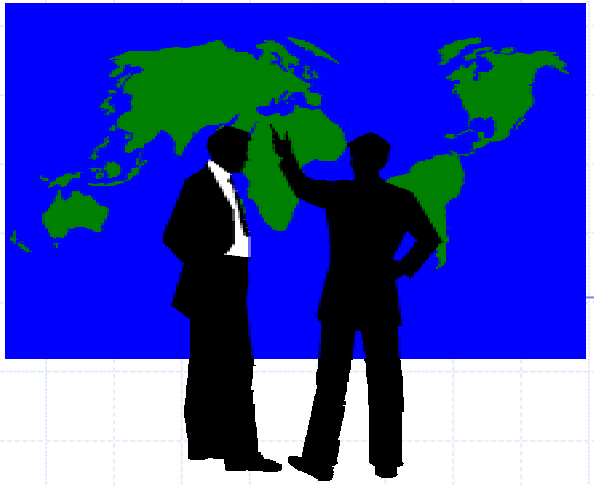
U.S. Department of Energy

OAK RIDGE NATIONAL LABORATORY

CHP Subcontractors Coordination Review Meeting

CHP/DG Applications and Analytical Support



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April 14, 2005
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CHP/DG Applications and Analytical Support

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Task Descriptions

- Task 1 – CHP Facility Database
- Task 2 – Installation Cost Analysis for Small CHP
- Task 3 – DG/CHP Financing Options
- Task 4 – Electric Rate Primer

Task 1 – CHP Facility Database

Objective: Collect basic information on existing CHP facilities and track new installations over time

- Measure progress toward CHP Challenge goal
- Gauge the impact of CHP on specific regions and applications

Overview: Builds upon previous work

- Complete merging and verification of EEA/Hagler Bailly data with EIA Non-utility Database
- Add additional sites from FEMP data, IDEA data, EEA reliability database and other sources
- Expand coverage of sites < 1 MW through equipment supplier and packager data

Task 1 – CHP Facility Database

Coordination:

- Work with manufacturers, packagers, ORNL contractors, associations, states and RACs
- DER Webcast

  http://www.intermountainchp.org/initiative/support/eea041013.pdf

Deliverables:

- Annual CHP market summaries that profile existing CHP installations by state, application, fuel, and technology;
- Will be available in hard copy and on-line

Task 1 – CHP Facility Database

Timeline:

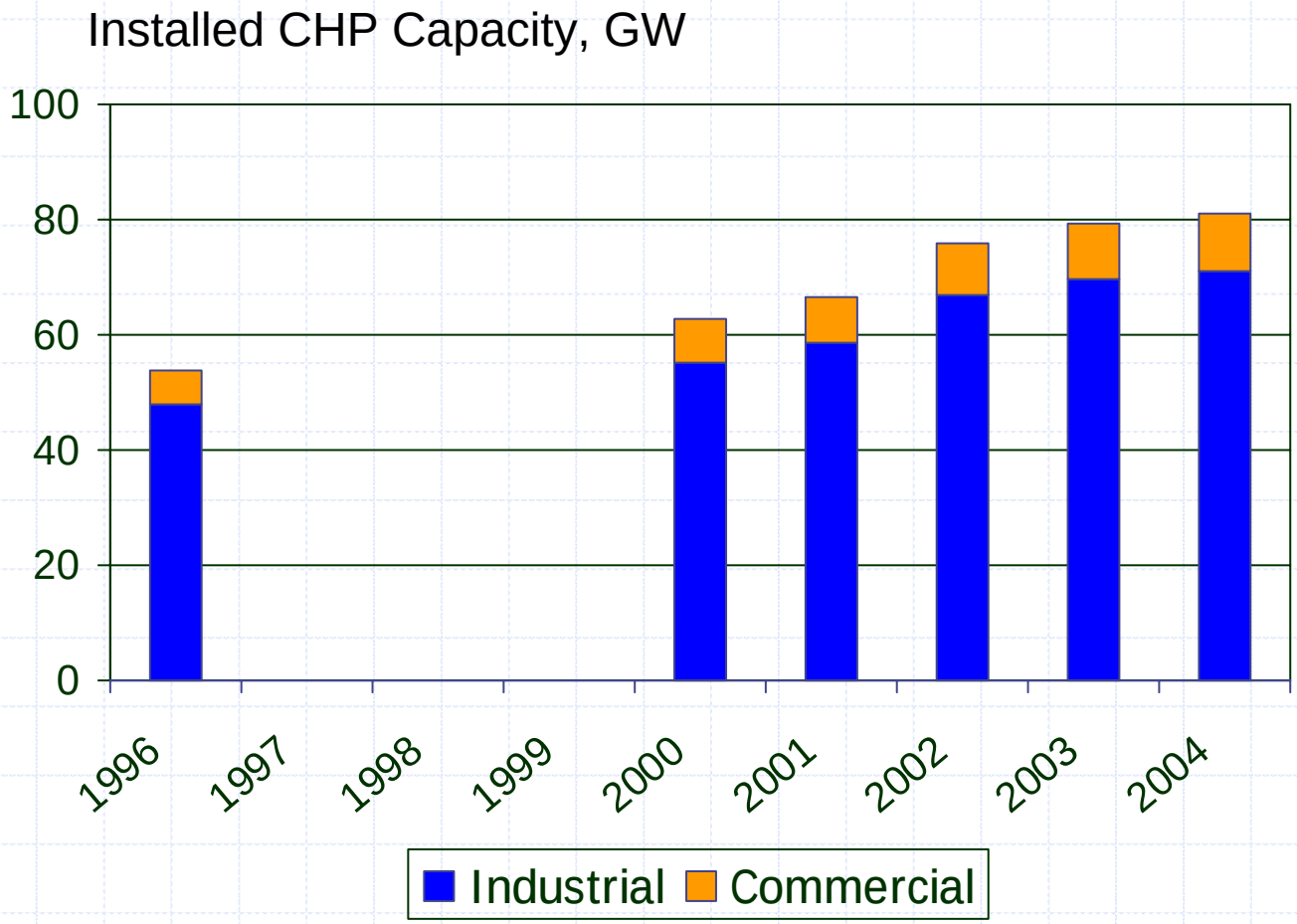
- State profiles submitted to Regional Application Centers in 2004 for review and update
- Preliminary 2004 profile developed for 2004 CHP Roadmap meeting
- Final 2004 report to be submitted 4/05
- Web accessible database in development

  http://www.eea-inc.com/testchp/index.html

Task 1 – CHP Facility Database

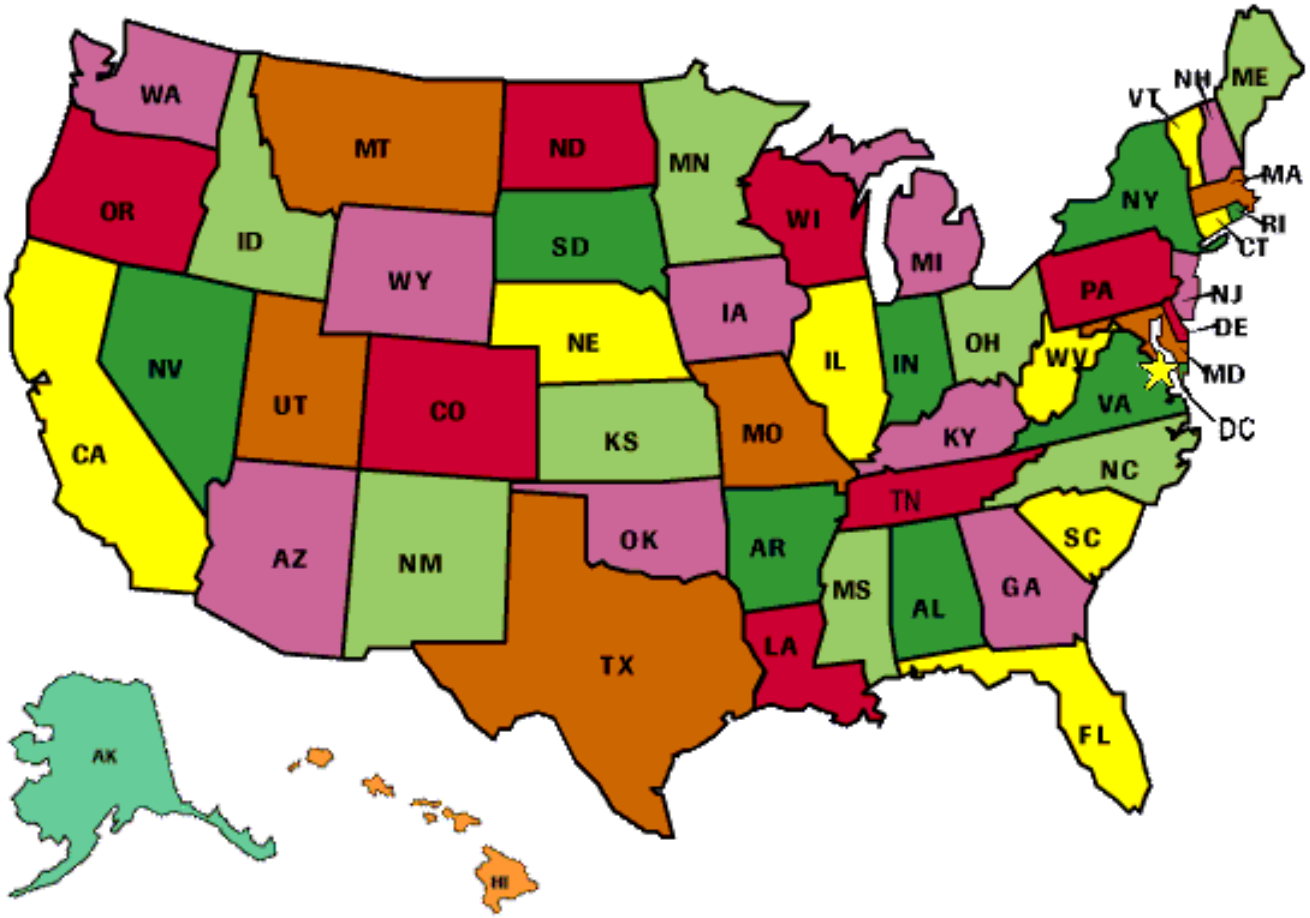
2004 Summary:

- **80,905 MW at 2845 sites**
- **Average capacity is 28.4 MW**



Combined Heat and Power Database

Click on any state to access state specific list of CHP Units,
or click on the state name in the drop box below:



Please Note: This database is a work in

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Combined Heat and Power Units located in North Dakota

City	Organization Name	Facility Name	Application	SIC4	NAICS	Op Year	Prime Mover	Capacity (kw)	Fuel Type
Drayton	American Crystal Sugar Co.	American Crystal Sugar Company	Food Processing	2062	311312	1964	B/ST	6,000	COAL
Enderlin	National Sun Energy Company	National Sun Industries, Inc.	Food Processing	2000	311	1982	B/ST	5,000	BIOMASS
Fargo	Holiday Inn	Holiday Inn Fargo	Hotels	7011	72111	2002	MT	30	NG
Hillsboro	American Crystal Sugar Co.	American Crystal Sugar Co.	Food Processing	2062	311312	1987	B/ST	13,300	COAL
Mandan	Tesoro Petroleum Corp / BP Amoco Oil Co	Mandan Refinery	Refining	2911	32411	1958	B/ST	7,500	WAST
Walhalla	Archer Daniels Midland Company	Walhalla	Food Processing	2046	311221	2000	B/ST	2,000	COAL

State Summary for North Dakota

Prime Mover Code	Sites	Capacity (kW)
Total	6	33,830
B/ST	5	33,800
CC	0	0
CT	0	0
FCEL	0	0
MT	1	30
OTR	0	0

Task 1 – CHP Facility Database (FY 05 Plans)

- Add new sites, expand coverage
  - EIA 2003, Manufacturers, RAC input, trade press
- Update/Expand Ownership, Thermal Information
- Complete Searchable On-Line Version
  - May 2005
- Annual Updates – fourth quarter

Task 2 – Installation Cost Analysis for Small CHP Systems

Objective: Quantify the range of small (<3 MW) CHP installation costs based on a sample of actual projects implemented in the last two years

- Detail installation costs for a mix of commercial, institutional, and light industrial customers
- Document driving factors to installed costs
- Identify areas for cost improvement

Task 2 – Installation Cost Analysis for Small CHP Systems

Task Overview:

- Installation survey– completed
- Data analysis – completed
- Installed cost characterization – completed
- Draft interim report – in review (3/05)
- Issues
  - Wide range of methods in recording costs
  - Confidentiality especially with regard to sensitive labor rates
  - Impact of state incentive programs on controlling costs

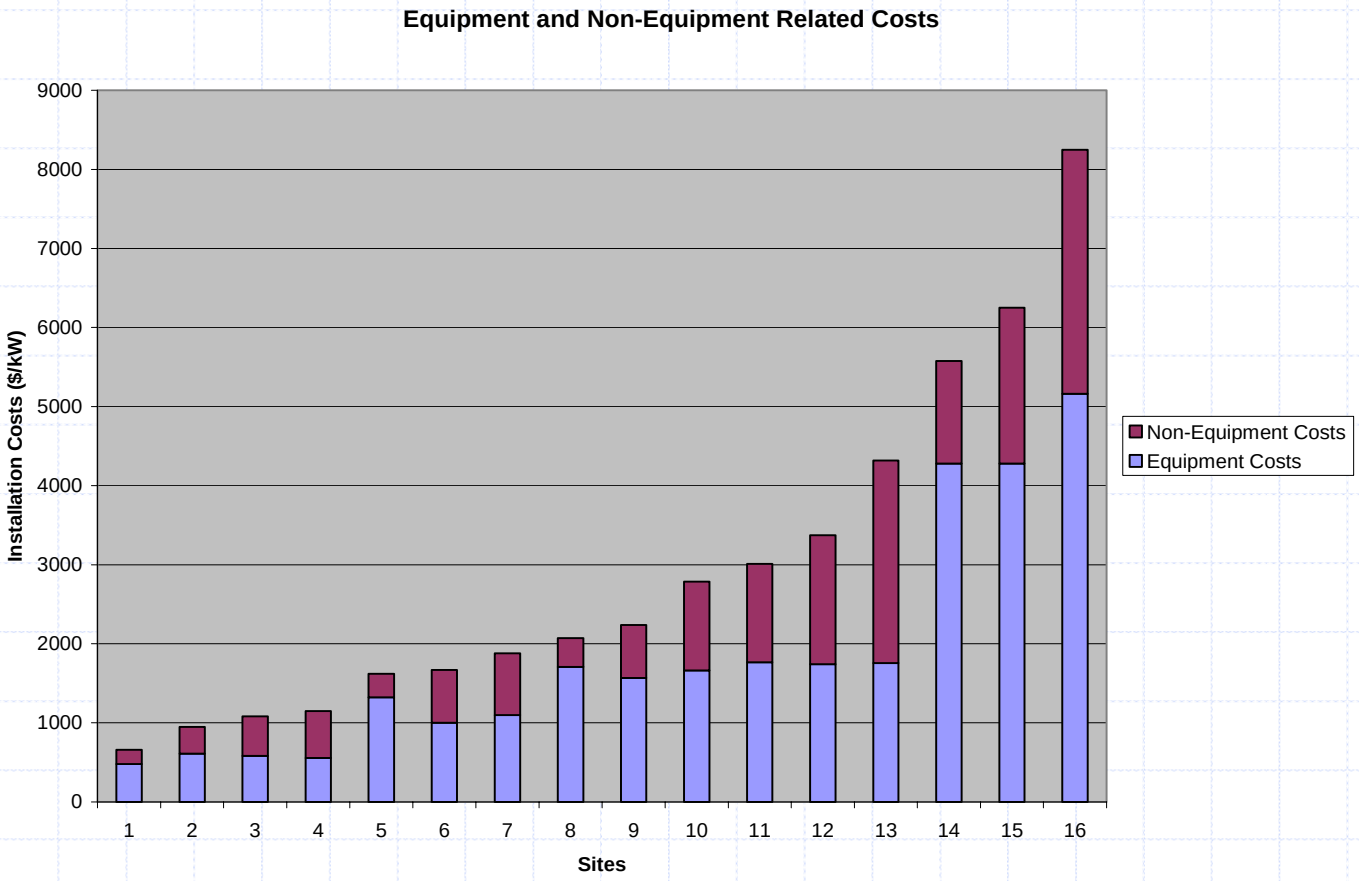
Facility Survey Results

- Goal of 15 sites for participation:
  - 4 Reciprocating Engine Projects
  - 8 Microturbine Projects
  - 3 Fuel Cell Projects
  - 1 Small Steam Turbine Project

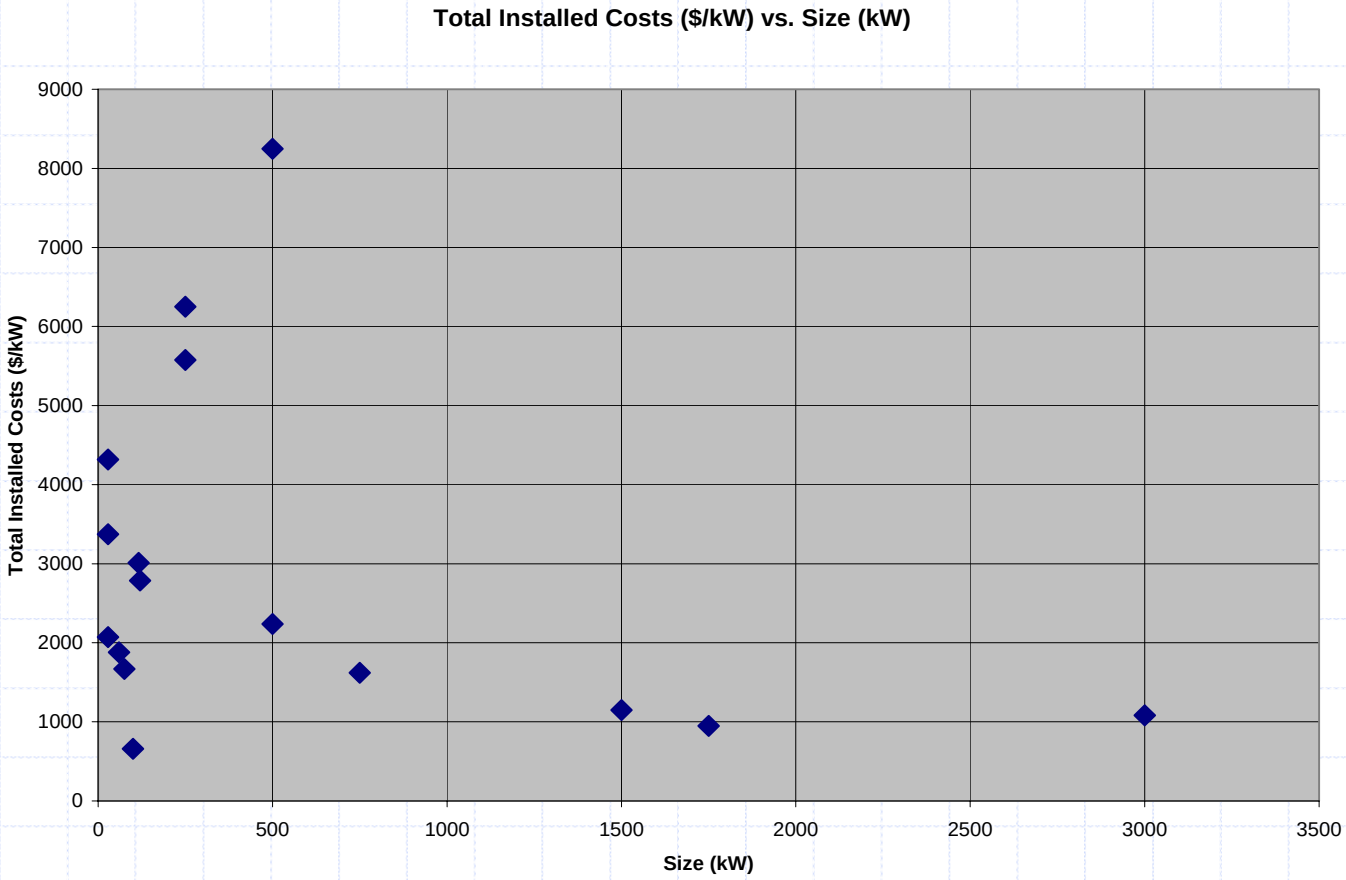
Facility Survey Results

- Commercial Carwash
- Hotel
- Industrial Food Facility
- Hotel
- College
- Museum
- Airport
- Hotel
- Hotel
- Hospital
- Commercial Building
- College
- IT Company Campus
- Health Club
- Industrial Facility
- Industrial Facility

Facility Survey Results



Facility Survey Results



Facility Survey Results

Reciprocating Engines

	Median Costs ($/kW)
Small Rich Burn RE 70-100 kW (n=1)	
Equipment Only	1000
Installation Labor/Materials	433
Engineering	200
Permiting Fees	20
Other Miscellaneous	30
TOTAL	1683
Midsized Lean Burn RE 100-500 kW (n=2)	
Equipment Only	1062
Installation Labor/Materials	333
Engineering	248
Permiting Fees	20
Other Miscellaneous	30
TOTAL	1694
Large Lean Burn RE >1000 kW (n=1)	
Equipment Only	611
Installation Labor/Materials	284
Engineering	11
Permiting Fees	3
Other Miscellaneous	40
TOTAL	948

Reciprocating Engines Example

Task 2 – Installation Cost Analysis for Small CHP Systems

Coordination:

- Sites identified using EEA CHP installation database
- Sites contacted that participated in Reliability database project
- SoCal Gas and California Self-Generation Incentive Program
- NYSERDA CHP demonstration project

FY05 Plans:

- Final report with additional site surveys and data analysis – 8/05

Task 3 – DG/CHP Financing Options

Objective: Evaluate the role of financing and ownership options in small CHP (< 2MW) deployment

- Internal hurdle rates for small CHP often high due to perceived risks and limited capital
- Various financing and ownership options are not well understood or documented for smaller CHP installations
- Provide overview of various financing and ownership options
- Compare effectiveness through case studies
- Highlight the pros and cons of different options

Task 3 – DG/CHP Financing Options

Coordination: Work with developers, ESCOs, financial institutions.

Deliverable: Public report that summarizes financing and ownership options, supported by case studies; hard copy and on-line version

Timeline: Task initiated FY2004, final report FY2005

Task 3 – DG/CHP Financing Options

Progress: Task initiated 2004

- Survey developers, suppliers, financiers – completed
- Summarize options, issues, problems – draft in review
- Develop case study pro formas – 5/2005
- Draft Final report – 8/2005

Financing Interviews

Role	Number of Interviewees
Developer	7
Engineer	4
Engineer/Developer	1
EPC Contractor	4
Equipment representative	1
Equipment Vendor	2
Gas Utility	4
Leasing company	4
Package Vendor	2
Package Vendor/Developer	2

Interview Impressions

Difficult to draw consensus

- Many felt financing was a minor barrier compared to other issues
- However, most cited examples where customers declined to proceed because they had higher priorities for internal capital
- Others cited a number of prospective customers looking for someone else to cover upfront capital
- Many developers lacked substantive knowledge of financing options and capital sources
- Capital providers complained that developers were not correctly incorporating financing costs leading to disparities in expectations

Real question may be would the availability of cost-effective, third party capital to build, own and operate small CHP lead to more dynamic market growth?

Task 4 – Electric Rate Primer

Objective: Identify primary types of electric rate structures and categorize their impact on on-site generation

- Growing recognition that tariff issues are key determinants of DG/CHP economics
- Need for detailed understanding of rate options and impact on DG/CHP for various state proceedings
- Identify range of applicable rate structures (retail and standby/backup)
- Compare impact on CHP economics for “sample customers” using applicable rates of specific utilities

Task 4 – Electric Rate Primer

Coordination: Work with regional CHP initiatives and Applications Center(s); CHP analysis team

Deliverable: Public report that profiles typical rate structures and their impact on on-site generation - hard copy and on-line version; Presentation(s) to state regulatory groups/NARUC

Timeline: Task initiated FY2004

Task 4 – Electric Rate Primer

Progress: Task initiated 2004

- Collect rates on 30+ utilities – completed
- Profile rate structures and ranges – completed
- Analyze prototype customers on 5 to 7 utilities that represent tariff structures – in process
- Interim report – 5/2005
- Final report – 9/2005

Electric Rate Structures

- Four primary types of rate structures
  - Simple Volumetric
  - Simple Demand
  - Declining Block
  - Time of Use/Demand
- Often found in combination
- Ratchets, exit fees and standby charges complicate matters

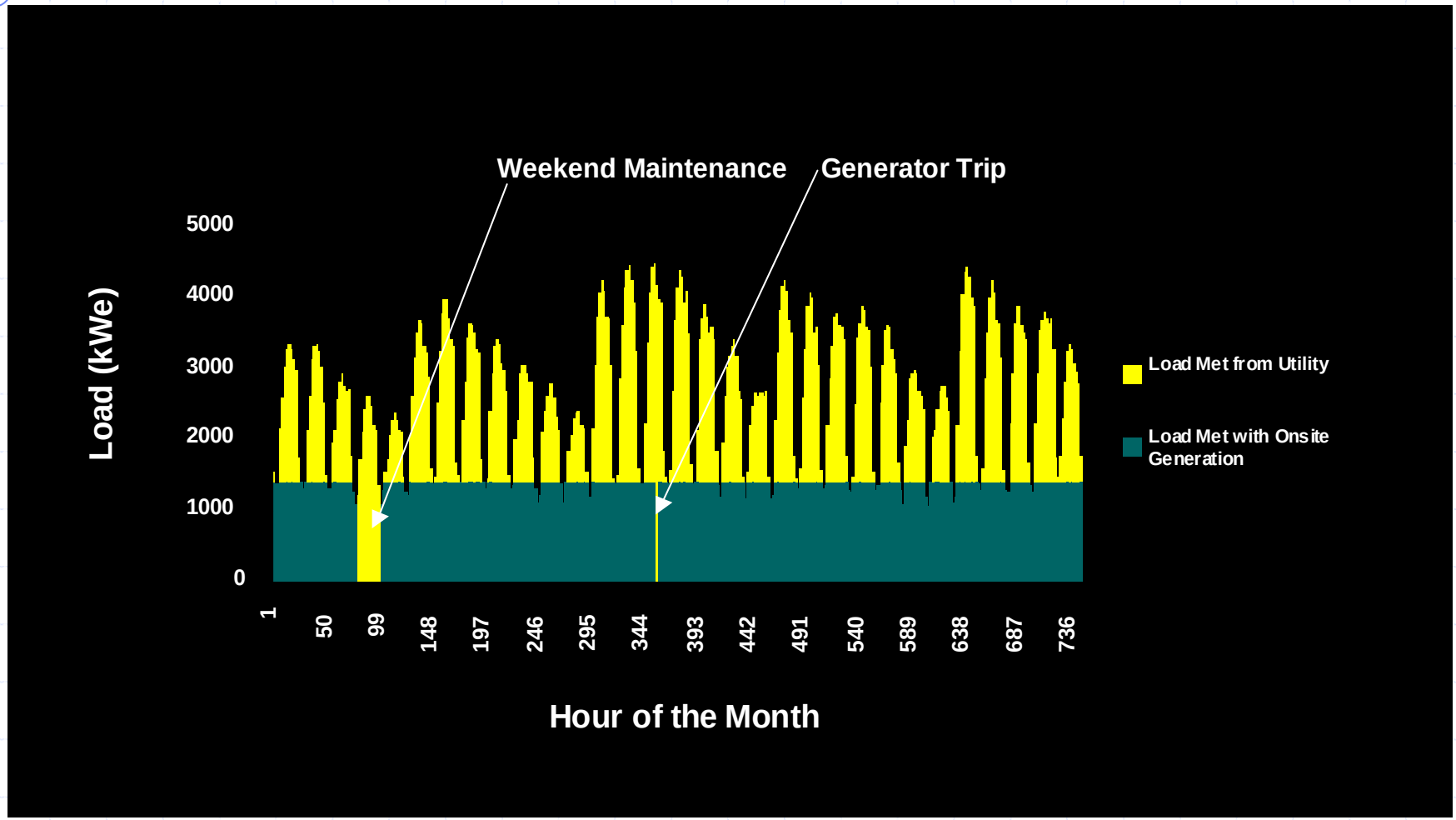
Impact of Rate Design on CHP Revenue

- Electric rate design has a high impact upon economic return on a CHP system.
- The following analysis examines the impact of six rate designs on customer energy savings.
- Each rates structure provides equal revenue to the electric LDC (revenue neutral to the utility), but has significant impact upon the customer's potential energy economics.

System & Application Studied

- Current August Load: 1,875,968 kWh
- Maximum Demand: 4512 kWe
- August Electric Bill: $300,192
- Installs CHP: 1,340 kWe
- The system is down for maintenance during a weekend in August.
- The system trips for an hour on peak in August.

Total Load for August and CHP Generator Performance



Sample Rates Used for Comparison

	Rate A	Rate B	Rate C	Rate D	Rate E	Rate F	Rate G	Rate H
* No Ratchet ** With Ratchet	Pure Volumetric	High customer charge	Declining Block	Non-coincident Demand Charge*	Non-coincident Demand Charge**	Standby Energy Charge	Standby Rate	Time of Use
Customer Charge ($/Mo)	299	24,000	299	299	299	299	299	299
Demand Charge ($/kWe)								
Combined				12.00	12.00			
Facilities								6.40
Time-Related - On-Peak								17.95
Mid-Peak								2.70
Standby							8.00	
Energy Charge ($/kWh)								
Summer - On-Peak								0.13987
Mid-Peak								0.08531
Off-Peak								0.07233
Winter - Mid-Peak								0.09333
Off-Peak								0.07302
Flat	0.15986	0.14723		0.13100	0.13100	0.15986	0.15986	
1st Block< or= 800,000 kWh			0.19000					
2nd Block > 800,000 kWh			0.13745					
Standby						0.40		

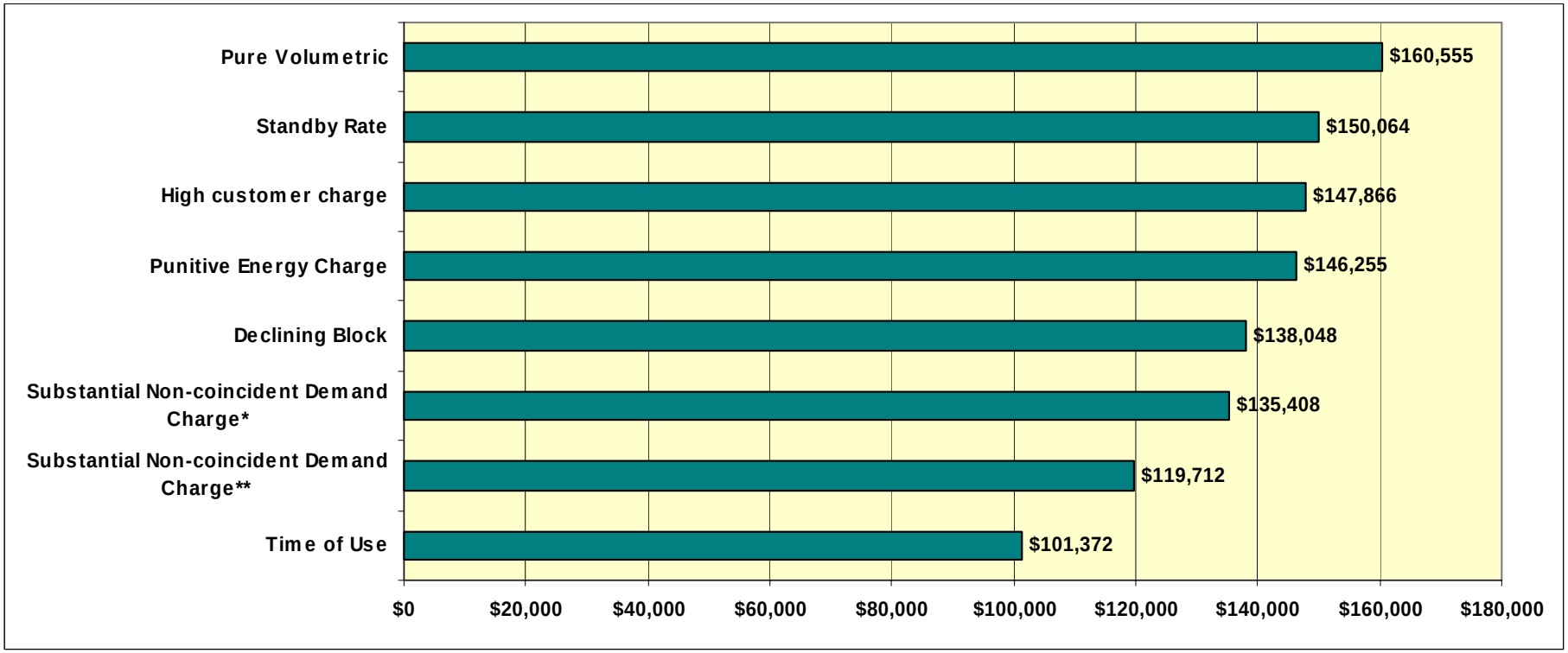
Cost of Electric Service Before CHP

	Rate A	Rate B	Rate C	Rate D	Rate E	Rate F	Rate G	Rate H
* No Ratchet ** With Ratchet	Pure Volumetric	High customer charge	Declining Block	Substantial Non-coincident Demand Charge*	Substantial Non-coincident Demand Charge**	Standby Energy Charge	Standby Rate	Time of Use
Customer Charge ($/Mo)	$299	$24,000	$299	$299	$299	$299	$299	$299
Demand Charge ($/kWe)								
Combined				$54,144	$66,000			
Facilities								$28,877
Time-Related - On-Peak								$80,990
Mid-Peak								$11,059
Standby								
Energy Charge ($/kWh)								
Summer - On-Peak								$71,914
Mid-Peak								$56,206
Off-Peak								$50,847
Winter - Mid-Peak								
Off-Peak								
Flat	$299,893	$276,192		$245,749	$245,749	$299,893	$299,893	
1st Block< or= 800,000 kWh			$152,000					
2nd Block > 800,000 kWh			$147,893					
Total Cost	$300,192	$300,192	$300,192	$300,192	$300,192	$300,192	$300,192	$300,192

Cost of Electric Service After CHP

	Rate A	Rate B	Rate C	Rate D	Rate E	Rate F	Rate G	Rate H
* No Ratchet ** With Ratchet	Pure Volumetric	High customer charge	Declining Block	Substantial Non-coincident Demand Charge*	Substantial Non-coincident Demand Charge**	Standby Energy Charge	Standby Rate	Time of Use
Customer Charge ($/Mo)	$299	$24,000	$299	$299	$299	$299	$299	$299
Demand Charge ($/kWe)								
Combined				50,304	$66,000			
Facilities								$26,829
Time-Related - On-Peak								$75,246
Mid-Peak								$7,198
Standby							$10,720	
Energy Charge ($/kWh)								
Summer - On-Peak								$44,512
Mid-Peak								$30,955
Off-Peak								$13,781
Winter - Mid-Peak								
Off-Peak								
Flat	$139,338	$128,326		$114,181	$114,181	$153,638	$139,109	
1st Block< or= 800,000 kWh			$152,000					
2nd Block > 800,000 kWh			$9,845					
Total Cost	$139,637	$152,326	$162,144	$164,785	$180,480	$153,937	$150,128	$198,820

Customer Savings by Rate Design



Task 4 – Electric Rate Primer

Utility	Rate Structure	Utility Size (S, M, L)	Electric Costs (L, M, H)	CHP Potential (L, M, H)	Region
Commonwealth Edison (Exelon)	Demand FB-S /Energy TOU-2	L	H	M	Midwest
Boston Edison	FB-S/TOU-2-S	S	H	H	New England
Consolidated Edison	FB/TOU-2	L	H	H	North East
Florida Power and Light	FB/TOU-2	L	L	M	South East
Georgia Power	FB/TOU-3-S	L	L	L	South East
Niagara Mohawk	TOU-2/FB	M	M	M	North East
Pacific Gas and Electric	TOU-2-S	L	H	H	West
Southern California Edison	FB-S/TOU-3-S	L	H	H	West
Nevada Power and Light	FR/TOU-2-S	S	L	L	Mountain
Public Service Electric and Gas	FB/TOU-3-S	M	M	M	Mid Atlantic
PECO (Exelon)	FB	M	M	M	Mid Atlantic

Questions?