NYISO ICAP and Reliability Considerations

Potential Challenges and Enhancements to NYISO's Capacity Market and Reliability Metrics for Economically, Efficiently, and Effectively meeting CLCPA mandates

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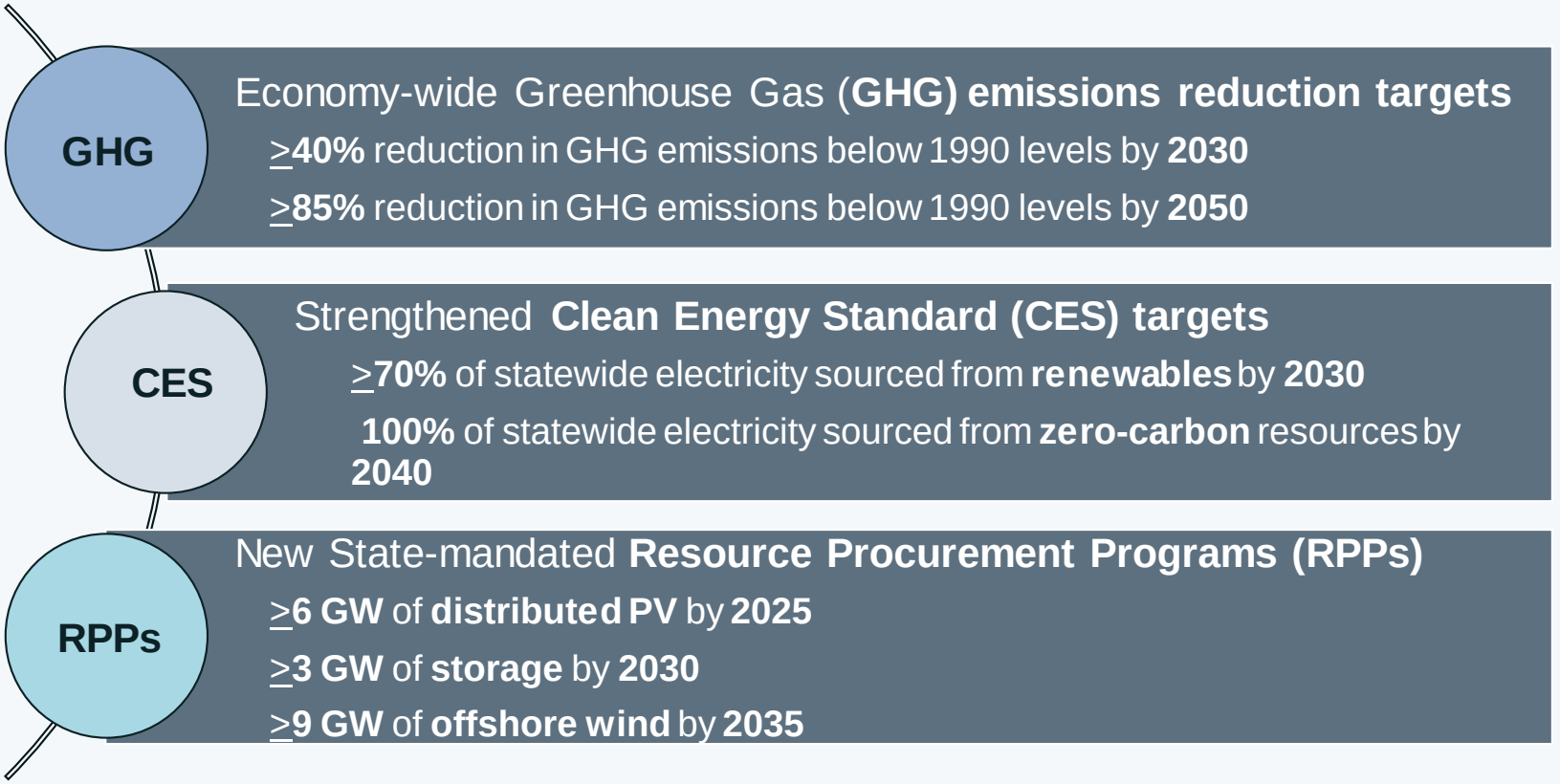
Includes both PA Consulting and LIPA Analyses

The CLCPA mandates some of the most ambitious clean energy and decarbonization targets in the United States.

Moving to a system dominated by low variable cost, high fixed cost resources – from one that is currently dominated by high variable cost, low fixed cost units – could have profound impacts to the state's capacity ("ICAP") market.

As such, NYISO and its stakeholders need to consider the long-term challenges and opportunities in the capacity market, along with near-term enhancements needed to efficiently meet these targets.



Challenges may include inaccurate market price signals, unbalanced resource mix, and increased customer costs.

More zero-cost resources in the energy market

Decreasing power prices, and thus, energy margins

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CLCPA additions will be dominantly fixed-cost

Increasing fleet-average fixed costs

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Greater emphasis on recovering 'missing money'

Lower, flatter energy prices reduce energy rents

- Can create excessive rents in capacity market, subsidies and gaming

State-sponsored resources are often subsidized for "green attributes"

- ICAP supply bids may not represent their true costs, may distort market price signals
- Both buyer-side mitigation and limited mechanisms to procure resource with desired characteristics increase consumer costs

Asset retirement risks

- Current UCAP metric is not sufficient to ensure reliability
- Resources needed for flexibility or other reasons may not clear a capacity market with large amounts of CLCPA mandated capacity

Indexing the Net Cost of New Entry (Net CONE) to a gas-fired unit may no longer be appropriate.

Existing Net CONE determination:

- Tied to a new thermal entrant (currently a frame gas-fired turbine)
- Proxy unit must have lowest fixed and highest variable cost (geared towards thermal peakers)
- Might not be plausible moving forward (GHG-reduction mandates + no new fossil gas sentiment)

Potential Alternatives:

- Net CONE indexed to the going-forward costs of a retiring thermal unit
  - With additional attribute pricing (e.g. missing money if any for flexible capacity attributes) to ensure that units necessary for reliability remain economic
- As renewables and storage prices decline below fossil resources: Net CONE indexed to a standalone or hybrid (renewable-paired) storage resource
  - With offsets for expected energy and ancillary service margins, based on duration and dispatch profiles

The existing ICAP market structure may not best advance the State's aggressive clean energy standards.

The ICAP market has historically provided the "missing money" that is not recovered by generators in the energy and ancillary service markets.

CURRENT ICAP MARKET DESIGN

- Ensures reliability by retaining existing generation and incentivizing new entry
- Offers revenue certainty and reduces financial risk
- Provides fixed cost recovery not enabled by energy and ancillary markets
- Structured to meet capacity needs with high variable, low fixed cost additions

POTENTIAL ISSUES WITH THE ICAP MARKET

- Costs of future generator additions likely predominantly fixed, as potentially higher fixed costs are offset by declining energy and ancillary services margins.
- In the near-term, capacity could be retired on the margin (not added)
- Current capacity auction tenure may not be long enough to attract development

Can the market design be enhanced to support CLCPA milestones?

Granularity in how capacity is treated – based on attributes giving it extra value to the system – can enhance price formation.

Current treatment of capacity:

- Treated as a uniform product (all UCAP MWs assumed to be functionally equivalent);
- Uniform compensation for all clearing resources;
- Prices determined by locality (Zones G-J, J, K, and NYCA);
- Not all reliability attributes are recognized;
- Other attributes, compensated by out-of-market payments distort prices, invite mitigation(s) or introduce rents from capacity market

Potential Enhancements:

- Recognizing unique system-attributes of different resources (separate from capacity payments);
  - Products might include firming premiums for hybrids, ZECs, RECs, flexibility payments, etc.

As their penetration increases, renewables' capacity value declines, and net load shifts, posing reliability challenges.

As the share of variable and intermittent resources grows:

- Fleetwide average UCAP:ICAP ratio decreases
- Net load shifts to a later hour in the day
- Net load shapes become flatter in some periods but may ramp more steeply and more frequently, but for shorter durations
- Renewables' contribution to reliability – measured as their ELCC – declines more with entry than does thermal units' due to their temporal limitations.
- Market must still accommodate firm dispatchable resources needed for reliability

Thus, NYISO should consider:

- A robust scale of UCAP credits ascribed to different resources, as a function of their penetration and temporal attributes
- Recognition of technological and development improvements (e.g. Offshore wind and "Efficacy/applicability of NERC's 1-in-10 LOLE criterion as a measure of reliability)
- Requirements to firm renewable capacity
- Parallel markets for other reliability-related asset attributes
- Alternative reliability metrics

Granularity in how capacity is treated – based on attributes giving it extra value to the system – can enhance price formation.

Current treatment:

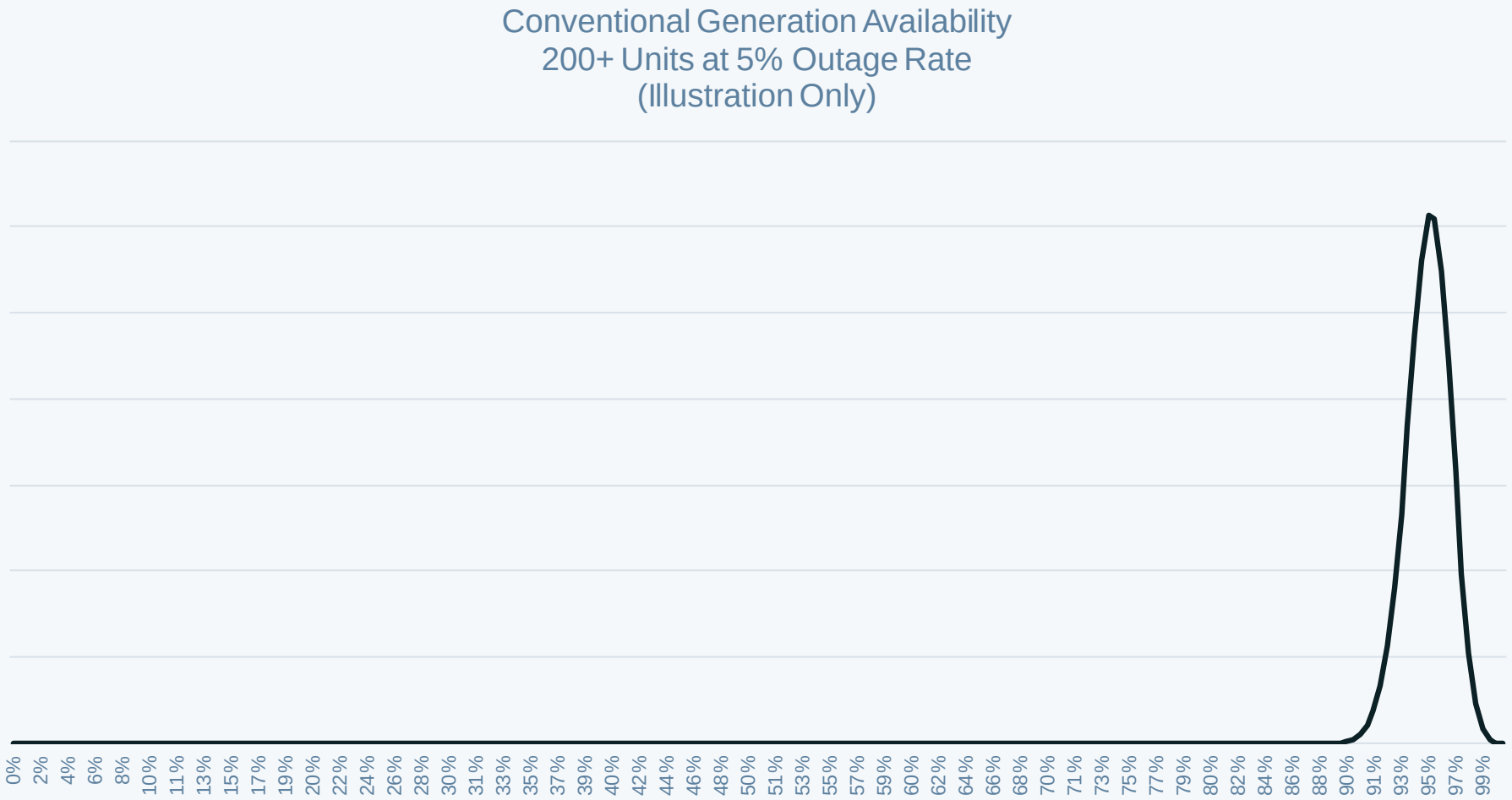
- Designed around equipment outages of conventional capacity
- Uses outage state transition matrices as input
- Measures Loss of Load Expectation (LOLE) and Loss of Energy Expectation (LOEE or unserved energy)

Potential Enhancements:

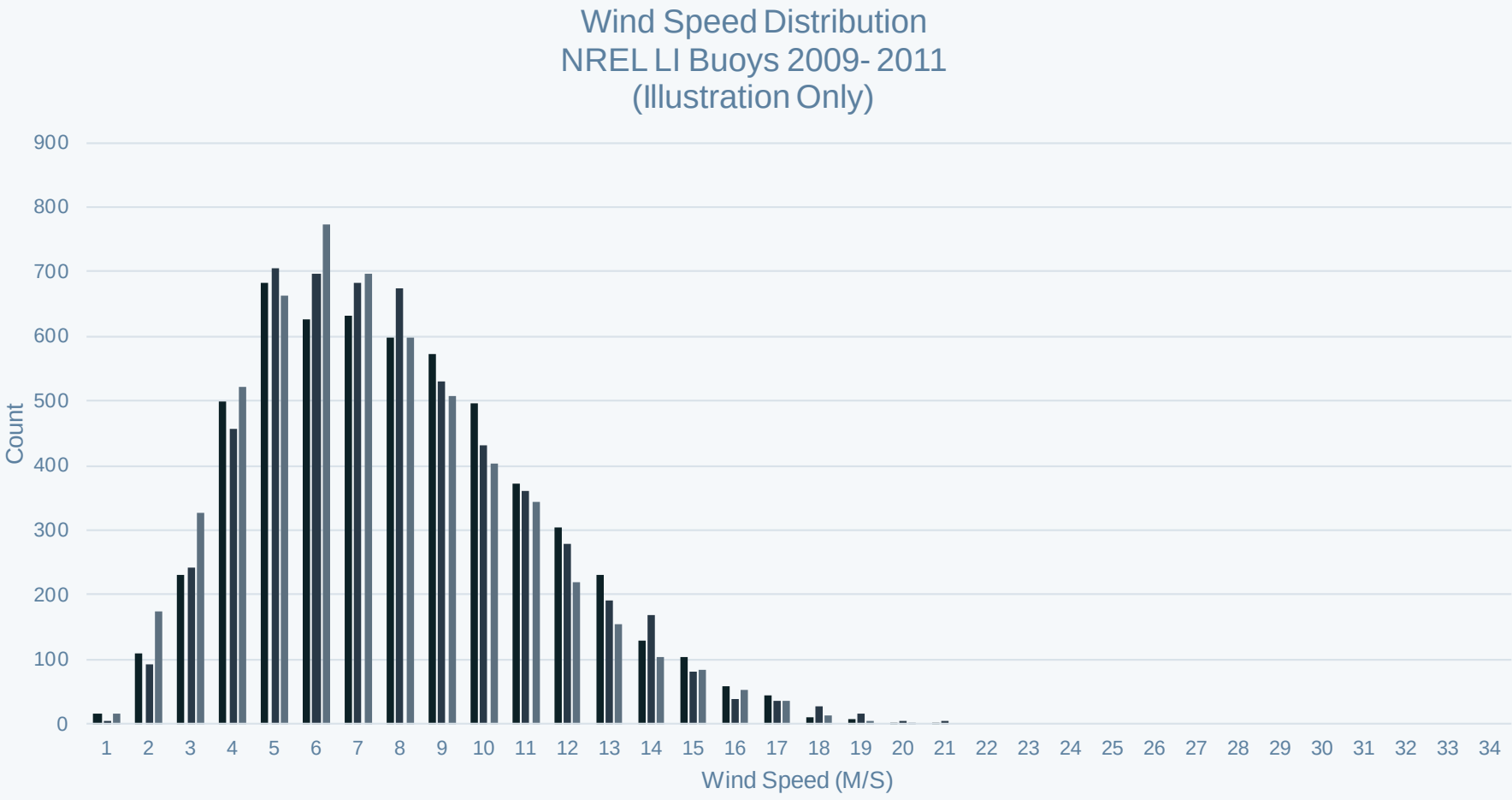
- Recognizing the increasing importance of intermittent outage duration
- Reporting distribution of simulated outage duration and magnitude
- Distinguishing characteristics of and resource needs driven by equipment versus resource driven intermittency outages (e.g. separate resource and equipment transition matrices)
- Tailoring products around varying characteristics required.
- Enhanced recognition and optimization of storage portfolio power and energy distribution in dispatch.

What portfolio of storage resources will be needed to cost-effectively address larger CL&CPA renewable penetrations ?

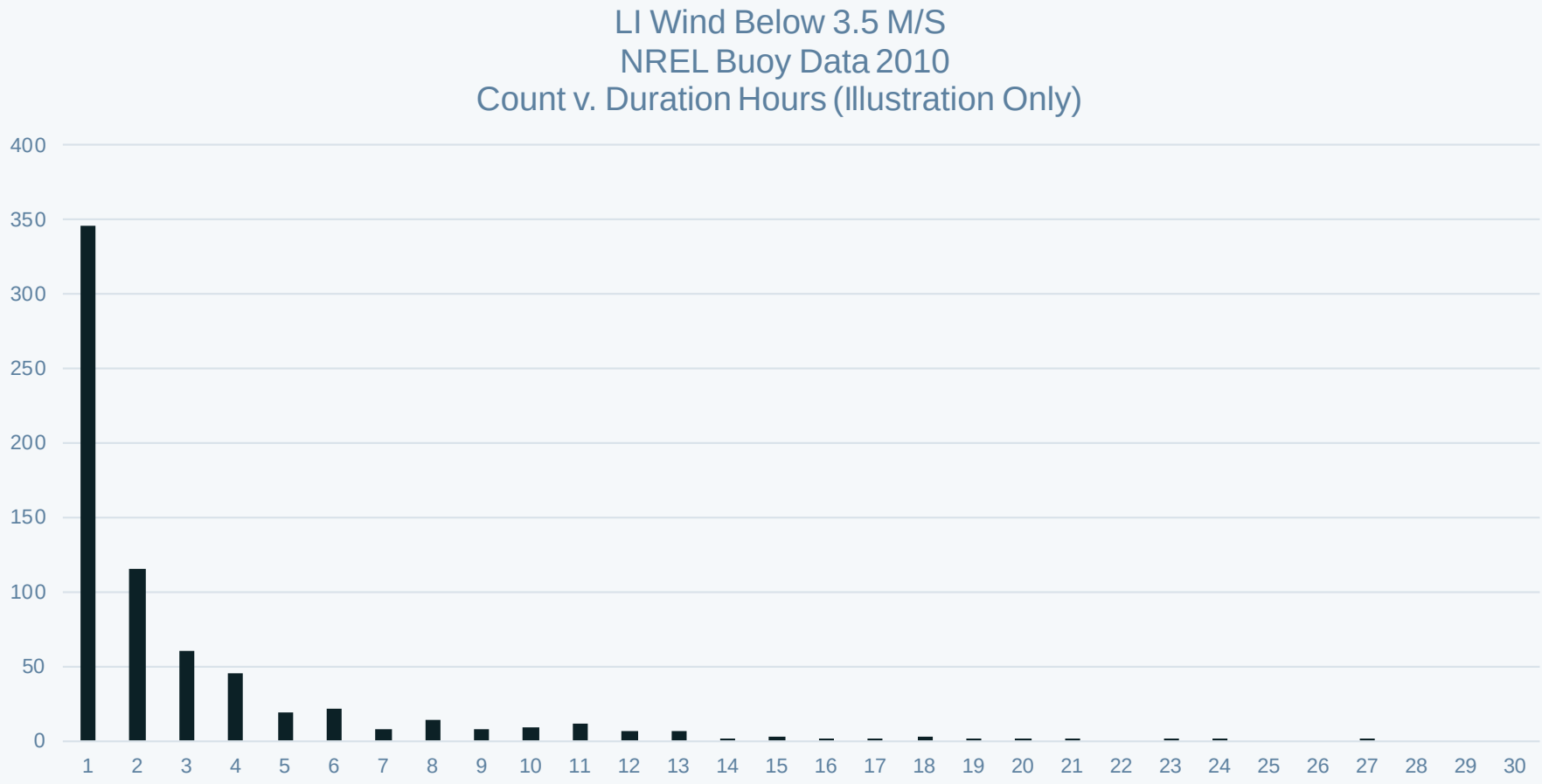
In Sufficient Numbers, Conventional Generation Availability Groups Tightly around Generators' UCAP Value



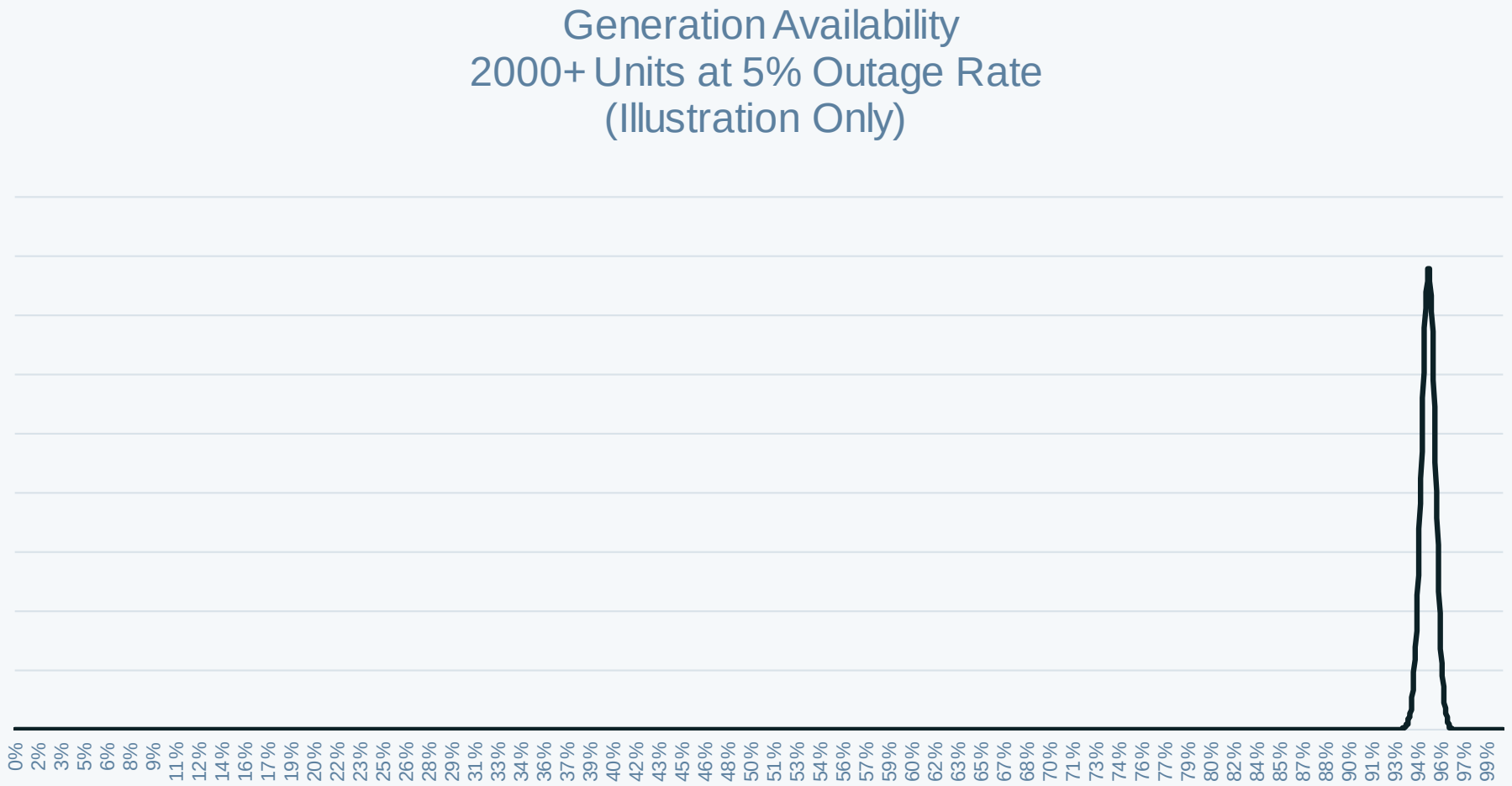
Off-Shore Wind Speed (and Ultimately Power) is More Broadly Distributed than Conventional Generation Outages



Renewable Intermittency Is Likely Shorter in Duration than Equipment Outages



For Renewables, Smaller Unit Size Also Tightens Equipment Outage Availability Distribution



Granularity in setting the types, duration and quantities or storage capacity required – can reduce cost of achieving reliability.

Equipment Outages:

- Longer duration storage defined by duration of net peak loads
- Operated less frequently, for high outage events

Resource Intermittency Outages:

- Shorter duration storage may be needed to firm renewables
- Operated more frequently, e.g. for daily resource intermittency
- Could contribute to reductions in curtailments and GHG emission
- Could reduce interconnection costs for given delivery

It will be fruitful to better understand and optimize, perhaps bifurcate, storage resource portfolio requirements.