



CHP – A Foundation for Microgrids



California Energy Commission

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Implications of CHP Deployment for Microgrid Implementation in California

J. David Erickson

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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.

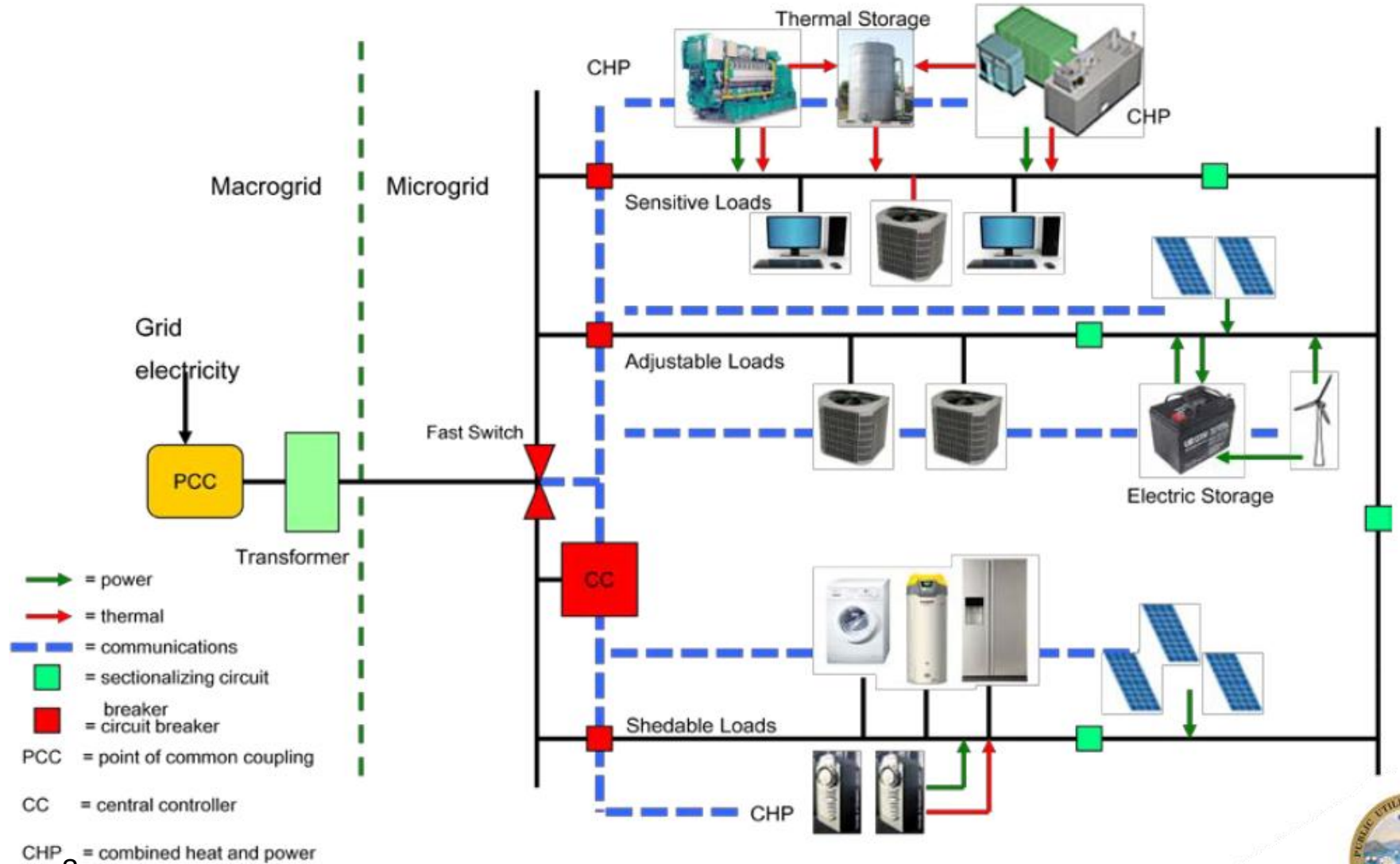
-NYSERDA microgrid whitepaper (Sept. 2010)

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





The Advanced Microgrid





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



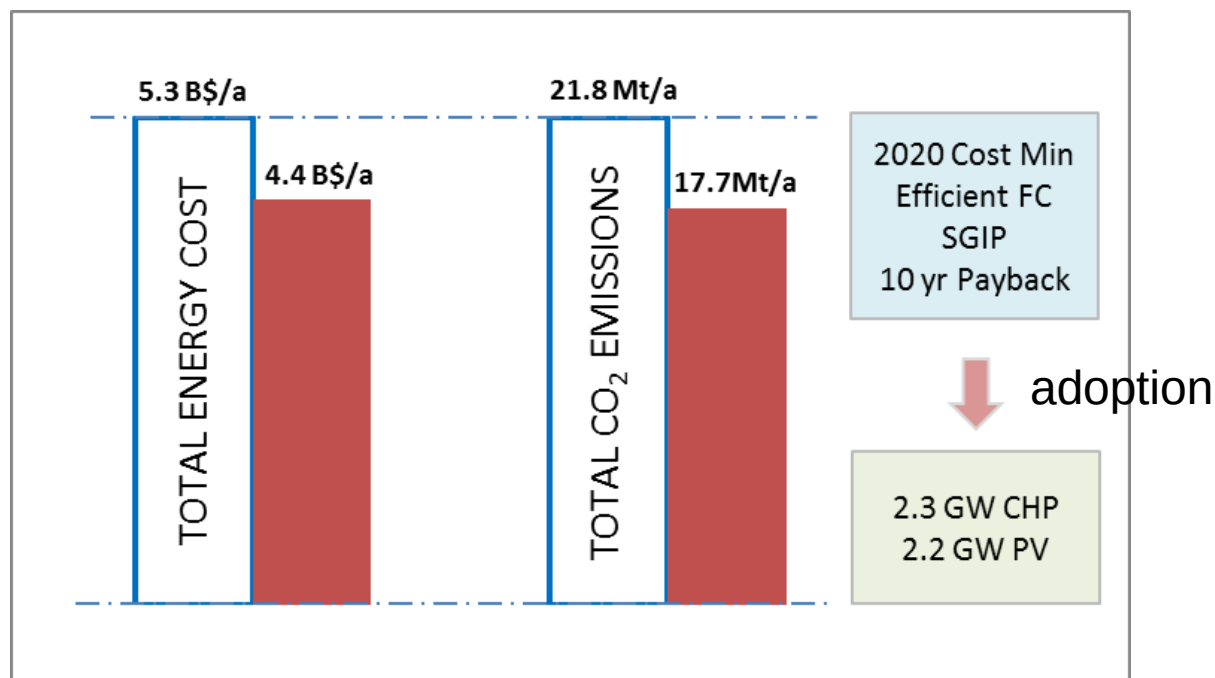


CHP and Microgrids

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

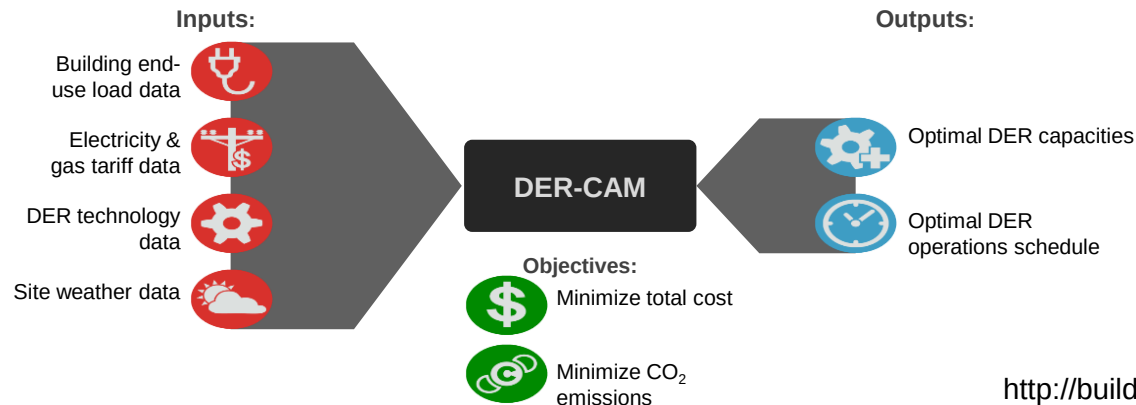
DER-CAM is an optimization tool, aimed at finding optimal capacity and dispatch of DER to minimize costs and/or CO₂ emissions in building microgrids.

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.





Microgrid Siting

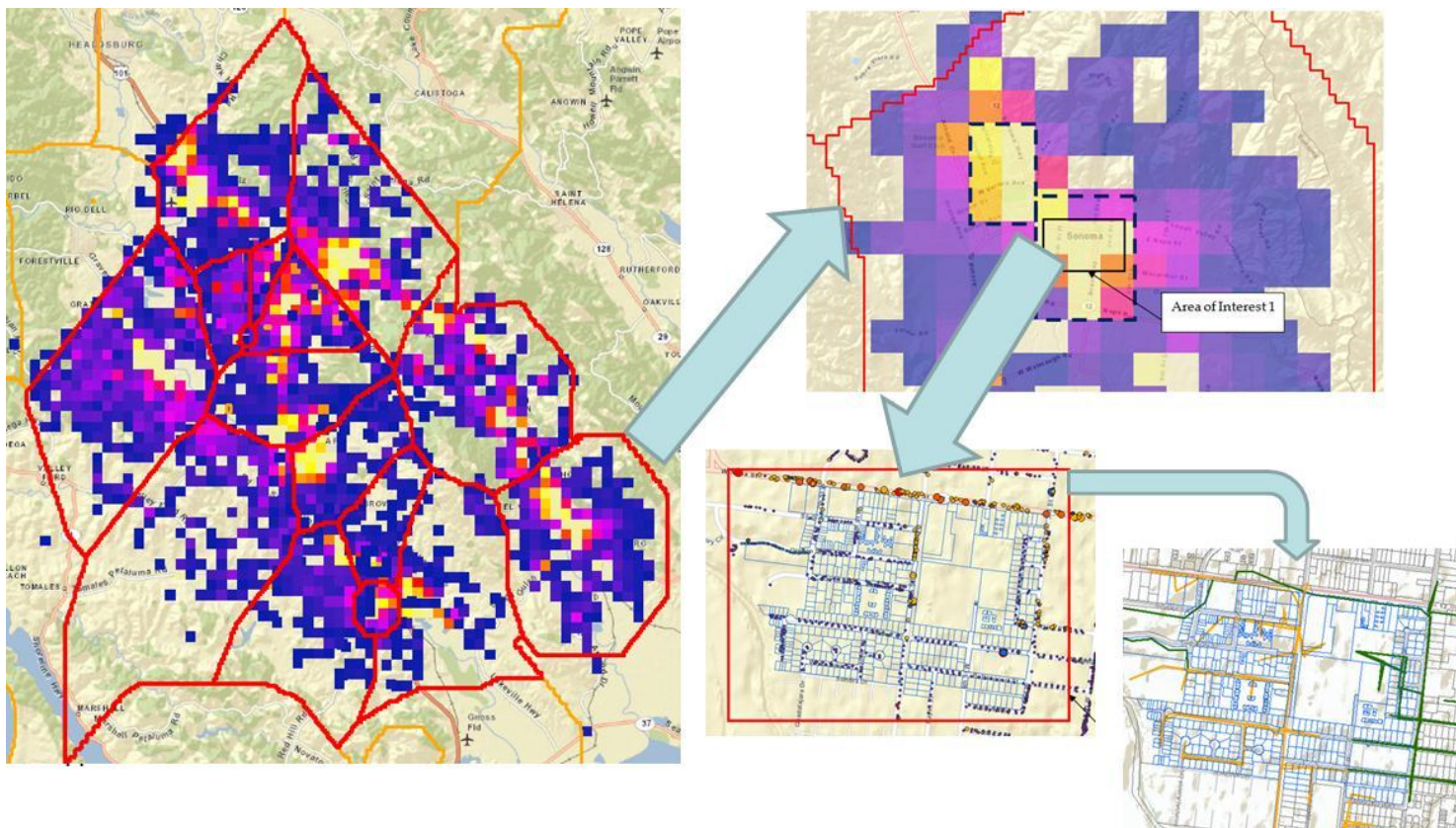
Microgrid friendliness?





Need for Siting Methodology

How to identify distribution area candidates suitable for microgrids? Start with existing CHP...



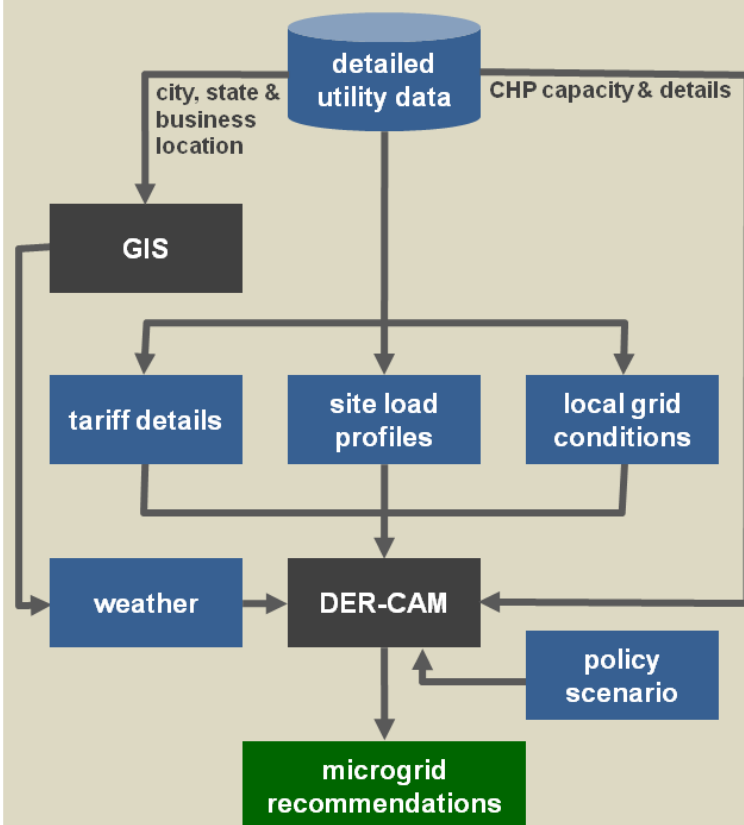


“Microgrid-ing” CHP in California

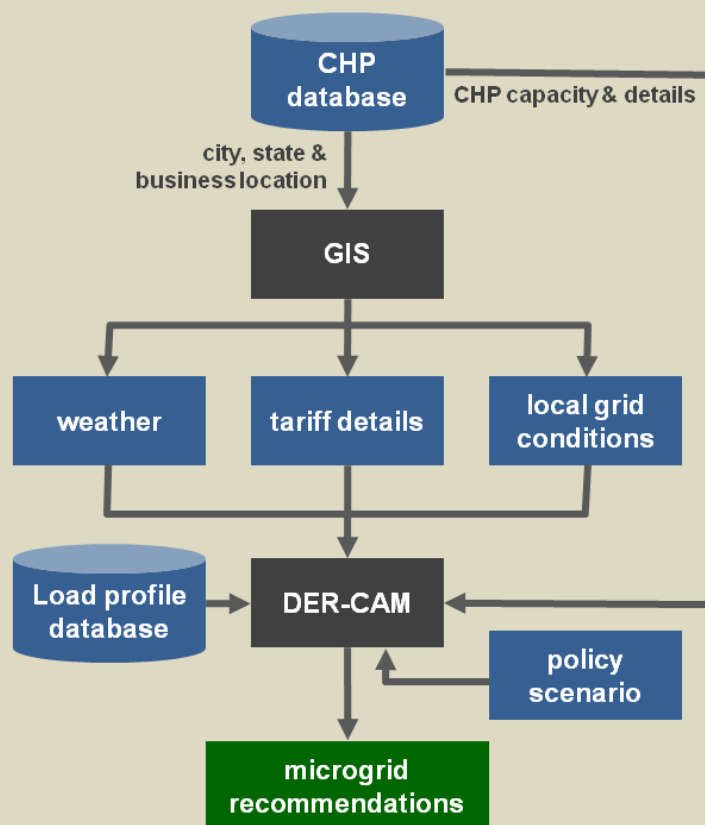
Identifying CHP sites with high potential for Microgrids

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

Site has detailed data available from utility



Site does not have detailed data available





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

