Date: March 15, 2022
To: Todd Schatzki, Analysis Group; Chris Geissler, ISO New England
From: LS Power
Topic: Comments & Observations on the Pathways Study Draft Report

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LS Power commends ISO-NE and NEPOOL on their focus identifying and exploring potential market frameworks that may help advance the region's clean energy transition. We also commend Analysis Group on their substantive and thoughtful analysis of these different pathways.

In general, LS Power supports this effort and appreciates the opportunity to provide comments on the draft Pathways Report (Report), as circulated to the NEPOOL Participants Committee on March 1, 2022.[1] We suggest clarifications and offer observations below related to the Report's analysis.

1. **Depict both total and incremental cost estimates**

The Report suggests that "decarbonization will be costly"[2] but does not report the actual total cost of decarbonizing the power sector. Instead, the Report notes this fact then quickly transitions into an assessment of the *incremental* cost of different market instruments. Incremental costs can only be understood in relation to the thing they are incremental *to.* Without that bearing, it can be hard to understand if the increment is meaningful. While Figure ES-I-1 and Table ES-I-2 provide valuable information, they fail to report the model's estimate of the full 20-year market cost of Decarbonization. (This appears to be the case both in the Executive Summary and the full analysis.)

A casual reader of the report's Executive Summary might incorrectly assume that decarbonization is not particularly costly in total terms, just $3.935 to $6.027 billion over the 20-year study period[3] and that those costs do not even begin to materialize until 2033.[4] Moreover, Table ES-I-2 and surrounding language suggests that social costs can be meaningfully reduced by shifting from the PPA-based status quo to a different policy pathway.

The detailed results offered in Figure VI-13 and the attendant workbooks tell a very different story, namely that social costs start at approximately $3.2 billion in 2021, rise to $9.1 billion by 2033 across all scenarios, and then increase to $11.3 to $15.6 billion by 2040. In other words, social costs will quadruple or quintuple over the next two decades. Table 1, below, depicts the 20-year present value (PV) of each scenario's social cost and consumer cost, assuming a 5%

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[1] https://www.iso-ne.com/static-assets/documents/2022/02/pathways-study-report.pdf
[2] ES-7
[3] Table ES-I-2 "Present Value of Incremental Social Cost" Column
[4] Figure ES-I-1

discount rate. Table 1 makes it clear that the social cost of decarbonization, now through 2040, is more than $90 billion dollars and that consumer costs are somewhere north of $130 billion. Decarbonization will be costly, indeed.

Table 1: 20-Year Present Value of Social Cost and Consumer Cost, by Scenario

	20 Year PV ($ Billions)	
Scenario	**Social Cost**	**Consumer Cost**
Status Quo	$95.42	$134.76
FCEM	$93.69	$134.67
NCP	$93.32	$131.94
Hybrid	$93.51	$129.51
Alternative Hybrid	$93.49	$131.64
Reference	$89.39	$116.07

We recommend that Analysis Group include these total costs *somewhere* in its report. Adding these estimates to the Executive Summary, would bolster the reports claim that "decarbonization will be costly" and provide a valuable supplement to the existing data depicting incremental costs. At minimum, we recommend that the report should include the total social cost of the reference case – $89 billion – in or around the end of page ES-7. For example, the sentence "Our quantitative analysis indicates that decarbonization will be costly…" sentence could be amended to read (changes in bold): "Our quantitative analysis indicates that decarbonization will be ***more than 90 billion in social costs over 20 years*** requiring the development of large amounts of higher-capital cost resources."[5]

More generally, we recommend that the Report *both* the total cost *and* the incremental cost of decarbonization throughout. In general, clarity is improved when these values are presented side by side.

Finally, we recommend replacing Figure ES-I-1 with Figure VI-13 in the Executive Summary because the latter figure would provide a more fulsome depiction about the *total* cost trajectory while still making clear that (a) cost separation begins in the 2033 time-frame and (b) that the market instruments are meaningfully lower than the "status quo".

2. **Use of the "reference" case as a baseline**

In various points in this Report, Analysis Group relies on a "reference" case (e.g. ES-7). This reference case appears to rely on the assumption that society will elect to *electrify* their energy consumption but that society will not (fully) *decarbonize* the power sector. While it can be useful to depict incremental costs, or cost savings, of one scenario to another – it is critical to measure against the right yardstick. In this case, the "reference" case appears to be no reference

[5] Report at ES-7

at all, because there is no evidence that society would elect to electrify without decarbonizing the power sector.[6] The reference is an interesting counterfactual, but not the right benchmark against which to compare different policy choices.

We recommend that the "status quo" or "alternative status quo" cases be relied on for all tables/charts that depict the incremental cost/benefit of a market construct. In our view, this is a better benchmark than the reference because it controls for both load growth *and* carbon emissions, so the change in social or consumer costs is *solely* a function of the alternative market instrument rather than a combination of the market instrument *and* more stringent decarbonization requirements.

Additionally, we recommend that Analysis Group rely on a single point of reference when comparing different decarbonization pathways. Taking Table ESI-I-2 as an example, Analysis Group computes its percent changes in two steps:

1) Calculate the incremental cost of each policy approach by subtracting it from the "reference" case costs.
2) Calculate the percent difference between a policy approach's *incremental cost* and the "status quo" case's *incremental* cost.

Between Step 1 and Step 2 there is a change in baseline, from the reference case to the status quo case, which is both confusing and unnecessary. In our view, it would be preferable to rely on a single reference point when generating tables such as Table ES-I-2 and we recommend that the "status quo" case provide that reference. Analysis Group could, for example, compare 20-year cost savings of the market constructs to the status quo case without needing to calculate the deviations from the reference case first. For example,

- Using the "status quo" scenario data from Table 1, above, it appears that each policy pathway has social costs which are approximately 2% lower than the "status quo" over the full 20 year timeframe.
- Alternatively, using the "reference" scenario data from Table 1, above, it appears that each market pathway has social costs which are approximately 4-5% higher than the "reference" over the full 20 year timeframe and that the "status quo" is about 7% more expensive than the reference.

[6] The Analysis Group Report relies on a load profile developed by Evolved Energy Research for the Massachusetts Decarbonization Roadmap sub-report: *Energy Pathways to Deep Decarbonization* (*see* Report at 120). That load profile, in turn, assumes that New England will both electrification and decarbonization (*see* Massachusetts Decarbonization Roadmap report, pages 1-9 available at https://www.mass.gov/doc/energy-pathways-for-deep-decarbonization-report/download). Figure ES-2 from the Massachusetts Decarbonization Roadmap shows that if society does not elect to decarbonize the power sector, that loads will not meaningfully increase from today's levels.

The Report's change in baseline, mid-analysis, allows for certain claims which might be technically true but are broadly confusing or misleading. For example, the report notes that: "By 2040, the incremental social costs in the Status Quo are 40% higher compared to Net Carbon Pricing." A lay reader would be excused if they read that statement as suggesting that status quo is significantly more expensive than NCP when, in reality, these two scenarios have costs of $90.87 and $88.88 billion respectively over the 20 year study period.[7]

The key observation here is that these scenarios are all more similar than different when it comes to quantitative outcomes. The significant savings depicted in Table ES-I-2 is mostly a numerical artifact of the changing baseline rather than a deeper observation about subtleties in how the different scenarios build and operate their resources.

The same observations we make about social costs apply to customer payments and related tables throughout the report.[8]

3. Policy Lock-in

We recognize that Analysis Group views this report as a *mechanism* study, however, one important implication for the ISO-NE Markets is that cost/pricing outcome divergence only starts in earnest around 2033 – some 12 years from today.

We recommend that the Executive Summary explain *why* there is a 12-year lull before the different market mechanisms "kick in" – namely procurement of OSW and other contracted renewables exceeding decarbonization targets or load growth. It would be helpful to clarify, perhaps around Figure ES-I-4, that early year carbon pricing or the FCEM are not strictly "free" so much as over-subscribed or "priced in" due to the existing PPAs. During the March 1 presentation, Analysis Group offered some helpful discussion about the causes of this "lull" which could help enhance the Report's discussion about the timing of non-zero carbon and CEC prices. This sort of discussion could be added at various points including Report pages ES-8, ES-11, or ES-13.

4. Battery Churning

One of the most interesting and unexpected results of the Pathways analysis relates to battery churning.[9] Analysis Group notes that in scenarios where there are a significant number of hours with negative LMPs that a battery can "churn" by arbitraging its own *in*efficiency. This churning can increase storage revenues and increase production of clean energy which would be

[7] *Infra* Table 1.
[8] E.g., ES-I-2, p88-9, 96-7, 114-6, 118, &c.
[9] Report at 70-75.

otherwise curtailed. It is also inefficient and socially worthless.[10] Table ES-I-1 highlights churning four times as a possible consideration when assessing different policy outcomes.

We recommend that Analysis Group add some additional discussion that churning is not a *necessary* outcome of any of these scenarios but instead an outcome of this particular model's assumptions and structure, and that churning could be reduced or eliminated through the thoughtful design of clean energy standards for the FCEM or through tariff rules. The suggestions, below, should not be construed as specific policy proposals by LS Power. Instead they highlight the ability of states or the ISO to limit the ability of churning to adversely affect the power system if it becomes an issue worth solving.

As modeled in the Report, churning can increase battery revenues without any discernable societal benefit. But, churning could be reduced if PPAs for contracted resources or CEC obligations were structured in ways that further devalued energy production during periods of overgeneration.[11] More drastically, churning could be eliminated if the ISO-NE tariff stipulated that batteries could not *discharge* when LMPs are negative Of course, tariff rules of this sort could have other adverse consequences.

On top of providing direct revenues to energy storage, churning can also increase the number of clean energy credits produced by renewable resources, by making use of otherwise curtailed clean energy.[12] The report notes that, from a policy standing, these churning-induced CECs "provide no environmental benefit, as they do not displace any fossil generation and thus do not reduce emissions, but generating these CEC increase social costs through increased battery degradation and potentially increased battery storage investment."[13]

We observe that churning induced CECs may be the result of how, specifically, the clean energy credit requirement target is formulated. Different CEC target formulations can reduce or altogether eliminate the value of churning-induced CECs and better align societal welfare with battery operation. Consider three different definitions of a clean energy standard / FCEM requirement:

> **<u>Option 1</u>: CEC requirement equals fraction of total MWh consumed, i.e.:**
> ***Target Requirement (%) = (Clean Energy / Total MWh consumed)***
> Under this CEC requirement formulation, optimization models may have batteries "cheat" the constraint by having batteries aggressively cycle because this increases the amount of electricity produced by renewables by reducing curtailment. In a system without storage, the quantity of clean energy is what it is, but if there is significant

[10] Report at 72.
[11] Report at 45-47 discusses how some PPA mechanics encourage negative offers in the energy market.
[12] Report at 71-72.
[13] Report at 72.

renewables curtailment *and* storage, then churning increases the amount of clean energy in the numerator of the requirement and total MWh consumed in the denominator. So, as the churning load increases towards infinity, the CEC compliance share approaches 100%.

<u>Option 2</u>: CEC requirement proportional to fraction of "useful" base loads, i.e.
Target Requirement (%) = Clean Energy / (Total Load - Churning Load) -- or –
Target Requirement (%) = Clean Energy / ("Useful End-use Load")
Here, the CEC requirement accounts for churning load when setting the overall target. Under this standard, churning-induced CECs are not allowed to "inflate" the denominator, but churning *still* has the effect of reducing curtailment and increasing the numerator, making the standard easier to meet.

<u>Option 3</u>: Account for churning in numerator and denominator; i.e.,
Target Requirement (%) = (Clean Energy + Churning) / (Total Load).
Here, churning does not affect the target because as the amount of churning increases, the standard itself becomes more difficult to meet. Implicitly this assumes that churning only occurs in conjunction with clean generation (not, for example, thermal with intertemporal constraints).

The key observation here is that while each of these clean energy credit requirements has the same *nominal* goal, they have different effects on overall system buildout *and* the economic value of churning.

This is not to say that the Analysis Group model does not make sense or is incorrect in some way, but instead to point out that policymakers are not helpless in the face of churning. They can formulate different clean energy standard or FCEM requirements – and make tariff changes – that better align their goals with the markets. To that end, we recommend that Analysis Group consider adding a short paragraph or footnote in the churning section, to this effect.

For sake of completeness, we also suggest that Analysis Group include its specific formulation of the CEC demand requirement. This could be integrated as a footnote on page 15 or page 32 of the report.

5. <u>Miscellaneous Clarifications and Suggestions</u>

- On page ES-7, it would be helpful to specify that the Reference Case relies on the same load profile as each of the carbon-compliant pathways.

- Somewhere in the Executive Summary, perhaps around page ES-7 or Table ES-I-2, it would be useful if the Report could include a footnote with the discount rate used for computing present values.
- On page ES-4, it would be helpful to elevate Fn 3 and bold the "hybrid approach" just to improve scanning of what kind of incentives each mechanism offers.
- Somewhere when discussing the Hybrid Approach, perhaps page 59, it might be helpful to drop a reference to a study out of MIT titled *Trade-offs in Climate Policy: Combining Low-Carbon Standards with Modest Carbon Pricing*[14], which provides fulsome analysis of the efficiency of pairing a clean energy requirement with carbon pricing. Admittedly this is a somewhat different combination of a clean energy requirement with carbon pricing, but the concept of combining a carbon price with a quantity-based clean energy procurement mechanism is not new.

LS Power appreciates your consideration of these comments, clarifications, and observations.

[14] https://ceepr.mit.edu/workingpaper/trade-offs-in-climate-policy-combining-low-carbon-standards-with-modest-carbon-pricing/