

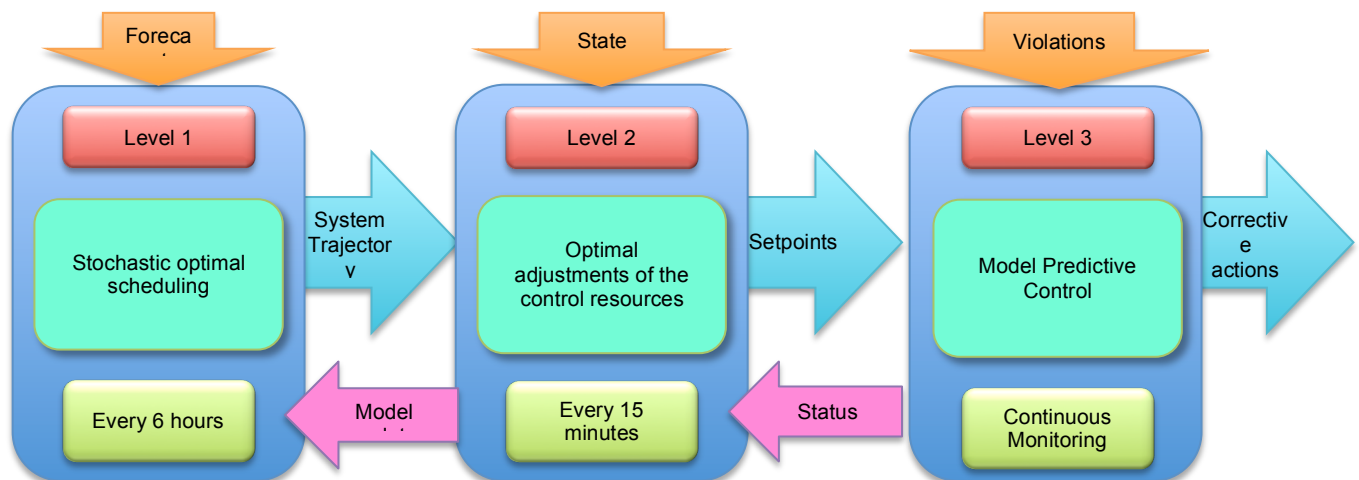
Energy Positioning: Control and Economics

The dominant power system operating paradigm is “supply follows demand”, i.e. consumers are able to change their load at will but generators have to adjust their output correspondingly to maintain stability. While this paradigm has worked extremely well for over a century, two issues make it increasingly difficult to uphold:

- Wind and solar generation are ill suited to following the load.
- Renewable energy resources are usually located far from the load centers. This creates congestion in the network and increases the risk of cascading outages.

We believe that these two issues must be considered together because coordinated control of well-positioned and properly sized storage facilities and demand response schemes (distributed energy control resources) would not only facilitate the large-scale integration of renewable generation but would also significantly reduce the need for transmission expansion and would improve system reliability. These additional benefits could tip the balance when considering the economic case for widespread deployment of storage and fast-acting load control.

This project will develop the control technologies needed to establish an “energy positioning” operating paradigm: Excess production from renewable energy sources is either consumed directly by flexible loads or directed to the storage facilities where it is best pre-positioned for later use. Following a contingency, control on a faster timescale reallocates the distributed stored energy and the flexible demands to alleviate overloads and stabilize the system.



This project addresses the Control Architecture primary technical target described in the GENI FOA. This new way of operating the grid will contribute to ARPA-E’s mission in the following way:

- Increase in the utilization factor of the transmission grid, which will reduce the need for building new transmission line
- Reduction in the proportion of spilled renewable energy
- Reduction in power system operating cost and improvement in electricity reliability, which will enhance industrial competitiveness and improve quality of life.