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# Fuel Cell Technology Case Studies

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# Agenda

- Fuel Cell Implementation
  - General Application Notes
    - Rules-of-Thumb
  - Case Studies
    - Alameda County
      - Planned Upgrades
    - City of Rialto
    - San Ramon
      - Planned Upgrades

# CHP Application Notes

- CHP (Combined Heat and Power)
  - In most cases CHP is desired for commercial installations
    - Sites with simultaneous heating and power needs are candidates
      - Continuous need for heat & power and long operating hours (>6,000 hr/yr)
    - Combined heating, cooling, and power is possible but at increased cost (typically)

# CHP Application Notes

## Rules-of-Thumb for Fuel Cells

<b>Proton Exchange Membrane (PEMFC)</b>	Electric Generation Efficiency, %	33-45
	Operating Temperature, °F	175
	Heat Utilization	Hot Water
	Availability	Demonstration
<b>Phosphoric Acid (PAFC)</b>	Electric Generation Efficiency, %	38-45
	Operating Temperature, °F	480
	Heat Utilization	Hot Water
	Availability	Commercial
<b>Molten Carbonate (MCFC)</b>	Electric Generation Efficiency, %	50-60
	Operating Temperature, °F	1,200
	Heat Utilization	Medium to High-Pressure Steam
	Availability	Commercial
<b>Solid Oxide (SOFC)</b>	Electric Generation Efficiency, %	40-45
	Operating Temperature, °F	1,800
	Heat Utilization	High-Pressure Steam
	Availability	Demonstration

**Case Studies => MCFC**

# CHP Application Notes

- Ratio of Gas to Electric Cost
  - \$12/MMBtu Ratio – Rough Estimating Guide
  - Waste Gas, Take or Pay Rates, On-Peak / Off-Peak

## Rules-of-Thumb for Acceptable Average Annual Fuel Cost

Average Annual Electric Energy Cost (¢/kWh)	Maximum Acceptable Average Annual Fuel Cost (\$/MMBtu)
≤ 4	0
5	2.6
6	5.6
7	8.5
8	11
9	14
10	17

# Case Study 1

## Alameda County Santa Rita Jail

**Technology:** 1 MW – MCFC

**Application:**

Base Load Power & CHP

Recovered heat used in hot water system

**Overall System Efficiency:** 58%

**Funding:**

23% - PG&E's Self-Generation  
Incentive Program

16% - U.S. Department of Defense  
Climate Change Fuel Cell Program

46% - Energy Savings

15% - Previous Energy Incentives



**CERTS Microgrid Upgrade  
Under Construction**

# Case Study 2

## City of Rialto

### Technology:

900 kW – Three 300 kW Units – MCFC

### Application:

Base Load Power

Digester Gas Powered

Kitchen Grease Reclamation

### Incentives:

27% - California's Self-Generation Incentive Program

73% - Energy Savings and Tipping Fee Revenue



# Case Study 3

## San Ramon Data Center

**Technology:** 200 kW – MCFC

**Application:**

Base Load Power & CHP  
Recovered heat used in  
hot water system

Supplements Critical Power System  
for Chevron Data Center

**Overall System Efficiency:** 59%

**Incentives:**

8% - DOE Grant

20% - California's Self-Generation  
Incentive Program

72% - Energy Savings and Capitol



**Upgrade to Run in Parallel with  
Standby Gens – Reduce / Postpone  
Standby Generator Plant Expansion**

# Fuel Cells are Viable

- CHP Opportunity?
- Favorable Rates?
- Local and National Incentives?
- Progressive Customer?

# Questions?

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