

MICHIGAN CHP APPLICATIONS IN PERSPECTIVE



Leslie E. Farrar
(MAC and UIC/ERC)

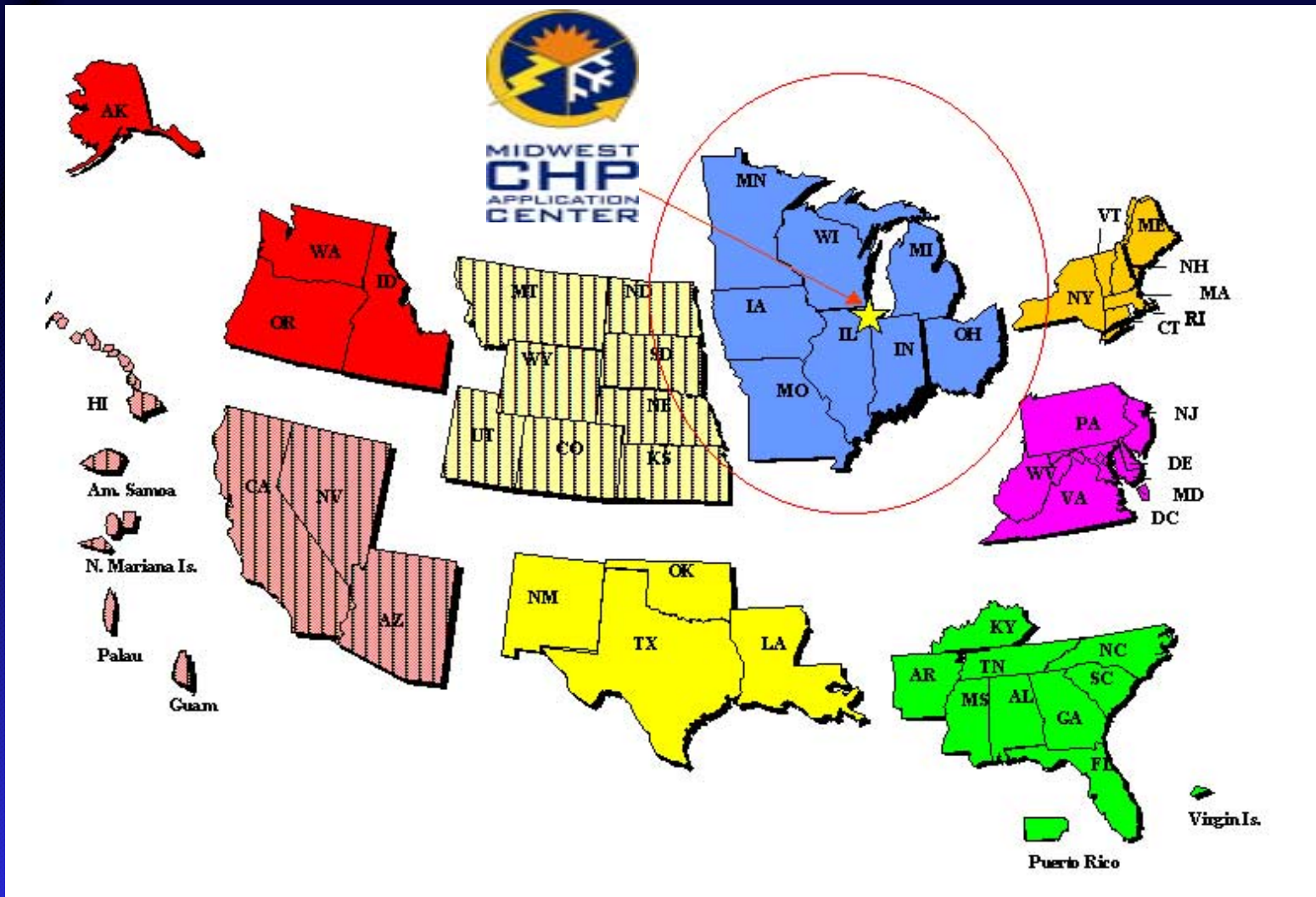


Michigan CHP Stakeholders Meeting

Lansing, MI

January 14, 2003

Midwest Regional Application Center



Midwest Application Center

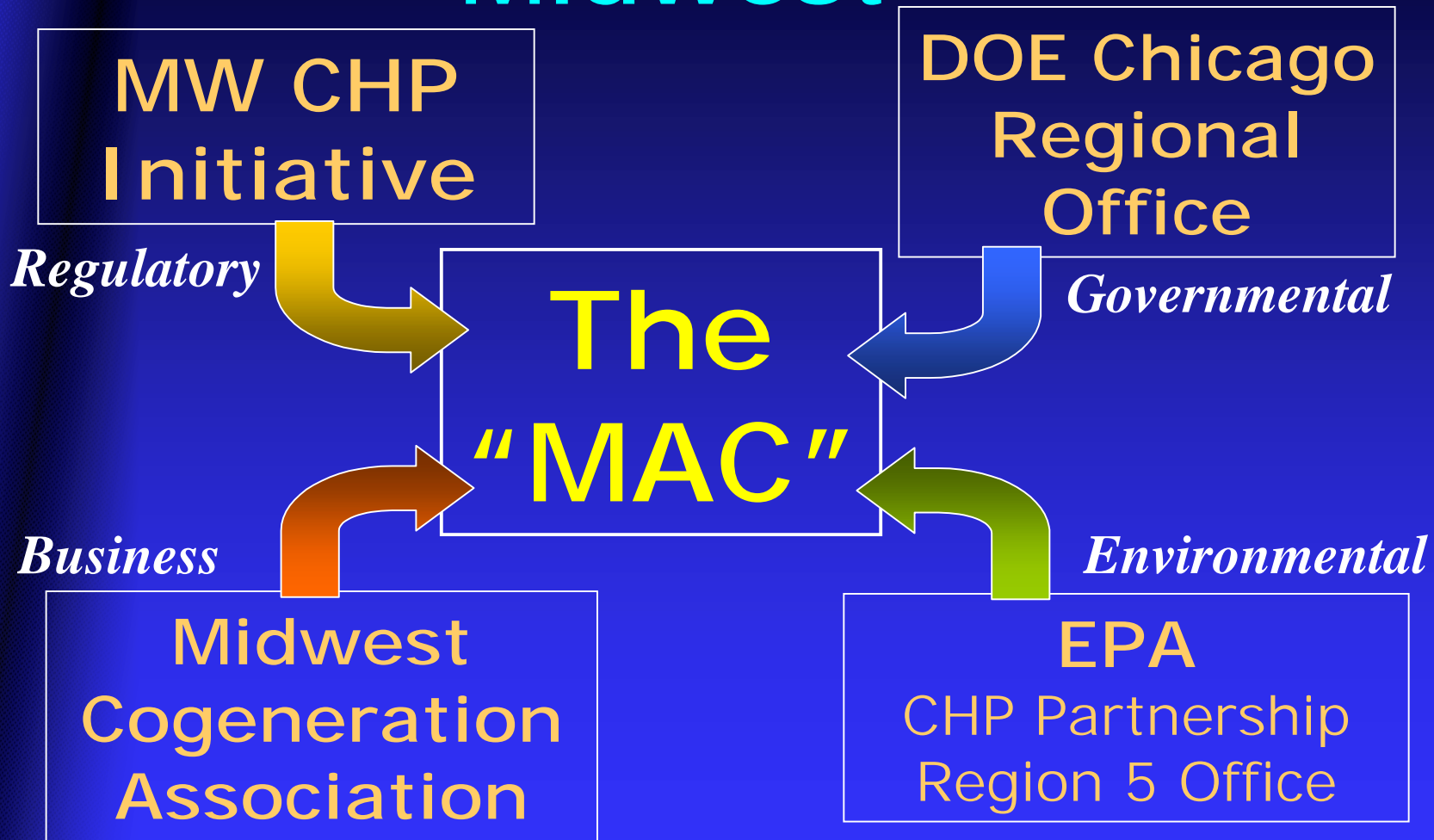
➤ What Do We Do?

- ❖ Technology Transfer
- ❖ Education
- ❖ Information
- ❖ Project Assistance/Technical Assessment

➤ How Do We See the Market in the Midwest?

The Economic, Reliability, and Emission Drivers are Emerging Whereby CHP Can Be Successful in the Midwest.

Working Together in the Midwest



Michigan CHP Baseline

What Have We Learned?

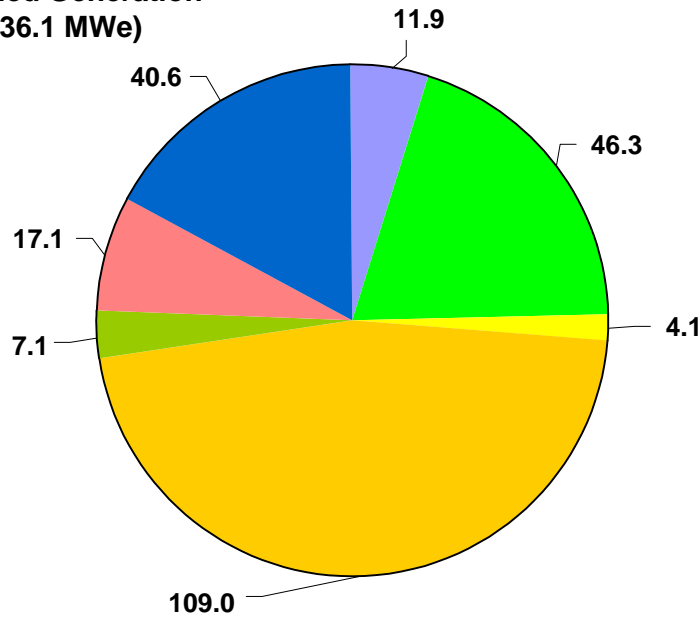
- Current Installations
 - ❖ Total Installations
 - ❖ Prevalent Sectors
- Energy Pricing Effects
 - ❖ Spark Spread
 - ❖ Electric verses Natural Gas Price Sensitivity

CHP Installations in Michigan

- Detroit Airport
- Hospitals
- Schools/Universities
- Landfills
- Municipal Water/Resource Recovery
- Hotels/Office Buildings

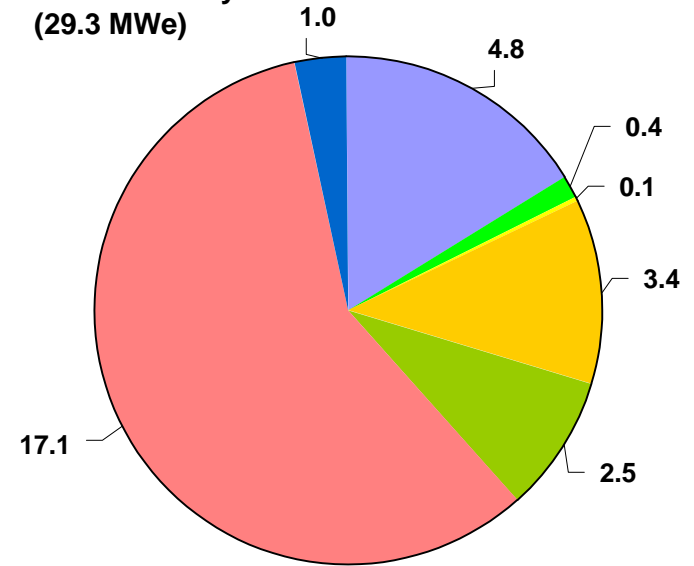
CHP in Michigan

Installed Generation
(236.1 MWe)



- Hospitals
- Municipal Water/Resource Recovery
- Hotels/Offices
- Schools/Universities
- Landfill Gas
- Airports
- Others

Installed Generation
w/ Heat Recovery
(29.3 MWe)



Estimated Theoretical Potential
2,410 to 7,480 MWE

"Spark Spread"

Electricity*	per MMBTU
Commercial	\$23.36
Industrial	\$14.93

minus

* EIA Energy Pricing Data 2000 (Latest Published Electric Prices). Includes Demand Charges.

Natural Gas**	per MMBTU
Commercial - Delivered	\$7.44
Industrial - Delivered	\$5.39
Wholesale - City Gate	\$3.68

> \$12 ?

**EIA State Average Prices August 2002 9



Energy Price Sensitivity

- Natural Gas Pricing
 - ❖ Recent Swings
 - ❖ Sensitive to Predictions, Production, Storage, and Usage
- Electricity Pricing
 - ❖ Bundled and Contract Service Adds Stability
 - ❖ Real Time Pricing Will Be More Volatile
 - ◆ Same Sensitivities as NG But Without Storage Capability

Electric Price Sensitivity

- Analysis More Sensitive to Electricity Prices
 - ❖ Higher Electric Prices = Quicker Payback
 - ❖ Electric Prices Relatively Stable But Increasing Over Time
 - ❖ Future Pricing Uncertain with True Deregulation and Real Time Pricing

Natural Gas Price Sensitivity

- Analysis Less Sensitive to Natural Gas Prices
 - ❖ Higher Natural Gas Prices = Longer Payback
 - ❖ Marginal Impacts Around \$4.50/MMBTU
 - ◆ Generation Heat Recovery Offsets Effects
 - ◆ Option to Use Electric Utility Remains
 - ❖ More Recent Swings Have End Users More Concerned

Michigan in Perspective

Michigan In Perspective

- Regionally Michigan is “Mid Pack”
 - ❖ Large “Grass Roots” Interest in Michigan
- Illinois Has ...
 - ❖ Better “Spark Spread”
 - ❖ Better Estimated Market Potential
- Wisconsin Has ...
 - ❖ Biomass as a Big Driver
 - ❖ Many State Initiatives for Improving Energy Efficiency (*Including Funding*)
- Other Midwest States Less Promising

Michigan in Perspective

- More CHP Favorable States
 - ❖ California and New York
 - ◆ Power and Transmission Deficit
 - ◆ High Electric Costs
 - ◆ Large Energy Funds to Support Deployment of CHP
 - Energy Charges (*NYSERDA & CEC*)
 - ❖ Texas
 - ◆ Favorable Interconnection Process and Standards
 - ◆ Michigan's Modeled After Texas

Michigan in Perspective

➤ National Perspective

- ❖ Regional CHP Support Leads the Nation
 - ◆ Midwest CHP Application Center (MAC)
 - ◆ Midwest CHP Initiative (MCHPI)
 - ◆ Midwest Cogeneration Association (MCA)
- ❖ DOE Support – Office of Distributed Energy and Electric Reliability
- ❖ EPA Support – CHP Partnership

Michigan Application Studies

- Key Commercial Application Examples
 - ❖ Hospitals
 - ❖ Midsize Hotels
 - ❖ Cities
 - ◆ Grand Rapids
 - ◆ Detroit
- Metropolitan Healthcare Village Development

What Makes CHP a Good Option?

- Long Operating Hours
 - ❖ Commercial > 3,200 Hours/Year
 - ❖ Industrial > 6,000 Hours/Year
- High Energy Needs
- Thermal and Electric Loads Concurrent
- Spark Spread >\$12 or Low/Free Fuel Costs
- Low Cost Financing Available
- 5 to 10 Year Payback Acceptable
- CHP Provides More Than Just Savings
 - ❖ Reliability/Backup Power
 - ❖ Power Quality

Hospital

- Long Operating Hours
- High Energy Needs
- Thermal and Electric Loads Concurrent
- 5-Year Payback Often Acceptable
- Improved Reliability Improves Bottom Line
 - ❖ Keeps Non-Life Critical Profit Centers Open
 - ❖ Keeps Sensitive Equipment Operating

Hospital

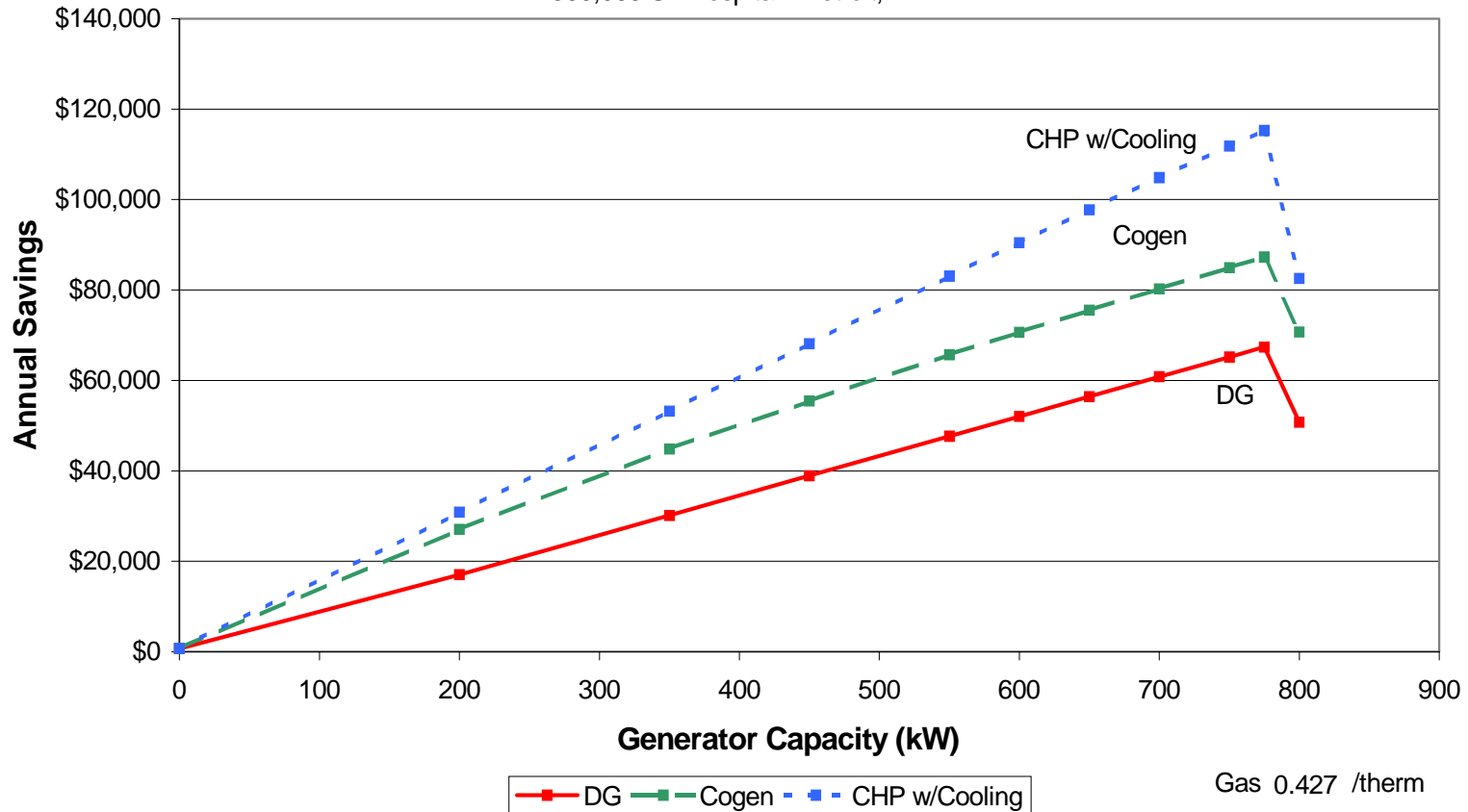
- ❖ CHP with Cooling
- ❖ 300,000 Square Feet
- ❖ CHP Operates "On Peak" Hours

	Installed First Cost	Detroit Edison		Grand Rapids	
		Annual Savings	Simple Payback (Years)	Annual Savings	Simple Payback (Years)
DG Only	\$784,479	\$67,376	11.6	\$34,206	22.9
Cogeneration	\$849,763	\$87,310	9.7	\$54,140	15.7
CHP with Cooling	\$941,013	\$115,303	8.2	\$69,977	13.4

Hospital Savings

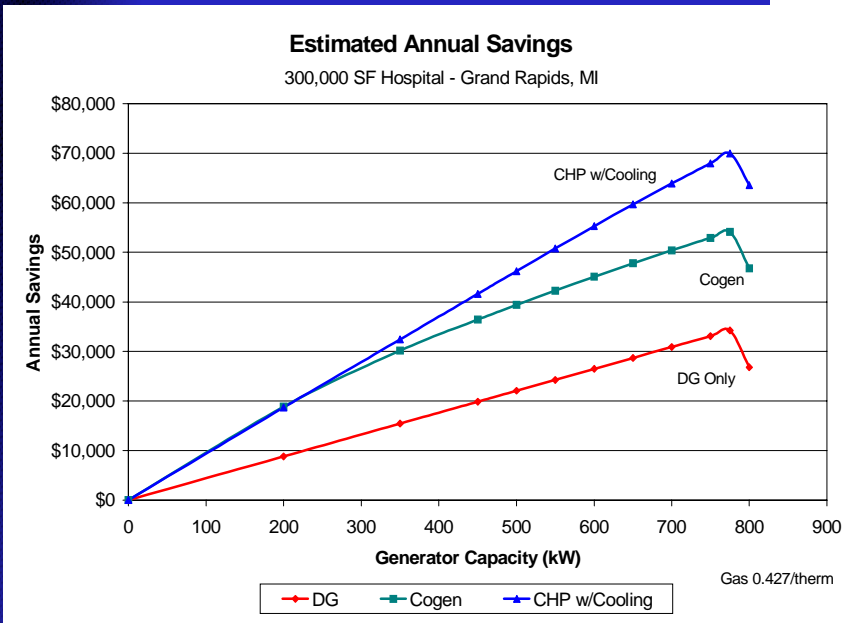
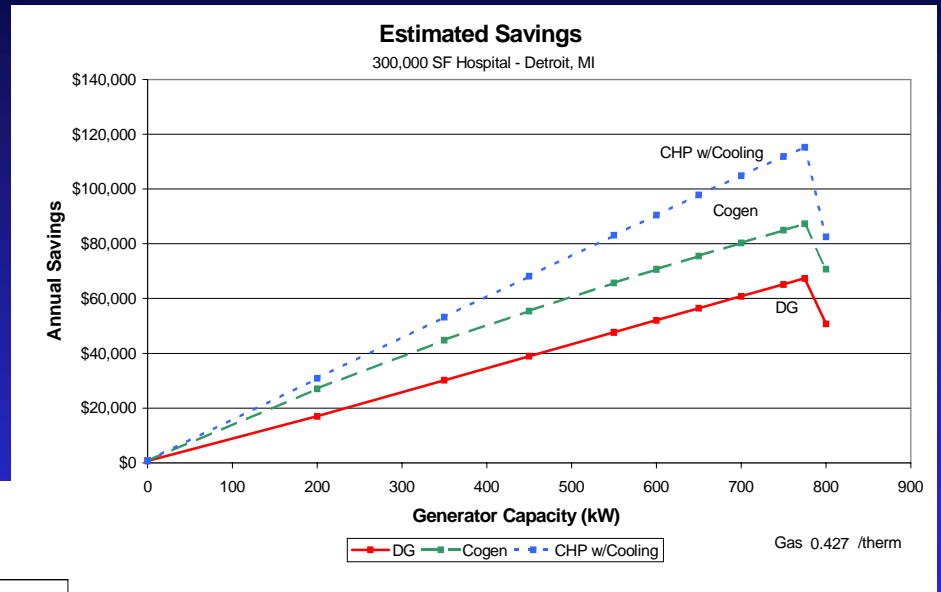
Estimated Savings

300,000 SF Hospital - Detroit, MI



Hospital Savings Comparison

Detroit:
Annual Savings \$115k
Payback 8.2 Years



Grand Rapids:
Annual Savings \$70k
Payback 13.4 Years



Hospital – CHP with Cooling

	Grand Rapids		Detroit Edison	
	No Generation	775 kW Generator	No Generation	775 kW Generator
Electric Energy	\$242,926	\$171,780	\$166,680	\$119,793
Electric Demand	\$146,867	\$63,967	\$252,070	\$71,631
Standby Charge	\$0	\$3,069	\$0	\$35,078
Monthly Electric Charges	\$44,243	\$33,146	\$59,196	\$43,999
Total Electric Charges	\$434,035	\$271,962	\$477,946	\$270,502
Natural Gas Charges	\$139,629	\$210,559	\$139,629	\$210,527
O&M Costs	\$0	\$21,225	\$0	\$21,225
Total Operating Costs	\$573,664	\$503,747	\$617,575	\$502,254
Savings		\$69,917		\$115,321

Midsized Hotel

- Long Operating Hours
- High Energy Needs
 - ❖ Especially During Electric Peak Charge Periods
- High Thermal Loads Associated with Pool and Laundry
- Concurrent Electric and Thermal Demand

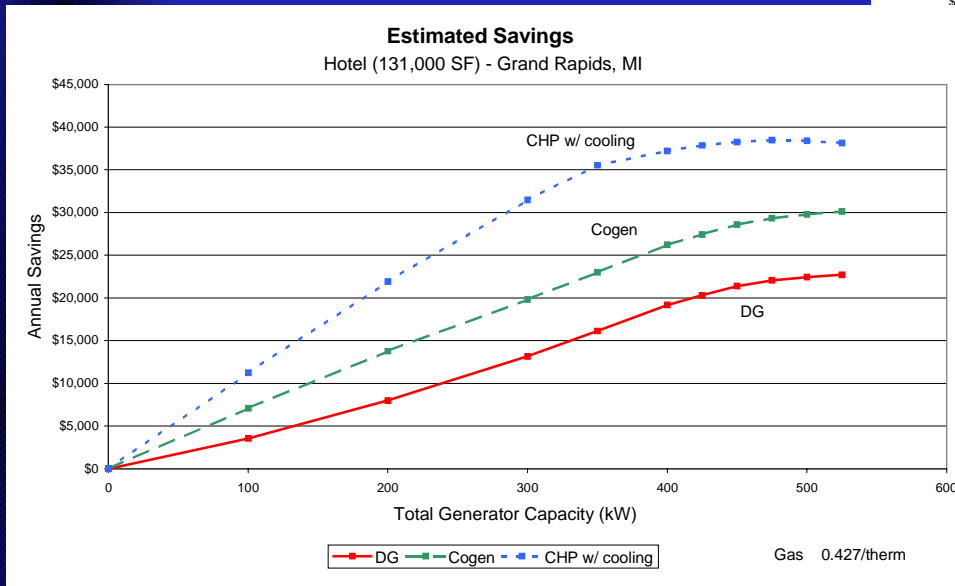
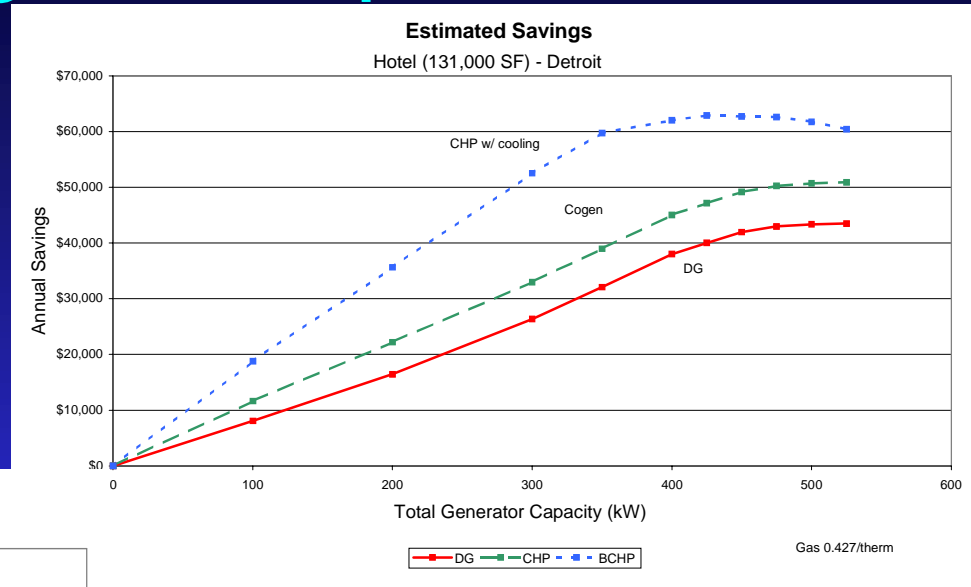
Midsize Hotel

- ❖ CHP with Cooling
- ❖ 131,000 Square Feet
- ❖ CHP Operates "On Peak" Hours

	Detroit Edison			Grand Rapids	
	Installed First Cost	Annual Savings	Simple Payback (Years)	Annual Savings	Simple Payback (Years)
DG Only	\$448,232	\$32,088	14.0	\$16,130	27.8
Cogeneration	\$481,115	\$38,958	12.3	\$23,001	20.9
CHP with Cooling	\$543,213	\$59,758	9.1	\$35,536	15.3

Hotel Savings Comparison

Detroit:
Annual Savings \$60k
Payback 9.1 Years



Grand Rapids:
Annual Savings \$35.5k
Payback 15.3 Years



Metropolitan Healthcare Village Development (MHVD)

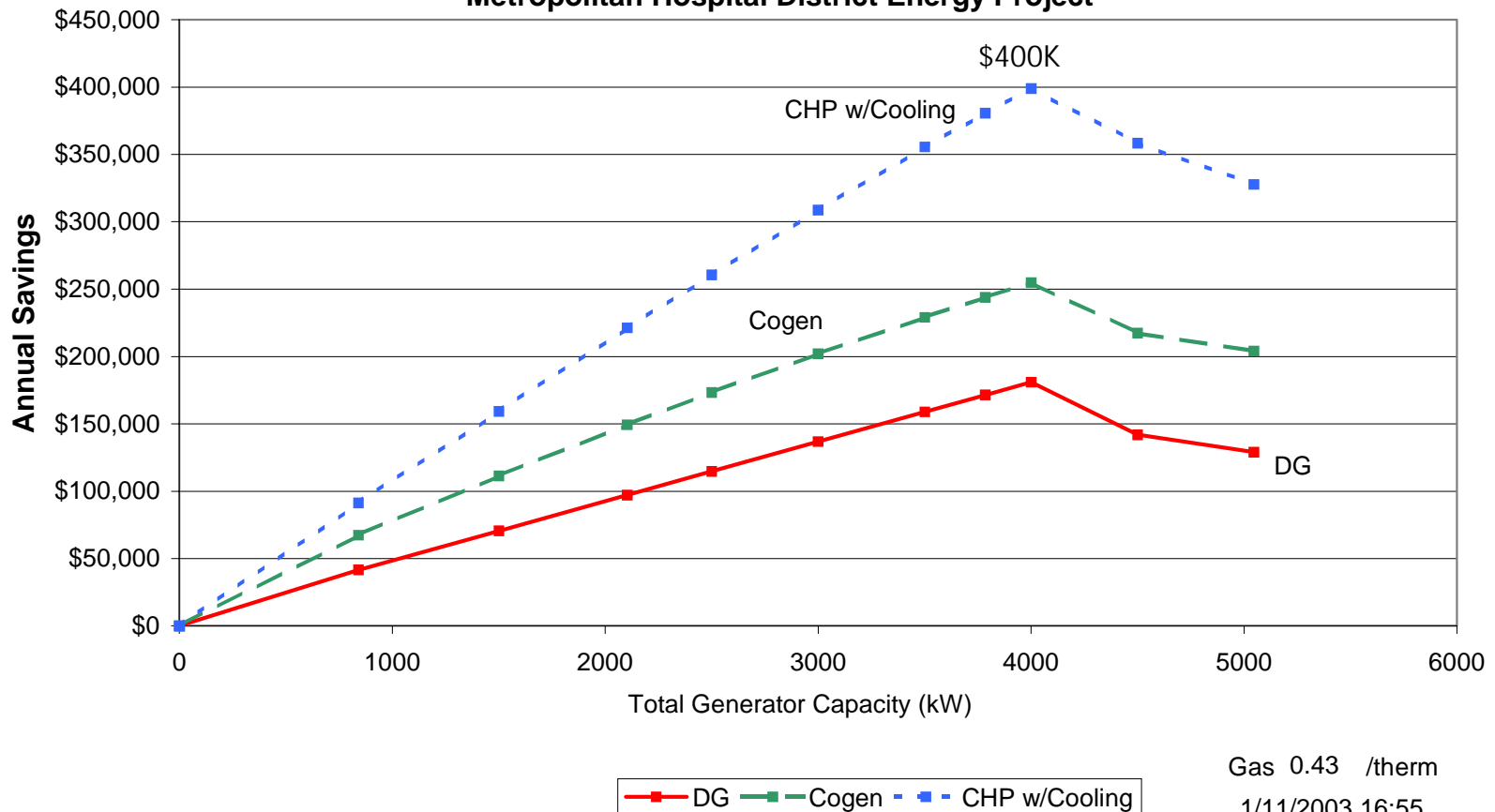
- Modeled as Both:
 - ❖ Individual Buildings (Quick Assessment – Building Energy Analyzer)
 - ❖ District Energy (Engineering Assessment)
- Individual Buildings – Best Candidates
 - ❖ Hospital
 - ❖ Restaurant
- District Energy - Improved Savings and Payback

MHVD Individual Buildings

	Building	SF	Generation (kW)	Annual Savings (\$1,000)	First Cost (\$1,000)	Payback (Years)	Absorption Chillers
Healthcare Buildings	Hospital	448,000	2,157	\$138	\$2,370	17	Yes
	Hospital	448,000	1,750	\$135	\$1,470	11	Yes
	Hospital	448,000	1,750	\$117	\$1,200	10	No
	Veteran's Administration Clinic	55,000	200	\$13	\$205	16	No
	Office Building	300,000	1,865	\$63	\$1,200	19	No
	Medical Wellness Center	200,000	707	\$40	\$666	17	No
	Center of Excellence	30,000	182	\$13	\$187	14	No
	Ambulatory Care Facility	112,000	674	\$38	\$635	17	No
Commercial Buildings	General Office Building	300,000	1,865	\$63	\$1,200	19	No
	Conference/Banquet Facilities	50,000	848	\$35	\$909	26	No
	Loft Apartments	54,000	297	\$11	\$305	28	No
	Bank Branch/Credit Union	30,000	204	\$10	\$210	21	No
	Hotel	21,000	1,252	\$56	\$1,180	21	No
	Restaurant	2,000	35	\$4	\$37	9	No
	Total	1,602,000	9,205 to 9,612	\$463 to \$484	\$7,934 to \$9,104	17.3 to 18.7	Average

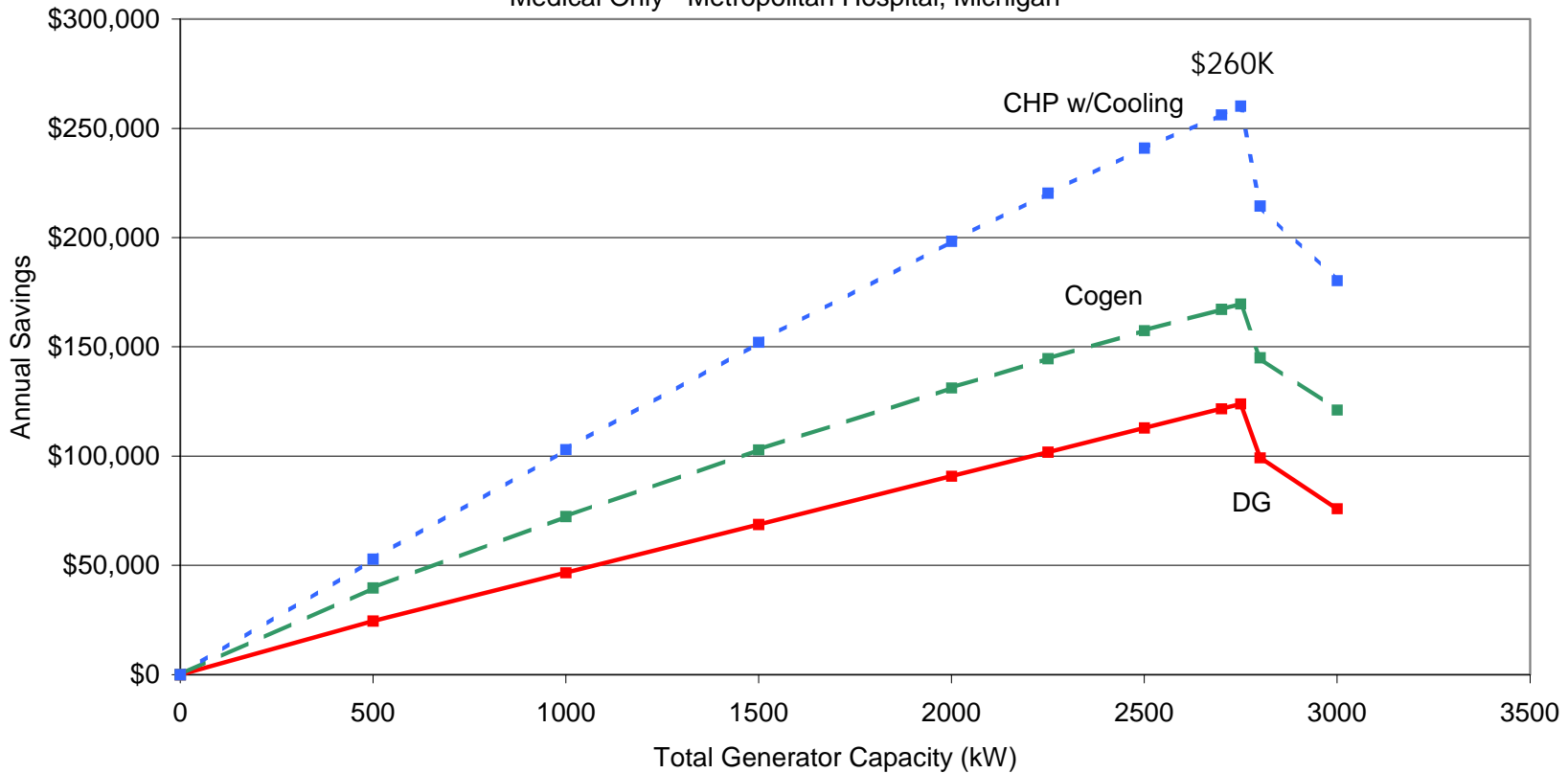
MHVD District Energy (DE) - Savings

**Estimated Savings
Metropolitan Hospital District Energy Project**



MHVD Hospital Only - Savings

Estimated Savings
Medical Only - Metropolitan Hospital, Michigan



Gas 0.43 /therm
1/11/2003 15:17

—■— DG —■— Cogen - - - ■ - - - CHP w/Cooling



MHVD – DE vs. Hospital Only

	District Energy Project		Hospital Only	
	No Generation	4000 kW Generator	No Generation	CHP 2750 kW Generator
Electric Energy	\$1,305,645	\$921,860	\$810,789	\$552,005
Electric Demand	\$836,611	\$391,409	\$513,310	\$212,645
Standby Charge	\$0	\$15,840	\$0	\$10,890
Monthly Electric Charges	\$230,902	\$171,087	\$144,046	\$103,595
Total Electric Charges	\$2,373,159	\$1,500,196	\$1,468,145	\$879,136
Natural Gas Charges	\$658,525	\$1,028,106	\$339,392	\$596,191
O&M Costs	\$0	\$104,556	\$0	\$72,257
Total Operating Costs	\$3,031,683	\$2,632,858	\$1,807,537	\$1,547,584
Savings		\$398,826		\$259,953

MHVD – DE vs. Hospital Only

	District Energy Project			Hospital Only		
	Installed First Cost	Annual Savings	Simple Payback (Years)	Installed First Cost	Annual Savings	Simple Payback (Years)
DG Only	\$2,491,349	\$180,975	13.8	\$1,913,632	\$123,896	15.4
Cogen	\$2,750,095	\$254,956	10.8	\$2,103,294	\$169,652	12.4
CHP w/Cooling	\$2,925,865	\$398,826	7.3	\$2,258,277	\$260,241	8.7



MHVD - Variables

- Multiple Generation Units to Load Follow on DE Application
 - ❖ Used 3 Smaller Generators
 - ◆ Increased Total Capacity to 6 MW and Increased Annual Savings By \$150,000
- District Energy Concept
 - ❖ Assumes Central Distribution System Would Be Part of Design – No Additional Costs Included
 - ❖ Difficult if Development Built in Segments Years Apart
- Use Gas Turbines Instead of Gas Engines

For Further Information

Midwest CHP Application Center

www.CHPCenterMW.org

Leslie Farrar (UIC/ERC): (312) 413-5448

Midwest CHP Initiative

www.nemw.org/uschpa/regional.htm

Ted Bronson (GTI): (847) 768-0637

DOE – Chicago Regional Office

www.eren.doe.gov/cro/

Gary Nowakowski (DOE Chicago Office): (312)
886-8561

Midwest Cogeneration Association

www.Cogeneration.org

Voice Mail (630) 323-7909

