eGrid: CAISO's Vision for California's Smart Grid

California ISO
Your Link to Power

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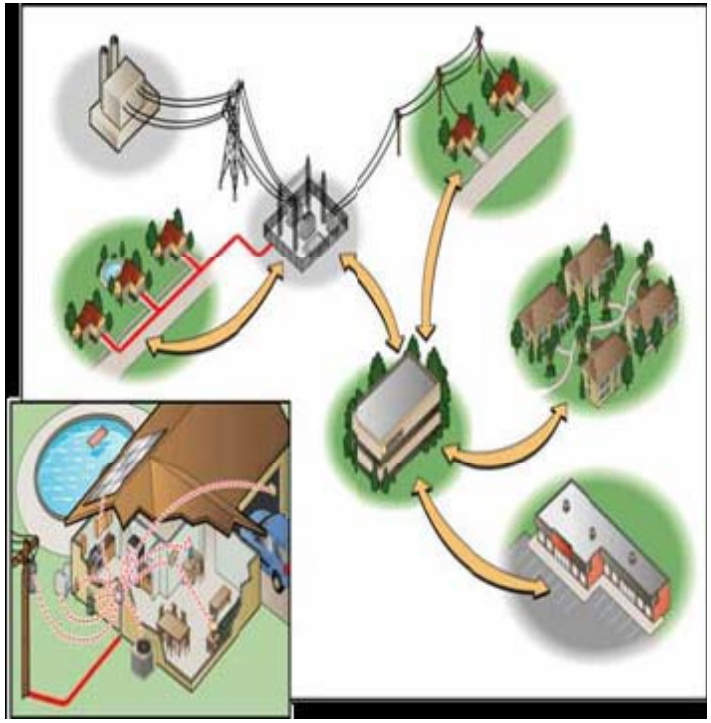
What the Smart Grid Is

Makes use of communications, computing & power electronics to create a system that is:

- *Self-Healing* and *Adaptive*
- *Interactive* with consumers and markets
- *Optimized* to make best use of resources and equipment
- *Predictive* rather than reactive, to prevent emergencies
- *Distributed* across geographical and organizational boundaries
- *Integrated*, merging monitoring, control, protection, maintenance, EMS, DMS, marketing, and IT
- *More Secure* from attack

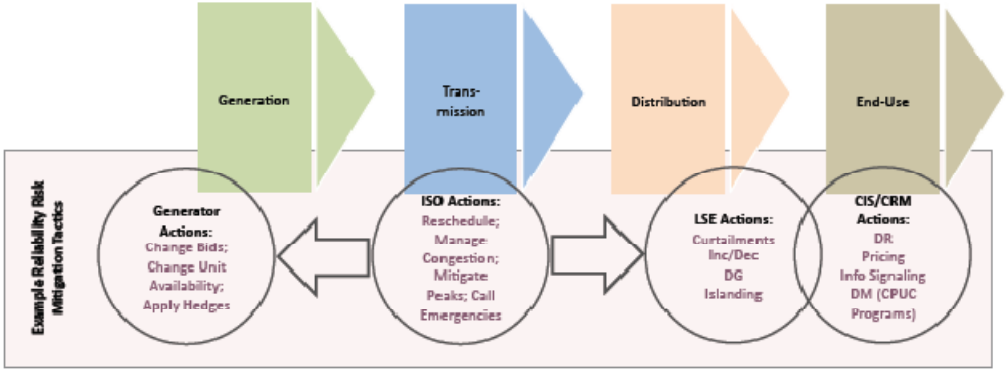


What the Smart Grid Is Not

- It is not really very smart (in its early versions)
  - While it can facilitate improved outcomes, its inherent intelligence will very limited
- It is not “self-operating” or “self-dispatching”
  - While it can provide rapid response to (and prediction of) outages, it does not automatically schedule its resources
- It is not “self-optimizing”
  - While it is “Optimized” (by definition), it does not achieve that condition by itself
- It is not “self-planning”
  - The intelligence in the Smart Grid is focused on improved operations, but does little to address “holistic planning”
- It is not just AMI

The End-to-End Energy Supply Chain (ESC)

- Traditional supply chain management focuses on reducing end-to-end variability to reduce costs and improve operating efficiency and/or productivity.
- For electric power, ESC variability reduction (i.e., ensuring system reliability) emanates in principle from the point of use, driving reliability requirements all the way upstream. In practice, variability reduction is driven from the point of end use *and by the transmission intermediary* (the ISO).
  - For Load Serving Entities that deliver power to the point of end use, variability management focuses on ensuring distribution grid-level reliability and customer comfort during "reliability events."
  - For the ISO, variability management involves managing sources of upstream variability (emanating from power suppliers and wholesale markets) and downstream variability (emanating from the LSE's management of customer service quality, first and foremo



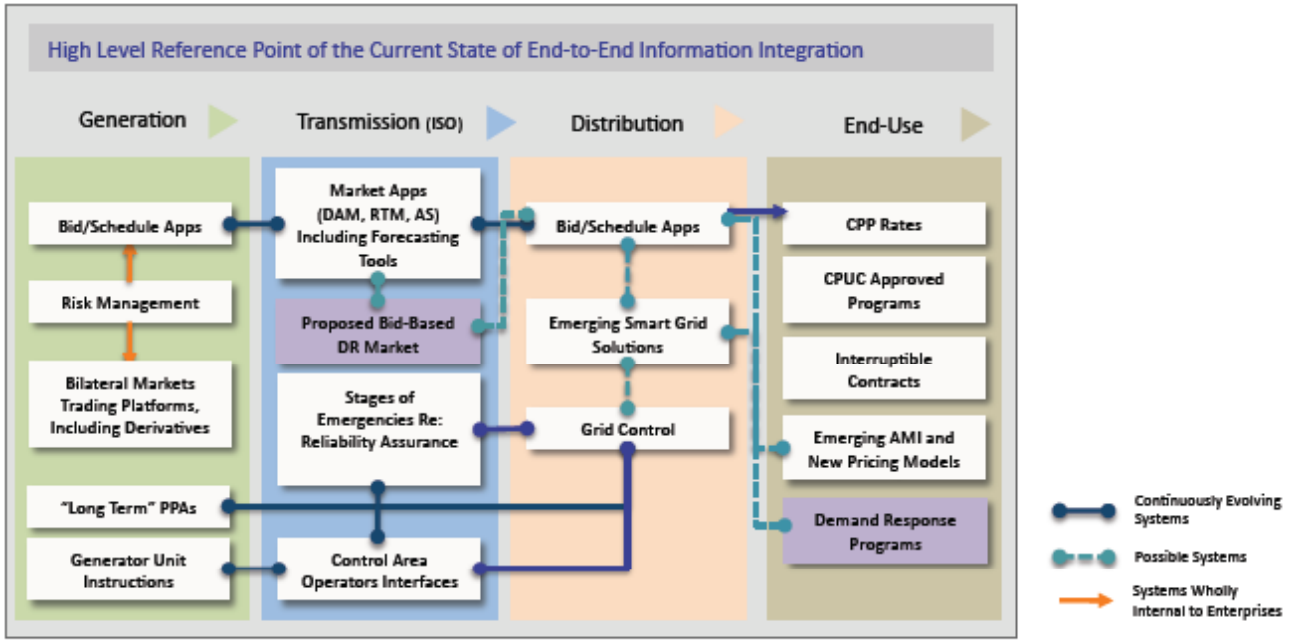
Reliability Assurance

- System reliability assurance is a two-tiered function:
  - LSE-level reliability focuses on customer quality assurance and is not wholly dependent on regional grid reliability
  - Regional grid reliability focuses on maximizing network uptime conforming to national reliability standards

- Smart Grid programs merit consideration in light of this. There are three central issues:
  - Information integration
  - Coordination of planning and forecasting
  - Effects of deploying new technologies

Information Integration

Below is a illustrative high-level map of the types of information and associated systems that are involved in end-to-end reliability assurance. Maximizing the potential of Demand Response (as well as Renewables and Storage) may depend on the information that will become available as a result of Smart Grid deployments. Furthermore, if such an integrated information infrastructure were to evolve, end-to-end variability might be minimized through new collaborative planning tools.



Effects of Deploying New Technology

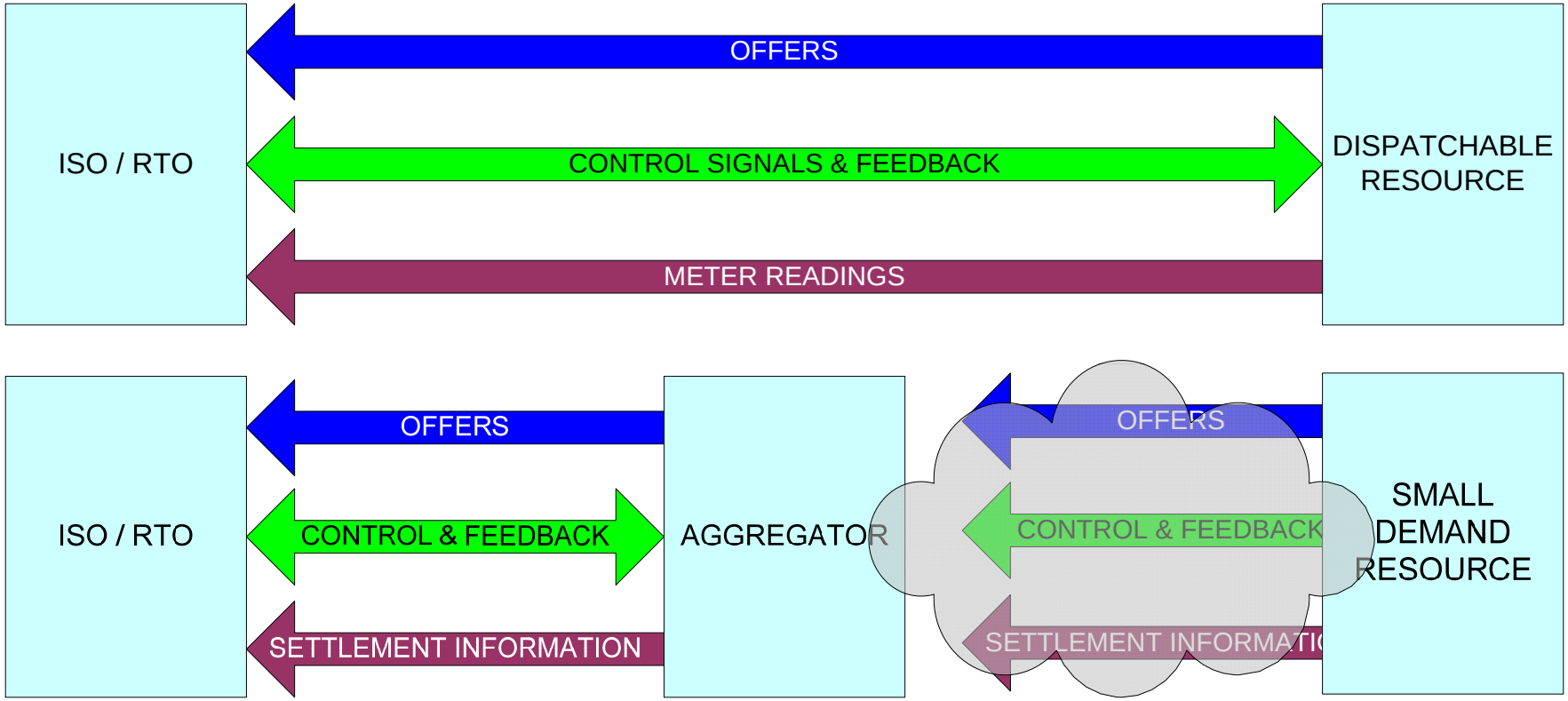
- Achieving maximum resource volume and reasonable costs hinges in large part on the deployment of new assets; specifically, AMI and Smart Grid solutions.
- Other technologies play important roles as well, but tend to be acquired by end users and often are not linked to utility infrastructures, e.g.:
  - Advanced building control systems
  - Onsite backup power systems
  - Passive solar and rooftop wind generators
- An end-to-end Smart Grid planning process that integrates assets and information along the supply chain may contribute to a more systematic specification of products, in turn resulting in maximum resource participation in both ISO-level and LSE-level reliability assurance.

An Example: Types of DR Functionality

	Response Initiation	Control Signal	Response Signal	Location Known
Autonomous	**Resource**			
Resource-Initiated	**Resource**	✓		
Bulk-Dispatched	**ISO/RTO**	✓		
Precision-Dispatched	**ISO/RTO**	✓	✓	✓

Note: Individual devices may possess more than one type of DR functionality

An Example: Communication Basics



PRE-DISPATCH

REAL-TIME

POST-DISPATCH

Conclusions

- The current vision of the Smart Grid is a beginning:
  - AMI is just a start
  - An end-to-end view of the Energy Supply Chain is critical to maximizing the value of the Smart Grid
  - Opportunities exist for innovative information and communication technologies that will take the Smart Grid to the next level of intelligence
- The Smart Grid can facilitate improved reliability and improved market outcomes for California electricity consumers
- The Smart Grid can be a key enabler of Demand Response, Renewables, Storage, and other energy technologies of the future
- Integration of information from the Smart Grid and establishment of a holistic grid planning process will be critical success factors