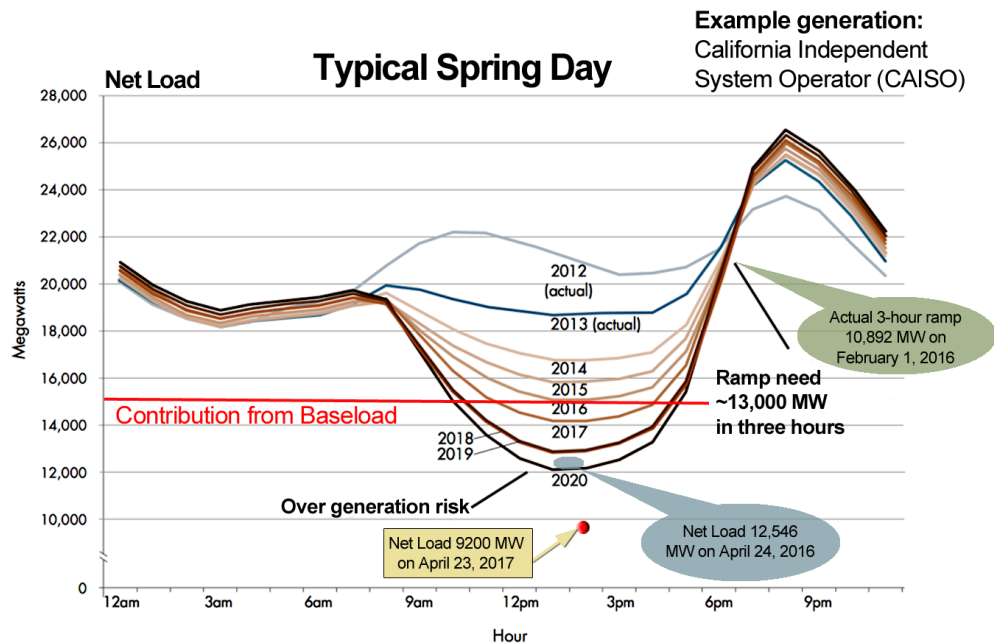




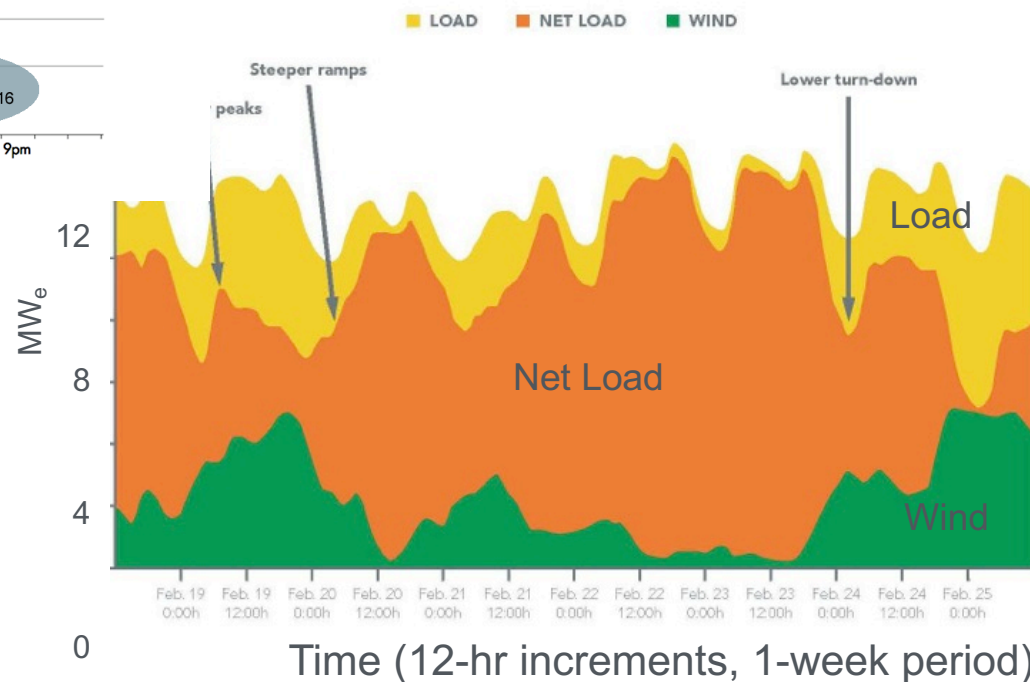
Nuclear Energy University Programs (NEUP) Fiscal Year (FY) 2020

NE-2:
Integrated Energy Systems Design and Modeling

Integrated Energy Systems (IES) - The Issue



Increased penetration of wind and/or solar generation can dramatically change the net demand seen by traditionally baseload plants.



Wind Image Credit:
Cochran, et al. "Grid Integration and the Carrying Capacity of the U.S. Grid to Incorporate Variable Renewable Energy" NREL/TP-6A20-62607

Integrated Energy Systems - The Solution

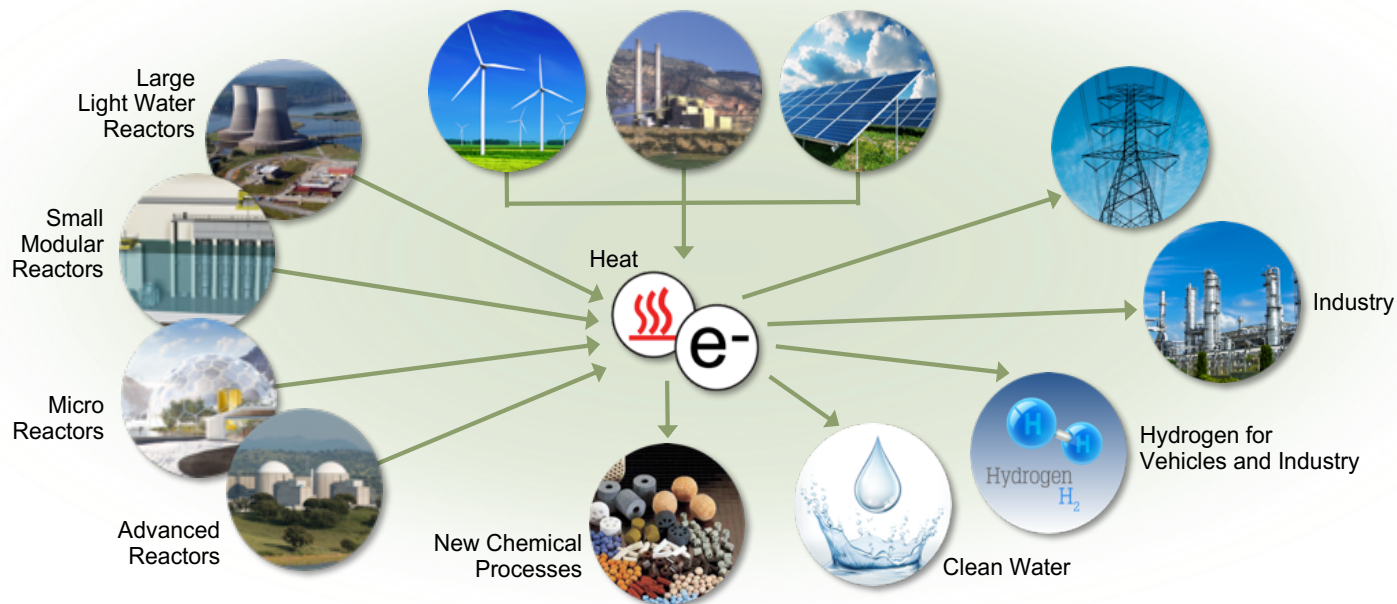
Energy Reimagined

Maximizing energy utilization, generator profitability, and grid reliability and resilience through novel systems integration and process design

Today
Electricity-only focus



Potential Future Energy System
Integrated grid system that leverages contributions from nuclear fission beyond electricity sector



Flexible Generators ❖ Advanced Processes ❖ Revolutionary Design

Water Security Grand Challenge

- A White House initiated, U.S. Department of Energy led framework to advance transformational technology and innovation to meet the global need for safe, secure, and affordable water.

GOALS

- Goal 1: Launch desalination technologies that deliver cost-competitive clean water
- Goal 2: Transform the energy sector's produced water from a waste to a resource
- Goal 3: Achieve near-zero water impact for new thermoelectric power plants, and significantly lower freshwater use intensity within the existing fleet
- Goal 4: Double resource recovery from municipal wastewater
- Goal 5: Develop small, modular energy-water systems for urban, rural, tribal, national security, and disaster response settings
- Link: <https://www.energy.gov/eere/water-security-grand-challenge>

NE-2:

Integrated Energy Systems Design and Modeling

- Interested in proposals that focus on use of nuclear power and Integrated Energy Systems to advance transformational technology and innovation to meet the global need for safe, secure, and affordable water.
- Specific Goals to Consider:
 - Launch desalination technologies that deliver cost-competitive clean water
 - Transform the energy sector's produced water from a waste to a resource
 - Achieve near-zero water impact for new thermoelectric power plants, and significantly lower freshwater use intensity within the existing fleet
 - Develop small, modular energy-water systems for urban, rural, tribal, national security, and disaster response settings

Federal POC – Melissa Bates

National Technical Director – Shannon Bragg-Sitton

- **Example:** Use of a nuclear thermal energy source to purify a large volume of waste water from the petroleum extraction process.
- **DO NOT:** Submit proposals on novel reactor designs.
- **DO:** Submit proposals on novel coupling technologies, system control, and/or optimized operational dispatch to support both water processing and electricity production demands.

- Other things to consider:
 - Cyber-informed engineering should be considered in system design, dispatch optimization, and system control.
 - Computational models should be capable of integrating with the Modelica and RAVEN-based ecosystem for modeling and analysis that is used by the lab team for IES.
 - Systems of interest could be applicable to fixed installations or could be modular and transportable in their design to address the range of applications called out within the Water Security Challenge.
 - Principle investigators are encouraged to investigate the potential markets and market competitiveness of proposed solutions within large-scale centralized grid or islanded micro-grids that may be applicable to SMR or micro-reactor technologies