



RAP

Energy solutions
for a changing world

Upending the Supply Stack: Variable and Responsive Resources as Primary Objectives

June 2011 Meeting of
NASUCA

Presented by Richard Sedano

June 27, 2011

The Regulatory Assistance Project

50 State Street, Suite 3
Montpelier, VT 05602

Phone: 802-223-8199
web: www.raponline.org

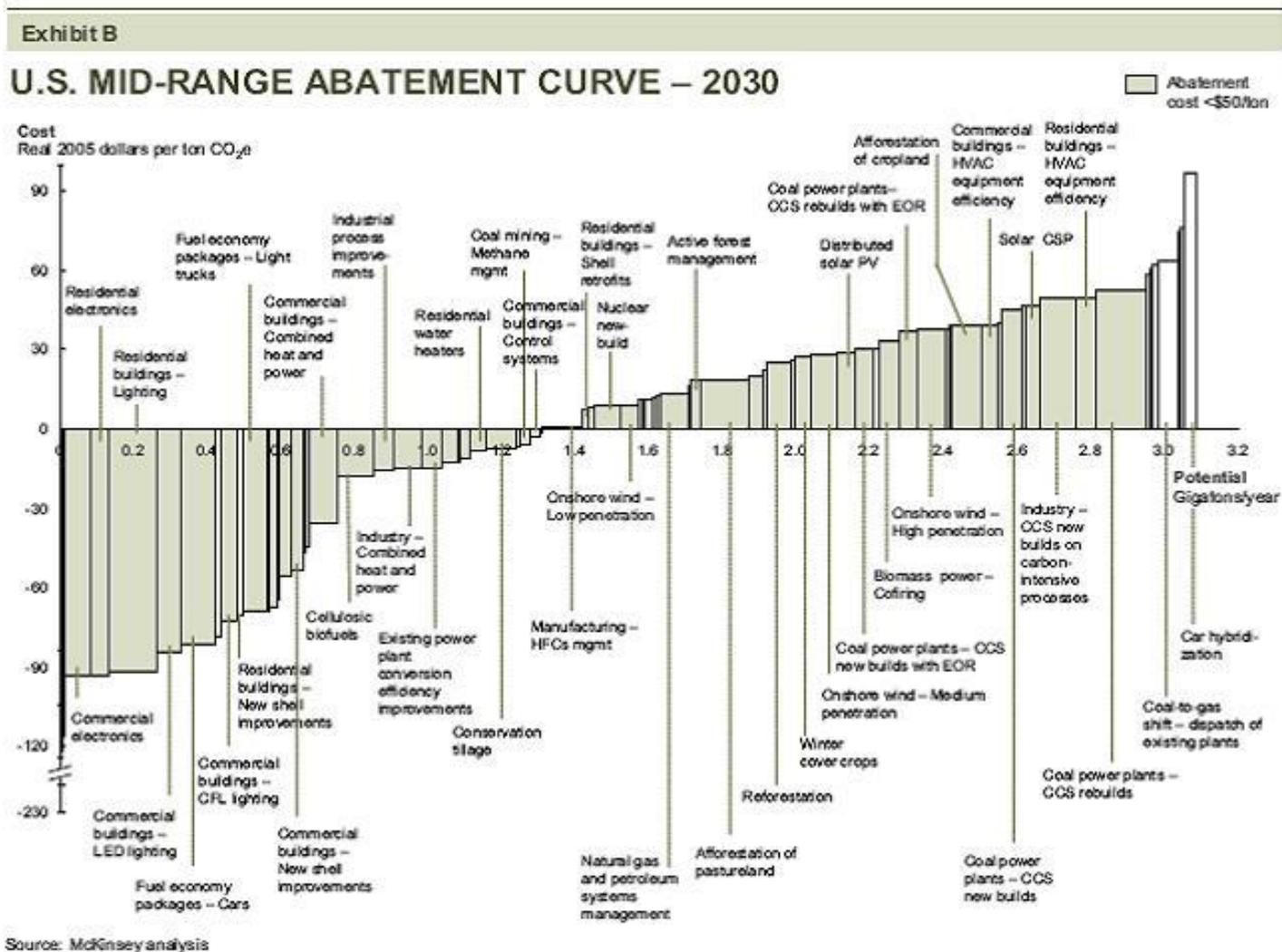
Introducing RAP and Rich

- RAP is a non-profit organization providing technical and educational assistance to government officials on energy and environmental issues. RAP Principals all have extensive utility regulatory experience.
 - Richard Sedano directs RAP's US Program. He was commissioner of the Vermont Department of Public Service from 1991-2001 and is an engineer.

Premise

- Energy and the environment are inextricably linked
- Making this connection explicit can either increase or decrease cost compared with addressing each separately

U.S. Mid-range GHG Abatement Costs



- Source: McKinsey & Co. 2007, *Reducing US Greenhouse Gas Emissions: How Much at What Cost?*

Change afoot

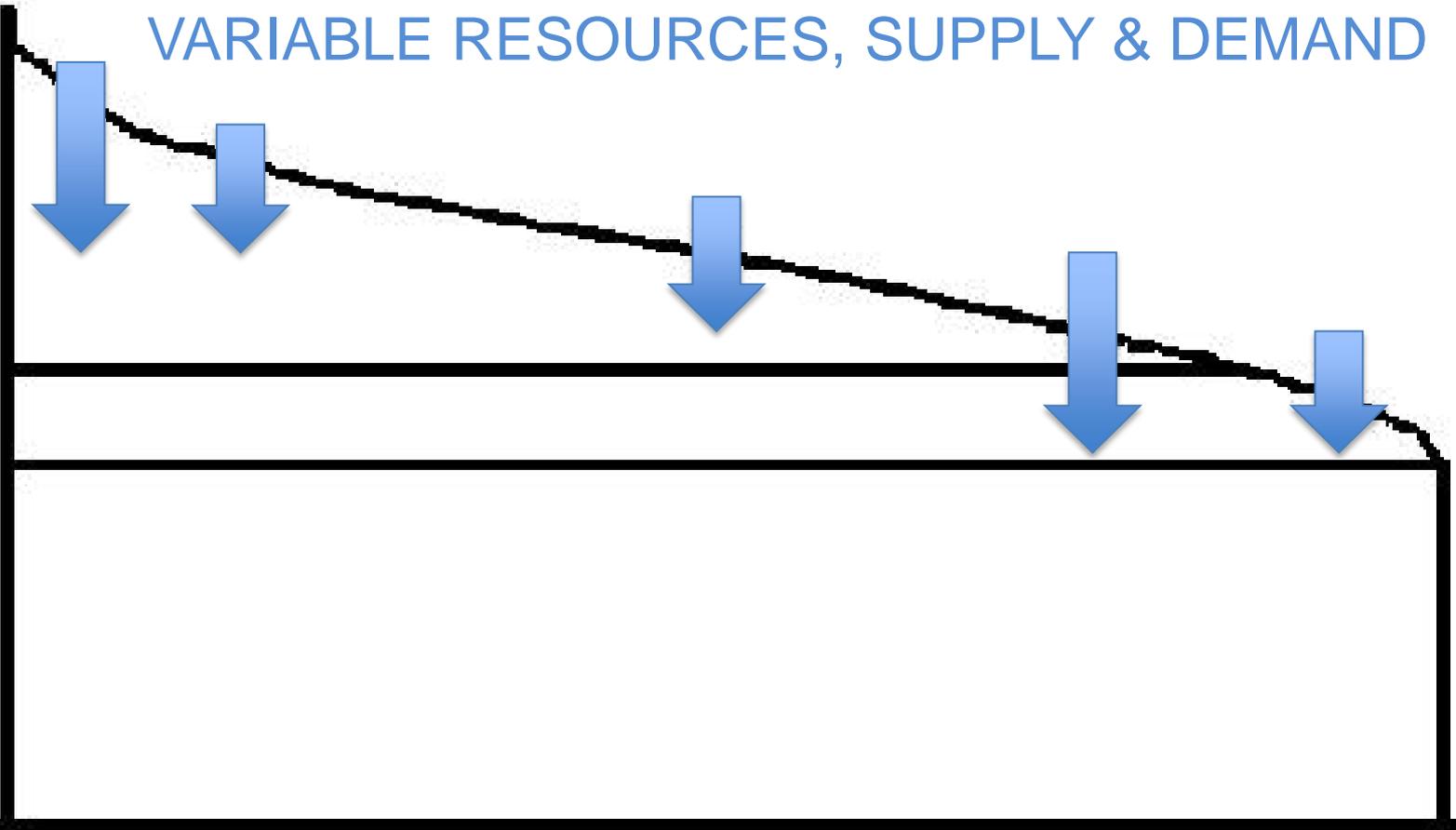
- Environmental Imperatives
- Expensive base load options
- Costs for variable resources (wind and solar) are dropping
- Costs for responsive resources (supply and demand) appear stable or improving
 - Supply of demand resources likely enhanced by smart grid and improved market rules

Turning the supply stack on its head

- Many are conditioned to start building a supply portfolio with base load sources
 - The name says it all
 - Lots of energy available all the time
- Fill in the high spots with generation that cost less to build and maintain at the ready (intermediate and peakers)
- Variable resources sub for intermediates and peakers

VARIABLE RESOURCES, SUPPLY & DEMAND

Capacity Requirements (Kilowatts)



Capacity Utilization Rate (0% to 100%)

In a Wholesale Market, How Do We Get the Generation We Want (Need?)

- What if the nation needs 30% wind and solar by 2030 in order to meet 2050 carbon goals in an orderly and economical way?
- 40%?
- 50%?

Brief History of Power Sector Resources

- In the beginning, utilities planned and acquired resources
 - Just and reasonable rates
 - No undue discrimination
 - Reliability
- 1970s: Disruptions in Confidence
 - Clean air and water
 - Expensive oil
 - Nuclear calamity

Government Rouses in Response to Performance

- Cost Disallowances
- Public Planning
- Competitive Generation
- Wholesale Markets Reforms
- Retail Markets and Restructuring Utility

Markets Lack Policy Wisdom

- States lose influence to guide planning and especially investment
- Reliance on markets means refining market rules, consistent with reliability
- New principles, new institutions
 - Open access
 - ISO, RTO

Doubling Down on Markets

- RTOs, where they exist, take on responsibility not just for reliability and market administration, but also for planning
 - Policy issues rest uneasily on RTO managers
 - Interest-based governance and voluntary nature accent influence of traditional resource owners
 - States uneasy with their lack of control of outcomes, some are responding
- Demand resources undervalued

Status

- There is enough power, but many problems
 - Aging, polluting, congesting, (add yours)
- Market rules retain bias
 - But they are consistent, respect precedents, and are within the Federal Power Act
 - Demand resources undervalued
 - Energy resources undervalued
 - Very responsive resources undervalued
 - Polluting resources overvalued
- States frustrated to varying degrees

Toward Better Decisions (Defining “Better”)

- How shall US Power Sector Decision-makers align **economic regulation** with **environmental goals**?
 - Focus only on reliability and markets won't do
 - Market Pushing state policies like RPS and net metering help but are rough
 - Carbon price – most anticipate it already, but vaguely

Clean First

- Clean resources as important as reliability and fair markets
 - Lisbon treaty language -- clarity
 - Redefine “undue discrimination” and “just and reasonable”
 - Risk aware
 - Calibrate markets and rules to clean portfolio results

Lisbon Treaty of European Union

- Article 11
 - Environmental Protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to the promotion of sustainable development.

Clean First

- Address bias in **choices** on wholesale market rules based on current perspectives
 - Reliability standards can be accomplished with multiple design philosophies
 - Fair markets can depend on your point of view
 - **Absolutes** are fewer than they might appear

Clean First Policy Categories

- Transmission Pricing and Access
- Capacity Markets
- Dispatch
- Ancillary Services
- Transmission Planning and Siting
- State initiatives

Transmission Pricing and Access - 1

- New interconnections
 - Managed queue gives **priority** to clean resources to address delay and uncertainty
 - Recognize **shared grid value** in interconnection

Transmission Pricing and Access - 2

- Interconnection Cost Allocation
 - Network costs based on all relevant factors, including **network environmental factors**
 - Consistent with beneficiary pays dicta
 - Redefines beneficiary value to include environment

Transmission

Pricing and Access - 3

- Firm Transmission Access
 - Address financial certainty of clean resource projects, drives changes in operations to anticipate higher renewable penetration
 - Conditional firm service with much longer duration, or, better...
 - System design paradigm based on grid sharing and optimizing (managing) to change imperative of service to more polluting resources to curtailing them, **produce FTR for renewables**

Transmission

Pricing and Access - 4

- Transmission Rate Design
 - Energy basis, not capacity, to **remove bias favoring high load factor** resources
 - Reflect long run marginal cost
- New Transmission
 - Incentives to favor facilities enabling connection of non-polluting resources
 - Non-wires alternatives required, **paid same as transmission** (see planning)

Capacity Markets

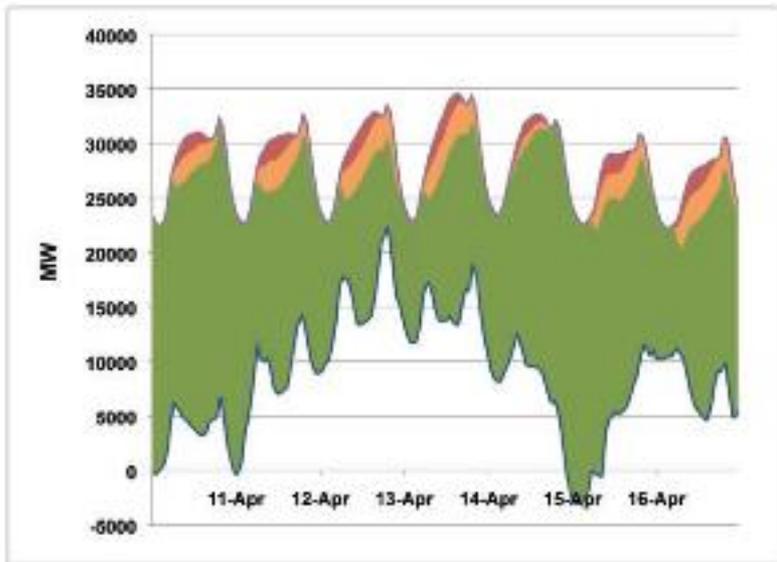
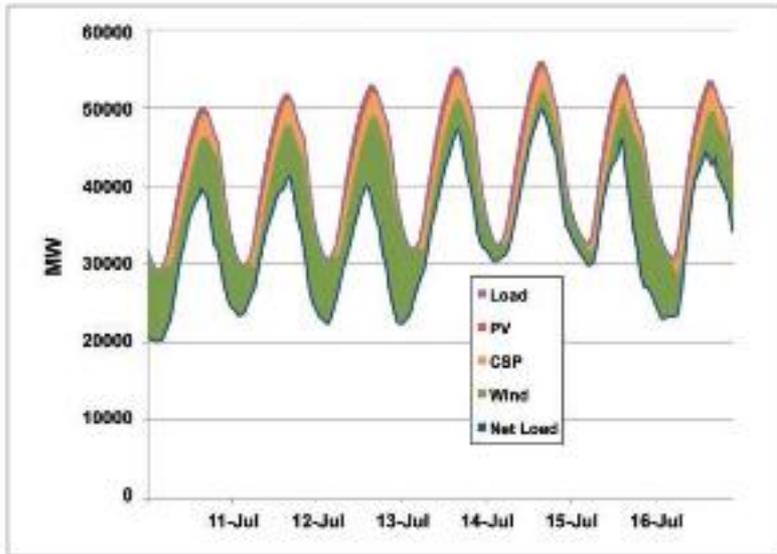
- Produce **right capacity in right places**
 - Non-polluting
 - Enabling non-polluting (dispatchable, responsive demand, storage and supply)
 - Payments, Auction winners differentiated by pollution costs, energy benefits
 - Phase out capacity payments to polluting resources
 - Differentiation already occurs between new and old

Dispatch

- Environmental Dispatch
- Efficiency (heat rate) Dispatch
- Operations including demand resources

Ancillary Services

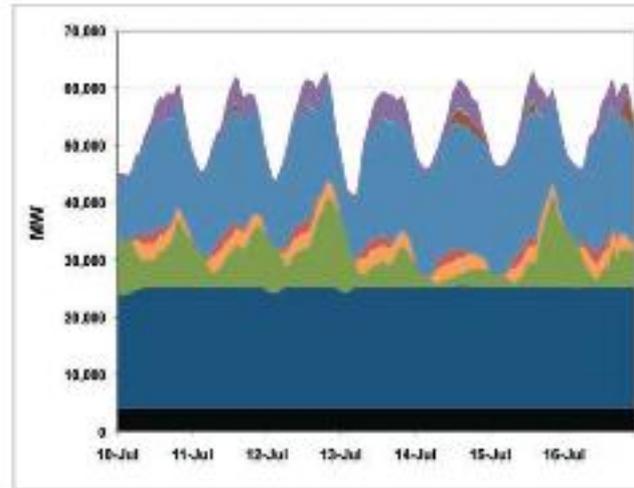
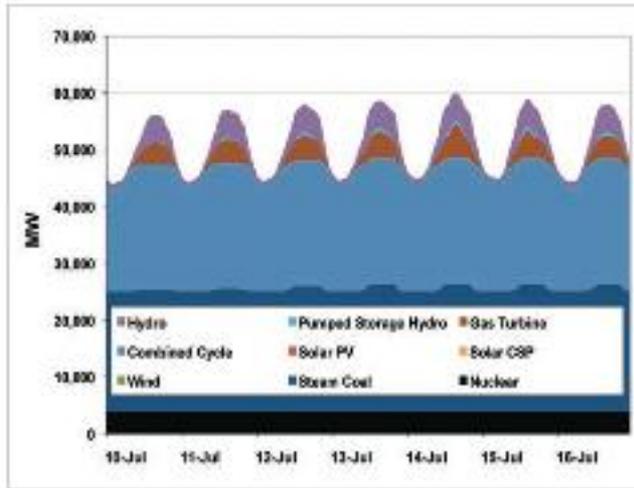
- Specific to supporting renewable resources
- Valuing **dispatchable and responsive resources** needs a reset
- Encouraged by new FERC NOPR
 - “Frequency Regulation Compensation in the Organized Wholesale Power Markets
 - Applies directly to RTO regions only



With 35% renewables,
system operators must
now balance
generation against the
net load. This may be
straightforward (top,
July) or challenging
(bottom, April)
Green is wind

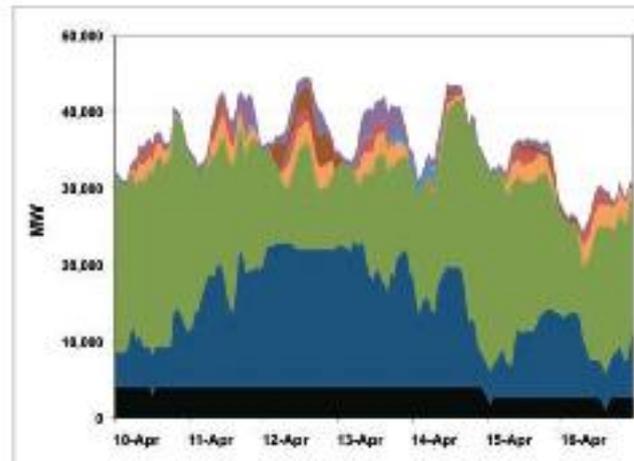
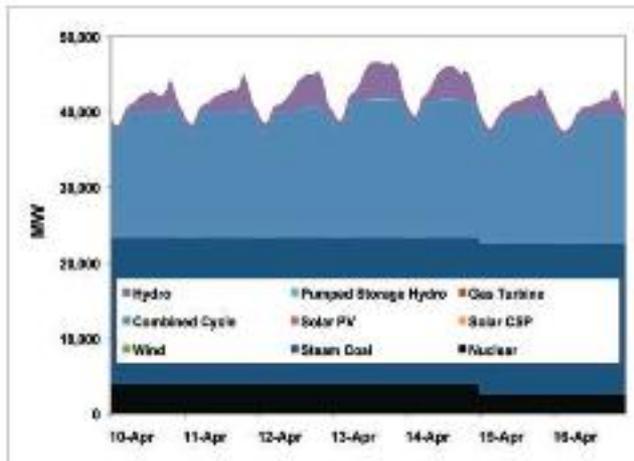
Western Wind and
Solar Integration
Study (WWSIS)
NREL May 2010

Figure 2 – With 35% renewables, system operators must now balance generation against the net load (blue) line. This may be straightforward (top, July) or challenging (bottom, April).



35%
renewables
have minor
impact on other
generation in
July

Figure 3 – 35% renewables have a minor impact on other generators during an easy week in July, 2006. WestConnect dispatch - no renewables (left) and 30% case (right)



35%
renewables
have significant
impact on other
generation in
April

Figure 4 – 35% renewables have a significant impact on other generation during the hardest week of the three years (mid-April 2006). WestConnect dispatch - no renewables (left) and 30% case (right)

Net loads in April at three RE penetration levels

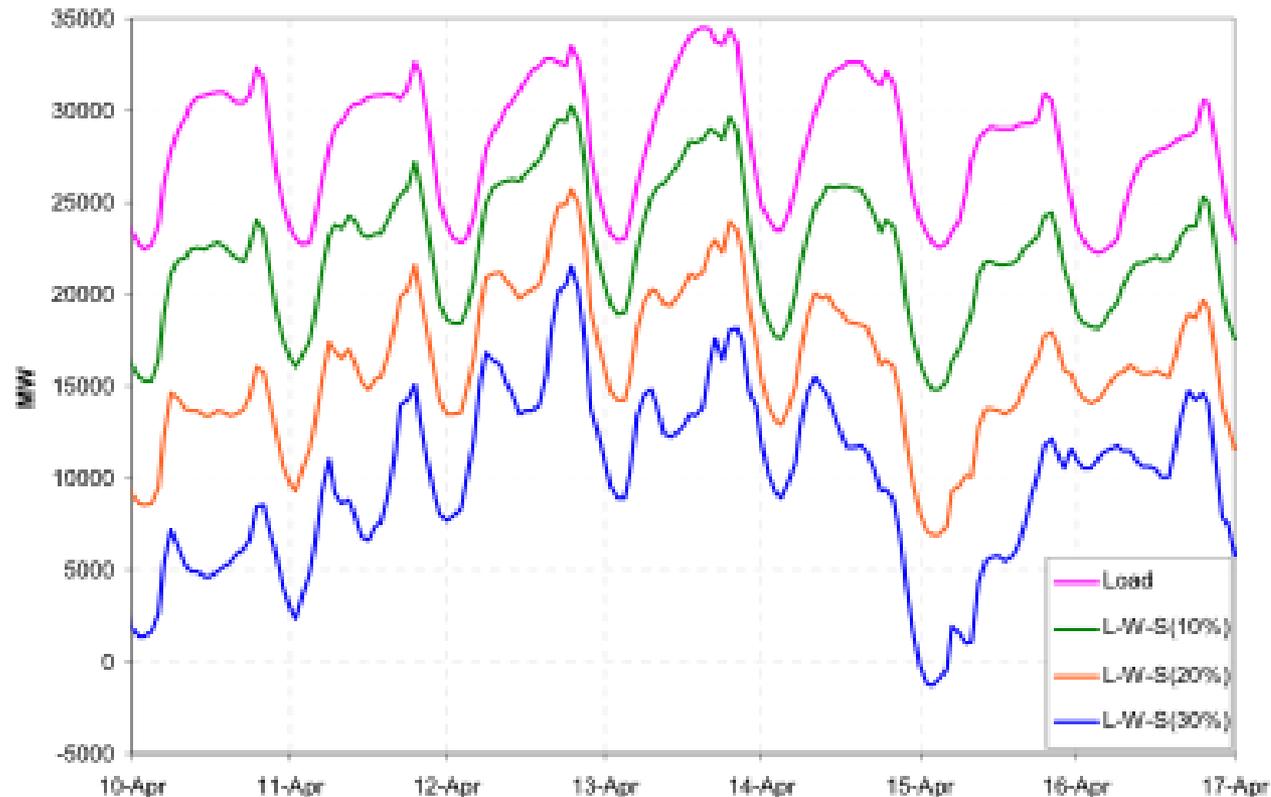


Figure 4.30 Study Footprint Net Load for a Week in April 2006 for 10%, 20%, and 30% Local-Priority Scenario

The Graphic I Want to See

- Load (adjusted for EE)
- Minus intermittent renewables (W-S)
- Minus base load generation
- Leaves load to be served by dispatchable resources
- Today, forecasted 30% renewables, that graphic would show **too much base load, not enough dispatchable**

- As wind and solar capacity rises, the amount of responsive resource needed to enable full use of this variable energy will rise, perhaps increasing compensation, perhaps drawing more suitable resources into the market
 - A response that simply curtails wind and solar is likely inconsistent with environmental goals

Transmission Planning and Siting

- Scenarios reflecting clean resource investment with plans to achieve them
 - Interconnection planning
 - Renewable Energy Zones
- Valuing system value of Non-wires Alternatives (equate to paying for transmission)
- “National Interest Renewable Transmission”

Public Policy Overlays - 1

- Directives
 - Energy Efficiency Standard
 - Loading Order
 - Renewable Energy Standard
 - Clean Energy Standard
 - DG Policies
 - Environmental regulation
 - Generation Performance Standard
 - Or an Emissions Portfolio Standard
- Statutory Limitations

Public Policy Overlays -2

- Considerations
 - Land and Water use
 - Prospective carbon limits
 - Cost
 - Local control or influence
 - Markets and Competition
 - Diversification
 - Energy Security (Yes! Still on this list!)
 - Emerging end uses (transportation)

Is Bias so Bad?

- Regulators don't want to “pick winners”
- Reliability and market rules strive to treat competitors fairly and assure safe, reliable SVC.
- If planning process only gets us enough power...
- How do we get the energy supplies we **want**?
- Policy is already guiding “winners”

What if Clean First takes hold?

- Environmental considerations are as important as reliability
 - Could influence generation queue, access, operating rules (imbalance penalties, dispatch)
 - Markets in service of reliability and environment
- Redefine “just and reasonable rates”
- Redefine “undue discrimination”

What can states do?

A Starter's List

- Renewable energy zones – consider building enabling transmission to where wind (location-constrained resource) is
- Reassess value of dispatchable resources (supply and demand) in higher wind volumes
- Coordinated procurement of renewables
- Use participant funding of transmission to assert participant priority rights
- Assess strategy for managing “reasonably foreseeable” new EPA regulations and effects on generating fleet, as Colorado has done
- State transmission authorities (more directed)

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.raonline.org

Richard Sedano

rsedano@raonline.org

802 498 0710



Global
US
China
EU

The Regulatory Assistance Project

50 State Street, Suite 3
Montpelier, Vermont 05602

phone: 802-223-8199
fax: 802-223-8172

www.raonline.org

- Upending the Supply Stack: Why Variable and Responsive Resources May Become Primary Generation Objectives for the US Power System and What It Will Take to Get There.

- If the United States is to adopt a significant atmospheric carbon reduction goal in 2050, significant intermediate goals, as well as significant changes to rules implementing clean air and water statutes, government will probably have to address matters of power sector investment. A commitment to cost-effective energy efficiency will reduce but not eliminate the challenge of getting the energy supply that meets these environmental objectives while also being attentive, as always, to cost and reliability. In order to think about this challenge, imagine that the US electric supply portfolio were built to maximize wind and solar (variable) resources. The US would need significant responsive resources as well as upgraded grid intelligence for system operators to manage a grid that would approach or exceed 50% variable resources. How would regulation have to change prevailing rules and practices to accomplish this?