

CHP in New York State – Two Years Later

Emissions Market Opportunities for Smaller-Sized Combined Heat and Power Projects in New York State

June 25, 2004
New York City

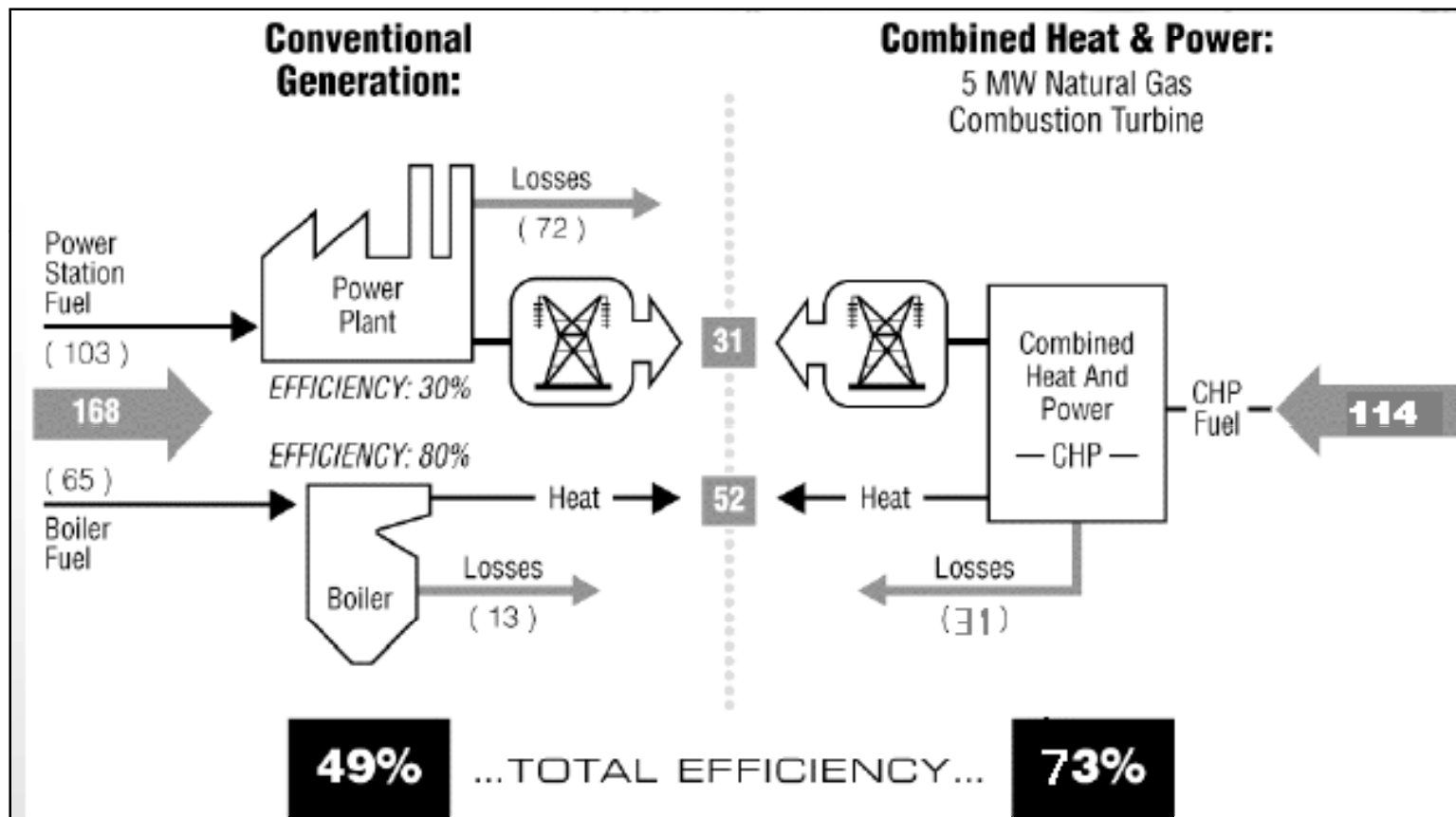
Overview of Discussion

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Efficiency Benefits of CHP Vs. Separate Heat & Power (SHP) *(Illustrative)*

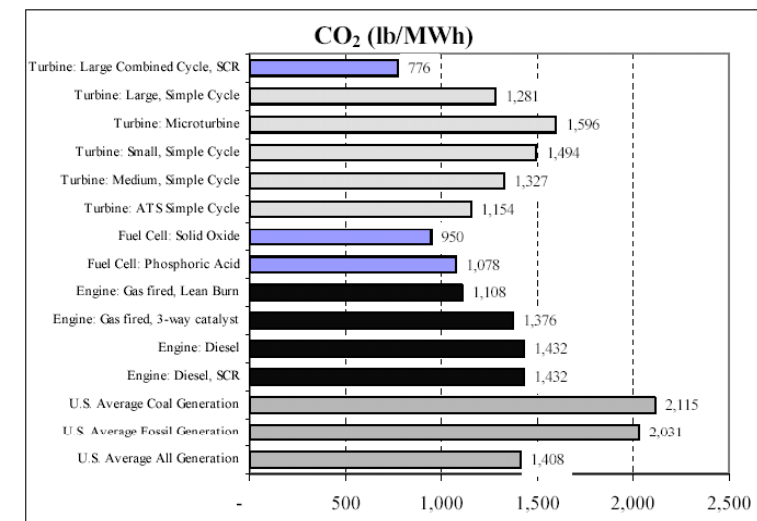
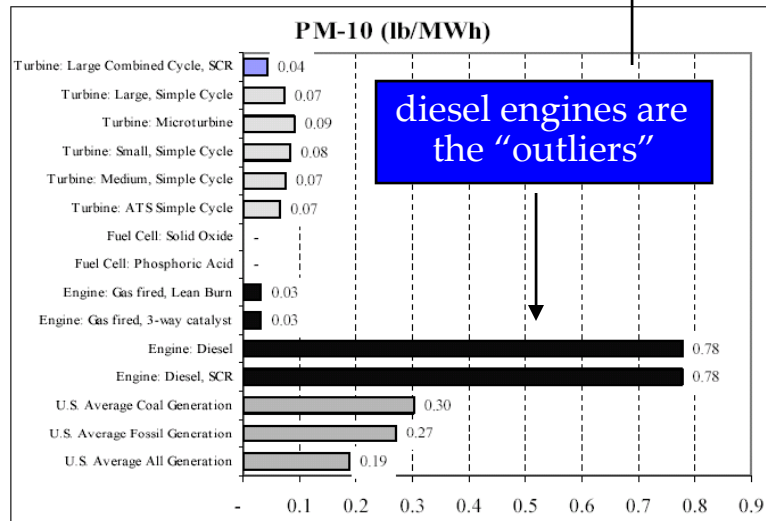
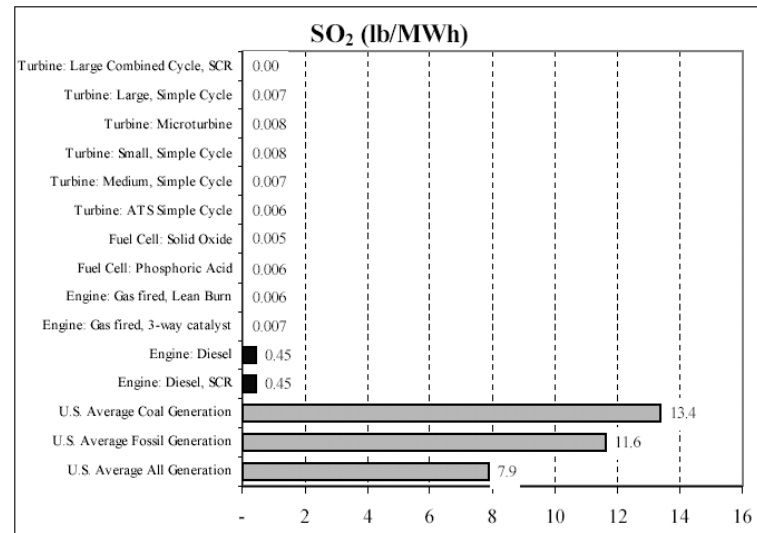
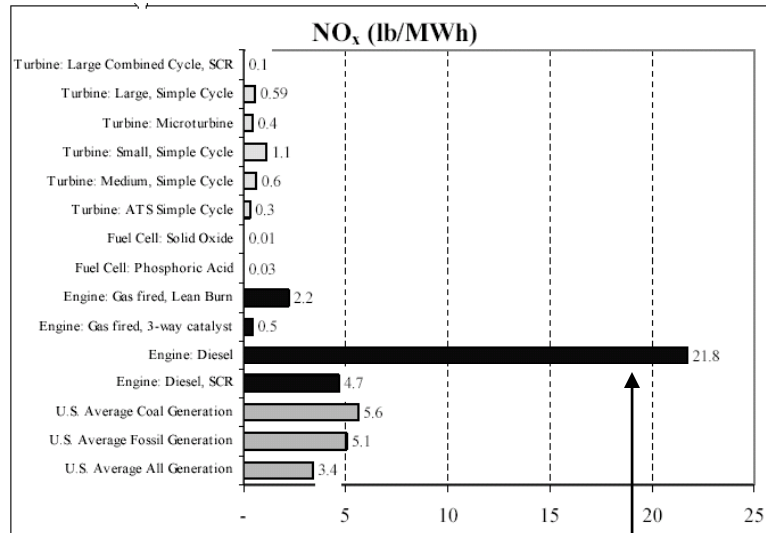
CHP efficiency is a key driver of the potential emissions benefit; less fuel burned means lower emissions (all else being equal)



Source: EPA CHP Partnership/Energy & Environmental Analysis, Inc.

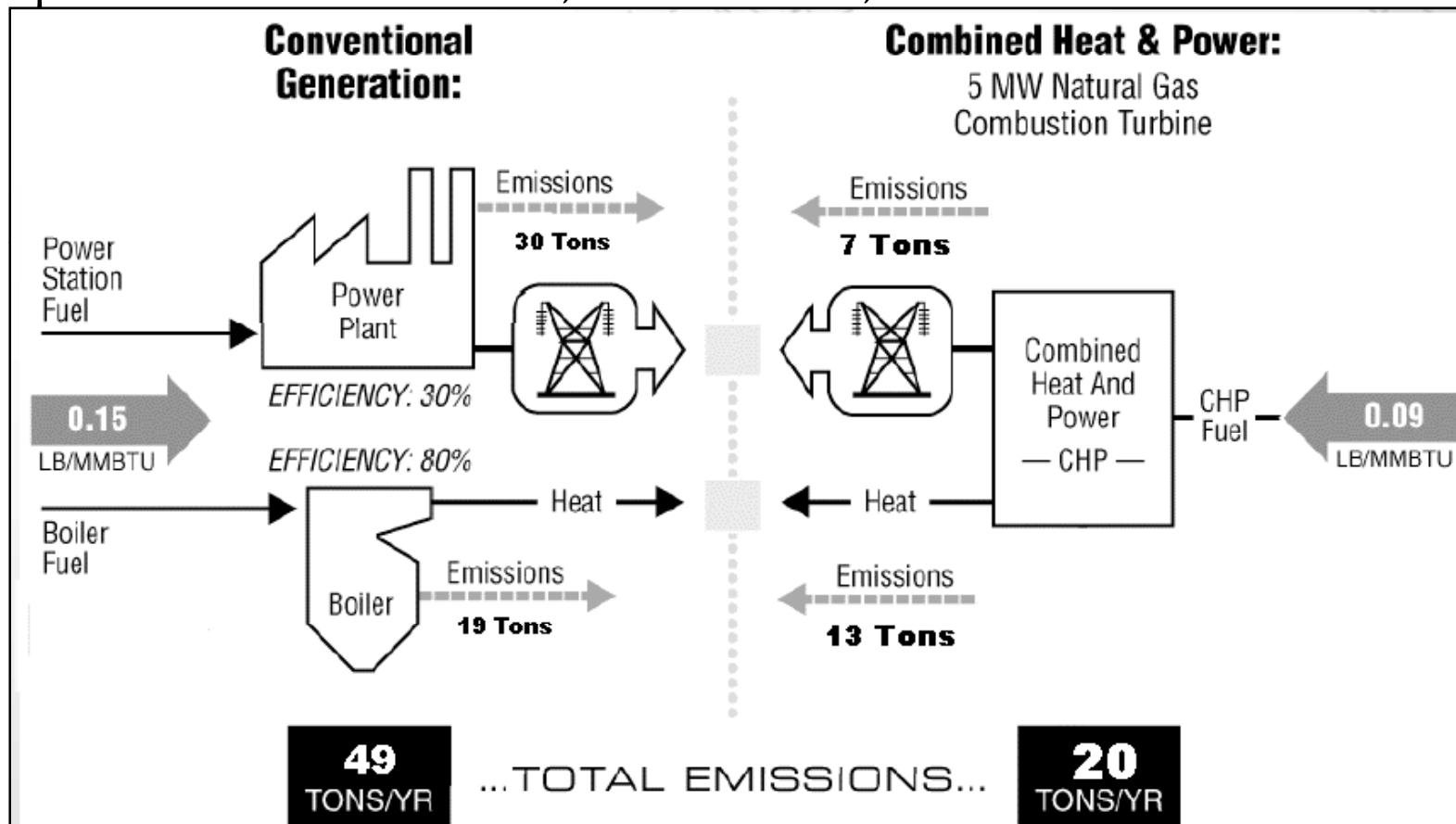
Output-based Emission Rates of DG vs. Central Station Power

(Note: CHP emission rates are lower than DG-only equipment **if** useful thermal energy is included in the "output" along with the electricity produced)



Annual NO_x Emission Benefits of CHP Vs. SHP With No. 2 Fuel Oil Boiler (*Illustrative*)

CHP emissions in this example are less than SHP emissions whether the comparison is based on total, thermal-side, or electric-side emissions

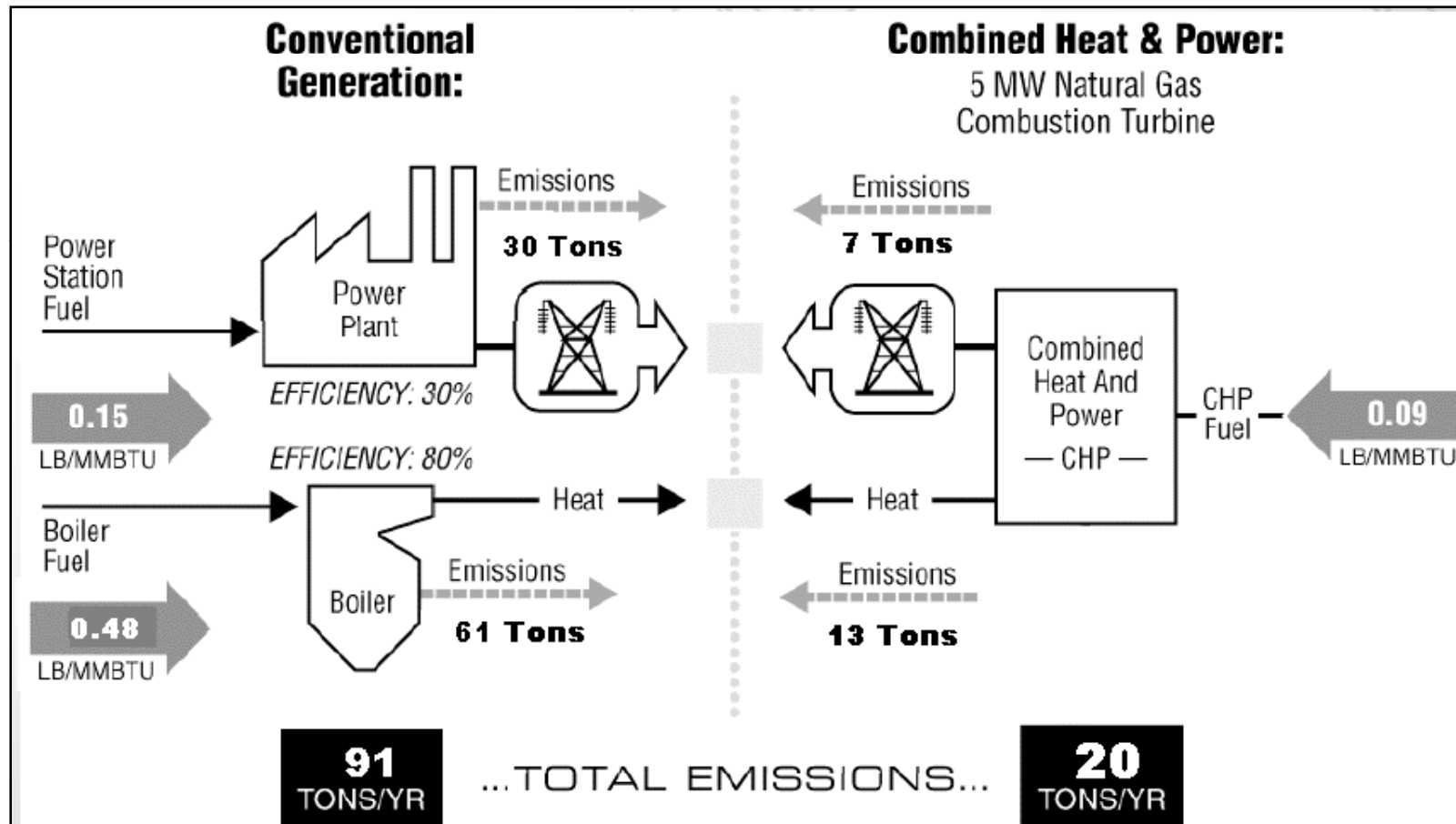


Source: EPA CHP Partnership/Energy & Environmental Analysis, Inc.

Pace Energy Project

Annual NO_x Emission Benefits of CHP Vs. SHP With No. 6 Fuel Oil Boiler *(Illustrative)*

Replacing an on-site #6 oil boiler with CHP offers even greater benefits



Source: EPA CHP Partnership/Energy & Environmental Analysis, Inc.

Pace Energy Project

Key Issues Driving Emission Comparisons of CHP vs. SHP

- Electric-side benefits depend on grid units displaced by CHP
 - In the short run, NYISO marginal units are a mix of various fuel types and technologies. CHP emissions are often lower.
 - In the long-term, avoided grid units are often combined cycle gas. CHP combustion emissions may be greater.
- CHP has virtually no T&D losses, which can run about 9%.
1 MWh of on-site CHP = 1.099MWh of central station power in terms of serving end-user loads.
- Regulation matters! Small CHP units are exempt from cap and trade requirements. Large migration of generation from capped central station plants to uncapped DG units may lead to:
 - downward pressure on allowance prices
 - reduced incentives for installation of central station emission controls

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Emission Reduction Credit Guide: Project Assumptions and Objectives

Key Assumptions

- Smaller CHP projects that could generate ERCs have not done so in the past and are unlikely to do so in the future.
- Capturing the value of ERC's could make more smaller-sized CHP projects more economically viable.
- Hurdles in getting ERCs for small CHP include:
 - Lack of awareness about ERCs in the CHP community
 - Uncertainty about how to apply ERC rules for CHP and whether it is worth the effort
 - Time and transaction cost barriers

Emission Reduction Credit Guide: Project Assumptions and Objectives

Key Project Objectives

- Inform the CHP community about ERC opportunities
- Reduce transaction cost for obtaining DEC certification
- Shorten the time duration
- Maintain the integrity of the ERC program
- Improve the liquidity of ERC markets to facilitate new projects

Emission Reduction Credit Guide: ERC Definition per NYCRR 231-2.1(b)(14)

Emission reduction credit (ERC). Any decrease in emissions of a nonattainment contaminant in tons per year, occurring on or after November 15, 1990:

- (i) which is surplus, quantifiable, permanent, and enforceable; and
- (ii) which results from a physical change in, or a change in the method of operation of an emission unit subject to Part 201 of this Title; and
- (a) is quantified as the difference between prior actual annual emissions or prior allowable annual emissions, whichever is less, and the subsequent maximum annual potential; and
- (b) is certified in accordance with the provisions of section 231-2.6 of this Subpart; or
- (iii) which results from a physical change in, or a change in the method of operation of an air contamination source not subject to Part 201 of this Title, and is certified in accordance with the provisions of section 231-2.6 of this Subpart.

Criteria for Creating Creditable Emissions Reductions

Longstanding EPA and NYSDEC principles require that ERCs must meet the following requirements:

- Real
- Quantifiable
- Surplus
- Permanent
- Enforceable

The 6 Key Steps for Creating ERCs

1. Select a “representative” baseline period
2. Compute prior actual annual emissions
3. Compute prior allowable annual emissions
4. Take the lesser of actual or allowable
5. Compute future maximum annual potential
6. Subtract line 5 from line 4 to obtain ERCs

Creating ERCs: Determining Baseline Emissions

Baseline time period:

- The most recent two consecutive year period immediately preceding the reduction
or (with the review and approval of DEC)
- A “representative” two-consecutive-year period within the last 5 years
 - based upon actual operating hours, production rates, and material input

Creating ERCs: Example of Baseline Emissions Determination

Example: A 1,100 HP ENGINE

Actual Emissions Rate	6 g/BHP-Hr.
Regulatory Emissions Rate note: use *NEW* rate	3.0 g/BHP-Hr
1999 Activity Level – 6500 hours	47.5 Tons
2000 Activity Level – 7200 hours	52.6 tons
Two Year Average Emissions	50 Tons

Creating ERCs: Example of Baseline Emissions Determination After a Regulatory Change

Example: A 1,100 HP ENGINE (cont'd)

Actual Emissions (previous page)	50 TPY
Emissions At Regulatory Rate 3.0 g/BHP-Hr for 1999 (6,500 hours)	23.8 TPY
Emissions At Regulatory Rate 3.0 g/BHP-Hr for 2000 (7,200 hours)	26.3 TPY
Two Year Average Baseline Emissions	25 TPY

Creating ERCs: Is the Reduction Surplus?

Example: A 1,100 HP ENGINE (cont'd)

Maximum Future Annual Emissions (0.5 g/BHP-Hr @ 8,760 hours)	5.3 TPY
New Emissions at 0.5 g/BHP-Hr) * 7,200 hours	4.4 TPY
Creditable Emissions Reduction Using PTE	$25 - 5.3 = 19.7$ TPY or ~ 20 TPY
Creditable Emissions Reduction taking cap	$25 - 4.4 = 20.6$ TPY or ~ 21 TPY

Value of NO_x ERCs

- During new power plant construction boom, prices were typically \$13,000 - \$15,000 per ton
- Most recent posted price (06/03) on Cantor Fitzgerald site was \$11,350/ton in NY severe nonattainment areas
- \$29,000 per ton was the highest trading price
- \$3,800 per ton was the lowest trading price

Illustrative Examples: Potential NOx Reductions at Multi-Family Sites

Multi-Family Site	Estimated Tons of NOx Reductions Per Year
Clinton Hill	~8
Ebbets Field	14 - 16
Rego Park	6 - 8

Potential Refinements to the ERC Process for CHP

- Use of emissions pre-certification data rather than stack testing or
- Manufacturers certification
 - State/federal agency certification (e.g. CARB)
 - Would reduce transaction costs for applicants and speed the review process for NYSDEC

In 2001, CARB confirmed that NO_x emissions of the 30-kW Capstone HEV microturbine were 0.53 lbs/MWH.

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Cap and Trade Programs in New York State: The Basics

- NYSDEC has issued 4 sets of “cap and trade” program rules which apply to electric generators > 15MW and boilers exceeding 250MMBtu/hr:
 - **“NO_x Emissions Budget and Allowance Program”** (NYCRR Part 227-3). NO_x set-aside of 115 tons per year for NYSERDA projects.
 - **“NO_x Budget Trading Program”** (NYCRR Part 204). Includes a 3% set aside (1,240 tons/yr) for EE/RE projects. Began in 2003; ozone season only.
 - **“Acid Deposition Reduction Trading Program”** for NO_x (6 NYCRR Part 237). 3% EE/RE set aside; covers the non-ozone season; starts 10/1/04) -- Recently ruled invalid in appeals court...status unclear
 - **“Acid Deposition Reduction Trading Program”** for SO₂ (6 NYCRR Part 238). 3% EE/RE set aside; year-round requirement; starts 1/1/05
– Recently ruled invalid in appeals court...status unclear

Cap and Trade Programs in New York State: the Basics

- Allocation methods in NYSDEC NO_x rules
 - Allocations are updated yearly based on fuel use (rather than electrical output) in baseline period.
 - Electric Generation Units (EGUs) receive approximately 0.15 lb of NO_x allowances per MMBtu of heat input in baseline period. Non-EGUs get 0.17 lb/MMBtu.
 - EA allocation is capped by the unit's "control period potential to emit" (CPPTE) to avoid "windfalls" for low-emitting units.
 - New units receive allowances from a new unit sector set-aside; are rolled into existing budget in future years.
 - Unclaimed allowances in EE/RE set-asides and new unit accounts are distributed to existing units (subject to CPPTE cap); benefits older, high-emitting units.

Cap and Trade Programs in New York State: EE/RE Set-Aside

- NYSDEC cap and trade rules have EE/RE set-aside for 3% of allowance budgets; projects are awarded allowances for up to five years after project completion. Eligible projects include:
 1. End-use energy efficiency projects (defined as a measure that uses a reduced amount of electricity to maintain or increase the level of energy service)
 2. Renewable energy projects (wind, solar thermal, photovoltaics, landfill/digester methane).
 3. In-plant energy efficiency projects.
 4. Fossil fuel-fired electricity-generating units which produce electricity more efficiently than the annual average heat rate of NY fossil units.

Cap and Trade Programs in New York State: EE/RE Set-Aside and CHP - How Does Small CHP Apply?

- CHP is not specifically cited as an EE/RE technology in the cap and trade rules.
- However, CHP (“cogeneration”) is mentioned in the context of the “efficient generation” EE/RE opportunity.
 - The “efficient generation” set-aside is based on the heat rate of a candidate fossil unit relative to the NY fossil unit. The rule does not provide a formula to translate this into an allowance allocation.
 - For cogeneration facilities, the rule specifies that the heat input used is “minus the net heat input of useful thermal energy provided for purposes other than electricity generation.”
 - Large CHP projects with adjusted heat rates better than NY fossil average (approximately 9,889 BTU/kWh) are eligible for EE/RE allowances
- If large CHP units can qualify for set-aside allowances; shouldn’t a similar mechanism be available for small CHP?

Cap and Trade Programs in New York State: EE/RE Set-Aside and CHP – How Does Small CHP Apply?

The “efficient generation” provision could work for small CHP.

1. Determine the heat rate of the small CHP
 - Allocate fuel use between the electric and thermal side of CHP to determine electric heat rate. There are numerous methods to do so.

2. Compare the net heat rate of the average NY fossil unit to the CHP :

$$\frac{\text{Heat Rate}_{\text{Avg. NY Fossil}}}{\text{Heat Rate}_{\text{CHP}}} = \text{“Efficient Generation Multiplier”}$$

3. Create a “surrogate allocation” for small CHP, as if the units were budget sources (e.g., allocate NOx allowances at 0.15 lb/MMBtu of heat input)
4. Scale up the “surrogate allocation” by the “efficient generation multiplier”
5. Subtract control period emissions to determine net allowance award.

Example of Efficient Generation Multiplier Approach for Small CHP EE/RE Set-Aside: 5MW Combustion Turbine

CHP Total Efficiency	73%
Heat rate (w/o allocation of fuel to thermal side)	12,366 Btu/kwH
Heat rate (w/ allocation of fuel to thermal side based on power-to-heat ratio)	4,670 Btu/kWh
Ozone Season fuel use	181,632 MMBtu
“Surrogate EA Allocation”	181,632 x 0.15 lb = 13.6 tons
Efficient Generation (“EGM”) Multiplier	$\frac{\text{Heat Rate}_{\text{Avg.NYFossil}}}{\text{Heat Rate}_{\text{CHP}}} = \frac{9,889}{4,670} = 2.12$
Scaled Surrogate Allocation	13.6 tons x 2.12 = 28.8 tons
T&D loss Factor @9%	$\left[\frac{\text{MWh}_{\text{CHP}}}{(1 - \text{T \& D lossfactor})} \right] - \text{MWh}_{\text{CHP}}$ $[14688/0.91] - 14688 = 1,453 \text{ MWh} \times 1.5 \text{ lb}$ $= 2,179 \text{ lb} = 1.09 \text{ tons NOx}$
Total NOx EA Allocations	28.8 + 1.09 = 29.9 Tons
NOx Emissions	8.4 tons (@0.09 lb/MMBtu)
Net Allocation of Allowances	29.9 – 8.4 = 21.5 Tons

@2.2 lb/MWh, control period potential to emit is 20.2 tons;
Allocation may be limited to CPPTE

Allocation if based on 1.5 lb/MWh = 11.0 tons
less 3.1 tons of electric-side emissions = 8.5 Tons (inc'l T&D)

EGM awards more EAs than 1.5lb/MWh

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Potential Market Effects of ERCs and EAs for CHP

- Awarding ERCs and EA to CHP is not double counting: ERCs focus on the boiler reductions; EAs focus on the electric side benefits.
 - With ozone season and non-ozone season NO_x allowances, plus SO₂, set-aside could reduce installed cost of CHP by 10%.
 - ERCs could provide a few percent additional cost savings.
 - Combined effect of ERC and EAs could stimulate small CHP market considerably.
 - If ERCs were determined by comparing old thermal emissions to new thermal emissions, ERCs would be even more lucrative.

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