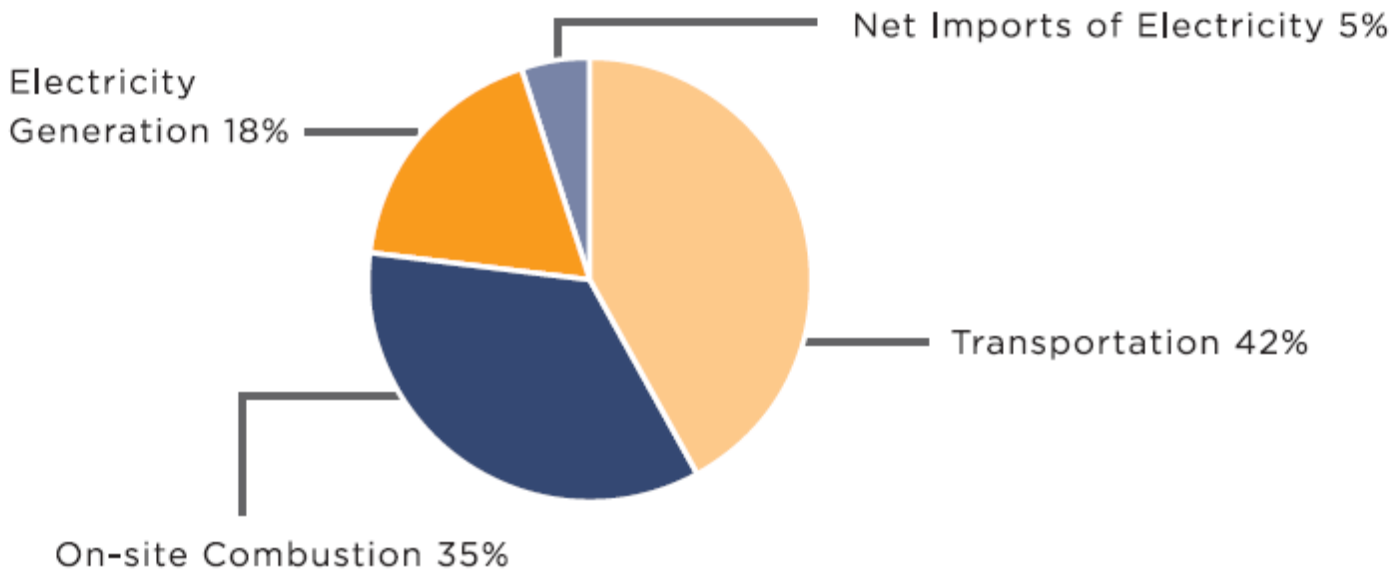
Presentation to the
NYS Department of Public Service
Geothermal Technical Conference
2017 02 08

Geothermal Heating and Cooling and the Clean Energy Standard

Figure 1 | 2011 Carbon Dioxide (CO_2) Emissions from Fuel Combustion by End Use Sector

PERCENT OF TOTAL CO_2 EMISSION FROM FUEL COMBUSTION



GEO Policy Advantages:

Attacks major NY source of GHGs

Creates Jobs

Keeps $ in NY

Storage 24/7/365

Increases Fuel Diversity

Reduces NY's Cooling Peak

Produces Renewable Energy

Increases utility system utilization

Net-zero when combined w renewable electric

Certain types of market developments and program initiatives will have the effect of reducing total carbon emissions while increasing electricity demand. These include electric vehicles and geothermal heat pumps.

CES Staff White Paper 2016 01 25 p. 13

increasing electricity demand. These include electric vehicles and geothermal heat pumps. If the adoption of these technologies has the effect of increasing the compliance obligation under the CES, then the CES could potentially have the inadvertent effect of deterring the adoption of beneficial technologies. Parties are encouraged to

es and

geothermal hea

CES Staff White Paper 2016 01 25 p. 13

TRECs can Neutralize CES Unintended consequences:

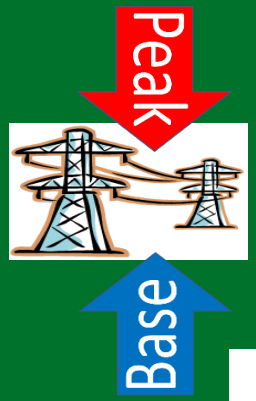
1. Increased supply of RECs lowers cost of compliance
2. Thermal tier creates utility need to acquire thermal load
3. Lower cost to consumers creates counterbalance to disincentive

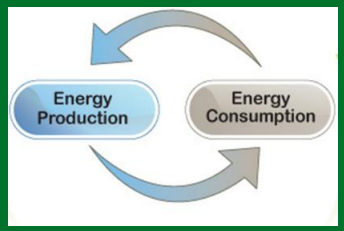
TREC weaknesses:

- Complicated
- Only monetize 1 of several values
- Don’t impact GHP upfront cost barrier
- Volatility
- Deeming required for now
- Limited by ACP
- Small projects not easily aggregated
- Taxable income
- Can work against energy efficiency

Geothermal HP: a Great Fit for NYS

- Produces the Least GHG Emissions
- Leverages NYS's Clean Electric Grid
- Reduces Summer Peak Demand
- Improves Winter Grid Utilization
- Shortest Path to Net-Zero
- Utilizes Solar Energy 24/7/365
- Contributes to Fuel Diversity
- Heating Cost Similar to NG
- Cooling Cost Approximately 1/2
- Applicable to All Building Types
- Works Extremely well in NYS Climates





NY-GEO

Heat Pumps Not Included as Prequalified in the HPwES Program

- GHP and ASHP are listed as Eligible Measures but not Prequalified as Primary Heating & Cooling in the HPwES program
- Fossil fuel heating systems are listed as Prequalified
- GHP's have recognized advantages over fossil fuels systems in relationship to NYS energy and environmental goals
- Prequalified status allows expanded access to rebates and/or loans making those systems more broadly affordable
- GHP Seems like a holdover from EEPs with limitations on fuel switching.
- What are the steps necessary to include heat pumps as Prequalified?

HOME PERFORMANCE WITH ENERGY STAR

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NY Home Performance with ENERGY STAR®
Eligible Measures and Accessories

Fossil Fuel Systems Listed As Prequalified

Table 1. Eligible Measures – Prequalified List

	Eligible Measures	Minimum Efficiency Requirements	Prequalified
Primary Heating and Cooling System [1, 6, 8]	Furnace[2] – Natural Gas or LP	AFUE 95% (as long as not prohibited by local codes). Furnaces with ECM Motor allowed.	✓
	Furnace[2] – Fuel Oil	AFUE 85%	✓
	Boiler – Gas Condensing	AFUE 90%	✓
	Boiler – Oil Condensing	AFUE 87%	✓
	Boiler – Non-Condensing[3]	AFUE 85% (project must include boiler reset control)	✓
	Boiler – Steam	AFUE 82% (size must be matched to cumulative capacity of connected radiators, per Institute of Boilers & Radiator Mfrs (IBR) standards)	✓
	Boiler Reset Controls	Programmed properly per manufacturer's specifications and site conditions. Maximum price of $500	✓
	Air Source Heat Pump (electric split systems)[2]	14.5 SEER / 12 EER / 8.2 HSPF	
	Ground Source Heat Pump[2]	ENERGY STAR Qualified (closed-loop, open-loop, or direct expansion). Requires submission of detailed engineering design work prior to approval	

Heat Pump Systems are Not Prequalified

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Home Performance with ENERGY STAR®
Fuel Conversion Policy

The types of fuel conversions that are allowable and the incentives they are eligible for are detailed in the matrix below:

Existing Fuel Source \ New Fuel Source	Natural Gas	Oil	Propane	Wood	Electric	Air Source or Ground Source Heat Pump
Natural Gas		Not Eligible	Not Eligible	Not Eligible	Not Eligible	GJGNY Loan
Oil	Contr. Inc. Subsidy GJGJNY Loan		Contr. Inc. Subsidy GJGNY Loan	Not Eligible	Not Eligible	GJGNY Loan
Propane	Contr. Inc. Subsidy GJGJNY Loan	Not Eligible		Not Eligible	Not Eligible	GJGNY Loan
Wood	Contr. Inc. Subsidy GJGJNY Loan	Contr. Inc. Subsidy GJGJNY Loan	Contr. Inc. Subsidy GJGNY Loan		Not Eligible	GJGNY Loan
Electric	Contr. Inc. Subsidy GJGJNY Loan	Contr. Inc. Subsidy GJGJNY Loan	Contr. Inc. Subsidy GJGNY Loan	Not Eligible		GJGNY Loan
Air Source or Ground Source Heat Pump	Contr. Inc. Subsidy GJGJNY Loan	Not Eligible	Not Eligible	Not Eligible	Not Eligible	Air source heat pump to ground source heat pump GJGNY Loan

- **Since Heat Pump Systems are <u>Not Prequalified</u> they are only eligible for the GJGNY financing**
- **GJGNY Financing has a 15 year payback requirement**
- **The 15 year payback requirement is waved for Prequalified measures for loans up to $13K**

Source: NY Residential Existing Homes Program 2016-2017-Contractor-Resource-Manual-11.09.2016

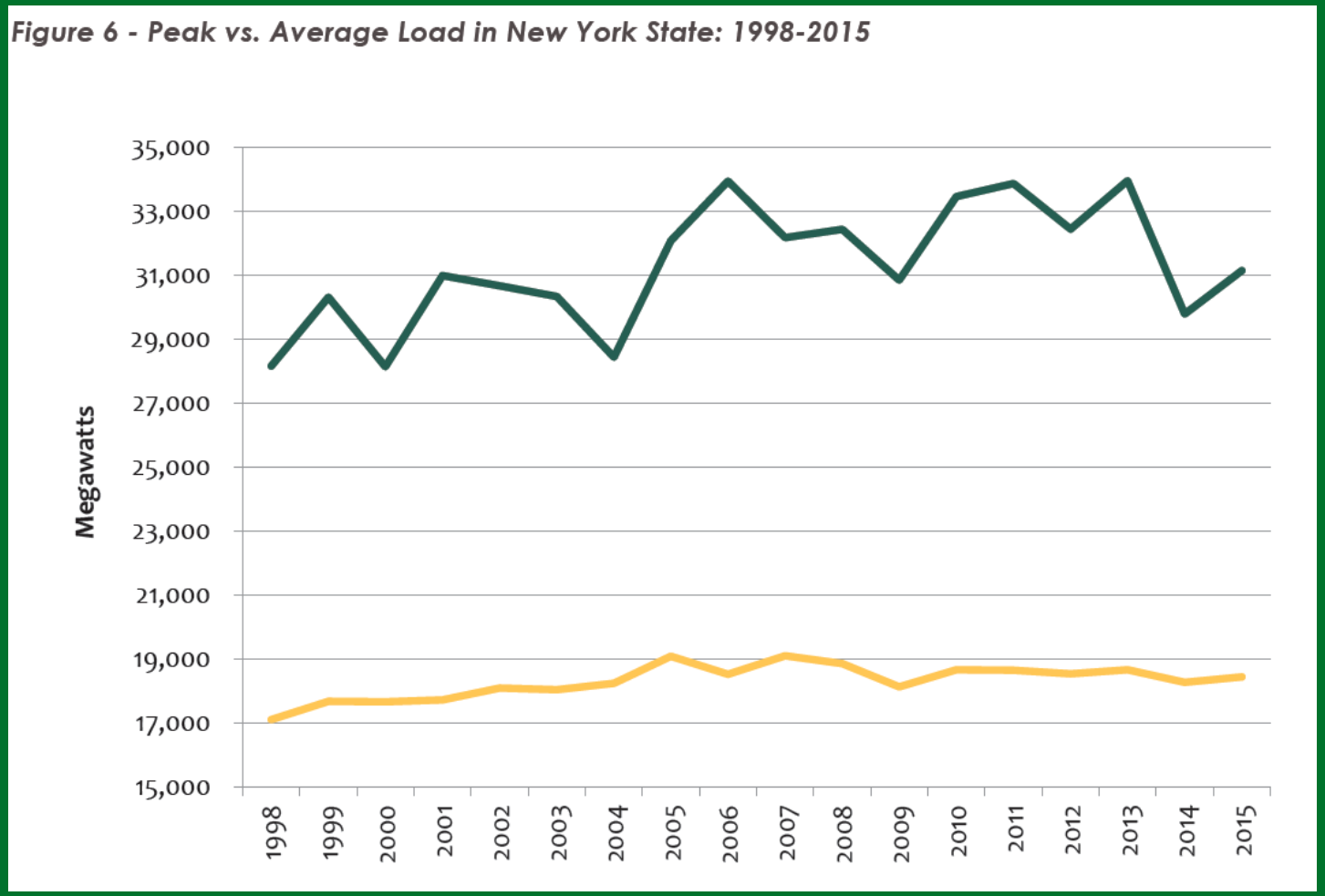
Geothermal Performance
Buffalo NY, 1600 sqf house retrofit

					Electricity				
Month	Year	Avg EWT (F)	Heating COP (-)	Cooling EER (-)	Total Unit (kWh)	Comp (kWh)	Fan (kWh)	Pump (kWh)	AUX (kWh)
6	2015	53.1	-	-	58.2	49.7	5.0	3.5	0.0
7	2015	60.7	-	29.9	111.2	96.7	8.4	6.1	0.0
8	2015	64.5	-	27.3	78.7	68.8	5.8	4.2	0.0
9	2015	66.5	-	25.6	100.6	88.4	7.1	5.1	0.0
10	2015	59.5	5.6	-	134.0	118.2	10.0	5.8	0.0
11	2015	52.7	5.3	-	271.9	245.7	15.7	10.5	0.0
12	2015	46.8	5.5	-	371.6	334.7	21.9	14.5	0.5
1	2016	38.6	4.9	-	826.6	754.4	42.8	29.3	0.1
2	2016	34.2	4.2	-	765.5	692.1	46.3	27.0	0.0
3	2016	34.1	3.8	-	608.9	564.9	26.8	17.3	0.0
4	2016	37.4	3.7	-	400.7	373.6	16.1	11.0	0.0
5	2016	44.5	-	-	135.3	127.1	4.0	4.2	0.0
6	2016	54.7	-	34.8	59.8	52.2	4.7	2.9	0.0
7	2016	61.6	-	30.7	130.9	115.8	9.5	5.7	0.0
Annual			4.5	29.3	3,884.5	3,535.9	210.6	137.4	0.6

Geothermal Performance
Buffalo NY, 1600 sqf house retrofit

- Annual COP = 4.5 (Peak COP 4.2-4.9)
- Annual EER = 29.3 (Peak EER 28)
- Total fan power 5.4%
- Total pump power 3.4%
- Included in above performance numbers

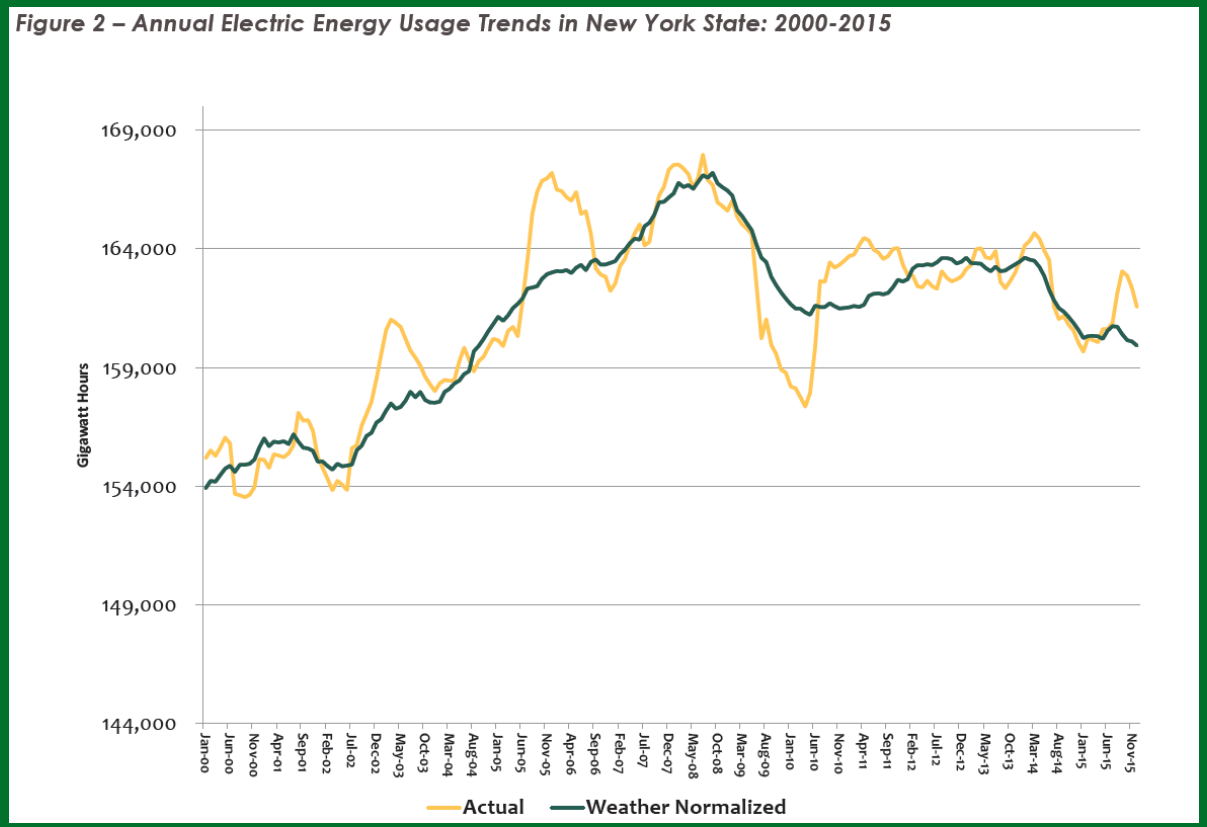
50% Summer Peak Shaving potential of Geothermal

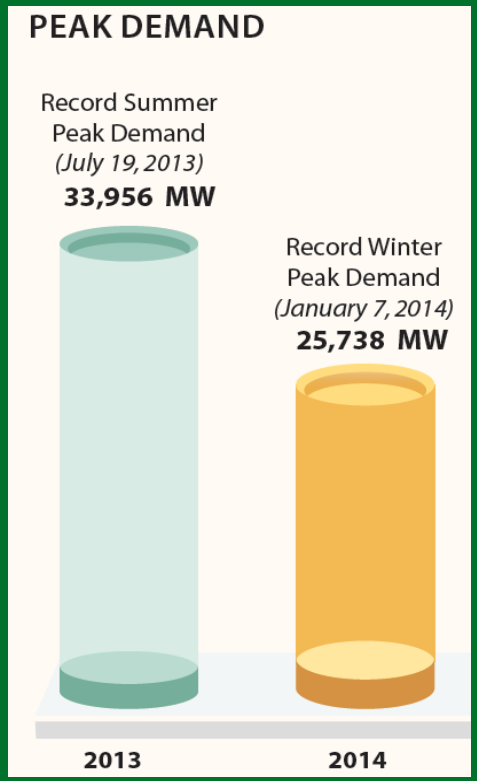


NYISO 2016 Power Trends

2000-2015 Electricity Usage

- **Grid utilization went from 58% to 52%**
- **Peak Summer and Winter Demand increased**





NYISO 2016 Power Trends

Geothermal Potential

- Geothermal HPs significantly reduce summer peak
- Have the least impact on winter peak of all renewable thermal technologies (RTAs)
- Improve grid utilization, thus reduce electricity costs to consumers

GHP Subsidizes Electric and Fossil Fuel Users

- Rates now ensure "average" home pays "fair share" of grid's costs
  - ~50% supply (covers cost of generating electricity)
  - ~50% delivery (covers grid fixed costs, transmission, distribution, etc.)
- GHP homes don't increase grid fixed costs
  - Home burning $3,000/year of oil may increase electricity demand by $1,800/year
    - Reduced summer peak demand (Due to greater efficiency in cooling.)
    - Increased off-peak load but no increase in annual peak load
  - Cost:
    - $900/year increased supply charges (Fair)
    - $900/year increased delivery charges (Unfair - Excess Delivery Charges)
- Rate Impact Metric (RIM) greater than one
  - RIM = Benefits/Costs
  - GHP use has long term effect of reducing rates for all ratepayers

Eliminating GHP's Subsidy Burden

- Natural Gas is only "cheaper" because of GHP excess delivery charges
  - In NYC area today, Gas = $0.05/kWh
  - In NYC area: GHP = $0.055/kWh today but would be $0.027 without subsidy
- GHP rates should be "RIM-neutral" (i.e. maximum RIM = 1)
- Options:
  - Dedicated meter for GHP use (preserves incentive to increase efficiency of non-GHP load)
  - "All-Electric" Rates: OK, but they reduce incentive to increase non-GHP efficiency
  - Fixed Demand Charges: Like All-Electric Rates
  - TRECs: Should be designed to at least return excess Delivery Charges to customer
- Even if inequity of excess charges is remedied, TRECs are still needed
  - Incentivize additional installations
  - Reward positive public good (reduced emissions, reduced fuel usage, balanced load, etc.)
  - If TRECs pre-minted, would address up-front-cost barrier