

SMALL CHP SYSTEMS FOR PUBLIC, NONPROFIT, & COMMERCIAL FACILITIES

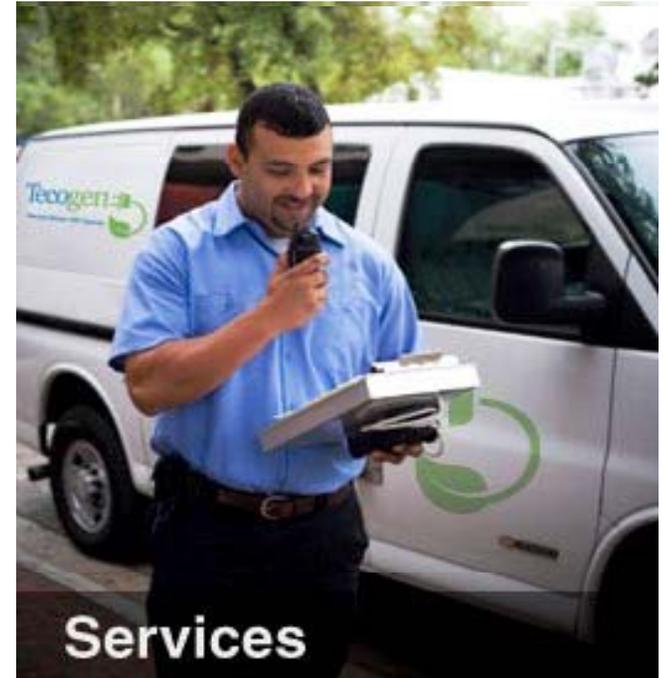
CEC IEPR Workshop
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Company Background - TECOGEN Inc.

- Founded 1982, as division of Thermo Electron Corp., with headquarters in Waltham, MA
- A leading manufacturer, installer, & servicer of small gas engine-driven CHP systems, including cogen modules (60-100 kW) & chillers
- Thousands of systems in operation, some for 25+ years



Combined Heat & Power (<500 kW)

Definition: The simultaneous production of two useful outputs (electricity + heat) from a single fuel source



2-for-1: "A generator that makes free hot water"
or
"A boiler that makes free electricity"

Sample Tecogen InVerde CHP system

6 INV-100's



Sample Tecogen CHP System

AT LOCAL BAY AREA SITE



Best Applications...

- Hospitals
- Schools
- Community Colleges
- Nursing Homes
- Retirement Residences
- Apartment Buildings/ Condos
- Athletic Clubs
- YMCA's
- Municipal Pools
- Jewish Community Centers
- Jails



Small-CHP Technology Breakthroughs

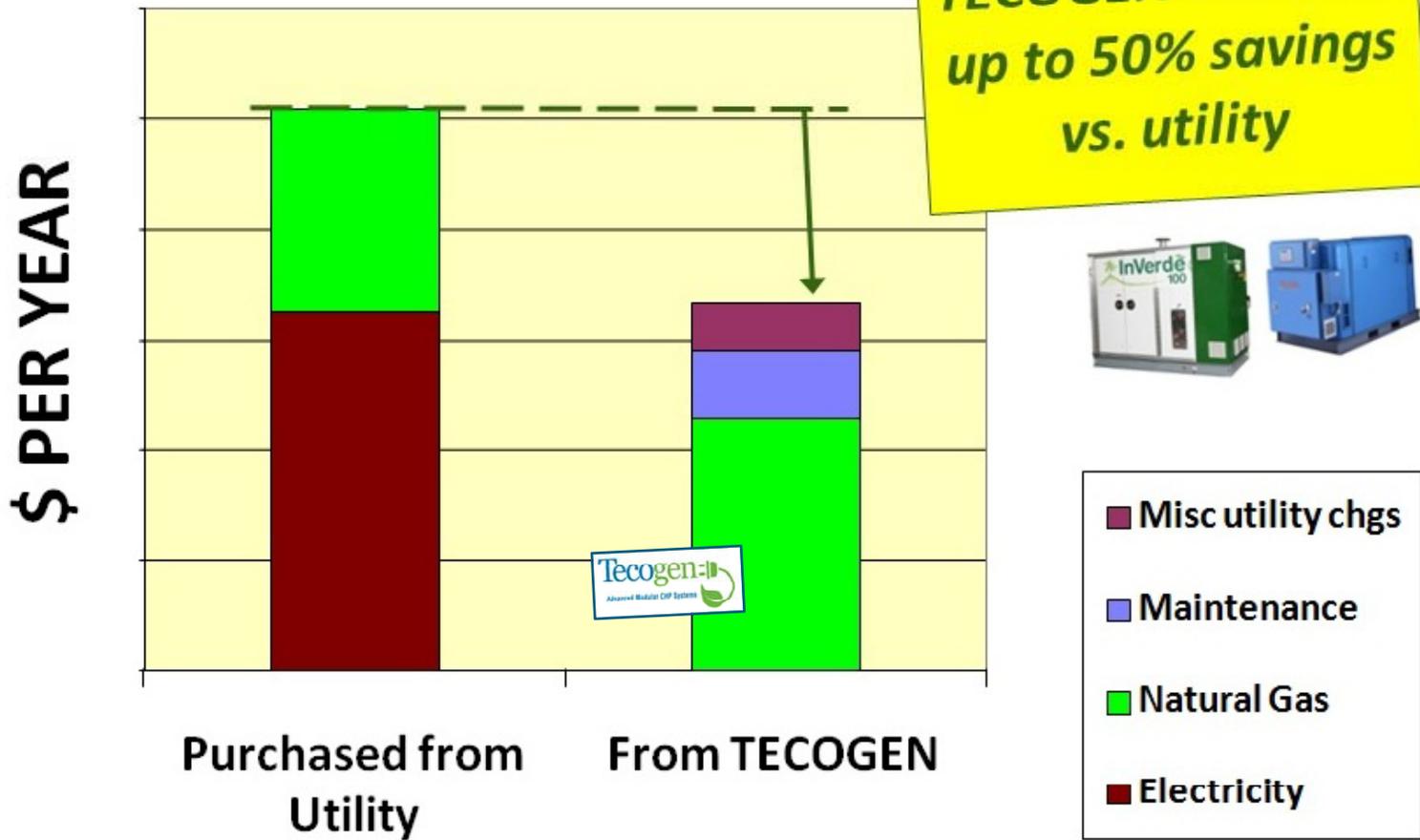
- Recent Small-CHP technical advances:
 - California Rule 21/ UL/ ETL/ NYSIR/ CE certifications *
 - InVerde CERTS Microgrid-compatible, inverter-based module *
 - Advanced engine *
 - Ultra-low emissions *

** All developed with
CEC support*



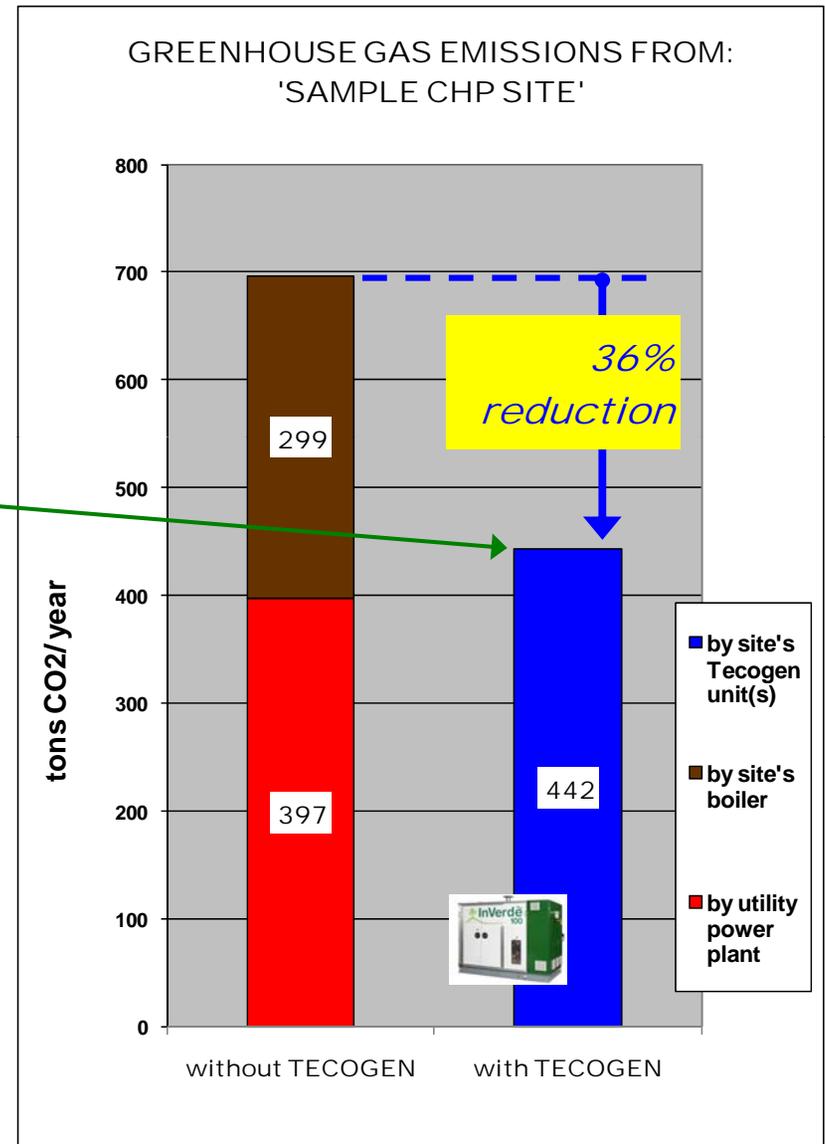
Economic Benefits

ANNUAL ENERGY COSTS (ELECTRICITY + HEAT)



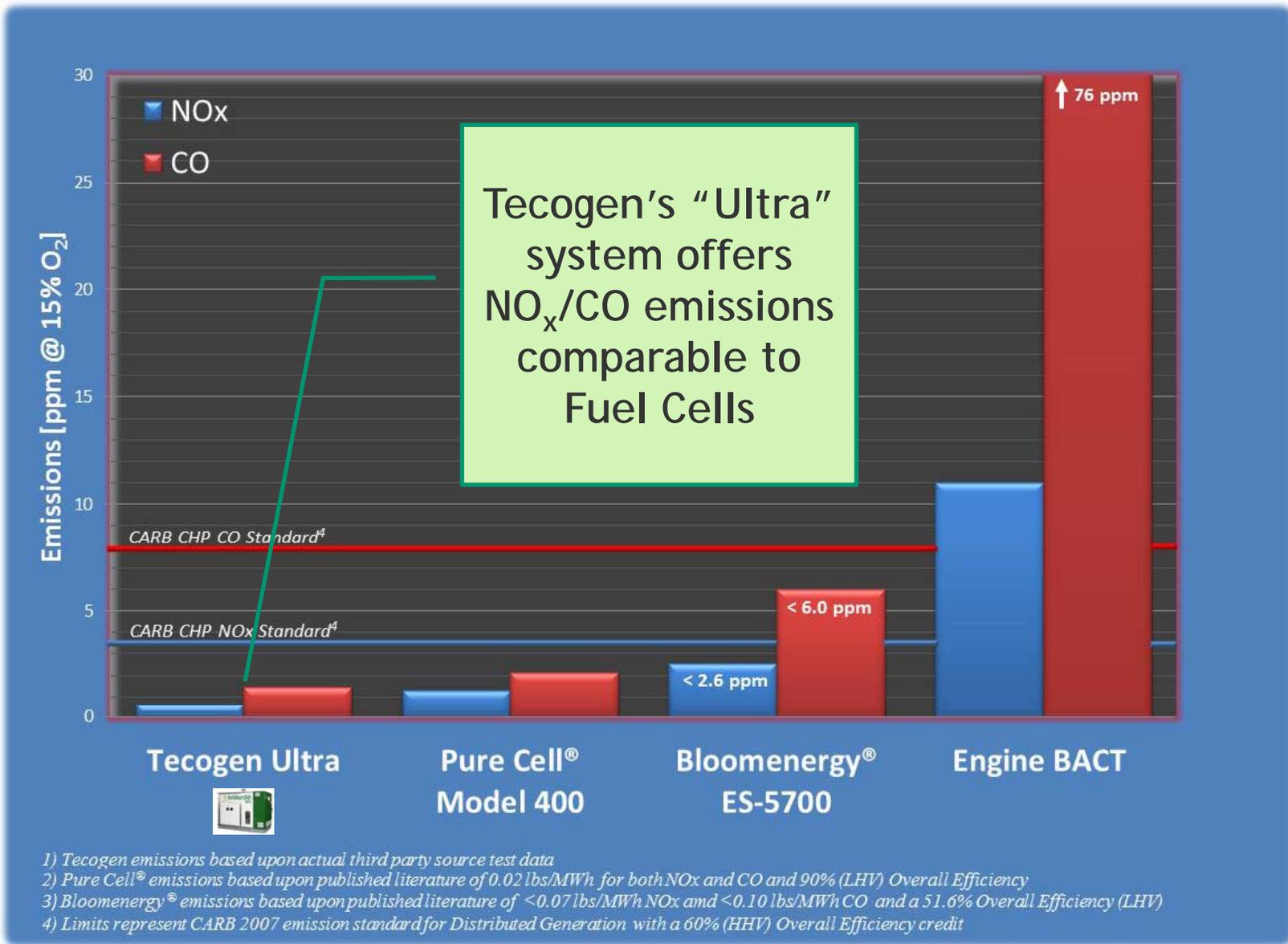
Environmental Benefits (GHG)

With TECOGEN, 254 fewer tons of CO2 are emitted each year, by 'SAMPLE CHP SITE'



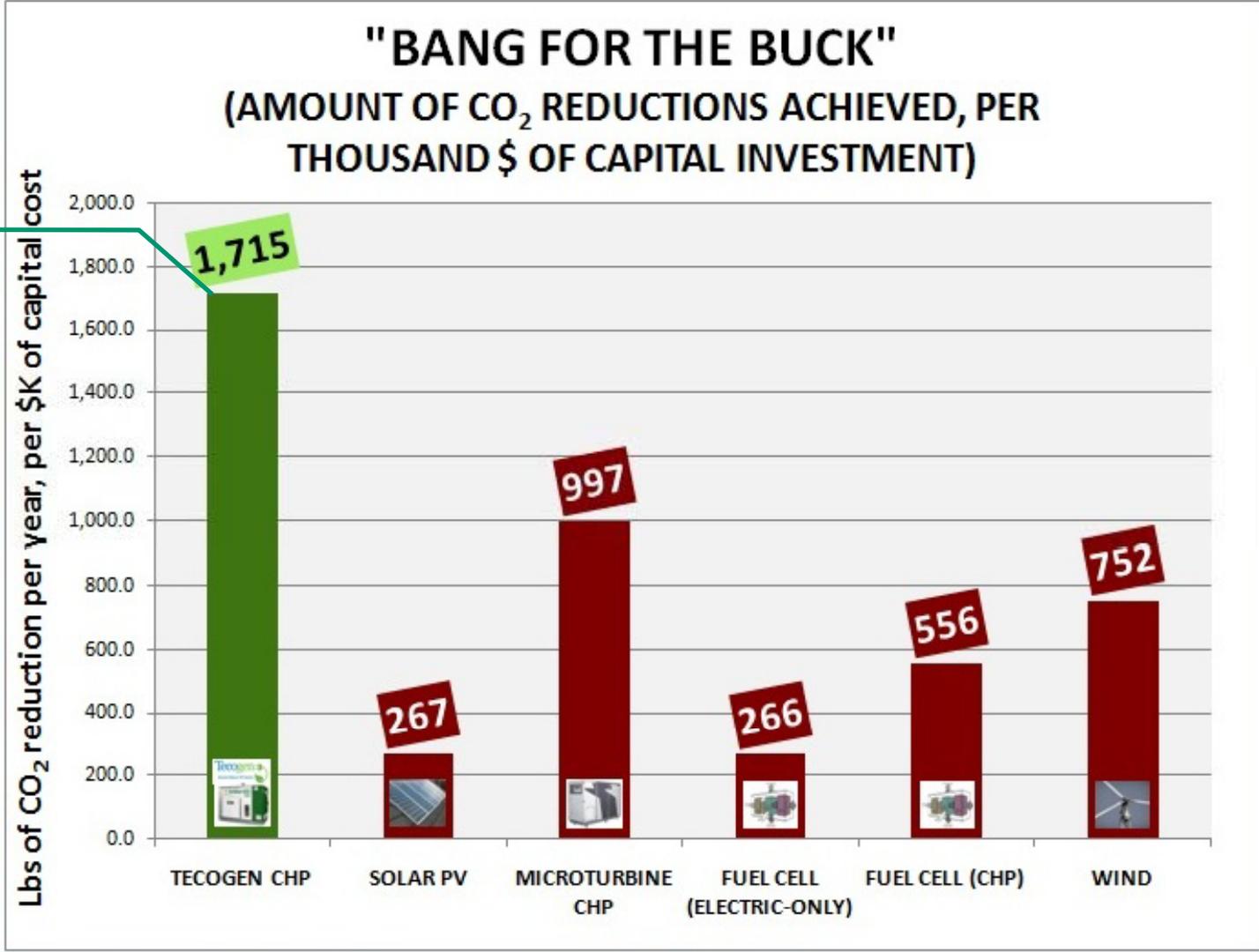
Assumes: 1 CM-75E

Environmental Benefits (NO_x/CO)



Cost-Effectiveness

Small
"Microengine"
CHP offers
excellent
"Bang for the
Buck"



Q1: What Motivates Decision-Makers to Install CHP?

- Economic benefits
 - Payback (<4 years required)
 - Excellent use of waste heat & electricity onsite
- Power reliability/ quality
- *Perception* of:
 - Utility & governmental support
 - Consistency with state energy policies
 - Green benefits (e.g., reduce GHG & NOx emissions)
 - Be good citizen
- Must be easy to implement

Q2: Market/ Regulatory Barriers to Installing CHP

- Utility-related
 - Excessive fees killing small-CHP economics:
 - departing load charges
 - standby charges
 - interconnection charges
 - SGIP metering & monitoring costs

Together, adding 2-3 years to payback, putting out of range of many users
 - Other tactics:
 - Complexity
 - Delays
 - CHP not eligible for Net Energy Metering (NEM)
 - No practical FIT contract yet for very small CHP systems (AB 1613)

Q2: Market/Regulatory Barriers to Installing CHP

Complexity: Sample chart for determining applicability of various utility charges to different DG technologies (about as simple as a third-world bus schedule!)

#	Utility exception PU Code 813 (except for category 1) (Y/N)	Physical location (Yes/No)	Interconnections and Meter (Yes/No)	IS (Interconnection Service) (Yes/No)													
1	Other - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Other - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
4	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
5	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
6	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	Not included under 1.1.1001 - DER entry into the market (10001)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Q2: Market/ Regulatory Barriers to Installing CHP

- Government (Legislature/ CPUC/ CEC)
 - CEC inverter certification process no longer available for CHP
 - Bureaucratic Catch 22
 - Something the CEC can fix today

Q2: Market/ Regulatory Barriers to Installing CHP

Unequal CPUC treatment for various DG technologies:

	Renewables (Solar PV, Wind, Hydro)	Onsite Biogas- Fired Fuel Cells	Onsite Biogas- Fired Turbines, or IC Engines	Natural Gas-Fired Fuel Cells (including "electric only" fuel cells, and "directed" biogas fuel cells, which actually burn natural gas)	Ultra-Efficient, Clean Natural Gas-Fired CHP (Microengines, Microturbines, & Large Engines/ Turbines, all with Full Heat Recovery)	Other Energy Efficiency (causing identical kW/ kWh reductions; lighting, etc)
CPUC Regulation:						
Exempt from having to pay stand-by charges	YES	YES	YES	YES	NO	YES
Exempt from having to pay all "departing load" charges (aka "exit fees")	YES	YES	YES	YES	NO	YES
Eligible for "Net Energy Metering (NEM)"	YES	YES	YES	YES	NO	(n/a)
Eligible for a practical Feed In Tariff (FIT)	YES	YES	YES	YES	NO	(n/a)
Utility interconnection application & study fees waived	YES	YES	YES	YES	NO	YES
"Net Generation Output Meter" requirement waived	YES	YES	YES	YES	NO	YES
Eligible to receive utility incentives	YES	YES	YES	YES	YES (but much lower incentive level)	YES

Q2: Market/ Regulatory Barriers to Installing CHP

Regulations are giving improper market signals:

		DG Technology 1	DG Technology 2
Characteristics			
	System size (kW)	100	100
	Fuel input	Natural gas	Natural gas
	NOx emissions	ultra low	ultra low
	Overall energy efficiency (HHV)	~49%	85%
	% GHG emissions reductions	0-10%	25-35%
	Module cost	\$700,000	\$130,000
Regulatory Treatment			
	SGIP incentive (\$/kW)	\$2,250	\$500
	Federal tax credit	30%	0-10%
	Eligible for NEM	Yes	No
	Exempt from departing load charges	Yes	No
	Exempt from standby charge	Yes	No
	Practical FIT available	Yes	No
		<i>oversubsidized</i>	<i>undersubsidized</i>

Q2: Market/ Regulatory Barriers to Installing CHP

- Government (Legislature/CPUC/CEC)
 - Unlevel playing field has been created
 - Arbitrary and prescriptive biases for certain DG technologies has become the norm
 - “Picking winners” not working
 - “Special interest” -driven prescriptive approach conflicts with rational energy policy-making
 - Instead: Who has the best lobbyist?
 - Focus on regulators, rather than facilities and efficiency engineering

Q2: Market/ Regulatory Barriers to Installing CHP

- Government (Legislature/CPUC/CEC)
 - Yields a lower benefit ("bang for the buck"), in terms of the GHG reductions and project economics achieved.
 - Causes inefficient deployment of taxpayer & ratepayer resources.
 - Creates market distortions, confusion, unfairness
 - Excessively complex rules deter end-users from adopting CHP technology.

Q3: How can state support active CHP development?

- Recommendations:
 - Phase out non-bypassable departing load charges
 - Phase out standby charges (esp. if already paying demand charge on same kW)
 - Extend Net Energy Metering (NEM) to CHP
 - Extend SGIP (also make it simpler and more sensible)
 - Restore a simpler and more **level playing field** for all technologies.
 - More uniform regulatory treatment.
 - Legislators and regulators should resist the temptation to "pick winners" among various technologies. Let technologies' inherent characteristics, efficiencies, and advantages play out instead.
 - Yields best "bang for the buck" for customers, ratepayers, GHG.