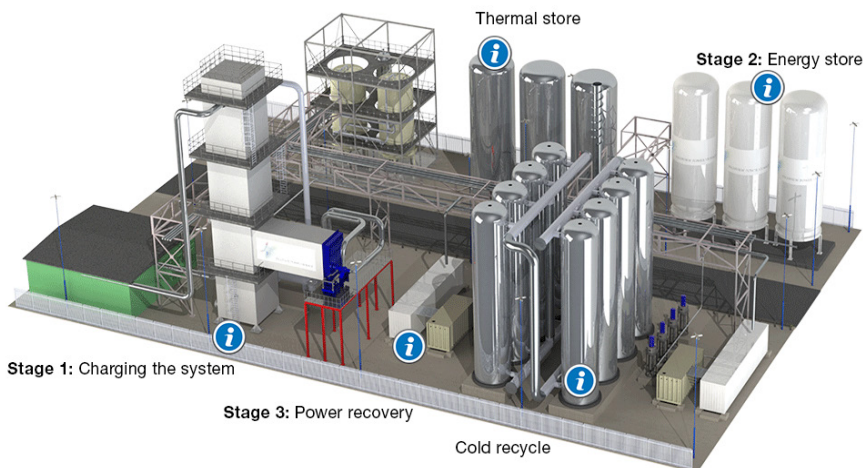


NYSP21 Performs Evaluation of Liquid Air Energy Storage Technology

Highview Power Storage, Inc. (Highview) (Brooklyn, NY) is a clean energy company providing large-scale energy storage systems utilizing Liquid Air Energy Storage (LAES) technology. The LAES system is capable of storing electrical energy in the form of compressed and liquefied air as a means to bulk-shift renewable energy from off-peak to times of peak energy demand. This can enable greater market penetration of renewable power generation by shifting “wrong-time” energy and providing the ancillary services required to reliably maintain the grid at the required frequency and voltage.

Highview completed the world’s first LAES system in 2011 with its 350 kW / 2.5 MWh pilot plant located in the UK, and the company is currently commissioning a 5 MW / 15MWh commercial demonstrator with expected completion in 2017. Highview is a member of the ACRE incubator at the Urban Future Lab, located at NYU Tandon School of Engineering, Brooklyn, NY.



Highview's LAES Pilot Plant including Charging System, Energy Store & Power Recovery
<http://www.highview-power.com/technology/>

CHALLENGE

Highview requested New York State Pollution Prevention Institute (NYSP21) to evaluate the potential energy and green house gas (GHG) emissions reduction with implementation of their LAES systems in New York State (NYS).

SOLUTION

NYSP21 worked together with ACRE to support Highview with an energy and GHG emissions evaluation. Based on a numerical model, NYSP21 determined the potential GHG reduction with LAES by considering NY State’s 2016 electricity profile as well as the predicted 2030 profile under the NYS Reforming the Energy Vision (REV). Several LAES charge/discharge scenarios were considered. NYSP21 summarized impact metrics for New York State, including Technology Readiness Level (TRL), energy, environmental and economic impact.

CHALLENGE

- Highview requested NYSP21 to evaluate the direct energy and green house gas (GHG) emissions reduction with implementation of their LAES systems

SOLUTION

- NYSP21 evaluated the potential energy impact and GHG reduction with LAES, considering availability of NYS renewable energy consistent with NYS REV initiative

RESULTS

- Highview's LAES system enables increased utilization of wind and solar energy
- NYSP21 estimates the following NYS benefits using 5.0 GWh of LAES systems in 2030:
 - > 198.9 GWh of peak energy is displaced annually
 - > 291.4 GWh of renewable energy curtailment will be avoided annually
 - > A more renewable fuel mix in 2030 vs. 2016 results in 56.3% reduction in CO₂ emissions, partially enabled by LAES technology
 - > 94.5 Thousand Metric Tons of CO₂ emissions reduction can be achieved annually in NYS by 2030 using LAES as compared to 2030 without storage
- Economic/Business Impact:
 - > Highview LAES is currently at DOE TRL-7, and estimated TRL-9 commercialization in 2021
 - > (6) engineering and support staff jobs created for Highview design development
 - > (20-50) estimated construction jobs for LAES site implementation

TESTIMONIAL

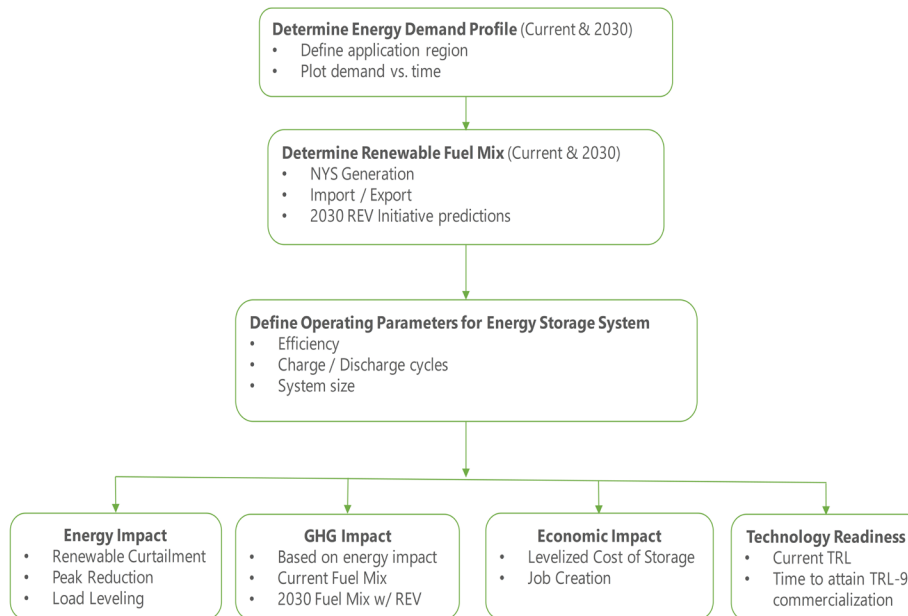
“Energy Storage will be key to maintaining a reliable supply of electricity as the penetration of intermittent renewable energy sources grows. Massive carbon savings from these renewables will only be possible with a stable grid. Traditional plants used to respond to load are highly polluting and Energy Storage can already play a role in displacing the dirty peaking power currently used to reconcile supply and demand. The NYP2 analysis shows how Liquid Air Energy Storage could play a significant role in reducing the carbon intensity of peaking power in 2030. It is well suited to the task due to its low lifetime cost at scales large enough to make a significant impact.”

– Richard Riley, Business Development Manager
Highview Power Storage, Inc.

www.highview-power.com

NYSP2I Metrics Analysis Methodology:

NYSP2I developed and applied the following analysis methodology, considering regional energy demand, current and future fuel mix, and specific parameters for each new technology under evaluation. The following flowchart illustrates the steps used to evaluate the technology, resulting in the following impacts: Energy, GHG, Economic and Technology Readiness.



RESULTS

Highview’s LAES enables an increase in renewable energy utilization on a grid scale by shifting power to better match supply and demand and providing the ancillary services required to maintain a reliable grid. In addition to supporting low-carbon generation, direct CO₂ emissions reductions are attributable to LAES. With 50% renewable fuel sources available in 2030 and 5.0GWh of LAES storage, a portion of peak loads in NYS can be shifted from fossil fuel based sources to clean energy sources. The CO₂ emissions impact for 5.0 GWh of LAES storage is calculated based on the predicted fuel mix for NYS in 2030, resulting in annual reduction of 94.5 thousand metric tons of CO₂ emissions and avoidance of 291.4 GWh of renewable curtailment. Direct CO₂ emissions reduction from peaker plant displacement may be greater than the combined NYS fuel mix utilized for this analysis, and can be further enabled by increased LAES system capacity in NYS.

The CO₂ emissions are based on reported and analysis-predicted fuel mix data. Data sources include both open cycle peaking plant and more efficient combined-cycle natural gas plants used for baseload; therefore an average CO₂ emission value of 1034.5 lbCO₂/MWh electricity was used for all natural gas sources based on all MWh produced by gas plants. Increased transmission losses during peak hours also affect the carbon intensity of the energy delivered.

NOTES

- Historical electricity information from NIYSO, ISO-NE, IESO, PJM, Hydro-Quebec
- Fuel mix used for analysis at 50% renewables in 2030, consistent with NYS REV initiative (<http://rev.ny.gov>)
- NYS GHG emissions impact based on 2015 U.S. EIA study (<https://www.eia.gov/electricity/state/newyork/>)

For additional information on this study, please contact Highview Power Storage Inc.

NYSP2I PARTNERS

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The State University of New York

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UNIVERSITY

New York Manufacturing Extension Partnership

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