

# **Why NY State Must Rethink Its Energy Plan**



**The Pessimist complains  
about the wind;**

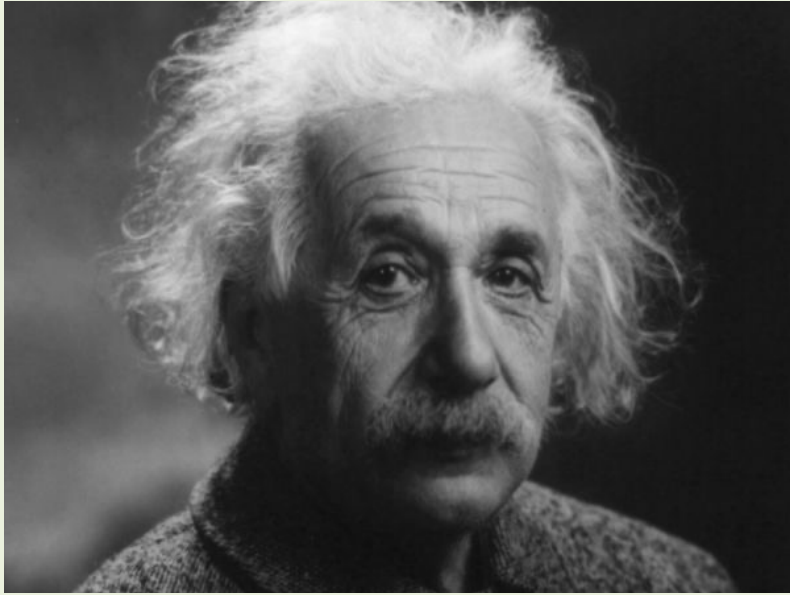
**The Optimist expects  
it to change;**

**The Realist adjusts  
the sails.**

William Arthur Ward

# **Why NY State must Rethink Its Plan**

- **Plan will double energy costs in the State**
- **Plan will actually raise the carbon footprint of NY State – the Opposite of its stated goal**
- **Plan cannot be implemented in NY State's stated timeframe with the currently available resources or 15 year timeframe available resources**



**Insanity Is Doing the Same Thing  
Over and Over Again and  
Expecting Different Results**

Albert Einstein

# GERMANY – A CAUTIONARY EXAMPLE

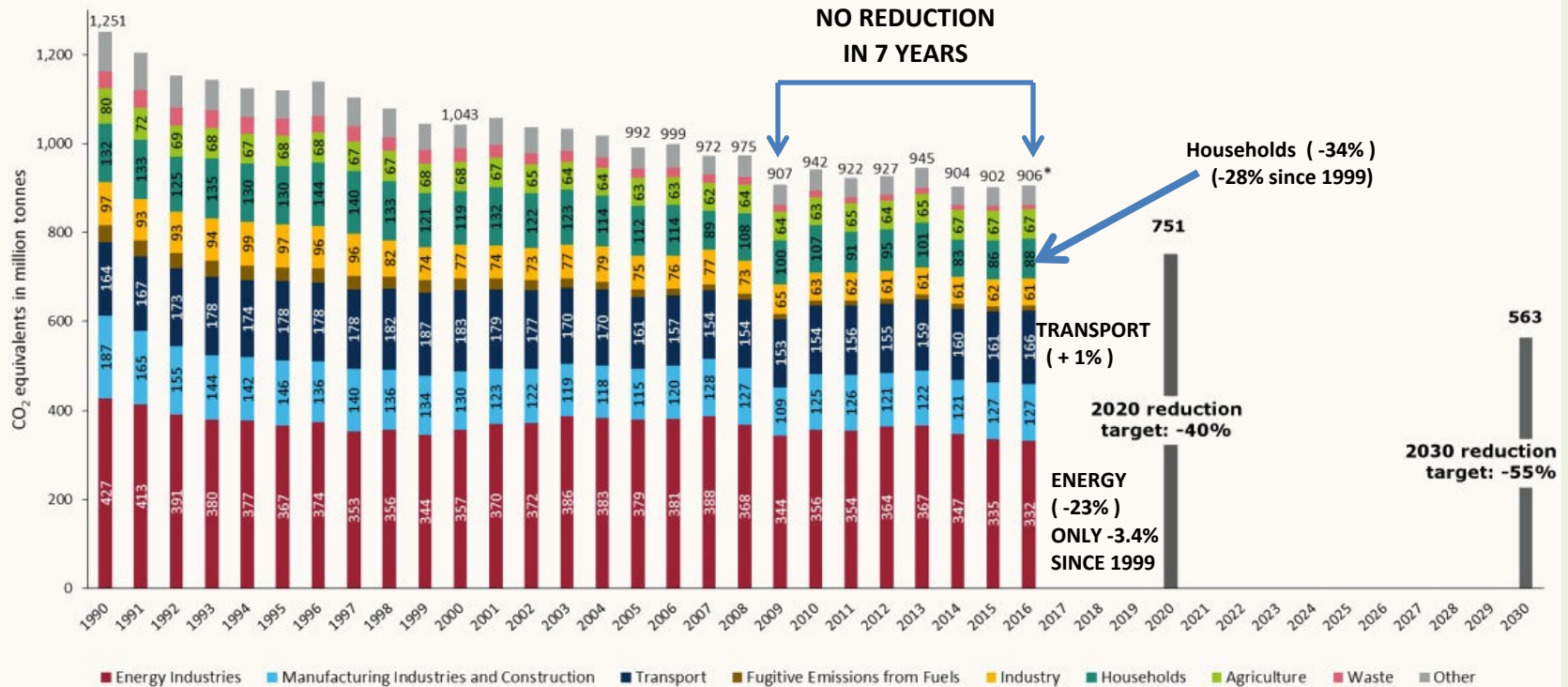
After 30 years, 30,000 wind turbines installed, and soaring energy costs,  
Germany is missing it's GHG targets. WHY?

Not enough resources were devoted to reducing the carbon footprint of **TRANSPORTATION** and the **ENERGY INDUSTRY** and too much **ELECTRIC LOAD** was added without sufficient **RENEWABLE GENERATION** to **COMPENSATE** for the **ADDITIONAL LOAD**.

(Those Accounted for 47% of GHG in 1990 - Reduced by only 16% in 27 years - 1% since 1999 - They Account for 66% of GHG now)

**WITH THE CURRENT NY PLAN, GERMANY'S PAST 30 YEAR HISTORY IS NEW YORK'S FUTURE**

Greenhouse gas emission trends in Germany by sector 1990-2016.



# German Energy Mix 2016-2017

Year	TWh									Total CO2 (Millions of Tons)	TWh		
	Nuclear	Wind	Solar	Hydro	Coal	Gas	Biofuels/ Waste	Oil	TOTAL		Renewables /Nuclear	Fossil/ Other	% Renewable
2016	85	79	38	26	273	82	58	8	649	906	228	421	35.1%
2017	76	107	40	26	252	87	59	8	655	903.5	249	406	38.0%
Change	-9	28	2	0	-21	5	1	0	6		21	-15	

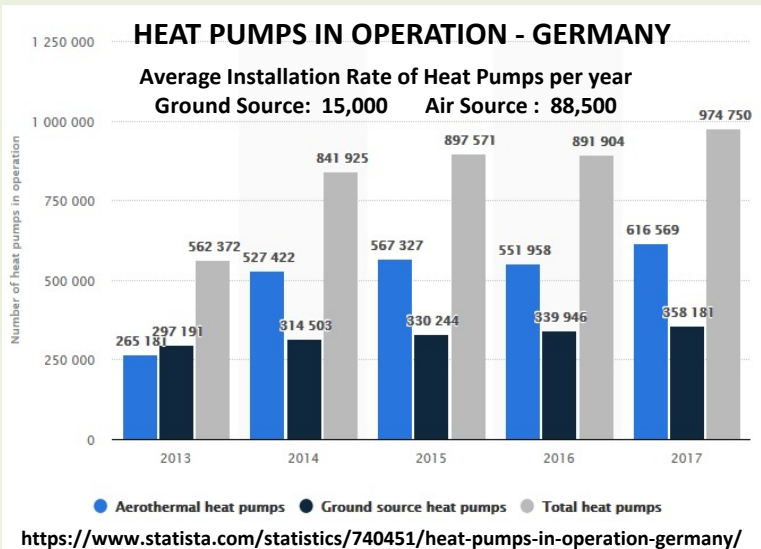
Despite the net addition of 21 Terawatt Hours of Non-CO2 Producing Generation, corresponding to approximately 8 GW of additional Wind Turbines and 80 Megawatts of additional Solar, and a reduction of 21 Terawatt hours of coal production, CO2 Production barely went down year over year as Electric usage went up.

**Without the added utility load, the improvement could have been more than twice as much.**

**\*New York is removing 16 Terawatt hours of Non-CO2 Producing Generation when Indian Point closes in 2022.**

# Heat Pumps Overtake Gas in Germany

Apr 23, 2018 - *GERMANY*: Heat pumps are said to have overtaken gas for the first time in 2017 to become the most popular form of domestic heating in Germany. Based on figures released by the Federal Statistical Office, the German heat pump association BWP reveals that heat pumps were installed in 43% of new residential buildings in 2017.



<https://www.coolingpost.com> › World News

In Germany & in New York, installing Air-Air Heat Pumps on a grid that is not supported by 100% renewable generation **DOES NOT** reduce CO<sub>2</sub> footprint.

**IT JUST MOVES THE CO<sub>2</sub> EMISSIONS TO A DIFFERENT LOCATION WITH A LARGER CO<sub>2</sub> FOOTPRINT AND WITH MUCH HIGHER OPERATING COSTS !**

# Comparison of Various Heating Methods

## Holistic Energy Usage and Cost

**ADDITIONAL MARGINAL GRID LOAD WILL BE AT FOSSIL FUEL EFFICIENCY LEVELS WITHOUT SUFFICIENT RENEWABLES INSTALLED**

1 Therm = 100,000 BTUh = 29.307 KWh  
 141,700 BTUh = 1 gallon #2

11.7 LBS CO2 per Therm/.95 for gas at source

16.1 LBS CO2 per Therm/.87 for Oil at source

National Average- All Generation 1.004 pounds CO2 per KWh

<https://www.eia.gov/tools/faqs/faq.php?id=73&t=11>

Energy used to generate 100,000 BTUh of heat at the customer premises

Type of Heat	Efficiency	KWh/ Therm	KWh Used at premises	KWh Total (w/ T & D losses)	KWh Total (w/ generation losses and T & D losses)	Cost/ Therm	LBS CO2 EMITTED
Gas Boiler Conventional HW	0.95	29.31	30.85		30.85	\$1.38	12.32
Oil Boiler (#2) Conventional HW	0.87	29.31	33.69	0.82 gallons	34.36 **	\$2.75	18.88
<b>COP</b>							
GSHP-High Mass Radiant (100 deg-F)	4.5	29.31	6.51	7.00	17.60	\$1.50	7.03
GSHP-Conventional HW (150 – 160 deg-F)	2.5	29.31	11.72	12.61	31.68	\$2.70	12.66
	3.5	29.31	8.37	9.0	22.63	\$ 1.93	9.04
Air Heat Pumps Conventional HW	2	29.31	14.65	15.76	39.60	\$3.37	15.82
Electric Space Heating & Electric Cooking	1	29.31	29.31	31.51	79.21	\$6.74	31.64
				Leaving Power Plant	Entering Power Plant		

\$1.30/therm

\$.23/KWh

\$ 3.35/gallon #2 Fuel Oil (NYSERDA Website)

<https://www.nysERDA.ny.gov/Researchers-and-Policymakers/Energy-Prices/Home-Heating-Oil/Average-Home-Heating-Oil-Prices>

37% Efficient Utility system (Generation and Distribution)

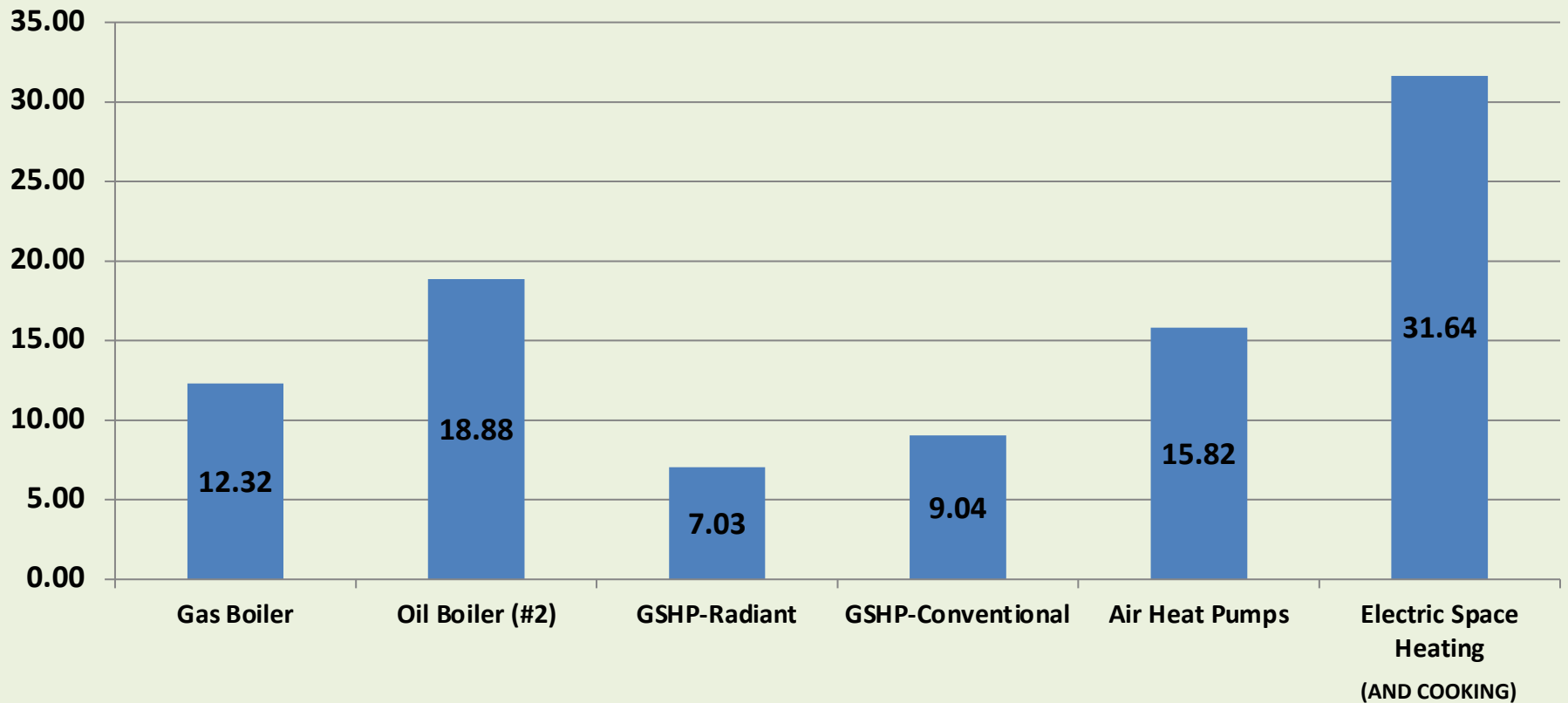
\*\* 2% added to Energy usage for Oil Transportation - Diesel Fuel used to transport the oil is identical to #2 Fuel Oil



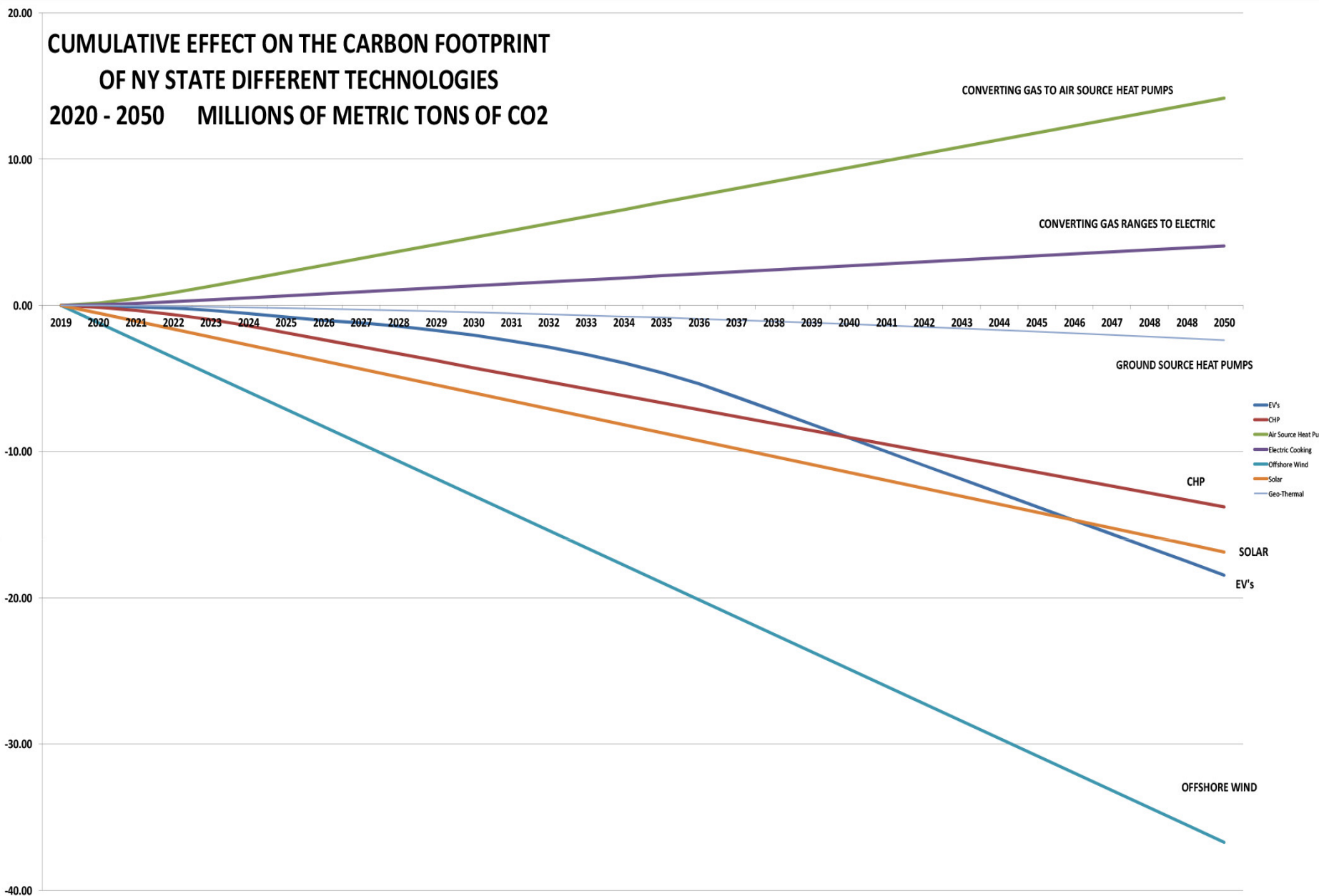
# COST TO DELIVER ONE THERM OF ENERGY AT THE CUSTOMER PREMISES USING VARIOUS HEATING METHODS (In the NY Metro Area)



# **POUNDS OF CO<sub>2</sub> EMITTED PRODUCING ONE THERM OF ENERGY AT THE CUSTOMER PREMISES FOR VARIOUS HEATING METHODS** (In the NY Metro Area)



# CUMULATIVE EFFECT ON THE CARBON FOOTPRINT OF NY STATE DIFFERENT TECHNOLOGIES 2020 - 2050 MILLIONS OF METRIC TONS OF CO2



- EV's
- CHP
- Air Source Heat Pumps
- Electric Cooking
- Offshore Wind
- Solar
- Geo-Thermal

CONVERTING GAS TO AIR SOURCE HEAT PUMPS

CONVERTING GAS RANGES TO ELECTRIC

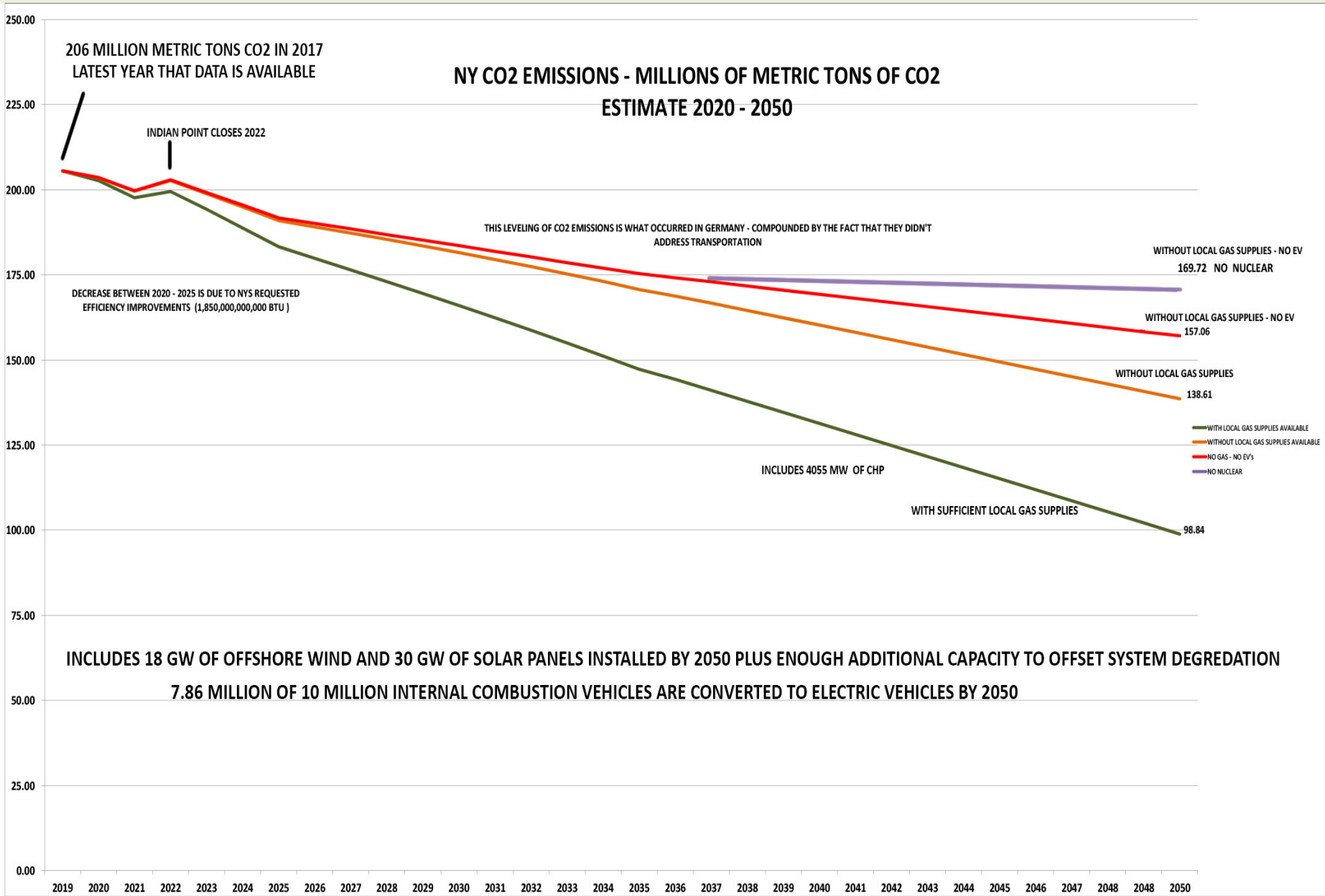
GROUND SOURCE HEAT PUMPS

CHP

SOLAR

EV's

OFFSHORE WIND



# The Lansing Gas Moratorium

- Commenced in early 2017 - nearly 3 years old
- NYSEG filed an RFP in 12/2019 for solutions to the resulting energy shortage
- Solutions include trucked in Natural Gas that will require 15 Tractor Trailer loads per day at 7.7 pounds of CO<sub>2</sub>e per mile or \$ 35 million in additional heat pumps for a Town of 11,000 people to offset the energy shortfall.

# The Lansing Gas Moratorium

- Plans have been in place for over two years for an 18 Megawatt Solar Array in Lansing
- The winter output of the solar array, if it is ever built, will operate the additional heat pumps for a total of 216 hours ( 9 days)
- The balance of the winter, the heat pumps will operate on fossil fuel generation with a higher carbon footprint and much higher costs than with a natural gas fired boiler

# WE NEED TO DECOUPLE THE DISCUSSION OF METHANE(CH<sub>4</sub>) EMISSIONS AND CARBON DIOXIDE(CO<sub>2</sub>) EMISSIONS

IN THE REAL WORLD, NY STATE HAS FAR MORE  
LONG TERM CONTROL OVER ONE (CO<sub>2</sub>) (100%)  
THAN IT DOES OVER THE OTHER (CH<sub>4</sub>) (50%)

PA PRODUCES 5.4 Trillion cf of Gas Annually - NY Uses 1.3 Trillion cf Annually **(24%)**

*PA has approximately 60,000 Residents Directly or Indirectly Employed by the Natural Gas Industry.*

*State and Federal Officials will be extremely reluctant to put that many people out of work by shutting it down.*

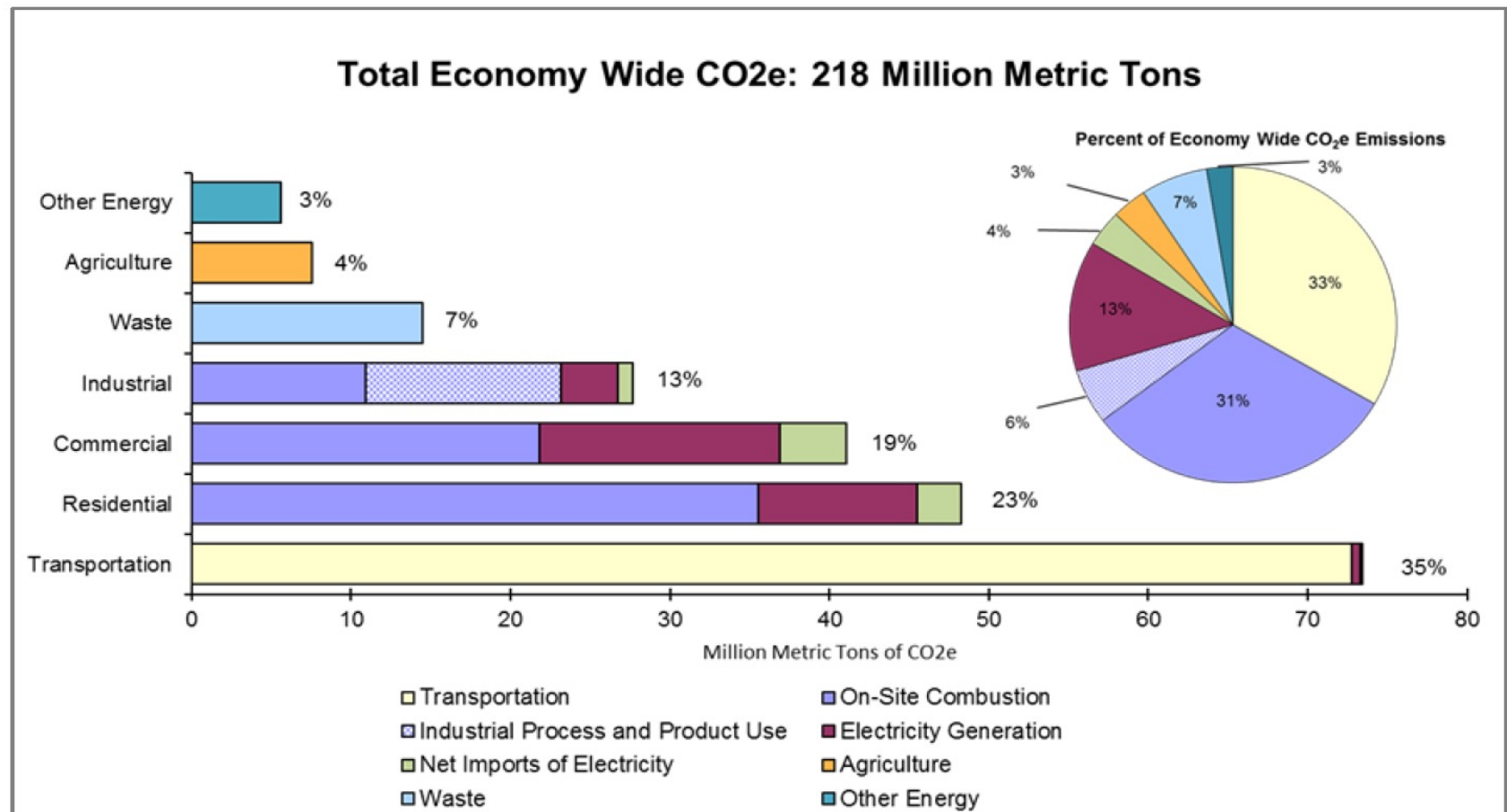
WITHIN THOSE PARAMETERS, HOW DO WE **REDUCE GHG EMISSIONS**  
**THE MOST RAPIDLY** AND **PUT THE BIGGEST DENT IN THAT 24%** WITH  
THE REALISTICALLY AVAILABLE RESOURCES? THE CURRENT NY PLAN  
ALLOCATES THE AVAILABLE RESOURCES VERY INEFFICIENTLY.

WE DON'T WANT TO REPEAT GERMANY'S MISTAKES

# CO<sub>2</sub> Emissions in NY State

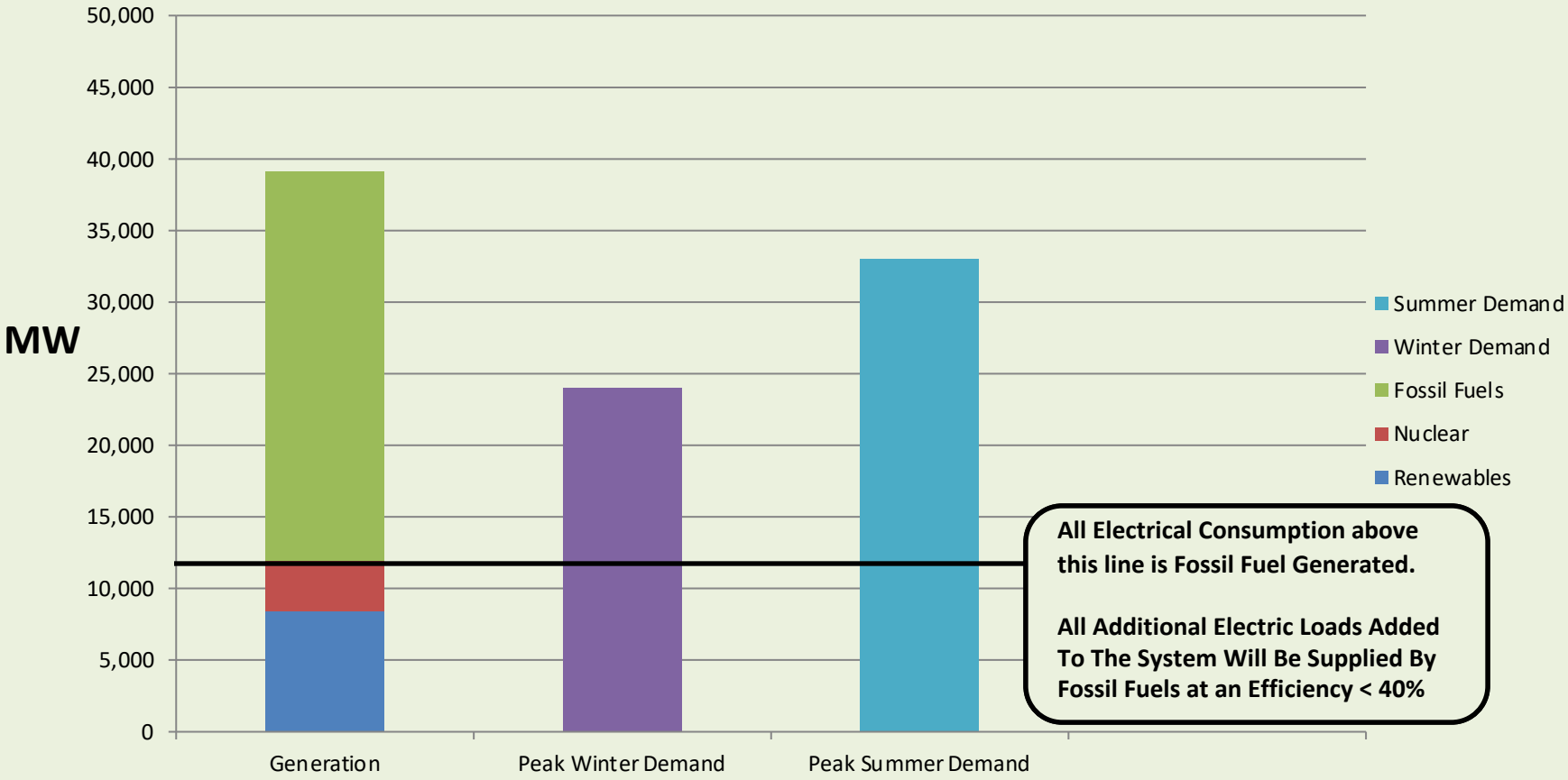
Transportation and Electric Generation account for 50% of NY CO<sub>2</sub>e Emissions

**THE 31% CARBON FOOTPRINT RELATED TO COMMERCIAL AND RESIDENTIAL ON-SITE COMBUSTION WILL ACTUALLY INCREASE IF THE GAS LOAD IS TRANSFERRED TO ELECTRICITY BEFORE SUFFICIENT RENEWABLES ARE INSTALLED**





# NY STATE'S PEAK ELECTRICAL GENERATION MIX AND LOAD (2022\*\*)



DATA FROM NYISO GOLD BOOK 2019

\*\*2022 INDIAN POINT CLOSSES

**WITH SUFFICIENT SUPPLIES OF LOCAL  
NATURAL GAS AND THE PROJECTED  
RENEWABLES, A 50% REDUCTION OF  
CO<sub>2</sub> EMISSIONS IS POSSIBLE BY 2050.**

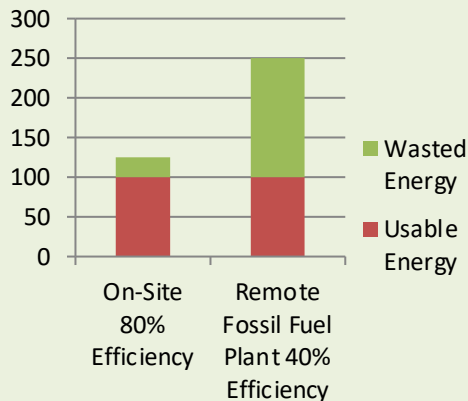
**WITH A GAS MORATORIUM IN PLACE,  
THAT IS REDUCED TO 15% - 30%**

# What Energy Efficient Options Does Natural Gas Make Available?

## TWA Hotel Doesn't Need City's Power Grid. It Has Its Own.

New complex at JFK airport draws from its own, self-sufficient power plant—a rarity for commercial buildings

For 100 KWh of Used Energy



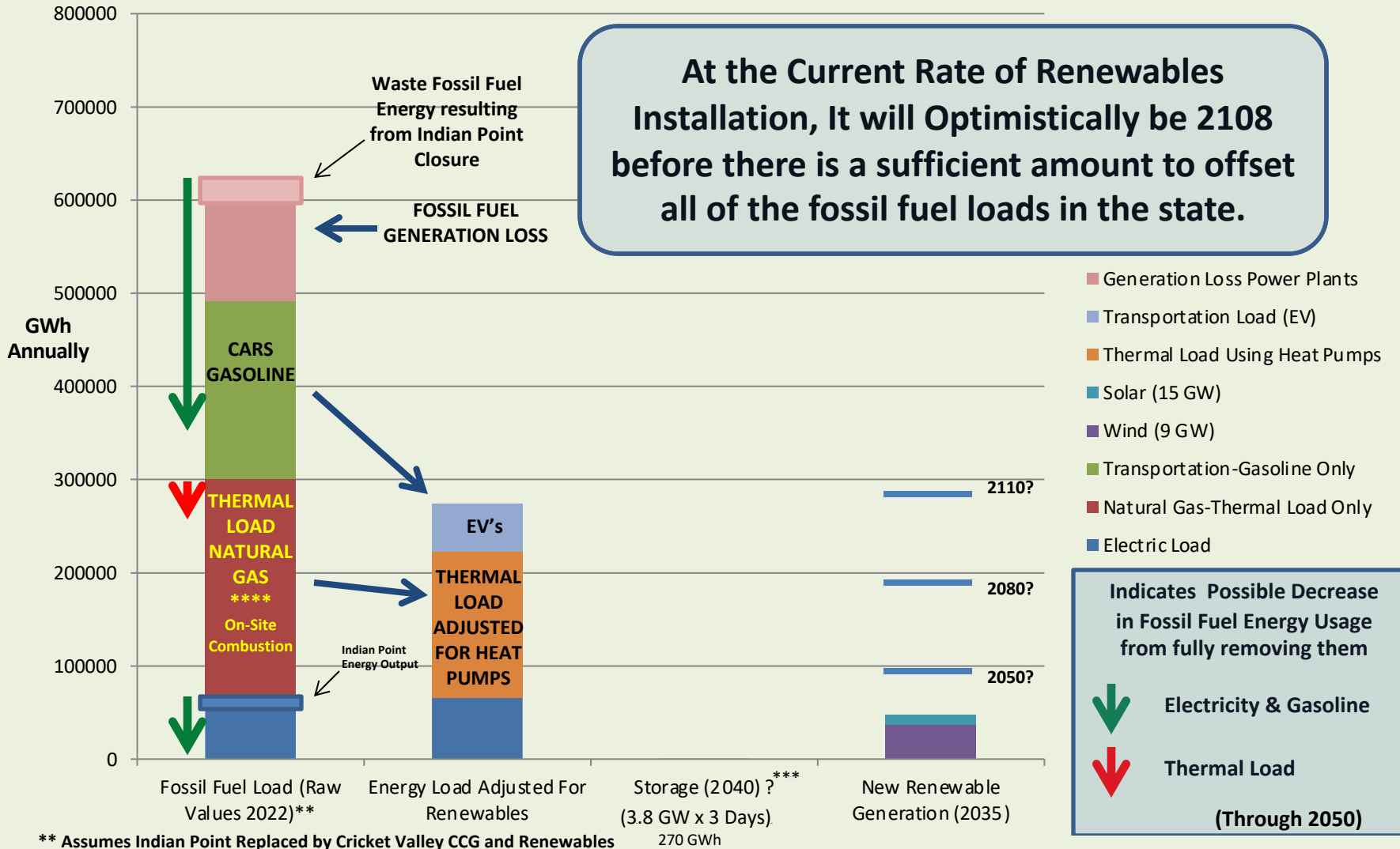
**With On-Site Generation, Far Less Waste is put into the Atmosphere (Both Heat & CO<sub>2</sub>)**



<https://www.wsj.com/articles/twa-hotel-doesnt-need-citys-power-grid-it-has-its-own-11558555953?mod=searchresults&page=1&pos=1&ns=prod/accounts-wsj>

Oil to Gas Conversions have Stopped, Many New Locations are switching to Dual Fuel, raising the CO<sub>2</sub> Footprint at those locations by 50%. In densely populated areas, Geo-Thermal is not always a viable option, especially on retrofits.

# New York State's Current Fossil Fuel Energy Load and Projected Renewable Equivalents Compared To Projected Additional Renewable Generation and Storage-2035 (GWh)

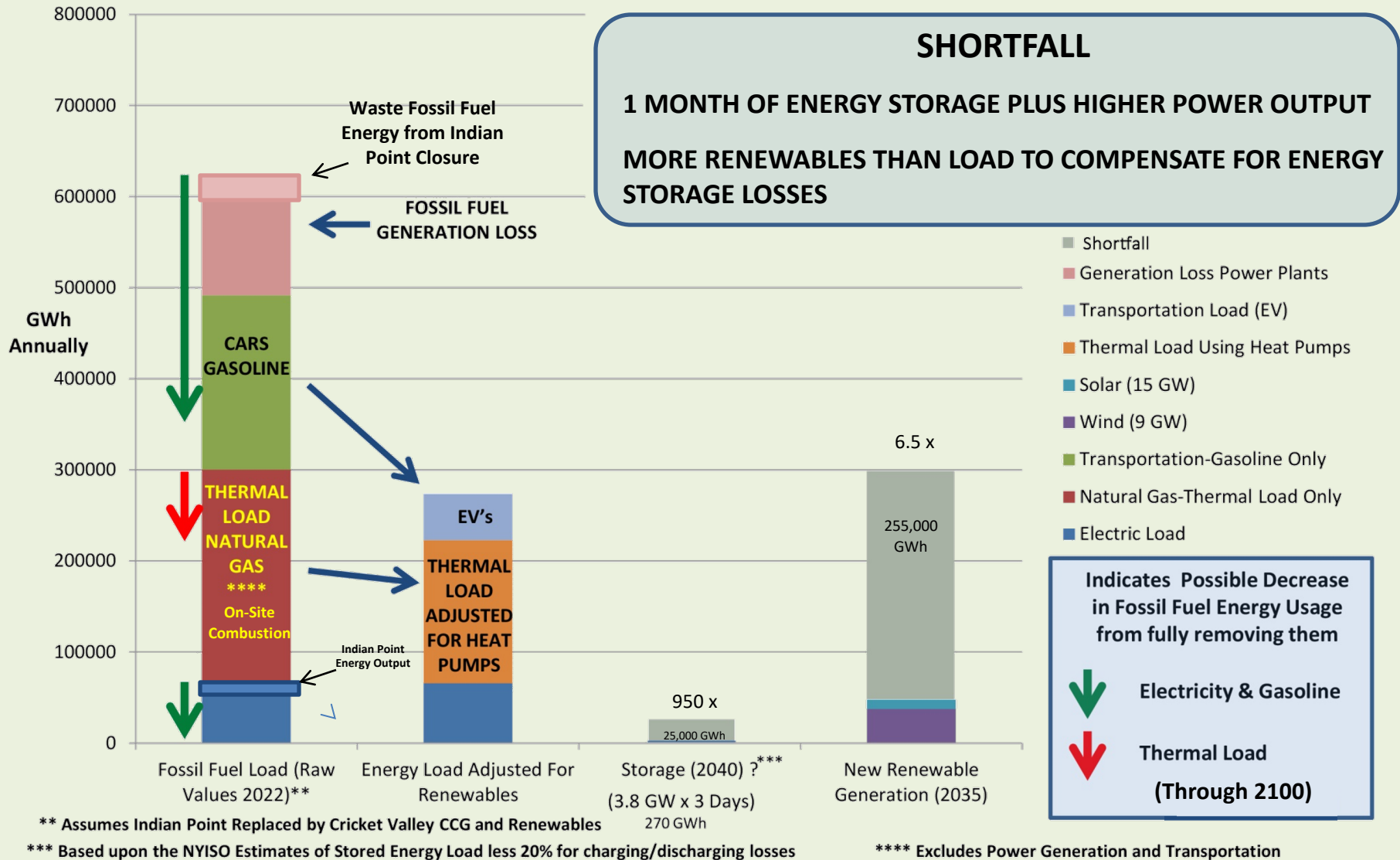


\*\* Assumes Indian Point Replaced by Cricket Valley CCG and Renewables

\*\*\* Based upon the NYISO Estimates of Stored Energy Load less 20% for charging/discharging losses

\*\*\*\* Excludes Power Generation and Transportation

# New York State's Current Fossil Fuel Energy Load and Projected Renewable Equivalents Compared To Projected Additional Renewable Generation and Storage-2035 (GWh)



# Electric Vehicles are Going to Increase the Amount of Electricity Needed

Electric Vehicle Sales in NY State were up 63% in 2018.

While they eliminate sales of gasoline, they add additional load to the utility grid.

**When charged from the utility grid, electric vehicles are only 5%- 8% more energy efficient than an internal combustion vehicle.**

**Renewable resources should be used to offset vehicle emissions which are the largest source of GHG Emissions**

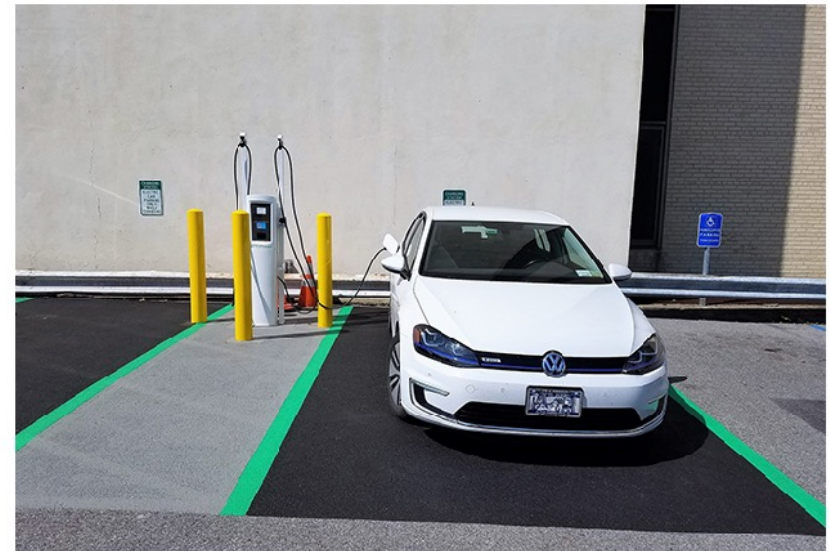
## Gov. Cuomo charged up over electric vehicle sales in NY state

by Peter Katz April 24, 2019

[SHARE](#) [TWEET](#) [SHARE](#) [EMAIL](#) [PRINT](#)

Sales of electric vehicles in New York state soared 63% in 2018 as compared with the number sold in 2017, according to a new report which was funded by the New York State Energy Research and Development Authority.

Gov. Andrew M. Cuomo released the report and he was out front in extolling the virtues of New Yorkers buying electric vehicles at a record pace.

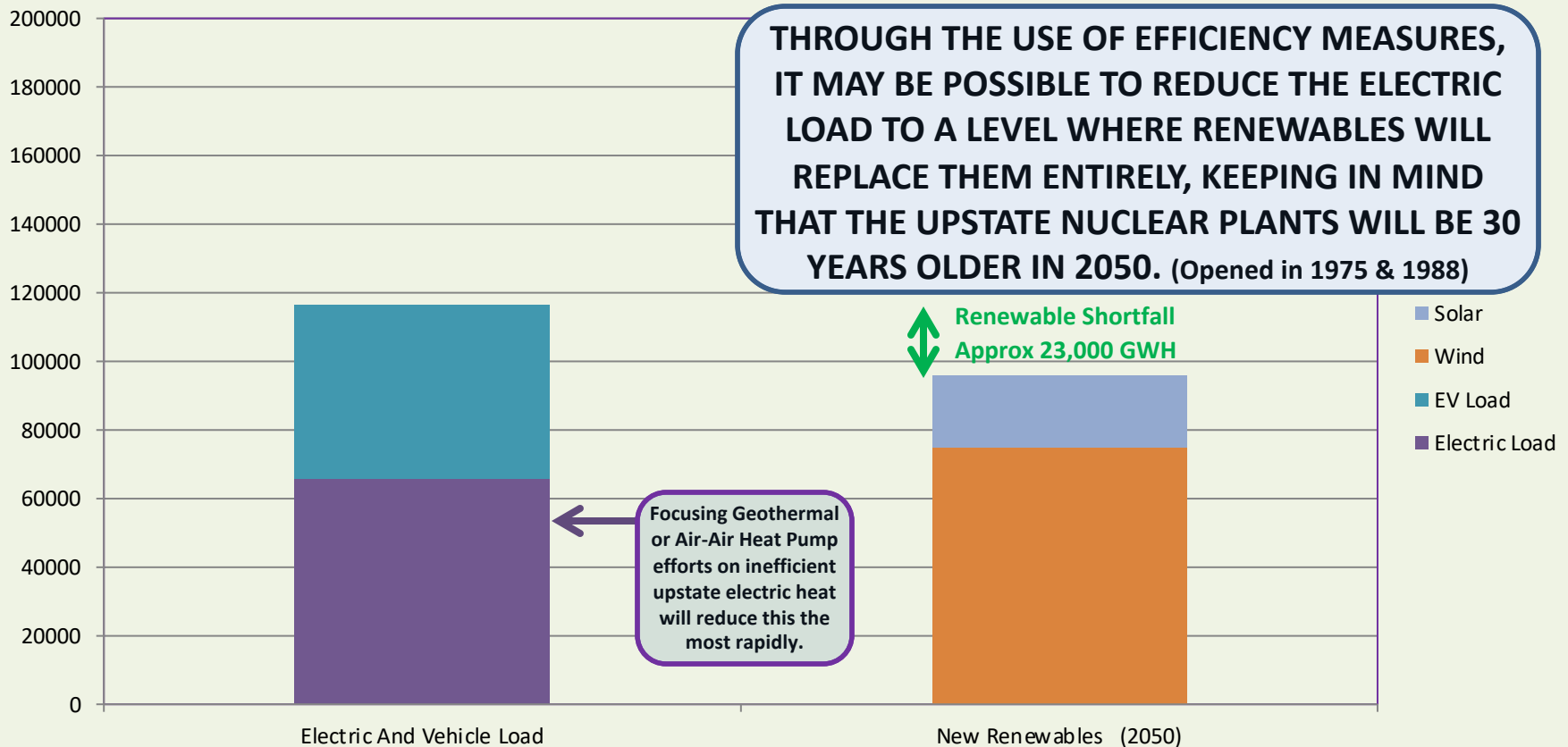


An electric vehicle charging station installed at the Dutchess County Office Building in Poughkeepsie. Photo courtesy of the county government.

The number of electric vehicles on the road jumped to 36,854 in 2018, up from 24,551 in 2017. The report has a new cost-benefit analysis showing increased deployment of electric vehicles in New York state could provide up to \$5.1 billion in net spin-off benefits, including reduced costs of driving by eliminating gasoline and maintenance costs of internal combustion engines and the complex systems needed to make today's vehicles move.

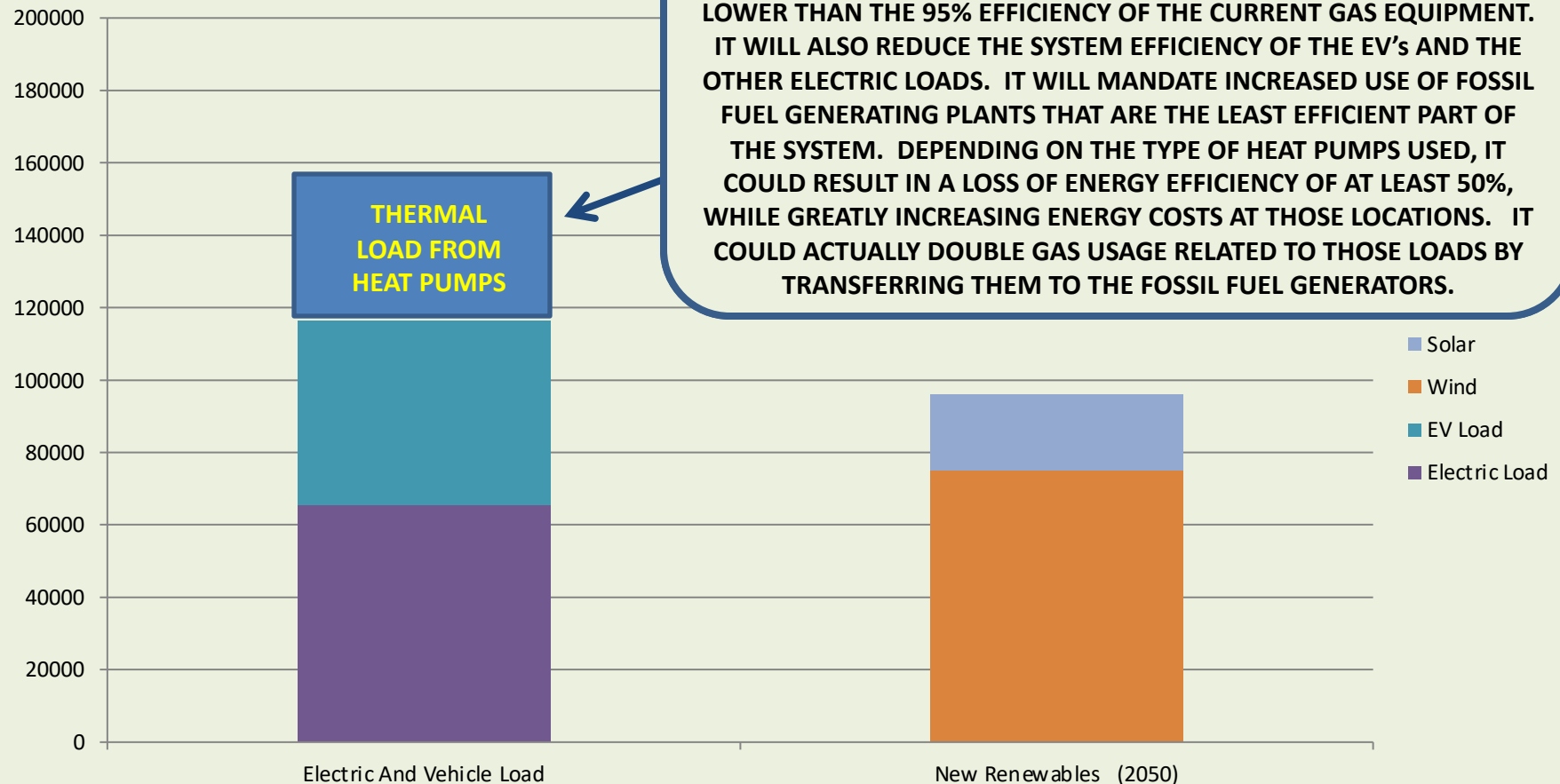
# PROJECTED INSTALLED RENEWABLE GENERATION COMPARED TO ELECTRIC FOSSIL FUEL GENERATION AND VEHICLE LOAD USING EV's

THIS IS POSSIBLE TO ACHIEVE WITHIN THE NEXT 30 YEARS AND IT WOULD  
ELIMINATE THE TWO LARGEST SOURCES OF CO<sub>2</sub>



**A portion of the EV Load could be used for grid storage, but that is only efficient if the Renewables Generation is larger than the load**

# WHY IS IT A PROBLEM TO MOVE THERMAL LOAD ONTO THE ELECTRIC GRID BEFORE ALL OF THE RENEWABLES CAN HANDLE THE LOAD?





# WHERE WILL THE ENERGY COME FROM?

WITHOUT SUFFICIENT RENEWABLE GENERATION, LOAD ON THE UTILITY GENERATING PLANTS WILL BE INCREASED AND THAT IS THE SECOND MOST INEFFICIENT USER OF ENERGY IN THE STATE.

THE GOALS OF THE PLAN ARE NECESSARY TO ACHIEVE AND EXTENSIVE WORK SHOULD BE DONE TO PROGRESS TOWARDS THOSE GOALS, HOWEVER THE TIMEFRAME IS TOTALLY UNREALISTIC AND SOME OF THE UNINTENDED CONSEQUENCES WILL RAISE SHORT-TERM AND MID-TERM CARBON FOOTPRINT FOR DECADES.

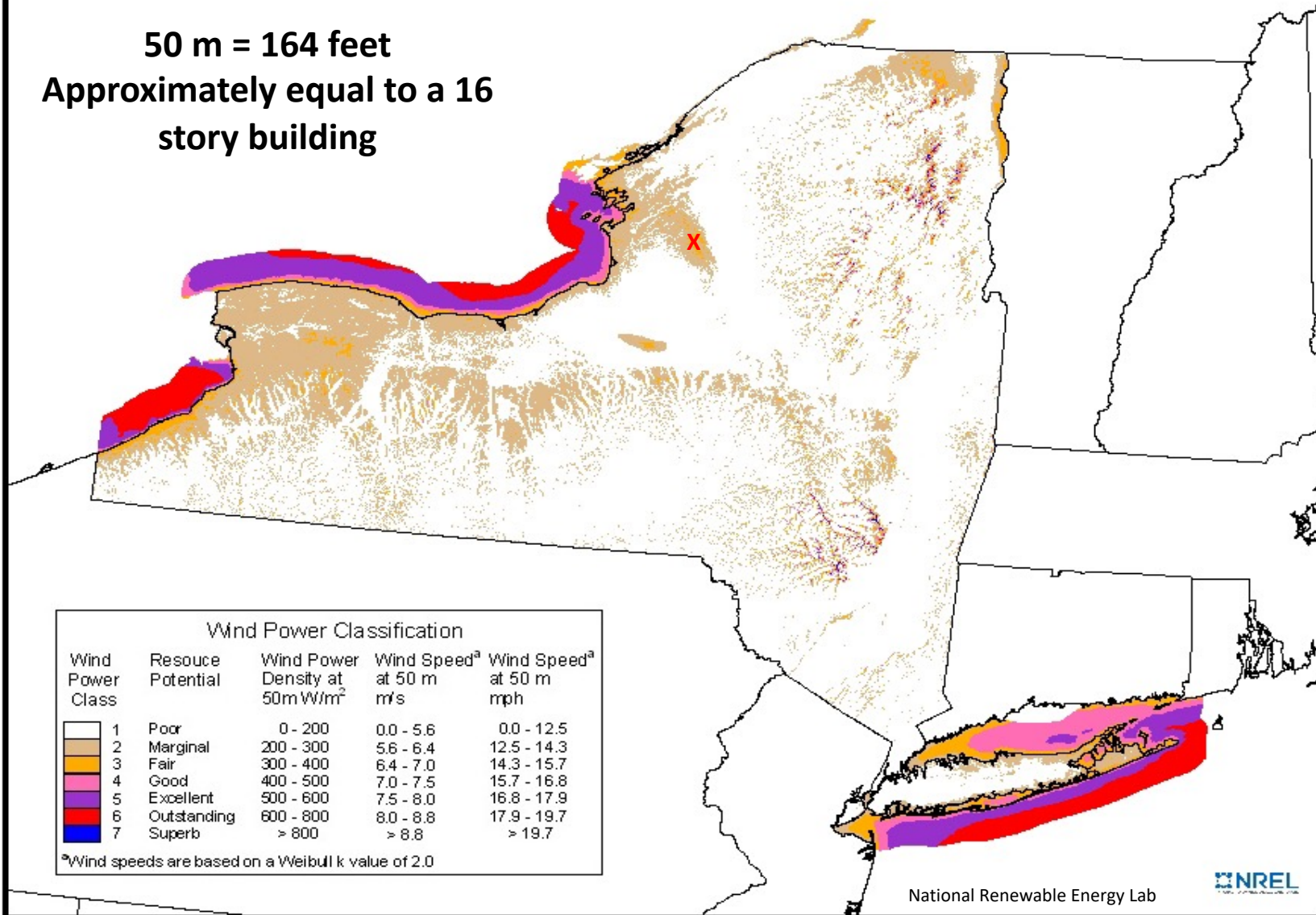
# OBSTACLES TO LARGE SCALE RENEWABLES

- **The Jones Act – Enacted in 1920. Requires that Ocean Based Wind in US Waters be installed from US built Ships. Currently, only 55 of the 60 ships needed to install 1.7 Gigawatts exist. Ships take years to build.**
  - <https://www.offshorewind.biz>
- **NY needs over 25 Gigawatts of Offshore Wind in place by 2030 for its plan to work. **2,750** 9 MW Wind Turbines.**
- **Lifespan of wind turbines is between 12 – 25 years. Some studies have shown that output is reduced by up to 50% after 12 years.**
  - <https://www.telegraph.co.uk/news/earth/energy/windpower/9770837/Wind-farm-turbines-wear-sooner-than-expected-says-study.html>
- **Lifespan of Solar Arrays is 20 – 25 years with output starting to taper off after 10 years.**
- **NIMBY-ism in NY State is Rampant and will be a major obstacle to all Energy Projects on Land and on the Great Lakes.**
- **The Fishing Industry** (7/29/2019)
  - <https://www.reuters.com/article/us-usa-wind-fishing-exclusive/exclusive-first-big-u-s-offshore-wind-project-hits-snag-due-to-fishing-industry-concerns-idUSKCN1U00EK>

# NY Wind Opportunities

New York - Annual Wind Power at 50-m Height

50 m = 164 feet  
 Approximately equal to a 16  
 story building



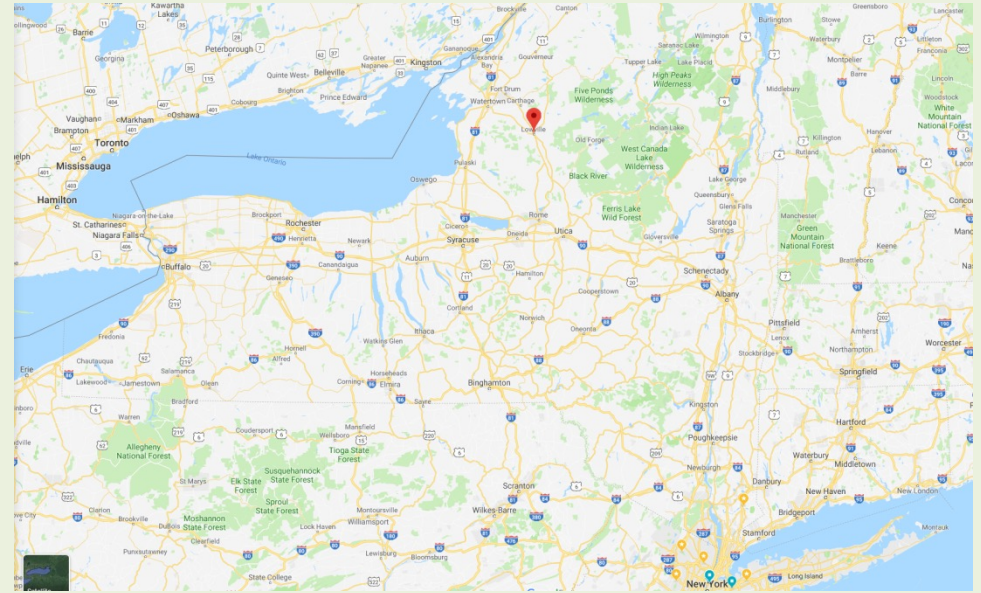
# NIMBY-ism IS RAMPANT in NYS

## Lewis county residents speak out against wind farms in Deer River hearings

Of the combined 14 speakers in the two sessions, only one, Pinckney Supervisor Sherry Harmych, spoke in favor of the project.

[https://www.nny360.com/communitynews/business/lewis-county-residents-speak-out-against-wind-farms-in-deer/article\\_1f453391-b1db-51d3-94c3-7749ee3dcce7.html](https://www.nny360.com/communitynews/business/lewis-county-residents-speak-out-against-wind-farms-in-deer/article_1f453391-b1db-51d3-94c3-7749ee3dcce7.html)

By [JULIE ABBASS](#) Aug 8, 2019

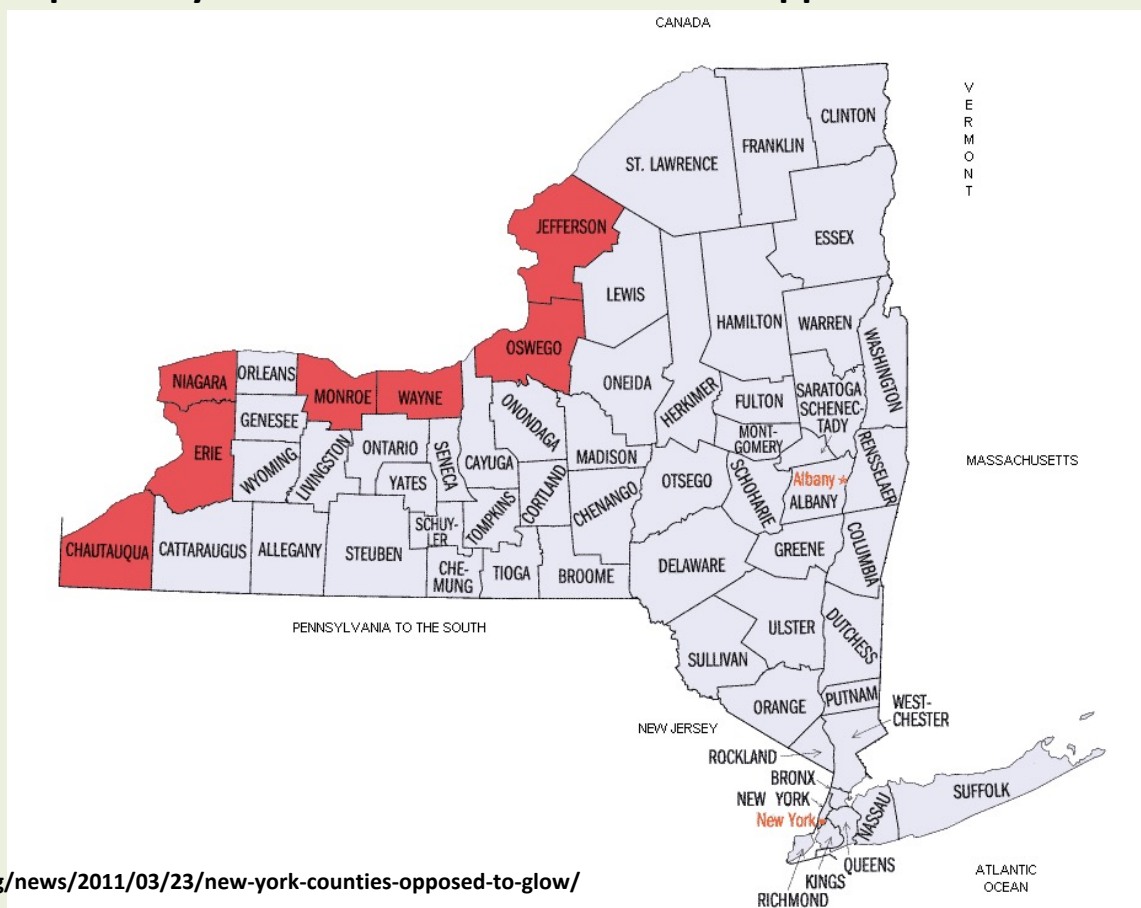


# OPPOSITION TO “GLOW” in 2011

## GREAT LAKES OFFSHORE WIND

The indicated counties have passed resolutions against GLOW, New York State’s “Great Lakes Offshore Wind” project: Chautauque, Erie, Niagara, Monroe, Wayne, Oswego, and Jefferson.

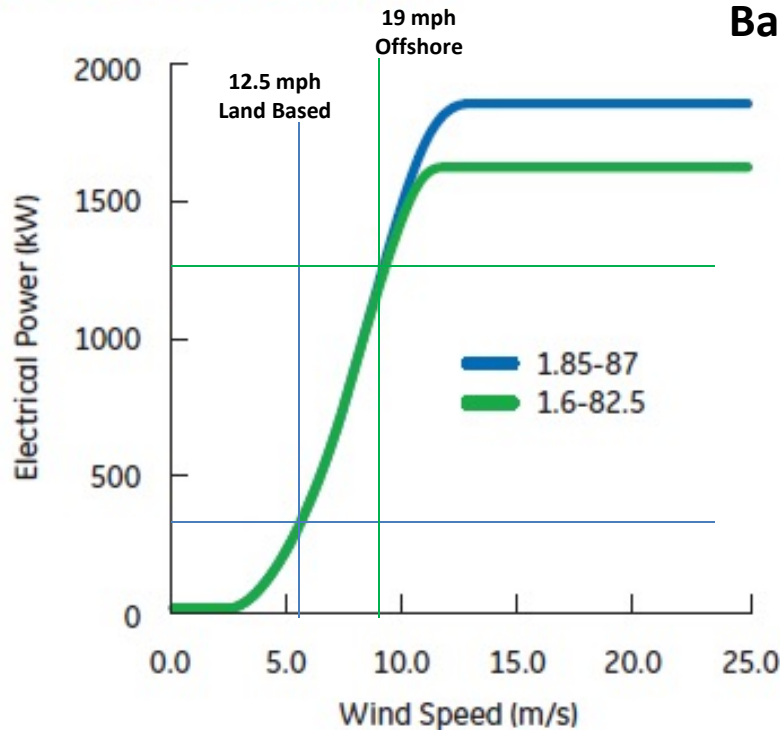
Project Proposed by NYPA in 2009 - Plans were scrapped in 2011 because of opposition



# Wind Turbine Power Output

A Large Land Based Wind Turbine will only output at 16% (or less) of its capacity in all but a few locations in NY State

## Power Curve



An Offshore Wind turbine will Generate more than 3 x as much power than a Land Based Wind Turbine in NY State

GE 1.85-1.87 Wind Turbine

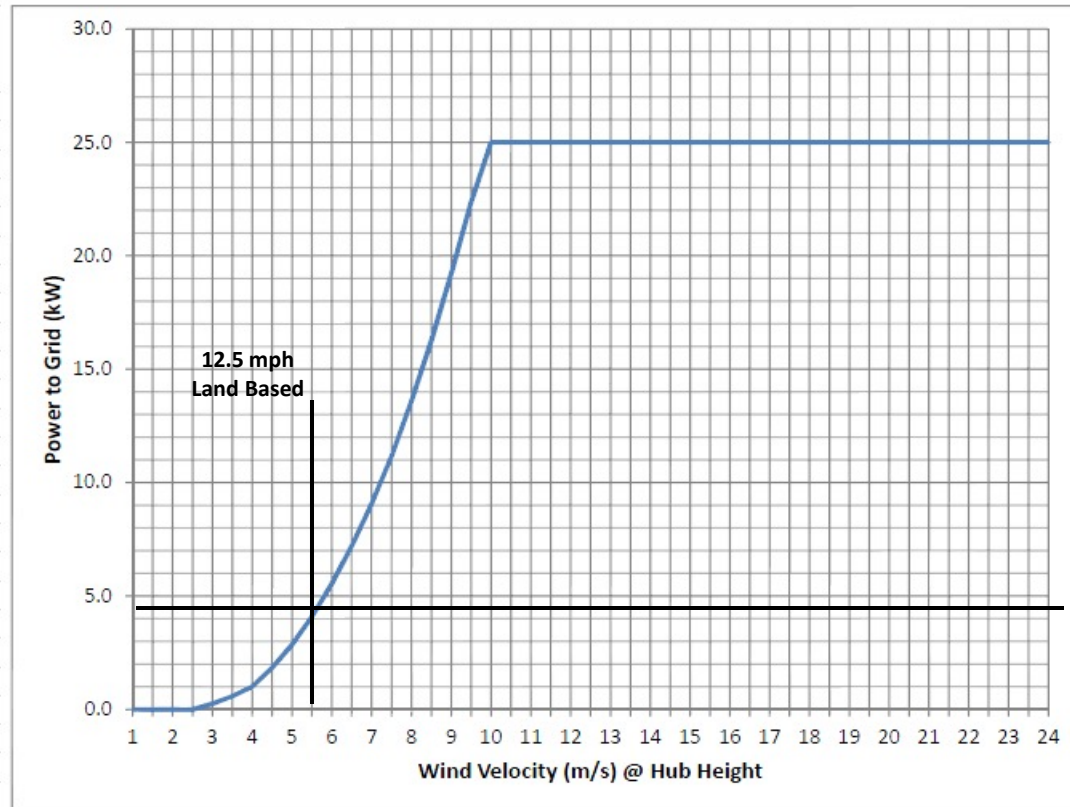
# A Small Wind Turbine will Operate at 18% (or less) of its rated Power Output in All but a Few Locations in NY State



Power Curve - P12-25

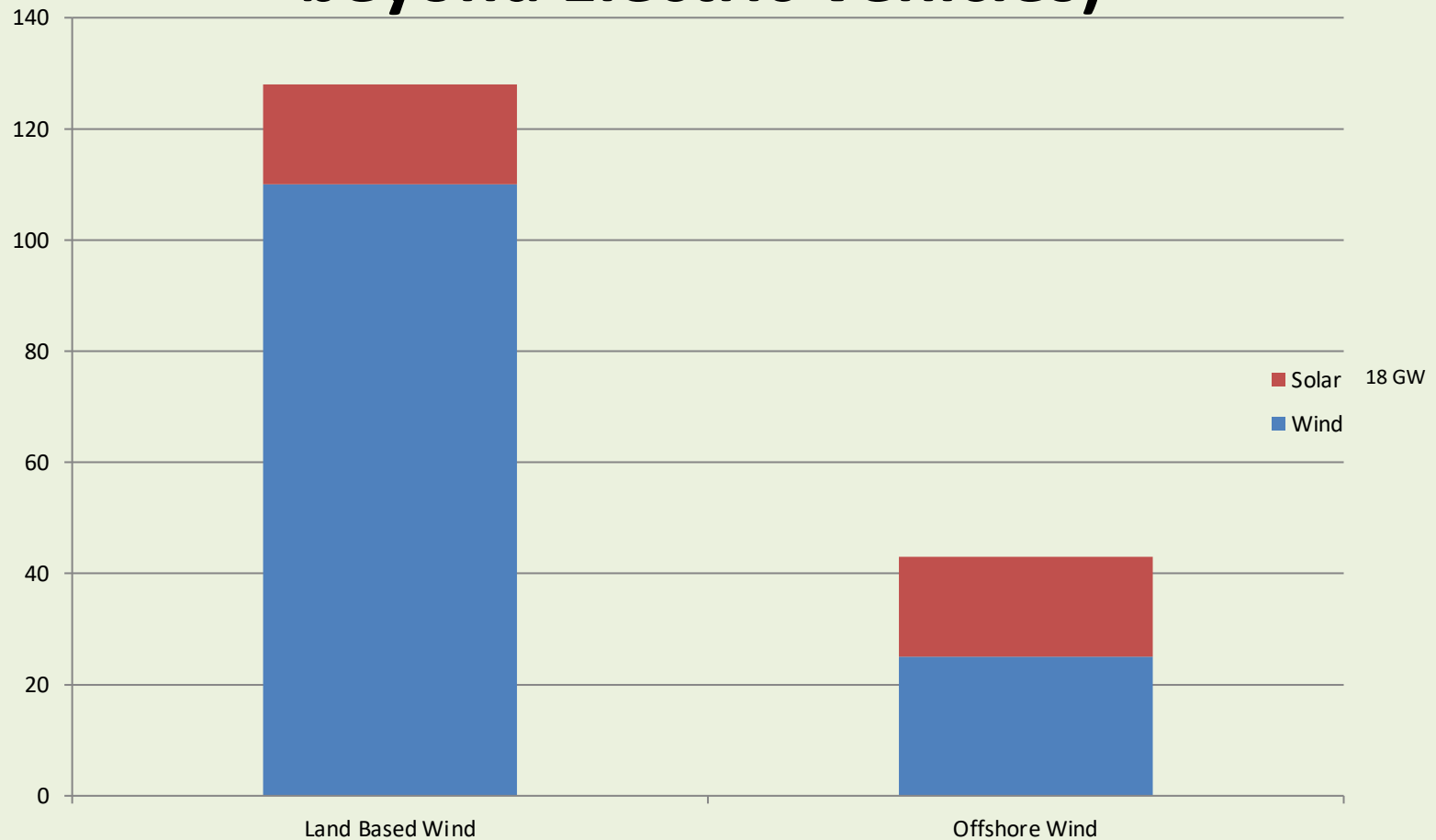
WP-0009

Wind Velocity (m/s)	Wind Velocity (mph)	Grid Power (kW)
1	2.2	0.0
2	4.5	0.0
3	6.7	0.2
4	8.9	1.0
5	11.2	2.9
6	13.4	5.5
7	15.7	9.1
8	17.9	13.6
9	20.1	19.2
10	22.4	25.0
11	24.6	25.0
12	26.8	25.0
13	29.1	25.0
14	31.3	25.0
15	33.6	25.0
16	35.8	25.0
17	38.0	25.0
18	40.3	25.0
19	42.5	25.0
20	44.7	25.0
21	47.0	25.0
22	49.2	25.0
23	51.4	25.0
24	53.7	25.0
25	55.9	25.0



Standard Conditions are considered for calculations

# Gigawatts of Additional Installed Renewable Capacity to Achieve NY State's Goals by 2050 (Assuming No Increase in Utility Grid Load beyond Electric Vehicles)





**BASED UPON THE CURRENT AND  
FUTURE FORESEEABLE RATES OF  
RENEWABLES INSTALLATION,  
LOCALIZED SUPPLIES OF NATURAL GAS  
WILL BE NEEDED TO RAPIDLY REDUCE  
NEW YORK'S  
CARBON FOOTPRINT**

**Even if Sufficient Renewable Generation can be added, it will take nearly as long to convert all onsite combustion locations to electric based heat.**

# **The Opportunity Cost Of Focusing On The Thermal Loads With Limited Renewable Generation Sources**

- **Higher Potential Reductions on the Power Grid and in the Transportation Sector are Lost.**
- **Renewables Efforts are focused on replacing 95% Efficient Equipment as Opposed to Much Less Efficient Upstate Electric Heat and Locations with Oil Heat that ARE MORE Energy Intensive and Have Higher Carbon Footprints.**
- **NY State Gas Usage Actually Drops Much More Slowly**
- **Localized High Efficiency Generation Is Unavailable**
- **Costs Of Climate Mitigation Are Much Higher**

# What Will Happen Without Sufficient Local Gas Supplies ?

- **New Buildings** may switch to oil to cover their heating load. This is already happening in Westchester. 1.5 times the CO<sub>2</sub> Footprint, plus higher particulate and NOX (Nitrogen Oxide) emissions. Many will not use Heat Pumps because they are too expensive to operate without substantial subsidies. Even more expensive after IP closes or if demand rises to support heat pumps. Summer pricing will transfer to winter.
- Oil to Gas conversions at existing sites have ceased resulting in a 50% higher carbon footprint at those locations.
- If Heat Pumps are used, natural gas electrical generating plants will be needed to provide the energy, except the efficiency will be much lower than the 95% efficient gas boilers. (max of 45% Delivered) 50% Efficiency reduction
- **Even If we can manage to install sufficient Renewables, STORAGE** is going to be a huge hurdle as seen with the Storm King experience. Without 100% System reliability, there is going to be enormous resistance to this conversion. Unlike with summer blackouts, even though they can cause a few deaths, winter blackouts will cause much more property destruction and much more loss of life which will put a huge wrinkle into any conversion plans.
- Are there Sufficient Resources to Install Onsite Geothermal Heating Systems throughout the entire state and is leaving them as the only option the best policy? Will diverting limited resources to Westchester and Long Island take them from the rest of the state where greater energy efficiency gains could be obtained by offsetting electric heat in Central and Upstate NY.

**IN A RENEWABLES DRIVEN ENERGY  
SYSTEM, LARGE AMOUNTS OF  
STORAGE ARE CRITICAL TO  
BRIDGING TIMES OF LOW WIND  
AND PERIODS OF LOW SUN**

**WHERE IS THIS GOING TO COME  
FROM ?**

# WHY IS STORAGE SO CRITICAL IN AN ELECTRICALLY DRIVEN SYSTEM?

It would take 380 GWh to handle the Con Ed Load on this one day using Heat Pumps. That doesn't include the rest of NY State. The predicted installed renewable generation in 2050 would have a peak output of approximately 410 GWh on December 31, including existing renewables. *What will power the rest of the state which would have a similar, or higher, load?*

## Con Edison Customers Ring Out 2017 With Record Natural Gas Usage

Con Edison Media Relations New York – January 02, 2018 -- 12:00 PM

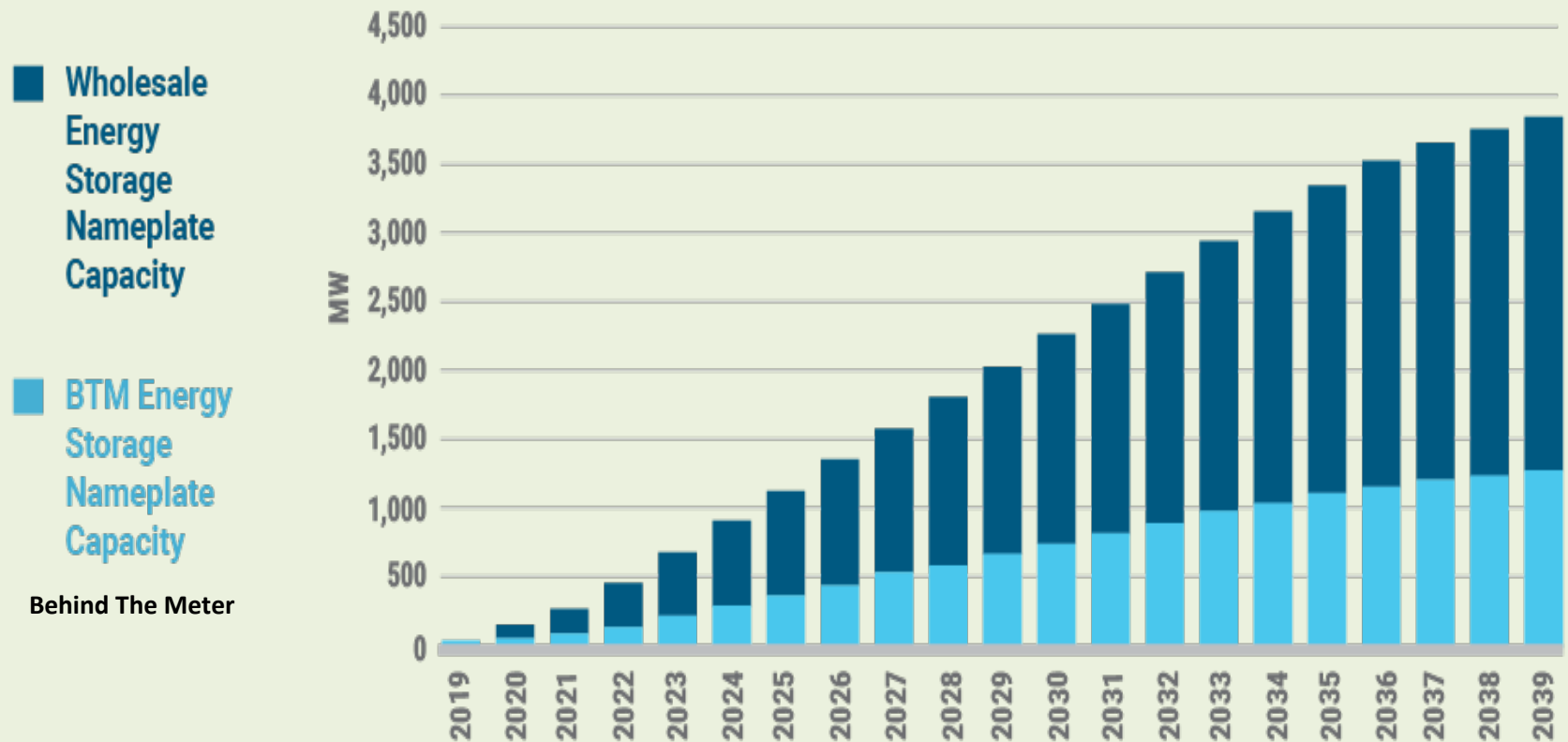
Con Edison met unprecedented demand for natural gas on New Year's Eve, as customers sought to stay warm during the frigid finish to 2017.

**The company provided distribution customers in New York City and Westchester County with 1.3 million dekatherms of gas on Sunday, setting a daily record. The previous record was set just three days earlier, last Thursday, when the sendout reached 1.26 million dekatherms.**

**New records were also set for winter electric usage. Con Edison reported the highest winter weekend sendout of electricity from December 30-31, 2017 of 337,323 megawatt hours (MWh),** beating the previous winter weekend electric sendout record of 321,947 MWh from January 4-5, 2014. A new all-time peak demand for Sunday electric usage was also reached on December 31, 2017 at 7 p.m. at 8,183 megawatts (MW).

# Storage Capacity – NY State

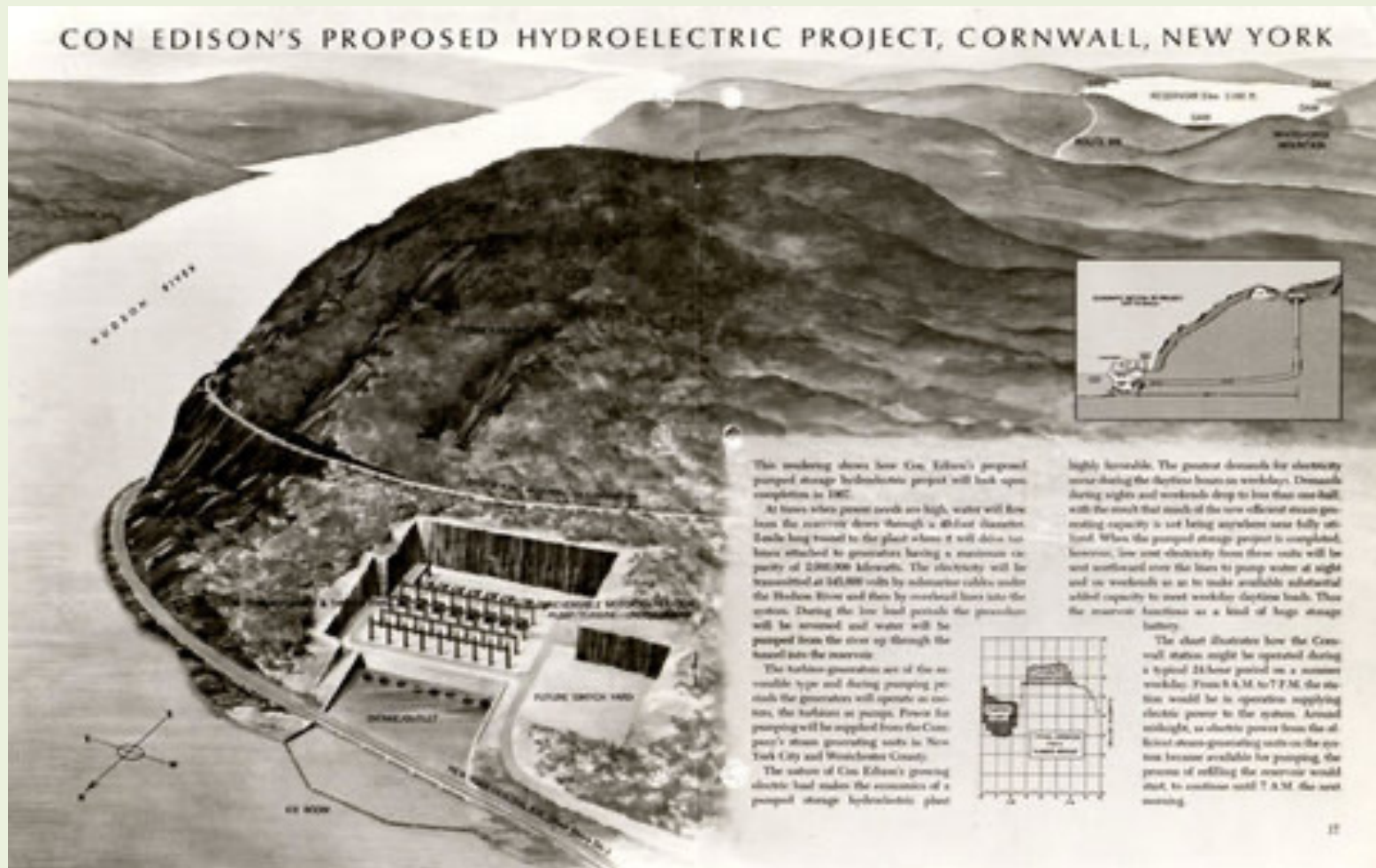
TOTALLY INADEQUATE FOR EVEN THE NIGHTTIME ELECTRIC LOAD  
WITHOUT FOSSIL FUEL PLANTS BY 2040 – ONLY 3800 MW of Power \*\*



From: NYISO – POWER TRENDS 2019

\*\*The NYISO Does Not Provide an Estimate of Stored Energy Capacity

# HISTORY TELLS US THAT IT IS GOING TO BE DIFFICULT TO SITE LARGE ENERGY STORAGE



Consolidated Edison's 1962 proposal for a pumped-storage power facility in Storm King Mountain was abandoned in 1979 over scenic and environmental concerns.

# A Google Search of “Fossil Fuels Plant Construction NY State”

[NYS climate bill must target 100% clean energy by 2030 - www.gp.org](http://www.gp.org)

[https://www.gp.org/clean\\_energy\\_by\\_2030](https://www.gp.org/clean_energy_by_2030)

Feb 12, 2019 - It does not halt *new* fracked-gas pipelines and power *plants* that will increase ... provisions to workers and communities dependent upon *fossil fuel plants*. ... 100% by 2030 should be the target in a *New York State* climate bill. .... including 4.5 million *construction* and manufacturing jobs during the build out ...

[Could New York go carbon free by 2050? | CSNY - City and State](#)

<https://www.cityandstateny.com/.../energy.../could-new-york-go-carbon-free-in-2050...>

Dec 12, 2018 - Currently, *New York* only uses 3 percent wind energy. ... needs of environmental justice communities where many *fossil fuel plants* are currently located. .... of wind and solar *construction*, but the *state* has the same number of ...

[The World Needs to Quit Coal. Why Is It So Hard? - The New York Times](#)

<https://www.nytimes.com/2018/11/24/climate/coal-global-warming.html>

Nov 24, 2018 - A *coal*-fired power *plant* under *construction* in Ramagundam, .... China has imposed tariffs on *coal* imports from the *United States*, in the ...

[Climate Movement Demands New York Move Off Fossil Fuels | Food ...](#)

<https://www.foodandwaterwatch.org/news/climate-movement-demands-new-york-mo...>

Mar 5, 2019 - ALBANY - Dozens of climate activists swarmed the *state* capitol on ... called for an immediate ban on the *construction* of *new fossil fuel* projects. ... It's a triathlon, and *New York Off Fossil Fuels Act* gets us across the ... "The IPCC says we have 12 years left for dramatic climate action to save life on the *planet*.

## Where Did These Dates (2030, 2050) Come From ?



## Some commonly asked questions:

**How long will the transition take?** The plan calls for all new electricity generation to come from wind, water, and sun by 2020, leading to 80-85% conversion by 2030 and all fossil-fuel use fully phased out by 2050.

**Is there any precedent for such a rapid technological transition?** Yes, many. For example, cars replaced horse-drawn carriages as the major means of transportation in the US in just 10 to 20 years between 1910 and 1930.

**Are the necessary technologies available now?** Yes, the plan relies only on presently available technologies already in commercial use. Engineers have made amazing progress over the past decade, and with support and investment will continue to do so. The time is ripe for moving quickly to renewables.

**Won't the transition be expensive?** No, many forms of renewable energy are already cost effective compared to fossil fuels (even without considering the external costs to health and global warming), and will only become more so in the future.

**What happens when the winds are calm, or at night?** The plan calls for storing energy in a variety of ways, and for connecting wind turbines across a large area. (with diverse wind patterns). There is no need for base-load production from coal.

**Can't shale gas serve as a bridge fuel, until renewables can be fully deployed?** Shale gas is disastrous in terms of global warming, competes with renewables in terms of scarce capital for energy investment, requires large-scale industrialization of the landscape, and simply is not needed.

**Does the plan call for nuclear energy?** No. Unsolved issues of waste disposal and other dangerous risks make nuclear an unacceptable option, and renewable energy is less expensive.

**Don't wind turbines kill birds?** Pollution from coal and natural gas kill more than 10 times as many birds as wind turbines, per kilowatt of electricity produced.

# The 2030 Plan for a fossil-fuel free New York



Contents lists available at SciVerse ScienceDirect

Energy Policy

journal homepage: [www.elsevier.com/locate/enpol](http://www.elsevier.com/locate/enpol)



Examining the feasibility of converting New York State's all-purpose energy infrastructure to one using wind, water, and sunlight

Mark Z. Jacobson<sup>a,\*</sup>, Robert W. Howarth<sup>b</sup>, Mark A. Delucchi<sup>c</sup>, Stan R. Scobie<sup>d</sup>, Jannette M. Barth<sup>e</sup>, Michael J. Dvorak<sup>a</sup>, Megan Klevze<sup>a</sup>, Hind Katkhuda<sup>a</sup>, Brian Miranda<sup>a</sup>, Navid A. Chowdhury<sup>a</sup>, Rick Jones<sup>a</sup>, Larson Plano<sup>a</sup>, Anthony R. Ingraffea<sup>f</sup>

<sup>a</sup> Atmosphere/Energy Program, Department of Civil and Environmental Engineering, Stanford University, Stanford, CA 94305, USA

<sup>b</sup> Department of Ecology and Evolutionary Biology, Cornell University Ithaca, NY 14853, USA

<sup>c</sup> Institute of Transportation Studies, U.C. Davis, Davis, CA 95616, USA

<sup>d</sup> PSE Healthy Energy, NY, USA

<sup>e</sup> Pepecton Institute LLC, USA

<sup>f</sup> School of Civil and Environmental Engineering, Cornell University, Ithaca, NY 14853, USA

**In March 2013**, a team of scientists and engineers from Stanford, Cornell, and other institutions published a peer-reviewed study calling for an aggressive transition to make New York State completely free of fossil fuels. All energy for electricity generation, transportation, heating, and industry, would come from the wind, water, and sun.

**The plan uses only presently available technologies already in commercial use. This cost-effective plan saves lives, reduces global warming, and increases the energy security and competitiveness of New York.**



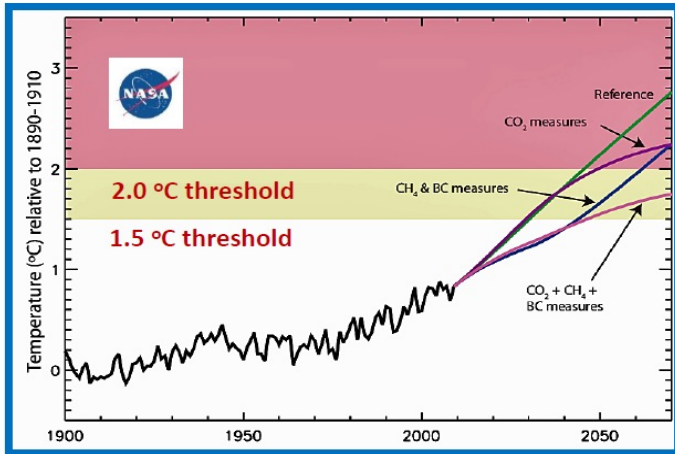
STANFORD  
UNIVERSITY



Cornell University

**The 2030 plan: The time is NOW!**

**Why the plan?** Urgent need to slow global warming, and to reduce illness and death from fossil-fuel driven pollution. The plan offers New York an alternative to shale gas, with far greater benefits and fewer risks.



Source: Drew Shindell and others (2012). Simultaneously mitigating near-term climate change and improving human health and food security. *Science* 335: 183-189.

The Earth has already warmed by 0.7 degree C, and is on track to warm to 1.5 degrees within 17 years and 2.0 degrees within 20 years. Such temperatures pose serious risk of spiraling feedbacks, leading to further uncontrollable warming. To avoid this requires huge reductions in both carbon dioxide and methane emissions. Over the coming few decades, controlling methane is essential. Yet natural gas is the largest source of methane pollution in the US, and shale gas only aggravates this. **We simply must end our addiction to fossil fuels, including coal, oil, and natural gas.**

Fossil-fuel driven air pollution causes widespread illness, lost time from work and school, and 4,000 deaths each year in New York State. **This illness and death costs the residents and taxpayers of New York \$33 BILLION every year.**

### The plan:

- **Calls for use of electric vehicles, and high-efficiency electric heat pumps for commercial and domestic heating (resulting in 37% less total energy use, simply due to greater efficiencies of these modern technologies).**
- **Uses the most environmentally benign generation technologies for electricity (as one example, the plan details the costs and benefits of using 40% offshore wind, 10% onshore wind, 28% photovoltaic, 10% concentrated solar, and 12% geothermal, hydro, tidal, and waves).**
- **Relies only on technologies that are commercially available today.**
- **Uses a variety of energy storage techniques and approaches for balancing demand to production (hydrogen generation, flywheels, compressed air, pumped hydroelectric, batteries, and seasonal heat storage through geothermal storage all play a role).**
- **Is cost effective (the \$570 billion price tag over 20 years is less than the health-care savings from reduced air pollution).**
- **Leads to greater energy security, and more stable energy pricing into the future.**
- **Creates far more jobs than does the continued reliance on fossil fuels.**
- **Is only a start. The creative minds of New Yorkers can build on it, and make it even better. Yet even in this beginning stage, the plan is so much better than the continued use of coal, oil, and natural gas.**

The full paper behind the plan is available on line at <http://www.stanford.edu/group/efmh/jacobson/Articles/I/NewYorkWWSEnPolicy.pdf>

# THE 2030 PLAN SEEMS GREAT IN THEORY

BUT DID ANYONE ANALYZE THE STATE'S ACTUAL ENERGY LOAD AND MAKE A REALISTIC ASSESSMENT OF THE TIME FRAME TO INSTALL THE NECESSARY RENEWABLES?

## Claims of the 2030 Plan

- The plan, from 2013, calls for all new electricity generation to come from wind, water, and sun by 2020, leading to 80-85% conversion by 2030 and all fossil-fuel use fully phased out by 2050. No Nuclear Energy.
- Claims that cars replacing horses between 1910 and 1930 mean that the rapid changeover to renewables is possible.
- Plan calls for large amounts of energy storage •
- Calls for Electric Vehicles
- Claims a 37% Reduction in Load from the Use of Heat Pumps

## Realistically

- NY has already had to add a fossil fuel plant going on-line in 2020 to compensate for the closure of the Indian Point nuclear plant. The plan is already falling behind and it is only 7 years in.
- Cars were a significant upgrade over horses both from a comfort standpoint and a public health standpoint. At present rates, Thermal Electrification is going to increase everyone's utility bill with no easily viewable improvement in the quality of life. It could take up to 100 years to replace all of the gas equipment in NY State.
- According to the NYISO, there will only be 3.8 GW of Peak power storage installed by 2040. Not nearly enough to make the system functional.
- This is another load on a system that already doesn't have enough renewable capacity if gas is removed.
- This is only true if the system is running entirely from renewables

**THE WORST DEAL THAT YOU CAN MAKE IS THE ONE THAT YOU CAN'T AFFORD NOT TO MAKE!!!**

# THE METHANE ISSUE

- One argument for the 2030 Plan is that 50% of all methane leaks occur in distribution systems within cities and the funds that are being used to repair that system should be used to install heat pumps and electric stoves. The plan also seems to make the assumption that removing fossil fuels from NY will stop energy fracking. In theory, that seems like a great idea.
- **In practice, if 100% of the gas load cannot be removed from the service, then those services will still be leaking if they aren't repaired.** Some locations require steam, gas generation or gas backup generators, which will need their gas service maintained so the gas mains cannot be removed. Densely populated and developed downstate areas of NY cannot easily switch to Geothermal. **There are over 2.3 million gas customers in NY City, Westchester, and Long Island.** How would rapid disconnection and replacing equipment work? What are the logistics? Plumbers need special licenses to work on gas in New York. There is a shortage of licensed plumbers that can work on gas in customer premises.
- **Air-Air Heat Pumps will add a large amount of energy load to the utility grid at a low holistic efficiency if renewable generation sources are not available and it will actually increase gas usage.**
- **Removing Sufficient Gas Supplies from Lower NY will not stop fracking in the Bakken and Marcellus Shale Areas.** It will however force diversion of limited geothermal installation resources from upstate NY where they can have a higher rate of efficiency improvement by reducing electric load in areas that don't have alternative energy sources.
- **Based upon analyzing energy usage in NY State, there will not be enough renewables by 2050.** The question that needs to be answered quickly is how to get the most CO2 reduction in a short time with the resources available.
- **However, gas mains in the streets and all aging gas infrastructure must be repaired to minimize methane leaks.** This is a real issue but the alternative plan will actually result in more methane release if the pipes are not fixed and funds are diverted to renewables. **Once the gas supply is not leaking, what is the argument against using it?**

# **Is Additional Gas Service Cost Effective ?**

- **Recovery of Infrastructure Costs on New Gas Pipelines can be achieved in 40 – 60 years, at least 25 years before 2108.**
- **Building Heating Plants have a lifetime of 30 – 40 years. The replacement units will be wearing out by 2108 and can be replaced with Heat Pumps if the renewables are there in either 2060 or 2100.**
- **50% Lower Heating Costs will allow customers to redirect funds towards Energy Efficiency improvements**

# A REALISTIC PLAN THAT CAN WORK AND ACCOMMODATES THE STATE'S ACTUAL ENERGY USAGE

- The authors of the plan are correct in their assessment that we have to reduce carbon footprint quickly. However, basing the plan on an unrealistic renewable installation schedule will not reduce New York's Fossil Fuel Usage and will actually increase New York's GHG footprint.
- Place a tax on conventionally used natural gas and use the funds to offset renewable installation. Gas prices are historically low and that will make renewables more competitive. It will also incentivize the use of CHP.
- At present installation rates, there will not be sufficient Renewable capacity installed to energize the electric grid, replace the thermal loads of buildings, and replace all of the automotive gas stations (to accommodate electric vehicles) in NY within the next 100 – 150 years. {Renewables and the ESSENTIAL associated storage would have to be installed at 7 times the current rate to make the current plan work, along with converting over every kitchen and customer heating plant during that time frame.} We Need to Triple the Rate of Installation for Renewable Generation and Storage.
- Alternative, localized Energy Sources are needed which will reduce utility line loss and increase energy efficiency. Those need Natural gas and would actually result in increased EV Efficiency now. A Tesla rated at 92 mpg actually gets the equivalent of 34 mpg when charged from the grid, less than a Prius. That would rise to 65 mpg if charged from CHP generated energy.
- Localized, gas based generation with heat recovery can raise the electric grid efficiency by 30%-35% at those locations, greatly reducing carbon footprint. This can be done in 10 years, not 100 years.
- Energy Loss Analysis Should be Done on All Buildings In the State to Reduce Thermal Loss In Preparation Of Moving To Renewables Within 60 – 80 Years. Buildings using Electric Heat should be converted to heat pumps immediately. (Preferably Geothermal)
- Water Cooled Air Conditioning Should be Mandated on All Large Buildings to Reduce Electric Load as is done in California.
- Renewables and other resources should first be directed at the 37% Efficient Utility Grid and then the 20% Efficient internal combustion engines. The 95% Efficient Gas Boilers should be saved for last.

# THE GOOD NEWS

- **NY STATE CAN ELIMINATE MOST OF ITS CARBON FOOTPRINT RELATED TO POWER GENERATION AND AUTO TRANSPORTATION BY 2050 THROUGH THE USE OF RENEWABLES. TRANSPORTATION AND POWER GENERATION ACCOUNT FOR 46% OF GREENHOUSE GASES IN NY STATE.**
- **REPAIRING AND UPGRADING ALL OF THE STATES GAS INFRASTRUCTURE WILL GREATLY REDUCE METHANE EMISSIONS**
- **REMOVING NATURAL GAS FROM NY STATE WILL NOT REDUCE EMISSIONS IN THE BAKKEN OR MARCELLUS SHALE GAS OPERATIONS BUT NEW YORK CAN APPLY PRESSURE ON THE STATE'S GAS SUPPLIERS AND HELP TO REDUCE OUT OF STATE METHANE EMISSIONS**
- **REMOVING NATURAL GAS AND ALL FOSSIL FUELS FROM THE NY STATE ENERGY EQUATION IS A NECESSARY THING TO DO. BUT BASED UPON THE NUMBERS, IT MUST BE DONE IN A REALISTIC TIMEFRAME REGARDLESS OF THE EMOTIONAL ARGUMENT TO DECOUPLE FROM FOSSIL FUELS**

# **SUPPLEMENTAL SLIDES**



# **WHY WILL ENERGY COSTS DOUBLE WITH HEAT PUMPS?**

**(ASSUMES CURRENT ELECTRIC COSTS, NO TARIFF ADJUSTMENTS\*\*,  
AND NO GAS SUPPLY FOR A BUILDING)**

**CURRENT NATURAL GAS COSTS ARE \$1.38 PER THERM IN THE NY METRO AREA  
ELECTRIC COOKING COSTS OVER \$ 6.70 per THERM  
(ALMOST 5 TIMES HIGHER THAN GAS)**

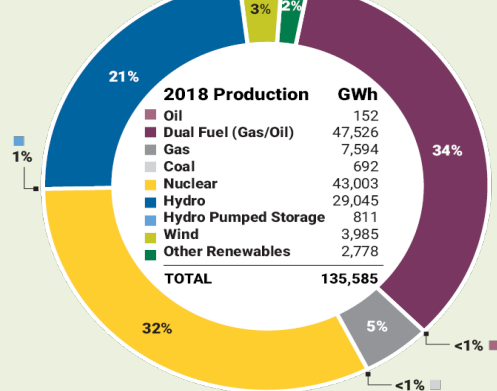
**AND ELECTRIC HEATING COSTS BETWEEN \$2.00 PER THERM AND \$ 3.30 PER  
THERM, DEPENDING ON THE HEAT PUMP SYSTEM USED. (45% - 145% Higher)**

**\*\* EVEN IF TARIFFS ARE ADJUSTED, THE ADDITIONAL COST WILL BE ABSORBED  
SOMEWHERE ELSE, EITHER BY OTHER UTILITY CUSTOMERS OR TAXPAYERS**

# Electric Generation Sources NY State - 2019

NYCA ENERGY PRODUCTION

From: NYISO – POWER TRENDS 2019

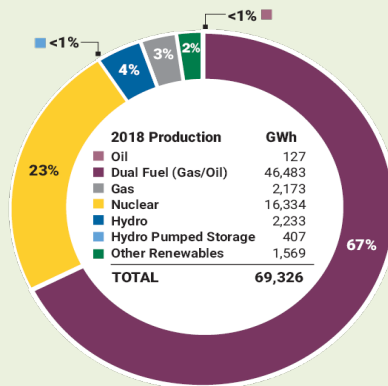
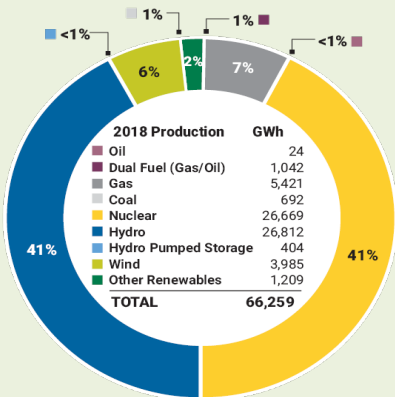


Current Distribution - Electric Grid Only

55,964 GWh from Fossil Fuels  
 43,003 GWh Nuclear  
 29,856 GWh Hydro/Pumped Hydro  
6,763 GWh Renewable  
 135,586 GWh Total

UPSTATE ENERGY (Zones A-E)

DOWNSTATE ENERGY (Zones F-K)



2022 Distribution\*\* – After Indian Point Closure

Reduction of 16,334 GWh – Nuclear  
 Includes Cricket Valley GCC – 9636 GWh

65,600 GWh from Fossil Fuels  
 26,669 GWh Nuclear  
 29,856 GWh Hydro/Pumped Hydro  
 6,763 GWh Renewable  
6,698 GWh Other – Balance of Lost Production from IP  
 135,586 GWh Total

\*\* Assumes Constant Load But Usage in NY State  
 Actually Increased by approx. 3% from 2017 to 2018

**DOES NOT INCLUDE ANY CAPACITY FOR  
 INCREASED EV CHARGING**

State Forecast Electric Usage 157,000 GWh.  
 21,500 GWh from Out of State

# How Much Energy Will Come From Renewables ?

- **Long Island Wind Farm – 9,000 MW Will be Completed by 2035** (in theory)
- **37,528 GWh per Year** (based upon 47.6% Duty Factor At Block Island, RI Wind Farm)
- **3 GW Solar Installation next 5 years.**  
**Extrapolates to 9 GW in 15 years.**
- **10,250 GWh Per Year** (based upon 13% Solar Duty Factor in NY State)

**TOTAL RENEWABLE ADDITIONS THROUGH 2035**  
**47,778 GWh Per Year**

# **What is the Renewable Shortfall Needed To Power The Electric Grid by 2035 and Eliminate Fossil Fuels ?**

- **Fossil Fuel Usage 2022 - 65,600 GWh**
- **Renewable Additions through 2035 – 47,778 GWh**
- **SHORTFALL - 17,822 GWH**
- **WOULD REQUIRE 4.5 GW Additional Wind Installed or 15 GW Additional Solar or a combination of the two**
- **THIS IS ONLY TO REPLACE THE ELECTRIC GRID AND DOES NOT FIGURE IN INCREASED LOAD FROM EV CHARGING OR ANY THERMAL LOAD FROM NATURAL GAS**

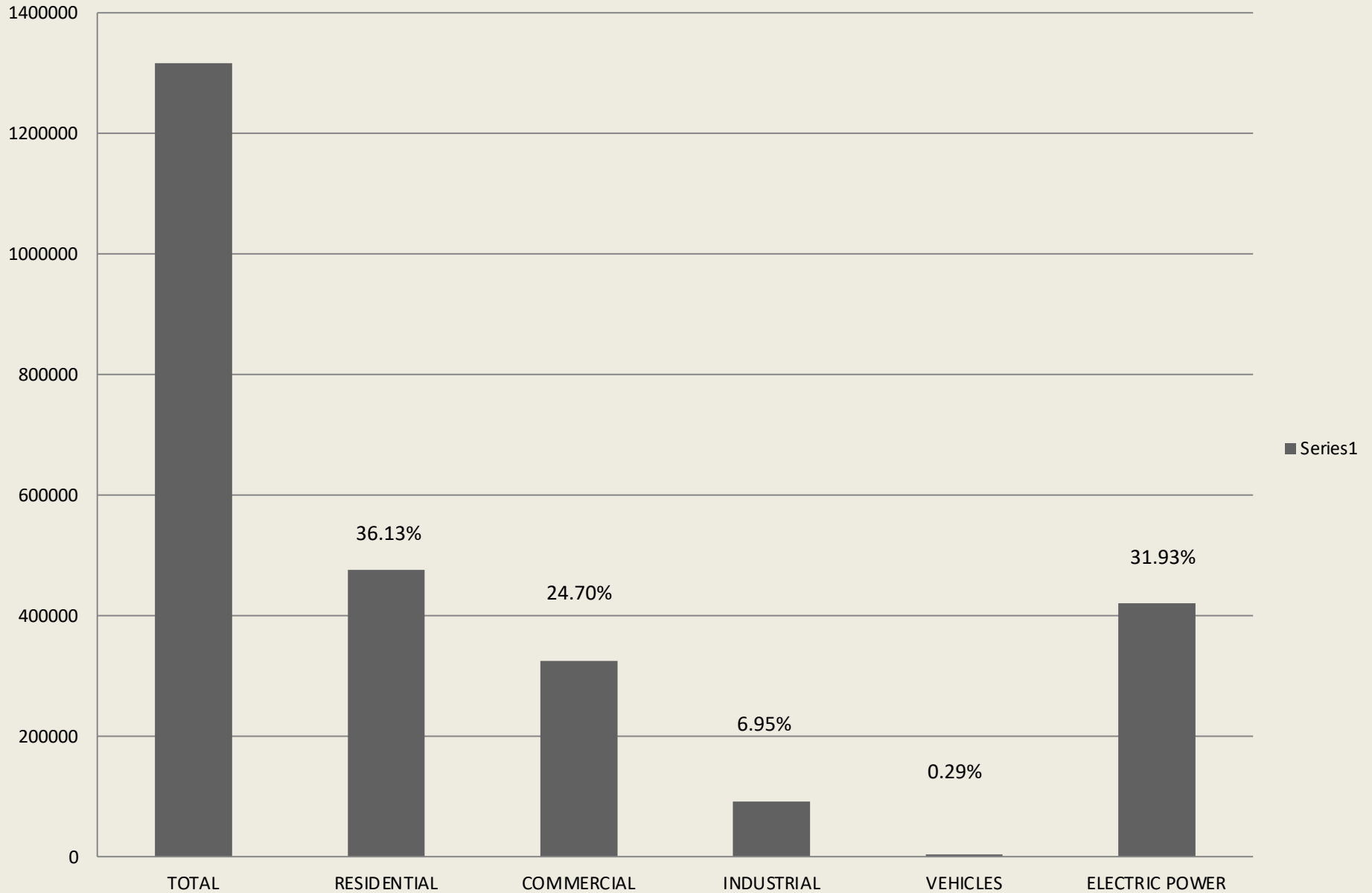


# What is the Total Natural Gas Load in NY State ?

Date	Natural Gas Delivered to Consumers in New York (Including Vehicle Fuel) (MMcf)	New York Natural Gas Residential Consumption (MMcf)	Natural Gas Deliveries to Commercial Consumers in New York (MMcf)	New York Natural Gas Industrial Consumption (MMcf)	New York Natural Gas Vehicle Fuel Consumption (MMcf)	New York Natural Gas Deliveries to Electric Power Consumers (MMcf)
Jan-2018	175,515	89,778	47,822	9,652	317	27,946
Feb-2018	139,857	63,551	36,591	8,834	286	30,594
Mar-2018	142,375	67,187	38,731	8,806	317	27,334
Apr-2018	111,185	47,627	28,745	8,231	307	26,275
May-2018	70,869	18,783	14,732	5,842	335	31,178
Jun-2018	68,614	12,261	14,359	5,842	324	35,828
Jul-2018	84,057	10,830	14,812	6,275	335	51,805
Aug-2018	86,732	9,705	14,844	6,342	335	55,506
Sep-2018	72,803	10,494	15,264	6,247	324	40,474
Oct-2018	87,435	22,820	23,058	7,804	335	33,418
Nov-2018	130,890	54,825	36,464	8,854	324	30,423
Dec-2018	145,958	67,676	39,678	8,754	335	29,514
Totals 2018	1,316,290	475,537	325,100	91,483	3,874	420,295

78,418 Average May-October  
 140,963 Average November-April  
 62,545 Average Monthly Heating Load  
 100,000 Approximate Peak Heating Load in January  
 892,120 Total Annual Thermal Load

# 2018 GAS CONSUMPTION - NY STATE (MMcf)



# What Does That Translate to in Electrical Production ?

- **892,120 MMcf of Natural Gas Delivered for Industrial Purposes, Heating and Cooking in 2018** (800,637 MMcf for Residential & Commercial)
- **1 MMcf=1,000,000 Cubic Feet = 293,100 KWh = 0.2931 GWh**
- **800,637 MMcf = 234,667 GWh annually**
- **Renewable Additions through 2035 – 47,778 GWh**
- **$234,667/47,778 = 4.91$  times more than what is being planned x 15 years = 73 Years which optimistically puts Full Renewables out to the year 2108 (Year 2035 + 73 Years)**



# Is 2108 Realistic ?

- **Air-Air Heat Pumps at twice the efficiency of Gas will reduce the heating load, shortening the time frame. However during the cold winter months, their efficiency is greatly reduced. This isn't California (63 deg-F average winter temp). Cooking Loads will use as much energy as gas. Systems have to be sized for peak winter load or the system will collapse, similar to summer brown outs/blackouts, but with frozen and broken pipes added in. It will likely be necessary to install more than 5x the additional wind capacity. With no fossil fuels, there will be no gas backup generators for homes. Large batteries will be essential in customer premises.**
- **Electric Vehicle charging will radically increase the time frame**
- **Enormous amounts of energy storage will be needed to shift renewables to times of low wind or sun. Where will these be sited? Where will the solar be sited? NIMBYism is rampant. Without energy storage, the renewables just don't work as a reliable energy source if fossil fuels aren't present.**
- **Is it feasible to site 58 GW of Wind Generation in the Atlantic Ocean? That is 6.5 times as much as is currently planned. Where will it be sited otherwise? Will Land Based Wind have as high of a duty cycle? If not, even more will be needed.**
- **There is nothing in the calculation for population growth which will likely increase load**
- **With the life of a solar array being 25 – 30 years, after 2050 much of the new solar installations will be replacing old capacity, not adding capacity.**
- **What will replace the remaining 26,669 GWh of Nuclear? That will require an additional 6GW of installed Wind**

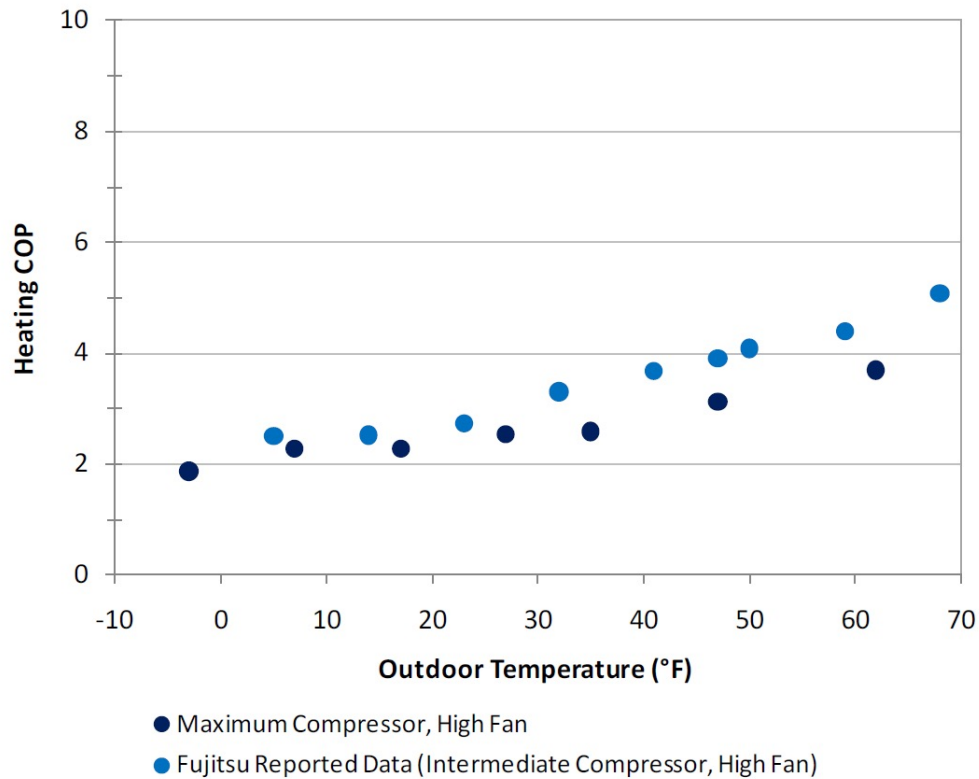
# WHAT WILL IT TAKE TO POWER THE EV FLEET IN NEW YORK STATE ?

- IN 2017, NY STATE GASOLINE SALES WERE 136,414,000 BARRELS @ 42 GALLONS/BARREL. EQUATES TO 5,729,388,000 GALLONS
- 33.4 KWh in 1 GALLON OF GASOLINE = 191,362 GWh ANNUALLY
- INTERNAL COMBUSTION ENGINES ARE 22% EFFICIENT. EV's ARE APPROX. 83% EFFICIENT (INCLUDING T&D CHARGING LOSSES)
- NET ENERGY NEEDED= $191,362 \times 0.22 / 0.83 = 50772$  GWH
- THIS WOULD REQUIRE ANOTHER 12 GW WIND FARM WITH A 47% DUTY CYCLE PLUS 15 GW SOLAR. (ADDITIONAL 20 YEARS AT CURRENT RATE)
- EQUIVALENT TO ANNUAL OUTPUT OF 3 INDIAN POINT POWER PLANTS
- DOES NOT INCLUDE DIESEL SALES

# **CURRENTLY AVAILABLE ALTERNATIVES THAT CAN BE IMPLEMENTED NOW**

- **If 50% of All Methane Leaks are in Gas Distribution Infrastructure under the streets, repair these immediately. Replace old pipeline compressor stations with the newer, more efficient ones. Demand that gas suppliers in NY State meet certain realistic and verifiable methane loss standards.**
- **Improve Grid (T&D) Efficiency, reduce KVA load, and install large quantities of high efficiency gas driven distributed generation. These immediately result in a 5% - 12% energy efficiency improvement by eliminating T&D losses plus a 30% efficiency improvement through heat recovery. 70% efficiency as compared to 35% utility efficiency. These can be installed in all of the large new buildings for less than the additional cost of alternative oil infrastructure that will be needed if there is no gas. This is critical as EV charging is going to tax the distribution system in the not too distant future. Energy cost reductions pay for the systems.**
- **Mandate water cooled air conditioning on all large and medium size buildings. This is done in California and is working well to reduce energy losses. Results in a 58% energy reduction related to AC and a holistic reduction in water use when power plant water is included. Energy cost reductions pay for the systems.**
- <https://www.buildings.com/article-details/articleid/5757/title/what-a-water-cooled-hvac-system-can-do-for-your-building>
- **Provide low interest loans to assist utility customers with implementing the large energy efficiency projects. It is far less expensive to the state than grants and results in implementation of the projects.**
- **Relax lot coverage restrictions and height restrictions for renewable projects**
- **All of these improvements now will reduce fossil fuel consumption rapidly and make adoption of renewables simpler and more palatable to the public.**

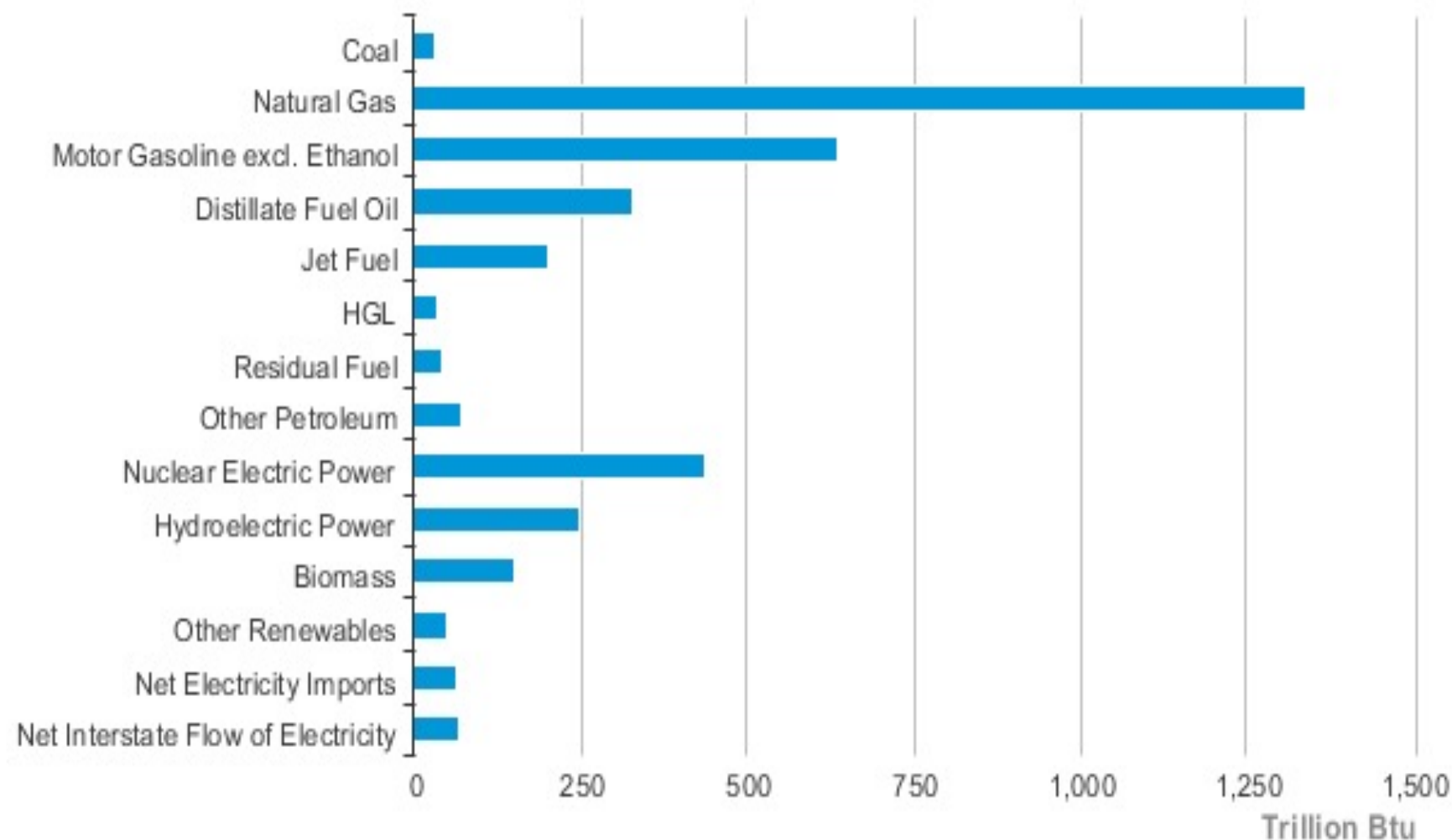
# COP Air-Air Heat Pumps



**Figure 6. Fujitsu 12RLS heating COP compared to manufacturer-reported data (70°F return temperature)**

Source: Fujitsu 2009

## New York Energy Consumption Estimates, 2016



Source: Energy Information Administration, State Energy Data System

# The fallacy of using Bio-mass as a Renewable Fuel

- Environmental Orthodoxy states that burning trees is carbon neutral because the tree absorbs as much oxygen while growing as is released during burning.
- The NY Times highlighted Copenhagen as an example of what should be done to achieve Carbon Neutrality.  
<https://www.nytimes.com/2019/03/25/climate/copenhagen-climate-change.html?ref=climate&module=Ribbon&version=context&region=Header&action=click&contentCollection=Climate&pgtype=Multimedia>
- Copenhagen is using wood pellets in lieu of Natural Gas to state that they are becoming carbon neutral. This clearly documents the issues that cities face in trying to become carbon neutral because their claim is false.
- Burning Bio-Mass produces a higher carbon footprint than any other fuel, even coal. It releases twice the CO2 emissions of Natural Gas and greatly reduces CO2 absorption in forests.

# The fallacy of using Bio-mass as a Renewable Fuel

- If a tree takes over 30 years to grow and it is burned in a day, this results in nearly 11,000 times more CO<sub>2</sub> released than is absorbed while the tree grows.
- To be truly carbon neutral, over 11,000 trees would have to be planted for every one that is burned. Small saplings don't absorb as much CO<sub>2</sub> as the larger trees being cut.

<http://theconversation.com/big-old-trees-grow-faster-making-them-vital-carbon-absorbers-22104>

## Specific Carbon Dioxide Emissions of Various Fuels

Fuel	Emissions in kgCO <sub>2</sub> / kWh	Emissions in kgCO <sub>2</sub> / GJ
<b>Wood *)</b>	<b>0,39</b>	<b>109,6</b>
Peat	0,38	106,0
Lignite	0,36	101,2
Hard coal	0,34	94,6
Fuel oil	0,28	77,4
Diesel	0,27	74,1
Crude oil	0,26	73,3
Kerosene	0,26	71,5
Gasoline	0,25	69,3
Refinery gas	0,24	66,7
Liquid petroleum gas	0,23	63,1
<b>Natural gas</b>	<b>0,20</b>	<b>56,1</b>

\*) not sustainable used without reforestation

[https://www.volker-quaschnig.de/datserv/CO2-spez/index\\_e.php](https://www.volker-quaschnig.de/datserv/CO2-spez/index_e.php)

# Resistance to Wind

- **Exclusive: First big U.S. offshore wind project hits snag due to fishing-industry concerns**
- <https://www.reuters.com/article/us-usa-wind-fishing-exclusive/exclusive-first-big-u-s-offshore-wind-project-hits-snag-due-to-fishing-industry-concerns-idUSKCN1U00EK>