

Higher Renewables Portfolio Standards (RPS), Markets and Grid Reliability

Can Restructured (a.k.a. “Deregulated”) Electricity Markets Achieve High Renewable Percentages of Total MWh While Keeping the Lights On?

Harold Ray, Retired Executive Vice President, Southern California Edison
October 29, 2014

- California PUC “Yellow Book” – “Perspectives on the Past, Strategies for the Future” – February 3, 1993
- California Assembly Bill 1890 – Restructured the electric industry in the state – September 23, 1996
- California electricity crisis – 2000/2001 – PG&E declares bankruptcy
- Gov. Gray Davis recalled – October 7, 2003

A decade later in California:

- More complex market mechanisms have been established to limit the exercise of market power and to address local area reliability and overgeneration
- Experience has shown how to keep the lights on using these mechanisms with non-dispatchable, intermittent, must-take resources (a.k.a., “renewables”) contributing 20 – 25% of annual GWh
- Modest renewables curtailment required when renewables contribute up to 33% of annual GWh and further curtailment of conventional generation is not possible
- Maximum expected overgeneration: 6,300 MW; 99th percentile: 610 MW

But, can existing market mechanisms keep the lights on when:

- Renewables contribute 40-50% of annual GWh?
- 40% Maximum overgeneration: 14,000 MW; 99th percentile: 5,600 MW
- 50% Maximum overgeneration: 25,000 MW; 99th percentile: 15,000 MW

In addition to curtailment of renewables, there is a major impact on conventional generation. For example, in the 50% renewables case:

- 35% of CCGTs and 20% of CTs only start once per week
- 10% of CCGTs and 35% of CTs start once per day, or more
- Overgeneration increases steeply between hours 0700 and 1300
- Overgeneration decreases more steeply between hours 1400 and 1700

Variable Value of Generation

Value of both renewable and conventional generation highly variable, depending on location, ramp-rate, etc.

- Value of MWh depends on transmission cost to deliver to load
- Value of dispatchability depends on location, relative to load and to area of over/under generation at any point in time (includes storage)
- Area value of capacity depends on level of imports to an area

When using competitive markets, total cost must equal long-term value of both the commodity and the value of the resources required to deliver the commodity under all foreseeable circumstances.

Wholesale markets regulated by the FERC; retail markets regulated by the States. Consumers generally pay much more, or much less, than the cost to serve their class.

California crisis, why?

A major cause of the 2000/2001 California electricity crisis was the exercise of market power for the commodity. A lesser cause was the exercise of market power in providing Local Area Reliability.

The excessive exercise of market power for the commodity and other grid services can only be minimized by long term contracts (power purchase agreements). But, what credit-worthy entity should be responsible for these contracts?

- Grid operator?
- Load-serving entities/regulated investor-owned or municipal utilities?
- Wholesale commodity consumers?

Sustainable Energy for Global Cities

- **Fact:** Increasing level of renewable generation requires increased resource integration planning and execution to achieve both reliability and avoid excessive exercise of market power.
- **Consequence:** Development and achievement of public policy goals for increased use of renewable sources will require continued evolution of market structures at both the Federal and State levels.