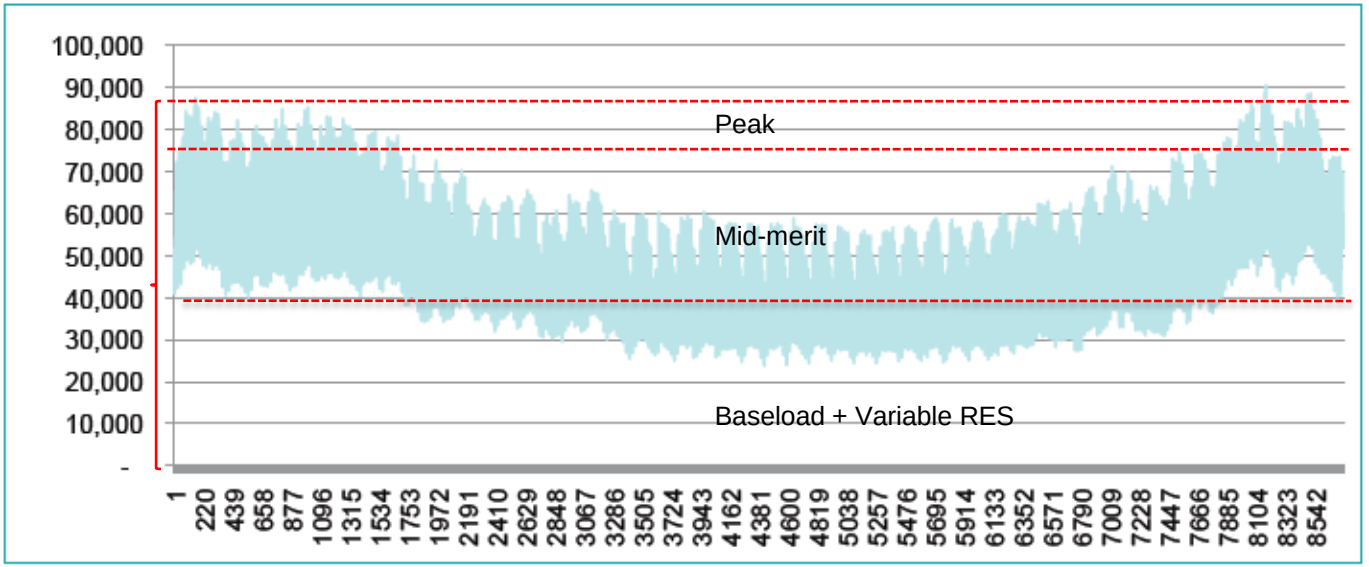

CAISO Net Load --- 2012 through 2020
Typical March Day – significant change starting in 2015
Potential Over-generation
MW
27,000
25,000
23,000
21,000
19,000
17,000
15,000
13,000
11,000
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
2012
2013
2014
2015
2016
2017
2018
2019
2020

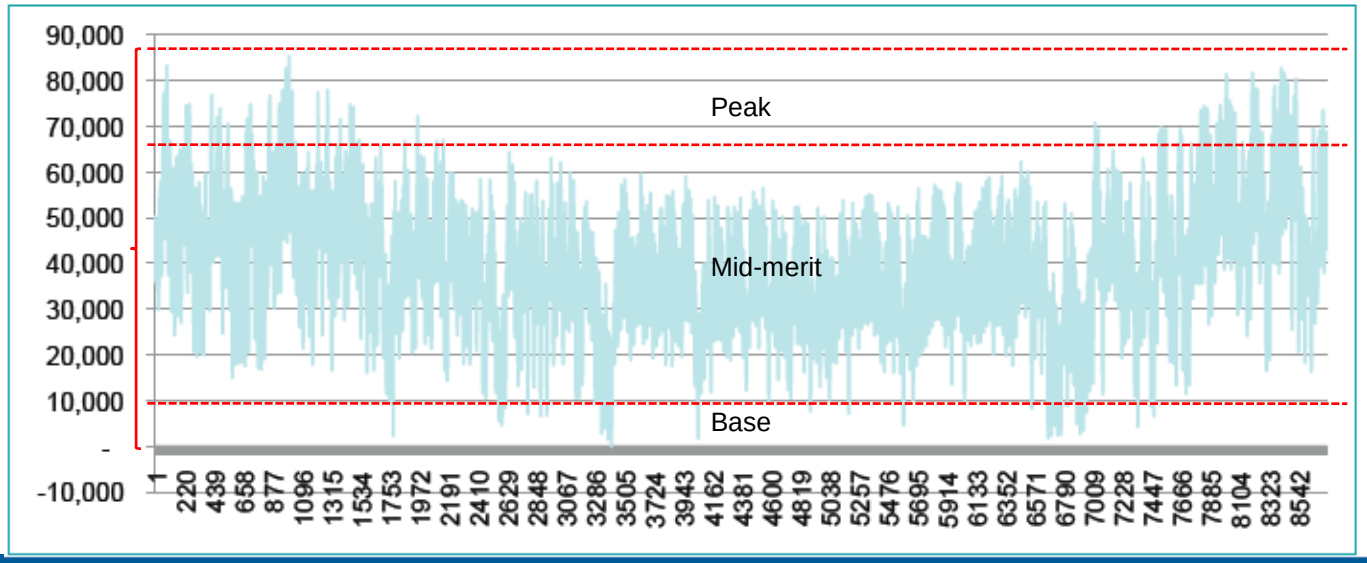
Challenges

Gross

Gross & net demand in UK_South in 2030…

Net

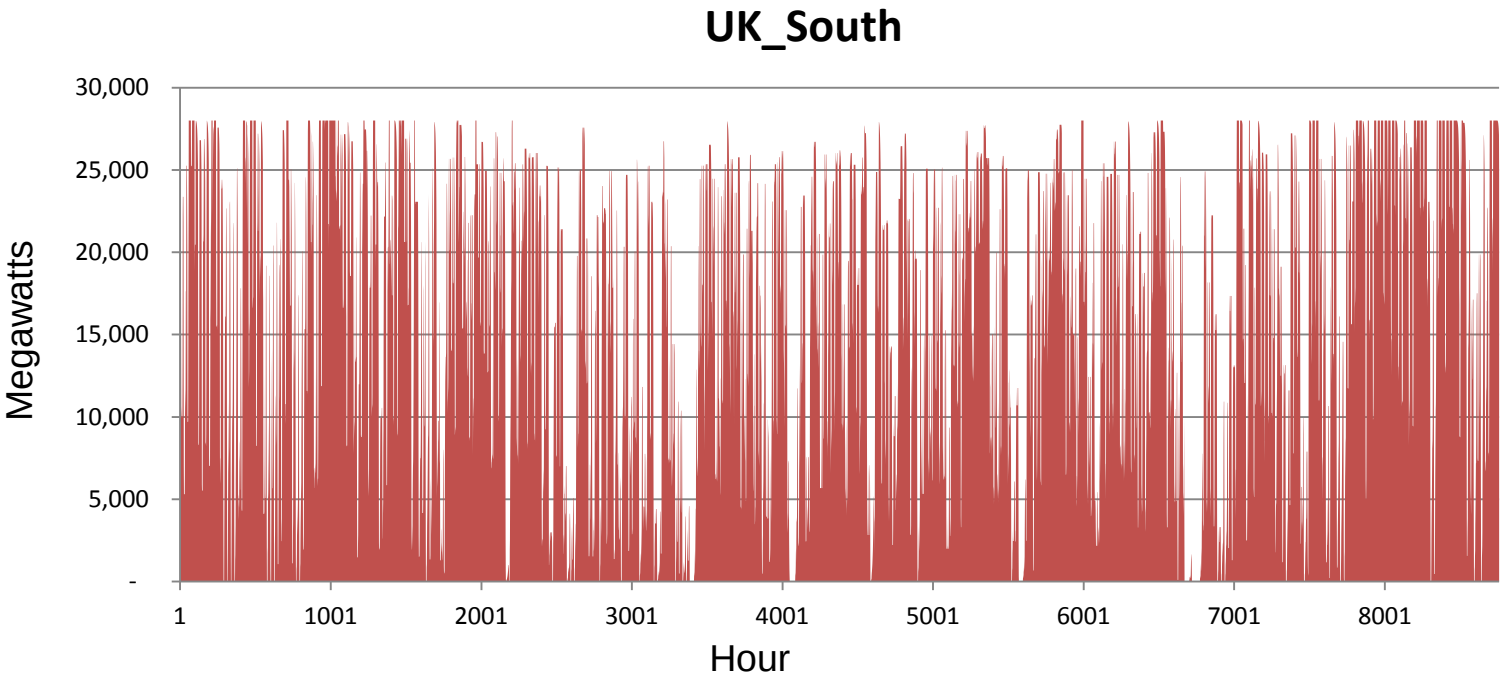




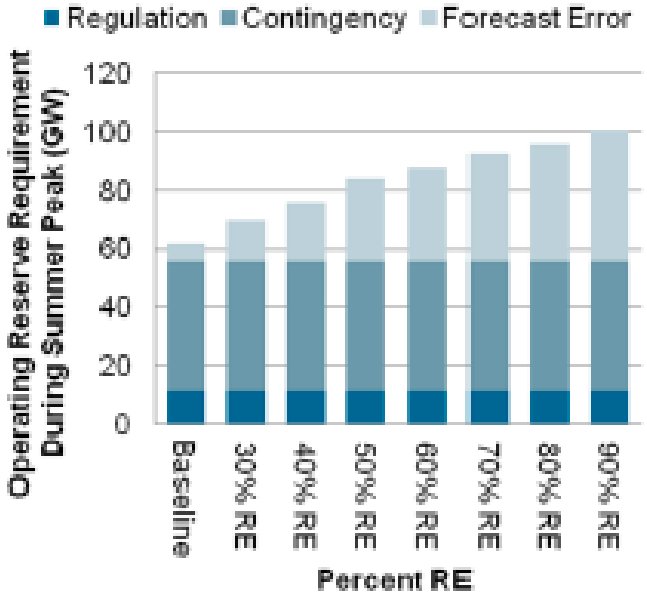
Challenges

Operating Profile of mid-merit CCGTs in 2030

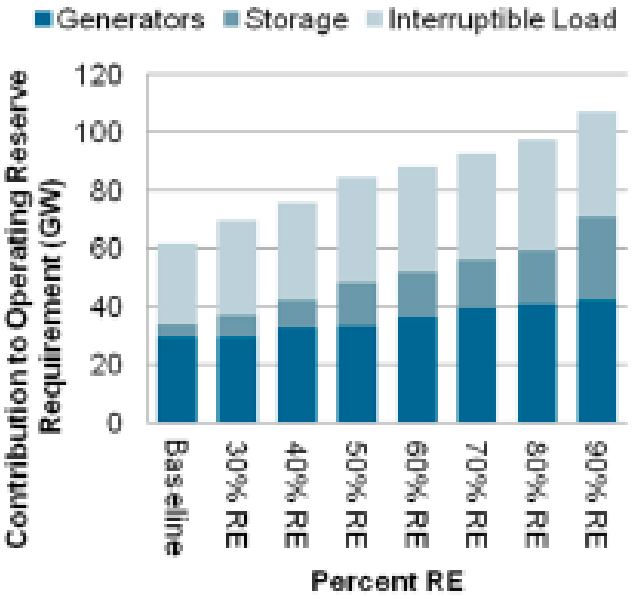
Example of large CCGT fleet with “typical” average load factor (58%)*



Challenges



(a) 2050 operating reserve requirement during the summer peak by reserve type



(b) 2050 contributions toward total operating reserve requirement by technology type

RE Futures, Fig 2.7 (Vol. 1, pg 2-18): "…an increasing fraction of the existing conventional fossil fleet may evolve from an energy-providing role to a reserve-providing role as renewable energy supply increases, thereby reducing the need to install new generation capacity solely to meet operating reserve requirements."

Markets that value whatever is needed

- Recognize the value of efficiency
- Update system operations to unlock flexibility in the short term
- Update investment incentives to drive cost-effective flexibility in the long term

…another resource for those not familiar with it:

"*Meeting Renewable Energy Targets in the West at Least Cost: The integration challenge*"

(Prepared in 2012 for Western Governors' Association)

Markets that value whatever is needed

- Recognize the value of efficiency
  - Programs (rather than markets) will continue to be the primary vehicle for delivering cost-effective efficiency, but opportunities do exist
  - Allow energy efficiency to participate in capacity markets
  - Standardize M&V procedures and capacity values for a menu of common EE measures
  - Consider location-specific EE as a competitive alternative to transmission

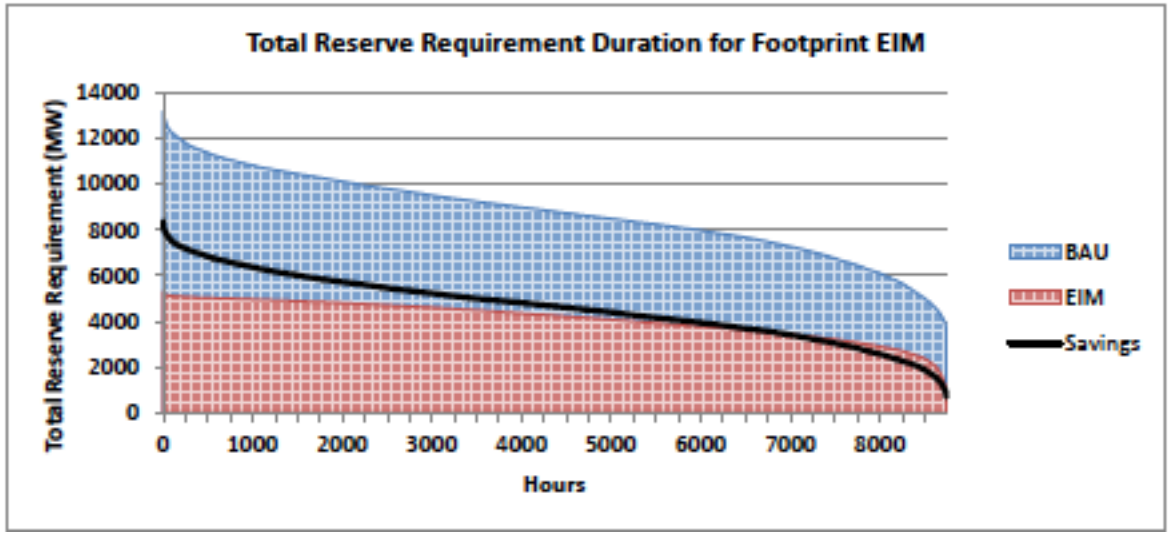
Markets that value whatever is needed

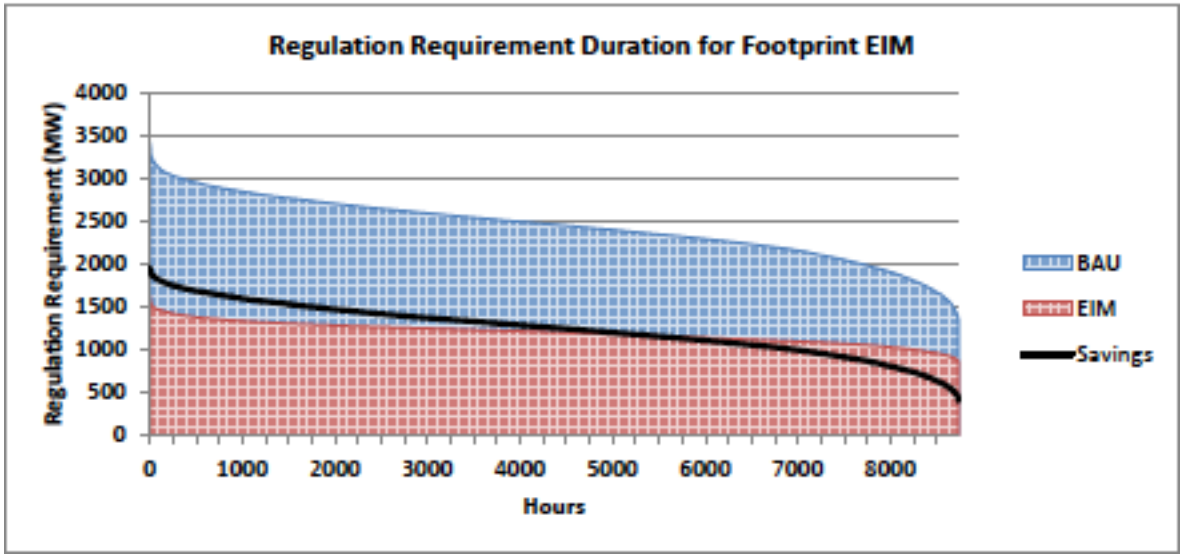
- Update system operations to unlock flexibility in the short term
  - Upgrade scheduling, dispatch and weather forecasting processes
  - Consolidate/integrate balancing areas
  - Access dispatchability of renewable energy assets
  - Employ day-ahead markets for current ancillary services; qualify new services
  - Co-optimize energy and reserves
  - **Expand the roles of demand response**

Markets that value whatever is needed

- Update investment incentives to ensure flexibility in the long term
  - Develop tools to forecast net demand and forward value of critical capabilities
  - In regulated markets, survey embedded options; invest to increase asset capabilities
  - Adapt forward mechanisms to capture the value of critical operational capabilities
  - Adopt forward markets for critical services
  - Create forward market for temporal decoupling service
  - Encourage new entrants wherever possible consistent with overall market structure

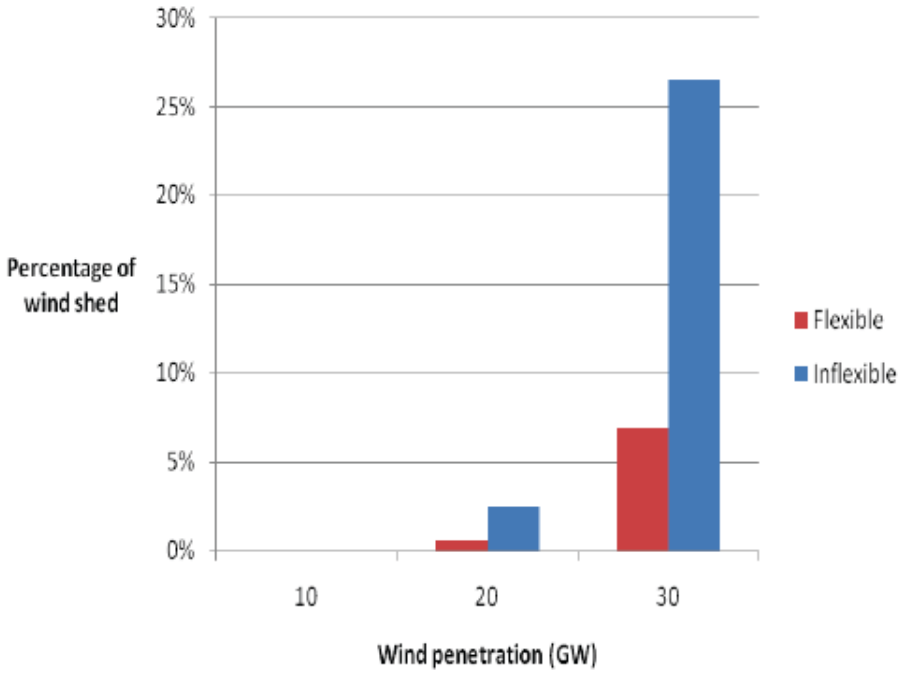
Benefits of wide-area regional imbalance markets





Source: "Flexibility Reserve Reductions from an Energy Imbalance Market with High Levels of Wind Energy in the Western Interconnection" King, Kirby, Milligan and Beuning

The forward value of flexible resources



Number of hours with zero or negative prices

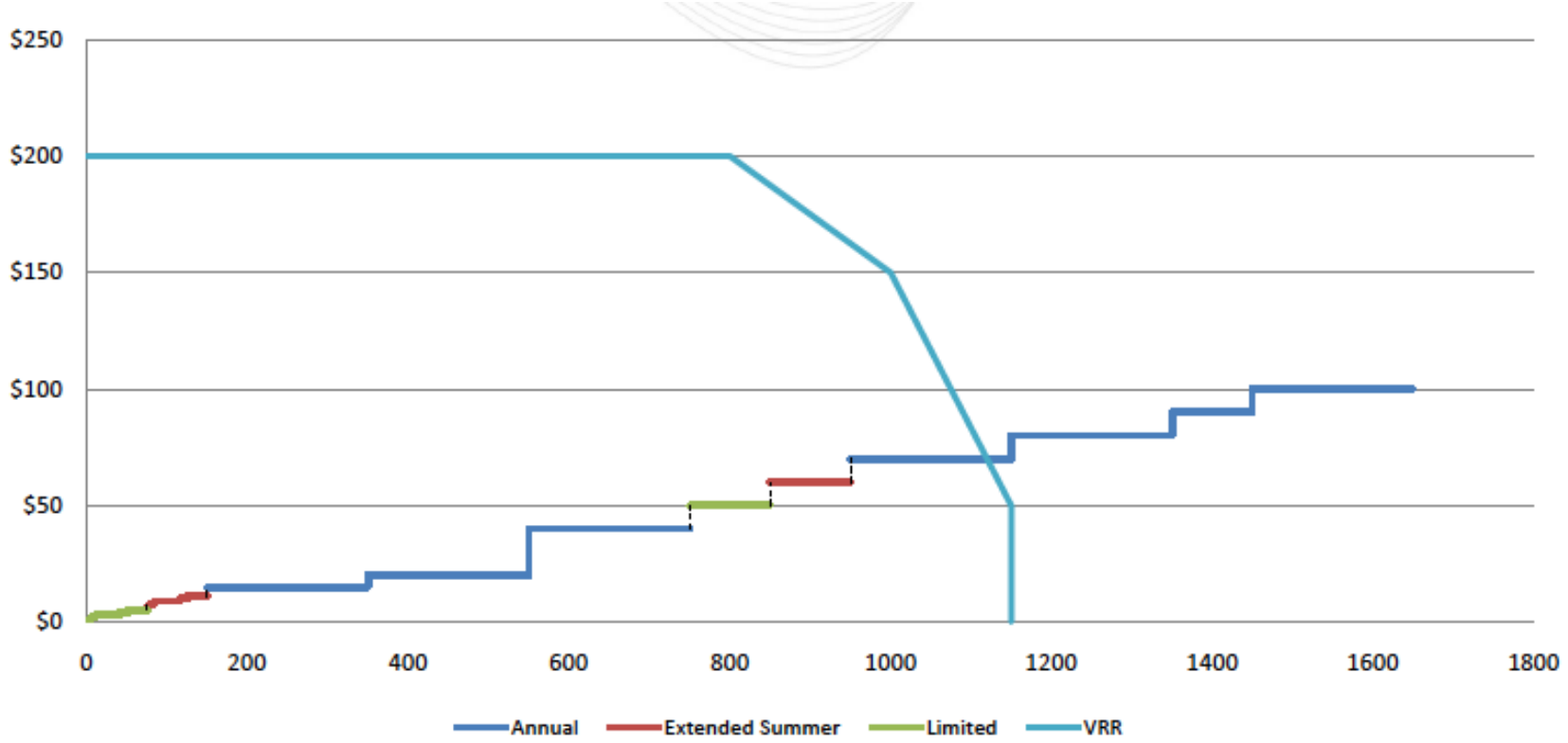
High Generation Flexibility	Low Generation Flexibility
200	>1500

leading to increased base-load & peak generation investment risks...

...while providing significant opportunities for demand response, storage, flexible generation, ……

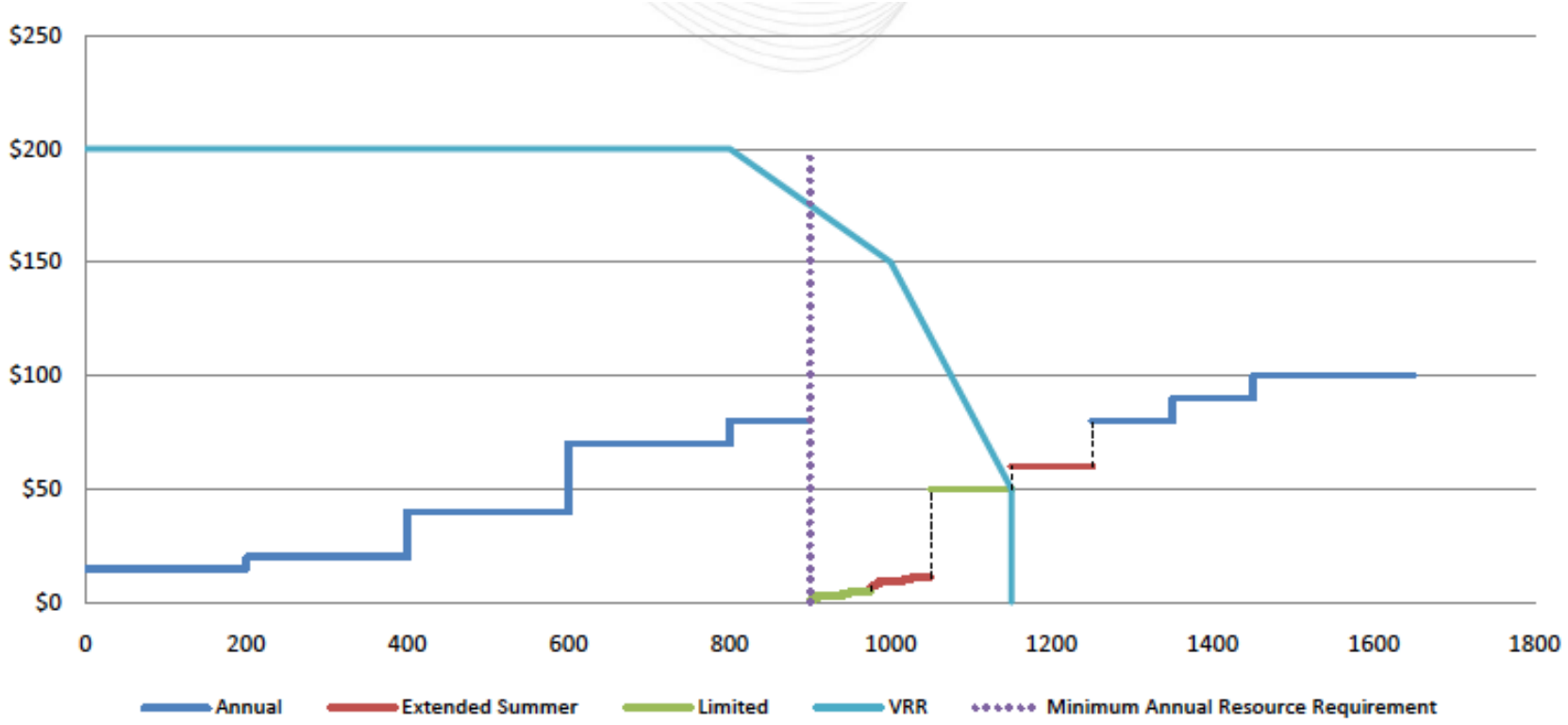
Source: Energy Futures Laboratory, Imperial College London

Increased demand flexibility through 'smart' grid investments is a cost-effective alternative to curtailing low-carbon sources



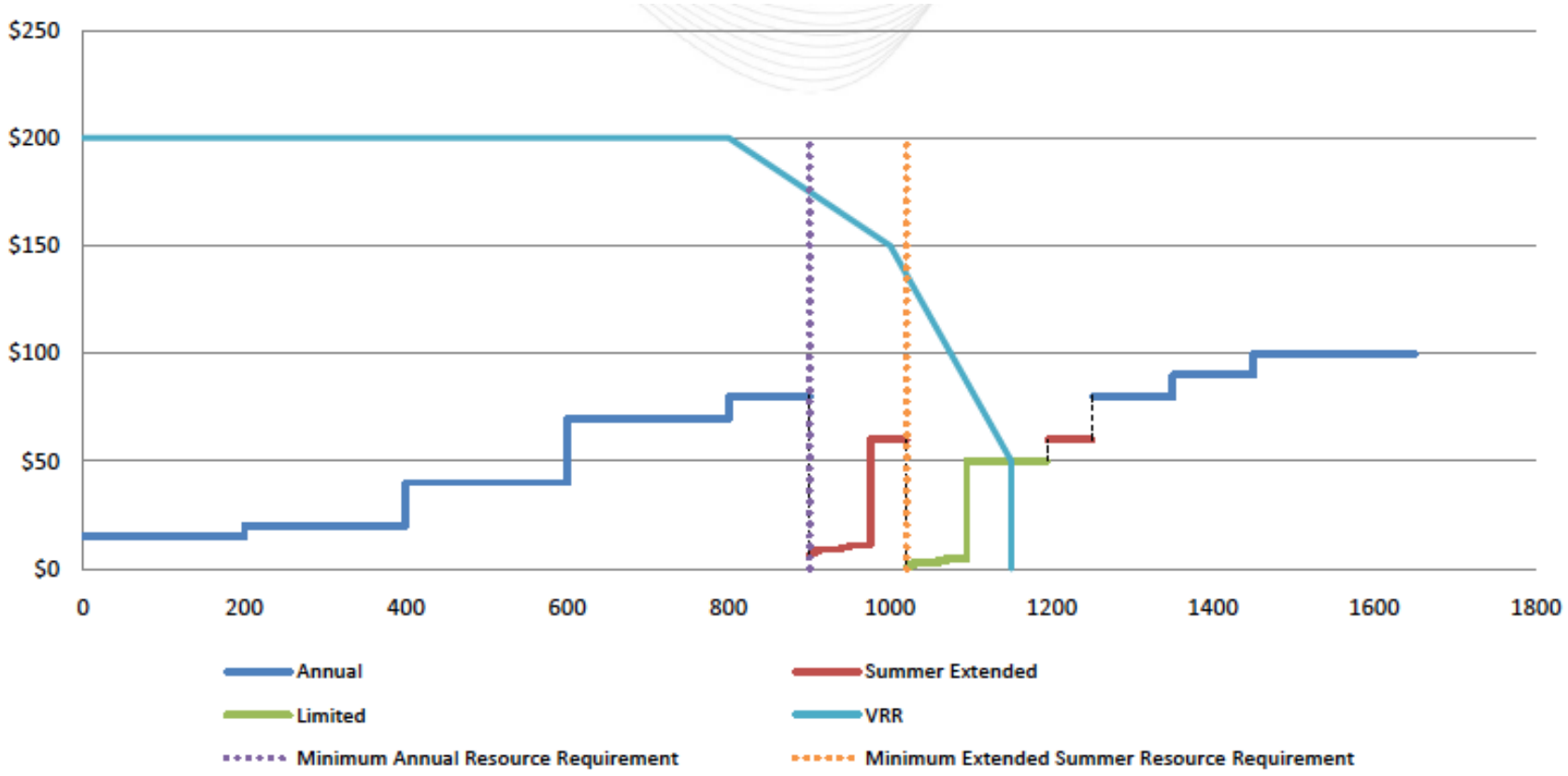
Marginal Value Of System Capacity = $70
Annual Resource Price Adder = $0
Extended Summer Price Adder = $0

Increased demand flexibility through 'smart' grid investments is a cost-effective alternative to curtailing low-carbon sources



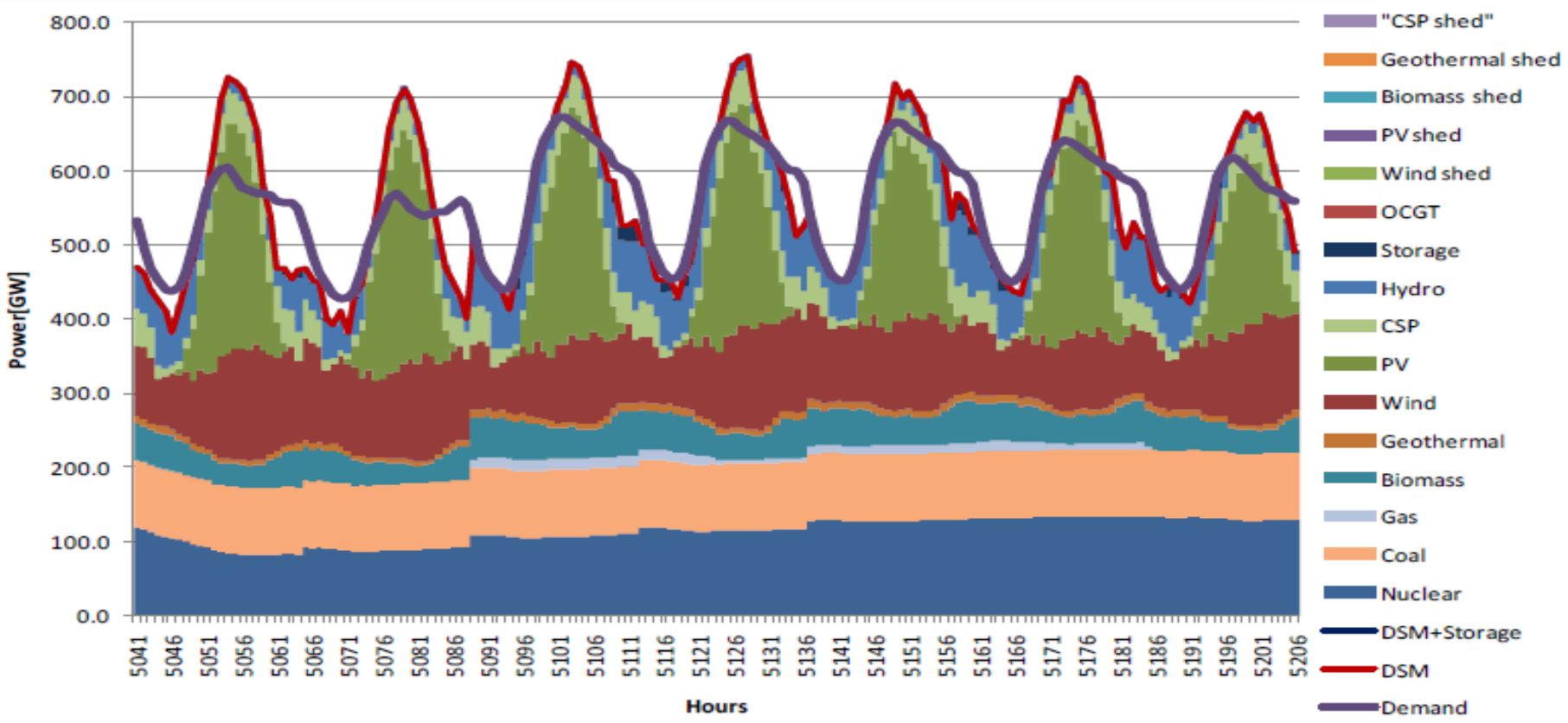
Marginal Value Of System Capacity = $50
Annual Resource Price Adder = $30
Extended Summer Price Adder = $0

Increased demand flexibility through 'smart' grid investments is a cost-effective alternative to curtailing low-carbon sources



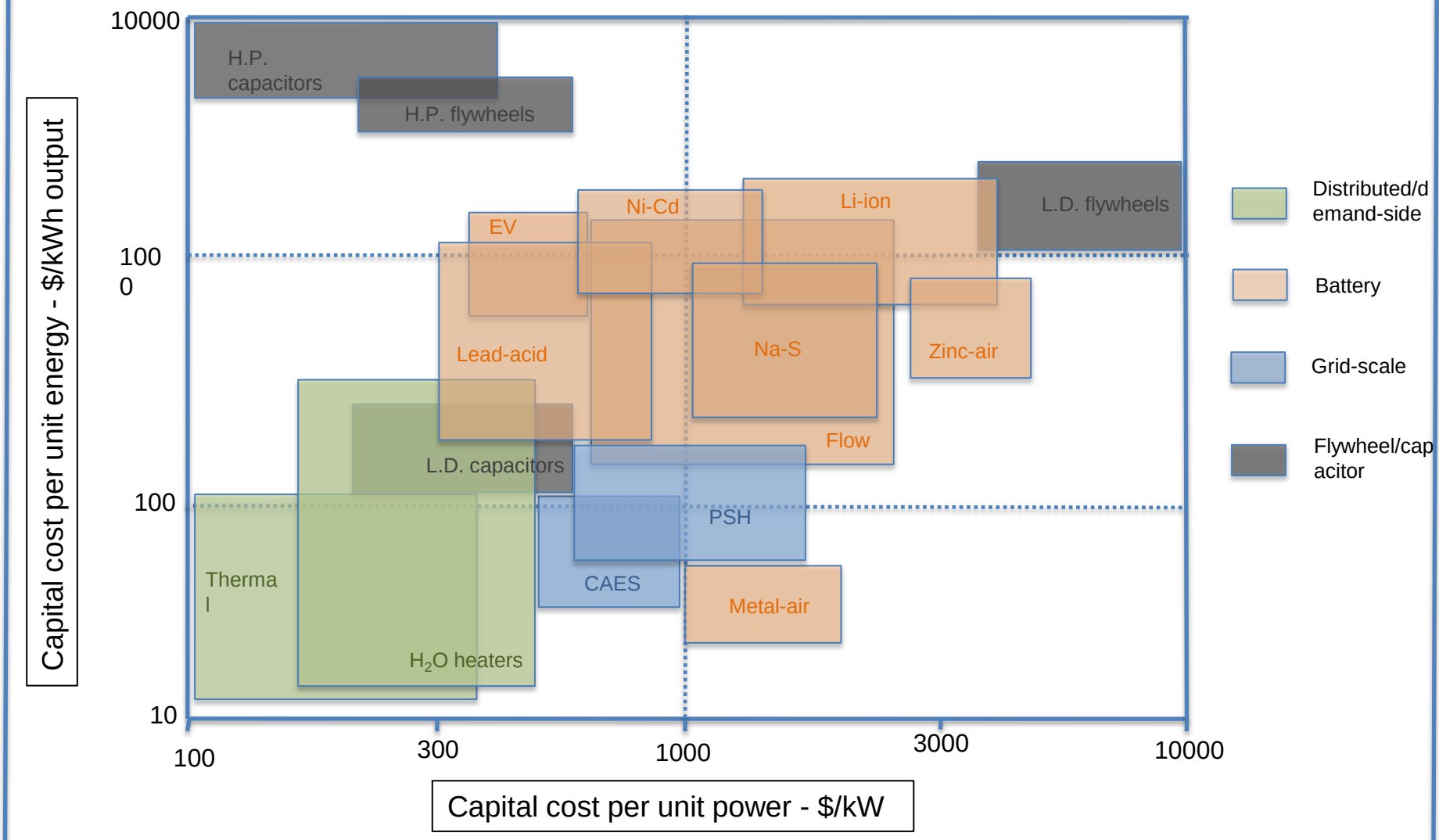
Marginal Value Of System Capacity = $50
Annual Resource Price Adder = $20
Extended Summer Price Adder = $10

Responsive demand – in *both directions* - is a cost-effective solution to both curtailment and excessive price volatility



End-use energy storage is feasible, low-cost and widely available

Cost per Unit of Performance for Various Energy Storage Options



Sources: Electricity Storage Association, EPRI, Sandia National Laboratories, Ecofys

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

Global
US
China
EU

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Increased demand flexibility through 'smart' grid investments is a cost-effective alternative to curtailing low-carbon sources

Grid Scale Battery Technology	Demand Response Costs Compared to Various Grid Scale Battery Costs		
	DR Cost* ($/kW)	Battery Cost** ($/kW)	DR / Battery (% cost)
Lithium-ion - High Power	$230	$2,050	11%
Advanced Lead Acid	$230	$2,100	11%
Lithium Ion - High Energy	$230	$2,750	8%
Vanadium Redox Battery	$230	$2,375	10%
Zinc Bromine	$230	$1,625	14%
Sodium Sulfur (NaS)	$230	$3,500	7%
Zinc- Air Battery	$230	$2,625	9%

* DR Cost = Deployed cost, average. (Wikler et al. 2009)
** Battery Costs = Deployed cost, average. (Seto 2010)

Source: Lawrence Berkley National Laboratory, June 2012

Distributed Generation's Role in Our Clean Energy Future

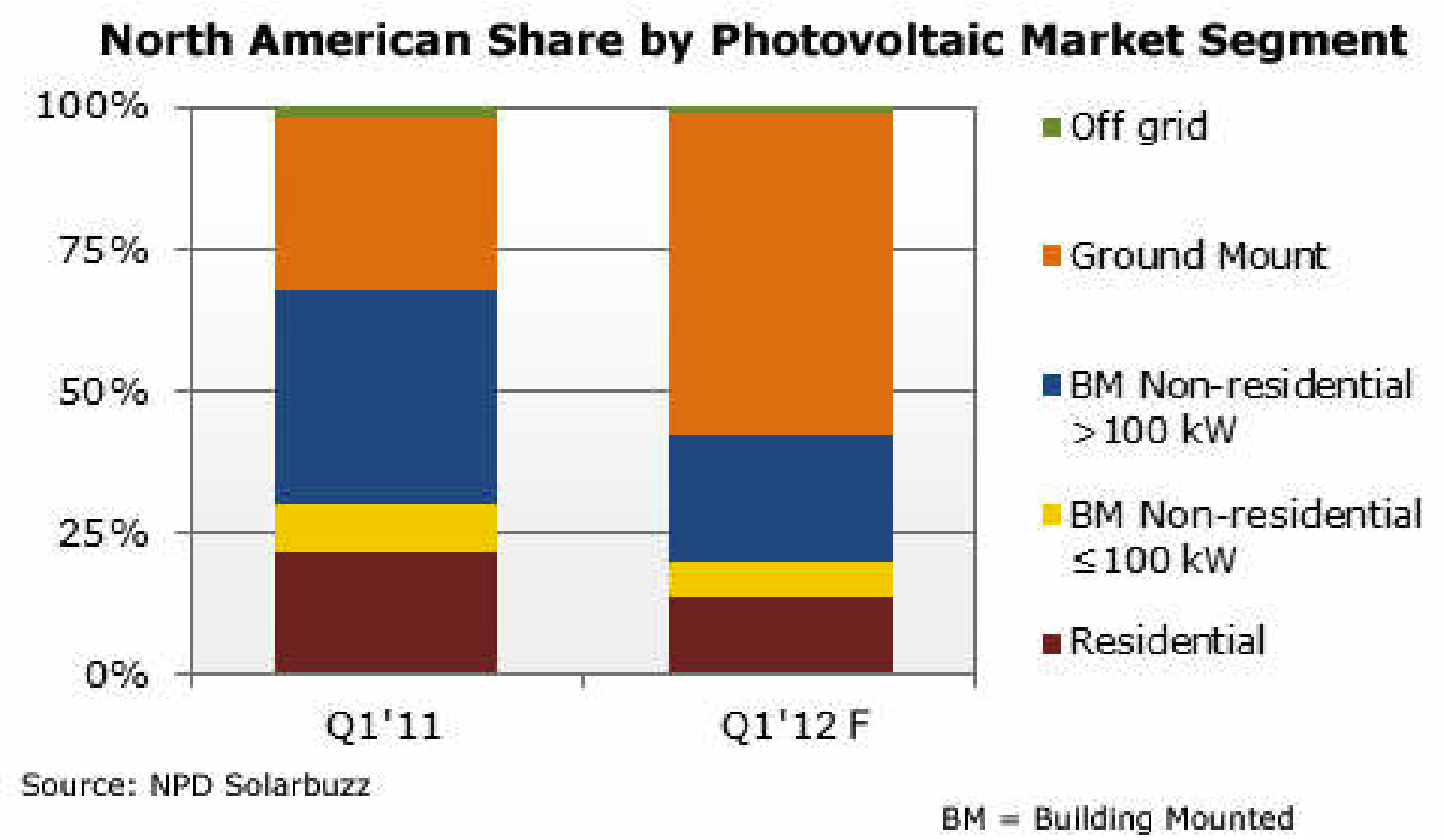
Joseph Wiedman
Interstate Renewable Energy Council
October 2, 2013

Curated by the Energy Foundation in partnership with Energy Innovation.

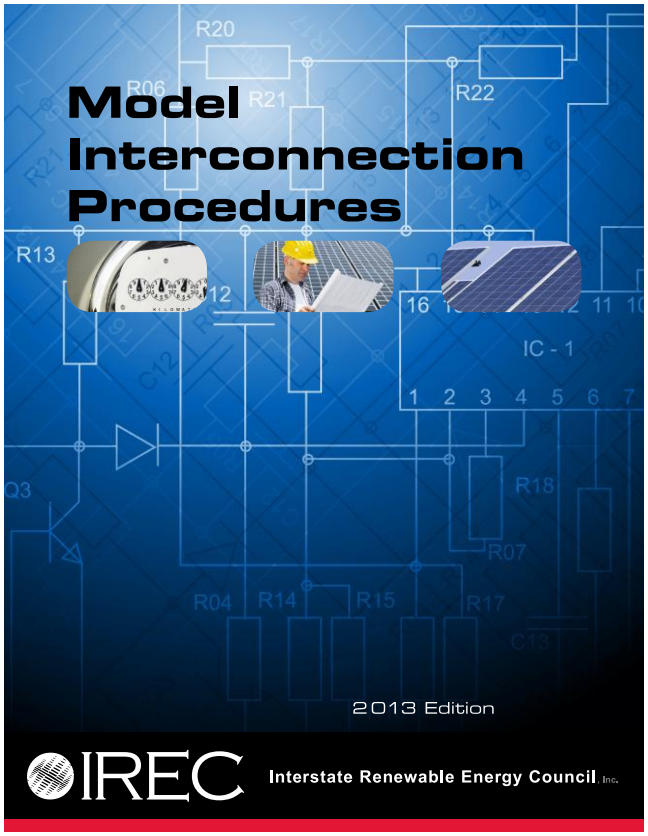
Mechanisms that Support Retail Solar

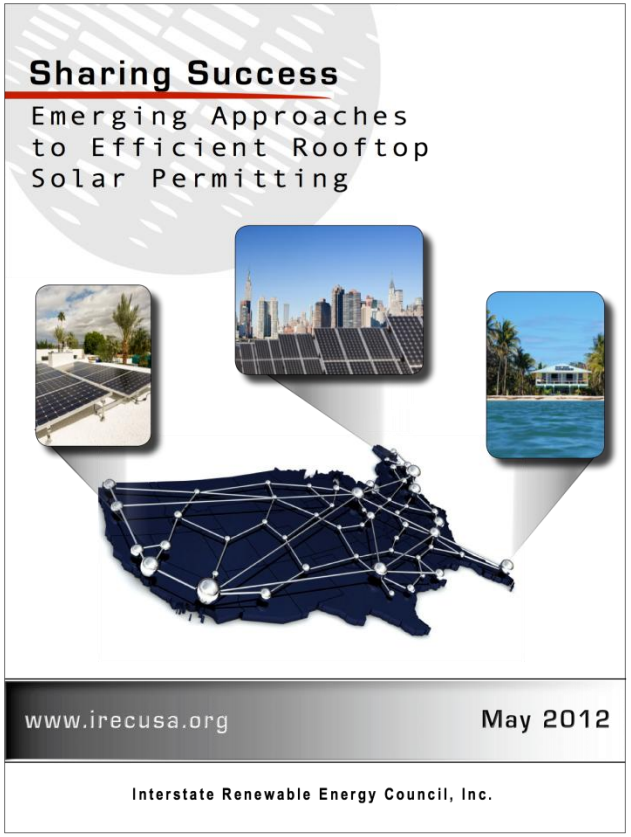
Shared Renewables
Multiple Customers, Multiple Meters, Multiple Locations

Wholesale Segment Growth



Bringing Down BOS costs – Permitting and Interconnection





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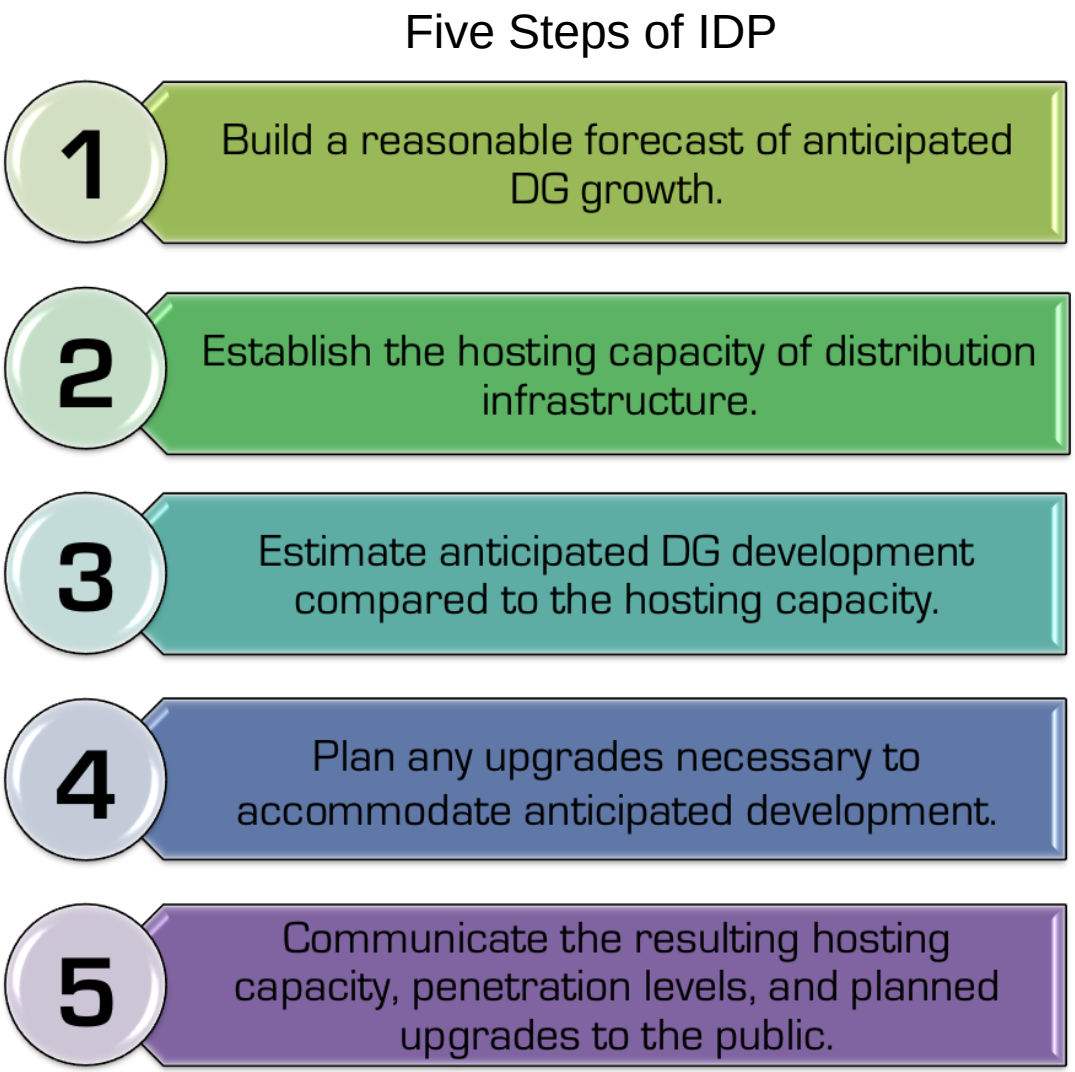
Integrated Distribution Planning



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Discussion

Have further questions?

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