

SUNY DECARBONIZATION – AN ELECTRIC PANEL DISCUSSION ON HEAT PUMP IMPLEMENTATIONS

NYAPPA Winter Conference
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Matthew Meyer, PE, LEED AP
Bill Bishop, PE, CEM, LEED AP
Bruce Buerger, PE
Aaron LaFave, CEM

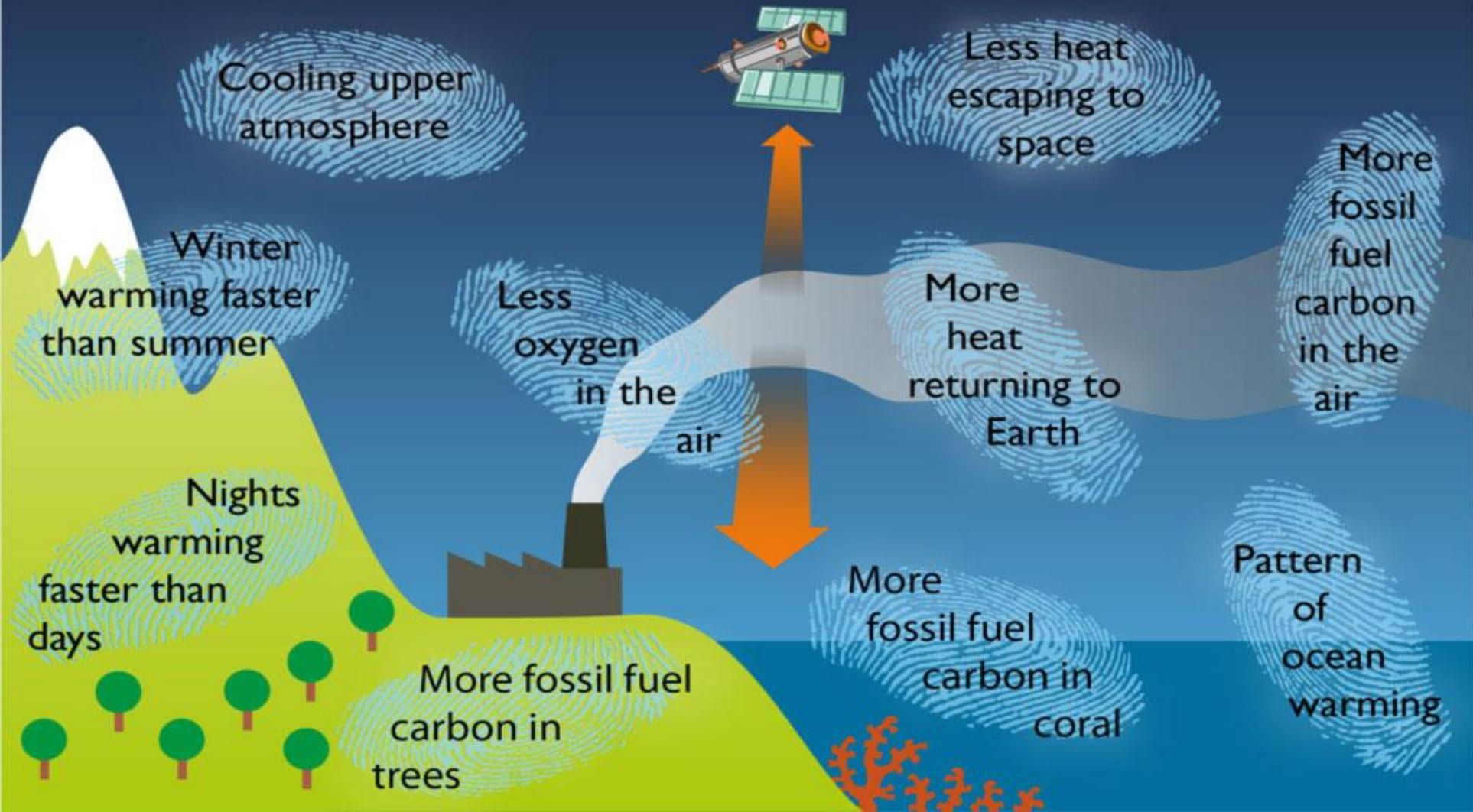
Panel Agenda

- New York State Decarbonization Refresher/Update
- SUNY Energy & Emissions Reductions & Electrification
- Recap of Deployed Solutions across SUNY
- Project Highlights
 - University at Buffalo
 - SUNY ESF
 - SUNY Poly
- Panel Discussion



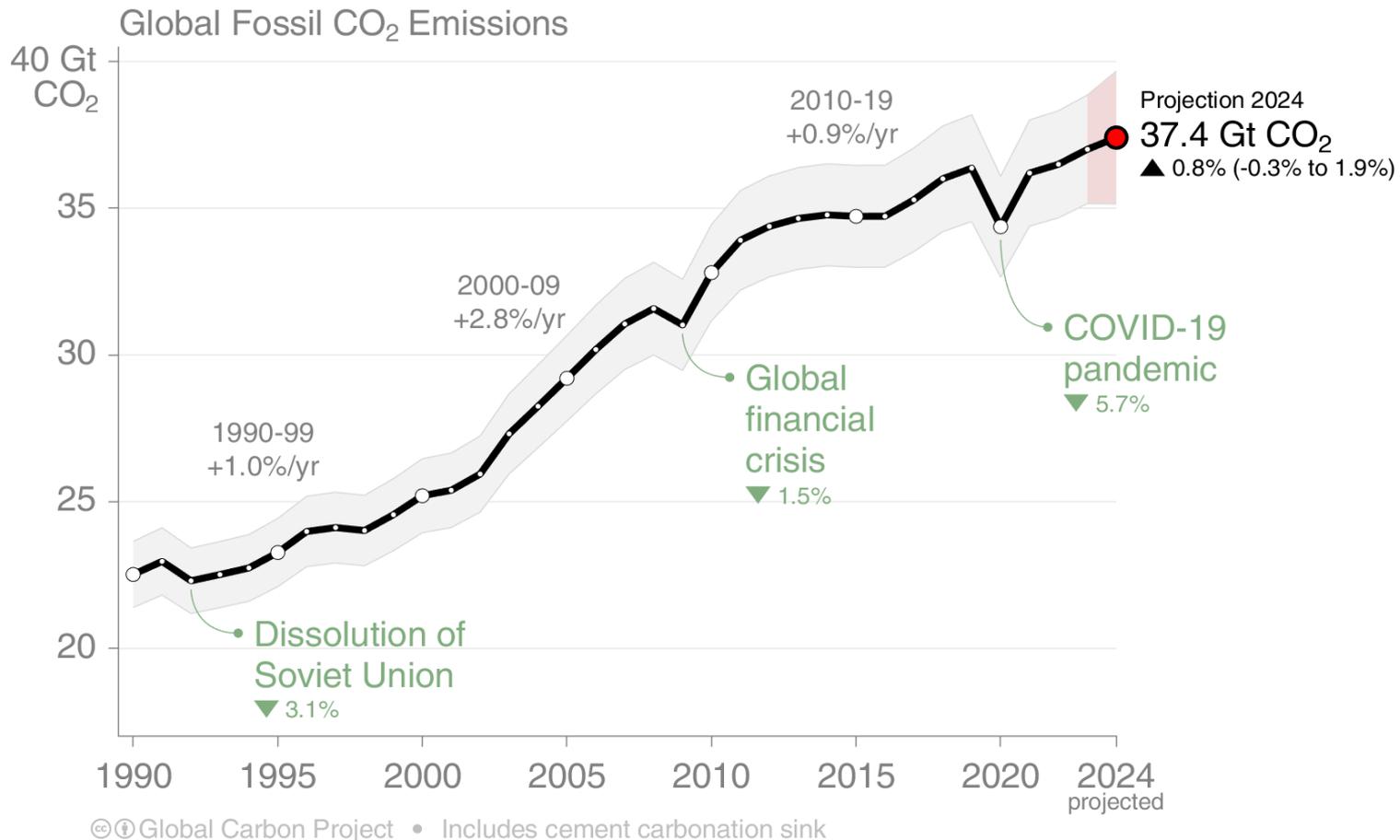
Greenhouse Gases & Global Warming

Human fingerprints are all over our climate



Climate change updates

Global fossil CO₂ emissions have risen steadily over the last decades. Emissions are set to grow again in 2024.

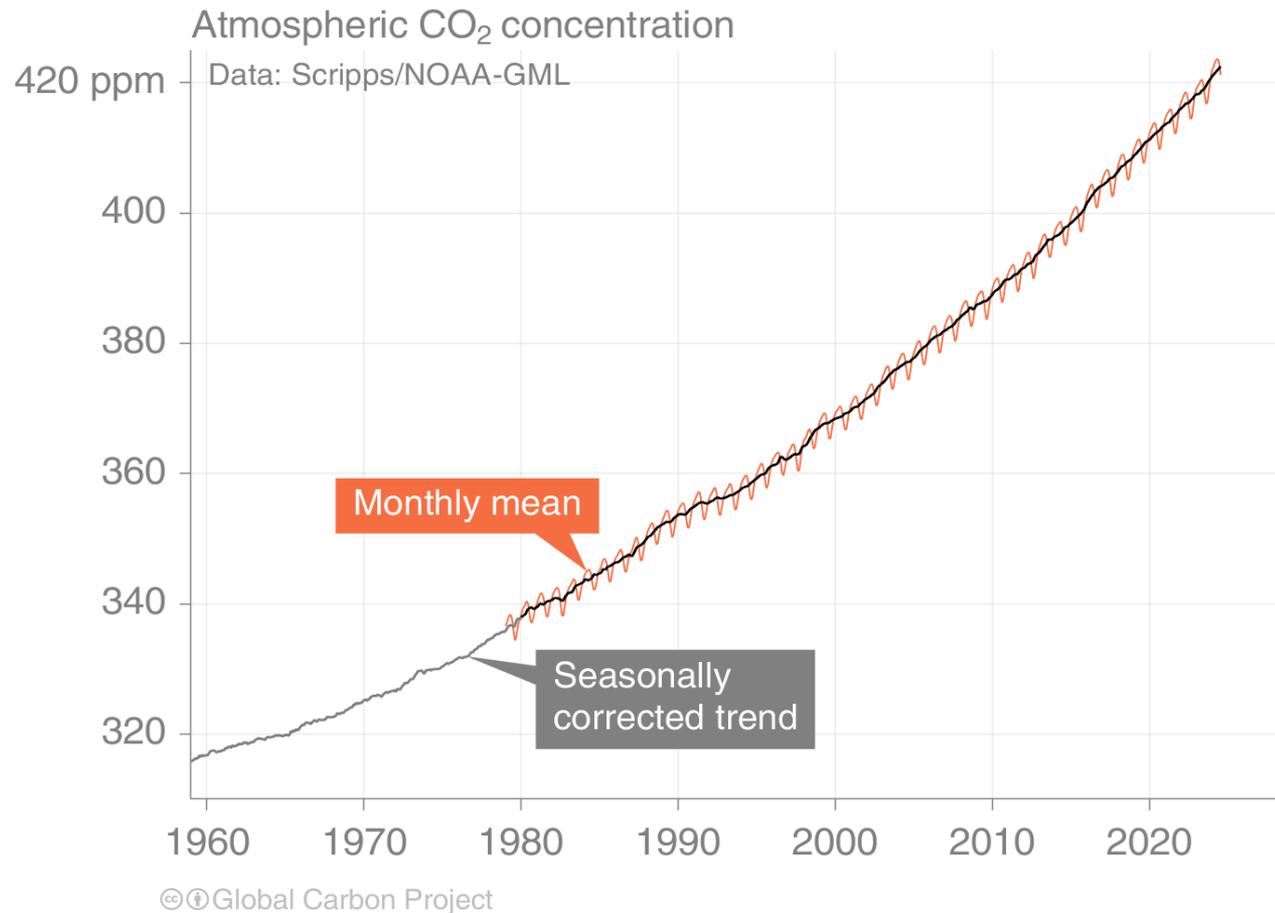


The 2024 projection is based on preliminary data and modelling. The global total includes a cement carbonation sink of 0.8 GtCO₂.

Source: [Friedlingstein et al 2024](#); [Global Carbon Project 2024](#)

Climate change updates

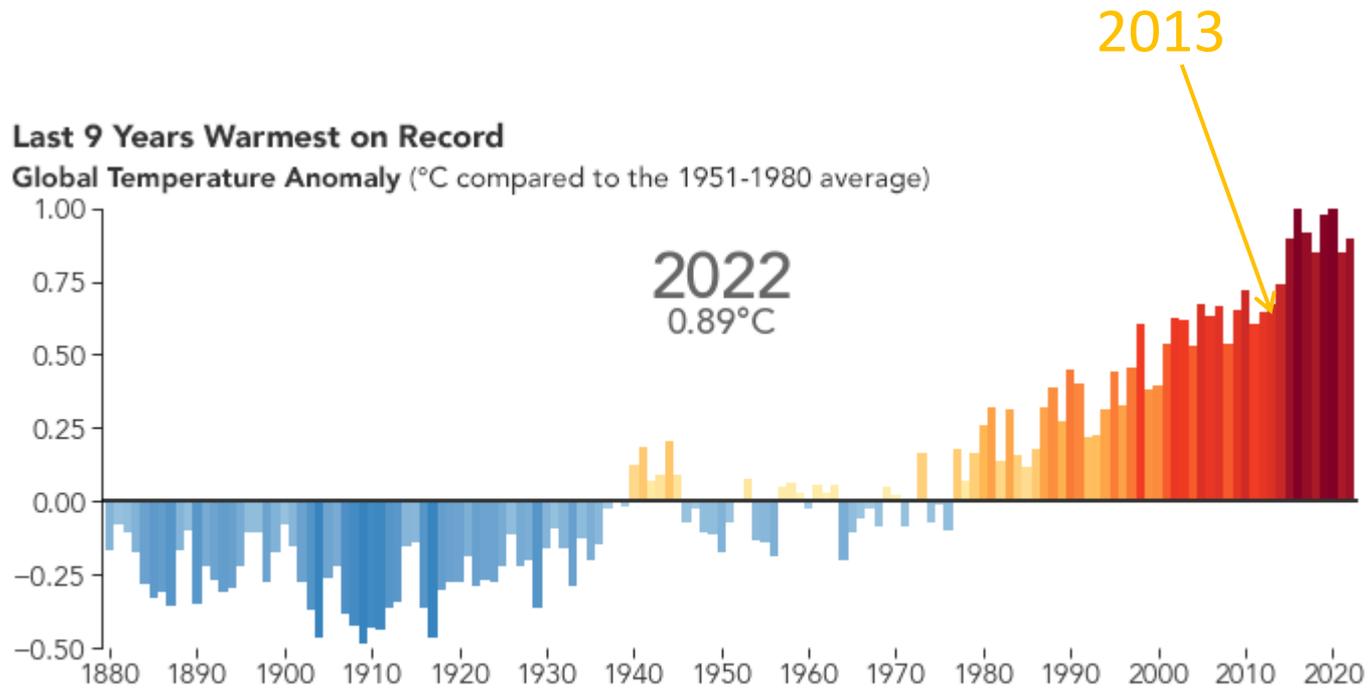
The global CO₂ concentration increased from ~277 ppm in 1750 to 422.5 ppm in 2024 (up 52%)



Globally averaged surface atmospheric CO₂ concentration. Data from: NOAA-GML after 1980; the Scripps Institution of Oceanography before 1980

Source: [NOAA-GML](#); [Scripps Institution of Oceanography](#); [Friedlingstein et al 2024](#); [Global Carbon Project 2024](#)

Climate change updates



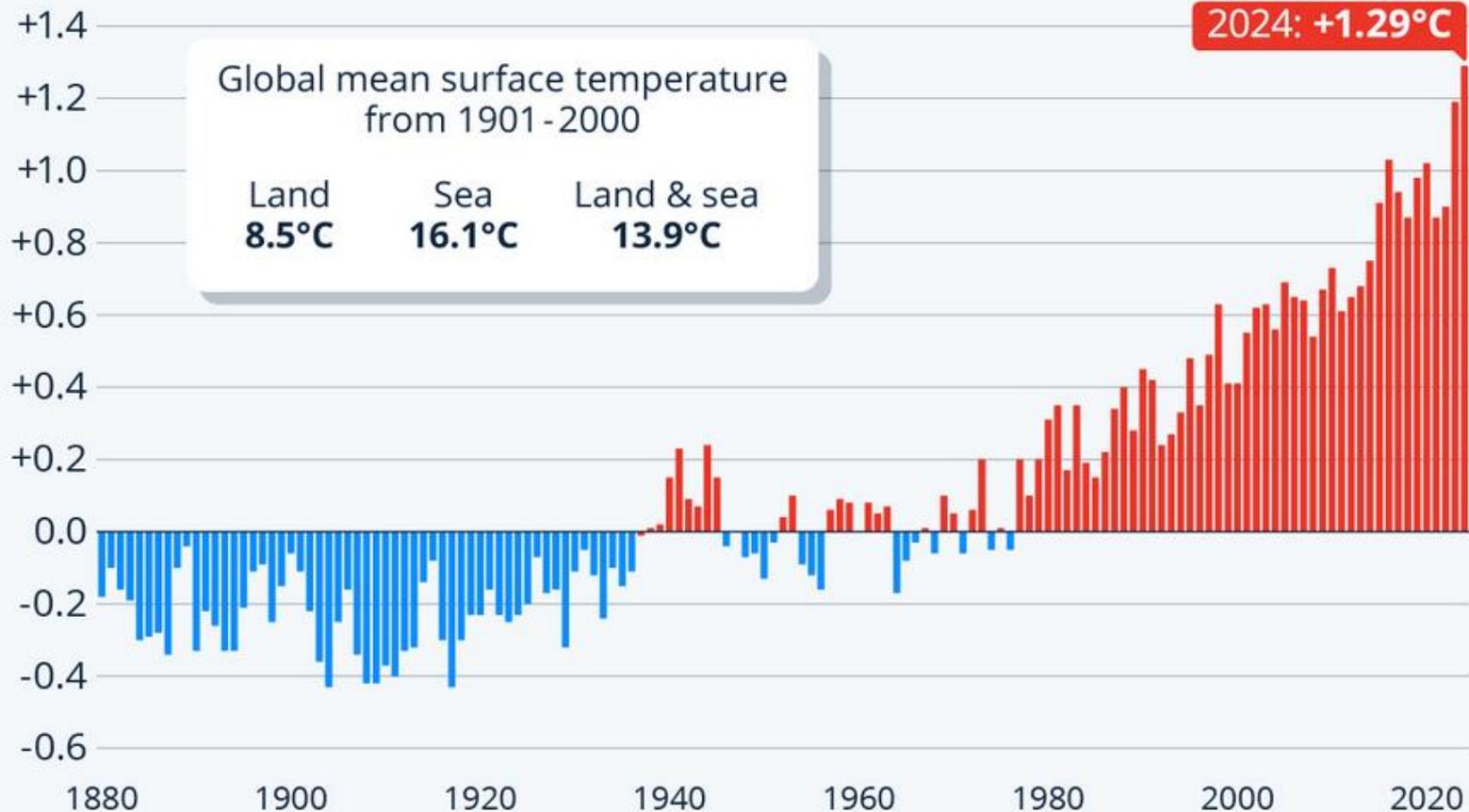
1880 - 2022

<https://earthobservatory.nasa.gov/images/150828/2022-tied-for-fifth-warmest-year-on-record>

Hottest in at least 12,000 years and maybe 125,000 years.

Climate change updates

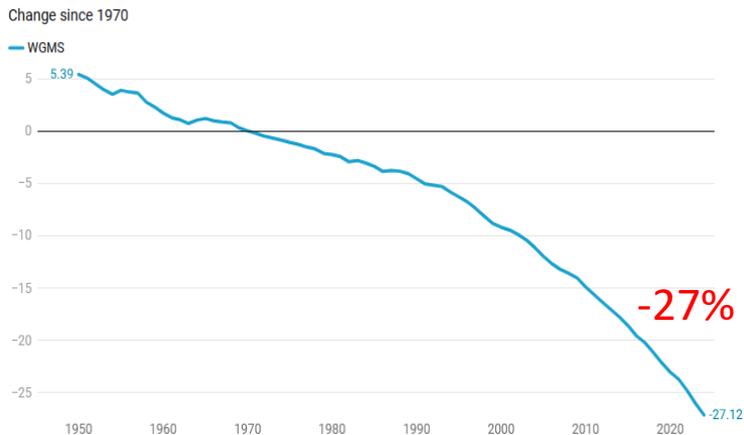
Global land and ocean surface temperature anomalies
(in degrees Celsius compared to the 1901-2000 average)



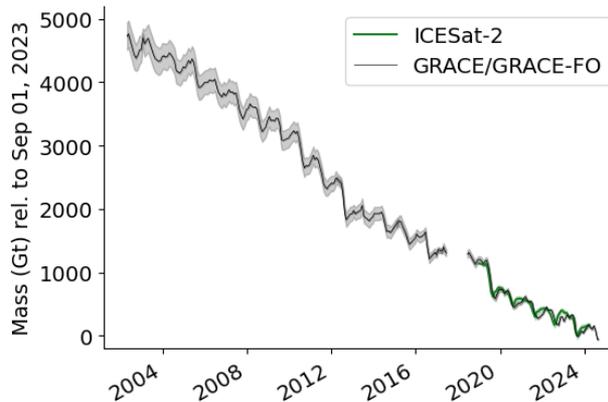
Source: NOAA National Centers for Environmental Information

Climate change updates – Ice Loss and Sea Level

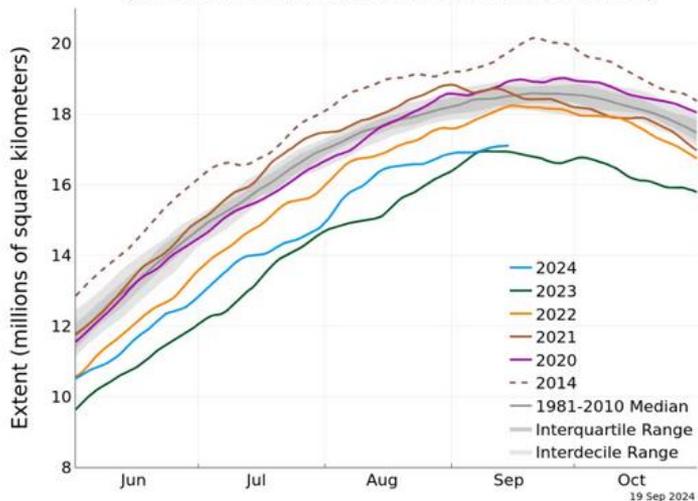
Glacier cumulative mass balance 1950-2024



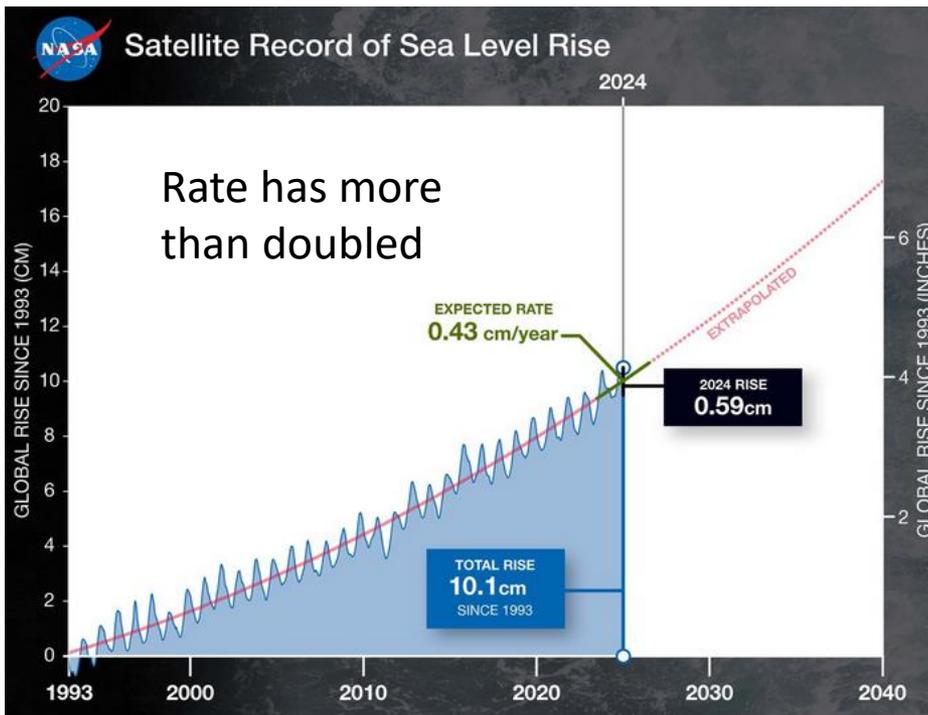
Greenland Ice Sheet



Antarctic Sea Ice Extent (Area of ocean with at least 15% sea ice)



Satellite Record of Sea Level Rise





DECARBONIZATION Practical Approach

FOUNDING PILLARS

1

ASSESS CARBON FOOTPRINT

Understand major
sources of carbon
emissions

2

OPTIMIZE PERFORMANCE

Minimize operational
and embodied
carbon

3

ELECTRIFICATION

Eliminate the use of
fossil fuels on site

4

OFFSET WITH RENEWABLES

Consider on-site,
off-site and
storage solutions

CLCPA



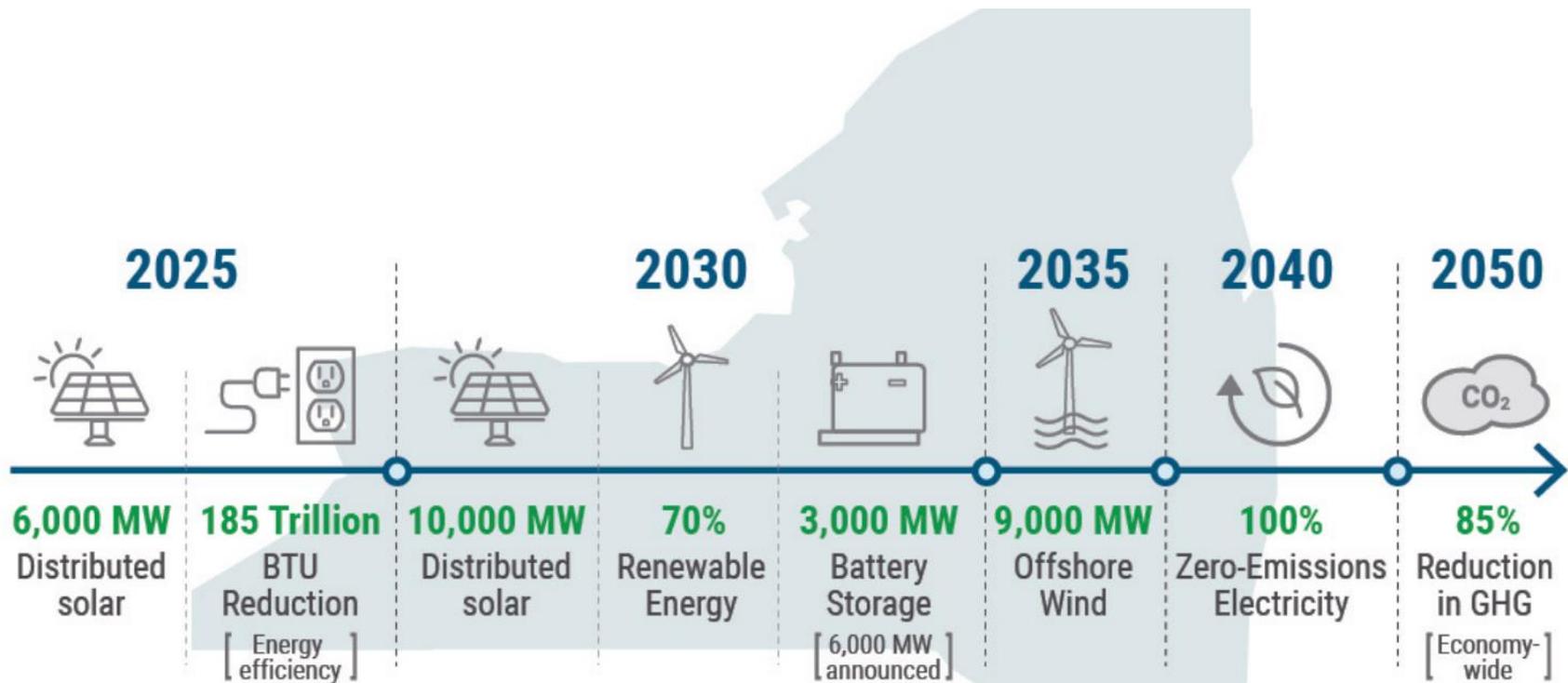
CLCPA

- ~~Conference?~~
- ~~Council?~~
- ~~Coordinated?~~
- ~~Corporate?~~
- ~~California?~~

NEW YORK'S CLIMATE LEADERSHIP and COMMUNITY PROTECTION ACT



New York energy policy goals



1

2

3

4

ASSESS CARBON
FOOTPRINT

OPTIMIZE
PERFORMANCE

ELECTRIFICATION

OFFSET WITH
RENEWABLES

Building Level – SUCF Directive 1B-2



State University
Construction Fund

Directive: 1B-2 CLCPA, E.O. 22 and SUNY Policy Compliance

Responsible Office: Design & Construction

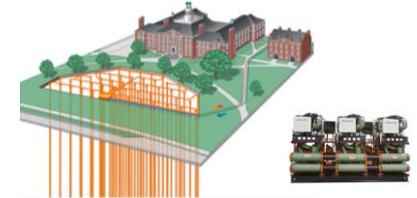
Last Revised Date: January 2024

- Aligns SUNY’s energy and carbon reduction goals with CLCPA
- Requires compliance with the NYStretch Energy Code – 2020
- Requires use of electric building systems and equipment
- Prohibits new on-site fossil fuel combustion except for emergency back-up power, emergency heat, and some process loads
- Discourages connection to fossil fuel-fired central plants
- Establishes maximum allowable site EUI values by project type and building/space type
- Requires embodied carbon reporting

Systems Recap

- Decentralized Water Source Heat Pumps (WSHPs)
 - Adiabatic Coolers
 - Condensing Boilers
 - Steam to HW Heat Exchangers
- Geothermal Water to Water Heat Pumps
 - Condensing Boiler Backup
 - Steam to HW Heat Exchangers
- Water-Cooled VRF
 - Geothermal Applications
- Air-Cooled Chillers & AHSP HW Heaters
 - Steam to HW Heat Exchangers
- District Chilled Water and WSHPs
 - Steam to HW Heat Exchangers

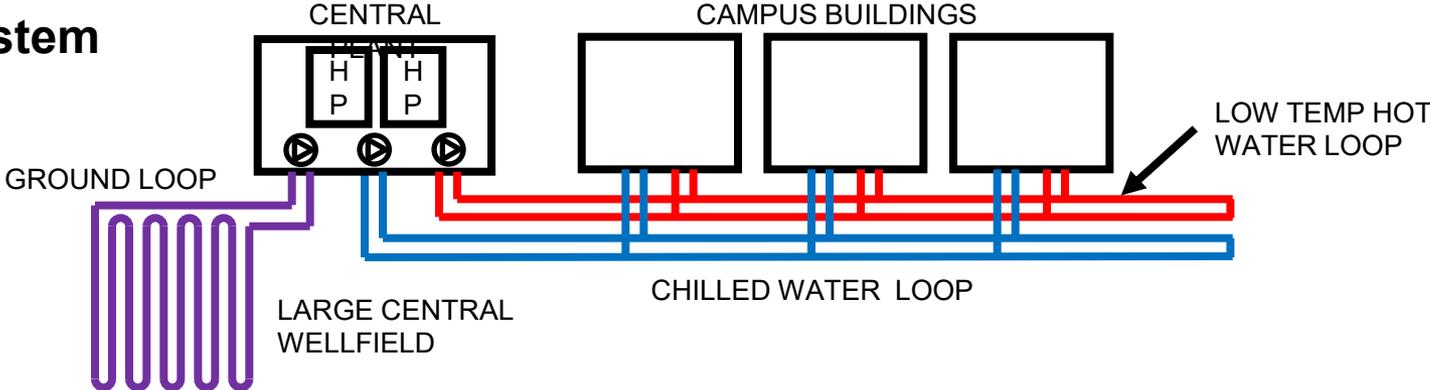
Generating HWS



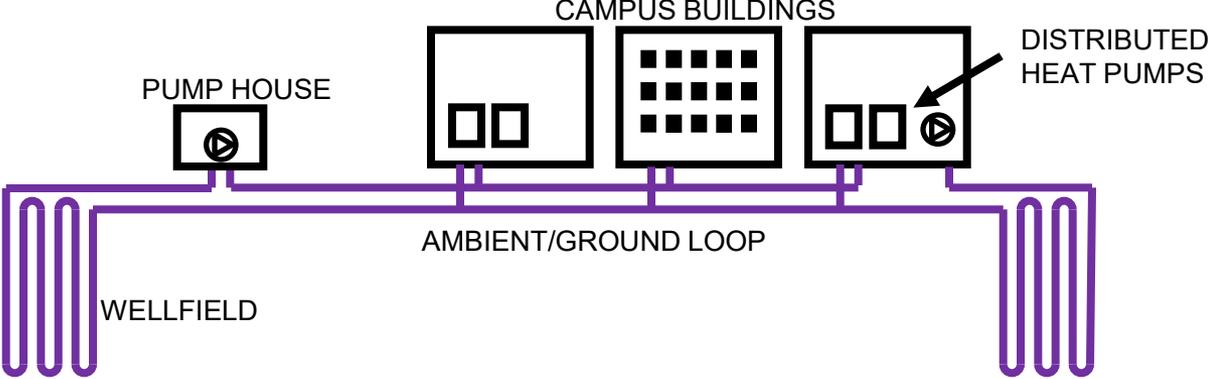
	Electric resistance	Air Source Heat Pump	Heat recovery chiller	Geothermal WTW HP
Minimum OA operating temp.	NA	0 - 15 F	NA	NA
Heating COP	1.0	2.0 - 3.5	3.5 - 7.0	4.0 - 5.5
Key Benefit	Lowest first cost	Energy cost on par with gas when OA >30F	High COP at any OA temp	Ground heat exchange, not air
Key Limitation	High energy cost 3x+	Minimum OA temp Low HWS temp Capacity falls off as OA drops	Only handles simultaneous load Maintenance and min. load	Well field size and cost
Max HWS temp	Same as gas	125 - 130 F	130 - 140 F	130 - 140 F

Campus Electrification: Clean Energy Technology Summary

4G System



5G System



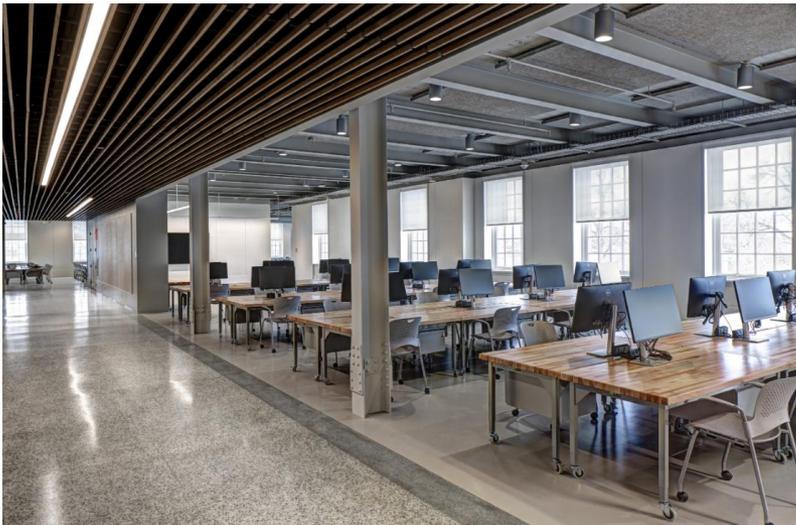
Dozens of Projects in Design & Construction



Project Spotlights

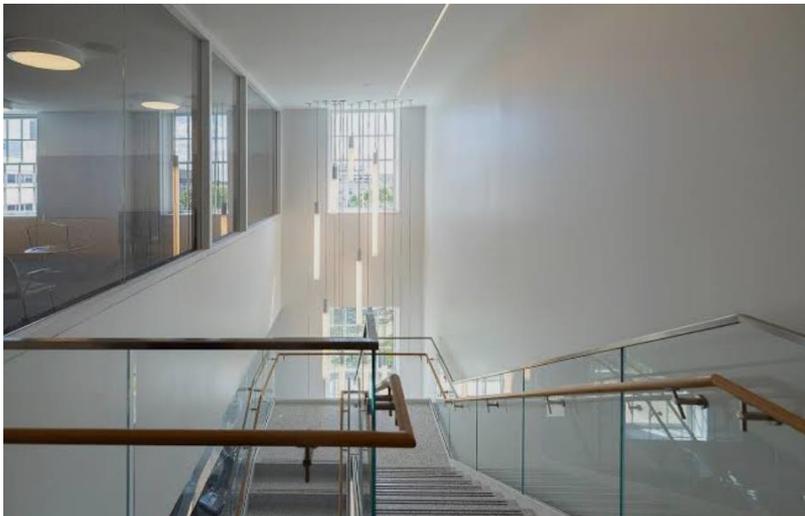
- University at Buffalo
 - Crosby Hall
 - Foster Hall
- SUNY ESF
 - Marshall Hall
- SUNY Polytechnic
 - Hilltop Residence Hall
 - Campus Center

UB – Crosby Hall



- 65,000 sf – Deep Energy Retrofit
- \$21 Million Construction Cost
- Completed in 2023
- Envelope Upgrades
 - New Windows
 - Exterior Wall Improvements
- WSHPs w/ Steam Backup

UB – Foster Hall



- 77,000 sf – Deep Energy Retrofit
- \$40 Million Construction Cost
- Completed in 2025
- Envelope Upgrades
 - New Windows
 - Exterior Wall Improvements
- WSHPs w/ Steam Backup

SUNY ESF - Marshall Hall



- 90,000 sf – Deep Energy Retrofit
- \$32 Million Construction Cost
- Completed in 2023
- Envelope Upgrades
 - New Windows
- WSHPs w/ Adiabatic Coolers and Condensing Boilers



SUNY Poly - Hilltop Residence Hall



- 78,000 sf – New Build
- \$28 Million Construction Cost
- Completed in 2020
- Geothermal VRF
- Net Zero Carbon Design



SUNY Poly - Campus Center



- 120,000 sf – Deep Energy Retrofit
- \$32 Million Construction Cost
- Complete in 2026
- Envelope Upgrades
 - New Windows
 - Exterior Wall Improvements
- Geothermal WWHPs w/ Condensing Boiler Backup



Fireside Chat

Panel Discussion

- Successes
- Challenges
- Lessons Learned

Campus Implementation

- Question 1 - How successful has your campus been at meeting the State's and SUNY's goals for decarbonization and electrification?

Directive 1B-2 Benefits

- Question 2 - On your Campus's projects to date, how have you benefited from pursuing and complying with these SUNY goals and directives?

Post Construction Performance

- Question 3 - How are these recent projects performing?

System Commissioning

- Question 4 – How important was the role of commissioning in the success of your project(s)?

Campus Operations

- Question 5 – How have campus operations personnel been able to adapt to operating and maintaining these newer fully electrified systems?

Training Personnel

- Question 6 – Has there been a need for additional training and have you been able to identify reliable training resources?

Electrical Infrastructure Challenges

- Question 7 - What concerns or challenges have you had with grid electric supply and building electrical service capacity to support these projects?

Renewables Integration

- Question 8 – What is your approach to renewables and solar PV at the building and Campus level?
Will the new energy code expedite implementation of PV?

Building Upgrade Challenges

- Questions 9 – What unique challenges have you had to overcome upgrading these existing buildings?

Change in Approach?

- Question 10 - Has your approach changed on how you plan to implement future electrification and decarb projects on your Campus?

Questions?



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