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Connecticut General Assembly Energy and Technology Committee
Legislative Office Building, Room 3900
Hartford, Connecticut 06106

Re: Testimony in Support of HB 5406, An Act Establishing a Task Force to Study Transmission and Grid Enhancing Technologies, HB 5438, An Act Concerning Energy Efficiency Funding and Programs, and HB 5439, An Act Concerning Heat Pump Adoption

Dear Chair Needleman, Chair Steinberg, and Honorable Members of the Committee:

My name is Jayson Velazquez, and I am the Climate and Energy Justice Policy Associate for Acadia Center. Thank you for the opportunity to provide testimony. Acadia Center is a non-profit research and advocacy organization that works to advance bold, effective, and equitable clean energy solutions. Acadia Center supports HB 5406, An Act Establishing a Task Force to Study Transmission and Grid Enhancing Technologies which will establish a task force to study transmission and grid enhancing technologies with a report submitted by January 1, 2025. Acadia Center also supports HB 5438, An Act Concerning Energy Efficiency Funding and Programs which makes a $145 million dollar appropriation to the Department of Energy and Environmental Protection, from the General Fund, for the fiscal year ending on June 30, 2025, for energy efficiency programs identified in the Conservation and Load Management Plan, and directs a study on the current structure and effectiveness of energy efficiency funding in the state, and HB 5439, An Act Concerning Heat Pump Adoption which sets a target of deploying 310,000 heat pumps in the state by 2030. This written testimony will specifically cover HB 5406.

Through HB 5406, Connecticut is in a great position to continue leading the charge on Grid Modernization. The Public Utilities Regulatory Authority's (PURA) leadership has taken many steps to ensure that the state's grid is prepared to serve the increased electricity demand that will result from the electrification of heating and transportation. Those increases in demand are not insubstantial: the regional grid operator, ISO New England, is estimating that New England's electricity demand may double by 2050, from the current record peak of 28 gigawatts to 57 gigawatts. That doubling of demand resulting from the decarbonization of the regional economy via electrification will necessarily require substantial increases in the capacity of the transmission system to deliver power from where it is generated to where it consumed.

PURA has been engaged in many dockets that incorporate elements of Grid Modernization and is leading the development of an integrated distribution system planning process that will support diverse dialogue and stakeholder participation. PURA's work to increase transparency around utility and grid planning has been coupled with establishing a leading non-wires solution program that will provide lessons learned to guide further action. Connecticut legislators can strengthen this leadership further through support for HB 5406.

Grid Enhancing Technologies (GETs) increase the efficiency of electric transmission through a suite of technologies that include sensors, power flow control devices, and analytical software tools.[1] In terms of their use-cases, GETs can be used to manage power flows on the electric transmission system and reveal where additional, unutilized capacity exists on the system: capacity that current transmission rating solutions cannot detect. GETs can also be used to assess and validate the cost-effectiveness of planned upgrades to transmission in existing rights of way, as well as the design of new transmission lines. In short, GETs have the potential to significantly increase the capacity of transmission in existing rights of way, and thereby minimize the impacts associated with the construction of new transmission lines. Moreover, because the design, permitting, and construction of new transmission lines may take years to complete, GETs represent an opportunity to bolster efforts to increase the capacity of the existing transmission system and address energy equity concerns.

The maximum capacity on a transmission line is limited by temperature: the higher the temperature the lower the capacity of the line. Conducting power through a transmission line creates heat, and fluctuating ambient temperatures will increase and decrease the maximum power flow that the transmission line can carry. Power flows on transmission lines must thus be managed to ensure their temperatures remain within design tolerances.

The maximum power flow capacity on transmission lines is currently determined by Static Line Ratings, or "SLRs." SLRs are usually calculated using conservative assumptions about the transmission-line operating environment, and generally increase or decrease the rated capacity of the line seasonally, taking only average seasonal temperatures into account. SLRs do not account for daily or hourly temperature variations, and do not take advantage of changing or favorable environmental conditions (e.g., wind cooling) that increase maximum power flow capacity.

SLRs will soon be replaced by Ambient Adjusted Ratings or "AARs." Federal Energy Regulatory Commission, or "FERC," Order 881 requires all regional transmission authorities, including ISO New England[2], to implement AARs by 2025. Unlike SLRs, AARs apply to periods of not more than one hour, include up-to-date forecasts of ambient air temperatures across those one-hour periods, and reflect the absence of solar heating during nighttime hours. Because they consider temperature changes over much smaller time scales, AARs assess power flow capacity more accurately than SLRs. AARs do not require installation of equipment to implement but employ algorithms to calculate capacity based on ambient temperatures and time-of-day.

Dynamic Line Ratings or "DLRs," one of the grid enhancing technologies specifically cited in HB 5406, DLRs utilize real-time data collected from sensors that are installed along the length of existing transmission lines. DLRs monitor and report real-time weather conditions and continuously determine capacity ratings with improved accuracy. DLRs also rely on forecasted weather data to develop ratings near-term operations planning and the day-ahead dispatch of

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[1] See U.S. Department of Energy Grid Enhancing Technologies A Case Study on Ratepayer Impact: https://www.energy.gov/sites/default/files/2022-04/Grid%20Enhancing%20Technologies%20-%20A%20Case%20Study%20on%20Ratepayer%20Impact%20-%20February%202022%20CLEAN%20as%20of%20032322.pdf

[2] ISO New England is the independent not-for-profit corporation responsible for regional transmission serving New England, including Connecticut. https://www.iso-ne.com/about

power plants and other generation resources. Because DLR don't rely on conservative weather assumptions, dynamic ratings are often higher than traditional AARs.[3]

An example of DLRs' advantages over SLRs and AARs was documented by National Grid in neighboring Massachusetts. That deployment of DLRs by National Grid resulted in:

- DLRs exceeding Static Rating 94% to 97% of the time, revealing consistent capacity underutilization;
- DLRs yielding a mean (average) increase of 47% in line capacity above SLRs overall; and
- DLRs yielding a mean (average) increase of 31% in transmission line capacity above AARs.

Similarly, a recent implementation of DLRs by Pennsylvania Power and Light (PPL) – now also the parent company of Rhode Island Energy – further validated their effectiveness. Instead of rebuilding or reconductoring two 230-kV lines, PPL spent less than $300,000 installing DLR sensors on the lines. The utility saved approximately $50 million in costs and immediately began saving about $20 million in annual congestion costs. Average capacity ratings increased 18% on one line and 19% on the other, while "emergency" ratings (i.e. specified maximum capacity) on the first line increased about 9% and on by 17% on the second line. Congestion costs in the 2021/22 and 2022/23 winters on one line fell from more than $60 million to about $1.6 million.[4]

DLRs do not only reveal unutilized capacity on existing transmission lines, they also serve as the backbone for two other important grid enhancing technologies: power flow control and topology optimization, which together enable a level of efficient transmission utilization than is currently available.

Power flow control technologies balance the flow of electricity across transmission lines by transferring electricity from one line to another. Imagine, for example, three transmission lines with the same maximum design capacity: one line is operating at 35% capacity, the second 55% capacity, and the third operating above its rated capacity at 105%. Power Flow Control could more evenly redistribute the electricity across all three lines so that allow for the lines are each operating at 65% of their design capacity.

Topology optimization software models the transmission network and power flows across the network to reroute power flow around congested or overloaded transmission elements. By evenly distributing power flows, topology optimization increases the transfer capacity of the grid, and decreases the need to curtail generating resources.

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[3] **Static Line Ratings (SLRs)**: a fixed capacity for transmission lines based on the design parameters of the line and historical data regarding seasonal weather conditions (wind, temperature, etc.) They ignore the fact that due to variables like ambient temperature, the capacity of transmission lines varies all the time.
Ambient Adjusted Ratings (AARs): allow for daily and hourly adjustments to transmission line capacity ratings based on ambient temperatures, but still incorporate assumptions regarding other factors.
Dynamic Line Ratings (DLRs): can support transmission planning in addition to transmission system operation. The distinction regarding DLRs is critical to cost-effectiveness. DLRs use sensors to collect real-time data regarding conductor temperature, the sag of the transmission line, and weather conditions such as air temperature, solar radiation, wind speed and direction, and accurately represent true capacity ratings for lines.

[4] https://www.utilitydive.com/news/transmission-grid-enhancing-technologies-gets-utilities-naruc-ferc-clements/699686/.

In addition to DLRs, power flow control, and topology optimization—the grid enhancing technologies named in the current bill—another advanced transmission technology, high performance conductors (HPCs), have also demonstrated significant potential to increase transmission line capacity in existing rights of way. A study released last month by the Hass School of Business at the University of California, Berkeley, found that HPCs "can cost-effectively double transmission capacity with existing right[s]-of way." [5]

Acadia Center therefore recommends revising Section 1 of current bill to include reconductoring with HPCs. The recommended Section 1 would read as follows:

> Section 1. (Effective from passage) (a) There is established a task force 1 to study transmission infrastructure in the state and the potential use of advanced transmission technologies, including, but not limited to, reconductoring with high performance conductors and the grid enhancing technologies, dynamic line rating, advanced power flow control and topology optimization.

HB 5406 is needed not just because of its emphasis on the efficient use of existing transmission assets, its potential to minimize the need to site new transmission lines, and its purpose in minimizing the cost of building a transmission system with sufficient capacity to meet future demand. Establishing a taskforce to study GETs in Connecticut will serve as an example to ISO New England in support of the role of implementing GETs in the regional clean energy transition, and Connecticut has an opportunity to lead on cutting-edge and much needed technology to upgrade our grid.

HB 5406 is forward looking in its approach to planning the transition system that will be needed to decarbonize the bulk power system. Thank you again for your time and the opportunity to testify in support of HB 5406.

Sincerely,

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[5] https://haas.berkeley.edu/energy-institute/research/abstracts/wp-343/