

Adding “Off Grid” Electrical Systems to the Future Electrical Grid Systems



Jackson Norwood, Alfred University, jln3@Alfred.edu



Rooftop solar system.

Outline

- Implementation of “off grid” systems, such as solar panels and batteries
- Impact on the future electrical grid

Introduction

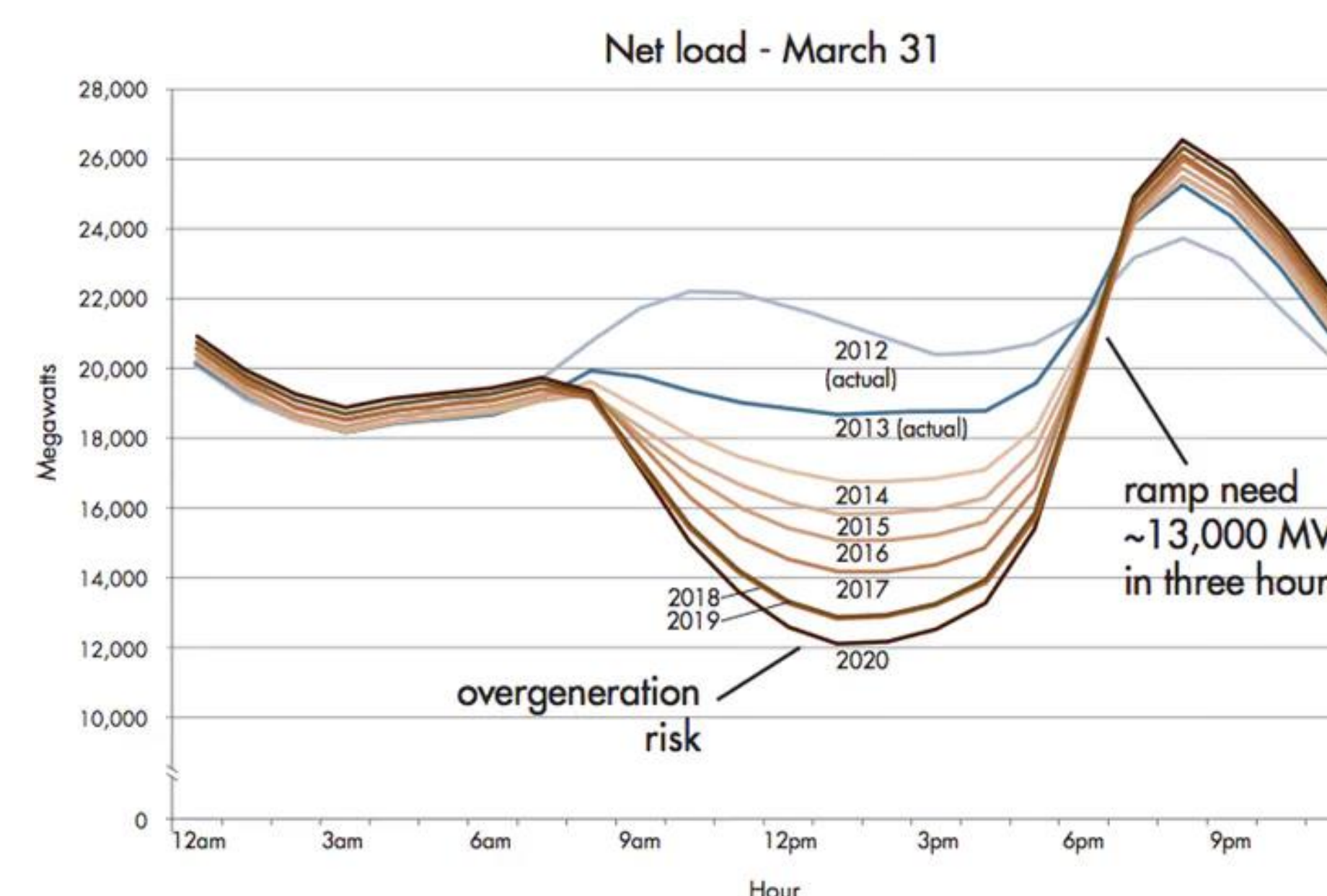
- Residential rooftop solar systems may affect electric grids.
- All power systems should operate within voltage and frequency regulations.
- Large scale battery storage installations may smooth fluctuations.



Large scale battery storage inside of a substation.

Residential Rooftop Solar Systems

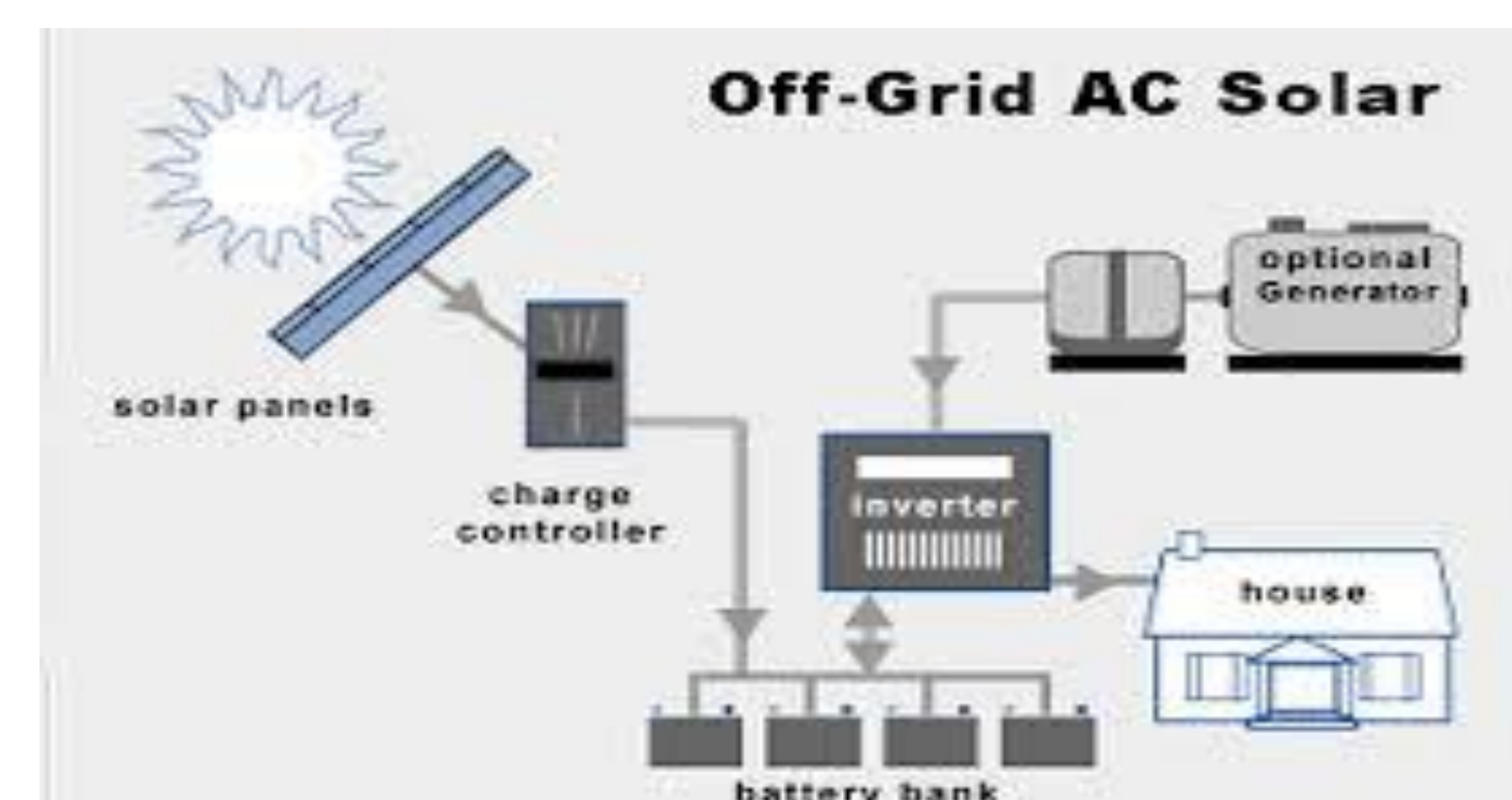
- The systems that are typically installed onto homes are around 6kW.¹ Most systems are “behind the meters.”
- Known as duck curve, the solar harvesting systems may affect grids.²
- If the grid system operators do not “see” demand in the middle of the day, they will have to adjust the productions.²
- Reduction in productions is difficult because solar harvests may be affected by instantaneous solar radiation or weather. With cloud covering a large area, the duck curve will become a camel curve.



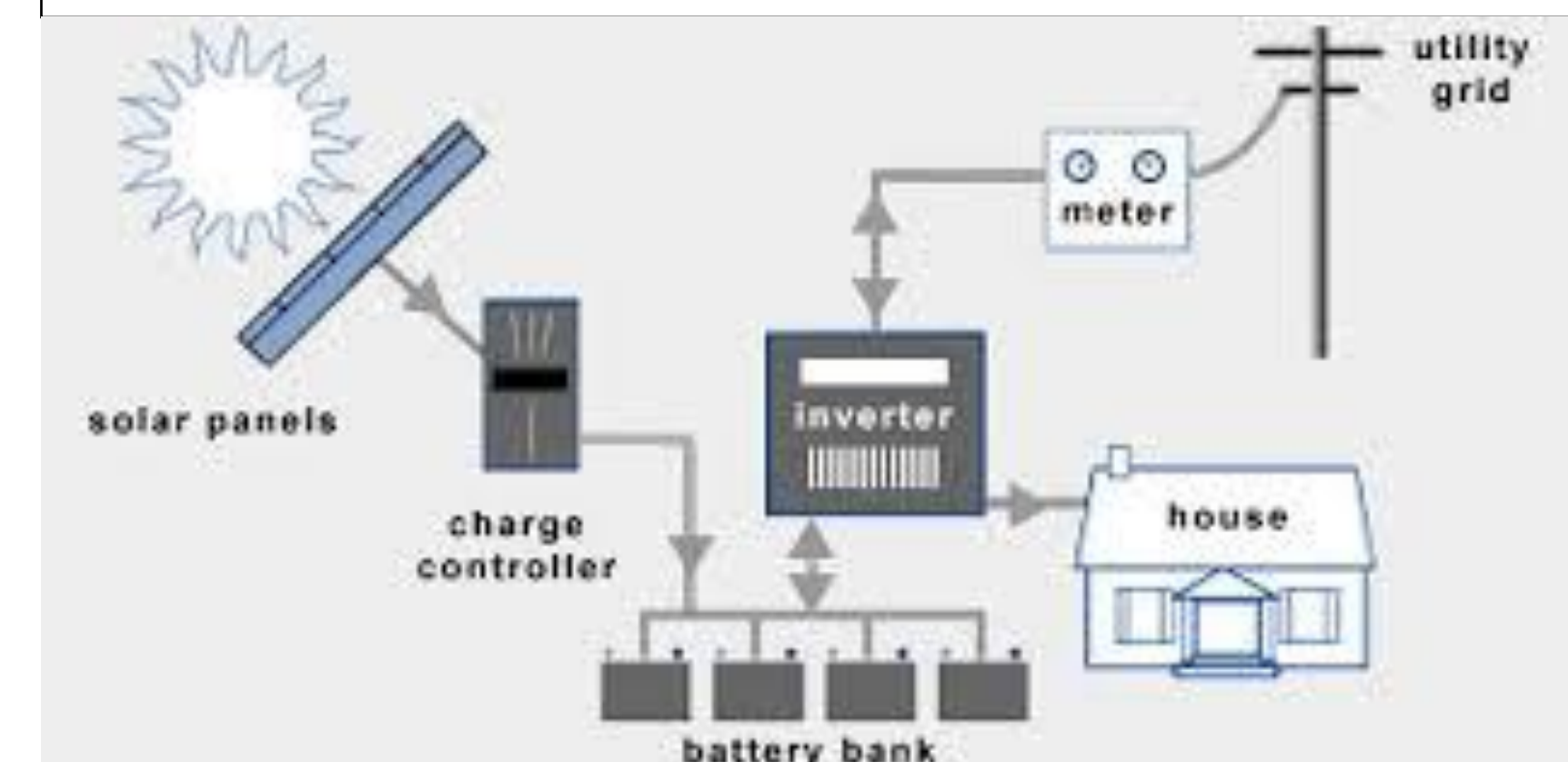
Duck curve, made by the California Independent Systems Operator.²

Battery Storage Systems

- Battery storages and power electronics are combined in modern control systems.³
- These systems can be used to offset voltage variations, correct frequency fluctuations and shave peak loads



Scenario 1 is a true “off grid” system which would alleviate some of the demand which falls on the grid.



Scenario 2 is grid tied system which would allow them to put the solar energy produced back onto the grid or can use its batteries to support the energy production.

References

1. <https://news.energysage.com/average-solar-panel-size-weight/>
2. <https://theconversation.com/why-rooftop-solar-is-disruptive-to-utilities-and-the-grid-39032>
3. <https://www.eia.gov/todayinenergy/detail.php?id=35132>