GRID with Intelligent Periphery

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Summary

- Electric Power Grid with 40% renewable energy (80% capacity) will require change in current operations.
- At least 50% of renewables will be located in distributed power, demand, storage in the periphery, which is invisible to grid operators.
- An Intelligent Periphery must be designed with dense sensing, coordination and control.

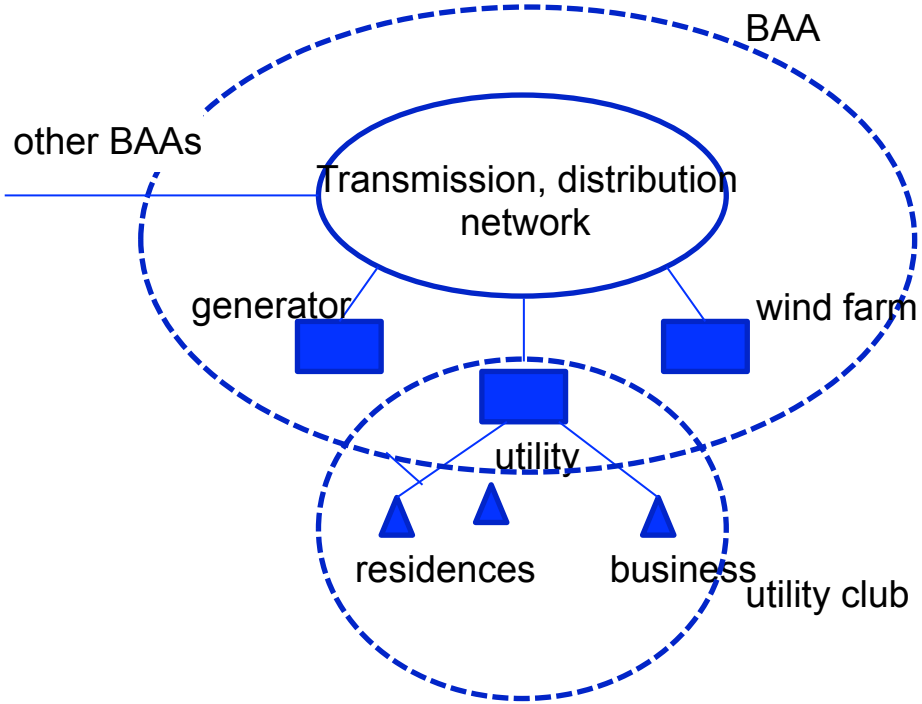
Dilemma facing California ISO

- With 50GW peak power in 2000-10, CAISO purchases 2.5GW of reserves.
- CAISO regards 6+-hour wind forecast as uncertain.
- With 30% renewable energy in 2020, CAISO will need 15-20GW of reserves. This seems economically unaffordable.

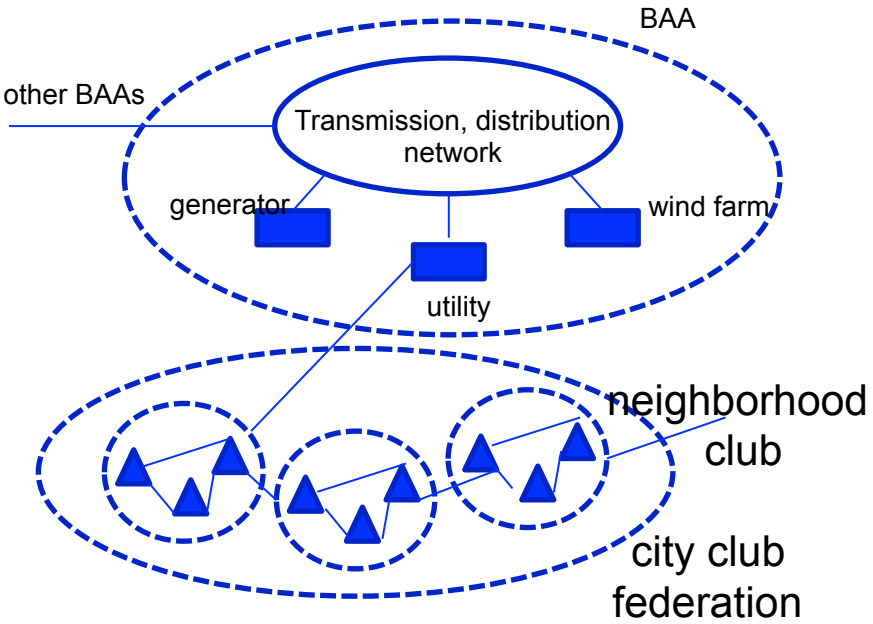
Where will renewables be located

- At least 50% of renewables will be in ‘periphery’ or distribution system. CAISO has no knowledge of these.
- Periphery will also have distributed storage, deferrable demand.
- Together these amount to 100,000 to 1,000,000 ‘nodes’
- It may be much better to move a lot of control authority to periphery, changing GRID to GRIP – Grid with Intelligent Periphery.

Grid2010 vs GridIP



Grid2010



GridIP

Benefits of GRIP

- Increased utilization of distribution network
- Reduced need for transmission capacity to accommodate new variable generation (wind, solar)
- Reduced need for additional reserves to accommodate renewables
- Increased capacity to produce new Ancillary Services in IP
- Market opportunities for coordination and control of Intelligent Periphery

Challenges

- Coarse economic analysis of social benefits of GridIP
- If these social benefits are significant, what kinds of regulatory changes are needed to monetize the benefits
- What kinds of sensing-control-coordination technologies and enterprises are needed to build the Intelligent Periphery
- How different is the role of renewable energy in France vs US