Energy on Demand as the Life Blood of Business and Entrepreneurship in the State

Why NY State Must Rethink Its Energy Plan

PLUS

10 Suggestions to Help Fix the Problems

Richard Ellenbogen – MEE June 3, 2023
PRESIDENT – ALLIED CONVERTERS, INC.
www.alliedconverters.com

BELL LABS NEWS

FOR THE PEOPLE OF BELL LABORATORIES

Vol. 19 No. 41 Oct. 15, 1979

For speaker verification

Employees to try out experimental system

For the next six months, 120 employees will dial a special Murray Hill number twice a week and hear a computer say, "This is Bell Labs Automatic Speaker Verification System. Please dial your identification number."

After doing so, they will be asked to recite the test phrase "We were away a year ago," then be told to "Stand by for analysis. Finally, the computer will usually conclude with, "Your identity has been verified. Thank you."

This seemingly odd exchange between employee and computer is an "on-line" evaluation of a voice recognition experiment being conducted by Sadaoki Furui, a member of the Acoustics Research Department. This work could lead to a system useful to telephone companies in authenticating credit card customers, and to other businesses that require voice identification.

"It's very hard to fool the experimental system," said Furui. "It can use voice measurements to authenticate a person's claimed identity with an accuracy exceeding 95 percent."

The high accuracy is achieved, Furui went on, by utilizing a measurement technique called Cepstral Analysis. A computer records, digitizes and transforms voice signals into what is called a spectrum.

"Changes in voice sounds appear in the spectrum as 'peaks' and "valleys," said Furui. "The computer measures time variations between peaks at intervals

(See EMPLOYEES, page 4)

AUTOMATED FACILITY for testing power converters is demonstrated at Western's Kearny Works by Rich Ellenbogen, second from right, to WE's John Turdy, foreground, and, standing from left, Bob Shennum, director, Electronic Power Systems Laboratory; Dom Cuomo, WE director of Engineering; and Charles W. Hoover, executive director, Systems Assembly Technology Division.

Automated facility developed for testing power converters

A team of Whippany and Western Electric engineers have developed a new automated facility to test power converters—the devices that transform electricity supplied by central office battery plants at high voltage to the low, controlled voltages required by modern electronic switching and transmission equipment.

The facility, at WE's Kearny, N.J., Works, includes a console and three cabinets which house a minicomputer and test equipment. The setup is duplicated at Whippany. Common software and hardware test fixtures are used at the two locations. Plans are being made to place similar sets at other WE locations.

"Before we developed the new facility, converters were tested manually—a complex, time-consuming process," said Jim McElroy, supervisor, Automatic Test and Diagnostic Systems Group. "Now, a technician can perform many more tests—from measuring output voltage to checking a converter's emergency shutdown system—in a fraction of the time and with greater precision and reproducibility."

As converters come off the assembly line, they are plugged into the test facility computer and test results are displayed on a video screen.

"If a problem shows up, the computer probes circuits to locate it," said Rich Ellenbogen, a member of McElroy's group. "Next, the computer prints out a label identifying the problem

RENOVATED FACTORY IN 1998 – 2001
INSTALLED CHP IN 1999 - 2003 & SOLAR IN 2007

DEFEATED CON ED IN A TARIFF BATTLE IN 2008-2009 TO ALLOW INCREASED CONNECTION OF RENEWABLES TO THE UTILITY SYSTEM. FIRST BUILDING IN NY STATE WITH MULTIPLE SOURCES OF GRID CONNECTED HIGH EFFICIENCY GENERATION

TECHNOLOGY FROM THE FACTORY WAS USED AS THE BASIS FOR A PSC UTILITY CONFERENCE THAT RESULTED IN A REDUCTION OF LINE LOSSES IN NY STATE TOTALING 50,000 – 70,000 MEGAWATT HOURS ANNUALLY

BELL LABS ENGINEER POWER SYSTEMS LABORATORY 1978 - 1980

CREDENTIALS

NEW YORK

Westchester Plastics Maker Embraced Renewable Energy Decades Before Gas Moratorium

Allied Converters saves with cogeneration system and solar panels, while business community worries over potential natural-gas shortage

Richard Ellenbogen installed solar panels at his factory, allowing him to sell about $21,000 in solar renewable-energy credits a year. PHOTO: THE WALL STREET JOURNAL

By Kate King
Oct. 27, 2019 7:00 am ET

NEW ROCHELLE, N.Y.—Plastics manufacturer Richard Ellenbogen has found a way to keep the lights on: He makes his own electricity.

The New York Times

In the Region | Westchester

Going Green: Still Challenging Turf

UNDER THE SUN Solar panels are just one of many energy-saving features in Richard and Maryann Ellenbogen's new house.Credit...Suzanne DeChillo/The New York Times

By Elsa Brenner

- Nov. 14, 2008

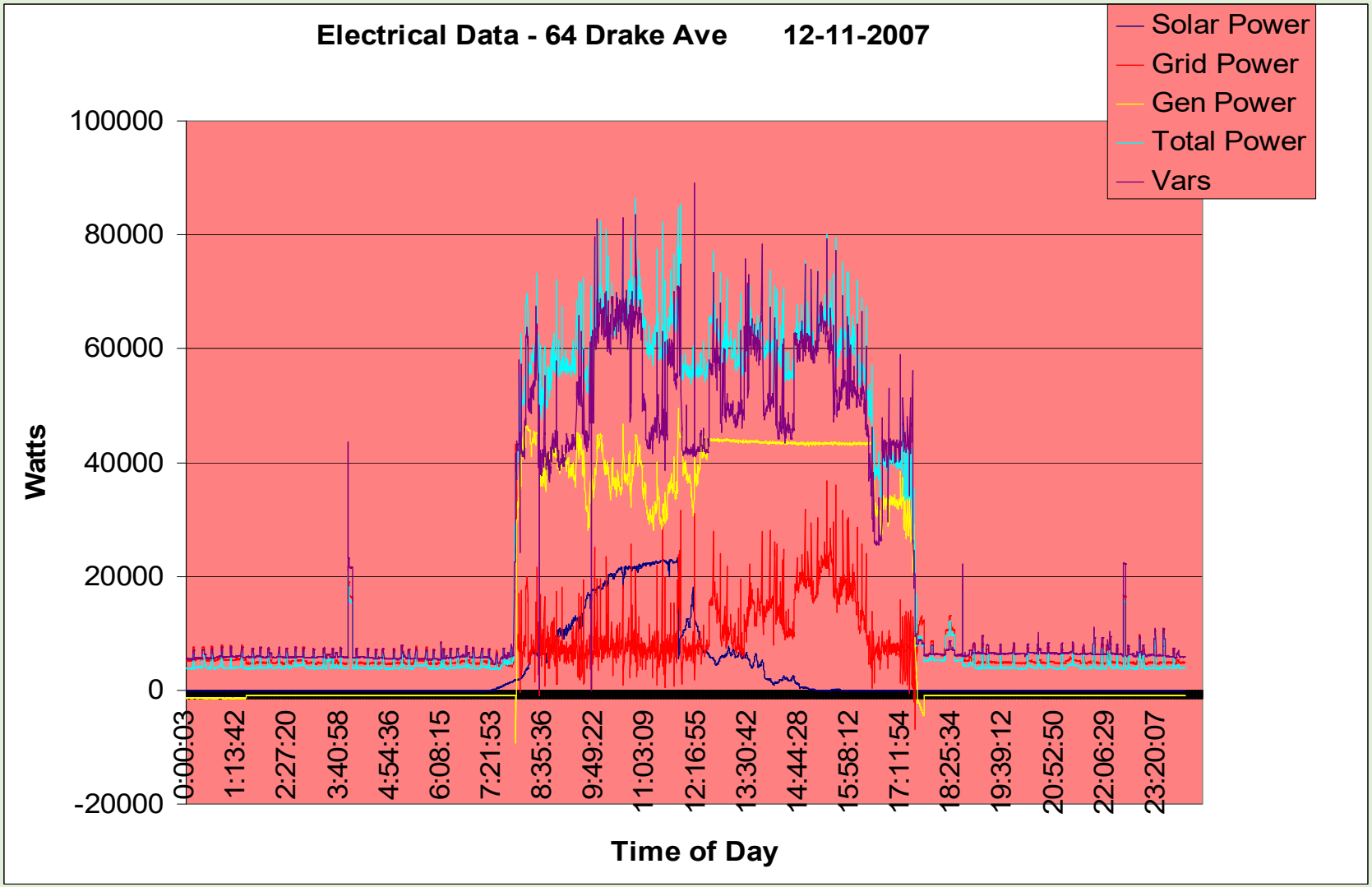
HOME DESIGNED IN 1999
CONSTRUCTION COMPLETED IN 2004

USES GEOTHERMAL, HIGH MASS RADIANT HEAT AND SOLAR ARRAYS
1.5 ACRES WITH NO CITY WATER USED FOR IRRIGATION

IN 2008 THE FACTORY WAS OPERATING WITH A TOTAL ENERGY COST 67% LOWER THAN THE AVERAGE COMMERCIAL FACILITY IN WESTCHESTER AND A CARBON FOOTPRINT 30% - 40% LOWER THAN THE UTILITY WHILE USING NATURAL GAS

BETWEEN 2006 – 2022, RECYCLED OR REPURPOSED 100% OF ITS INDUSTRIAL WASTE BYPRODUCTS

VIDEO: https://youtu.be/j4jyg5b5w7M



DATA COLLECTED AT THE FACTORY ON DECEMBER 11, 2007

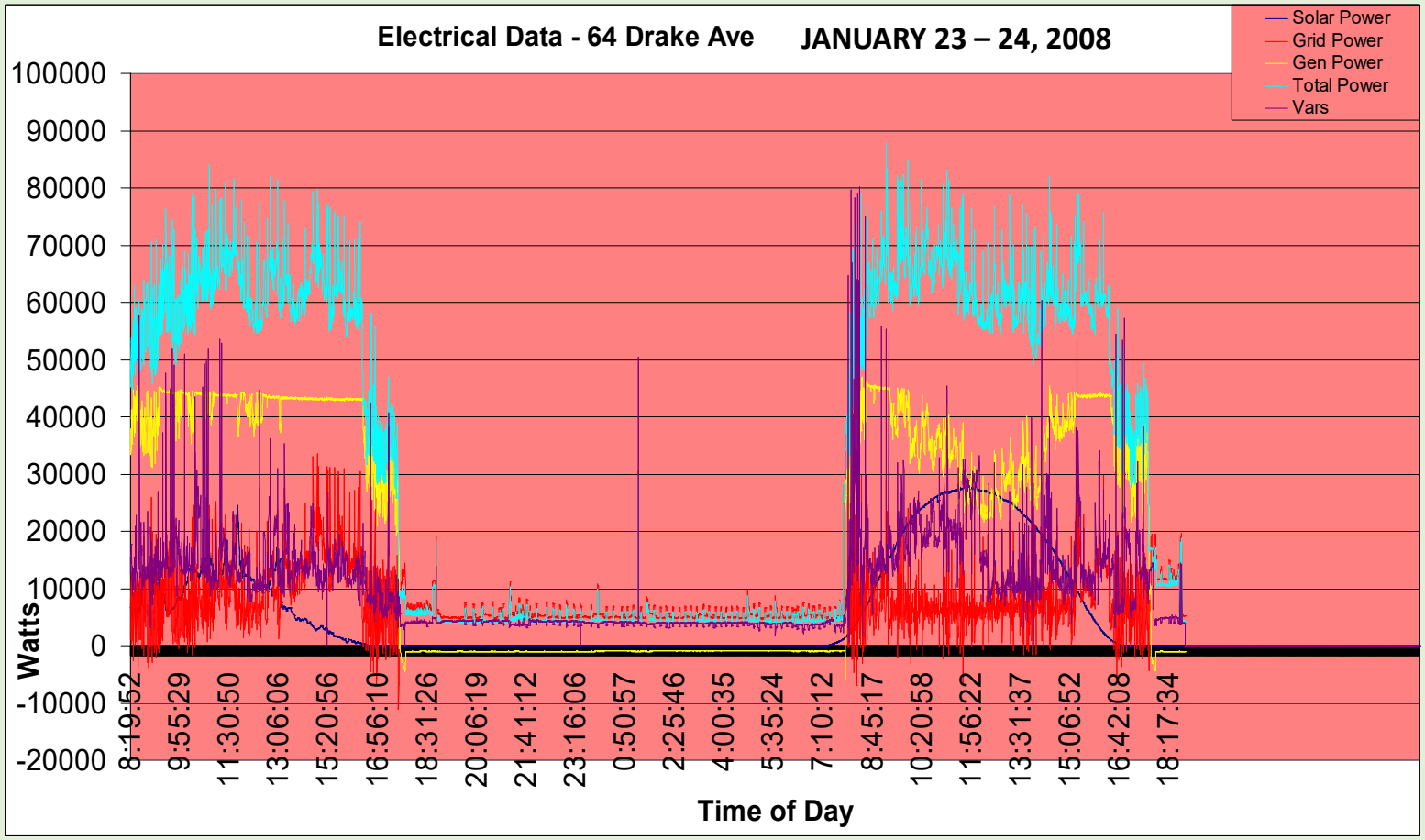
3 ENERGY SOURCES

RED – UTILITY
DARK BLUE – SOLAR
YELLOW - GENERATOR
LIGHT BLUE – TOTAL
PURPLE – VARS (UTILITY WASTE)

WHEN THE SOLAR ENERGY DROPS, THE GENERATOR MAXES OUTPUT AND THE UTILITY COMPENSATES

OPERATING 100% ON RENEWABLE GENERATION WOULD BE IMPOSSIBLE AND THE AREA REQUIRED FOR A SOLAR ARRAY TO PROVIDE THAT MUCH ENERGY WOULD BE AT LEAST 40 TIMES THE AREA OF THE BUILDING PLUS AN EXTREMELY LARGE BATTERY INSTALLATION

FACTORY AFTER POWER FACTOR CORRECTION - FROM A REPORT GIVEN TO THE PSC THAT INITIATED THEIR REACTIVE POWER CONFERENCE IN JULY, 2008



3 ENERGY SOURCES

RED – UTILITY
DARK BLUE – SOLAR
YELLOW - GENERATOR
LIGHT BLUE – TOTAL

PURPLE – VARS (UTILITY WASTE)

BY REDUCING VARS, UTILITY LOAD IS REDUCED BY REDUCING CURRENTS AND THE ASSOCIATED LINE LOSSES

WHAT DO WE WANT FROM AN ENERGY SYSTEM?

- **RELIABILITY**
- **AFFORDABILITY – LOW COST**
- **CLEAN AND EFFICIENT**

A CLEAN AND EFFICIENT SYSTEM WILL USUALLY, BY ITS NATURE, HAVE LOWER COSTS BUT THERE ARE CAVEATS TO THAT STATEMENT. WITH NY STATE'S PLAN, THAT WILL NOT OCCUR. IF GERMANY IS ANY INDICATOR, ENERGY COSTS IN NY STATE WILL DOUBLE UNDER THE CLCPA AND THAT IS ALREADY STARTING TO OCCUR. CON ED'S RECENT RATE INCREASES ARE PRIMARILY TO ACCOMMODATE REQUIREMENTS OF THE CLCPA.

ADDITIONALLY, RELIABILITY AND CARBON REDUCTION WILL BOTH BE NEGATIVELY IMPACTED

CLIMATE CHANGE IS REAL

METHANE IS AN ISSUE

BUT REMOVING LOCAL SUPPLIES OF NATURAL GAS AND FOSSIL FUEL GENERATION WILL DECREASE THE RATE OF CO_2e REDUCTION IN NEW YORK STATE

PEOPLE PUSHING THE "NO GAS" AGENDA ARE TOO FOCUSED ON A SINGLE ISSUE AND ARE NOT SEEING THE BIGGER PICTURE

RESOURCES ARE BEING SQUANDERED ON TECHNOLOGIES THAT ARE NOT GOING TO RESULT IN LARGE CARBON REDUCTIONS

INCLUDING THE BATTERIES SPECIFIED IN THE RECENTLY RELEASED NY STATE ENERGY STORAGE ROADMAP, THE COST OF THE CLCPA AS IT IS WRITTEN COULD EXCEED

$4 TRILLION

WORSE, THE CLCPA IS ACTUALLY GOING TO CAUSE AN INCREASE IN CARBON EMISSIONS IN NY STATE. THE MICRON FACILITY IS A CLEAR EXAMPLE OF THAT.

TRANSMISSION LINE LOSSES CAUSED BY THE CLCPA RELATED TO THE MICRON FACILITY IN CLAY, NY COULD EXCEED 350 GWh ANNUALLY.

NYPA HAS COMMITTED TO ALLOCATING 140 MW OF HYDRO GENERATION TO MICRON EXCEPT THAT EXCESS HYDRO DOESN'T EXIST

EXPLANATION ON SLIDE 21 AND UNDER "ADDITIONAL INFORMATION" AT THE END OF THE POWERPOINT

$ 4 Trillion Dollar Analysis

Excluding the cost of Renewable Generation

The Cost of the CHPE has now increased to $6 Billion. That is a 235% increase in inflation adjusted dollars since it was first proposed in 2011 and approved in 2013. That is just for one Power Cable.

Does anyone really believe that every transformer, street and building in NY State can be rewired for less than 100 times that cost? Plus, there is the additional cost of new equipment. Minimum Cost $600 Billion.

NYSERDAS Own Storage Report shows a $3.4 Trillion Battery Cost At 2022 Storage Costs And The Batteries Will Only Last 10 Years - THEY WILL WEAR OUT BEFORE THE DEBT SERVICE IS PAID ON THEM

Champlain Hudson Power Express Announces Financial Close

November 1, 2022

New York – November 1, 2022 – Today, *Champlain Hudson Power Express* (CHPE) announced it has closed on the financing required to begin construction on the approximately 339-mile fully-buried transmission line that will deliver 1,250 megawatts of clean and renewable hydropower from Québec to New York City. The overall project cost is approximately $6 billion. The lead financial advisor on the deal was Societe Generale supported by Coordinating Lead Arrangers Societe Generale, MUFG, Mizuho and CIBC. Kirkland and Ellis LLP served as counsel for the Blackstone/CHPE team while Norton Rose Fulbright represented lenders. Marsh served as insurance broker and risk advisor to CHPE.

Financial close is the last step before the transformative project can begin construction this fall and also begin delivering significant project benefits throughout New York State by distributing funds to community partners, initiatives and municipalities, including:

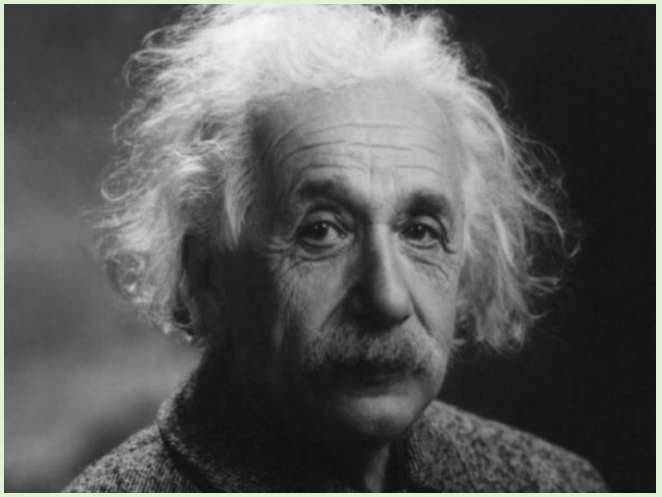
The Pessimist complains about the wind;

The Optimist expects it to change;

The Realist adjusts the sails.

William Arthur Ward

NY STATE MUST ADJUST ITS SAILS QUICKLY TO AVERT A CATASTROPHE FOR BOTH THE SAFETY OF ITS RESIDENTS AND TO SAVE ITS ECONOMY



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

Albert Einstein

THE CLIMATE LEADERSHIP AND COMMUNITY PROTECTION ACT IS NOT LEADERSHIP AND IT WILL NOT PROVIDE PROTECTION AGAINST ENERGY FAILURES FOR NYS COMMUNITIES

NY STATE IS FOLLOWING A PLAN THAT HAS BEEN TRIED IN GERMANY FOR 33 YEARS AND HASN'T WORKED

WHY DOES NY STATE BELIEVE THAT THEY CAN GET IT TO WORK IN 17 YEARS ?

GERMANY HAS REOPENED COAL GENERATING PLANTS AND RECENTLY SIGNED AN AGREEMENT WITH QATAR TO IMPORT 30 MILLION METRIC TONS OF LIQUID NATURAL GAS (15 YEARS AT 2 MILLION TONS PER YEAR)

OBSTACLES TO IMPLEMENTATION

- **LACK OF LAND BUT AN ABUNDANCE OF NIMBY SENTIMENT**
  NY STATE HAS MORE LAWYERS PER CAPITA THAN ANYWHERE BUT WASHINGTON, D.C.
- **UTILITY SYSTEM IS WIRED "BACKWARDS" MAKING INTERCONNECTION OF RENEWABLE GENERATION DIFFICULT – High Interconnection Costs Are Resulting In Numerous Project Cancellations**
- **THE JONES ACT WILL SLOW THE RATE OF OFFSHORE WIND INSTALLATION – Lack of Jack Ships**
- **LACK OF LABOR – LOW UNEMPLOYMENT – NO TRAINED WORKFORCE**
- **EXTREMELY INSUFFICIENT FUNDING FOR THE MAGNITUDE OF THE PROJECT**
- **HIGH COSTS OF COMMODITIES SUCH AS LITHIUM, COPPER AND ALUMINUM**
- **SHORTAGE OF TRANSFORMERS AND OTHER EQUIPMENT**
- **WILL REQUIRE 60 YEARS TO REWIRE THE UTILITY SYSTEM FOR FULL ELECTRIFICATION**
- **HIGHER INTEREST RATES RAISE PROJECT COSTS**
- **ACUTE LACK OF ENERGY NEEDED TO OFFSET THE LOADS BEING PLANNED**

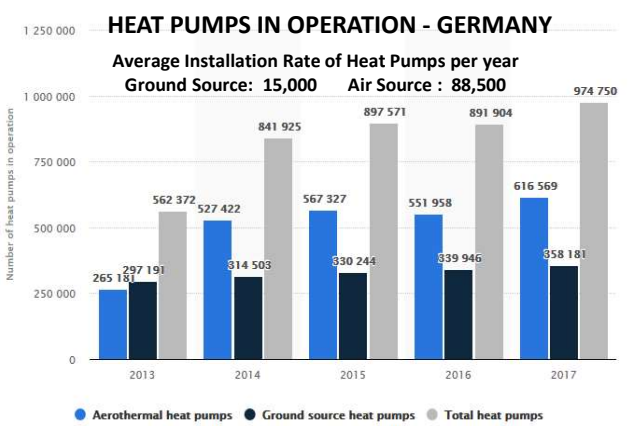
CONVERTING GAS COMBUSTION TO HEAT PUMPS WILL NOT REDUCE ATMOSPHERIC CARBON EMISSIONS OR ENERGY PRICES ON A GENERATION SYSTEM SUPPORTED BY FOSSIL FUELS

GERMANY HAS A 33 YEAR HISTORY OF FAILURE WITH THIS IDEA

AFTER 33 YEARS, GERMANY WHICH HAS CHOSEN THIS ROUTE IS SUPPLIED BY 34% RENEWABLE GENERATION AND HAS ENERGY COSTS TWICE THOSE OF FRANCE WHICH IS 70% NUCLEAR, 10% HYDRO

FRANCE IS CURRENTLY OPERATING 55 NUCLEAR REACTORS TOTALING 61.3 GW AND BUILT BETWEEN 1978 and 1999, A PERIOD OF 21 YEARS, WITH A CAPABILITY OF 480 TWh at 0.90 CF AND IS BUILDING 14 NEW REACTORS TO GO ONLINE BY 2035

Heat Pumps Overtake Gas in Germany



https://www.statista.com/statistics/740451/heat-pumps-in-operation-germany/

- **Apr 23, 2018 - *GERMANY*: *Heat pumps* are said to have overtaken gas for the first time in 2017 to became 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, Replacing Gas Combustion with Air-Air Heat Pumps on a grid that is not supported by nearly 100% Carbon Free Generation DOES NOT reduce CO2 Footprint

IT JUST MOVES THE CO_2 EMISSIONS TO A DIFFERENT LOCATION WITH AN AS LARGE OR LARGER CO_2 FOOTPRINT AND WITH MUCH HIGHER OPERATING COSTS !

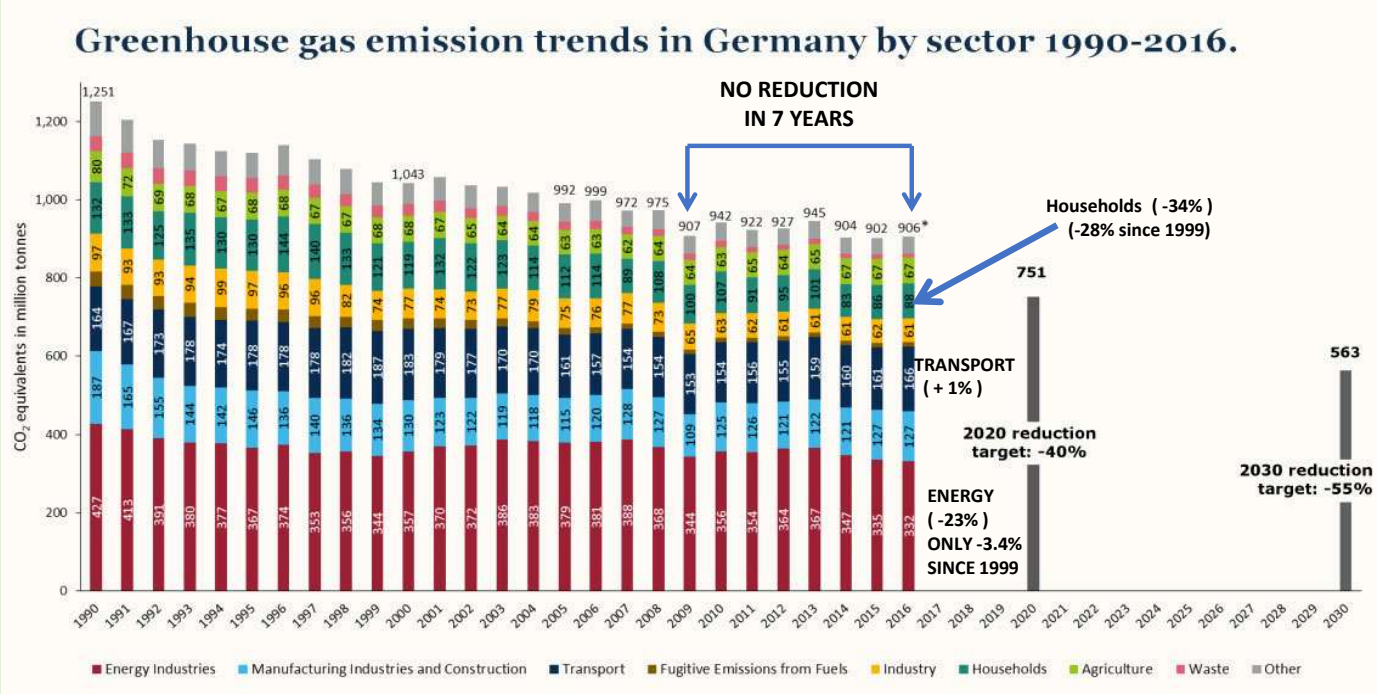
GERMANY – A CAUTIONARY EXAMPLE

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 - 6% 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



https://e360.yale.edu/features/carbon-crossroads-can-germany-revive-its-stalled-energy-transition

The Conclusions of the Recent Gas Stove Study are Extremely Questionable

The Study States that Use of Gas Stoves Increases the Risk of Childhood Asthma

- **The Study Relied on 30 – 40 Year Old Data and an Analytical Tool Called PAF**
- **PAF is Unreliable when Used in Multivariable Systems with Non-Specific Data (Will Work Well for Analyzing a Single Virus, Less so for Asthma which can have more than seven risk factors)**

BEYOND USING THE INCORRECT TOOL, RESULTS ARE CALLED INTO QUESTION BY THE FOLLOWING FACTS:

- **The Top 10 States for Asthma use 80% Electric Stoves**
- **The Top 8 States for Childhood Asthma use 80% Electric Stoves.**
- **THE STUDY IS SO FLAWED THAT IT SHOULD NOT BE USED TO SET PUBLIC POLICY FOR 19.5 MILLION PEOPLE**
- **OVER TIME, IT WILL ADD OVER $18 BILLION EXTRA DOLLARS FOR THE STOVES AND AT LEAST $54 BILLION IN OTHER WIRING COSTS FOR LITTLE TO NO HEALTH IMPROVEMENTS IN THE STATE. THE $72 BILLION WILL BE SHOULDERED ON THE BACKS OF THE RESIDENTS.**
- **THERE IS A BETTER WAY TO ACHIEVE SIMILAR RESULTS THAT WILL REDUCE GAS LEAKAGE AND IMPROVE HEALTH WHILE ELIMINATING $72 BILLION IN COSTS AND CAN BE ACHIEVED IN A FRACTION OF THE TIME**

Background on PAF

While the Population Attributable Fraction (PAF) provides potentially valuable information regarding the community-level effect of risk factors, significant limitations exist with current strategies for estimating a PAF in multiple risk factor models. These strategies can result in paradoxical or ambiguous measures of effect, or require unrealistic assumptions regarding variables in the model.

FOR A MULTI-VARIABLE ANALYSIS, VERY SPECIFIC DATA IS NEEDED.

A VERY SHORT PHYSICS LESSON

POWER AND ENERGY ARE NOT THE SAME THING

- **THE MEDIA IS CONFUSING THEM AND GIVING AN UNKNOWING PUBLIC A FALSE SENSE OF THE CAPABILITIES OF RENEWABLE GENERATION**
  - **NY TIMES ARTICLE ABOUT ONE VANDERBILT IS A CLASSIC EXAMPLE OF THIS ERROR. STATED THAT THE 1.2 MW COGEN PLANT COULD BE REPLACED BY SIX FOOTBALL FIELD SIZED SOLAR ARRAYS. THE POWER OUTPUT WOULD MATCH EIGHT FOOTBALL FIELDS OF SOLAR ARRAYS BUT THE ENERGY OUTPUT WOULD NEED ABOUT 150 FOOTBALL FIELDS OF SOLAR ARRAYS OCCUPYING AN AREA ABOUT 25% OF CENTRAL PARK JUST FOR ONE BUILDING**
    - **https://www.nytimes.com/2023/02/14/climate/green-skyscraper-one-vanderbilt.html**

- **POWER IS THE INSTANTANEOUS OUTPUT OR USAGE OF ANY ELECTRIC DEVICE OR GENERATOR**
  (EXAMPLE: KILOWATTS or KW) 40 Watt Lightbulb 40 Watts is the Power rating of the Light Bulb

- **ENERGY IS THE AMOUNT OF ELECTRICITY GENERATED OR USED OVER TIME (EXAMPLE: KILOWATT HOURS or KWh)**
  A 40 Watt Lightbulb Left on For 25 Hours will use 1 Kilowatt Hour of Energy

- **20 GIGAWATTS (20 BILLION WATTS) OF SOLAR ARRAYS IN NY STATE COVERING APPROXIMATELY 200 SQUARE MILES WILL HAVE THE SAME ENERGY OUTPUT AS A 3 GIGAWATT FOSSIL FUEL OR NUCLEAR PLANT COVERING 3 SQUARE MILES.**

- **A typical 1,000-megawatt nuclear facility in the United States needs a little more than 1 square mile to operate. NEI says wind farms require 360 times more land area to produce the same amount of electricity and solar photovoltaic plants require 75 times more space.**
  - **COPIED FROM AN NEI ANALYSIS**

- **WHILE THE FOSSIL FUEL OR NUCLEAR PLANT WILL MAINTAIN THE SAME OUTPUT FOR 70 YEARS, THE SOLAR ARRAYS WILL LOSE 1% PER YEAR AND NEED TO BE REPLACED AFTER 25 YEARS**

- **THE UTILITY SYSTEM RUNS ON ENERGY OVER THE COURSE OF A YEAR – POWER WILL DETERMINE THE PEAK LOAD THAT CAN BE HANDLED**

UNITS OF MEASURE

POWER (PEAK POWER USAGE SHOWS UP IN THE DEMAND CHARGE ON A COMMERCIAL UTILITY BILL)

- 1 Kilowatt (KW) = 1000 watts
- 1 Megawatt (MW) = 1000 KW
- 1 Gigawatt (GW) = 1000 MW
- 1 Terawatt (TW) = 1000 GW

ENERGY

- 1 Kilowatt-Hour (KWh) = 1000 Watts used or generated for 1 Hour
- 1 Megawatt-Hour (MWh) = 1000 KWh
- 1 Gigawatt-Hour (GWh) = 1000 MWh
- 1 Terawatt-Hour (TWh) = 1000 GWh

WHAT IS CAPACITY FACTOR (CF) ?

CAPACITY FACTOR IS THE AVERAGE AMOUNT OF TIME PER YEAR THAT A GENERATION RESOURCE WILL OPERATE

FOR FOSSIL FUEL AND NUCLEAR PLANTS	**CF=0.8 – 0.9**	**(80% - 90%)**
FOR OFFSHORE WIND IN NY STATE	**CF=0.46**	**(46%)**
FOR LAND BASED WIND	**CF=0.25 – 0.3**	**(25% - 30%)**
FOR SOLAR (FIXED ARRAY)	**CF=0.12 - 0.13**	**(12% - 13%)**

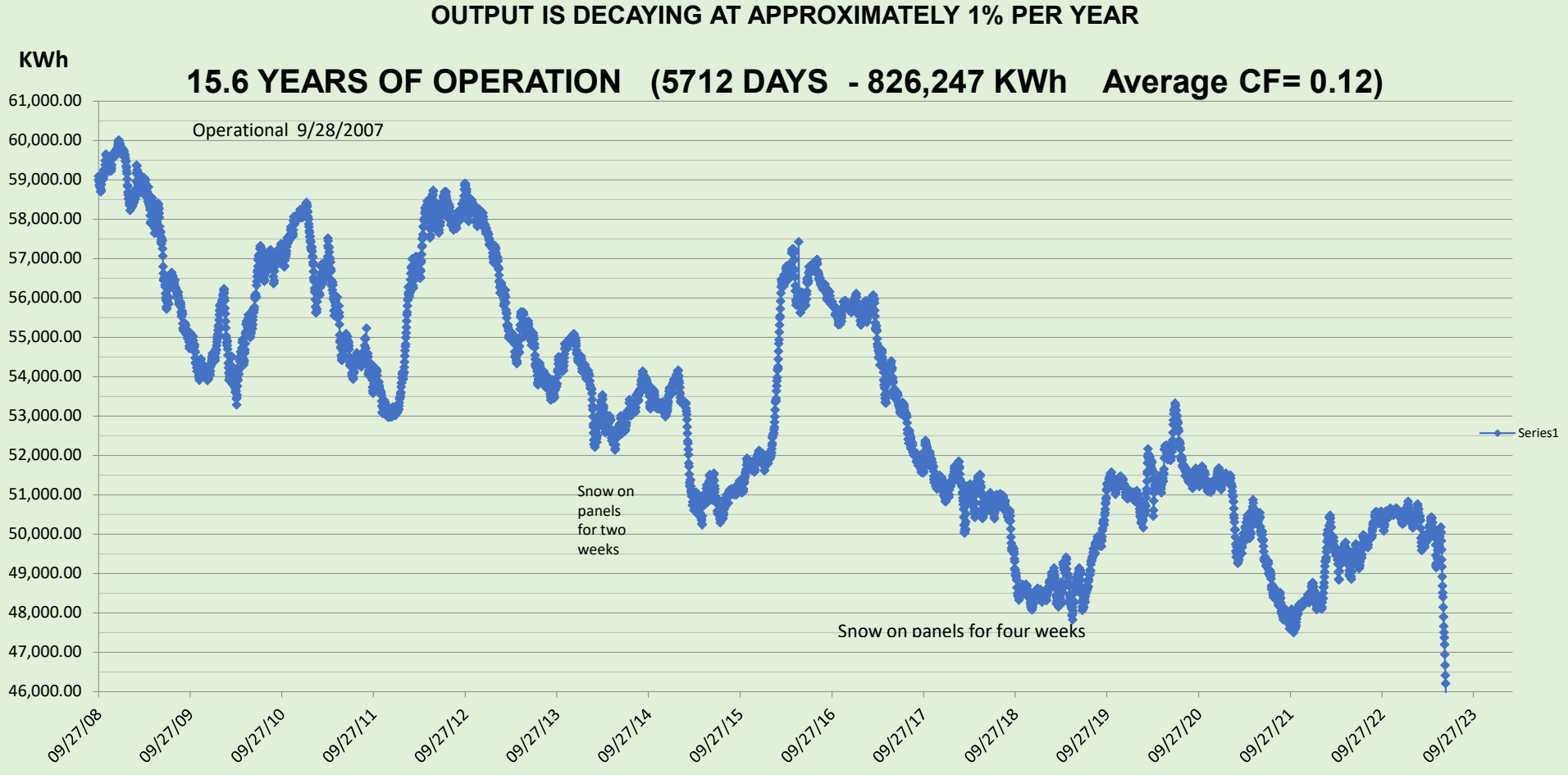
TO CALCULATE THE ENERGY OUTPUT OF A GENERATION RESOURCE IN MWh,

MULTIPLY THE CAPACITY OF THE GENERATOR IN **MW x 365 DAYS x 24 HOURS x CF = MWh / YEAR**

A 1.2 MW COGENERATION SYSTEM WILL GENERATE SEVEN TIMES AS MUCH ELECTRICAL ENERGY AS A 1.2 MW SOLAR ARRAY, PLUS THE COGENERATION WILL PROVIDE THERMAL ENERGY.

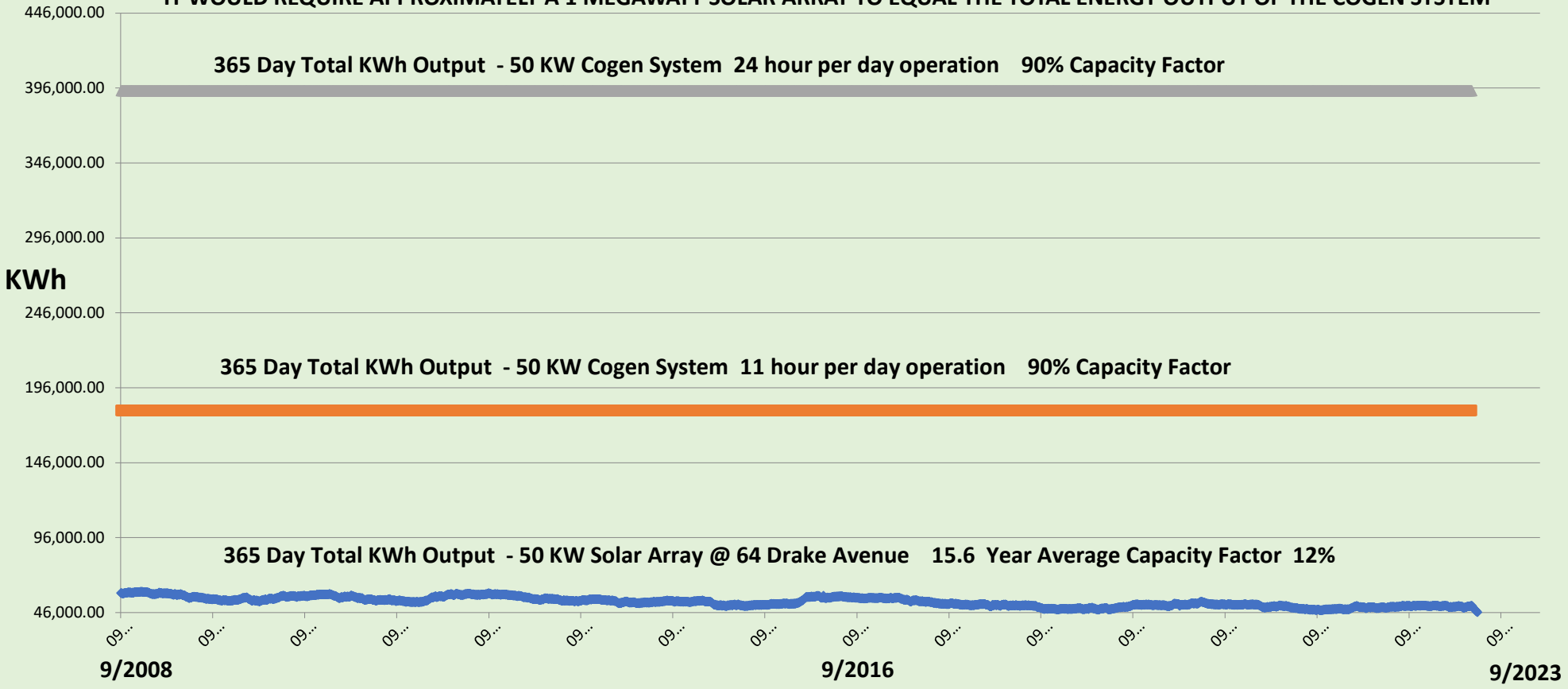
IN ITS LAST FULL YEAR OF OPERATION, INDIAN POINT GENERATED 16.3 TWh with a CF =0.93

365 Day Total KWh Output - 50 KW Array @ 64 Drake Avenue



COMPARISON OF ANNUAL ELECTRIC ENERGY OUTPUT OF A 50 KW SOLAR ARRAY vs. A 50 KW MICROTURBINE SYSTEM RUNNING 11 HOURS PER DAY OR 24 HOURS PER DAY

THESE FIGURES DO NOT INCLUDE THE ENERGY UTILIZED FROM HEAT RECOVERY THAT ALSO OCCURS WITH THE COGENERATION SYSTEM
IT WOULD REQUIRE APPROXIMATELY A 1 MEGAWATT SOLAR ARRAY TO EQUAL THE TOTAL ENERGY OUTPUT OF THE COGEN SYSTEM



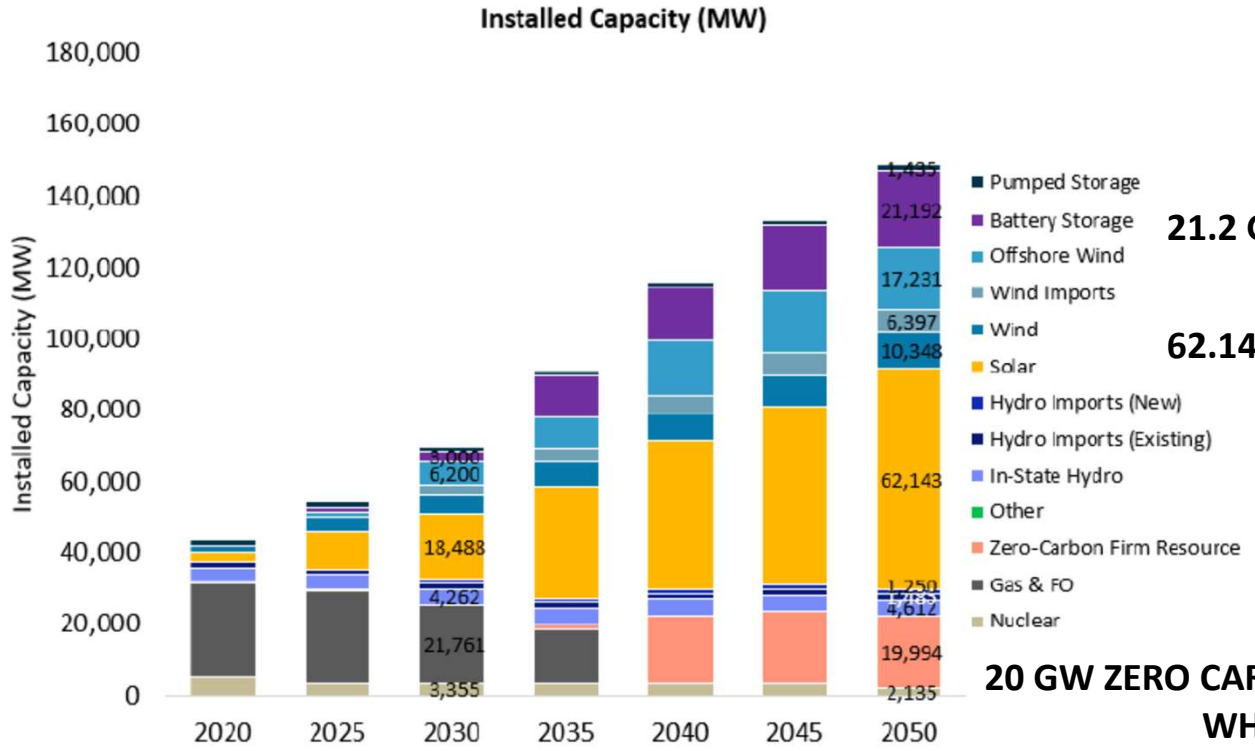
15.6 Years of Operation of the Solar Array – Turned On 9/29/2007

THE CLCPA FANTASY

CLCPA APPENDIX G - Power

SHOWS 18.5 GW OF INSTALLED SOLAR ARRAYS BY 2030. AT PRESENT INSTALLATION RATES, THEY WILL BE LUCKY TO ACHIEVE 13 GW BY 2035

Figure 29. Installed Capacity and Annual Generation for Scenario 3: Accelerated Transition away from Combustion[34]

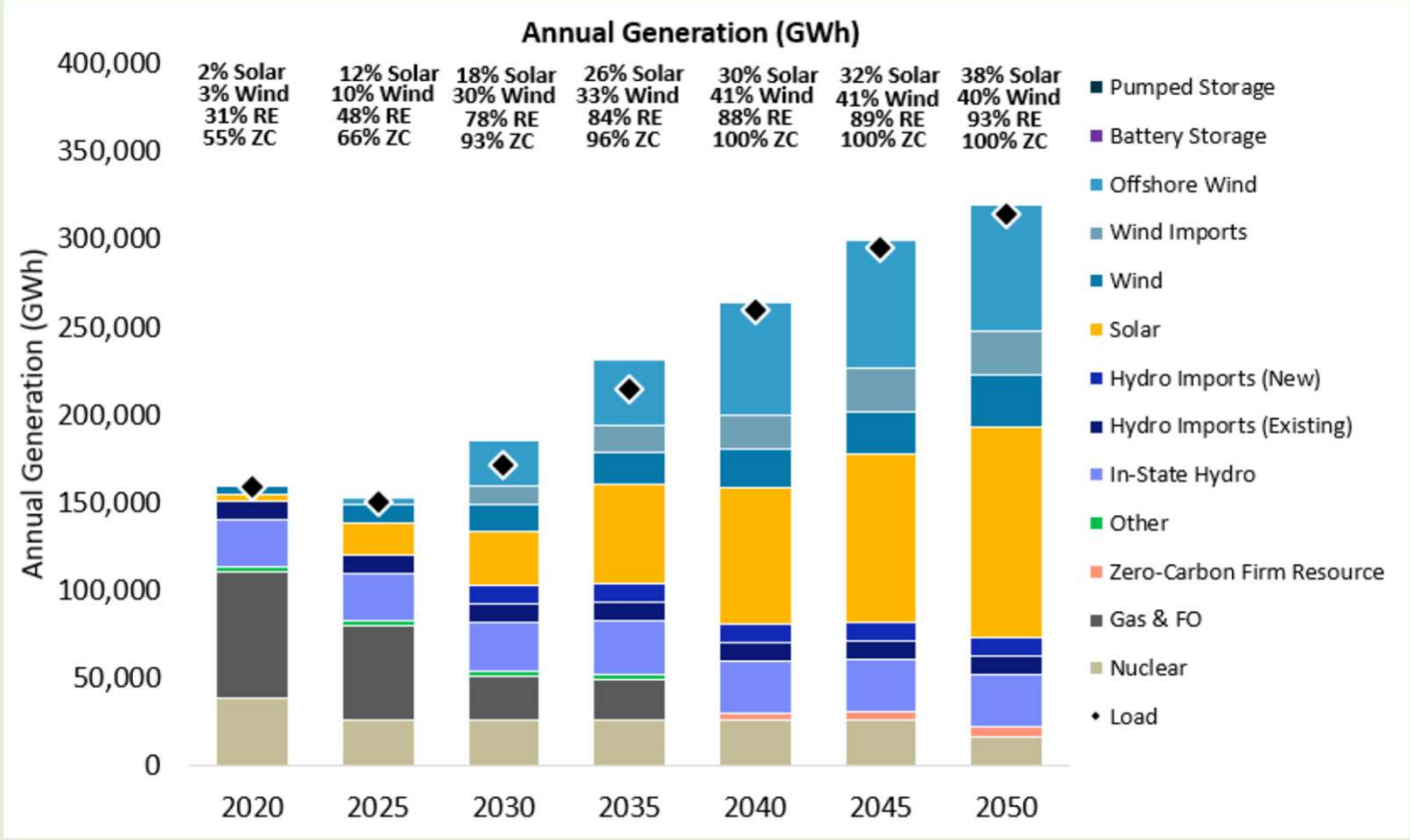


21.2 GW BATTERY STORAGE

62.143 GW SOLAR

20 GW ZERO CARBON FIRM RESOURCE WHAT IS IT ?

CLCPA APPENDIX G - Energy



SHOWS 320,000 GWh OF ENERGY PRODUCTION THAT IS 38% SOLAR IN 2050

121,600 GWh

EVEN IF THEY COULD MIRACULOUSLY FIGURE OUT HOW TO INSTALL EVERYTHING, THE PLAN IS 100,000 GWh SHORT OF THE 430,000 GWh THAT WILL BE NEEDED FOR FULL ELECTRIFICATION BY 2050 AND AS WILL BE SHOWN, THE 320,000 GWh SHOWN IS EXTREMELY OVER ESTIMATED

CLCPA AND STATE DOCUMENTS ARE USING UNREALISTIC ENERGY ESTIMATES

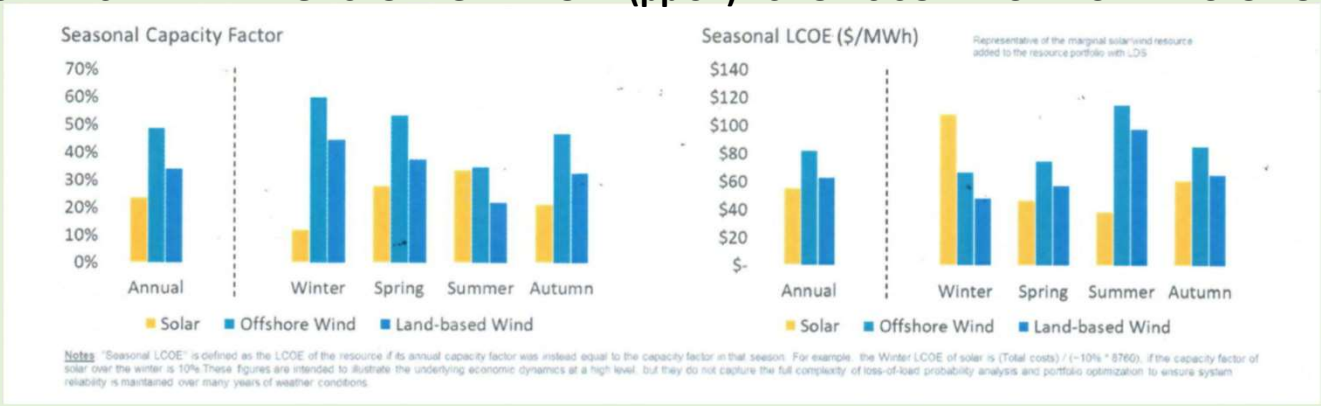
COPIED FROM NYS SOLAR BLOCK INCENTIVE ESTIMATOR – SHOWS SOLAR CAPACITY FACTORS FROM 13.4% - 17.5%

$$\$_{MAX} = \left(PBI \frac{\$}{kWh}\right) \times (System\ Size\ KW_{DC}) \times (Capacity\ Factor) \times \left(8{,}760 \frac{hours}{year}\right) \times (3\ Y$$

- Fixed mount systems use 13.4% capacity factor
- Single-axis tracking systems use 16.0% capacity factor
- Dual-axis tracking systems use 17.5% capacity factor
- If the project qualifies for a strategic location incentive, multiple $\$_{MAX}$ by 1

https://ny-Sun.ny.gov/

COPIED FROM NYSERDA ENERGY STORAGE REPORT (pp 92) - SHOWS SOLAR CAPACITY FACTOR OF 22%



FIXED ARRAYS WILL HAVE A CAPACITY FACTOR (CF) OF APPROXIMATELY 13% WHEN NEW AND WILL DROP TO 10% TO 11% AFTER AGING

AVERAGE CF OVER THE LIFE OF THE ARRAY = 11.5%

THE CF=22% HAS SHOWN UP IN SEVERAL DOCUMENTS

CLCPA AND STATE DOCUMENTS ARE USING INCORRECT ENERGY ESTIMATES

- **PREVIOUS SLIDES SHOW 62.143 GW of SOLAR ARRAYS AND 38% SOLAR OF 320,000 GWh = 121,600 GWh OF SOLAR ENERGY PER YEAR IN 2050**

- **TO ACHIEVE THAT MUCH SOLAR ENERGY USING 62.1 GW OF SOLAR WOULD REQUIRE A SOLAR CAPACITY FACTOR OF 0.2235**

62.143 GW x 365 DAYS x 24 HOURS x 0.2235 CF = 121,600 GWh

USING THE CORRECT SOLAR CAPACITY FACTOR OF 0.13 YIELDS 70,768 GWh 51,000 GWh LESS.

SOLAR ENERGY OUTPUT IS BEING OVERESTIMATED IN THE CLCPA BY 72%

CLCPA GENERATION PLAN – APPENDIX G

3.3 Sectoral Results

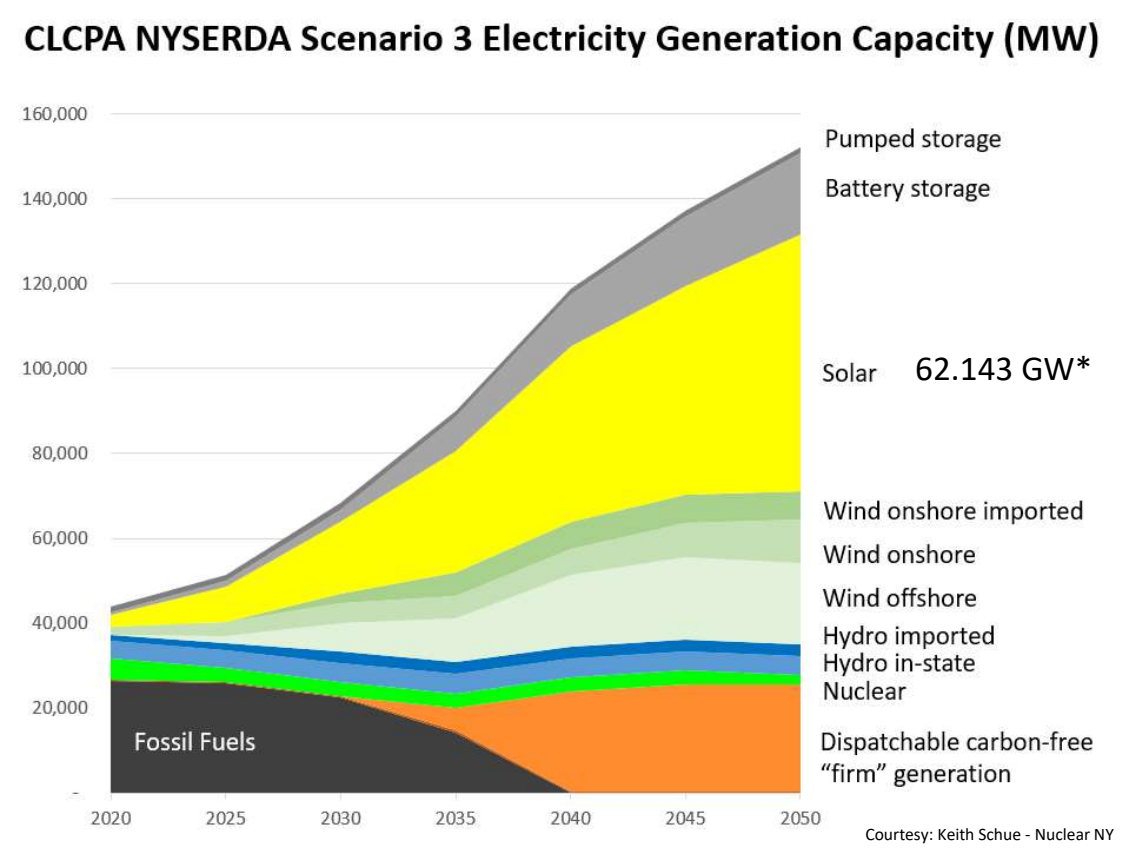
Buildings

Direct emissions in the buildings sector are dominated by emissions from space and water heaters (note that indirect emissions associated with electricity generated to power electric appliances are captured under electricity generation). Although population and households are expected to grow in New York, all scenarios see a significant decline in building sector emissions through energy efficiency, rapid electrification, and improved building shells.

SHOWS ALL FOSSIL FUEL GENERATION ENDING BY 2040 BEING REPLACED BY RENEWABLE SOURCES

AS WILL BE SHOWN IN LATER SLIDES, THE ASSUMPTIONS THAT THIS GRAPH ARE BASED UPON ARE A FANTASY

WHAT IS THE SOURCE OF 20 GW OF DISPATCHABLE CARBON FREE GENERATION?



62.143 GW OF SOLAR WILL OCCUPY BETWEEN 450 – 600 SQUARE MILES OF FARMLAND

CLCPA GENERATION PLAN – APPENDIX G

THE FOLLOWING STATEMENT IS USED AS A JUSTIFICATION FOR THE MONETARY BENEFITS OF GHG REDUCTION

Value of Avoided GHG Emissions and Health Co-Benefits

Reducing GHG emissions in line with Climate Act emissions limits avoids economic impacts of damages caused by climate change equaling approximately $240 to $255 billion. Improved health outcomes, including improvements in air quality, increased active transportation, and energy efficiency interventions in low- and moderate-income homes generate additional benefits ranging from $155 to 160 billion. As shown in Figure 46, collective benefits range from $400 to $415 billion over the next 30 years.

THE CLCPA IS WRITTEN AS THOUGH NY STATE IS OPERATING IN A VACUUM

NY STATE'S TOTAL GHG EMISSIONS ARE 350 MILLION METRIC TONS (MT) ANNUALLY
(160 MILLION METRIC TONS ARE FROM OUT OF STATE – MOST FROM FOSSIL FUEL EXTRACTION)

OVER THE PAST TWO YEARS INCREASED WORLDWIDE GHG EMISSIONS FROM CHINA, INDIA, AND OTHER COUNTRIES WAS 2.5 BILLION METRIC TONS - 7 TIMES AS MUCH 40% OF THAT WAS FROM INCREASED COAL COMBUSTION

NY STATE COULD STOP USING FOSSIL FUELS ENTIRELY AND THE 160 MILLION MT OF OUT OF STATE EMISSIONS WILL STILL BE THERE
NY STATE COULD ELIMINATE 100% OF ITS GHG EMISSIONS AND NOT AFFECT DAMAGES CAUSED BY CLIMATE CHANGE
HOWEVER, REDUCING VEHICLE EMISSIONS AND IMPROVING GENERATING PLANT COMBUSTION EFFICIENCY WILL HAVE A POSITIVE HEALTH IMPACT

REALITY

THE FOLLOWING NY STATE ENERGY CHART IS DIVIDED INTO FOUR COLUMNS

ALL VALUES ARE IN GIGAWATT-HOURS (ENERGY)

- **A – EXISTING NY STATE FOSSIL FUEL USAGE AFTER THE CLOSURE OF INDIAN POINT NUCLEAR. IT INCLUDES ENERGY USED FOR ELECTRIC GENERATION (BLUE), ONSITE GAS COMBUSTION (YELLOW), ONSITE OIL COMBUSTION (GRAY), TRANSPORTATION GASOLINE (YELLOW), TRANSPORTATION DIESEL FUEL (BLUE) AND ENERGY LOST UP THE CHIMNEY OR AS HEAT AT THE GENERATING PLANTS (GREEN)**

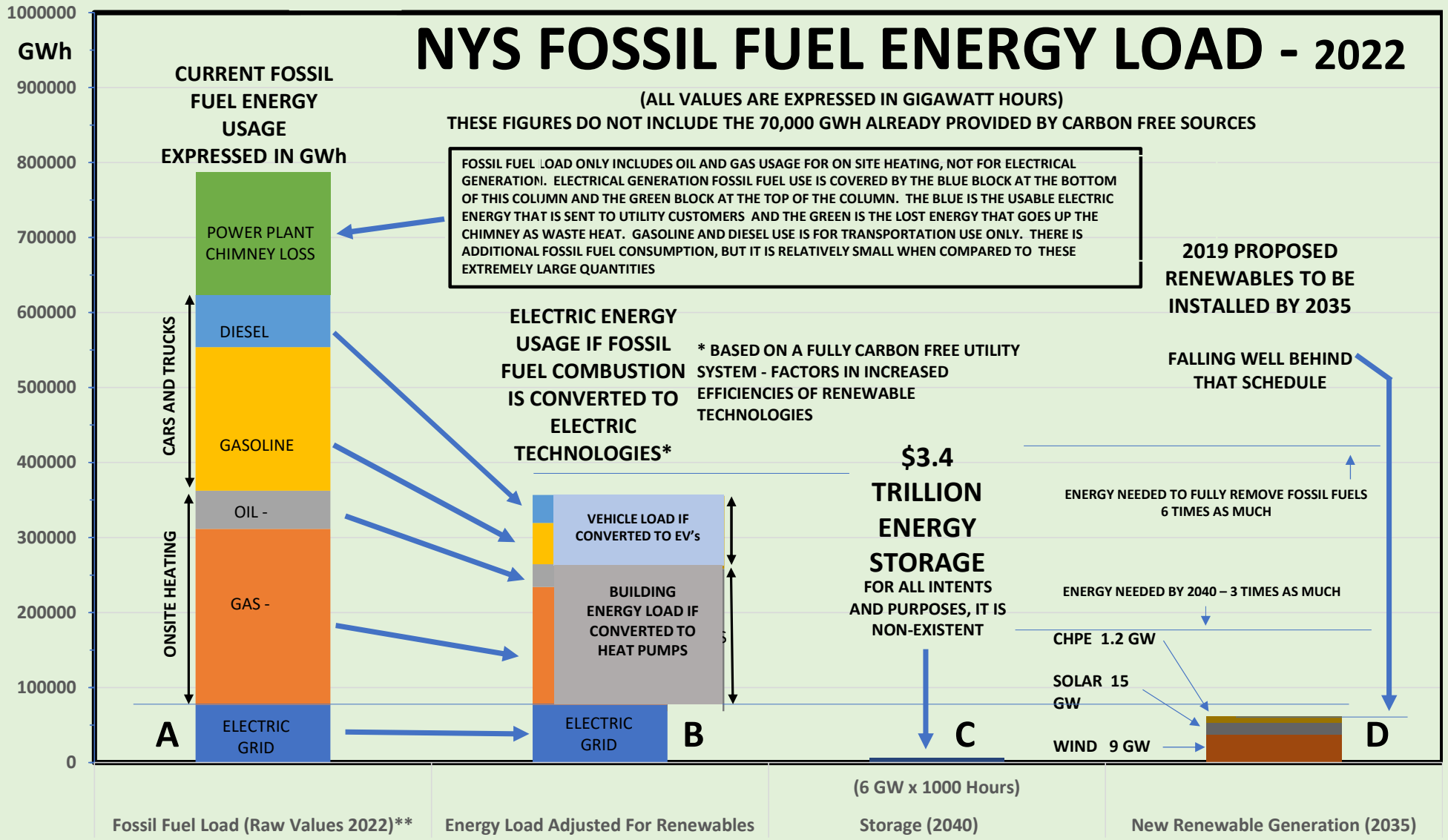
- **B - THE ENERGY USAGE OF THE SYSTEM IF IT WAS FULLY CONVERTED TO ELECTRIC SYSTEMS – HEAT PUMPS AND EV's**

- **C - THE AMOUNT OF STORAGE THAT WILL BE INSTALLED BY 2040 ACCORDING TO THE RECENTLY RELEASED NYSERDA NY STATE ENERGY ROADMAP**

- **D – THE AMOUNT OF NEW RENEWABLE GENERATION THAT WILL BE INSTALLED BY 2035. KEEP IN MIND THAT THE STATE IS FALLING WELL BEHIND THIS SCHEDULE BECAUSE OF COSTS AND INTERCONNECTION DIFFICULTIES, AS I TOLD THEM WOULD OCCUR IN MARCH,2019.**

NYSERDA AND THE PSC DID NOT DISAGREE WITH MY ANALYSIS FOUR YEARS AGO BUT SAID THAT THEY WOULD INSTALL RENEWABLES FASTER THAN I WAS CALCULATING BUT I WAS USING THEIR INSTALLATION RATES. THEIR INITIAL SCHEDULE WOULD NOT HAVE WORKED LET ALONE THE CURRENT DELAYED ONE.

WHAT THE PUBLIC DOES NOT UNDERSTAND IS THE ENORMOUS AMOUNT OF ENERGY DELIVERED BY THE GAS PIPELINES THAT IS ACTUALLY USED WITH AN EFFICIENCY OVER 80% TO 95% DURING ONSITE COMBUSTION SO REPLACING IT WILL REQUIRE STAGGERING AMOUNTS OF ELECTRICAL GENERATION. POWER PLANT EFFICIENCIES ARE IN THE RANGE OF 33% - 50% WITH 7% OF THAT ENERGY LOST ON TRANSMISSION LINES DELIVERING IT TO THE END USER.


NYS FOSSIL FUEL ENERGY LOAD - 2022
(ALL VALUES ARE EXPRESSED IN GIGAWATT HOURS)
THESE FIGURES DO NOT INCLUDE THE 70,000 GWH ALREADY PROVIDED BY CARBON FREE SOURCES
GWh
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
CURRENT FOSSIL FUEL ENERGY USAGE EXPRESSED IN GWh
FOSSIL FUEL LOAD ONLY INCLUDES OIL AND GAS USAGE FOR ON SITE HEATING, NOT FOR ELECTRICAL GENERATION. ELECTRICAL GENERATION FOSSIL FUEL USE IS COVERED BY THE BLUE BLOCK AT THE BOTTOM OF THIS COLUMN AND THE GREEN BLOCK AT THE TOP OF THE COLUMN. THE BLUE IS THE USABLE ELECTRIC ENERGY THAT IS SENT TO UTILITY CUSTOMERS AND THE GREEN IS THE LOST ENERGY THAT GOES UP THE CHIMNEY AS WASTE HEAT. GASOLINE AND DIESEL USE IS FOR TRANSPORTATION USE ONLY. THERE IS ADDITIONAL FOSSIL FUEL CONSUMPTION, BUT IT IS RELATIVELY SMALL WHEN COMPARED TO THESE EXTREMELY LARGE QUANTITIES
POWER PLANT CHIMNEY LOSS
DIESEL
GASOLINE
OIL -
GAS -
CARS AND TRUCKS
ONSITE HEATING
ELECTRIC GRID
A
ELECTRIC ENERGY USAGE IF FOSSIL FUEL COMBUSTION IS CONVERTED TO ELECTRIC TECHNOLOGIES*
* BASED ON A FULLY CARBON FREE UTILITY SYSTEM - FACTORS IN INCREASED EFFICIENCIES OF RENEWABLE TECHNOLOGIES
VEHICLE LOAD IF CONVERTED TO EV's
BUILDING ENERGY LOAD IF CONVERTED TO HEAT PUMPS
ELECTRIC GRID
B
$3.4 TRILLION ENERGY STORAGE
FOR ALL INTENTS AND PURPOSES, IT IS NON-EXISTENT
C
2019 PROPOSED RENEWABLES TO BE INSTALLED BY 2035
FALLING WELL BEHIND THAT SCHEDULE
ENERGY NEEDED TO FULLY REMOVE FOSSIL FUELS 6 TIMES AS MUCH
ENERGY NEEDED BY 2040 – 3 TIMES AS MUCH
CHPE 1.2 GW
SOLAR 15 GW
WIND 9 GW
D
(6 GW x 1000 Hours)
Fossil Fuel Load (Raw Values 2022)**
Energy Load Adjusted For Renewables
Storage (2040)
New Renewable Generation (2035)

SOLAR PANELS – BAVARIA, GERMANY – DECEMBER 2022

EVERY SOLAR ARRAY IN GERMANY WAS COVERED IN SNOW FOR AT LEAST 3 WEEKS

NO SOLAR ENERGY GENERATION - STORAGE ON A FULLY RENEWABLE SYSTEM WILL BE CRITICAL

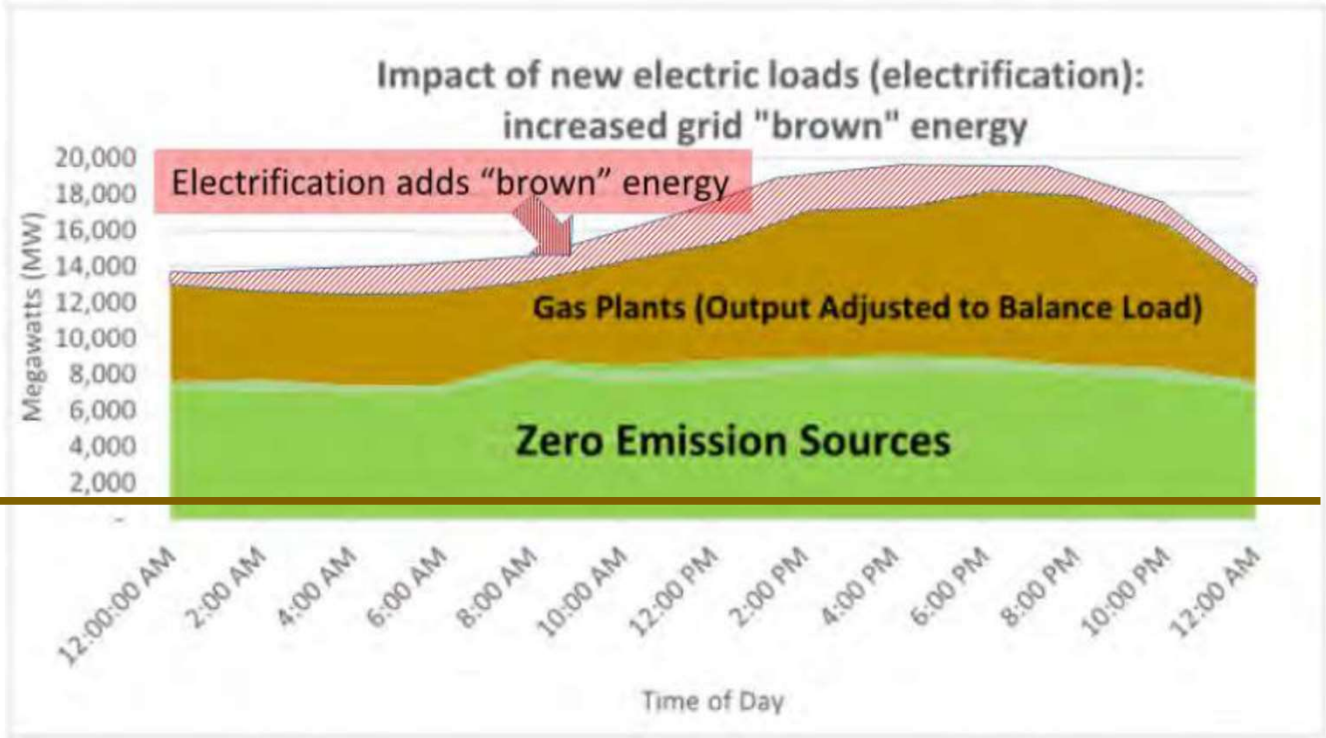
AT PRESENT, STORAGE COSTS ARE EXTREMELY HIGH AND THE STORAGE LIFETIME IS EXTREMELY SHORT

ON NY STATE'S UTILITY SYSTEM, BUILDING ELECTRIFICATION WILL INCREASE BROWN ENERGY (FOSSIL FUEL GENERATION)

Figure 5c: New loads from electrification are directly balanced by more natural gas electric power generation.

GRAPH IS FOR NY STATE DURING THE SHOULDER MONTHS AND SHOWS THAT EVEN DURING TIMES OF LOW LOAD, ALL ADDITIONAL LOADS ARE SUPPORTED BY FOSSIL FUEL COMBUSTION

AS LOADS INCREASE, THE NEXT BEST FOSSIL FUEL GENERATION WILL BE ACTIVATED, HOWEVER IN TIMES OF HIGH LOAD DURING COLD PERIODS THE HEAT PUMPS WILL BE SUPPORTED BY THE LEAST EFFICIENT FOSSIL FUEL GENERATION AND WILL OPERATE AT A SYSTEM WIDE EFFICIENCY BELOW 60%, WHEREAS ONSITE FOSSIL FUEL COMBUSTION HAS EFFICIENCIES OVER 80%



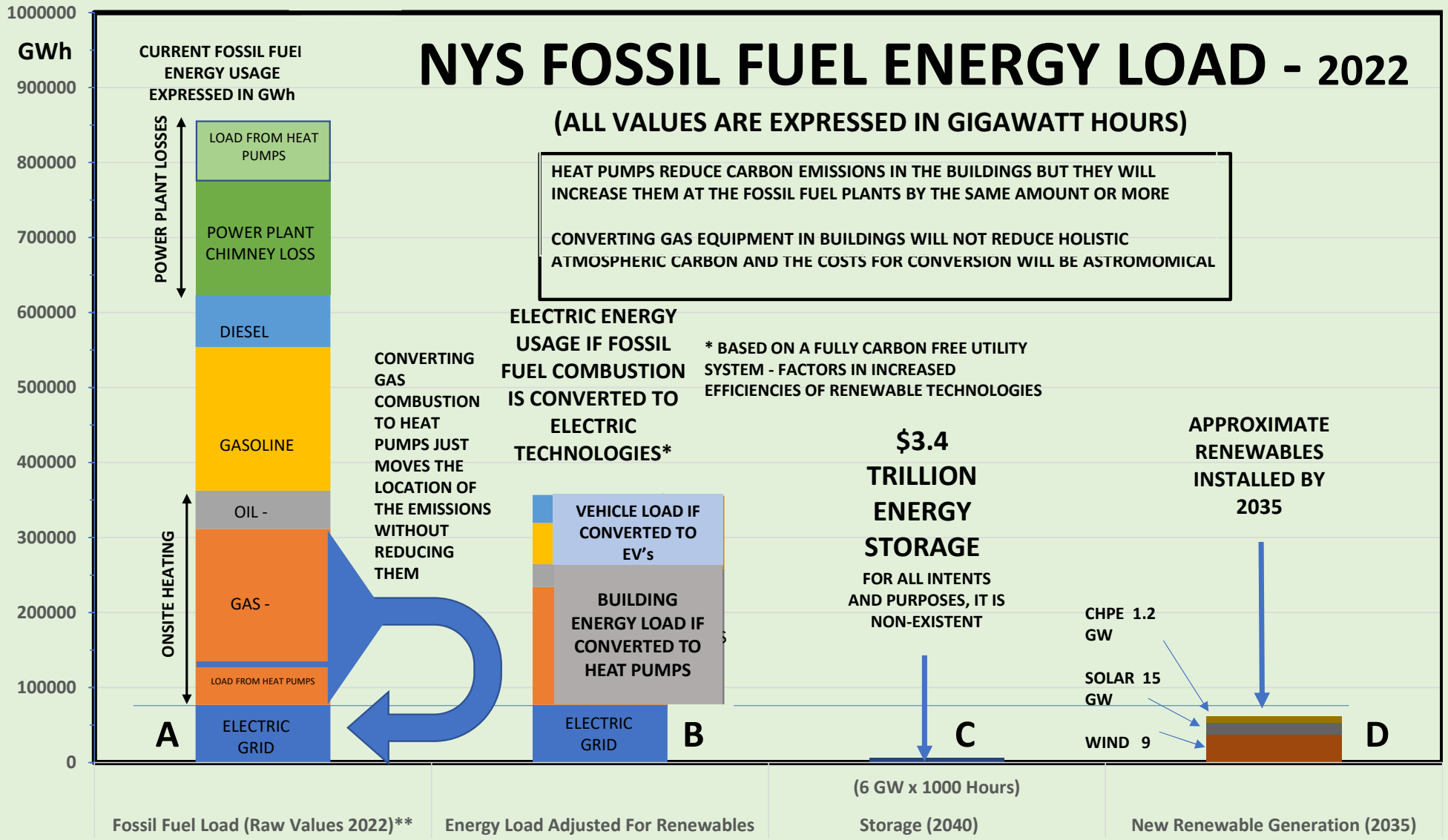
IN THE DOWNSTATE REGION, ALL LOADS ABOVE THE BROWN LINE ARE SUPPORTED BY FOSSIL FUEL GENERATION

Steve Beyers[1], Koenraad Beckers[2], and Jefferson Tester[1]

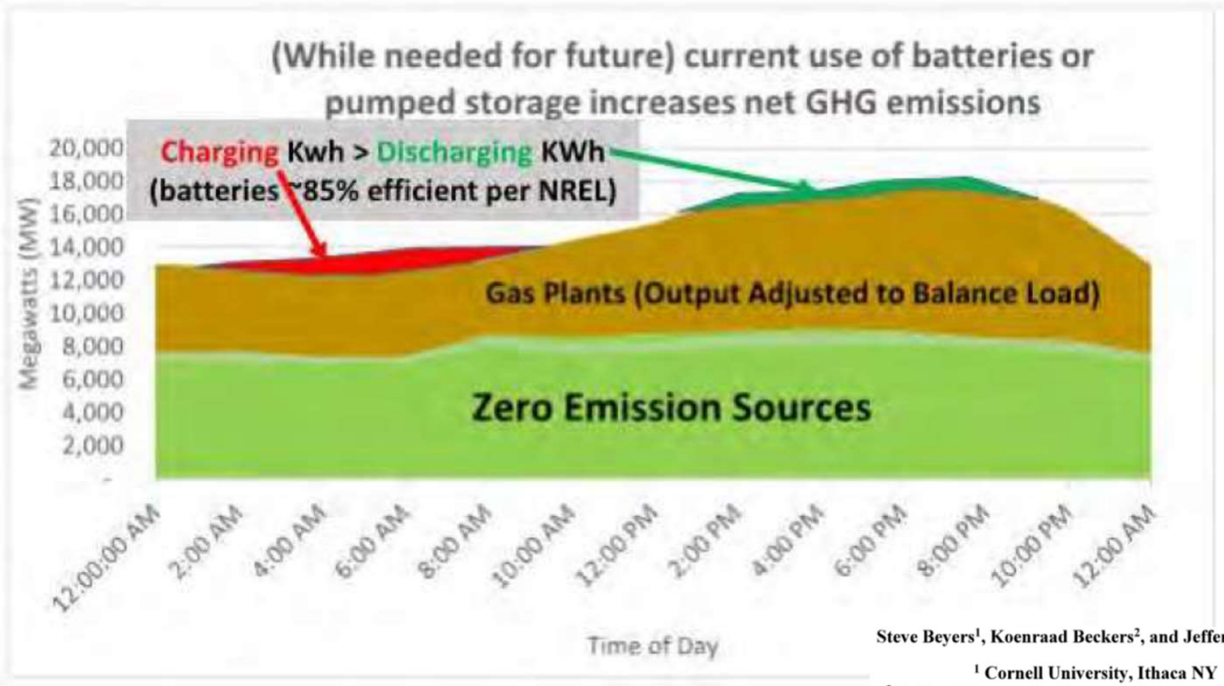
[1] Cornell University, Ithaca NY
[2] National Renewable Energy Laboratory, Golden CO

TO REDUCE CARBON FOOTPRINT

- **WE NEED TO DECREASE COLUMN A AND INCREASE COLUMN D**
- **ANY ELECTRIFICATION HAS TO DECREASE COLUMN A MORE THAN IT INCREASES IT**
- **WITH LIMITED RESOURCES, ANY TECHNOLGIES THAT DON'T PROVIDE A LARGE DECREASE IN COLUMN A SHOULD BE LEFT FOR A LATER DATE**
- **UTILITY CUSTOMERS ARE ALREADY REBELLING AGAINST HIGH COSTS**
  ALL UTILITY IMPROVEMENTS END UP BEING PAID BY RATEPAYERS AND IF THE PUBLIC DOESN'T SUPPORT IT, THE PROJECT WILL FAIL - SEE ONTARIO CANADA – PASSED "GREEN" LEGISLATION IN 2009 AND REPEALED IT IN 2019


NYS FOSSIL FUEL ENERGY LOAD - 2022
(ALL VALUES ARE EXPRESSED IN GIGAWATT HOURS)
HEAT PUMPS REDUCE CARBON EMISSIONS IN THE BUILDINGS BUT THEY WILL INCREASE THEM AT THE FOSSIL FUEL PLANTS BY THE SAME AMOUNT OR MORE
CONVERTING GAS EQUIPMENT IN BUILDINGS WILL NOT REDUCE HOLISTIC ATMOSPHERIC CARBON AND THE COSTS FOR CONVERSION WILL BE ASTROMOMICAL
GWh
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
CURRENT FOSSIL FUEI ENERGY USAGE EXPRESSED IN GWh
POWER PLANT LOSSES
LOAD FROM HEAT PUMPS
POWER PLANT CHIMNEY LOSS
DIESEL
GASOLINE
OIL -
GAS -
LOAD FROM HEAT PUMPS
ONSITE HEATING
ELECTRIC GRID
A
CONVERTING GAS COMBUSTION TO HEAT PUMPS JUST MOVES THE LOCATION OF THE EMISSIONS WITHOUT REDUCING THEM
ELECTRIC ENERGY USAGE IF FOSSIL FUEL COMBUSTION IS CONVERTED TO ELECTRIC TECHNOLOGIES*
VEHICLE LOAD IF CONVERTED TO EV's
BUILDING ENERGY LOAD IF CONVERTED TO HEAT PUMPS
ELECTRIC GRID
B
* BASED ON A FULLY CARBON FREE UTILITY SYSTEM - FACTORS IN INCREASED EFFICIENCIES OF RENEWABLE TECHNOLOGIES
$3.4 TRILLION ENERGY STORAGE
FOR ALL INTENTS AND PURPOSES, IT IS NON-EXISTENT
C
(6 GW x 1000 Hours)
APPROXIMATE RENEWABLES INSTALLED BY 2035
CHPE 1.2 GW
SOLAR 15 GW
WIND 9
D
Fossil Fuel Load (Raw Values 2022)**
Energy Load Adjusted For Renewables
Storage (2040)
New Renewable Generation (2035)

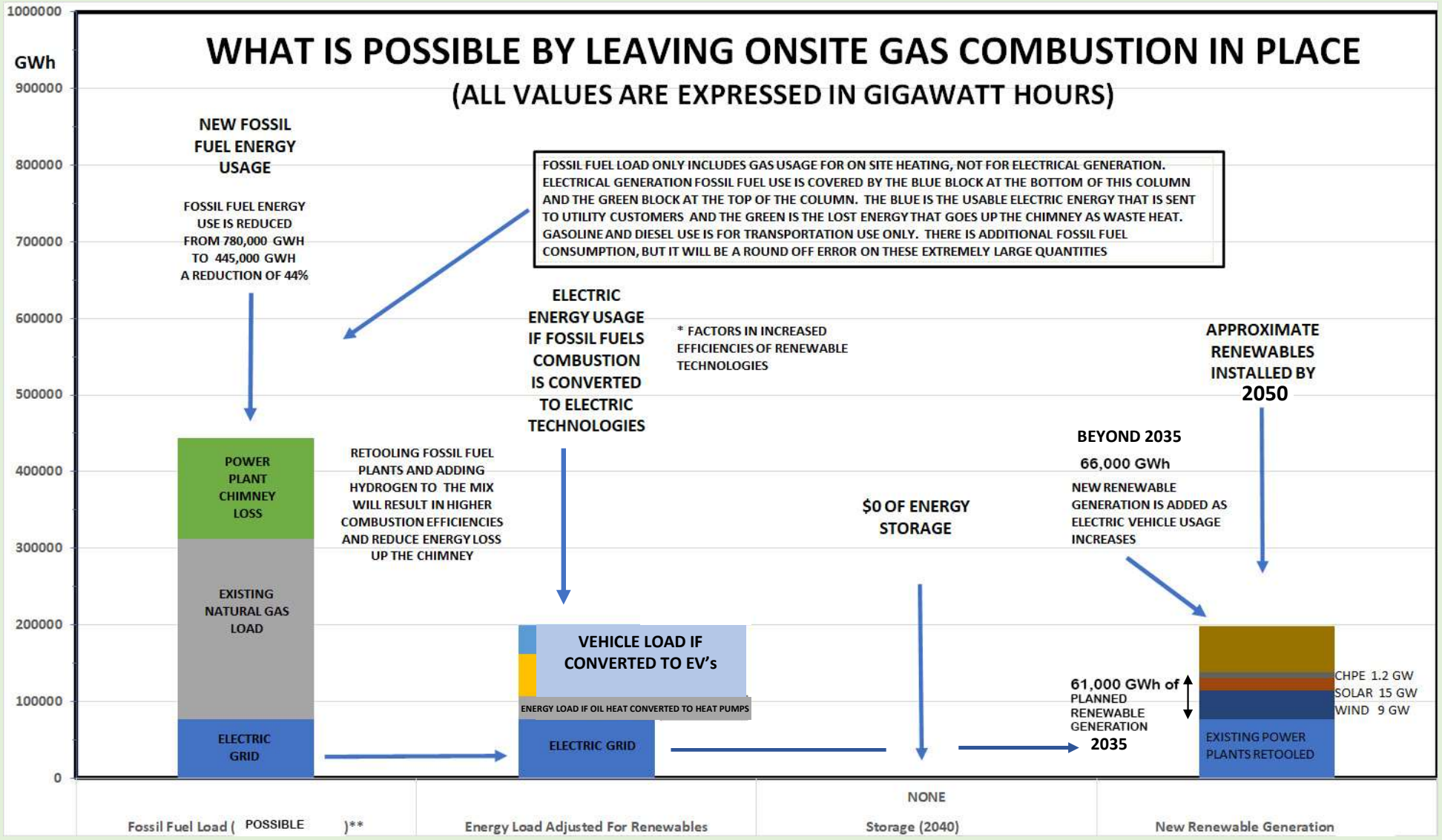
BATTERIES CHARGED ON NY STATE'S ELECTRICAL SYSTEM WILL INCREASE CO2e EMISSIONS 15% - 20% RELATED TO THAT ENERGY



Steve Beyers[1], Koenraad Beckers[2], and Jefferson Tester[1]

[1] Cornell University, Ithaca NY
[2] National Renewable Energy Laboratory, Golden CO

Figure 5d: Battery (or pumped) storage. Batteries and other load-shifting technologies shift the times of natural gas power production, smoothing the grid and reducing the need for excess capacity – but for a grid balanced with natural gas, may marginally increase overall emissions (since more power is needed to charge batteries than is returned).


WHAT IS POSSIBLE BY LEAVING ONSITE GAS COMBUSTION IN PLACE
(ALL VALUES ARE EXPRESSED IN GIGAWATT HOURS)
GWh
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
NEW FOSSIL FUEL ENERGY USAGE
FOSSIL FUEL ENERGY USE IS REDUCED FROM 780,000 GWH TO 445,000 GWH A REDUCTION OF 44%
FOSSIL FUEL LOAD ONLY INCLUDES GAS USAGE FOR ON SITE HEATING, NOT FOR ELECTRICAL GENERATION. ELECTRICAL GENERATION FOSSIL FUEL USE IS COVERED BY THE BLUE BLOCK AT THE BOTTOM OF THIS COLUMN AND THE GREEN BLOCK AT THE TOP OF THE COLUMN. THE BLUE IS THE USABLE ELECTRIC ENERGY THAT IS SENT TO UTILITY CUSTOMERS AND THE GREEN IS THE LOST ENERGY THAT GOES UP THE CHIMNEY AS WASTE HEAT. GASOLINE AND DIESEL USE IS FOR TRANSPORTATION USE ONLY. THERE IS ADDITIONAL FOSSIL FUEL CONSUMPTION, BUT IT WILL BE A ROUND OFF ERROR ON THESE EXTREMELY LARGE QUANTITIES
ELECTRIC ENERGY USAGE IF FOSSIL FUELS COMBUSTION IS CONVERTED TO ELECTRIC TECHNOLOGIES
* FACTORS IN INCREASED EFFICIENCIES OF RENEWABLE TECHNOLOGIES
APPROXIMATE RENEWABLES INSTALLED BY 2050
BEYOND 2035
66,000 GWh
NEW RENEWABLE GENERATION IS ADDED AS ELECTRIC VEHICLE USAGE INCREASES
POWER PLANT CHIMNEY LOSS
EXISTING NATURAL GAS LOAD
ELECTRIC GRID
RETOOLING FOSSIL FUEL PLANTS AND ADDING HYDROGEN TO THE MIX WILL RESULT IN HIGHER COMBUSTION EFFICIENCIES AND REDUCE ENERGY LOSS UP THE CHIMNEY
VEHICLE LOAD IF CONVERTED TO EV's
ENERGY LOAD IF OIL HEAT CONVERTED TO HEAT PUMPS
ELECTRIC GRID
$0 OF ENERGY STORAGE
61,000 GWh of PLANNED RENEWABLE GENERATION
2035
CHPE 1.2 GW
SOLAR 15 GW
WIND 9 GW
EXISTING POWER PLANTS RETOOLED
Fossil Fuel Load (POSSIBLE)**
Energy Load Adjusted For Renewables
NONE
Storage (2040)
New Renewable Generation

ALL IS NOT DOOM AND GLOOM

WHAT CAN BE DONE TO REDUCE GHG EMISSIONS CONSIDERING THE STATE'S LACK OF FINANCIAL RESOURCES, LACK OF LABOR, AND THE LACK OF SUFFICIENT RENEWABLE GENERATION FOR AT LEAST 7 DECADES?

10 IDEAS THAT CAN BE IMPLEMENTED RELATIVELY QUICKLY THAT WILL HELP TO RAPIDLY LOWER GHG WITH MUCH LOWER INSTALLATION COSTS WHILE ALSO SLOWING OR REVERSING THE INCREASE IN UTILITY BILLS

AND A LONGER TERM SOLUTION

1 - DO NOT ELECTRIFY BUILDINGS THAT RUN ON NATURAL GAS – WHILE IT WILL REDUCE GHG AT THE BUILDING, IT WILL INCREASE IT AS MUCH AT THE GENERATING PLANTS WHILE FORCING RESIDENTS AND THE UTILITIES TO INCUR ENORMOUS REWIRING COSTS. THERE WILL BE NO REDUCTION IN COLUMN A (FOSSIL FUEL CONSUMPTION). ALSO, THE GAS STOVE ANALYSIS THAT WAS DONE RECENTLY WAS MATHEMATICALLY FLAWED AND SHOULD NOT BE USED TO SET PUBLIC POLICY. HOWEVER OLD GAS STOVES SHOULD BE REPLACED WITH NEW ONES AND A GAS DETECTOR.

2 - FOCUS HEAT PUMP EFFORTS ON LOCATIONS THAT USE OIL HEAT OR THAT USE RADIANT ELECTRIC HEAT. THOSE LOCATIONS WILL SEE A SIGNIFICANT REDUCTION OF GHG AND HEAT PUMPS WILL REDUCE GRID LOAD WHEN COMPARED TO RADIANT ELECTRIC HEAT.

3 - FOCUS RESOURCES ON EXPANDING GRID INFRASTRUCTURE. THIS WILL REDUCE THE COST OF INSTALLING SOLAR IN UPSTATE LOCATIONS AND REDUCE THE NUMBER OF SYSTEM CANCELLATIONS ALLOWING THE STATE TO INCREASE COLUMN D

4 - INCREASING GRID INFRASTRUCTURE WILL ALSO HELP WITH THE INSTALLATION OF CHARGERS FOR THE ELECTRIC VEHICLE WAVE THAT IS ABOUT TO ARRIVE, WITH OR WITHOUT THE STATE MANDATE.

5 - DO NOT INSTALL LARGE AMOUNTS OF BATTERY STORAGE UNTIL THERE IS SUFFICIENT RENEWABLE GENERATION TO SUPPORT THE STORAGE. IT WILL INCREASE COLUMN A (FOSSIL FUEL USAGE). WHILE INCURRING AN ENORMOUS CAPITAL OUTLAY AND STARVING OTHER PROJECTS OF FUNDING. THEY WILL ALSO DECAY WELL BEFORE SUFFICIENT RENEWABLE GENERATION IS INSTALLED.

6 - REPLACE OLDER GENERATING PLANTS WITH HIGHER EFFICIENCY COMBINED CYCLE NATURAL GAS GENERATING PLANTS. THE STATE WILL NEED THE ENERGY TO SUPPORT THE EV's AND THE NEWER PLANTS ARE FAR MORE EFFICIENT. IT WILL LOWER COLUMN A, REDUCE GAS USAGE AND PUT DOWNWARD PRESSURE ON THE COMMODITY PRICE.

7 – DEVELOP TECHNOLOGIES OTHER THAN ELECTROLYSIS TO GENERATE GREEN HYDROGEN. (THERMOCHEMICAL, PYROLISIS, ETC.) PLACE AN EMPHASIS ON HYDROGEN INJECTION INTO NATURAL GAS COMBUSTION PLANTS. IT WILL DECREASE GAS USAGE AND INCREASE COMBUSTION TEMPERATURES WHICH REDUCES NOx EMISSIONS AND LOWERS COLUMN A. IT WILL GREATLY LOWER GHG EMISSIONS RELATED TO THOSE GENERATING PLANTS

8 - FOCUS AVAILABLE NATURAL GAS RESOURCES ON COMBINED HEAT AND POWER SYSTEMS. IT WILL REDUCE THE UTILITY BILLS FOR THE SYSTEM OWNERS WHILE ALSO REDUCING REQUIREMENTS FOR GRID INFRASTRUCTURE. ALLOW MULTIPLE BUILDINGS TO FORM MICRO-GRIDS TO UTILIZE THE THERMAL OUTPUT AND INCREASE THE GENERATION CAPACITY. IT WILL GREATLY REDUCE COLUMN A AND REDUCE THE NEED FOR AS MUCH TRANSMISSION INFRASTRUCTURE

9 - ALLOW MICRON TECHNOLGIES TO BUILD A COMBINED CYCLE PLANT THE SIZE OF CRICKET VALLEY ENERGY CENTER ON THEIR PROPERTY. THE MICRON FACILITY WILL USE MORE ENERGY THAN THE STATE OF VERMONT. WITH GENERATION ON-SITE, THE THERMAL ENERGY COULD BE USED AT THE PLANT AND THE 350 GWh OF ANNUAL LINE LOSS WILL BE ELIMINATED. INSTEAD OF MAKING THEM LOOK "GREEN" ON PAPER BY BUYING CARBON CREDITS, LET THEM BE GREEN IN REALITY WITH HIGH EFFICIENCY GENERATION AND HAVE LOWER ENERGY COSTS TO MAKE THEM MORE COMPETITIVE AND ABLE TO RECOUP THE $5 BILLION REBATE WITHOUT FAKING IT. THAT WILL ELIMINATE THE INCREASE IN COLUMN A RELATED TO THE FACILITY.

10 - FIGURE OUT HOW THE UTILITIES CAN INTERCONNECT THE 9 GW OF OFFSHORE WIND BECAUSE AT THE MOMENT, NO ONE IS CERTAIN HOW TO DO IT. THERE IS LIMITED SPACE FOR UNDERWATER CABLES. WITHOUT THAT, ENERGY CURTAILMENTS WILL OCCUR AND IMPEDE THE INCREASE OF COLUMN D, UNLESS THEY USE THE ALTERNATIVE IDEA WHICH IS TO RUN TRANSMISSION LINES ACROSS LONG ISLAND WHERE THERE WILL BE INEVITABLE NIMBY DELAYS.

LONG TERM SOLUTIONS

- ADD 12 GW OF NUCLEAR TO THE GENERATING SYSTEM, PREFERABLY NEAR THE EXISTING NUCLEAR PLANTS WHERE THEY WILL BE MORE ACCEPTED AND WHERE AN EVACUATION PLAN ALREADY EXISTS
- ENERGY OUTPUT WILL BE APPROXIMATELY 100,000 GWh
- USE THE CIRCULAR FUEL CYCLE THAT GENERATES LESS NUCLEAR WASTE
- THIS OUTPUT CAN PROVIDE THE FOLLOWING:
  - 75,000 GWh TO REPLACE THE EXISTING FOSSIL FUEL GENERATION
  - 7,000 GWh TO SUPPORT THE MICRON FACILITY
  - 18,000 GWh TO SUPPORT FUTURE BUILDING ELECTRIFICATION MANDATED BY THE CURRENT BUDGET

TOTAL COST WILL BE APPROXIMATELY $150 BILLION FOR THE PLANTS AND $75 BILLION FOR THE TRANSMISSION LINES - $225 BILLION TOTAL

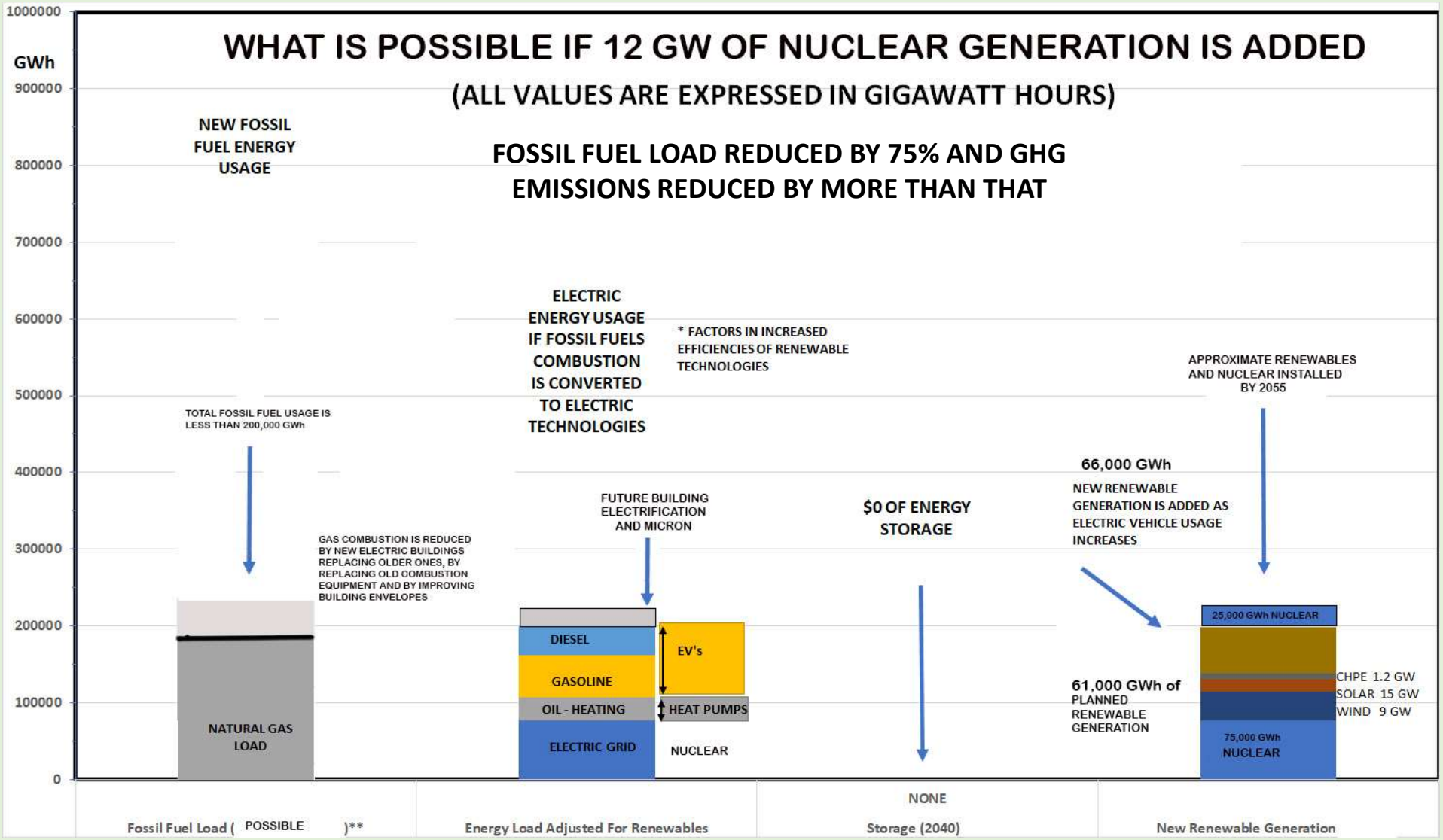
90% LESS THAN JUST THE BATTERY COST THAT WILL BE REQUIRED ON A FULLY RENEWABLE SYSTEM

LAND AREA REQUIRED WILL BE APPROXIMATELY 20 SQUARE MILES - 3% OF THE TOTAL REQUIRED FOR 60 GW OF SOLAR

IF THE "STRANDED ASSETS" OF THE EARLY RETIRED FOSSIL FUEL PLANTS ARE FIGURED, IT WILL ADD AN ADDITIONAL $30 BILLION. $ 255 BILLION IS STILL FAR LESS THAN THE BATTERIES.

https://www.youtube.com/watch?v=QzTgZ6kOEM8

https://www.iaea.org/newscenter/news/frances-efficiency-in-the-nuclear-fuel-cycle-what-can-oui-learn


WHAT IS POSSIBLE IF 12 GW OF NUCLEAR GENERATION IS ADDED
(ALL VALUES ARE EXPRESSED IN GIGAWATT HOURS)
FOSSIL FUEL LOAD REDUCED BY 75% AND GHG EMISSIONS REDUCED BY MORE THAN THAT
GWh
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
NEW FOSSIL FUEL ENERGY USAGE
TOTAL FOSSIL FUEL USAGE IS LESS THAN 200,000 GWh
NATURAL GAS LOAD
GAS COMBUSTION IS REDUCED BY NEW ELECTRIC BUILDINGS REPLACING OLDER ONES, BY REPLACING OLD COMBUSTION EQUIPMENT AND BY IMPROVING BUILDING ENVELOPES
ELECTRIC ENERGY USAGE IF FOSSIL FUELS COMBUSTION IS CONVERTED TO ELECTRIC TECHNOLOGIES
* FACTORS IN INCREASED EFFICIENCIES OF RENEWABLE TECHNOLOGIES
FUTURE BUILDING ELECTRIFICATION AND MICRON
DIESEL
GASOLINE
OIL - HEATING
ELECTRIC GRID
EV's
HEAT PUMPS
NUCLEAR
$0 OF ENERGY STORAGE
66,000 GWh
NEW RENEWABLE GENERATION IS ADDED AS ELECTRIC VEHICLE USAGE INCREASES
61,000 GWh of PLANNED RENEWABLE GENERATION
APPROXIMATE RENEWABLES AND NUCLEAR INSTALLED BY 2055
25,000 GWh NUCLEAR
CHPE 1.2 GW
SOLAR 15 GW
WIND 9 GW
75,000 GWh NUCLEAR
Fossil Fuel Load (POSSIBLE)**
Energy Load Adjusted For Renewables
NONE
Storage (2040)
New Renewable Generation

OTHER IMPORTANT CONSIDERATIONS

START PREPARING THE PUBLIC NOW TO ACCEPT THE RECERTIFICATION OF THE UPSTATE NUCLEAR PLANTS. THERE IS A SEGMENT OF THE PUBLIC THAT SEEMS TO THINK THAT THEY AREN'T NEEDED. THEY COULDN'T BE MORE WRONG.

START NOW WITH PLANNING TO FIGURE OUT WHAT WILL REPLACE THE LOST ENERGY WHEN THE UPSTATE NUCLEAR PLANTS HAVE TO BE RETIRED BECAUSE THEY ARE TOO OLD. THEY ARE NOT GOING TO LAST LONG PAST 2050 AND THAT IS ONLY 27 YEARS AWAY. WHILE THAT MAY SEEM LIKE A LONG TIME, IT WILL HAVE TAKEN 15 YEARS TO GET THE CHPE UNDER CONSTRUCTION BETWEEN IDEA AND ACTUALLY HAVING IT OPERATING. RENEWABLES WILL NOT PROVIDE NEARLY ENOUGH ENERGY TO OFFSET THE NUCLEAR PLANTS AS THOSE PLANTS GENERATE 20% OF THE STATE'S ELECTRIC ENERGY.

LET'S USE COMMON SENSE SOLUTIONS TO KEEP THE LIGHTS ON IN NY STATE BECAUSE

WHEN FANTASIES MEET REALITY, REALITY ALWAYS WINS!!

ADDITIONAL INFORMATION

ADDITIONAL INFORMATION CAN BE FOUND AT

WWW.SAVENYENERGY.COM

PAGES 35 & 92 FROM THE NYSERDA ENERGY STORAGE REPORT EXPLAINING THE $3.4 TRILLION ENERGY STORAGE COST

4 Storage Deployment Barriers

4.1 Supply Chain and Material Costs

The rapid growth of the energy storage and EV industries has been fueled by the technological improvements and price reductions in lithium-ion batteries. Lithium-ion batteries represent an overwhelming majority of all stationary and mobile storage deployments, resulting in both competition between automotive and grid-connected segments and sensitivities across segments to supply chain issues and material price increases.

Since July 2021, prices for lithium carbonate, a key ingredient of lithium-ion batteries, have increased 500%.[34] Among projects awarded NYSERDA incentives, average total installed costs for non-residential, retail projects averaged $567/kWh for installations occurring in 2022 and 2023, up from $464/kWh for installations in 2020 and 2021, an over 20% increase in total costs.[35] This is consistent with recent industry reports that indicate near-term increases in storage costs.[36] Also in 2021, the electric vehicle market more than doubled while global energy storage deployments tripled.[37] Manufacturing and distribution of battery components and battery packs have struggled to keep up with the pace of demand growth. This has led to delays in deliveries, higher costs for storage assets, and in some cases, unmet demand. These factors are likely to impact the ability of storage to be deployed by the market until supplies increase.[38] Furthermore, this combination of factors has kept energy storage from being able to be deployed in the absence of market support mechanisms.

Efforts by the Federal Government, as well as the European Union, seek to expand and diversify supply in the coming decade to address overall supply, supply chain, and material cost issues.[39] However, the impacts of these interventions will take time to manifest and are unlikely to begin easing the cost issues until 2024-2025 at the earliest, with major improvements only expected by the end of the decade and into the 2030s. Given the time required to plan, study, construct, and commission energy storage projects, simply waiting for cost reductions, driven by factors outside New York's control, before beginning new deployments is not an option as the state pursues its decarbonization and renewable integration goals. For example, large-scale bulk storage projects often require five years or more between interconnection request and commissioning. Waiting to procure these resources until price reductions have been achieved near the end of the decade will result in projects coming online in the mid-2030s, beyond the timeline

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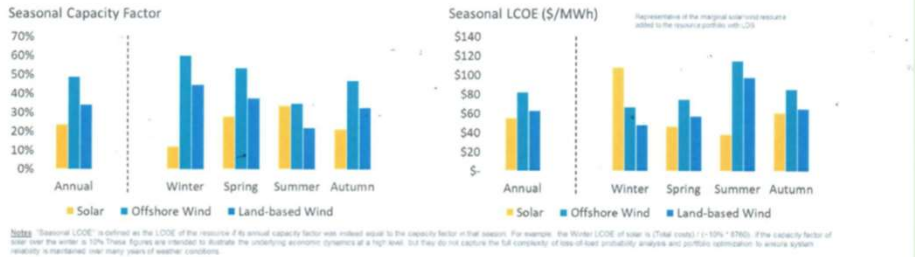
Page 92 of the document. Page 94 of the pdf. New York's 6 GW Energy Storage Roadmap:

Math at bottom of page.

Solar output is highest in the summer and lowest in the winter, and wind output is complementary to solar, as shown in Figure 40. With seasonal storage (1000+ hours), the availability of a specific resource during critical weeks – or in between multiple critical weeks in a season matters less; instead, the cheapest form of energy, such as solar in the spring and summer, can be stored and discharged over multiple winter weeks.

In the challenging weeks highlighted in Figure 41, output is lower than average while wind output is at or above average. As a result, although solar is cheaper on average over the course of the year, 100-hr storage needs to be paired with more expensive land-based or offshore wind, which can both directly meet load and be used to recharge storage between multiple critical weeks in this period. Figure 42 illustrates how the 100-hr storage with added renewables can fill the firm-resource need in the week highlighted in Figure 41.

Figure 40. Variation in Solar and Wind Generation over a Year



GW = Gigawatt=1 billion watts Watts are a measure of Power
KW = Kilowatt = 1000 watts

KWh = Kilowatt-Hours Kilowatt-Hours are a measure of Energy

6 GW = 6,000,000 KW x 1000 hours = 6,000,000,000 KWh * $567/KWh = $3.4 Trillion

Page 64 From the

Initial Report on the New York Power Grid Study
January 19, 2021

Documenting Issues With Interconnection of 9 GW of Offshore Wind and Possible Curtailments

PREPARED BY

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ii. Feasible Siting and Permitting

The OSW Study concludes that interconnecting 5-6 GW of OSW into Zone J should be feasible with sufficient planning and coordination to efficiently use scarce cable routing corridors through the New York Harbor and limited space at the POI substations. In addition to the planned cables, it would require **siting four 1,300 MW cables and securing landing points** in Zone J. Routing four additional cables through the New York inner harbor may be challenging, however. For example, Intertek (in a study for Anbaric) previously concluded that limited space through the Narrows and into the inner harbor may be able to accommodate only four cables, including the two for the already-contracted OSW facilities.[58] This could limit OSW interconnections into New York City to only 3-4 GW, even assuming larger transfer capability of the individual cables. OSW interconnections into New York City would be further limited if the cables were sized below the 1.3 GW that the OSW Study assumed for all cables beyond those currently planned. Should these challenges limit interconnections in New York City below the 5-6 GW amounts studied—either routed through the harbor or brought into New York City through the Long Island Sound—more than 3-4 GW of OSW generation may need to be interconnected to the onshore grid on Long Island, leading to substantially higher curtailment and the need for additional onshore transmission from Long Island to the rest of the State to mitigate the risk of these curtailments.

Integrating offshore wind will also depend on **accessing POIs** that are jointly feasible on the transmission system and have sufficient space for the necessary interconnection equipment. The various studies do not all reach the same conclusions on which POIs are feasible, nor are the studied POIs consistent with utilities' study assumptions and the NYISO interconnection queue, as shown in Figure 13 below. In fact, the Beacon and Empire 2 Offshore Wind projects, which were provisionally awarded to Equinor Wind US LLC in January 2020, are expected to interconnect at different POIs—Astoria 138 kV in Queens, and Barrett Substation in Nassau County of Long Island; these projects provide a total 2,490 MW of offshore wind capacity.[59] In

STATE POLICY IS GOING TO INCREASE ENERGY LOSSES RELATED TO THE MICRON PLANT BY APPROXIMATELY 5% RELATED TO TRANSMISSON LINE LOSSES. ON THE EVENTUAL 7 TERAWATT HOURS OF USAGE, THAT AMOUNTS TO 350 GWh ANNUALLY BEYOND WHAT COULD BE DONE WITH INTELLIGENT PLANNING

MICRON GETS NYPA POWER BOOST: The New York Power Authority board of trustees is poised to approve a big chunk of lower-cost and market-purchased power for a megaproject in the Syracuse area. The board is set to vote today on awarding Micron, which has committed to building a $19.3 billion new semiconductor manufacturing plant in Clay, 140 megawatts of low-cost hydropower through the authority's ReCharge New York program geared toward economic development. NYPA would also supply 404 MW of market power under its "high load factor" program for large energy users which enables a lower delivery charge. That's likely the largest contract for the program, which has also approved an allocation for a cryptocurrency mining project, and currently total about 361 MWs including 143 MW for Plug Power, according to data including pending contracts through the end of 2022 provided by NYPA.

This is not the last round of electricity awards for the project, which is being built out in phases. Future applications for more power from NYPA are expected, according to NYPA's agenda for the meeting. Micron has committed to using 100 percent renewable energy at its new facility. The NYPA high load program is simply market electricity procured by NYPA, not hydropower or another renewable resource. — *Marie J. French*

WHERE IS THE RENWABLE ENERGY FOR MICRON GOING TO COME FROM? THE TWO LARGEST STATES TO THE SOUTH AND WEST (OHIO & PENNSYLVANIA) AVERAGE ONLY 1.4% RENEWABLE

Pennsylvania Energy Consumption Estimates 2020
https://www.eia.gov/state/?sid=PA
16:12:04 GMT-0400 (Eastern Daylight Time)
Source: Energy Information Administration State Energy Data System

Category	Pennsylvania Energy Consumption Estimates Trillion Btu
Coal	374.3
Natural Gas	1783
Motor Gasoline excl. Ethanol	465.5
Distillate Fuel Oil	309.8
Jet Fuel	45.1
HGL	48.6
Residual Fuel	1.4
Other Petroleum	87.8
Nuclear Electric Power	799.3
Hydroelectric Power	23.4
Biomass	152.3
Other Renewables	42.2
Net Electricity Imports	0
Net Interstate Flow of Electricity	-713.7
TOTAL BTU	3419
TOTAL Renewable	65.6
% Renewable	1.92%
Total Renewable/Nuclear	864.9
% Renewable/Nuclear	25.30%

Ohio Energy Consumption Estimates 2020
https://www.eia.gov/state/?sid=OH
16:11:20 GMT-0400 (Eastern Daylight Time)
Source: Energy Information Administration State Energy Data System

Category	Ohio Energy Consumption Estimates Trillion Btu
Coal	556.8
Natural Gas	1233.4
Motor Gasoline excl. Ethanol	489
Distillate Fuel Oil	289.3
Jet Fuel	31.4
HGL	37.3
Residual Fuel	2.2
Other Petroleum	142.7
Nuclear Electric Power	190.3
Hydroelectric Power	3.3
Biomass	120.8
Other Renewables	27.3
Net Electricity Imports	0
Net Interstate Flow of Electricity	288.7
TOTAL BTU	3412.5
TOTAL Renewable	30.6
% Renewable	0.90%
Total Renewable/Nuclear	220.9
% Renewable/Nuclear	6.47%

BENEFITS OF BURNING A HYDROGEN/NATURAL GAS MIXTURE IN GENERATING PLANTS

- **2. Burner Combustion of Natural Gas Mixed with Hydrogen**

Natural gas consists mainly of methane. Combustion properties of hydrogen and methane are given in Table 1. (Next Slide) Hydrogen has wider flammability limits, a faster burning velocity and a smaller minimum ignition energy than methane. Owing to these properties, the flame in burner combustion of hydrogen–air mixtures, with and without premixing, is hard to extinguish due to flame lifting and easy to backfire. The burner combustion is accompanied by generation of a considerable amount of nitrogen oxides (NOx), about 500 ppm. Although the NOx concentration decreases largely by increasing the premixing ratio of air, the increase of the air ratio causes the likelihood of backfiring. The suppression of NOx generation and backfiring is a trade-off, and is called “a dilemma in hydrogen combustion using burners.”

In contrast, when hydrogen is burned as a mixture with natural gas, in principle, its favorable and unfavorable combustion characteristics bring about the following positive features. The burner combustion proceeds stably due to the increase of the flammability limits and the reduction in backfire and ignition energy. A large thermal energy with a small burner is obtainable due to the increase of the combustion energy per volume. Generation of NOx can be suppressed without causing backfiring in a larger premixing ratio of air.

Copied from the following link: **https://www.eolss.net/ebooklib/sc_cart.aspx?File=E3-13-05-02**

TABLE 1.

COMBUSTION PROPERTIES OF HYDROGEN. METHANE AND PROPANE

CONTINUATION OF PREVIOUS SLIDE

Property	Hydrogen	Methane	Propane
Density of gas at NTP[a)] (kg m^{-3})	0.0838	0.6512	1.87
Heat of combustion[b)] (low) (MJ m^{-3})	10.78	39.72	99.03
Heat of combustion[b)] (high) (MJ m^{-3})	12.75	35.80	91.21
Flammability range (limits) in air[c)] (%)	4.1 - 75	5.3 – 15	2.1 – 10
Stoichiometric composition in air[c)] (%)	29.53	9.48	4.02
Minimum ignition energy (mJ)	0.02	0.29	0.26
Minimum self ignition temperature[d)] (K)	858	813	760
Adiabatic flame temperature in air (K)	2318	2158	2198
Burning velocity[d)] (cm s^{-1})	237	42	46
Detonability range in air[c)] (%)	18 – 59	6.3 - 13.5	3.1 – 7.0
Energy of explosion of gaseous fuel[b)] (MJ m^{-3})	9.9	32.3	93

a) NTP = normal temperature and pressure (293.15 K, 0.1013 MPa).
b) 273.15 K, 0.1013 MPa).
c) in a volumetric ratio.
d) a stoichiometric mixture.

Hord J., International Journal of Hydrogen Energy Vol. 3, 157-176 (1978). International Association of Hydrogen Energy.
Source Book for Hydrogen Applications, Hydrogen Research Institute and National Renewable Energy Laboratory.

Table 1. Combustion properties of hydrogen, methane, and propane.

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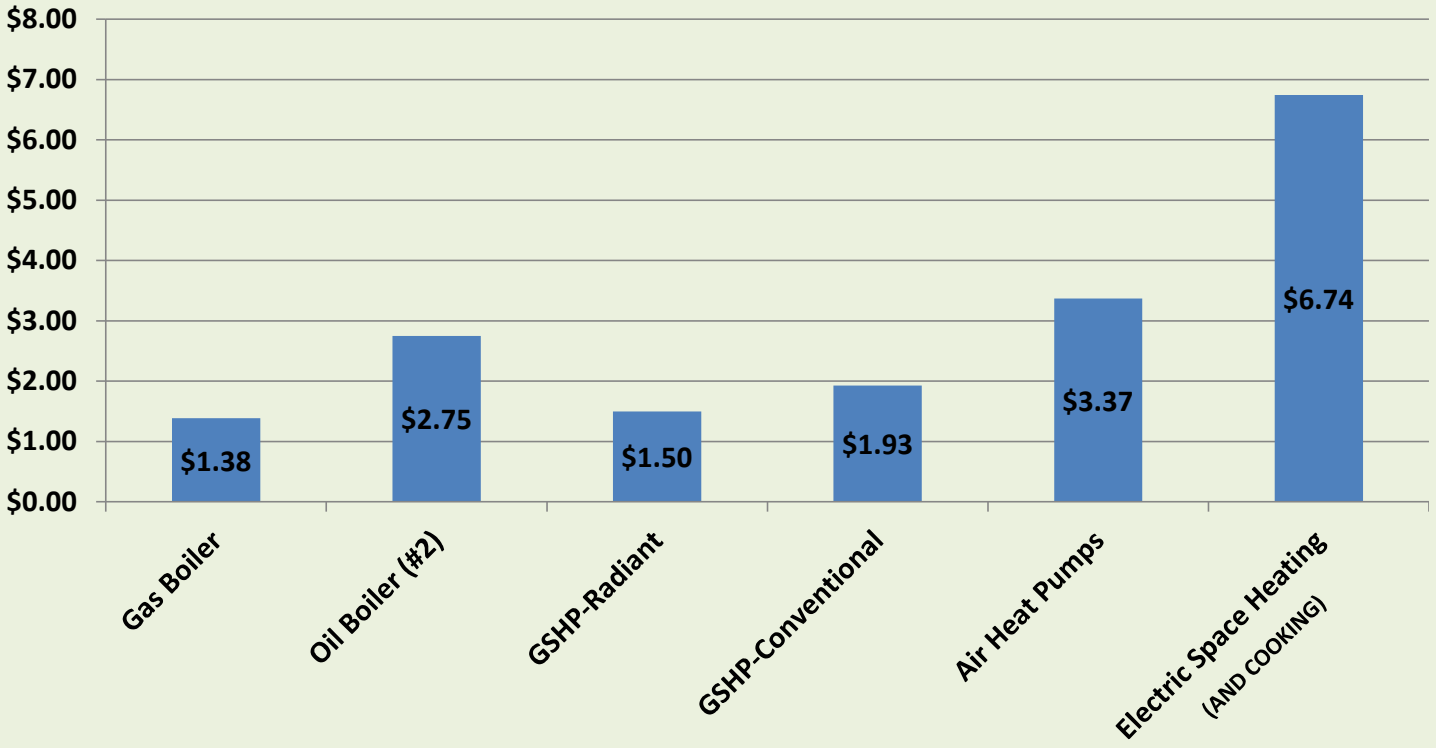
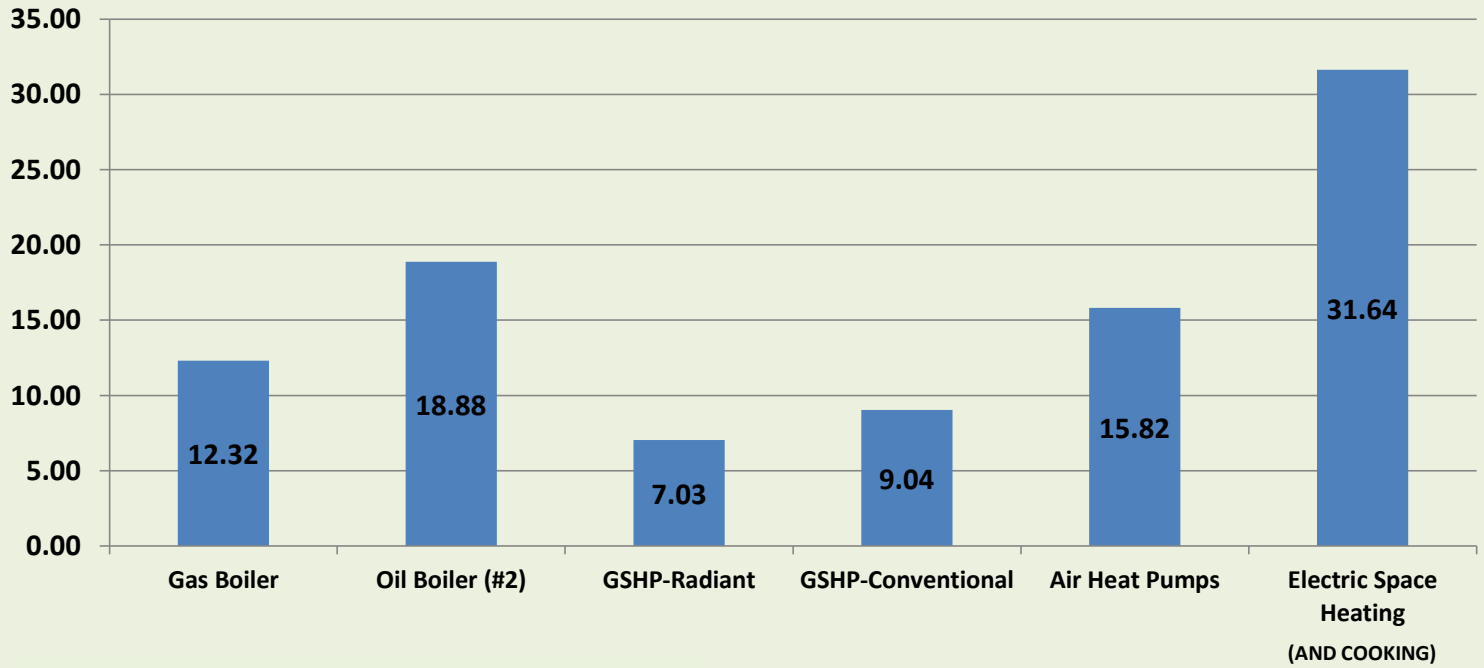
COST TO DELIVER ONE THERM OF ENERGY AT THE CUSTOMER PREMISES USING VARIOUS HEATING METHODS (In the NY Metro Area)



Refer to Slide #53 for Additional Information on these values

Based Upon April 2019 Commodity Prices

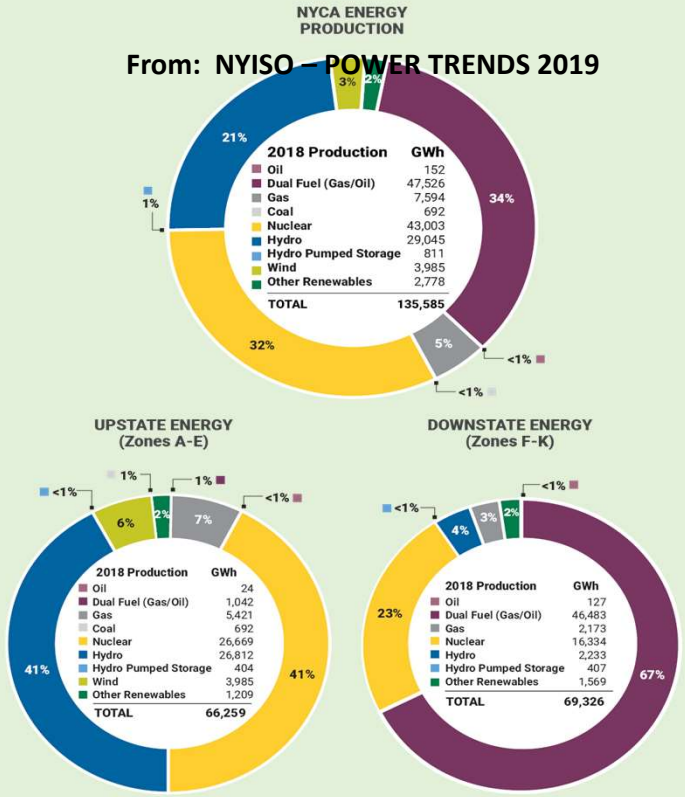
POUNDS OF CO_2 EMITTED PRODUCING ONE THERM OF ENERGY AT THE CUSTOMER PREMISES FOR VARIOUS HEATING METHODS (In the NY Metro Area)



Refer to Slide #53 for Additional Information on these values

Electric Generation Sources NY State - 2019

From: NYISO – POWER TRENDS 2019



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

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

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

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 CO_2 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
	COP							
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