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NCSEA Perspective on Beneficial Electrification by EMCs

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NCSEA is the leading non-profit organization
driving public policy and market solutions
that creates clean energy jobs,
economic opportunities, and affordable energy
to benefit all North Carolina.

NCSEA is North Carolina's Go To for All Things Clean Energy

NCSEA on Beneficial Electrification:
Why pay more for more emissions?

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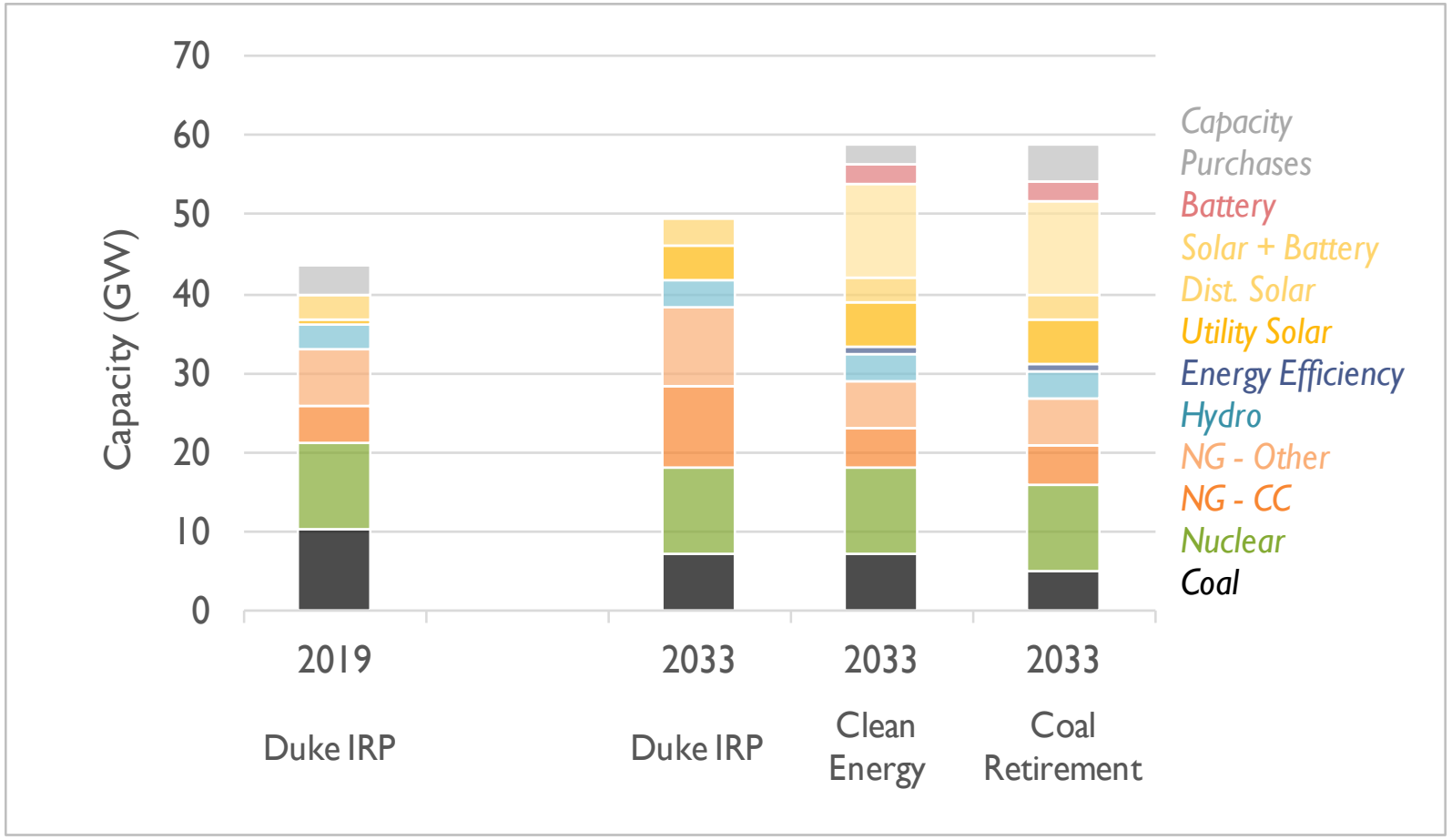
Agree with statement that replacing fossil fuel in end uses with electricity, where doing so meets at least one of four criteria without adversely affecting the others:

1. save consumers money over time;
2. benefit the environment and reduce greenhouse gas emissions;
3. improve product quality or consumer quality of life; and/or
4. foster a more robust and resilient grid.

We should expand these criteria to wholesale generation supplied by NC IOUs

- EMCs could be paying less for wholesale power for less emissions, while satisfying same criteria as beneficial electrification
- Overall generation cost lower, emissions from EMC power lower, and avoid locking today's entire electric generation portfolio into generation asset investments while cost dynamics play out
- Recent study by Synapse Economics, GridLab, and NCSEA shows how…

IRP Nameplate Capacity by Scenario



Modeled Generation (2019)

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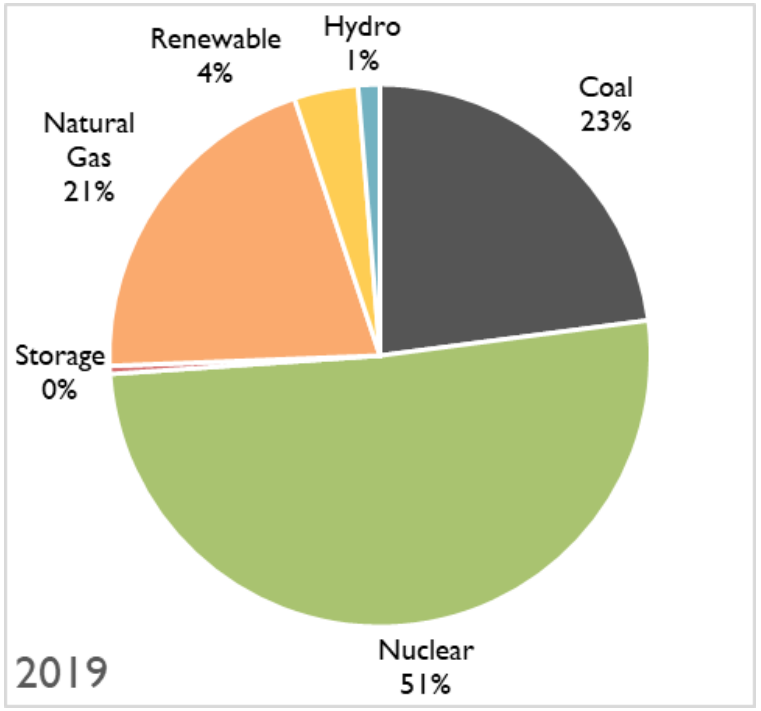
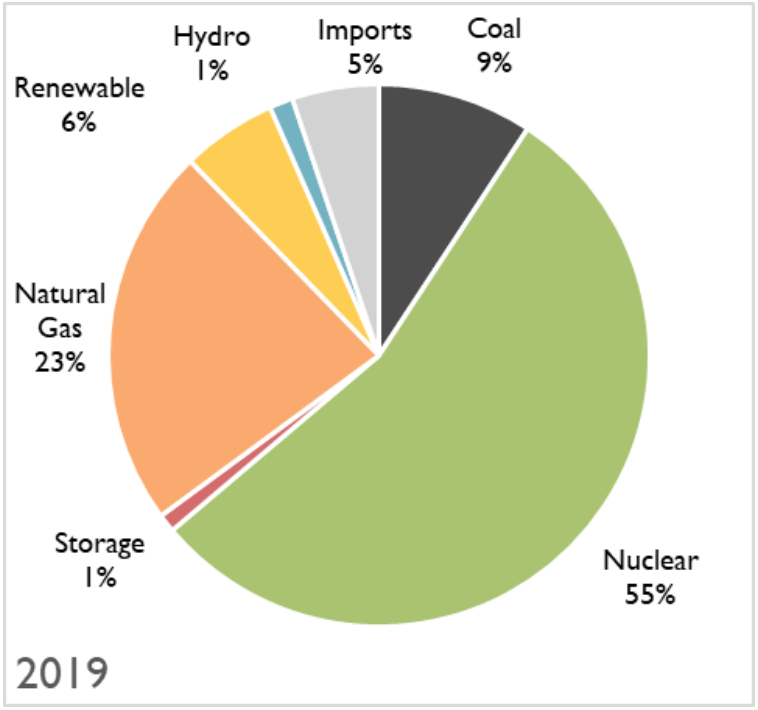
Duke IRP Baseline



Clean Energy Scenario



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GridLAB

Modeled Generation (2033)

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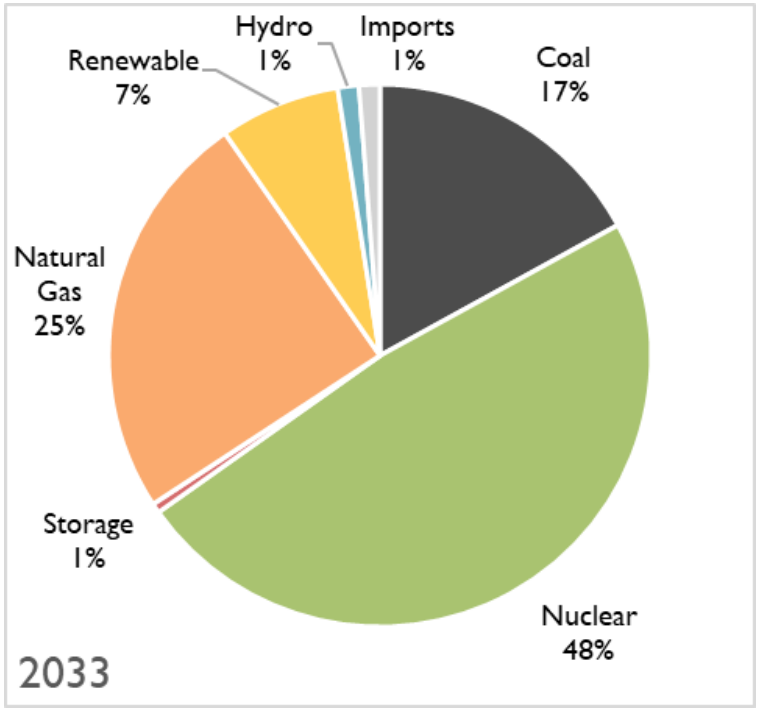
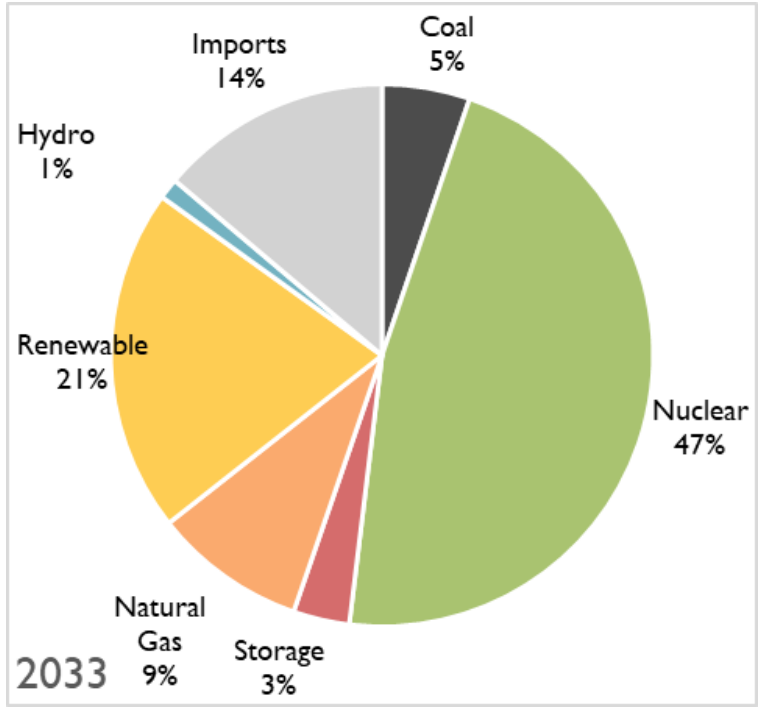
Duke IRP Baseline



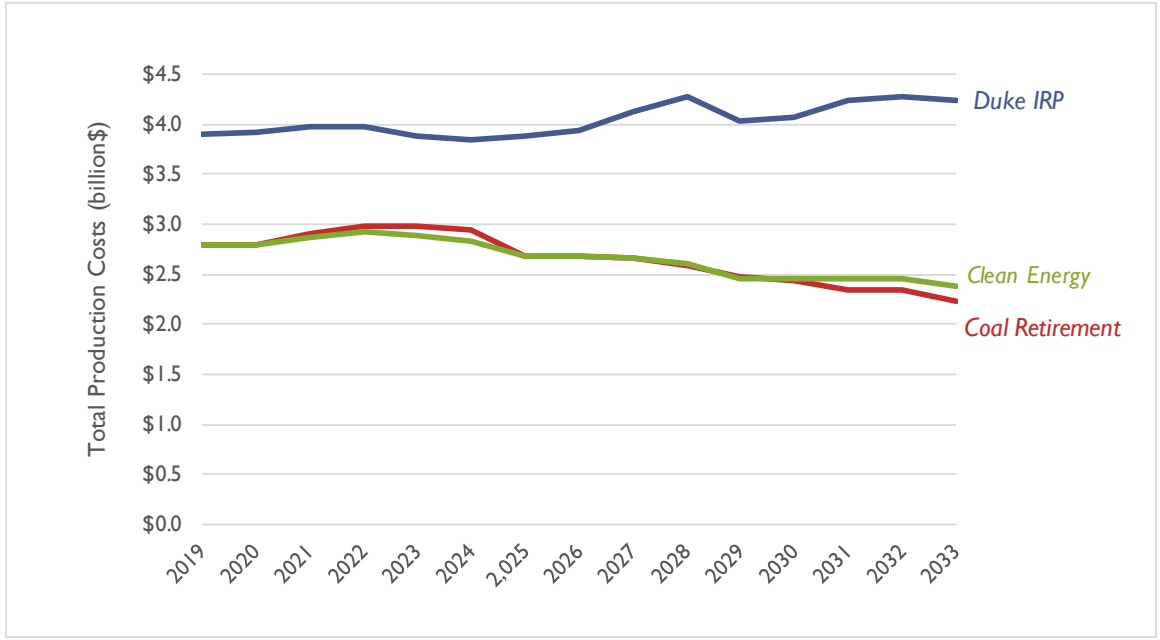
Clean Energy Scenario



Synapse Energy Economics, Inc.

GridLAB

Total Production Costs by Scenario



- The Clean Energy scenario is markedly cheaper than the current Duke IRP
- Production costs drop by 28% immediately when removing coal must-run designations leads to immediate cost savings
- Lower revenue requirement

Summary Duke IRP vs. Clean IRP

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Scenarios	% clean capacity	% fossil capacity	Comparison of Cost, Health, Emissions Impacts
Duke IRP	23% renewables and storage	56% coal and natural gas	• Status quo • 50 million tons CO_2 emissions
Clean Energy	49% renewables and storage	32% coal and natural gas	• $1.8B in production cost savings • 4%-9% annual savings on ratepayer spending • 40% lower CO_2 emissions (~30 million tons) • Increases imported power while cost dynamics play out

NCSEA's Policy Recommendation for EMC's Beneficial Electrification

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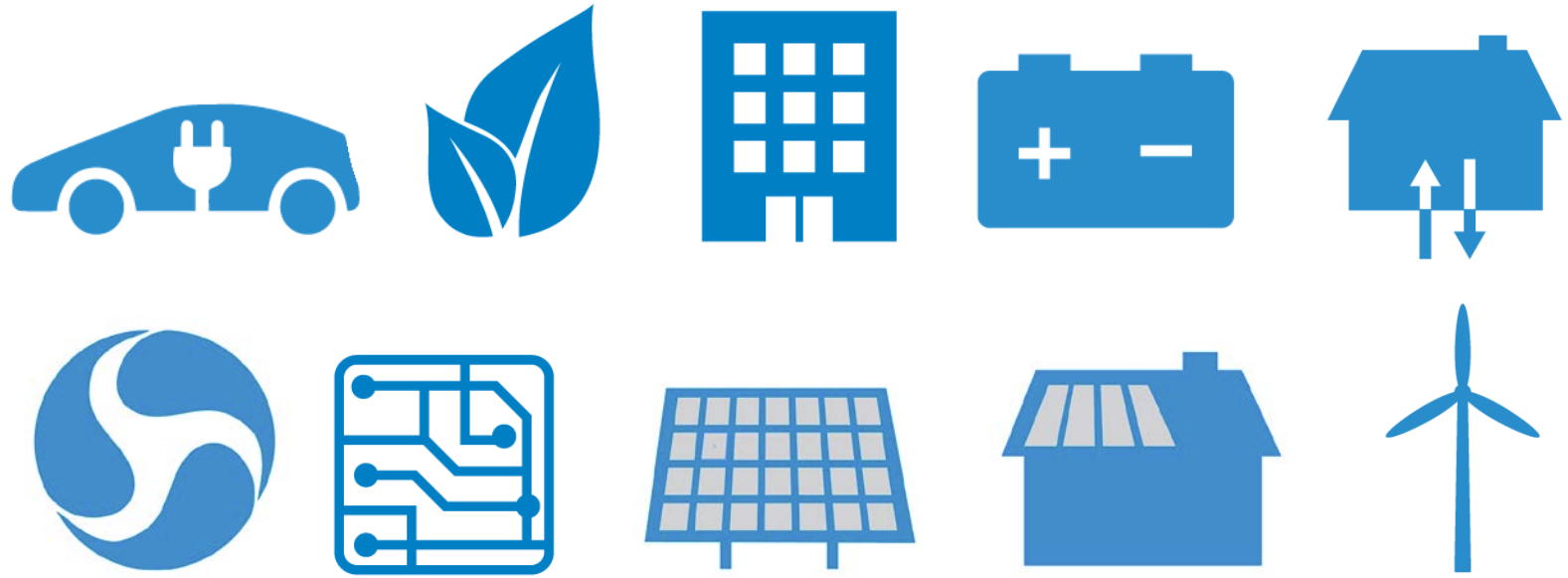
Reform how investor-owned utilities are regulated, so…

1. IOU decisions will result in wholesale customers of IOUs
   - paying less
   - for lower emitting power

   and

2. Retain future resource investment flexibility when keep energy imports in the power supply portfolio, allowing current cost dynamics more time to play out
   - Duke IRP almost eliminates purchased power by 2033

THANK YOU!



Slides that may be helpful for Q&A

Levelized Cost of Energy Comparison—Unsubsidized Analysis

Certain Alternative Energy generation technologies are cost-competitive with conventional generation technologies under certain circumstances[1]

Source: *Lazard estimates.*

Note: Here and throughout this presentation, unless otherwise indicated, the analysis assumes 60% debt at 8% interest rate and 40% equity at 12% cost. Please see page titled "Levelized Cost of Energy Comparison—Sensitivity to Cost of Capital" for cost of capital sensitivities.

(1) Such observation does not take into account other factors that would also have a potentially significant effect on the results contained herein, but have not been examined in the scope of this analysis. These additional factors, among others, could include: import tariffs; capacity value vs. energy value; stranded costs related to distributed generation or otherwise; network upgrade, transmission, congestion or other integration-related costs; significant permitting or other development costs, unless otherwise noted; and costs of complying with various environmental regulations (e.g., carbon emissions offsets or emissions control systems). This analysis also does not address potential social and environmental externalities, including, for example, the social costs and rate consequences for those who cannot afford distribution generation solutions, as well as the long-term residual and societal consequences of various conventional generation technologies that are difficult to measure (e.g., nuclear waste disposal, airborne pollutants, greenhouse gases, etc.).

(2) Unless otherwise indicated herein, the low end represents a single-axis tracking system and the high end represents a fixed-tilt design.

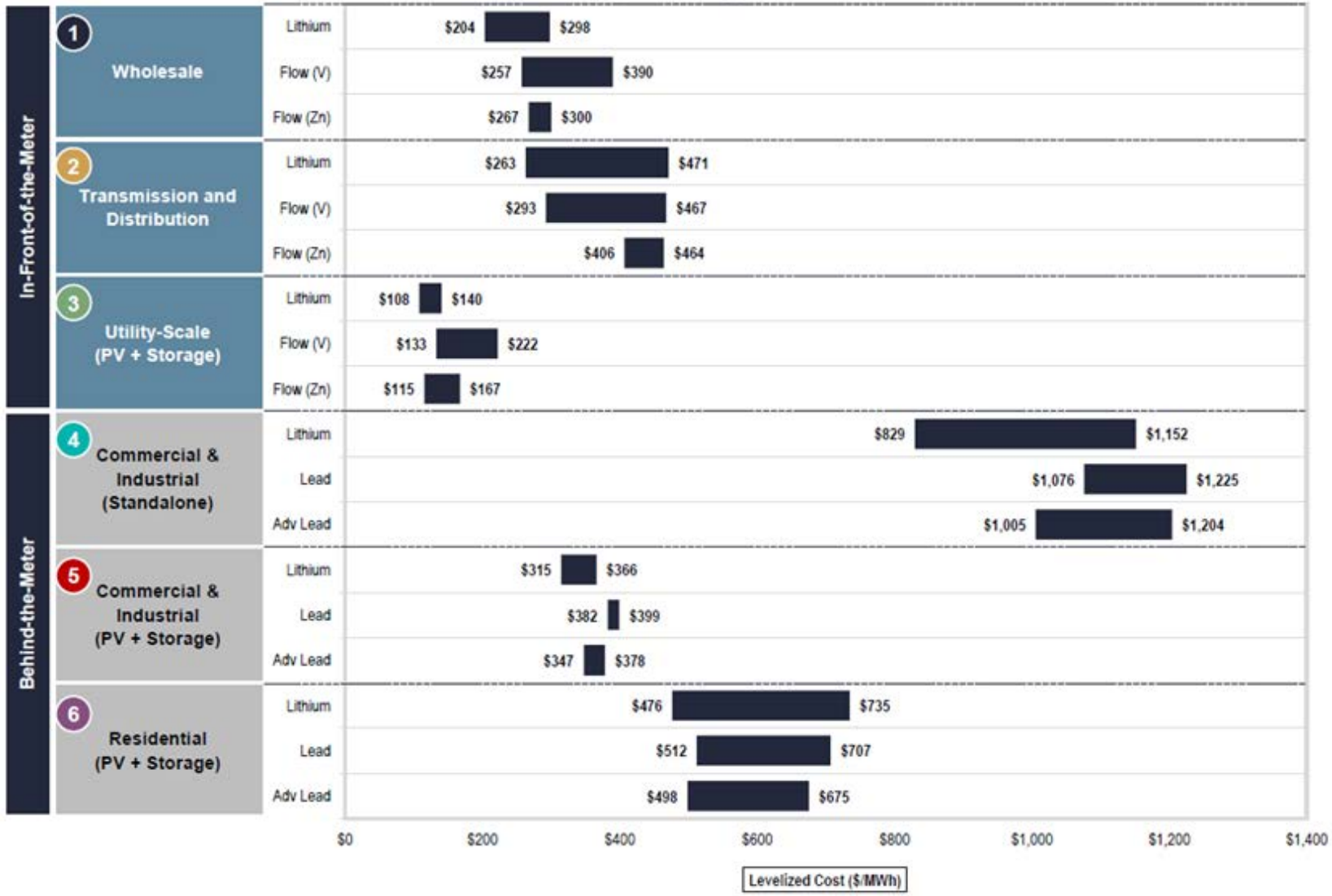
(3) Represents the estimated implied midpoint of the LCOE of offshore wind, assuming a capital cost range of approximately $2.25 – $3.80 per watt.

(4) Unless otherwise indicated, the analysis herein does not reflect decommissioning costs or the potential economic impacts of federal loan guarantees or other subsidies.

(5) Represents the midpoint of the marginal cost of operating fully depreciated coal and nuclear facilities, inclusive of decommissioning costs for nuclear facilities. Analysis assumes that the salvage value for a decommissioned coal plant is equivalent to the decommissioning and site restoration costs. Inputs are derived from a benchmark of operating, fully depreciated coal and nuclear assets across the U.S. Capacity factors, fuel, variable and fixed operating expenses are based on upper and lower quartile estimates derived from Lazard's research. Please see page titled "Levelized Cost of Energy Comparison—Alternative Energy versus Marginal Cost of Selected Existing Conventional Generation" for additional details.

(6) Unless otherwise indicated, the analysis herein reflects average of Northern Appalachian Upper Ohio River Barge and Pittsburgh Seam Rail coal. High end incorporates 90% carbon capture and compression. Does not include cost of transportation and storage.

Unsubsidized Levelized Cost of Storage Comparison—$/MWh



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Source: Lazard and Enovation Partners estimates.
Note: Here and throughout this presentation, unless otherwise indicated, analysis assumes 20% debt at an 8% interest rate and 80% equity at a 12% cost of equity. Flow Battery Vanadium and Flow Battery Zinc Bromide denoted in this report as Flow (V) and Flow (Zn), respectively.

NC Coal Fleet most at risk in U.S. vs. local wind and solar

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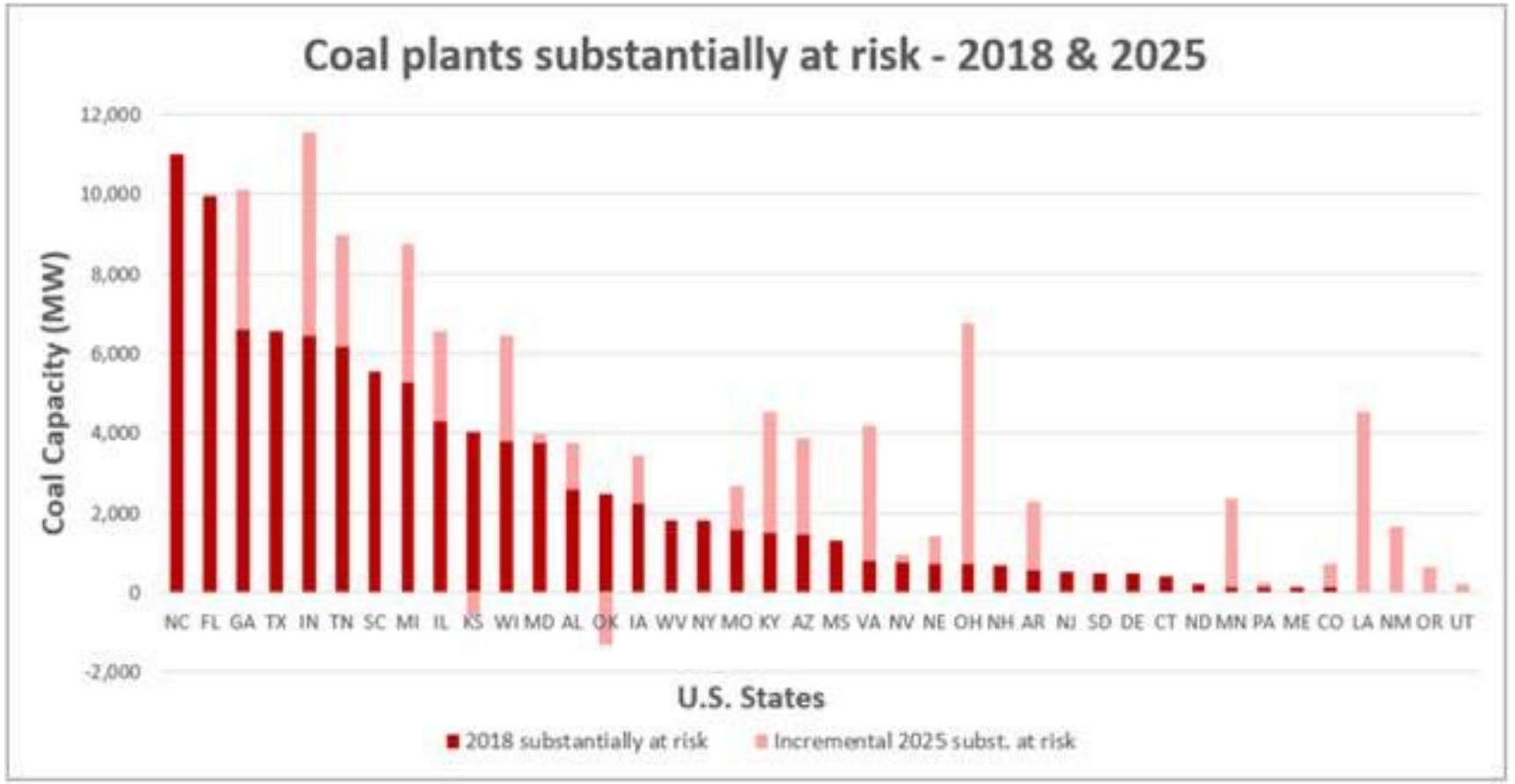
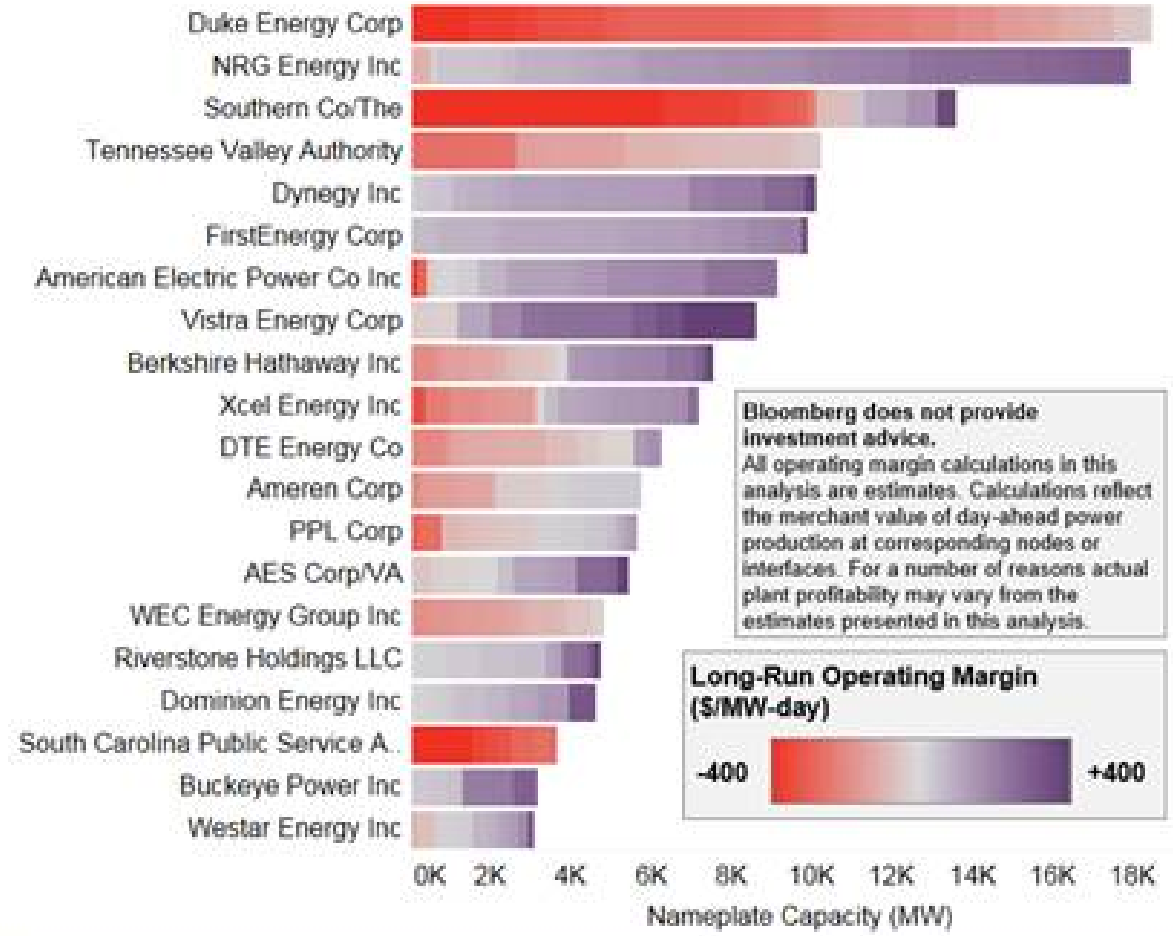


Source: Energy Innovation LLC / VCE report, March 2019

Economic footing for largest coal fleets

Online coal capacity – colored by long-run operating margin, 2012-17



Regulated Fleets

- The bulk of **Duke Energy's** coal capacity is based in the Carolinas. The costs of shipping coal over the Appalachian mountains renders coal more costly than local Transco Zone 5 gas – and more costly than importing replacement power from PJM or MISO. Duke's regulated plants remain online at the discretion of regulators, who may have good reason keep Duke's 'out-of-the-money' (i.e. red) coal capacity online: the Carolinas have the lowest reserve margins in the Southeast. As such, retiring Duke's coal capacity might jeopardize local grid reliability.
- The same *cannot* be said of **Southern Company's** coal fleet, which is concentrated in Georgia/Alabama, where coal costs more to burn than displace, and where in 2017 estimated reserve margins were 37%.

Deregulated Fleets

- **NRG's** coal fleet spans four ISOs (PJM, MISO, ERCOT, NYISO). Its Texas and Illinois capacity delivered healthy returns from 2012-17. But its plants in Pennsylvania are plagued by fire-sale natural gas prices emerging from the Marcellus and Utica shales. These plants and their neighbors were disappointed by the latest PJM capacity auction (EY2021), which saw 'Rest of RTO' capacity prices fall to $76/MWh-day.[1]
- **Dynegy Inc** and **Vistra Energy Corp** have fared relatively well in recent years, against all odds. Vistra's fleet in particular is among the cheapest-running in the nation, by our estimate, and Dynegy's exposure to Northeast ISO capacity prices will grant the soon-to-be-joint[2] fleets another pathway to profitability.

For More

The Excel File accompanying this report has details on every plant. Click here or on Terminal run 97<GO>.

[1] PJM Capacity Auction Plunders Coal Country, Pays Coast (web | Terminal)
[2] Vistra Doubles Down on Fossil Bet by Absorbing Dynegy (web | Terminal)

Offshore Wind and Solar?

- NC has more than 22,000 MW of viable offshore wind resource
- Offshore wind compliments solar and batteries
- By 2025 in NC: solar below 3 c/kWh? Offshore wind at 7 c/kWH? Batteries in that price range?

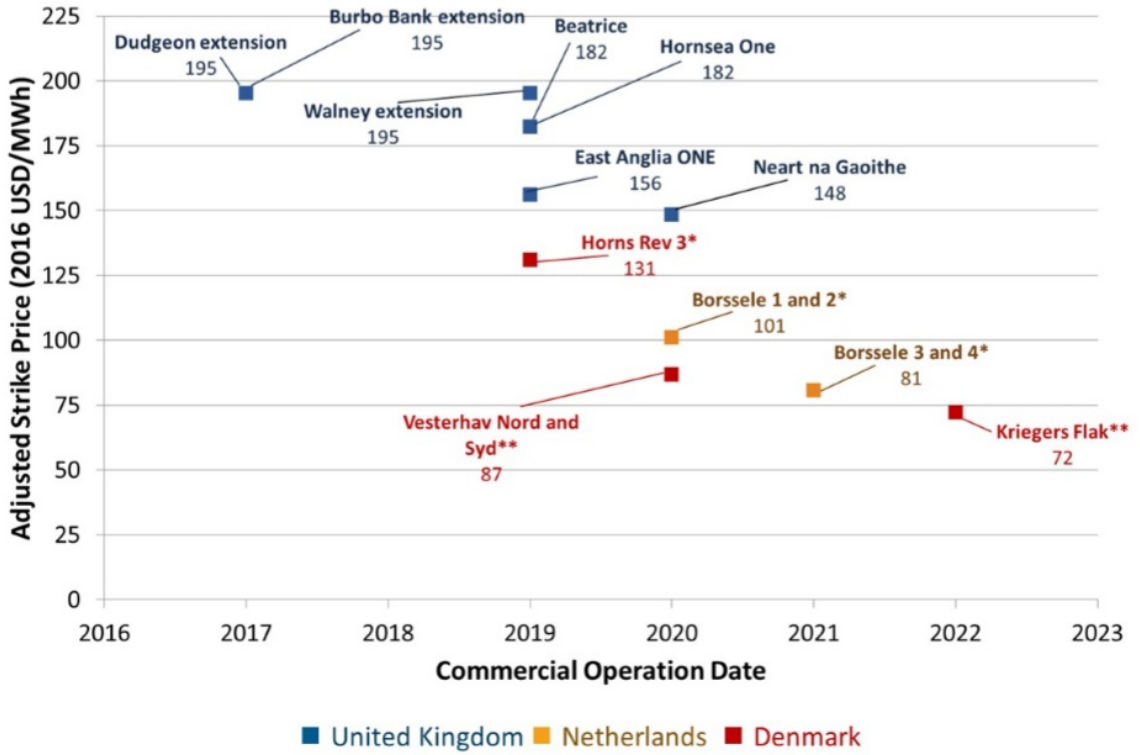


Figure 1. Recent strike prices of European offshore wind winning tenders adjusted to U.S. dollars, with grid cost, development cost, and contract length adders

Source: U.S National Renewable Energy Lab (NREL). Data Source: 4Coffshore
Provided to NCSEA by the South East Wind Coalition