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Malta Inc. Input to Massachusetts DOER and MassCEC LDES Study

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Introduction

Malta Inc. (Malta) appreciates the opportunity to provide input to the DOER and MassCEC with respect to the Long Duration Energy Storage (LDES) study to be conducted per the requirements of Section 80 of the 2022 Climate Bill (H5060). The following provides our view on general policy considerations, policy ideas to enable LDES, and the details of the specific approach to the study itself.

General Policy Considerations

Decarbonizing the electric sector presents a challenge that is solvable with ready-to-deploy LDES technologies

Traditional thermal, fossil-fuel generation plants in Massachusetts will continue to come offline as part of the energy transition. This creates a need for certain critical replacement services which can be met with LDES technology, particularly synchronous long-duration energy storage (SLDES). The types of services readily addressed by SLDES include synchronous inertia, capacity, load following, balancing services as well as firming of renewable generation (noted below).

Further, Malta's SLDES offers (i) the required energy density to slot into the existing footprint of land which either currently or historically has been the site of an operating fossil asset and (ii) the opportunity to make use of existing infrastructure. Therefore, not only can these technologies provide the lost grid reliability attributes that the fossil asset provided, they present a viable land-use and permitting pathway. SLDES technologies are critical to ensuring grid reliability while also enabling faster penetration and procurement of renewable technologies.

To enable SLDES plants to be deployed front-of-the-meter and at bulk scale, market mechanisms and reform are necessary to incent new build at a cost of new entry that reflects SLDES as the reference plant technology. In order to successfully deploy these large capital infrastructure projects, the assets need to be able to contract at levels that support the initial investment. Also, SLDES plants also would need to be compensated for the full value (value-stacking) the asset brings to the electric grid.

Moreover, Malta believes in the Just Transition of which the "S" in Environmental, Social, Governance (ESG) is critical and often overlooked. In this light, retrofitting an existing fossil plant with an SLDES system presents the opportunity to utilize the incumbent workforce from the retiring plant. Many SLDES systems look and feel like traditional fossil assets and therefore provide a distinct opportunity to hire these would-be displaced workers with little re-training required.

We encourage DOER and MassCEC to ensure strong consideration of SLDES assets in the study given their criticality to the Just Transition.

Maximizing use of existing infrastructure – i.e. converting wholesale generators to SLDES assets to meet critical transmission needs

DOER and MassCEC should explore how SLDES enables maximal utilization of existing infrastructure, particularly at critical locations from a transmission planning perspective. Using existing infrastructure can reduce the amount of new infrastructure required, therefore reducing the burden on ratepayers. An example of re-using infrastructure, as discussed prior, would be converting retired or to-be-retired wholesale generators to SLDES assets in order to meet transmission needs, increase hosting capacity and enable additional points of viable interconnection for off-shore wind.

Importance of synchronous inertia

Policy-making should consider the grid reliability benefits provided by synchronous (inertia-providing) storage solutions and inverter-based solutions. Rotational inertia is a critical grid reliability service provided by energy technologies that contain rotating equipment, such as turbomachinery. Inertia acts as a 'buffer' to grid operators, extending the time available to respond to contingency events (e.g., a power plant shuts down unexpectedly). Traditional energy technologies, such as natural gas-fired power plants, who use synchronous, rotating inertia, have historically provided this service to the electric grid. With the replacement of these synchronous resources with intermittent renewables and batteries (which are inverter-based), this critical service is lost.

To this point, The North American Electric Reliability Corporation (NERC) has issued dire warnings that great swaths of the country face high risk of energy emergencies during peak summer conditions citing loss of generation capacity and extreme weather conditions.[1] In its December 2021 Long-Term Reliability Assessment, NERC stated:

> *More transmission is necessary to get renewable power to load centers, but it takes time to build high-voltage transmission, and extraordinary siting challenges can be encountered. The shift to more and more inverter-based resources (IBR) brings unique opportunities but also integration challenges that can and must be addressed to assure continued reliability. This is not an argument against the transition but a recognition that,* ***without a collective focus, system reliability faces risk that is inconsistent with electric power's essentiality to the continent's economy as well as the health and safety of its population*** *[emphasis added].*[2]

Certain energy storage technologies, such as Malta's pumped heat energy storage (PHES) system, have synchronous, rotating equipment and can provide inertia, ensuring grid reliability.

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[1] North American Electric Reliability Corporation. (2022 May). 2022 Summer Reliability Assessment. https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_SRA_2022.pdf

[2] North American Electric Reliability Corporation. (2021 December). 2021 Long-Term Reliability Assessment. https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2021.pdf

Value of clean heat by-product in an SLDES system

The Commonwealth as a whole is seeking to decarbonize across all sectors inclusive of electricity, buildings, industrial and transportation sectors. Certain SLDES technologies offer a clean heat by-product that can be used to decarbonize traditionally hard to decarbonize sectors, such as heavy industry or district heating.

Massachusetts is highly reliant on natural gas for space heating. Not only does natural gas emit greenhouse gases, it is also expensive and supply-restrained in Massachusetts. The production of discharge heat from an SLDES system presents a clean, cost-effective way to reduce reliance on natural gas for space heating on top of the benefits to the electric grid – ***effectively creating cross-cutting "Clean Energy Hub" opportunities***.

Therefore, the inclusion of this specific item in this analysis will be beneficial to DOER, MassCEC, and virtually all regional stakeholders as they explore efficient ways enhance the reliable delivery and security of electricity to consumers, while looking to minimize ratepayer costs.

Policy Ideas to enable LDES

State laws that allow utilities to rate-base LDES

Electric utilities are often interested in purchasing and self-financing innovative technologies, but they face hurdles (regulatory, market-structure) that prevent them from doing so. Laws that explicitly allow electric utilities to self-finance (rate-base) new technologies such as LDES storage would greatly increase the incentive to procure these technologies. In Colorado, for example, Bill HB21-1324 was passed to Promote Innovative and Clean Energy Technologies,[3] and we recommend that DOER and MassCEC consider the value in making similar policy to promote SLDES development.

Given that there will be no new gas permitted in New England, the market needs to consider market mechanisms/products that incent dispatchable assets, particularly that offer load following, ramping capabilities, and inertia—whose values reflect the cost of new entry. As it stands right now, the market drivers will not support new SLDES capacity into the market under the current construct. Furthermore, the inability for storage to value-stack and be compensated for both transmission and generation benefits leaves critical dispatchable SLDES technology unable to support investment either as a market participant or as a regulated transmission asset. Therefore, this study should consider mechanisms to 'bifurcate' the asset to ensure that the asset value for both transmission and generation benefits can be realized to the overall benefit of ratepayers.

Special consideration and additional compensation should be afforded to those SLDES technologies which have the potential to create cross-cutting clean energy hubs that decarbonize across multiple sectors.

[3] Promote Innovative And Clean Energy Technologies | Colorado General Assembly

Interconnection queue preference for stand-alone, synchronous energy storage (SES) or renewable energy (RE) projects that include SES

Backlogged queues and long wait-times for interconnection are an acute pain-point for renewable energy and storage developers throughout the country. However, certain technologies, such as transmission or long-duration energy storage, enable the integration of even more renewable technologies than otherwise would be feasible. Providing interconnection preference to LDES in Massachusetts would result in more rapid adoption, which will, in turn, allow for the safe and reliable buildout of more renewable energy.

Long-duration storage – offshore wind landing hub

The study should give due consideration to creating and/or facilitating (e.g., provision of land, permits etc.) the creation of a SLDES hub that acts as a stabilizer for incoming offshore wind. This hub could firm the intermittent offshore wind resources, provide grid reliability services (e.g., inertia), and create economic development.

Legislation revamp modeling software to include LDES and 8760/100-year events

To build the energy system of the future, we need to model it correctly. Existing grid modeling software was designed to model traditional resources, such as baseload fossil-fired generation. And, to date, some improvements have been made to incorporate renewables and short-duration storage. However, many breakthrough technologies—such as LDES—either cannot be modeled correctly with the present software or are significantly undervalued. Furthermore, existing software does not model the hour-to-hour variability of energy demand and supply, the latter of which changes more rapidly with increasing penetration of renewables.[4]

The California Energy Commission (CEC) has recognized this deficiency in its own modeling software and as a result has issued a $1 M grant to the University of California, Merced to develop new tools to properly model the California power grid.[5] Massachusetts can follow California's lead and provide funding to improve or replace existing grid modeling software to ensure the Massachusetts grid is maximizing reliability and capturing the full potential of innovative technologies.

Study Considerations

General approach

The study should incorporate long-term capacity modeling. In addition, **we encourage the direct involvement of ISO-NE** to provide reliability parameters, metrics, data sets, forecasts, and other information that can enhance the validity of the study and ensure that the information being considered is consistent among the key stakeholders in the region.

Modeling considerations

The study should consider numerous scenarios, including:

[4] To build a zero-carbon grid, we first need to model it accurately | Utility Dive
[5] UC Merced Receives $1 Million Grant from California Energy Commission | Newsroom

- Proliferation of renewables above projections, especially considering the Inflation Reduction Act.
- Impact of gas and electric transmission constraints.
- Retirement of firm, dispatchable, synchronous resources at a faster pace than expected.

Best practices in grid modeling

The study should consider the following to ensure that best practices in grid modelling are incorporated:

- To best capture the value of LDES, reliability parameters (such as reserve %, frequency response etc.) should be set with input from ISO-NE.
- With respect to sub-hour vs. hourly dispatch forecasts: the sub-hour approach provides more precision, especially around ramp requirements. This is increasingly important as intermittent renewables are added to the generation mix
- Weather data: Our understanding is this study may utilize the DNV-GL offshore wind report. This is an excellent data source for past meteorological data, but we would recommend supplementing to account for the expected increase in extreme events, including cold snaps, due to climate change.

Expected outputs from the study

- Total Power Capacity of LDES Needed (MW)
- Total Energy Capacity of LDES Needed (MWh)
- Specific system size and durations needed (e.g., 100 MW, 10 hour duration)
- Ramp requirements – how fast do LDES resources need to be able to respond. This will be influenced by the amount of renewable generation
- Need for synchronous inertia (MW, MWh etc.)
- Value of clean discharge heat by-products from LDES systems