70 kWh battery energy storage technology development

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The data that support the figures and other findings of the study are available from the corresponding author upon reasonable request given the size of the data sets generated for this research. Input data and sources can be found in the Supplementary Information.

The code used to generate and analyse the data that support the findings of this study are available from the corresponding author upon reasonable request. The CEM model "GenX" used in this research is being prepared for open-source release.

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N.A.S. and J.D.J. conceptualized the study. N.A.S., J.D.J. and A.E. implemented the required model modifications. N.A.S., J.D.J., A.E. and D.S.M. developed the experimental design. N.A.S. and A.E. performed the model evaluations. N.A.S. developed the formal analysis, visualization and investigation, and produced the figures. N.A.S. and J.D.J. drafted and finalized the manuscript. D.S.M. and R.K.L. advised on the analysis and reviewed and revised the manuscript. N.A.S., J.D.J. and D.S.M. responded to reviewer comments and revised the manuscript for re-submission.

N.A.S. and J.D.J. are partners in DeSolve LLC which provides consulting and analytical services for for-profit and non-profit clients, including (within the last 12 months) CorPower Ocean, Westinghouse Electric Corporation, Qvist Consulting Limited, Environmental Defense Fund and Clean Air Task Force. R.K.L. serves on the Scientific Advisory Council of Engie. A.E. works at the Cadmus Group, a strategic and technical consulting firm where she works on clean and renewable energy planning projects for public, non-profit and private sector clients.

Discharge power capacity and charge power capacity are both normalized by the peak demand. The resulting values range between 0% and 100% of peak demand and the hexbins (2D bins) have a width of 2%. The dotted line indicates balanced or symmetrical charge and discharge power capacities and separates the space into two diagonal sub-spaces: the upper diagonal sub-space contains systems with more charge power capacity than discharge power capacity, and the lower diagonal space contains systems with more discharge power

capacity than charge power capacity.

See legend for use of colours. Square, white boxes indicate model outputs. Please see details for the model framework in the methods section. USDOE US Department of Energy, FASTSim Future Automotive Systems Technology Simulator, NREL National Renewable Energy Laboratory, IEA International Energy Agency, SoH State of Health.

These estimates of future demand are linked to an EV driving and charging behavior model for small, mid, and large-size BEVs (battery electric vehicles) and PHEVs (plug-in hybrid electric vehicles) based on daily driving distance distributions for different regions (Supplementary Figs. 4-6). EV use behavior, battery chemistry, and temperature in each region are combined with the latest battery degradation data for NCX14,15,17 and LFP16 chemistries to account for region- and chemistry-specific battery degradation (Supplementary Fig. 7).