Tompkins County Climate Protection Initiative

Minutes – Friday, June 28, 2024
Video Conference
9 am to 11 am

Attending: Bob Howarth, Garth Jay, Marie McRae, Marguerite Wells, Shimon Edelman, Sarah Carson, Bert Bland, Don Haas, Brian Eden, Leon Porter, Sara Culotta, Daniel Winters, Hailley Delisle, Luis Aguirre Torres, Gerrie Wiley, Susan Riley, Margaret Johnson, Dave Bradley, Tom Hirasuna, Siobhan Hull, Careen Arsenault, Dawn Montanye, Evan Kurtz, Fenya, Hilary Swartwood, bethany ojalehto mays, Carol Chock, Mike Straight, Margaret McCasland, Joe Wilson, Aimee Dailey, Paul Moore, Dan Antonioli, Wayne Bezner-Kerr, Inger Aaberg, Lisa Kilgore, Martha Roberson, Rebecca Evans, Rod Howe, Savannah Vega, Sheila Out, Terry Carroll, Peter Bardaglio

The Upstate NY Grid – Marguerite Wells
Marguerite Wells is the executive director of Alliance for Clean Energy New York and former Vice President for Renewable Development at Invenergy, LLC. Marguerite provided an overview of how the upstate NY grid operates.

- Overview
  - On annual average, upstate NY grid is the cleanest in nation, >90% of the power is generated from nuclear and hydro
  - Adding new electric loads to grid still causes combustion of gas to serve that new load by plants in NYS disadvantaged communities
  - Efficient electrification of transportation and HVAC should proceed in coordination with clean electricity and equipment life cycles
  - In case of a district energy system in transition, electrification can be timed so as not to increase gas usage
- NY grid divided into zones A-K from Buffalo to end of Long Island
- Big hydro at Niagara Falls, also in northern NY – smaller hydro plants throughout Adirondacks
- Three big nuclear plants on Lake Ontario – gas plants all over state with bunch in Albany area – others in Syracuse and Catskills
- Wind farms and solar mostly in northern and western NY – most of solar not utility scale yet – bunch of projects planned but only two under construction
- Vast majority of solar at this point behind meter
- Upstate energy production is 92% carbon free – 84% nuclear and hydro – very small percentage of energy production in upstate is gas or oil
- NYSIO definition of upstate NY doesn't include Capitol District or Hudson Valley

- Downstate energy production is 95% fossil based – state as a whole is roughly half fossil generation and half carbon free
- Electric generation dispatch order in NY:
    - First: Renewables and nuclear plants run at their full capacity
    - Second: Gas plants ramp up and down to meet changing load
    - Third: Fuel oil plants run in extreme circumstances – very expensive to run so only turned on when everything else is maxed out
- Hydro and nuclear provide base load for grid
- March 12th of this year most solar NY grid has even seen – 21% for couple of hours – all behind meter: rooftop and community solar
- When solar becomes available during day it pushes gas and dual fuel down and then at around 6 pm gas and dual fuel move up
- What is Carbon Intensity of Electricity in NYS?
    - Inventory (Attributional/Allocational) accounting framework uses average emission factors to proportionally allocate responsibility for emissions in a geographic region
    - Project (Consequential) accounting framework uses marginal emission factors to quantify actual changes in emissions as a consequence of specific projects and operational changes

Annual Average vs Marginal Emissions Statewide

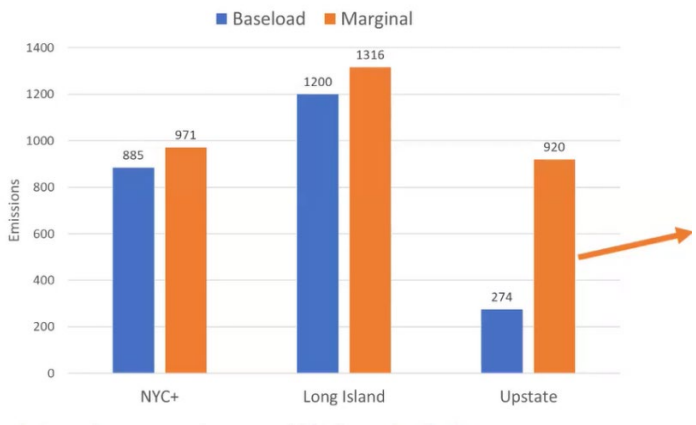
Location	Average (baseload) emissions CO2e lbs/MWh	Marginal (non-baseload) emissions CO2e lbs/MWh
NYC+ Westchester	885	971
Long Island	1200	1316
Upstate	274	920

Baseload: Any plant operating over 80% Capacity Factor
Non-Baseload: Any plant operating less than 20% Capacity Factor
CO2e: carbon dioxide equivalent, or # of metric tons of CO2 emissions with the same global warming potential as one metric ton of another greenhouse gas
MWh: 1,000 kilowatts of electricity generated for an hour, equivalent to ~1,000 households of demand for 1 hr

Source: US EPA eGRID 2022 Report.

- Upstream emissions are included for all fossil fuel electricity but not nuclear

Annual Average vs Marginal Emissions Statewide



- Some of larger combined cycle and peaker plants in upstate NY
- Independence - 1254 MW, Oswego NY
    - Summer Peak Capacity: 958 MW
    - Capacity Factor in 2022: 28%
    - Owner: Vistra
    - Commissioned: 1994
    - Combined Cycle
    - Adjacent to NYS disadvantaged community identified by the NY Climate Justice Council
- Oswego Harbor,1803 MW, Oswego NY
    - Nameplate: 1803 MW
    - Capacity Factor in 2022: 1%
    - Owner: Generation Bridge
    - Commissioned: 1975
    - Steam Boiler run on fuel oil primarily, natural gas backup
    - Within NYS disadvantaged community identified by the NY Climate Justice Council
- CPV - 770 MW, Middletown NY (Catskills)
    - Summer Peak Capacity: 680 MW
    - Capacity Factor in 2022: 64%
    - Owner: DGC Operations, LLC
    - Commissioned: 2018
    - Combined Cycle
    - Within NYS disadvantaged community identified by the NY Climate Justice Council
- Bethlehem - 893 MW, Glenmont NY (near Albany)
    - Summer Peak Capacity: 811 MW
    - Capacity Factor in 2022: 68%
    - Owner: PSEG Power NY
    - Commissioned: 2002

    - Combined or Simple Cycle: Combined
    - Adjacent to NYS disadvantaged community identified by the NY Climate Justice Council
- We do have very clean grid upstate – no coal – but we still rely on gas
- Every time we add MWh, combustion of gas to serve that new load has actual emissions impact of ~1000 lbs/MWh in NYS disadvantaged communities
- Hopefully as renewables come online, they'll drive gas plants out of market
- But current situation makes it tricky as electrification of buildings and cars ramps up – grid has to respond to increased demand and gas plants step up to fill gap in response

Q&A

- Peter: What happened when Indian Point nuclear plant shut down?
- Marguerite: Gas plants, including peakers, ran at full bore
- Bob Howarth: If you replace a gas furnace in your home and you replace it today with a ground source heat pump, even if 100% of electricity comes from natural gas power plants, your total GHG emissions go down immediately
- Even though we should be aiming at zero emissions grid, there's no reason to wait

Cornell Climate & Energy Update – Bert Bland, Sarah Carson, and Wayne Bezner Kerr
Bert Bland, the associate vice president for Energy and Sustainability at Cornell, Sarah Carson, director of campus sustainability, and Wayne Bezner Kerr, project manager for Earth Source Heat updated the group on the Cornell Climate Action Plan, including the campus district energy system, recent developments regarding energy efficiency and renewables, and the latest on the Earth Source Heat project.

Sarah Carson

- Goal of Cornell's climate action plan is to transition campus's energy systems to be fossil fuel free
- Overall strategy is to leverage campus's technology and resources to explore the lowest carbon solutions that could be groundbreaking and scaled beyond Cornell
- Have already cut campus energy use intensity by 25% and increased efficiency by 50% by making electricity on campus and capturing waste heat for buildings
- Have also built largescale solar that produces electricity to grid and displaces natural gas production, much of which is adjacent to or in disadvantaged communities
- We've shared our data and everything we've learned with peers and community
- World-class team of researchers and practitioners working on solutions
- Play short segment of Cornell's Carl Sagan testifying to Congress in 1985 about threat of climate change
- Guiding questions for presentation today:
- What is district energy? • How much energy does campus use?
- Guiding Questions

- What is district energy?
- How much energy does campus use?
    - Where does it come from?
    - How clean is it relative to the alternatives?
- How do we get to a fossil fuel free district energy system?
- How do we get to a fossil fuel free district energy system?
- Campus district energy system made up of steam heat, chilled water, and electricity – 150 buildings connected to this system connected to network of buried pipe and electrical lines, including 12 miles of buried steam lines, all of which is connected to central generating facilities
- There is also hydroelectric power plant and lake source cooling

Bert Bland

- We need to stop burning cheap fossil fuels which are abundant and electrify everything
- Goal of entire energy transition team is, first, to keep the lights on and our campus spaces heated and cooled, then rapidly decarbonize our system to create fossil-free district energy system
- Bert played brief video explaining what a district system is and why it makes sense
- Cornell's central coal-fired energy plant went on line in 1923 – in 2009 coal replaced with gas-fired combined heat and power – increased energy efficiency by 50% and cut stack emissions by half
- If Cornell purchased electricity from grid, carbon emissions would increase significantly
- We're reducing peak demand on grid in summer when less efficient peaker plants come online
- Hydroelectric plant first started up in 1904 – takes water from Beebe Lake – just replaced turbines – makes about 3% of power used on campus
- Lake source cooling started up in 2000 – uses about one-sixth of energy use to make chilled water for campus district energy system
- On a day when it's about 9 degrees F, total campus electricity demand is 27 MW, and total campus steam flow is 262 kLb/hr
- Roughly equivalent to boiling 10 barrels of water per minute for peak heating
- Using electric power equivalent to 40K work horses pulling nonstop

Sarah Carson

- Carbon action plan: carbon reduction framework
    - Avoid carbon-intensive activities
    - Reduce energy demand with building retrofits and engagement programs
    - Replace fossil fuels with lowest carbon renewable energy
    - Remove carbon through campus land management and other mission-related actions

- Carbon-free district energy system vision: earth-source heat along with largescale solar, hydroelectric, lake source cooling, and energy conservation – will also include thermal energy storage
- Make almost all heat & electricity on campus
- Need to transition heat distribution system from steam to hot water – will result in significant energy efficiency gains – progress will not be linear
- Zero-Carbon Firm Capacity needed for a challenging winter week in 2050
    - Significant overbuild of Li-ion batteries, solar, and wind will be required in extended periods of high load and low solar and wind generation
    - CLCPA Scoping plan calls for 18-23GW of Dispatchable Emission Free Resources (DEFRs) to fill the gap
- Recent analyses have shown that Zero-Carbon Firm Capacity needed for a typical winter week in 2050 closer to 40GW
- As we work toward electrification, peak load likely to shift from summer to winter
- The NYS grid transition will:
    - Shift to a winter peaking system
    - Increase peak load 2-3 times current levels
    - Significantly lower reliability margins

<u>Wayne Bezner Kerr</u>

- Campus uses tremendous amount of energy – everything we can do to reduce size of load on grid makes possibility of building reliable, dispatchable zero-carbon grid more possible
- As we move toward mid-century, biggest portion of increase in demand is from building electrification – right thing to do but we need to be careful about how we carry out transition
- Geothermal: Earth Source Heat (ESH)
    - Replace fossil fuels on campus
    - Highest efficiency of any system
    - Lowest electricity, lowest emissions, and chemicals used to operate it has lowest global warming potential (GWP)
    - Supports grid reliability
    - No refrigerants in system
    - Demonstrates Enhanced Geothermal Systems technology to world that can be deployed widely
- Electric Heat Pumps: A possible solution to Cornell heating and cooling needs
    - Air-Source and Ground-Source options
    - Require high GWP refrigerants
    - Displace Lake Source Cooling at significant cost in emissions
    - Substantial increases in electricity demand
    - Approximately 9000 boreholes required
- First ground source heat pump on campus: Cornell Child Care Center 2024
    - Decommissioned gas-fired infrastructure

    - Childcare center not on district energy system
- Earth Source Heat is the lowest electric demand
    - Using ground source heat pump would use twice as much electricity and air source heat pump and electric boiler would use six times as much
- What did we learn from CUBO?
    - Safe drilling environment
    - Ideal temperature for connecting to district energy – 185 degrees F at bottom of hole
    - Insights into deep geology and new technology make working at depth more attractive – drilled to 9,750 feet
    - Turned out to be easier engineering environment to work in than expected
- Cornell team has strong relationship with Fervo
- Fervo is the global leader in enhanced geothermal development
- Uses oil & gas technology to make electricity in high heat areas without subsurface water
- We are using these techniques to build system that can produce efficient heat almost anywhere
- Next steps:
    - 2025: Collect data for design
    - 2027: Working demonstration system
    - 2029: Expand locally and support partners
- Closing Thoughts about Low-Carbon Heat
    - A reliable, achievable source of decarbonization that limits stress on winter peaking electric grid
    - Deployable in many regions
    - Workforce development that utilizes expertise from the oil and gas industry and transitions to decarbonization

<u>Sarah Carson</u>

- Solar farms and hydro currently produce 22% of power -- have agreements in place to get to 100% before 2030 – studying crop integration
- Since 2020 on sunny afternoons 100% renewable in given hour or moment
- Cornell works with RGGI: Gas generation displaced by retiring carbon allowances from NYS carbon cap & trade program (RGGI) with RECs

<u>Bert Bland</u>

- Aggressive energy conservation program – campus has grown 20% since 2000 but kept energy demand of campus flat
- Beginning process of converting from steam to hot water distribution to get ready for ESH – also have constructed thermal energy storage tank

<u>Sarah Carson</u>

- Recap: There is a climate emergency
- We need to be fossil fuel free

- We are pursuing the lowest carbon solutions
- District energy creates the lowest carbon opportunities
- Our decisions are aligned with NYS grid status
- We need policies that enable solutions

Q&A

- Peter: Seems to be division between two schools of thought on how best to proceed: 1) on one hand, provide heat pump systems to individual buildings; and 2) proceed with ESH
- But there is third option: campuswide geothermal exchange system like ones constructed at Ball State, Swarthmore, and Princeton that have lots of boreholes across their respective campuses
- Why has the focus been on drilling one deep hole?
- Wayne: Pursuing that option, which lots of our peer institutions have, would double electricity demand on campus compared to ESH
- Martha Robertson: It sounds as if CUBO has been successful and you got the information you were looking for – is that right?
- Wayne: Yes but still facing hurdle of finance – in process of responding to new DOE grant opportunity – working with Sen. Schumer's staff
- Martha: If physics work, then money will follow – wish you'd spent more time about apparent success of CUBO
- bethany ojalehto mays: It seems like we're all on the same page as far as understanding energy transition is going to be extremely hard – but why aren't we asking question of what costs to future generations will be of failure? Doesn't this acknowledge we'll be participating in a 4 degree higher world? Shouldn't elite institutions such as Cornell be communicating this message?
- Dan Antonioli: Are there any pre-1970 buildings that have been renovated or retrofitted to be an efficient building?
- Bert: We definitely have examples of that and I'd be happy to show you some of them
- Sarah: Energy intensity of our campus is down 25%
- In closing, Peter urged folks to focus on stopping expansion of fossil fuel industry – we also need to put pressure on governor to get her to change her direction on climate and energy issues as well as General Assembly – last legislative session was very disappointing
- Bob Howarth and Climate Action Council put together plan on how to get where we need to go and we've been diverted from that road by governor