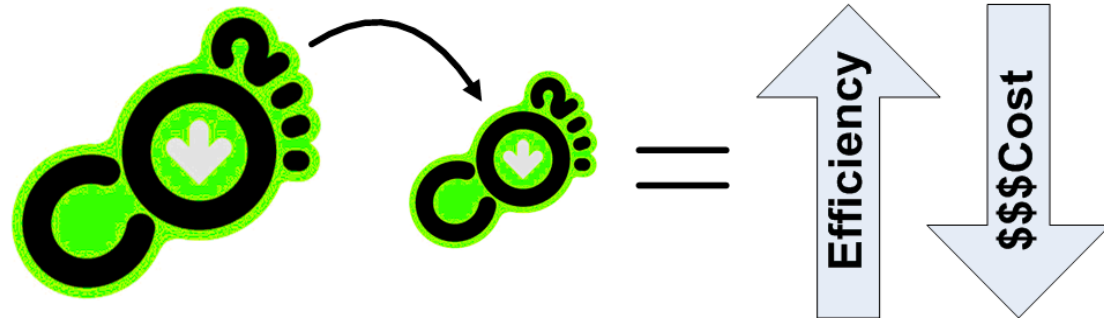




**Endurant**  
**energy**<sup>™</sup>  
Building Sustainable Power<sup>™</sup>

# Improving Building Sustainability

## Vornado Carbon Footprint



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## Carbon Footprint Steps

- Step 1: Determine organizational boundaries
- Step 2: Determine carbon sources/activities
- Step 3: Obtain source annual usage
- Step 4: Obtain carbon factors
- Step 5: Calculate carbon footprint and document sources, methods, assumptions
- Step 6: Calculate CHP carbon emissions and offsets

# Vornado Carbon Foot Print Methods

- Step 1: Boundaries were chosen using the Operational Control methodology, because the core of the company's business is to operate and manage office buildings
- Step2: Carbon Sources/Activities
  - Scope 1: Direct Emissions - Limited to small volumes of fuel oil for back-up generators and some gas used in kitchens
  - Scope 2: Indirect Emission – include steam and electricity imported into buildings.
  - Scope 3: Vornado include tenant energy use because any building changes would impact tenants

## Vornado Carbon Foot Print

- Ownes and managed 18 offices
- 12.5 million square feet
- Tenants are generally sub-metered for electricity use

<u>Facility Name</u>	<u>Main Energy Sources</u>	<u>Square Feet (useable)</u>
One Penn Plaza	Steam and Electricity	2,052,284
Two Penn Plaza	Steam and Electricity	1,239,560
20 Broad Street	Steam and Electricity	399,422
330 West 34 <sup>th</sup> Street	Oil and Electricity	553,668
40 Fulton Street	Oil, Gas and Electricity	186,167
150 East 58 <sup>th</sup> Street	Steam and Electricity	470,479
595 Madison Avenue	Steam and Electricity	252,782
689 Fifth Avenue	Steam and Electricity	76,769
90 Park Avenue	Steam and Electricity	745,167
1740 Broadway	Steam and Electricity	452,634
866 UN Plaza	Steam and Electricity	306,849
770 Broadway	Steam and Electricity	897,353
888 Seventh Avenue	Steam and Electricity	735,099
909 Third Avenue	Steam and Electricity	1,136,179
11 Penn Plaza	Steam and Electricity	855,860
330 Madison Avenue	Steam and Electricity	633,041
640 Fifth Avenue	Steam and Electricity	223,857
731 Lexington Avenue	Steam and Electricity	1,315,248
	<b>Total</b>	<b>12,532,418</b>

## Step 3: Vornado Carbon Footprint

- Vornado collected annual energy data from bills for all of the managed properties
  - 80,000 gallons of fuel oil
  - 177,000 therms
  - 510,000 mlbs of steam
  - 247,000 MWh of electricity
- New York Carbon Factors
  - Fuel Oil #2 10.15 kg/gal
  - Natural Gas 5.31 kg/therm
  - ConEd Steam 53.07 kg/mlb
  - ConEd Electricity 494.5 kg/MWh (2000 Egrid data)

Location	Square Feet (usable)	Natural Gas (therms)	Fuel Oil (gallons)	Steam (Mlbs)	Electricity (kWh)	GHG Emissions (Metric Tons, CO2)	GHG Emissions per sq ft (kg/sq ft)
ONE PENN PLAZA	2,052,284			119,089	48,689,600	30,397	14.8
TWO PENN PLAZA	1,239,560			62,126	31,483,720	18,866	15.2
20 BROAD ST	399,422			20,627	9,057,600	5,574	14.0
330 W 34TH ST	553,668	10,520	44,049	0	1,287,320	1,140	2.1
40 FULTON ST	186,167		35,328	0	1,959,975	1,328	7.1
150 E 58TH ST	470,479			23,055	7,397,600	4,882	10.4
595 MADISON AVE	252,782			6,422	5,145,600	2,885	11.4
689 FIFTH AVE	76,769			3,416	2,905,680	1,618	21.1
90 PARK AVE	745,167			33,607	14,944,800	9,174	12.3
1740 BROADWAY	452,634			21,236	5,955,960	4,072	9.0
866 UN PLAZA	306,849	227		36,178	6,021,600	4,899	16.0
770 BROADWAY	897,353	165,052		16,702	11,369,120	7,385	8.2
888 SEVENTH AVE	735,099			39,721	18,668,747	11,340	15.4
909 THIRD AVE	1,136,179			25,945	12,863,200	7,738	6.8
11 PENN PLAZA	855,860			39,017	16,734,620	10,346	12.1
330 MADISON AVE	633,041			28,220	14,522,560	8,679	13.7
640 FIFTH AVE LLC	223,857			2,644	4,771,152	2,500	11.2
731 LEXINGTON AVE	1,315,248	833		31,843	32,949,600	17,988	13.7
					(Incl 9,500,000 est. for Bloomberg)		
Totals	12,532,418	176,632	79,377	509,848	246,728,454	150,808	12.0

## CHP Impact

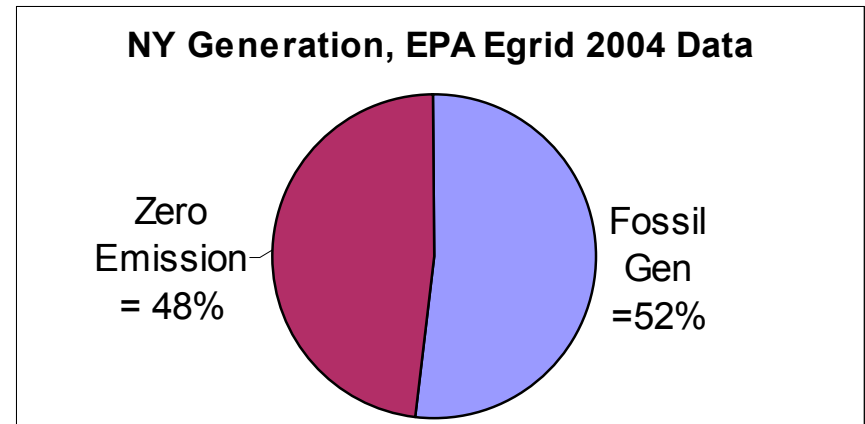
- Step 1: Determine the total electricity, steam, hot water, and chilled water production.
- Step 2: Calculate the carbon offsets
- Step 3: Calculate the direct carbon emissions from CHP
- Subtract the results of Step 3 from Step 2 to determine the carbon reduction from CHP

## Carbon Factors

- The World Building Council Indirect CO2 protocol refers to the EPA Egrid database for regional electricity carbon factors.
- Egrid supplies average and non-baseload carbon factors for 2004
- Utilizing the EPA methods Endurant calculated the non-baseload carbon factors
- The baseload and non-baseload carbon factors were then utilized to determine the impact of CHP

# On-Peak Versus Off-Peak Generation

- Roughly half of the electricity in NY is produced by sources with no carbon emissions – hydro and nuclear
- Hydro and nuclear provide baseload electricity
- Non-baseload or On-Peak\* electricity is supplied from coal, natural gas and biomass fired generation with efficiencies around 30%
- Carbon Factors, kg/kWh
  - Average = 0.4115 (2004)
  - Baseload = 0.2694
  - Non-Baseload = 0.7657



\*OnPeak in NYC is between 8am and 10pm, Monday through Friday

# One Penn CHP Production Estimates

Source	CHP	Carbon Savings (metric tons)
Non-Baseload, MWh	17,100	13,100
Baseload Electricity, MWh	4,400	1,200
Steam, mlb	56,700	3,000
CHP Natural Gas, mmbtu	225,500	-12,000
Unburned Methane		-2,500
<b>Total</b>		<b>+2,800</b>

## Energy Star

- The EPA Energy Star program provides a means for rating commercial buildings
- EPA requires a minimum score of 75 points to receive Energy Star certification
- Cogeneration can increase a building's Energy Star rating by 4 to 12 points depending upon the overall system efficiency

## LEED Certification

- The new LEED Existing Building Standard awards LEED points for achieving and exceeding Energy Star
- LEED EB awards 1 LEED point for every 4 Energy Star points above 63 total Energy Star points
  - Cogeneration could provide for 1 to 3 additional LEED points, assuming the building has a minimum score of 63