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NYISO 2025-2029 ICAP Demand Curve Reset

High-Level Considerations for Technology Screening Process

ICAP Working Group

September 26, 2023

Agenda

- Reminder: Timeline for 2025-2029 Installed Capacity Demand Curve reset (DCR) Process
- Review of 2021-2025 DCR Technology Screening Process
- High-Level Considerations for 2025-2029 DCR Technology Screening Process (technology-specific discussion by Burns & McDonnell [B&M] later)

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Reminder: Timeline for 2025-2029 DCR Process

Timeline for 2025-2029 DCR Process

- **Q4 2023 – Q1 2024**
  - Propose DCR principles and framework
  - Review of net energy and ancillary services (EAS) revenue estimation method and data sources
  - Initial technology screening assessment

- **Q2 – Q3 2024**
  - Finalize demand curve model
  - Final discussions and input
  - Draft report
  - NYISO staff draft recommendations

- **Q1 – Q2 2024**
  - Finalize net EAS modeling enhancements
  - Finalize DCR methods and assumptions
  - Finalize initial technology assessment to identify technologies for further, detailed evaluation
  - Preliminary assessment of identified peaking unit technology options and cost estimates
  - Review level of excess adjustment factors methodology
  - Preliminary demand curve model results

- **Q3 – Q4 2024**
  - Final report and NYISO final recommendations
  - NYISO Board review
  - FERC filing

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Review of 2021-2025 DCR Technology Screening Process

2021-2025 Initial Technology Screening

- In the last reset (i.e., the 2021-2025 DCR), B&M undertook an initial technology screening to identify technology options and models (Phase I) to include in a detailed economic evaluation (Phase II). For the initial technology screening, the following technologies and models were considered:

Simple Cycle Turbines
- 5 alternative models of aeroderivative combustion turbines
- 7 alternative models of frame combustion turbines
- Reciprocating internal combustion turbines (RICE)

Energy Storage
- Lithium-ion batteries (4-hour, 6-hour, and 8-hour)
- Pumped hydro
- Flow batteries

Combined Cycle
- 7 alternative models of combined cycle power plants

2021-2025 Initial Technology Screening Results: Simple Cycle Turbines

Aeroderivative combustion turbines

- Among the 5 aeroderivative combustion turbine models, B&M identified the GE LMS100 and Siemens SGT-A65 units as the best representative candidates because of their higher capacity and efficiencies. After accounting for multiple units to achieve output in the 200 MW range, costs associated with selective catalytic reduction (SCR) emissions controls, and actual market experience in New York City, B&M selected **three Siemens SGT-A65 units** as the representative aeroderivative technology

Advanced frame combustion turbines

- Among the 7 advanced frame combustion turbine models, B&M identified two units, the GE 7F.05 and GE 7HA.02, as the two models with the most operating experience and highest efficiency among similar advanced class units. The previous peaking plant technology, the Siemens SGT6-5000F5, was similar in performance capabilities to the GE 7F.05, but preliminary cost analyses slightly favored the GE 7F.05. As such, the **GE 7F.05 and GE 7HA.02 F models** were chosen for further assessment.

Reciprocating internal combustion turbines

- B&M found that, although reciprocating engines were generally competitive with aeroderivative gas turbines, the initial screening and the results of prior DCRs indicate that RICE technology is not likely to be the lowest cost alternative. As a result, B&M did not recommend further detailed analysis of any RICE units.

2021-2025 Initial Technology Screening Results: Energy Storage

Lithium-ion batteries

- Because the vast majority of new energy storage plants are lithium-ion batteries, B&M identified **200 MW lithium-ion batteries with 4-hour, 6-hour, and 8-hour durations** as representative technologies for further assessment.
- B&M found that three battery chemistries make up the bulk of the market: lithium nickel manganese cobalt oxide, lithium iron phosphate, and lithium nickel cobalt aluminum oxide.
- Rather than assume a specific chemistry or manufacturer, B&M estimated costs associated with a representative lithium-ion battery system.

Pumped hydro

- Pumped hydro is the most mature storage technology, but the technology is limited in siting potential and requires longer permitting and implementation timelines than battery technologies. As such, pumped hydro was not included for a detailed economic evaluation.

Flow battery

- B&M's preliminary evaluation suggested that the capital costs were higher than similarly sized lithium-ion systems and the market was still nascent for the technology at utility scale. As such, the flow battery option was not included for a detailed economic evaluation.

2021-2025 Initial Technology Screening Results: Combined Cycle

Advanced combined cycle plants

- Among the 7 advanced combined cycle plant models, B&M identified the **1x1 GE 7HA.02** as the highest efficiency unit and thus the unit that may be the lowest cost alternative on a $/kW basis among 1x1 combined cycle options.

2021-2025 Initial Technology Screening Results and Phase II Outcomes

- As a result of the process outlined above, B&M identified the following technologies and models as passing the initial Phase I technology screen and conducted a detailed Phase II economic evaluation for each technology for all locations assessed as part of the 2021-2025 DCR (i.e., zone C, zone F, zone G (Dutchess), zone G (Rockland), zone J, and zone K):

Aeroderivative combustion turbines
- Three Siemens SGT-A65 units
- Not recommended as peaking plant because it was not the lowest net CONE resource

Advanced frame combustion turbines
- GE 7F.05 and GE 7HA.02 F
- GE 7HA.02 selected as lowest net CONE resource in each location and recommended to serve as the peaking plant technology to establish the ICAP Demand Curves for the 2021-2025 reset period

Energy storage
- Lithium-ion batteries (4-hour, 6-hour, 8-hour durations)
- Not recommended as peaking plant because it was not the lowest net CONE resource

Advanced combined cycle plants
- 1x1 GE 7HA.02
- Completed for illustrative purposes only

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High-Level Considerations for 2025-2029 DCR Technology Screening Process

Proposed Technology Screening Criteria

- We are tasked to evaluate the net cost of a hypothetical peaking unit, defined as "the unit with technology that results in the lowest fixed costs and highest variable costs among all other units' technology that are economically viable"
- Technology screening criteria are required to narrow the potential list of technologies to study. As discussed by B&M, we propose to adopt the following screening criteria, which are consistent with the criteria applied in the last reset:
  1. Standard resource technology – available to most market participants;
  2. Proven technology – operating experience at a utility power plant;
  3. Unit characteristics that can be economically dispatched;
  4. Ability to cycle and provide peaking service;
  5. Can be practically constructed in a particular location; and
  6. Can be designed to meet environmental laws, regulations, and other operating requirements.
- We will also consider basic cost and market factors, and analyses from the last DCR, to screen technologies and models if deemed unlikely to result in the lowest net CONE (relative to other, more competitive models in the same technology class)

NYISO's interconnection queue: fewer fossil fuel fired generators, more renewables, and more battery storage

- NYISO interconnection queue reflects current developer technology interests relevant to the 2025-2029 DCR period:
  - Large amounts of new wind, solar, and energy storage capacity
  - No new fossil fuel fired generators
  - 81% of energy storage capacity is stand-alone, with a smaller amount in hybrid configuration

NYISO Interconnection Requests (as of September 2023)

Technology	Summer Rating (MW)	Percentage
Wind	62,452	53%
Energy Storage	32,382	28%
Solar	15,291	13%
Energy Storage + Solar	4,762	4%
Energy Storage + Wind	2,800	2%
Fossil Fuel Fired Generation	0	0%
Total	**117,687**	**100%**

Note: Only interconnection requests with non-missing in-service dates are included.

Initial considerations for technology types

- Fossil fuel fired combustion turbine
  - ***See B&M presentation***
  - Meets the screening criteria, had lowest net CONE in the 2021-2025 DCR, and has extensive operating experience
  - Consideration will need to be made regarding appropriate amortization period given the requirements of the Climate Leadership and Community Protection Action (CLCPA) (i.e., zero-emission resource requirement in 2040)
  - H Class and J Class frame combustion turbines are the most likely candidates; B&M expectation is that other fossil fuel technologies are not likely to pass beyond screening analysis
    - *These are preliminary expectations; review is in-process*
- Combustion turbines operating with zero-emissions fuel
  - Zero-emission fuels could include hydrogen, renewable natural gas, another fuel type, or some combination
  - In principle, combustion turbine operating on zero-emission fuel could be compliant with CLCPA, with use of zero-emission fuel either (1) starting when plant is first in-service or (2) starting in 2040 (with retrofits, if needed)
  - Will require consideration of available technology/retrofit viability and cost, viability and cost of fuel, and available guidance on qualifications to meet the CLCPA zero-emissions requirement.

Initial considerations for technology types

- Battery storage
  - ***See B&M presentation***
  - Meets the screening criteria, assessed as a clean energy technology alternative in the 2021-2025 DCR, and has recent market experience
  - Lithium-ion batteries dominate the commercial battery storage market
  - Economics of alternative battery storage durations (4-hour, 6-hour, and 8-hour) will be considered
- Hybrid configuration
  - Minority of energy storage projects in the NYISO interconnection queue
  - Has not been studied in previous DCRs
  - Potentially complex interactions between renewable and energy storage systems
    - Hybrid systems may be able to save costs due to shared equipment like inverters but may also sacrifice energy market revenues if not operating fully independently, and/or due to constraints on operational capability (e.g., inverter limits)
    - Could present complexities in net CONE valuation depending on the operational and cost assumptions of the components technologies that comprise the hybrid resource
    - May represent a higher cost alternative on gross CONE basis than assessing the component technologies separately
    - Previous market interest in hybrid units may largely reflect absence of tax credits for stand-alone storage prior to the Inflation Reduction Act, which is no longer the case
  - If studied beyond the initial screening process, would need to determine basis for the configuration studied

Next Steps

- Continue review of technology options in consideration of the initial screening criteria
- Develop recommendation for which technology options to further evaluate for this reset
- Begin to develop representative plant configurations and cost estimates
- Initial review of net energy and ancillary services (EAS) revenue estimation method and data sources

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Contact

Analysis Group

Paul Hibbard, Principal
617-425-8171
paul.hibbard@analysisgroup.com

Todd Schatzki, Principal
617-425-8250
todd.schatkzi@analysisgroup.com