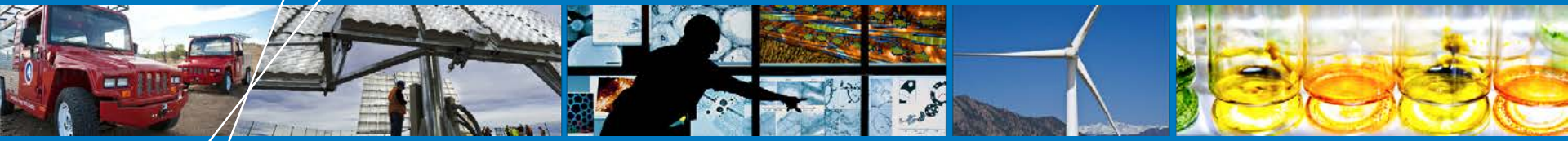
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Solar Plus: A Holistic Approach to Distributed Solar PV

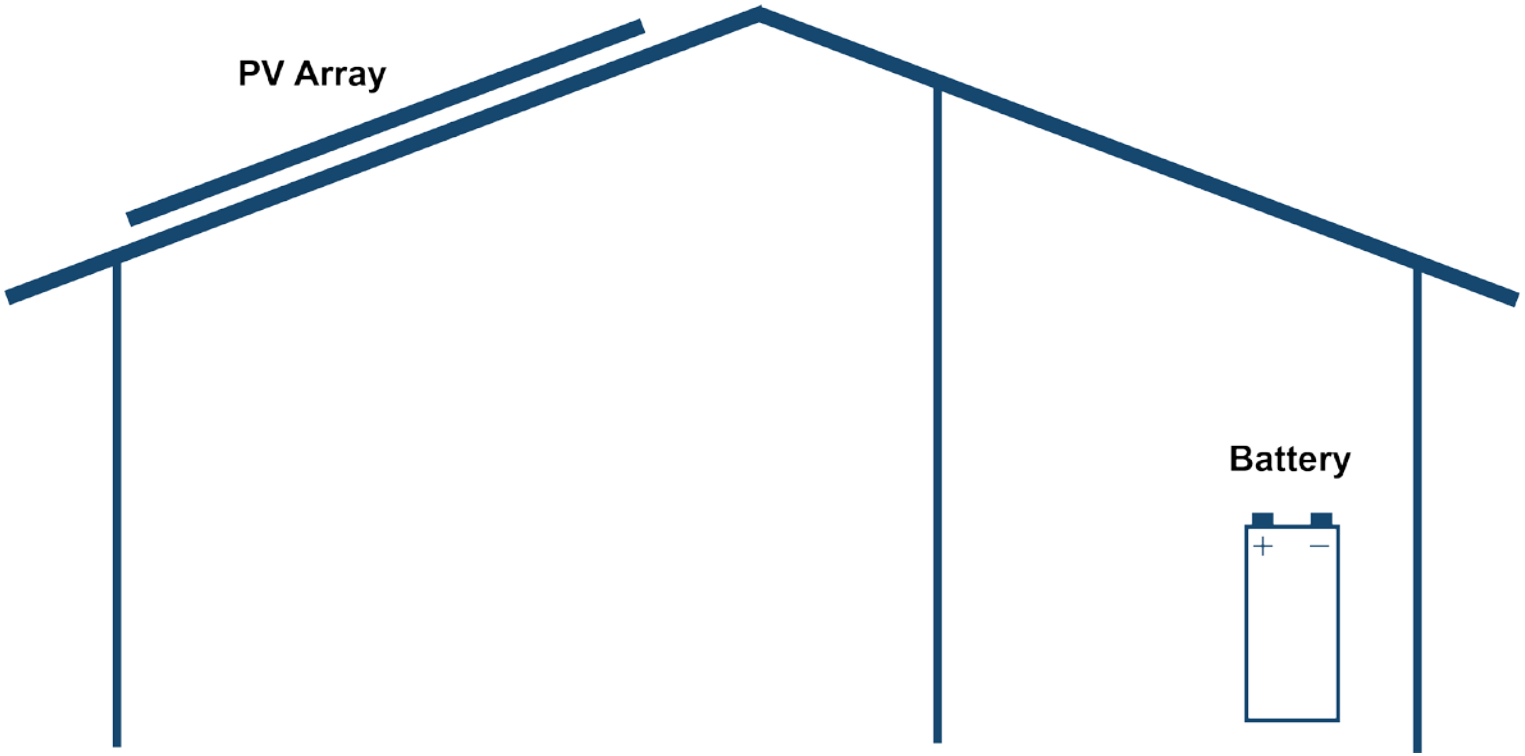


Eric O'Shaughnessy

Presentation for UT Energy Week
Austin, TX 1/29/2018

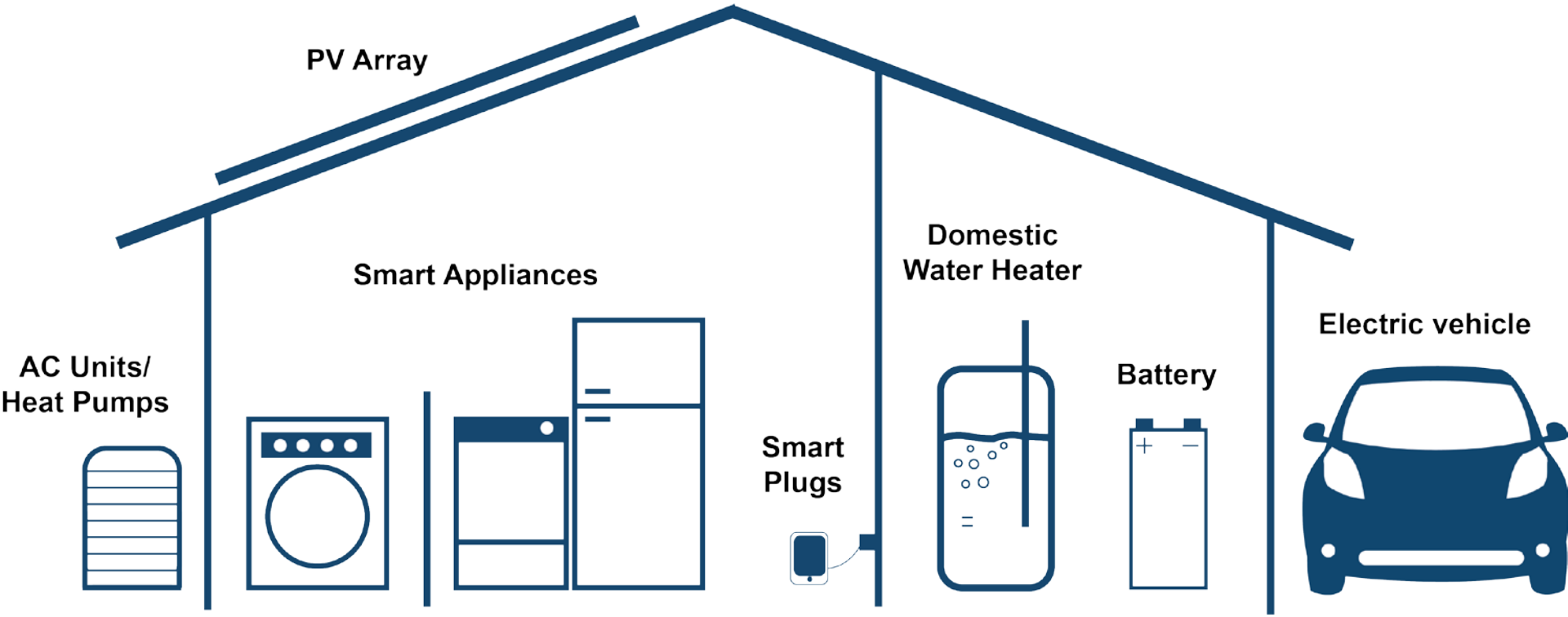
Solar Plus Battery Storage

The potential end-user and grid-level benefits of solar plus battery storage are numerous, but the conversation is much broader than batteries…



Solar Plus

PV system value can be optimized through integration with batteries and various load control devices—an approach we call "solar plus."



Sources: O'Shaughnessy et al. 2017; 2018

How Does Solar Plus Work?

- Solar plus optimizes customer economics through load shifting.
- Solar plus technologies shift customer loads "under" the PV output curve, reducing grid electricity use.
- In time-of-use rate structures, solar plus technologies can also shift grid electricity use from high-rate to low-rate periods.

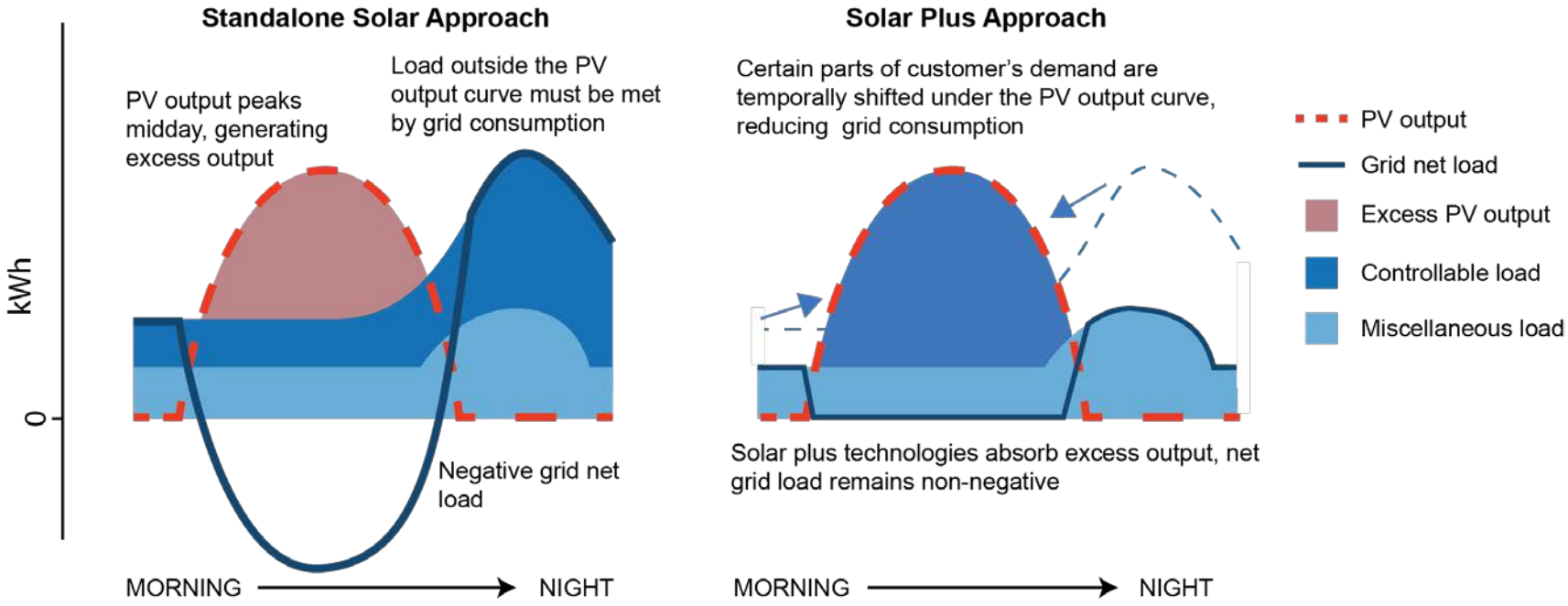
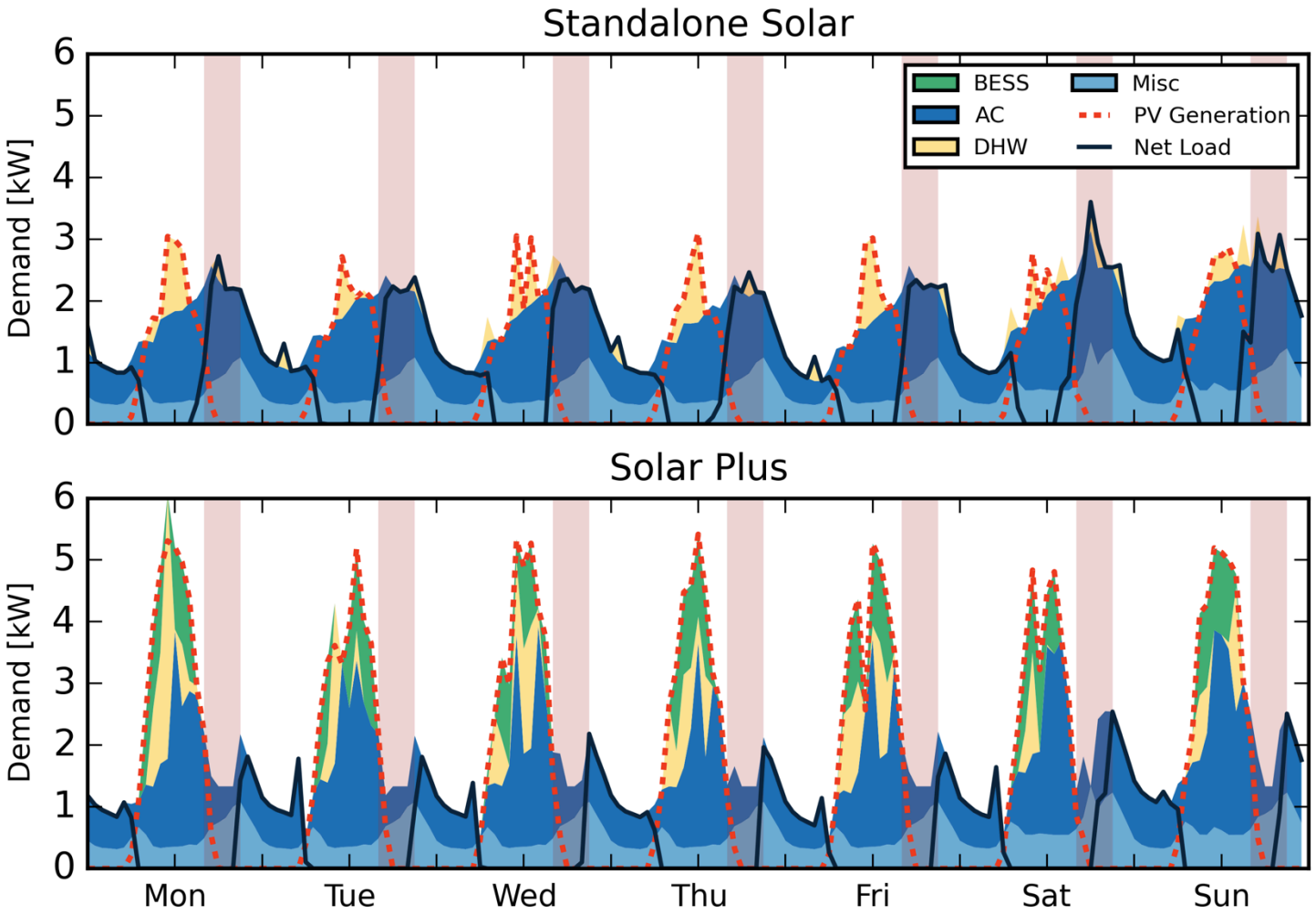


Figure note: "Grid net load" refers to customer load at the meter, the net sum of customer load and PV output. Negative grid net load reflects PV exports to the grid.

Sources: O'Shaughnessy et al. 2017; 2018

Case Study: Hawaii Self-Supply Rate

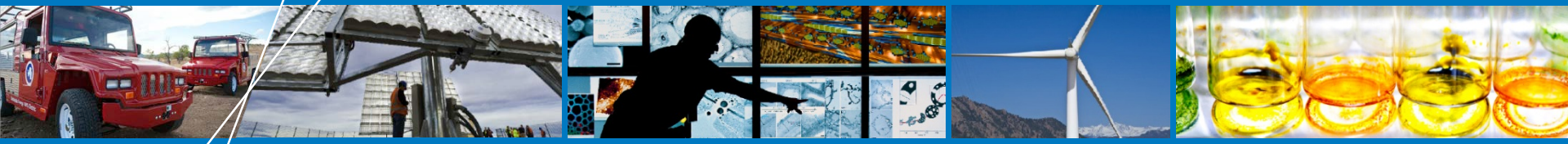


Hawaii PV and Customer Load Profiles under Standalone Solar and Solar Plus Approaches (based on week in August)

TOU peak periods depicted by shaded columns. Figure is output from a simulation of NREL's Renewable Energy Optimization (Reopt) model. See sources for details.

Sources: O'Shaughnessy et al. 2017; 2018

NREL
NATIONAL RENEWABLE ENERGY LABORATORY



Sources:

O'Shaughnessy, E., K. Ardani, D. Cutler, and R. Margolis. 2017. *Solar Plus: A Holistic Approach to Distributed Solar PV.* NREL/TP-6A20-68371.

O'Shaughnessy, E., D. Cutler, K. Ardani, and R. Margolis. 2018. "Solar plus: Optimization of distributed solar PV through battery storage and dispatchable load in residential buildings. *Applied Energy* 213:11-21.

eric.oshaughnessy@nrel.gov