

Combined Heat and Power: Economic, Proven, Reliable, Clean

Tom Bourgeois

US DOE Northeast Clean Energy Application Center

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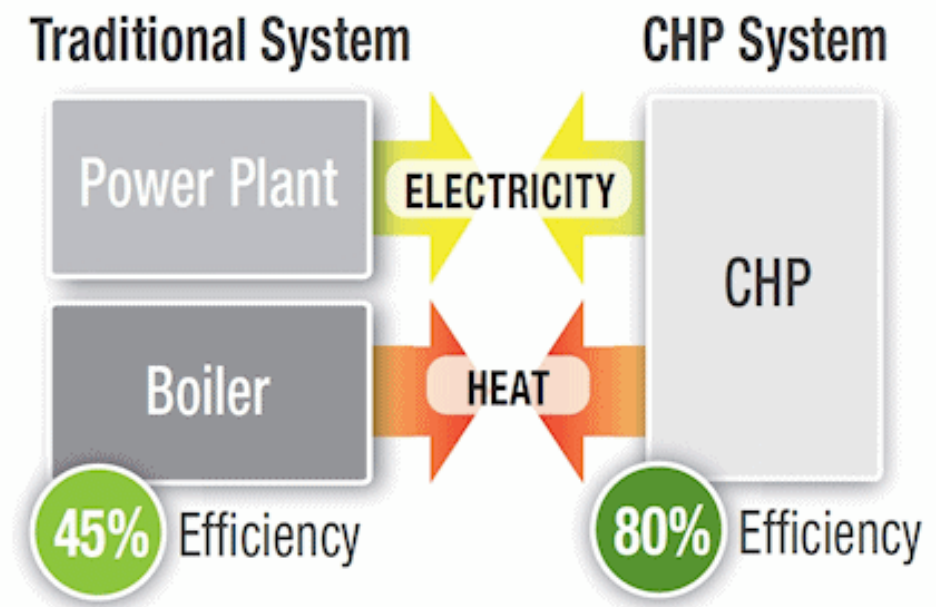
U.S. DEPARTMENT OF ENERGY

Northeast Clean Energy Application Center

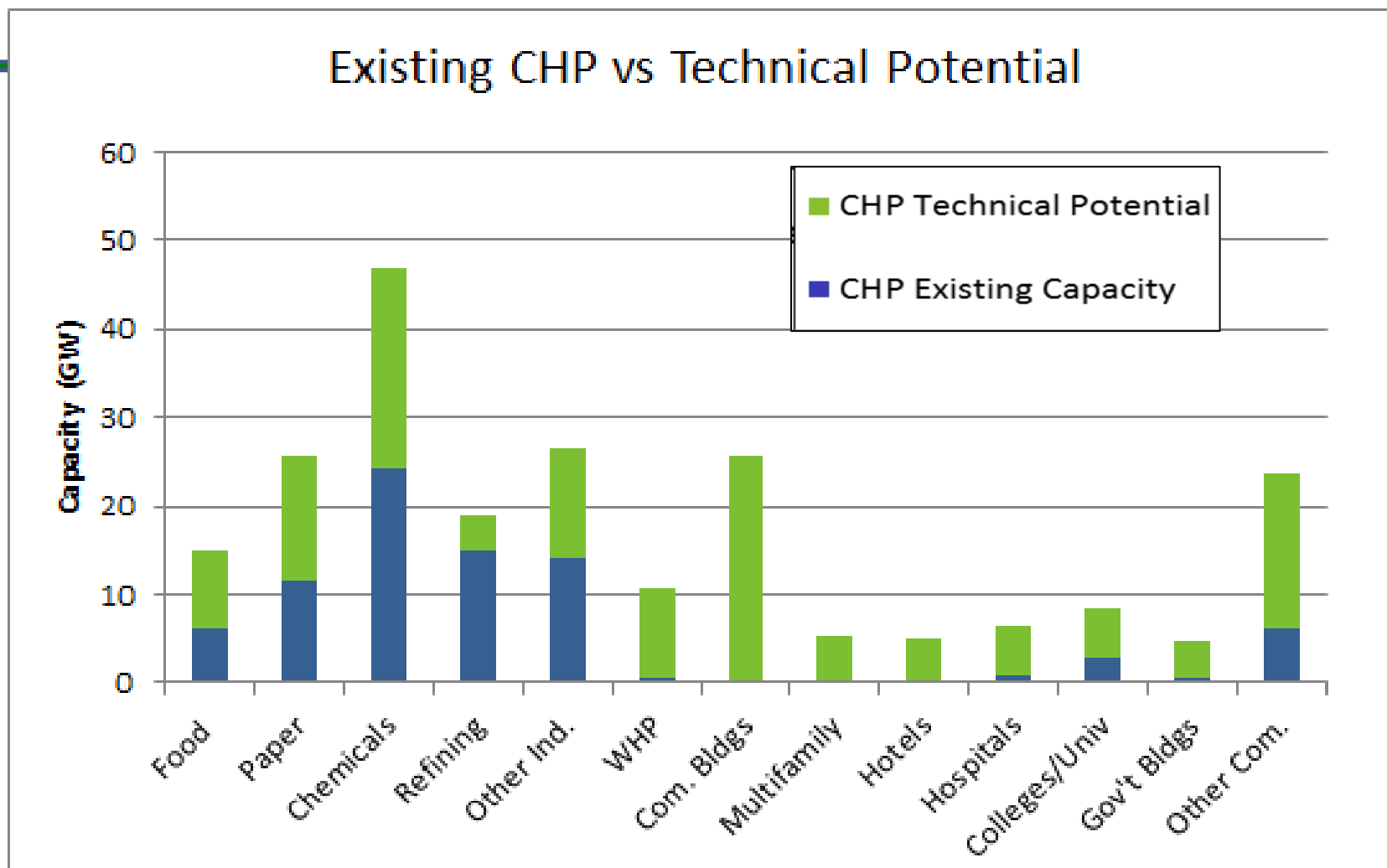
Promoting CHP, District Energy, and Waste Heat Recovery

CHP Benefits

- Improved fuel efficiency & reduced emissions
- Improved power reliability
- Energy cost savings
- Energy security
- Grid congestion relief



Where is the Remaining US Potential for CHP



Source: ICF internal estimates

CHP Technical Potential for the Northeast Region

State	Technical Potential (MW's)	Existing CHP (MW's)
Connecticut	1,400	713
Maine	900	900
Massachusetts	2,800	1,571
New Hampshire	600	58.5
New York	9,500	5,585
Rhode Island	500	114
Vermont	300	22
Northeast Total	16,000	8,963.5

Northeast Commercial/Institutional CHP Technical Potential

SIC	Application	50-1000 kW MW	1-5 MW (MW)	5-20 MW (MW)	20-50 MW (MW)	50-100 MW (MW)	Total MW
43	Post Offices	7	0	2	0	0	9
52	Retail	230	35	16	14	0	295
4222	Refrigerated Warehouses	8	1	3	0	0	13
4581	Airports	3	1	0	0	0	4
4952	Water Treatment	18	4	8	0	0	30
5411	Food Stores	308	78	36	26	0	447
5812	Restaurants	174	14	7	6	0	201
6512	Commercial Buildings	1,842	1,718	0	0	0	3,560
6513	Multifamily Buildings	939	375	0	0	0	1,313
7011	Hotels	304	89	193	57	21	664
7211	Laundries	24	7	3	0	0	34
7374	Data Centers	38	7	12	0	0	57
7542	Car Washes	6	0	1	0	0	8
7832	Movie Theaters	1	0	0	0	0	1
7991	Health Clubs	35	1	3	8	0	46
7997	Golf/Country Clubs	58	2	0	0	0	60
8051	Nursing Homes	257	33	47	0	0	338
8062	Hospitals	79	160	383	183	0	806
8211	Schools	383	21	19	0	0	423
8221	College/Univ.	121	104	386	473	238	1,320
8412	Museums	16	1	9	0	0	25
9100	Government Buildings	182	89	161	188	0	620
9223	Prisons	24	54	92	11	0	180
Total	Commercial Technical Potential	4,309	2,659	1,309	920	259	10,454
Total	Commercial & Industrial	5,284	3,952	2,597	1,951	1,088	15,870

CHP: What problems does it solve?

- Saves money, reduces operating costs
- More predictable, hedge against rising costs
- Greater efficiency
- Reduce GHG emissions (environmental performance)
- ..and following Superstorm Sandy, Hurricane Irene and October 2011 snowstorm – Resiliency, Business Continuity, Emergency Preparedness!

CHP Saves Money

- CHP was the single greatest opportunity to reduce utility costs at the NY Presbyterian Cornell Weill Campus
- UMass Medical Center Campus has expected payback < 3 years, \$6.2 Mil. in annual savings
- South Oaks Hospital system saves nearly \$540,000 annually (on \$1.467 Mil energy bill)
- NY Presbyterian reports that by purchasing 10% more fuel (natural gas) they avoid purchasing 80% of their electricity requirements
- Montifiore Hospital, NY reports a 4 year payback on their 5.5 MW Solar Turbines

Well designed CHP is highly efficient

- UMass Medical Center's new 16.5 MW system operates at 86% total system efficiency
- NY Presbyterian 7.5 MW system reports operating at 85% efficiency
- At full load, South Oaks hospital's CHP system operates at 88% efficiency (32% electrical, 56% thermal/mechanical)

CHP Markedly Improves Reliability

- NY Presbyterian System provides 100% redundancy to entire inpatient areas
- NYP system accounts for 100% of baseload and 2/3 of peak requirements
- UMass Medical Center system permits the Campus to operate with virtually no supplemental grid power
- UMass Amherst ran campus through Oct 2011 storm

CHP versus Backup Generation

- CHP provides continuous benefits to host facilities, rather than just during emergencies
- CHP can result in daily operating cost savings
- CHP offsets capital costs associated with investments in traditional backup power



CHP Reduces Emissions & CO₂

- UMass Medical Center net annual GHG reductions is 41,009 TPY (19% decrease)
- NY Presbyterian reduced CO₂ emissions by 27,000 TPY
- South Oaks Hospital reduced their carbon footprint by >1,900 TPY and NO_x was reduced 95% from 110,000 TPY to 5,698 tons in 2012 (removed hospital from Major Source site!)



Top 4 States for New CHP Installations: 2007-2011

New CHP Installations (#)	
State	Installations
CA	95
NY	92
CT	64
MA	44

New CHP installations for remaining Northeast states:

- New Hampshire – 6 installations
- Rhode Island – 4 installations
- Vermont – 3 installations
- Maine – 2 installations

Source: ICF/CHP
database

Favorable Characteristics for CHP Applications

- Concern about energy costs
- Concern about power reliability
- Concern about sustainability and environmental impacts
- Long hours of operation
- Existing thermal loads
- Central heating and cooling plant
- Future central plant replacement and/or upgrades
- Future facility expansion or new construction projects
- EE measures already implemented
- Access to nearby renewable fuels
- Facility energy champion

Factors Favoring CHP in Northeast

- High electricity prices in Northeast improve the economics of CHP investments
- Low gas prices and expectations for future low prices
- Additional incentives such as preferential gas rates for gas used in CHP

Factors Detering CHP Investments

- Onsite energy systems are typically NOT viewed as an investment core to mission
- Many sites are capital constrained – consequently direct limited funds elsewhere
- Utility interconnection can be costly, time consuming, complex
- Utility standby charges can reduce rate of return
- navigating codes, siting, permitting requirements can be challenging
- Decision-makers may overlook the long term benefits of CHP, including reliability, cost predictability, other savings



**It's the "Pain Adjusted"
Energy Savings that Matter!**

Specifying & Procuring,
Financing & Installing,

Operating & Maintaining this Technology
can NOT be materially more challenging than

the status quo alternative.

CHP Markets are Attractive in Northeast

- Incentives available in northeast states, including:
 - CT CEFIA
 - MA Alternative Portfolio Standard and Mass Saves Program
 - NYSERDA's suite of CHP Incentives
 - NJ's \$25 Million Allocation for CHP incentives
 - RI, ME, NH & VT all have incentives of some type

Mass-Specific Incentive Programs for CHP & Application to Greater Boston Hospital Projects

Two Programs

- MassSave Program (Cash Awards)
- Alternative Energy Portfolio Standard (APS) (Marketable Credits)

Both Programs are Based on CHP as an Efficiency Measure

Incentives for CHP: New York

CHP Acceleration Program (PON 2568)

- NYSERDA is offering incentives for pre-qualified CHP installations ranging from 50 kW to 1.3 MW through PON 2568
 - Program delivery mechanism is a catalogue of previously evaluated CHP systems
 - All systems in the catalogue are capable of both running every day and running during grid outages to power the site's priority loads
 - Incentive program is expressly designed to foster CHP as a mechanism to provide greater resiliency and reliability at host sites
- This program is unique in that NYSERDA only accepts applications from approved CHP system vendors
 - All incentive payments through this program are made to the CHP system vendors



Incentives for CHP: New York

Systems Greater than 1.3 MW

- NYSERDA is offering \$36 million in incentives for CHP installations larger than 1.3 MW through PON 2701
 - System must have black start capability
 - If the site is located in a flood zone, all necessary CHP components must be located above the expected flood level (lesson learned from Sandy)
 - \$0.10/kWh + \$600/kW (Upstate) or \$750/kW (Downstate)
- Bonus Incentives Available for the following features:
 - “Facilities of Refuge” and projects serving critical infrastructure
 - Projects located in utility-identified load service areas of particular interest
 - Demonstrate superior performance, measured by fuel conversion efficiency



Incentives for CHP: Connecticut

- CT Microgrid Grant and Loan Pilot Program
 - Program enacted in response to the widespread power outages resulting from Tropical Storm Irene in 2011
 - State will award \$15 million in the summer of 2013 to selected applicants
 - Governor Malloy has requested an additional \$30 million in program funding to support the most promising projects
 - 36 applications received, 28 projects deemed technically viable



Connecticut DEP Microgrid Grant & Loan Pilot Program

- The Goal of the Program is to fund technically feasible microgrids that best address the state's energy security and reliability needs.
- 36 Applications, 28 invited for 2nd Round of Application Review.
- The Program will fund projects that support local distributed energy for critical facilities during times of grid outages.

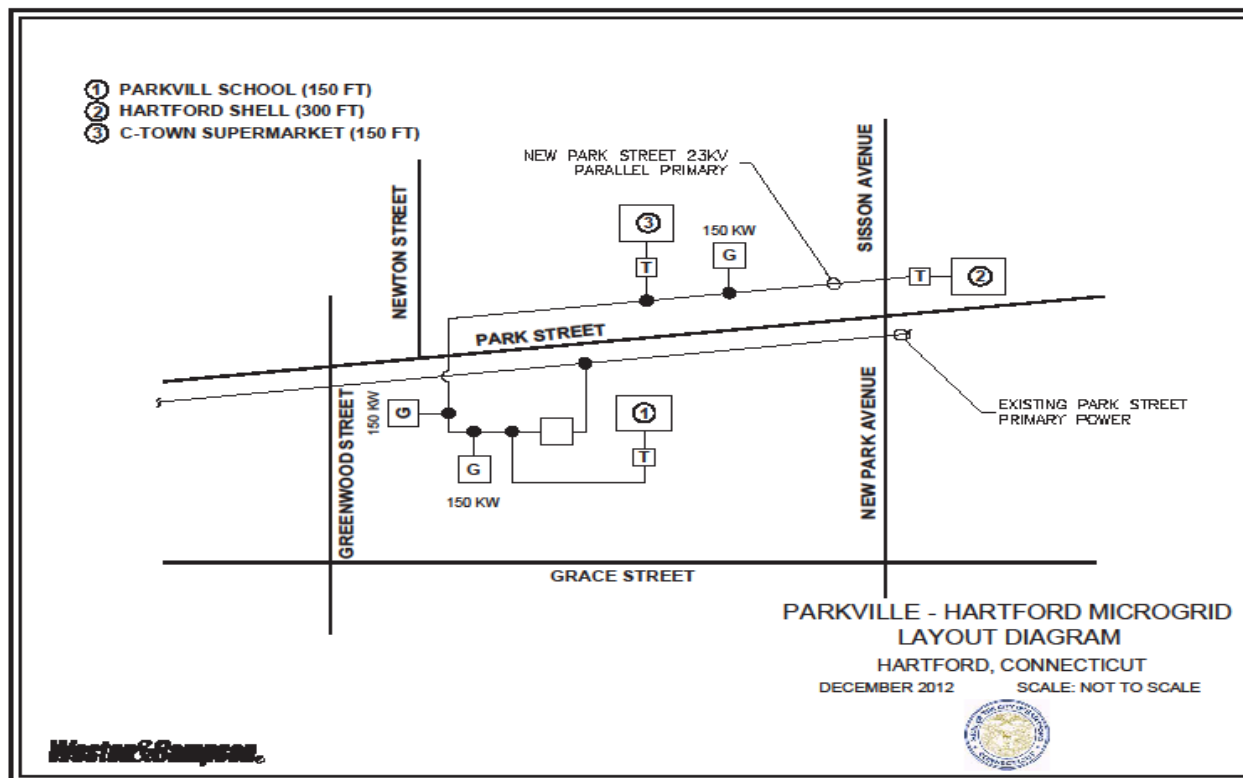


Connecticut Microgrid Applications for CHP Projects

- Many Projects invited to Submit for Round 2 incorporated CHP
- CHP projects primarily consisted of building local grids for municipal buildings and infrastructure to ensure the continuance of emergency operations
- Application districts included 5 Police and Fire Stations, 4 Town Halls, 4 Senior/Community Centers, and 3 DPW facilities.

Connecticut Microgrid Application - City of Hartford Parkville Cluster

- 550 kW CHP to cover the Parkville school, senior center, and library as well as the adjacent supermarket and gas station



South Oaks Hospital

Long Island, NY

- Operates a 1.3 MW CHP system
- Five 250-kW IntelliGen engines, 400-ton hot water absorption chiller
- During the blackout in August 2003, South Oaks Hospital never lost power.
- During Hurricane Sandy, South Oaks Hospital operated continuously for 15 days, isolated from the grid, providing full power and thermal energy to the hospital and nursing home



UMass Medical Center Example

- 2.4 years simple payback (with incentive)
- 58,124 MWHs of electricity savings
- Valued at \$6.1 Mil average annual savings
- Provides 80% of electrical & 100% steam & chilled water requirements

CHP Assistance from CEACs

CEAC Capabilities

- Qualification through Feasibility Analysis
- CHP Expertise thru all Steps
- Bringing customers and CHP engineering community together

Site Request

CHP Qualification

Feasibility Study

Investment Grade Analysis

Procurement
Installation
Operation

CEAC Project Support

- Over 225 assessments & 700 tech support activities
- Represents over 1.5 GW installed or in development

Thank You

Thomas Bourgeois
(914) 422-4013
TBourgeois@law.pace.edu

Beka Kosanovic
(413) 545-0684
kosanovi@ecs.umass.edu



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