CHP – A Foundation for Microgrids

Implications of CHP Deployment for Microgrid Implementation in California

J. David Erickson

California Energy Commission CHP Workshop

July 14, 2014

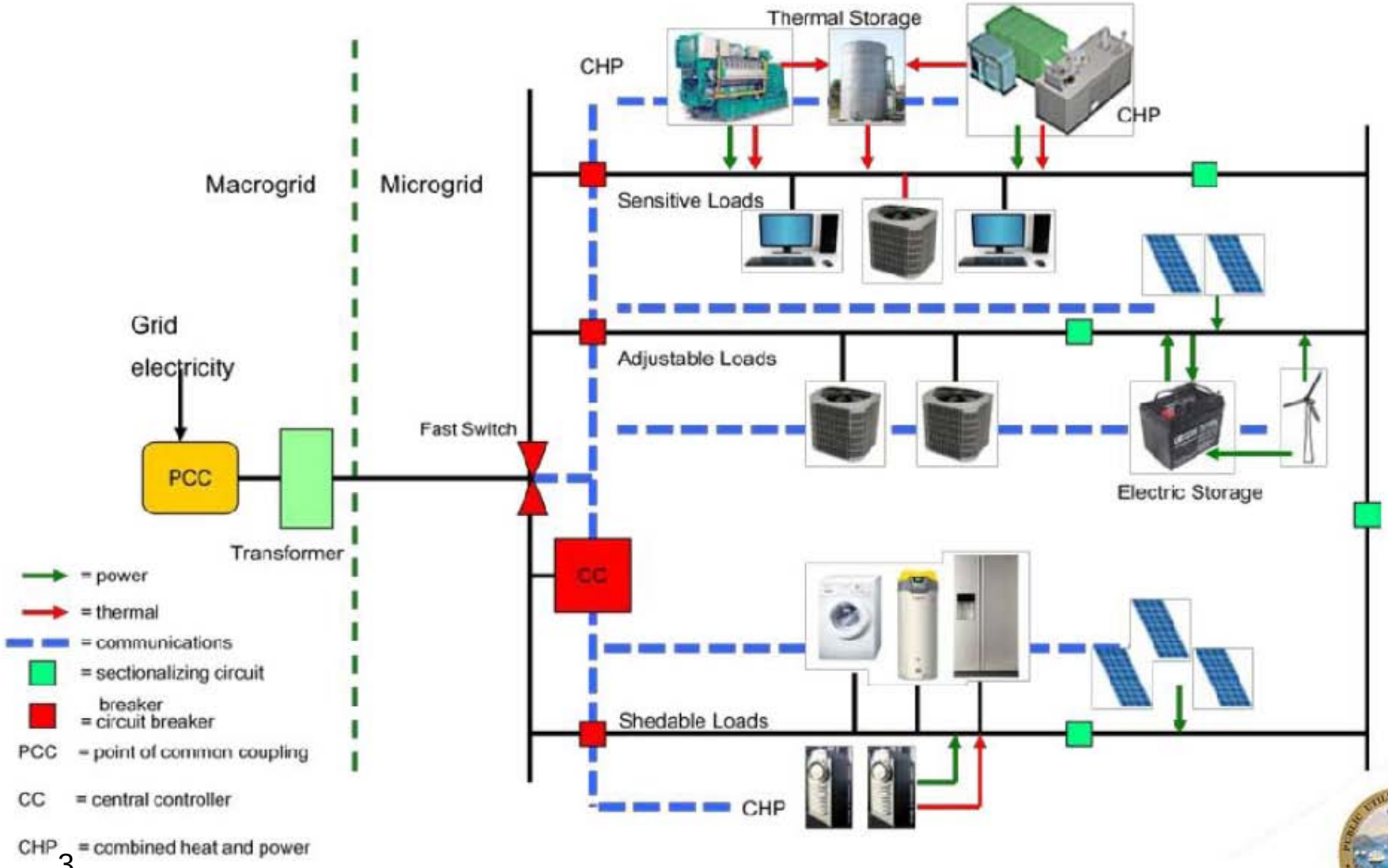
What is a Microgrid?

A small, integrated energy system of interconnected loads and distributed energy resources (producing electric [or], both electric and thermal energy), which can operate in parallel with the grid or in an intentional island mode.

-NYSERDA microgrid whitepaper (Sept. 2010)

And appearing to the grid as a multi-function resource.

The Advanced Microgrid



From Microgrids: An Assessment of the Value, Opportunities and Barriers to Deployment in New York State; NYSERDA; September 2010

Claimed Microgrid Benefits

- Energy Cost Reductions
  - Reduced purchases of grid power and transmission services
  - Reduced purchases of fuel for onsite thermal demand
  - Reduced resource interconnection cost
  - Additional value stream creation
  - Potentially greater customer participation in DR
  - Deferred T&D capacity investments
- Reliability and Power Quality Improvements
- Greater integration of renewables - reduced carbon and other emissions
- Greater security and safety during macrogrid outages – safe haven
- Grid Modernization - Move toward decentralized grid architecture and reduced reliance on utility scale resources

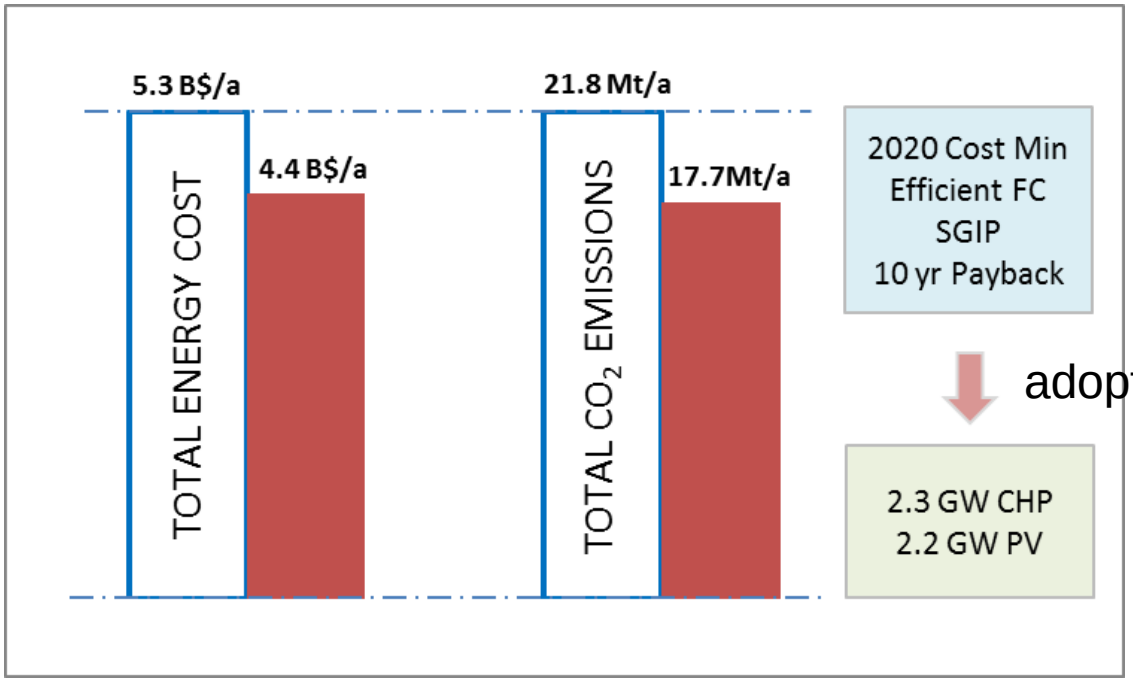
CHP and Microgrids

Investigating the feasibility of CHP in mid-sized commercial buildings in California

(Encouraging Combined Heat and Power in California Buildings –Task 2.8)

Universe: 2790 *simulated* buildings - 12 buildings types, 3 building sizes, 12 climate zones (no consideration of site specific details and microgrid conditions as by the ”Microgrid-ing” on the next slide)

Sample: Electric peak load between 100 kW and 5MW – no “misc” buildings. Approx. 35% of total consumption in CA (138 Bldg. Types)



- Significant economic and environmental benefits can be extracted from the efficient use of CHP
- CHP can be leveraged with renewable energy and storage technologies

CHP – The DER-CAM Modeling Tool

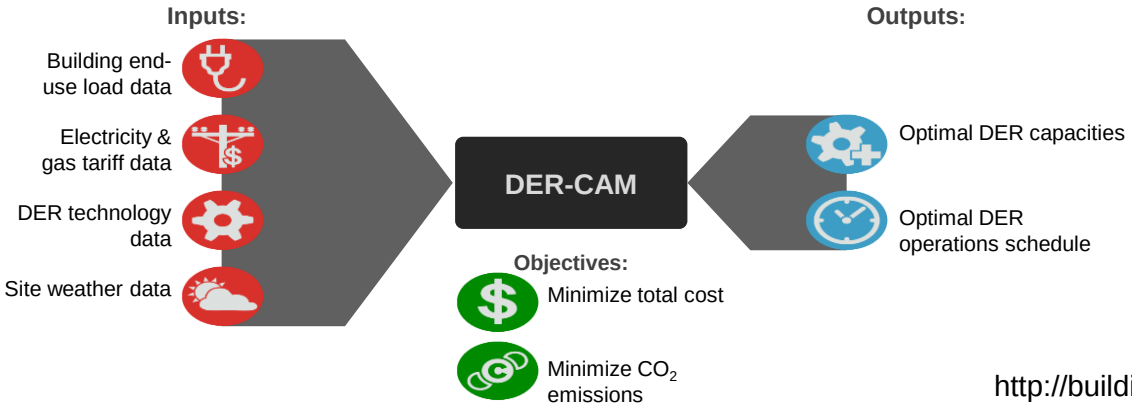
DER-CAM is an optimization tool, aimed at finding optimal *capacity* and *dispatch* of DER to minimize costs and/or CO_2 emissions in building microgrids.

The optimization problem is solved using (stochastic) mixed integer linear programming. DER-CAM considers a wide range of technologies and energy management strategies to optimize CHP in microgrids. Among these are photovoltaic and solar thermal panels, micro-turbines, energy storage, demand response, load prioritization and electric vehicles.

Two main branches of DER-CAM: Investment & Planning, and Operations DER-CAM

Investment & Planning uses historic or simulated hourly load data and considers up to 20 years to find optimal investment decisions and dispatch of representative day types.

Operations DER-CAM uses weather forecasts and recent load data to forecast loads on a week-ahead basis and finds optimal dispatch for existing DER in a 5 min to 1 hour time step, easily integrated with existing microgrid controllers and SCADA systems.



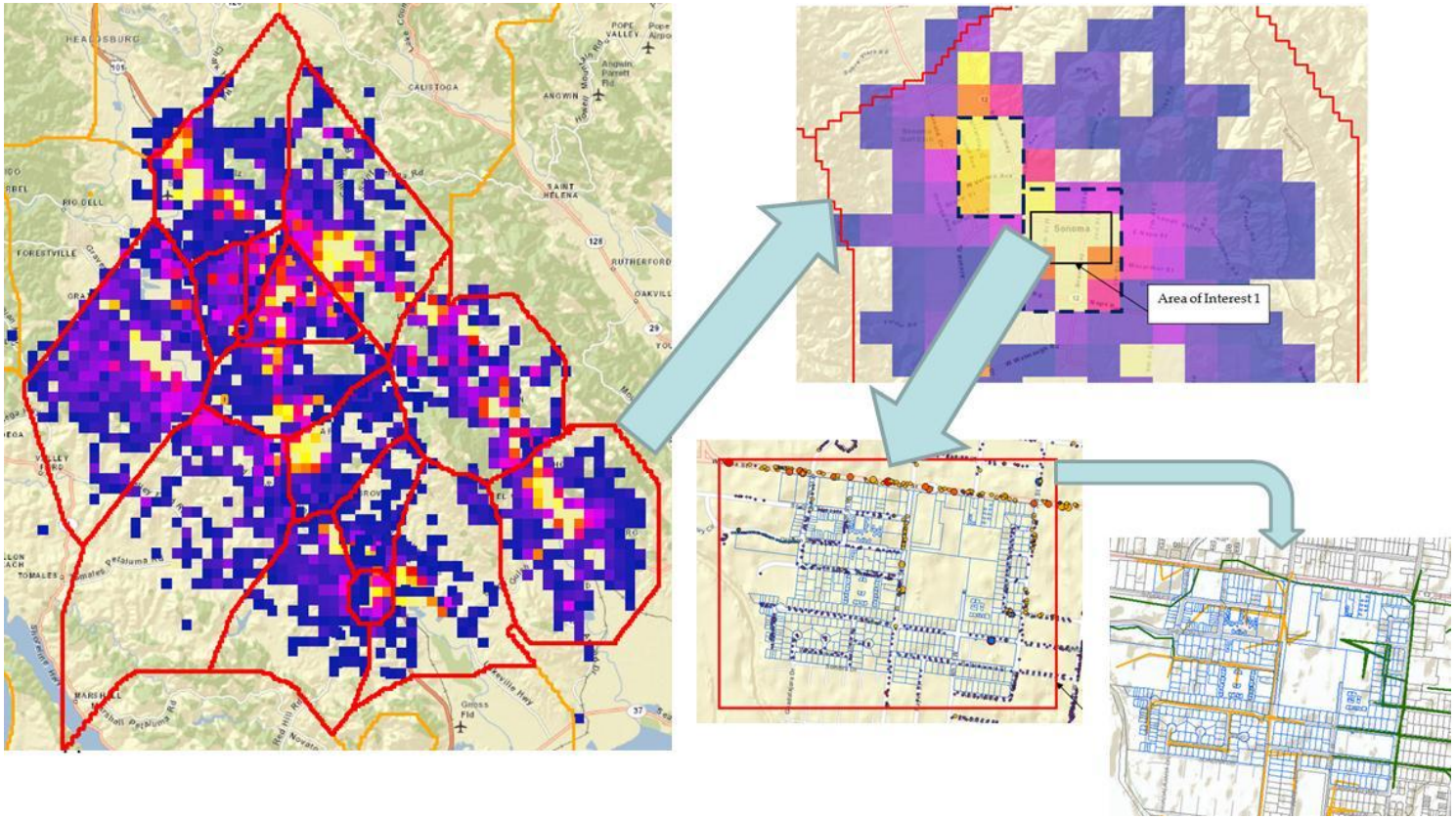
http://building-microgrid.lbl.gov

Microgrid Siting

Microgrid friendliness?

Need for Siting Methodology

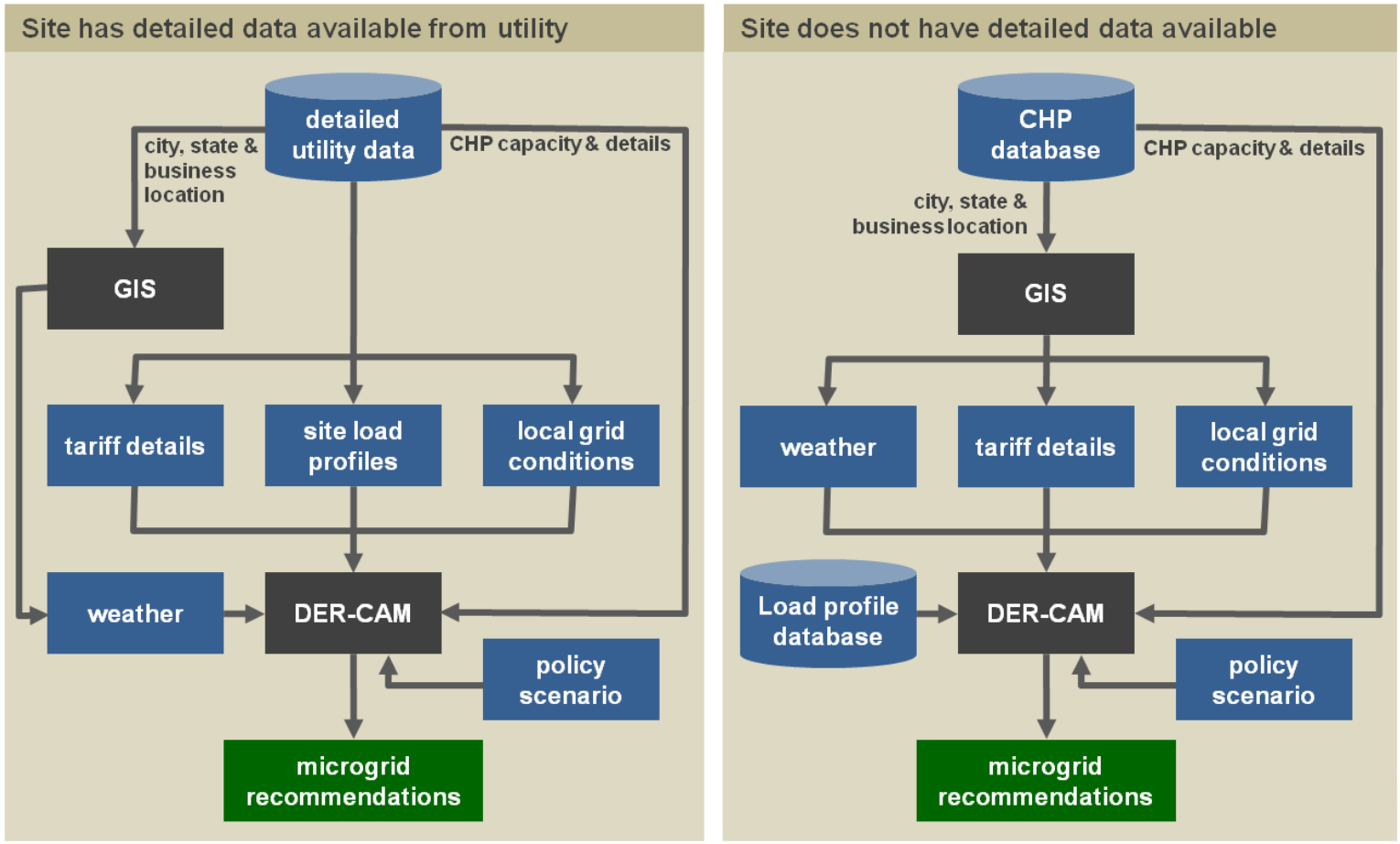
How to identity distribution area candidates suitable for microgrids? Start with existing CHP…



“Microgrid-ing” CHP in California

Identifying CHP sites with high potential for Microgrids

Leverage existing DER-CAM optimization capabilities to create a customized tool to identify CHP sites with high potential for microgrid development



Moving Toward General Microgrids (Section 769)

- New PUC Code Section 769
- Requires IOUs to file “Distribution Resources Plans” by July 2015
- Plans will define “optimal locations” for distributed energy resources
- Most likely will leverage existing resources

Thank You!

For further information related to Smart Grid and Microgrids please contact :

J. David Erickson, JE5@cpuc.ca.gov
415-703-1226

www.cpuc.ca.gov