Should There Be a Clean Peak Standard?

Hosted by
Warren Leon, Executive Director, CESA

May 9, 2017
Housekeeping

Use the red arrow to open and close your control panel.

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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 listserv to get the monthly newsletter and announcements of upcoming events, see: www.cesa.org/projects/state-federal-rps-collaborative
Today’s Guest Speaker

- Lon Huber, Senior Director, Strategen Consulting
Evolving the RPS:
A Clean Peak Standard for a Smarter Renewable Future

Lon Huber
Strategies for clean energy
Strategen provides insight to global corporations, utilities and public sector leaders, helping them to develop impactful and sustainable clean energy strategies.

CLIENTS
We work with governments, utilities, research institutions, technology providers, project developers, and large energy users seeking to evaluate and implement next generation grid and clean energy technologies.

MARKETS
Our exclusive focus on clean energy and advanced grid technologies means we bring our clients a sophisticated understanding of industry trends, market drivers and regulatory policy.

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Our clients come to us for our expertise in developing business models, commercial strategies, financing tools and regulatory support that empower them to create sustainable value and long-term solutions.

TEAM
Our team is comprised of well-respected thought leaders and industry experts who have played instrumental roles in shaping the power sector's transformation in the 21st century.

We are experts in power sector strategy. Our track record and networks are unmatched in the business.

- Cost/benefit analysis
- Market entry
- Public proceeding support
- Regulatory strategy
- Product development
- Grid resource planning and procurement
- Stakeholder engagement and education
- Mergers and acquisitions

Certified WBENC Women's Business Enterprise
Women OWNED
The Dichotomy Between Energy & Capacity

Peak Demand and Generation

U.S. Energy Information Administration (EIA), NERC Annual Report
Why Pay Attention to Peak Demand?

Electric Grid is Sized for Highest Hour of Demand

Top 1% of Hours accounts for 8% of Massachusetts Spend on Electricity
Top 10% of Hours accounts for 40% of Electricity Spend

MA DOER slide: Commissioner Judson presentation at Restructuring Roundtable, May 2016
Price of US Wind Power at ‘All-Time Low’ of 2.5 Cents per Kilowatt-Hour

New Record Set for World's Cheapest Solar, Now Undercutting Coal

by Anna Hirtenstein
May 3, 2016, 9:20 AM PDT

NV Energy buys utility-scale solar at record low price under 4 cents/kWh
Low Carbon Grid Study
Curtailment of Renewable Energy

A: 55% renewables, business as usual case:
- Solar PV dominates new procurement
- No additional bulk storage
- Continuation of today’s operation policies

B: 55% renewables, GHG target case:
- Balanced portfolio
- Additional bulk storage
- Economically rational imports and exports
- Renewables allowed to provide essential reliability services and flexibility

Difference in Cases: B minus A
CA Cost savings: $1.1 B/yr
CA Carbon saved: 5 MMT/year
Rest of WECC carbon saved: 2.5 MMT/yr

Diminishing Returns with High RPS

- E3 50% RPS Study:
  - Over $1 billion in unnecessary costs to ratepayers
  - Alternate case (RE procurement better matched to grid needs): rate impacts of achieving the RPS were reduced by 10-39%.
  - As RE added, marginal fossil generator displaced is increasingly efficient (i.e. fewer GHG reductions per MWh RE).

Energy and Environmental Economics, Investigating a Higher Renewables Portfolio Standard in California (PDF) (January 2014),
Arizona Context

▪ CAISO SB 350 Studies: A sizable amount of hours in Arizona balancing areas will be very low or negative pricing by 2030

▪ APS confirmed they are curtailing for a few hours during a majority of days in February/March

▪ Already 21% of capacity is being used to serve the top 5% of hours

▪ If Navajo Generation Station is closed, there will be pressure on reserve margin of the WECC
Arizona Public Service’s Load Forecast

• APS is currently projecting 2.3-4.3% average annual peak demand growth over the next 15 years

• Equates to 3,200-7,100 MW growth (prior to customer resources)
APS’ Proposed Resource Plan

Planned Capacity Additions (Arizona Public Service)

- >5,000 MW new natural gas;
- >$7 billion CapEx
- >$600M annual rev. req. increase
Renewable Energy Standards are based on yearly energy targets and do not consider peak demand. This encourages maximizing renewable production but does not consider dispatchable energy for peak demand during periods of low generation.
Taking a Step Back: Principles

- Design a simple policy mechanism to focus clean energy deployment on resources that maximize value to the grid.

- Encourage RE deployment *that also provides* essential reliability services.
  - Start simple: capacity = one of many possible essential reliability services to be provided (i.e. “head of duck”)

- Include some consideration of compliance and implementation details upfront (critical to successful market adoption).

- DO NOT replace existing, successful policies.
  - Intended to be a complement to other successful policies (e.g. RPS, EERS, etc.)
Clean Peak Standard (CPS)

From Clean Energy to Clean Energy **AND** Capacity:

- Add a carve-out, multiplier, or new target to existing state RPSs
- Target the top peak value hours each month with a focus on system peak
  - Transforms RECs to Clean Capacity Credits or Flexible Capacity Credits

*Policy design increases in sophistication as new building blocks are added*
Clean Peak Standard (CPS) - Basic Design

- Renewable Portfolio Standards (RPS): X Percentage of retail sales must be met by eligible renewable energy sources by X date.
  - Example – 30% of retail sales (MWh) by 2030

- Clean Peak Standard: X Percentage of peak hours must be met by eligible clean energy sources by X date.
  - Example – 30% of peak energy (on-peak MWh) by 2030
How can a CPS work?

- **RPS framework**: compliance based on (e.g.) MWhs from a production meter.
  - Renewable energy credits (RECs) awarded for every MWh produced for a renewable resource

- **CPS framework**: compliance based on monthly MWhs from a production meter *within a peak time window*.
  - RECs, or new version of a REC, such as a Clean capacity credit (CCC) can be awarded for production during peak time.
  - CCCs not awarded if output not maintained for sufficient duration (i.e. capacity product).
Implementation Considerations

- **Time Window**
  - Peak summer and high value hours in other months
  - Must get an average amount of RE over specified time period each month

- **Potential Qualifying Resources**
  - Renewables
  - Demand side resources (may require net vs. gross load calculation)
    - Active demand response
    - Energy efficiency
    - Distributed generation

- **Energy storage**
  - Directly charged by RE
  - Grid-charged, full credit if:
    - RE on the margin
    - Bundled with incremental RE production that coincides with charging
Setting the Peak Summer Window

- The clean peak standard is partly intended to help address emerging operational challenges associated with meeting electric power demand, net of renewable resources (i.e. the “duck curve”).

- Thus, the net load curve (duck curve) is used as the basis for establishing the peak window, which is aligned with the “head of the duck.”
Setting the Summer Compliance Target

- For compliance purposes, qualifying energy produced during the peak window would be measured against the total or gross load during that “head of the duck” peak window.

- Measuring compliance relative to gross load (rather than net load) is necessary to properly account for existing renewable resources and avoid double counting.
Setting the Peak Summer Window

- As net load peak moves, obligation on original hours still stands to avoid snap back
  - Initial 4-hour peak summer window remains
  - Additional windows can be added as needed
  - Brings scalability to the standard
Summer Load Example: 40% CPS

Summer (June to September)
Setting Non-Summer Months Targets

- Peak hours for non-summer months change based on a regularly updated schedule to allow for flexibility.
- Heat map with target capacity factor is one possibility

|        | 1am | 2am | 3am | 4am | 5am | 6am | 7am | 8am | 9am | 10am | 11am | noon | 1pm | 2pm | 3pm | 4pm | 5pm | 6pm | 7pm | 8pm | 9pm | 10pm | 11pm | midnight |
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| May    |    |     |     |     |     |     |     |     |     |      |      |     |     |     |     |     |     |     |     |      |      |         |
| June   |    |     |     |     |     |     |     |     |     |      |      |     |     |     |     |     |     |     |     |      |      |         |
| July   |    |     |     |     |     |     |     |     |     |      |      |     |     |     |     |     |     |     |     |      |      |         |
| August |    |     |     |     |     |     |     |     |     |      |      |     |     |     |     |     |     |     |     |      |      |         |
| September |    |     |     |     |     |     |     |     |     |      |      |     |     |     |     |     |     |     |     |      |      |         |
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| December |  |     |     |     |     |     |     |     |     |      |      |     |     |     |     |     |     |     |     |      |      |         |

- Low Loss of Load Probability
- High Loss of Load Probability

CPS Summer Compliance Target
# Heat Maps Generated to Determine Credit Value

## Peak Capacity Heat Map:

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## Flexible Capacity Heat Map:

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## Typical Summer Load Shapes

## Typical Winter Load Shapes

- Based on a rolling average
- Published annually and continuously updated
CPS for California

The most immediate need is for flexible capacity in non-summer months

- ISO working on a 50% duck curve:
There are Still Peak Supply Challenges

“Cal-ISO has found that the state faces up to about 9,660 MW of natural gas-fired generation retiring for economic reasons, with load following shortfalls beginning if less than 4,000 MW were to shut down, according to Millar.”

Actual Conditions – Far Worse than Forecasted

Actual net-load and 3-hour ramps are approximately 4 years ahead of the original estimate

15 GW Ramp surpassed in Feb 2017


12,960 MW on December 18, 2016

Net Load 10,669 MW on March 28, 2017

Figure 2: Forecasted Maximum Three Hour and One Hour Net Load Ramps

Hit in 2017

CAISO
California - April 2030

April

Gross Load

Net Load (Initial)

Strategen Modeling
Ramping after 40% CPS

- “Dumb charging” still reduces ramp from ~23 GW to ~13 GW

“Dumb charging” - Assumes charging during times of overgeneration/negative prices and dispatches evenly over peak defined hours. Not optimized for maximum benefit
Implementation Considerations

- Locational considerations
  - E.g. load pocket carve-outs

- Cost containment
  - Benchmark CCC procurement to the cost of a new natural gas peaker (adjustments allowed to account for fact that these are clean resources)

- Longer peak windows (e.g. 6-8 hours) can divided
  - E.g. two compliance buckets
Should There Be a Clean Peak Standard?
‘Load growth can cover a lot of sins’

All Sector Use of Electricity (MWH)

U.S. Energy Information Administration (EIA)
The Temporary Absolver

U.S. Natural Gas Pipeline Imports Price (Dollars per Thousand Cubic Feet)

U.S. Energy Information Administration (EIA)
Peak Demand and Peaker Plants

- According to EIA:
  - Average peaker plant runs about 2-7% of the year
  - Over 70 GW of new peaker plants will be built in the U.S. before 2026

- According to ISO-NE’s State of the Grid 2016 report:
  - Peak demand continues to grow in the region at a rate of 1.5% per year
  - Peak cost is so high that every $1 spent on reducing peak demand translates into about $3.26 of savings to ratepayers
Peak Demand – ConEdison Example

- While load growth is flattening, peak demand may not be and load shapes are changing.

- Problem with peak demand is steepness:
  - 15% of total production assets run less than 7 days per year or less than 2% of that time.
  - NYS PCS’s REV recently estimated that cutting top 100 hours of peak demand could save New York State up to $1.7 billion per year.
  - Idle plants and overbuilt infrastructure handles load levels that only occur a small fraction of time.

ConEd: 2012 Load duration data; note CECONY overlaps Westchester City but is mostly New York City.
# The Rise of DC Coupled Batteries

## AC/DC/HYBRID SYSTEM COMPARISON

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AES’ New Kauai Solar-Storage ‘Peaker’ Shows How Fast Battery Costs Are Falling

The Kauai Island Utility Cooperative continues its innovation streak with the solar-plus-storage plant for peak capacity.

by Julian Spector
January 16, 2017
More Information

Thank you!

Lon Huber
Senior Director
Strategen Consulting, LLC

Download white paper:
Appendix
# Assumptions

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<td>Load Data</td>
<td>[2016] 8760 Hourly Data from OASIS</td>
<td>Uses 2016 Load Data; 0.5% yearly peak load growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2040 Load Data is same as 2016 Load Data</td>
</tr>
<tr>
<td>Solar Data</td>
<td>[2016] 8760 Hourly Data from OASIS [2040] E3 SB 350 Study Scenario 1a</td>
<td>Uses 2016 Solar Data; Assumes by 2040, 7601 MW Installed in CA, and 1000 MW Solar delivered from out of state</td>
</tr>
<tr>
<td>Wind Data</td>
<td>[2016] 8760 Hourly Data from OASIS [2040] E3 SB 350 Study Scenario 1a</td>
<td>Uses 2016 Wind Data; Assumes by 2040, 3000 MW Installed in CA, and 4551 MW Solar delivered from out of state</td>
</tr>
<tr>
<td>Geothermal</td>
<td>[2016] CEC RPS Tracking [2040] E3 SB 350 Study Scenario 1a</td>
<td>Assumes 2016 annual production is evenly distributed among all the 8760 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assumes by 2040, 500 MW of Geothermal is added</td>
</tr>
<tr>
<td>Biomass/Biogas/ Small Hydro</td>
<td>[2016] CEC RPS Tracking [2040] E3 SB 350 Study Scenario 1a</td>
<td>Assumes 2016 annual production is evenly distributed among all the 8760 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assumes by 2040, the Biomass/ Biogas and Small Hydro increases by 1% annually</td>
</tr>
<tr>
<td>Distributed Generation</td>
<td>[2040] E3 SB 350 Study Scenario 1a</td>
<td>Assumes 16 GW of Behind the Meter Solar Resources</td>
</tr>
</tbody>
</table>
Implementation Considerations

Illustration of Clean Capacity Credit (CCC) awards for a hypothetical solar PV resource

- Period 1: 2 CCCs awarded
- Period 2: 0 CCCs awarded

Gross Load: Red line
Net Load: Blue line
Solar: Yellow line
Implementation Considerations

- Scalability

- Additional periods can be added as solar penetration reduces and moves the peak later in the day.
Thank you for attending our webinar

Warren Leon
RPS Project Director, CESA Executive Director
wleon@cleanegroup.org

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