

Deploying DER/CHP in California and Hawaii

*Workshop on Distributed Energy Resources
and CHP in Regulated & Competitive Markets
Honolulu, Hawaii*



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California Energy Commission
August 24, 2004

Presentation Agenda

- Making a Case for CHP
- California DER Policy Overview
- Interconnection Issues
- Net Metering Policies
- Rate Design and Standby Charges
- R&D Efforts Related to DER Deployment

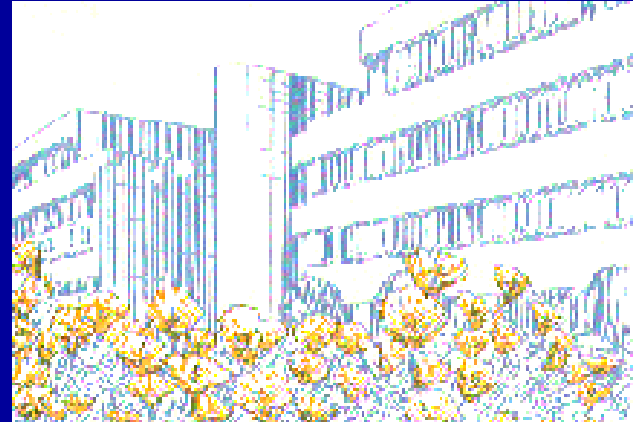


And a Break!!!



California Energy Commission

- Energy policy and information advisor to the California governor and legislature.
- Major Functions:
 - License power plants
 - Promote energy efficiency and conservation.
 - Advance energy technologies.
 - Assess current and future energy trends.



California is a Leader in Self-Generation

Distributed generation accounts for more than 2500 megawatts in California.

Reliability
Power Quality



CHP is an Important Piece of the National Energy Picture

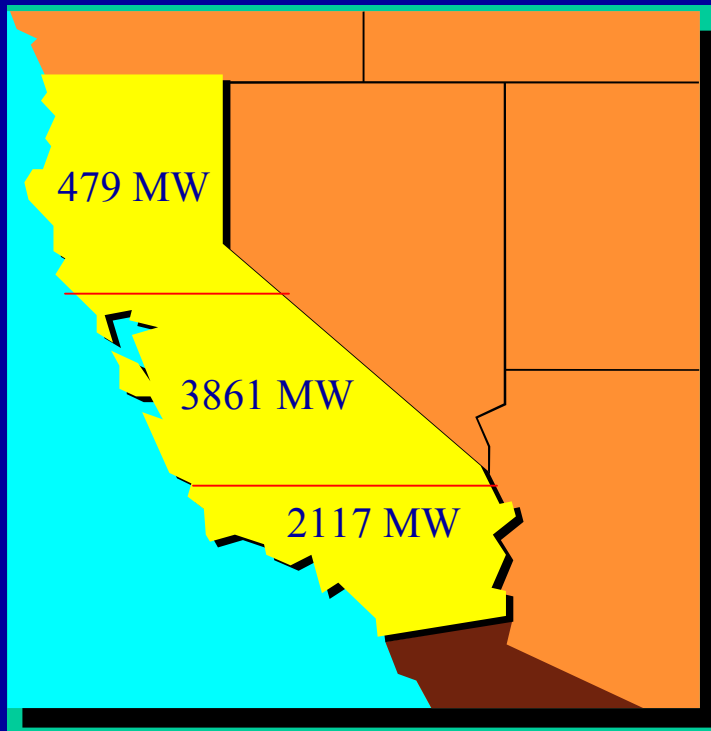
CHP accounts for more than 77 gigawatts of capacity in the United States.

Heavy Industry States Have the Most CHP

Texas	(10000 MW)
California	(6500 MW)
New York	(5100 MW)
Louisiana	(3500 MW)
New Jersey	(3500 MW)



CHP Can Be Found in All Parts of California



- Highest concentration of CHP found in areas with heavy oil production and refinery operations.
 - Kern County accounts for 30% of total.
 - Los Angeles and Contra Costa Counties are second and third.
- CHP represents approximately 10% of total generation capacity in California.



Source: Onsite Sycom Energy Report, Market Assessment of Combined Heat and Power in the State of California, December 1999.

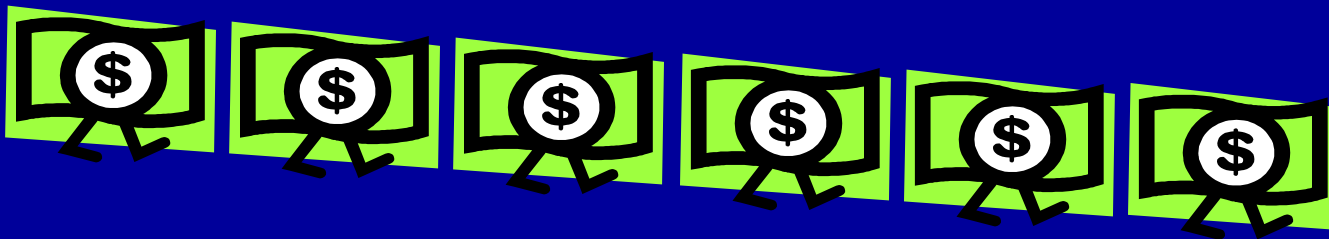
And Look at All of the Potential Benefits!

Customer-Side

- Better power reliability and quality
- Lower energy costs
- More choice in energy supply
- Energy and load management
- Cleaner, quieter operation, and reduced emissions
- Faster response to new power demands

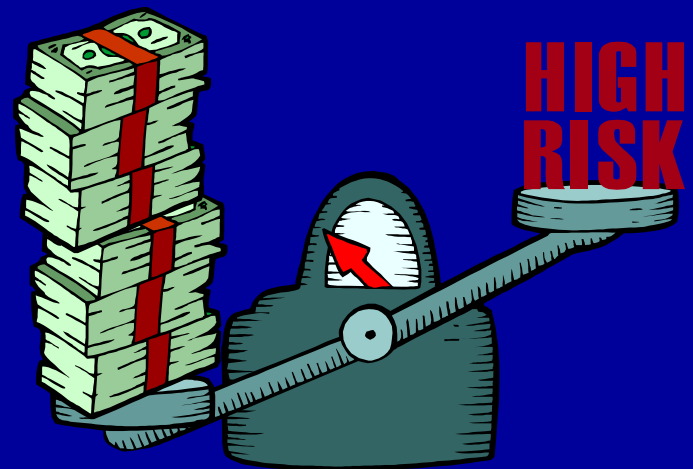
Grid-Side

- Reduced transmission losses and congestion on transmission lines
- Reduced or deferred T&D infrastructure needs
- Improved grid reliability
- Faster permitting
- Ancillary benefits— voltage support and stability, contingency reserves, and black start capability



So Why Isn't There More Deployment of CHP?

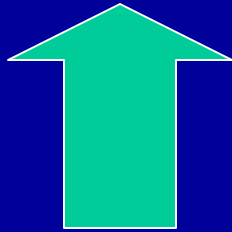
- Numerous Potential Benefits of CHP
- State Policies Generally Reflect a Preference for DG
 - CHP is emissions friendly.
 - CHP adds to generation capacity without central station power plants.



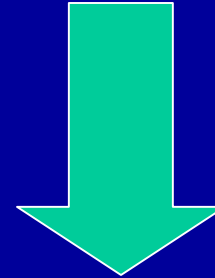
Prospects for effective CHP deployment depend upon removing regulatory, institutional, and business-related barriers.



CHP: A Hawaii Perspective



- Cost-effective, high-efficient CHP is compatible with state energy policy and the RPS.
- Defers need for central station generation and T&D upgrades.
- Utility-owned CHP protects ratepayer interests.

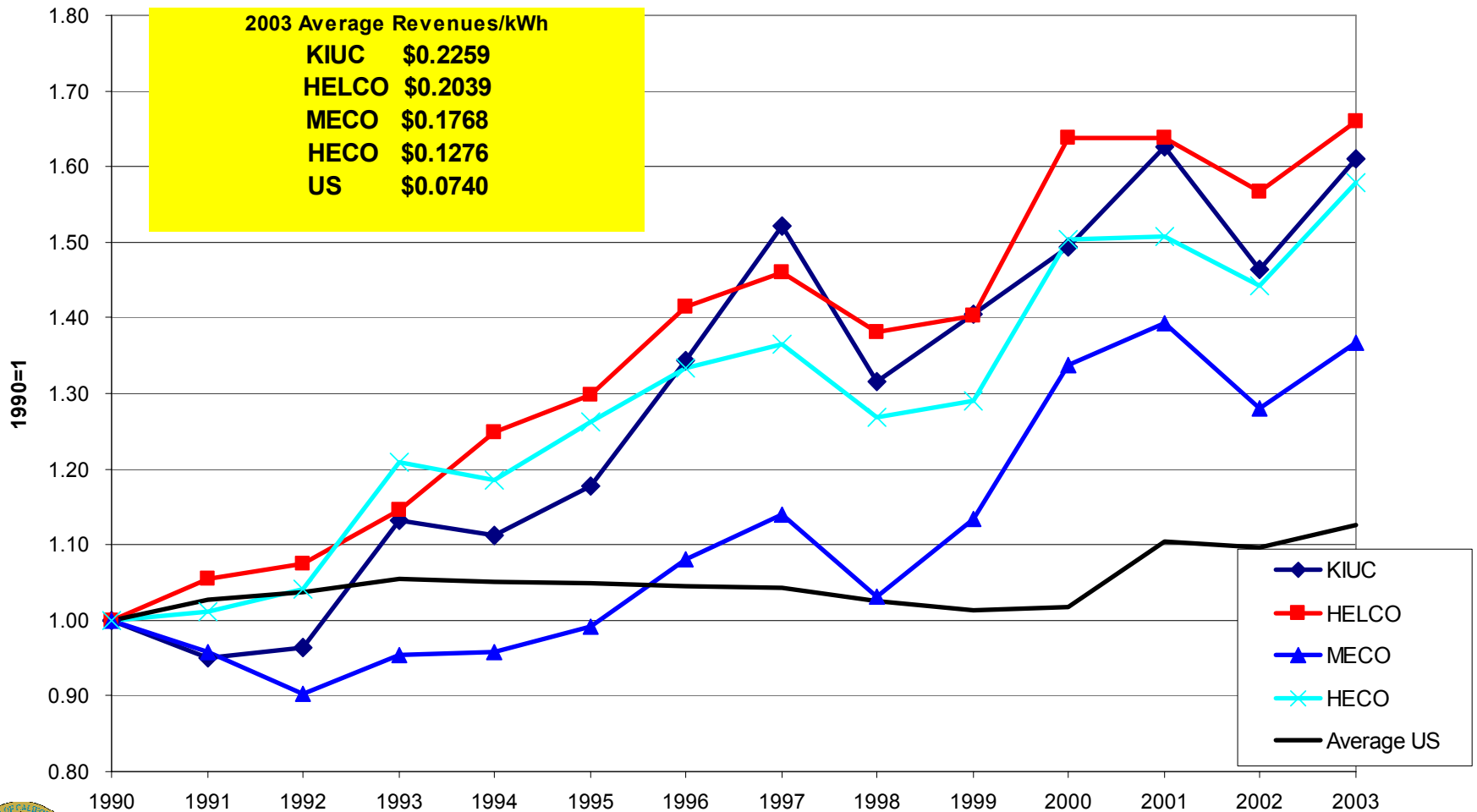


- Third-party CHP has a negative impact on utility customers.
- Only the interests of the CHP owner and the developer are considered with a non-utility CHP project.



Do CHP Projects Have a Role in Hawaii?

Comparison of Hawaii and US Electricity Costs, 1990-2003



High cost of electricity makes DER/CHP an attractive option.

Do CHP Projects Have a Role in Hawaii?

- Hawaii: CHP can address imbalance between generation in the East and load growth in the West.
- Oahu: CHP can help meet demand until next planned central station addition in 2009.
- Maui: CHP defers need for Waena Unit 1 generation from 2008 to 2010.
- Lanai: Manele Bay CHP planned in 2007 defers need for central station additions from 2007 to 2013.
- Molokai and Kauai: New generation not needed until 2012.
- May be able to help avoid some transmission upgrades.

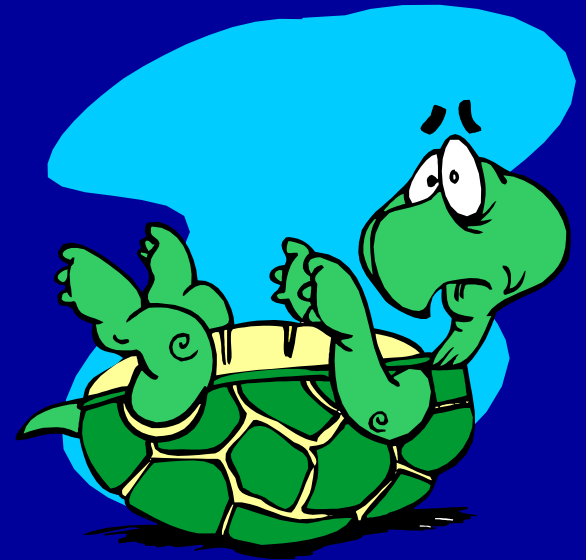


An Opening Thought on DER Policy

Effective Deployment of DG Needs Clear Direction From Policymakers.

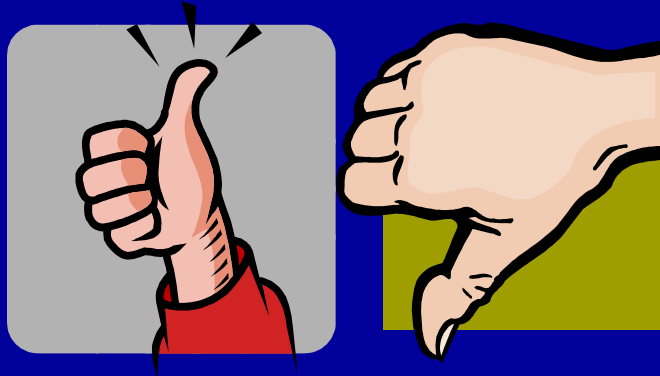
The energy policy California has right now is a little like the turtle on the fence post. We know it didn't get there by itself, we're not quite sure who put it there or why, and we know it can't get down by itself.

Senator Debra Bowen
Chair, Senate Energy Committee
Winter 2003

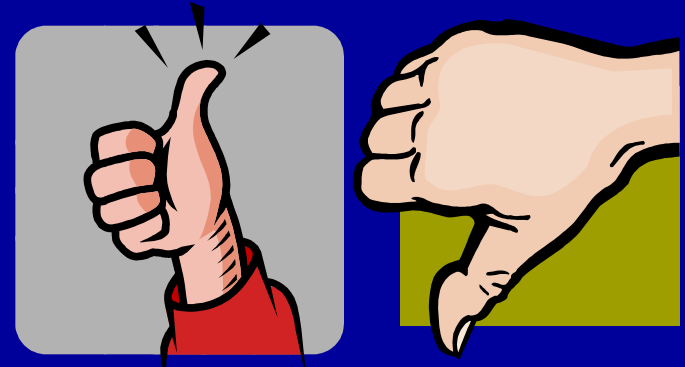


DER Policies in California Have Had Mixed Results

Surcharges



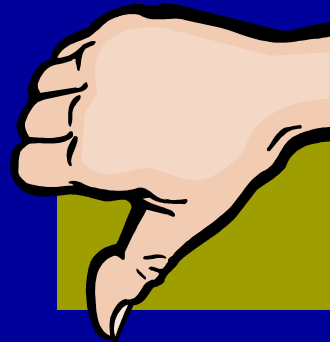
Incentives



Interconnection



Utility Procurement

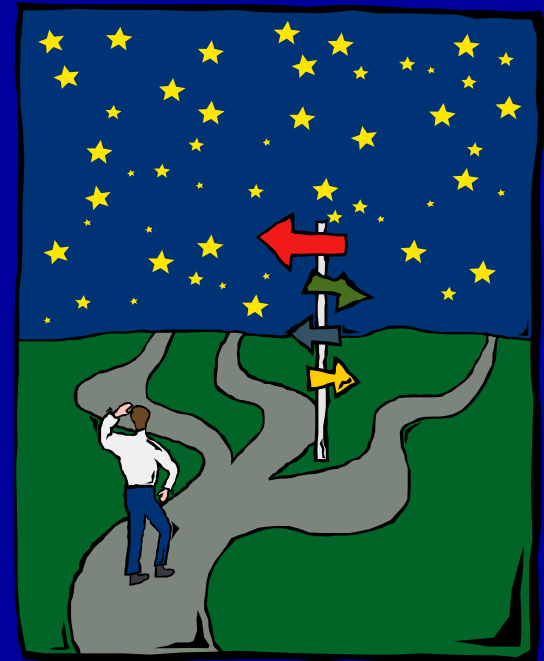


Net Metering



California Has a DER Strategy...

- Energy Commission adopted DG Strategic Plan in June 2002.
- Plan's Vision: DG will be an integral part of California's energy system...provided it makes sense to do so.
- However, prospects for effective DG deployment depend upon removing regulatory, institutional, and business-related barriers.



Agency Collaboration is Essential to the Future Success of the Plan!!!!



DER is Part of the “Energy Action Plan”



**CONSUMER POWER AND
CONSERVATION
FINANCING AUTHORITY**



**CALIFORNIA
ENERGY COMMISSION**



**PUBLIC UTILITIES
COMMISSION**

Action Item 6:

Promote Customer and Utility-owned Distributed Generation.

The agencies will work together to further develop distributed generation policies, target research and development, track the market adoption of distributed generation technologies, identify cumulative energy system impacts and examine issues associated with new technologies and their use.



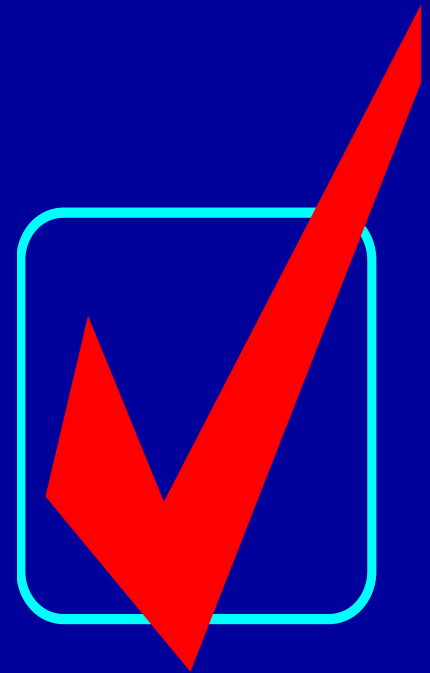
General Barriers to Effective DER Deployment

- Lack of standardized interconnection rules.
- Standby charges.
- Stranded assets and exit fees.
- Air quality rules.
- Siting regulations.
- Financial barriers.

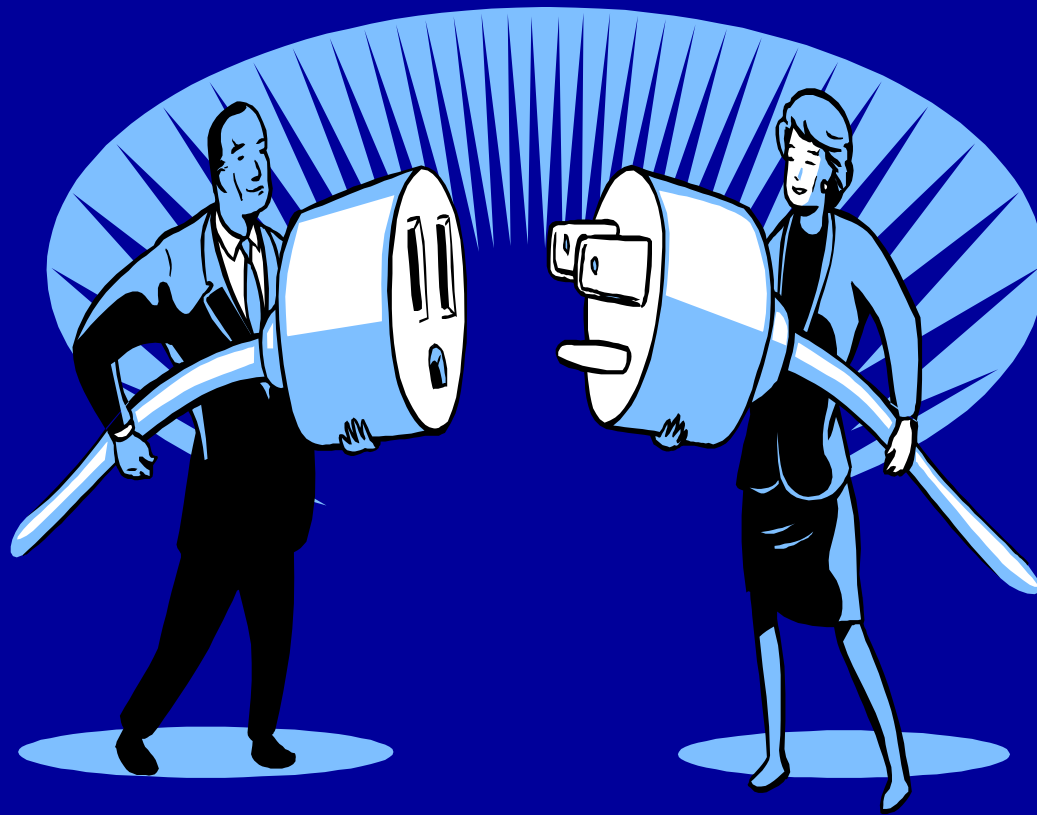


California Policymakers Remain Interested in DER

- Energy Action Plan adopted by the CPUC, Energy Commission, and Power Authority commit to the active deployment of DG.
- CPUC initiated a new DG rulemaking in March 2004, with close collaboration with the Energy Commission.
 - Major emphasis is on cost/benefit analysis.
 - Will tie in Energy Commission R&D efforts to public policy objectives.
- DG Equipment presently being certified by California Air Resources Board and reviewing emission standards established in 2002.



Interconnection Issues...



What Is Rule 21?

- A term commonly referred to as interconnection rules.
- Specific rule contained in the electricity tariff booklets of the utilities under CPUC jurisdiction.
- Provides technical and non-technical criteria for connecting generation equipment to the utility systems.
- Rule is technology and size neutral.



Why Did Rule 21 Need Refinement?

- Rule was not designed for small-scale DG interconnections.
- It did not address the benefits of having a standardized rule in place.
 - Increased cost to DG manufacturers.
 - Larger degree of customization required.
- It did not obligate utilities to review applications within a particular timeframe or provide any detailed cost estimate to applicant.



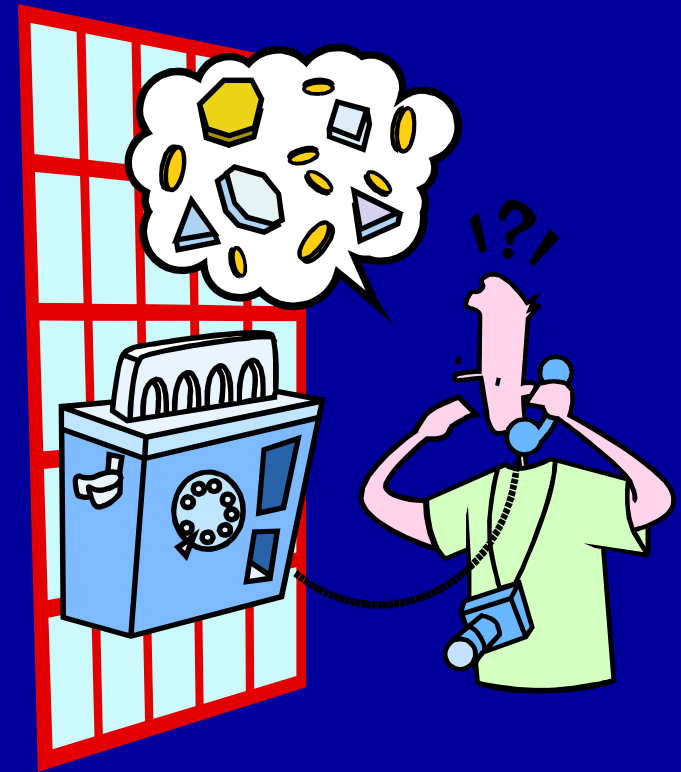
What Were the Guiding Principles?

- Rules, protocols and processes should be clear and transparent.
- Rules should be technology neutral, except when differences are fully justified.
- A level playing field should be established for all DG providers.
- Rules should be uniform throughout California.
- Utilities should be fairly compensated for distribution services that support DG installations and customers.



Issues Addressed by the Rule 21 Working Group

- Interconnection Fees
- Testing and Certification Procedures
- Clear Engineering Review Process
- Interconnection Agreements
- Application Forms (Paper and Electronic)
- Process for Continuing Refinement

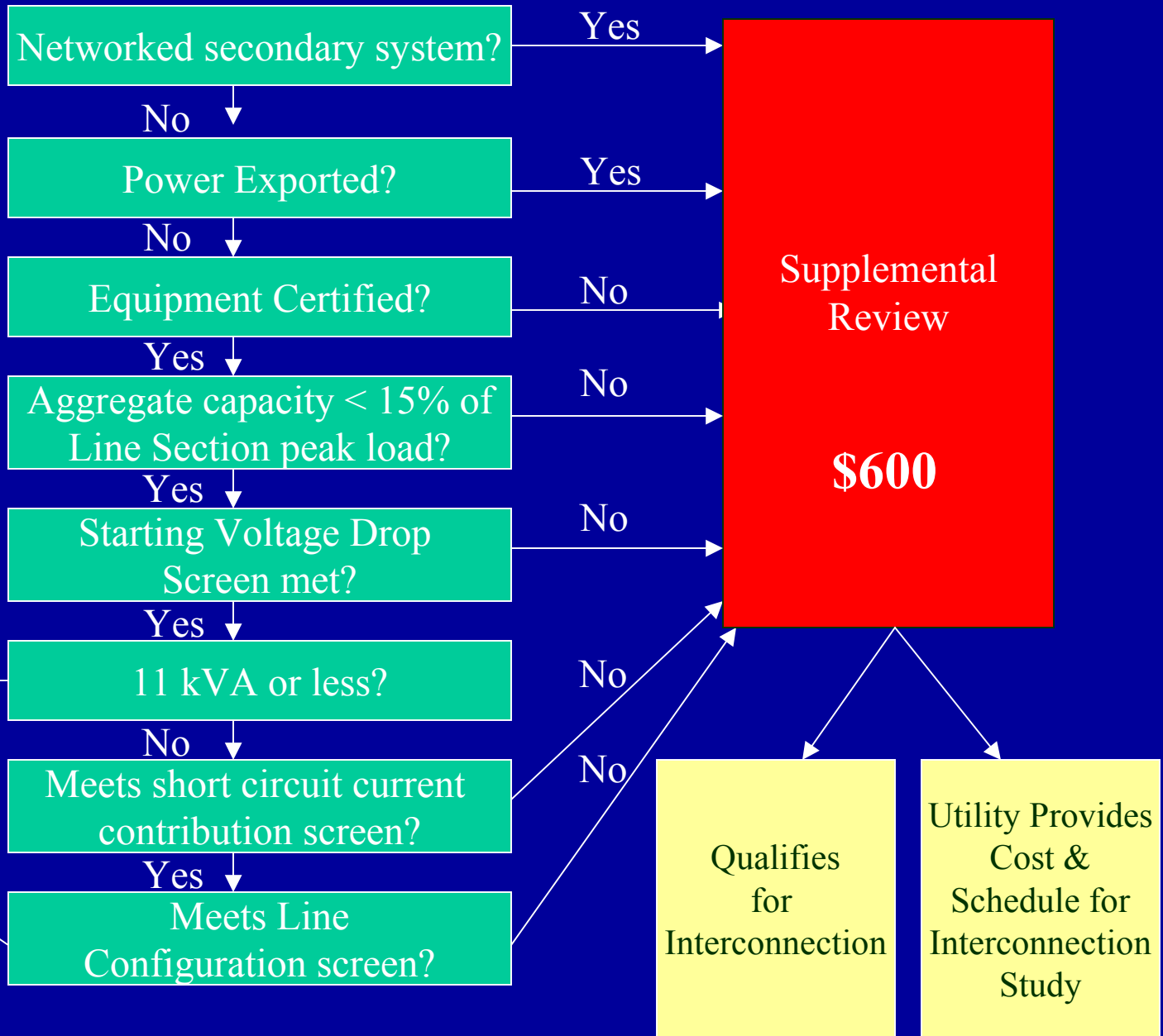


Accomplishments of Rule 21 Working Group

- Standardized rule language for PG&E, SCE, and SDG&E.
- Standardized application forms and agreements.
- Clear procedures for evaluating DG applications.
 - More certain time review.
 - Costs of review not prohibitive.
 - Equipment testing procedures identified.
- Tools continue to be developed to help understand and evaluate DG projects.



The Review Process



Qualifies for Interconnection

Supplemental Review
\$600

Qualifies for Interconnection

Utility Provides Cost & Schedule for Interconnection Study

\$800



Rule 21 Provides Streamlined Review for Certified Equipment

8 Items on Certification List

- **Capstone: 30 kw & 60 kw microturbines**
- **Fuel Cell Energy: 300 kw fuel cell system**
- **Plug Power: 5 kw fuel cell system**
- **Tecogen: 60 kw & 75 kw induction generator systems (High and Low Voltage)**

Type Test	Reference	Inverter	Synchronous Machine	Induction Machine
Utility Interaction	UL 1741 - 39	X	X	X
DC Isolation	UL 1741 - 40.1	X	—	—
Simulated PV Array (Input) Requirements	UL 1741 - 41.2	X	—	—
Dielectric Voltage Withstand	UL 1741 - 44	X	X	X
Power Factor	UL 1741 - 45.2.2	X	X	X
Harmonic Distortion	UL 1741 - 45.4	X	X	X
DC Injection	UL 1741 - 45.5	X	—	—
Utility Voltage and Frequency Variation	UL 1741 - 46.2	X	X	X
Reset Delay	UL 1741 - 46.2.3	X	X	X
Loss of Control Circuit	UL 1741 - 46.4	X	X	X
Short Circuit	UL 1741 - 47.3	X	X	X
Load Transfer	UL 1741 - 47.7	X	X	X
Surge Withstand	J.3.a	X	X	X
Anti Islanding	J.3.b	(2)	(2)	(2)
Non-Export	J.3.c	(3)	(3)	(3)
In-Rush Current	J.3.d	(4)	(4)	(4)
Synchronization	J.3.e	(5)	X	—

Notes: X = Required; — = Not required;



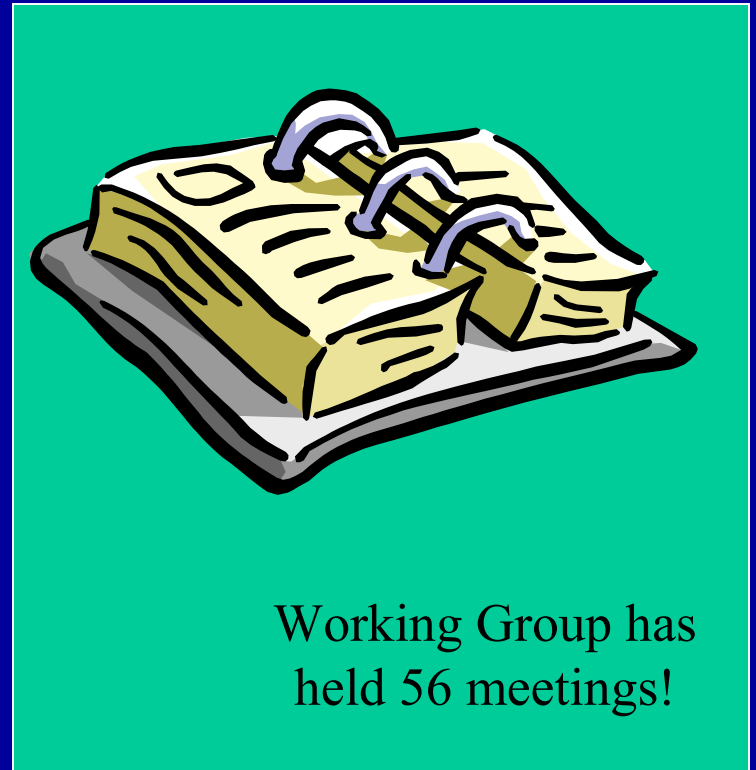
Equipment Certified by Certification Subcommittee

- Subcommittee includes five individuals:
 - One protection engineer from PG&E, SCE, and SDG&E.
 - Independent consultant serving as technical expert.
 - Rule 21 moderator
- Process takes about 2-4 months to complete.



What is the Rule 21 Working Group Currently Doing?

- Refining present rule language.
- Responding to policy directives of CPUC and Energy Commission.
- Facilitating utility responses to CPUC directives.
- Developing tools to help understand DG complexities.
- Providing forum to address new issues surrounding interconnection process.

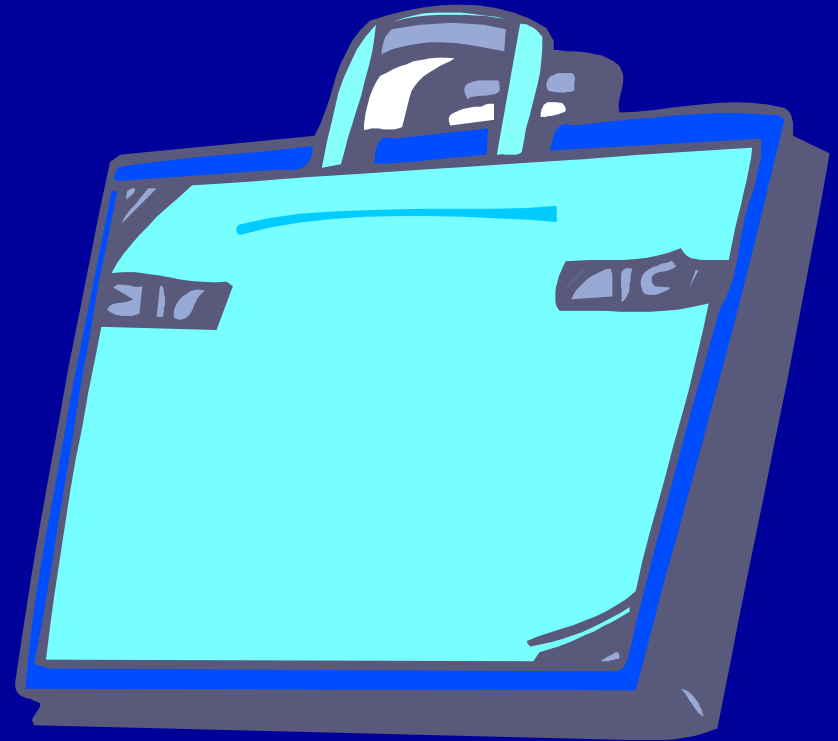


Working Group has held 56 meetings!



Tools Are Being Developed to Assist Protection Engineers with Project Evaluation

- Supplemental Guideline currently on Energy Commission website.
- Intent is to assist protection engineers with Rule 21 Supplemental Review.
- Guideline provides suggested approaches for resolving outstanding protection issues.
- Document is ever-changing as more information is developed.



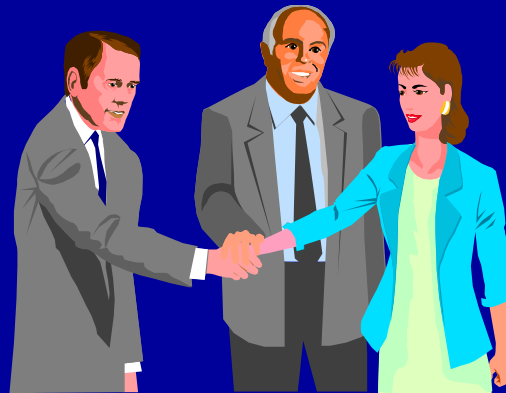
Key Observation of Working Group Process

Success Stems from Effective Collaboration Among Stakeholders, Utilities, Regulators, Vendors, and Manufacturers!

Regulators and Legislators



Utilities and Municipalities



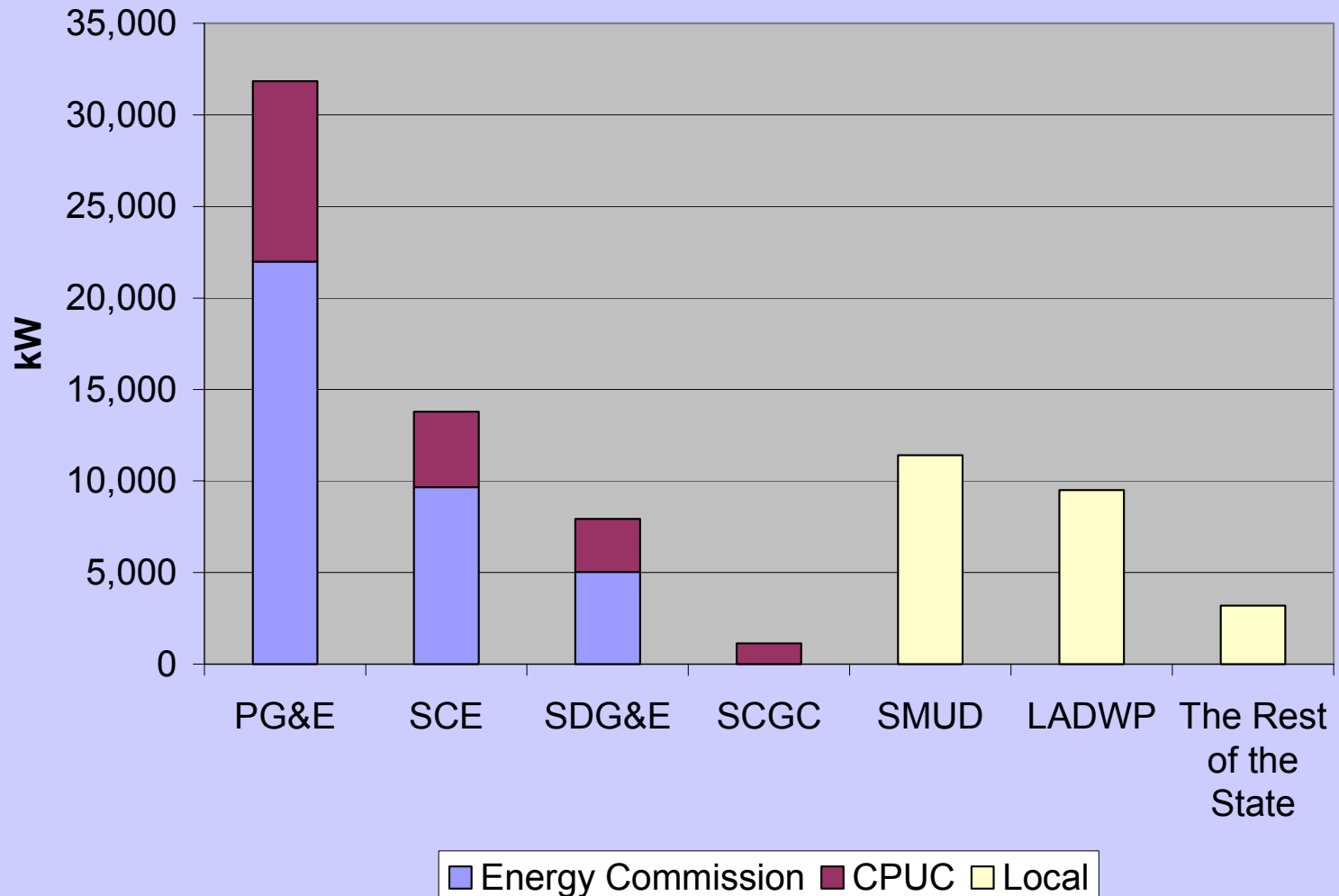
Industry and Stakeholders



Let's Talk About Net Metering...



Net Metering Preamble: California Has Lots of PV



Net Metering Overview

- Defined as the ability to generate electricity to an electric distribution grid system and receive a bill credit for deliveries to the grid.
- Size limited to one megawatt or less in California.
- Recent mandates have extended the program from PV and wind to fuel cells and biomass.



Recent Net Metering Legislation in California

Assembly Bill 58 (2002)

- Extended expanded net metering program.
- Wind greater than 50 kw receives generation-only credit.
- Public purpose program charges apply.
- Utilities required to interconnect within 30 business days of complete application.
- Aggregated limit to net metered MW equals $\frac{1}{2}$ of 1% of system-wide peak demand.

Assembly Bill 1X29 (2001)

- Temporary expanded net metering program to 1 MW from 10 kw.

Assembly Bill 2228 (2002)

- Net Metering for biogas.

Assembly Bill 1214 (2003)

- Net Metering for fuel cells.



Net Metering is Very Popular in California

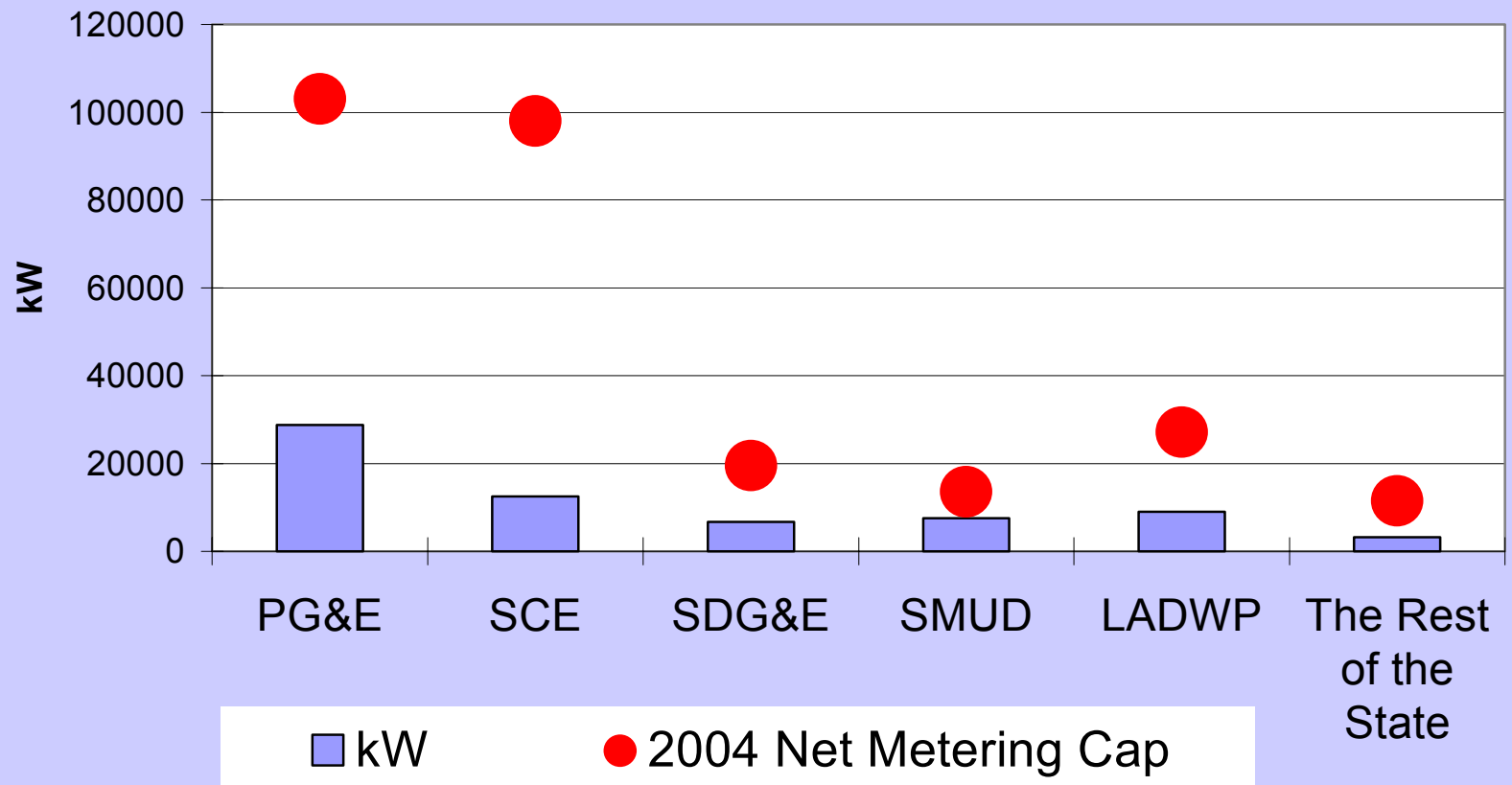
Projects Receiving Energy Commission Rebates

Year	Number	MW	Payments (\$ Millions)
1998	41	181	\$0.5
1999	197	1,060	\$2.9
2000	235	802	\$2.2
2001	1,292	4,294	\$16.9
2002	2,331	8,501	\$36.4
2003	3,022	12,917	\$52.1
2004*	2,938	12,641	\$47.6
Grand Total	10,056	40,395	\$158.7

* 2004 figures through August 2nd.



Estimated Net Metering Caps and Grid-Connected PV Capacity Installed in California by Service Territory



Net Metering Issues to Consider

????

??

- Does wide-scale deployment impact the work of the grid protection engineers?
 - Do net metering caps address the issue?
- Do customers need incentives to participate?
- How should “hybrid” systems be administered?
- Should net metering be expanded to other technologies?

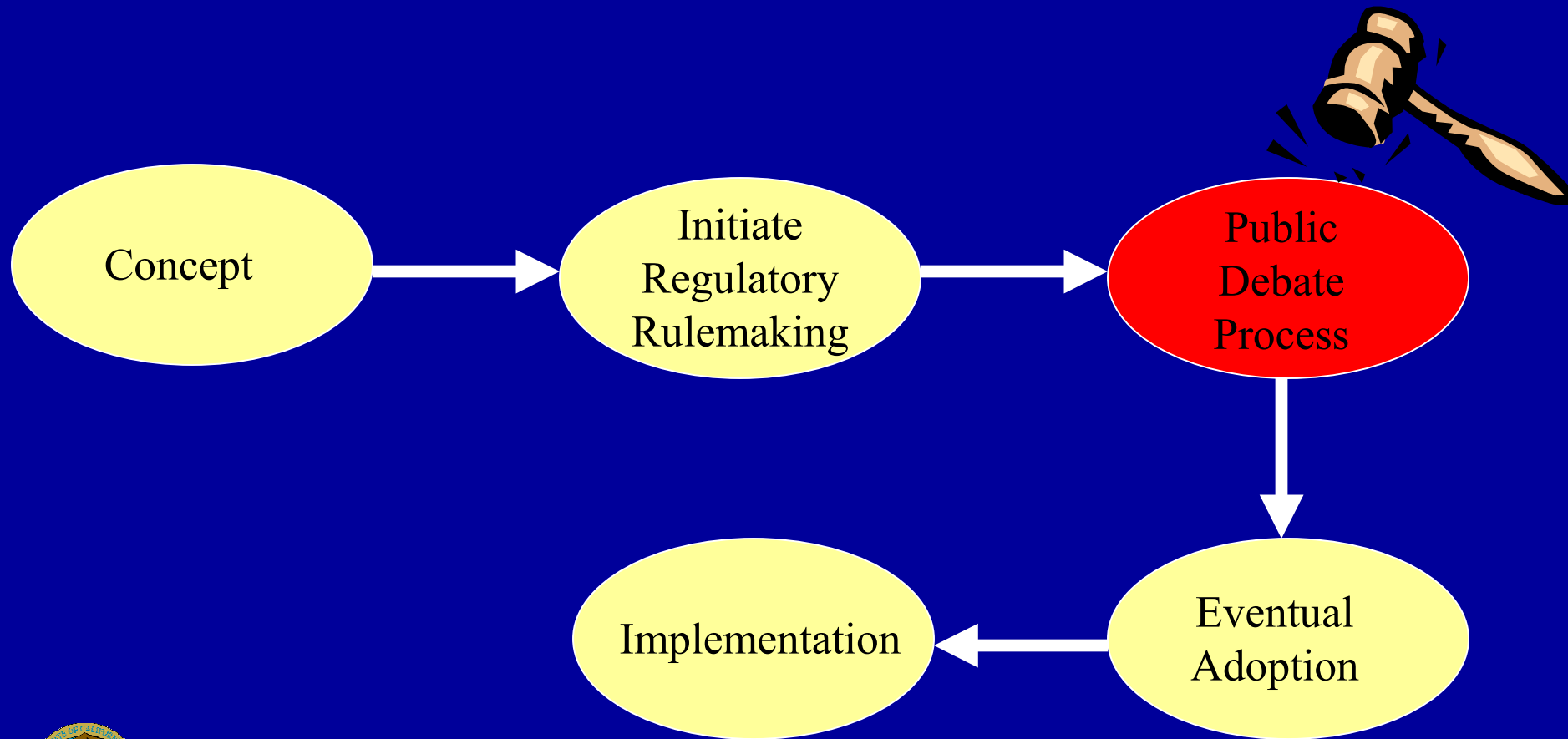


Let's Talk About Rate Design...



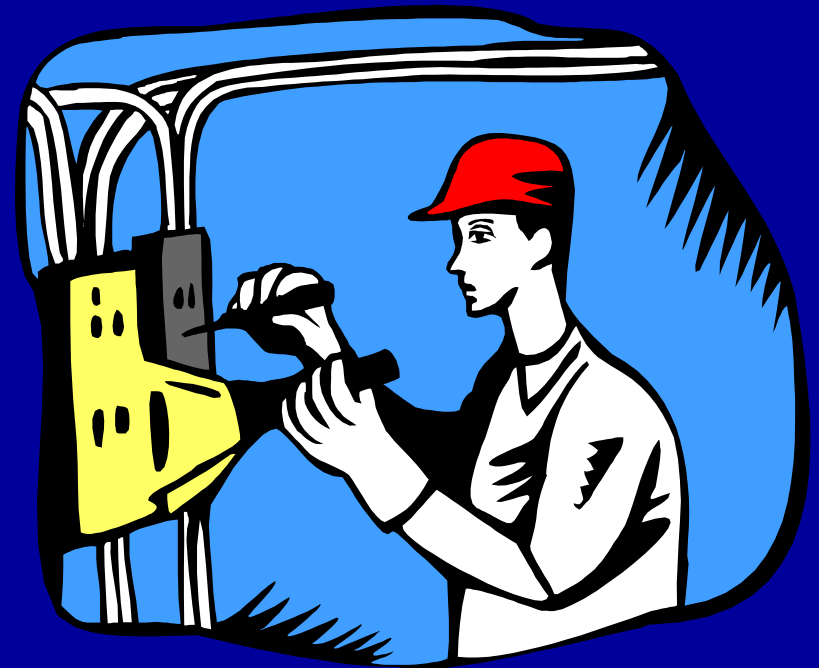
Another Opening Thought:

Rate Design Implementation Takes Time!

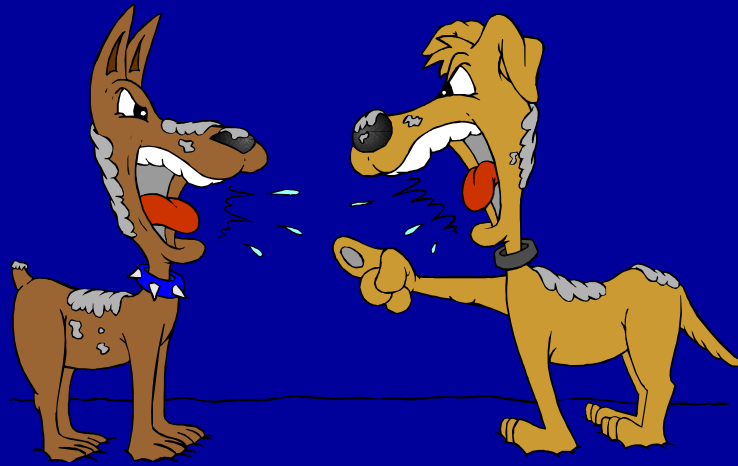


California Standby Rate Design Policies for Distributed Generation

- DG customers can avoid standby charges if it provides utility with physical assurance.
- It is appropriate to recover distribution infrastructure costs from backup customers.
- Public purpose costs should continue to be collected from standby customers.
- Charges should recover fixed costs through reservation charges and variable costs through usage charges.



DG Rate Design Has Progressed Slowly in California



- Utilities submitted DG rate design applications in September 2001.
- Parties filed comments in utility proposals in October/November 2001.
- No action taken through most of 2002, eventually rejecting utility proposals.
- CPUC instead decided to incorporate rate design proposals into utility rate design proceedings.
- Unclear when final resolution will occur.



California Standby Rate Exemptions Are Available



California Senate Bill 28 1X
required utilities to provide DG
customers with exemption
from standby charges



- Through June 2011 for customers installing CHP-related generation between May 2001 and June 2004.
- Through June 2006 for customers installing non-CHP applications between May 2001 and September 2002.
- Through June 2011 for “Ultra-Clean and Low-emission DG customers 5 MW and less installed between January 2003 and December 2005.
- Solar less than or equal to 1 MW that do not sell power to the grid.

And Finally, Our R&D Efforts...



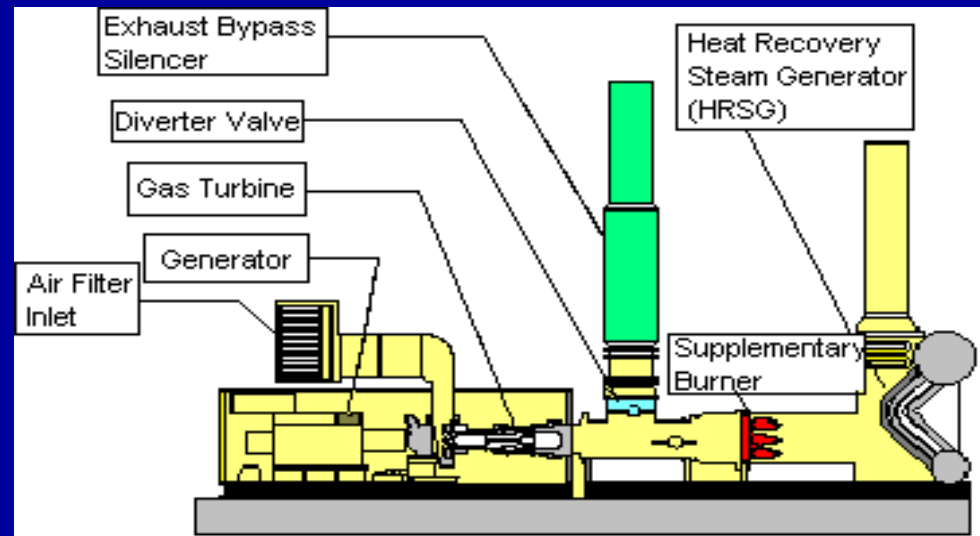
California CHP R&D Funded Through CEC's PIER Program

- RFP released in October 2003
- 4 projects funded out of 22 submittals
 - \$5.2 MM in PIER funds awarded
 - \$2.4 MM in match funding contributed



California CHP R&D Project #1: High Efficiency, Low Emissions Burners

- Goal: Develop new design of supplemental firing burners.
 - High-efficiency, ultra-low NO_x burners.
 - 3 ppm NO_x (0.01 pound per MMBtu/hr or 0.03 pound/MW-Hr)
- Field demonstration in an industrial facility exceeding 1 MW.
- Project runs from June 2004 – November 2006.

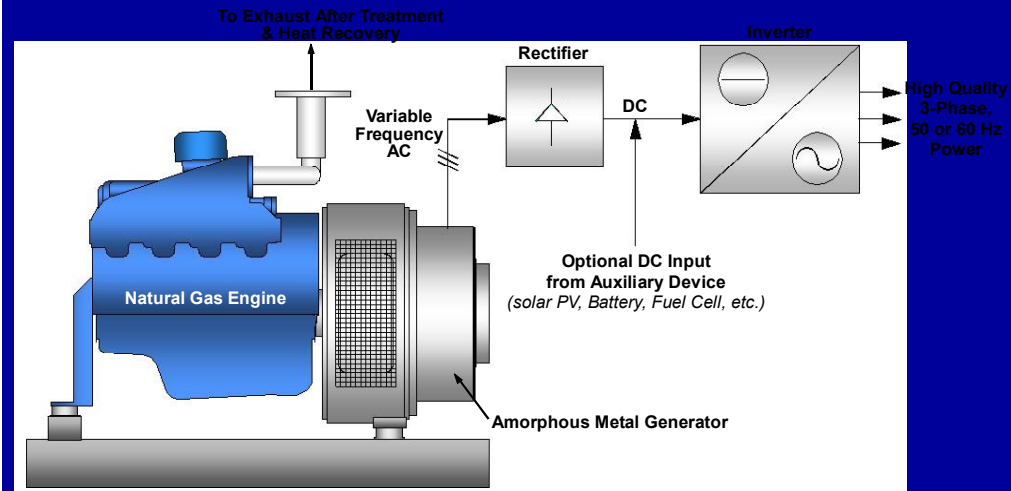


Alzeta Corporation: \$2.08 Million
(\$1.54 Million funded by CEC –
Contract 500-03-040)



California CHP R&D Project #2: Integrating Inverter Technology into CHP System

- Design, build, and test a CHP system using integrating inverter technologies in a 100 kw CHP system.
- Field test at commercial site in California.
- Project runs from June 2004 – June 2006.

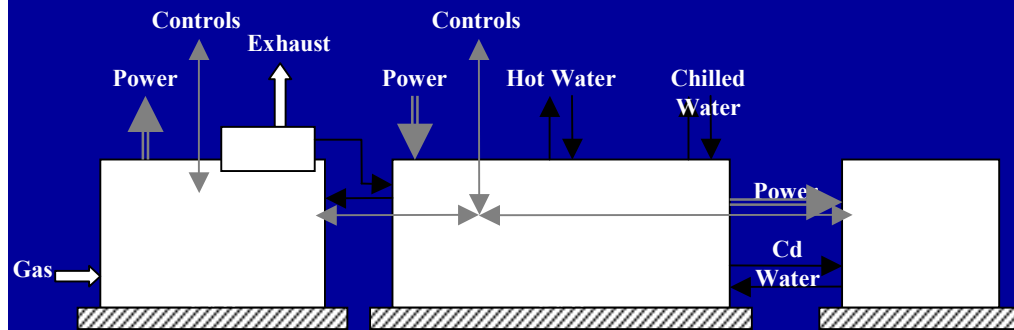


Tecogen Inc.: \$1.5 Million
(\$0.941 Million funded by CEC –
Contract 500-03-039)



California CHP R&D Project #3: Integrating Heating and Cooling Module

- Create pre-packaged CHP system with absorption chiller.
- Goal: Reduce installation cost of CHP integrated with HVAC system.
- Field test conducted at the Normandie casino in Gardena, California.
- Project runs from June 2004 – December 2006.

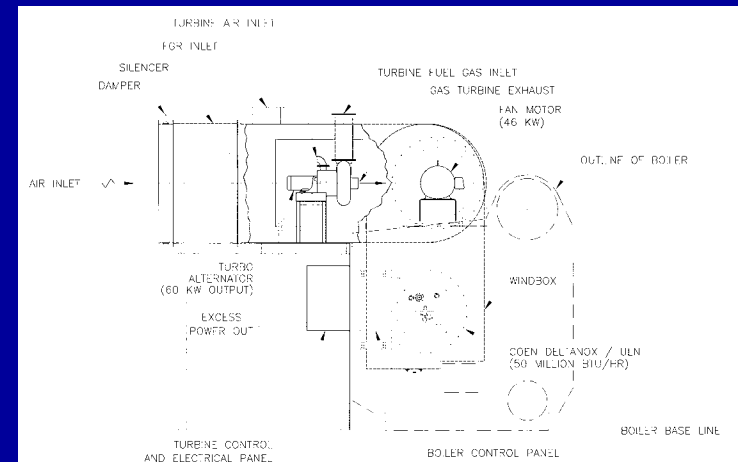


DE Solutions: \$2 Million
(\$1.17 Million funded by CEC –
Contract 500-03-038)



California CHP R&D Project #4: Using Waste Heat from Microturbines in CHP Application

- Create pre-packaged CHP system with absorption chiller.
- Goal: Develop packaged boiler that supplies 80 kw of power.
- Project runs from June 2004 – April 2007.

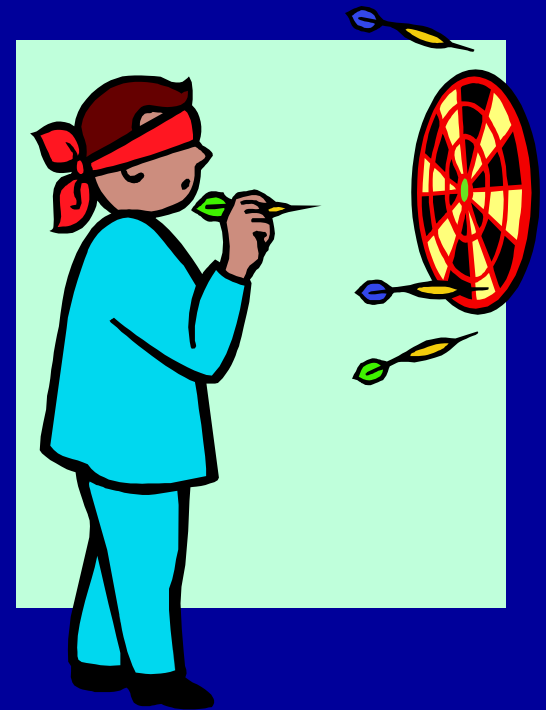


CMC Engineering: \$1.9 Million
(\$1.51 Million funded by CEC –
Contract 500-03-037)

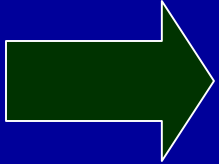


Some Final Thoughts

- CHP is a critical piece of the energy solution in California and the nation.
- With merchant generation a major uncertainty, Industry stakeholders, utilities, regulators, and policymakers must work toward the effective deployment of CHP.
- R&D efforts must continue despite growing frustration with barrier removal.



For Additional Information, Please Contact Me...



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