Dynamic Reserves Implementation & Impacts

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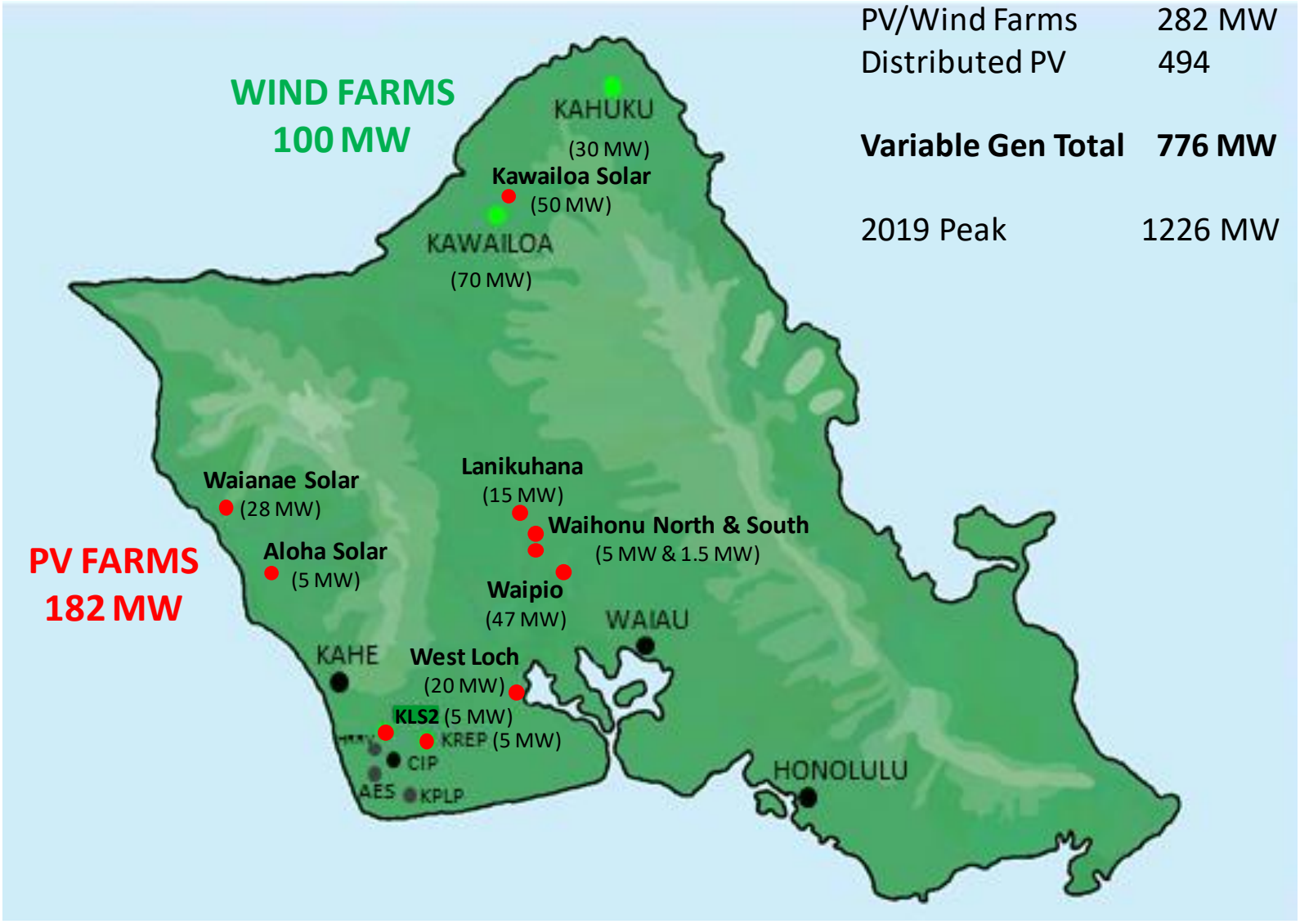
Oahu Variable Generation



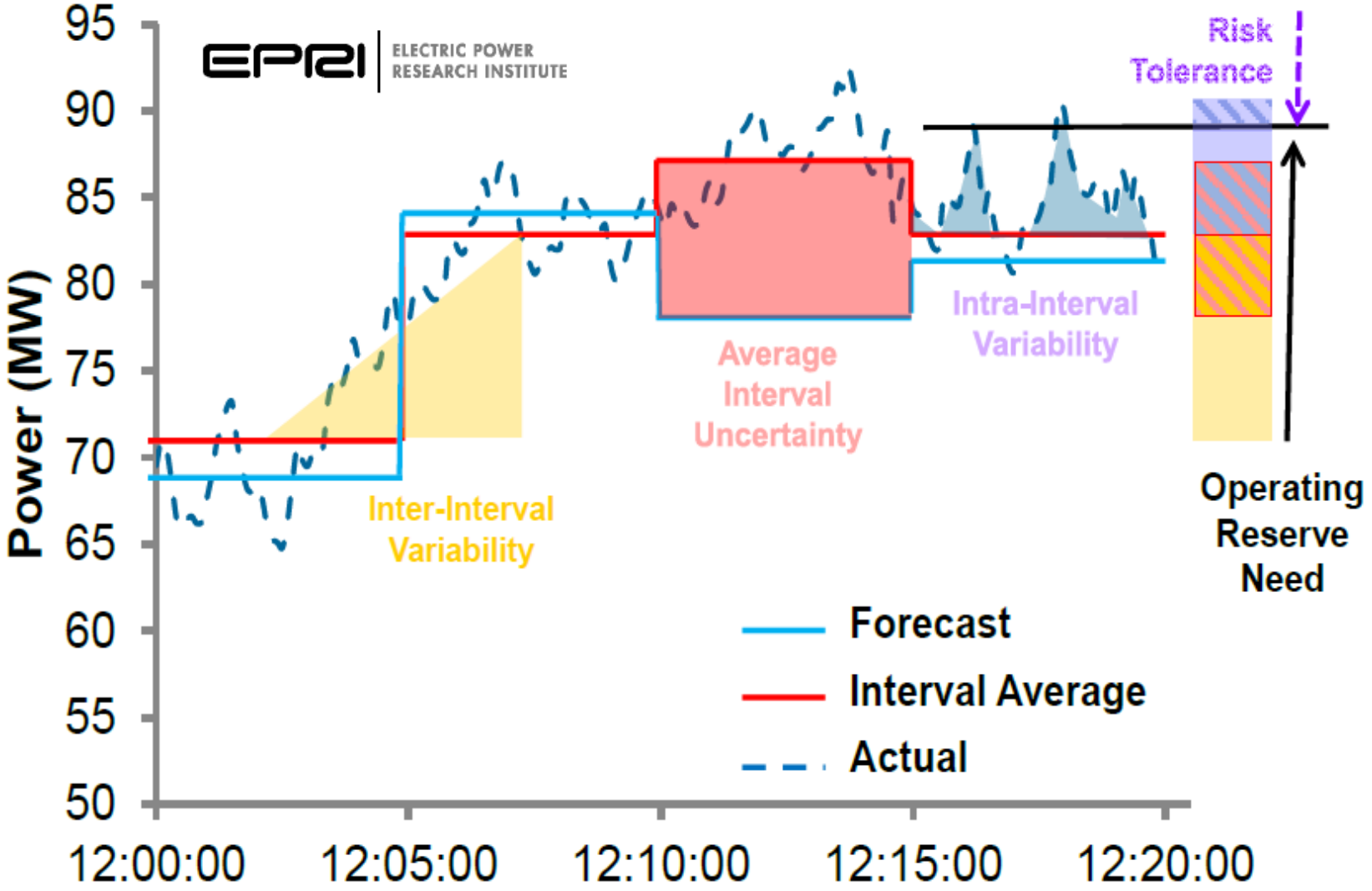
Dynamic Reserves

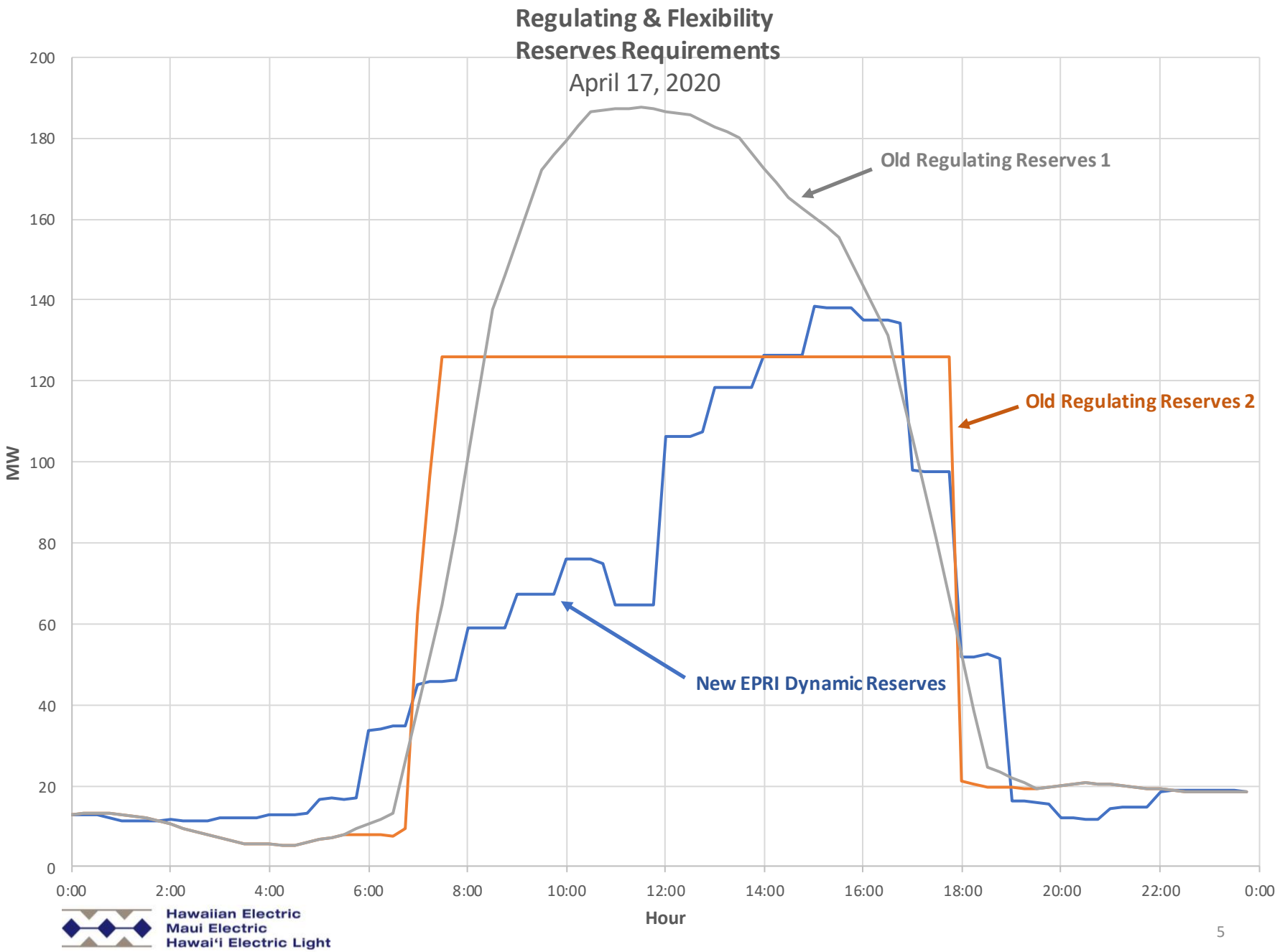
- *PV & Wind -> Variable Resources*
  - *Uncertainty &Variability*

- *EPRI Dynamic Reserves Method (E. Ela)*
  - *Regulating & Flexibility (uncertainty) Reserves*
  - *Considers time, time frame, & system conditions*
  - *Confidence-based reserve estimation based on historic balancing needs & forecasts and current forecasts.*
    - *UL/AWS renewable forecasts*
  - *EPRI DynADOR and NREL/EPRI FESTIV software*

- *Old "Static" Methods*
  - *Historic worst-case variability over large period*
  - *Time (?), time frame, uncertainty, system changes not considered*

Dynamic Reserves - Time Frames





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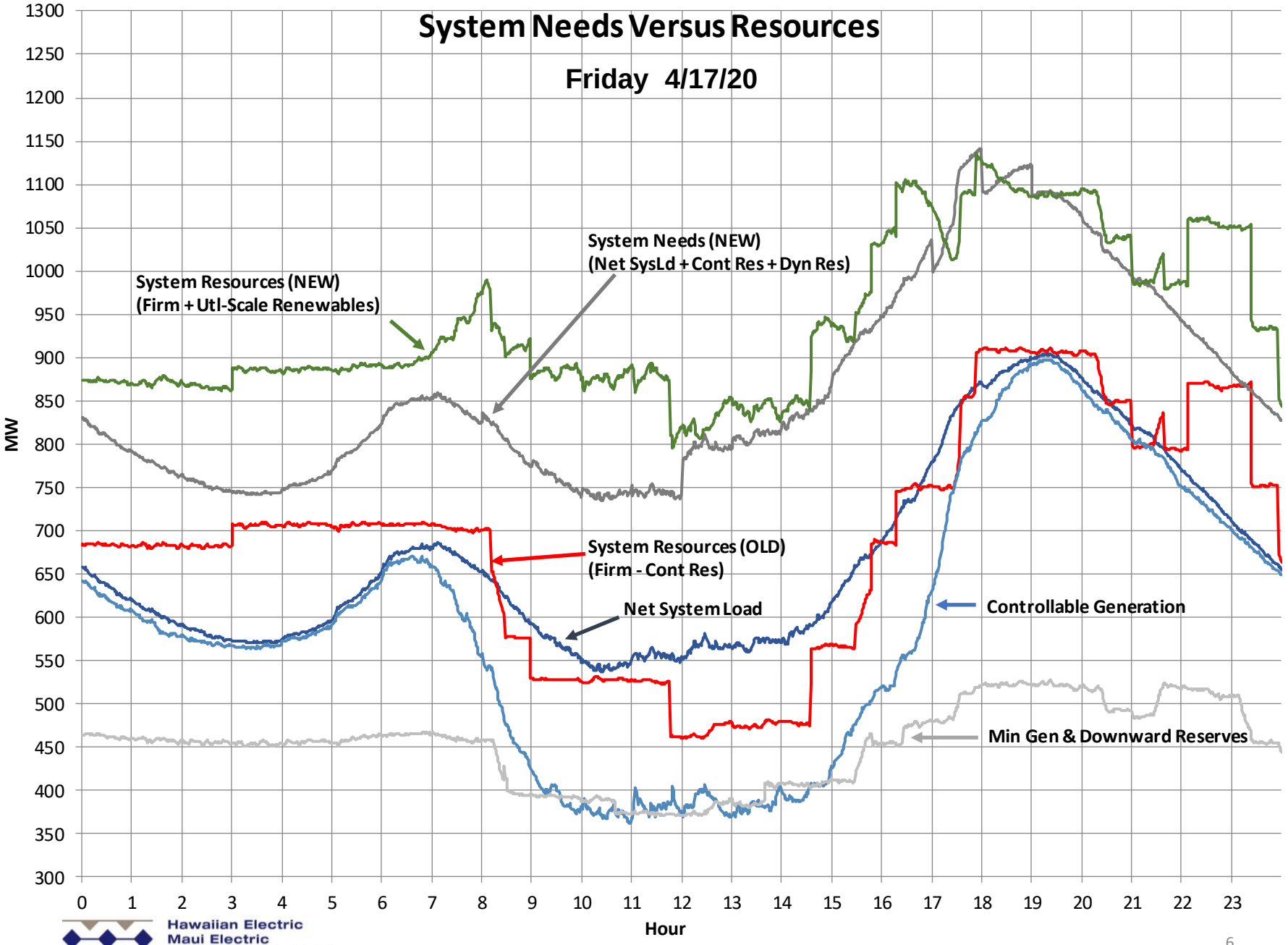

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Dynamic Reserves Impacts

- *Lower Resource Requirements*
  - *Apr-May, 56 of 61 days, old method would require additional online capacity.*
- *Control-Frequency Performance Compliance*
  - *Feb-May, 98.7% (new) versus 99.2% (old), decreased 0.5% (?); within compliance limit of 98.1%.*
- *Curtailment Impact*
  - *April 17, avoided 30 MW curtailment for 5 hours of take-or-pay PV.*

Future Direction

- *DOE FOA 1649, stochastic optimization.*
- *HECO/EPRI project to add renewable plants with storage.*

Questions