



TIM VP,
District
Energy
PEER
PRESENTS

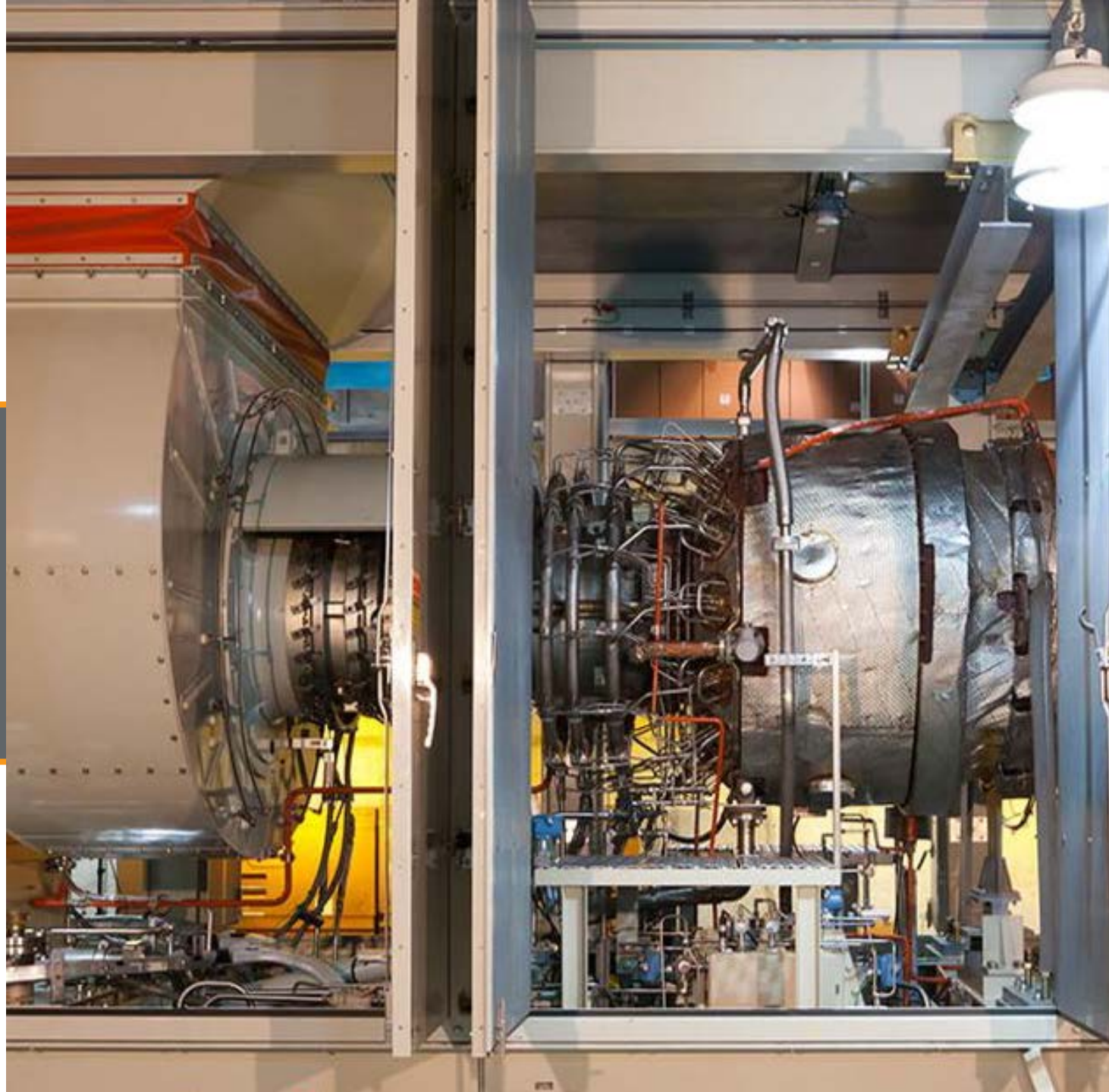
CLIMATE CHANGE AND RESILIENT DISTRICT ENERGY

Microgrid 2017
CONFERENCE

Nov. 6-8, 2017 • Boston, MA



INTERNATIONAL
DISTRICT ENERGY
ASSOCIATION



AGENDA



- Climate Change
- Grid Decarbonization
- District Energy
- Unique Solutions

CLIMATE CHANGE

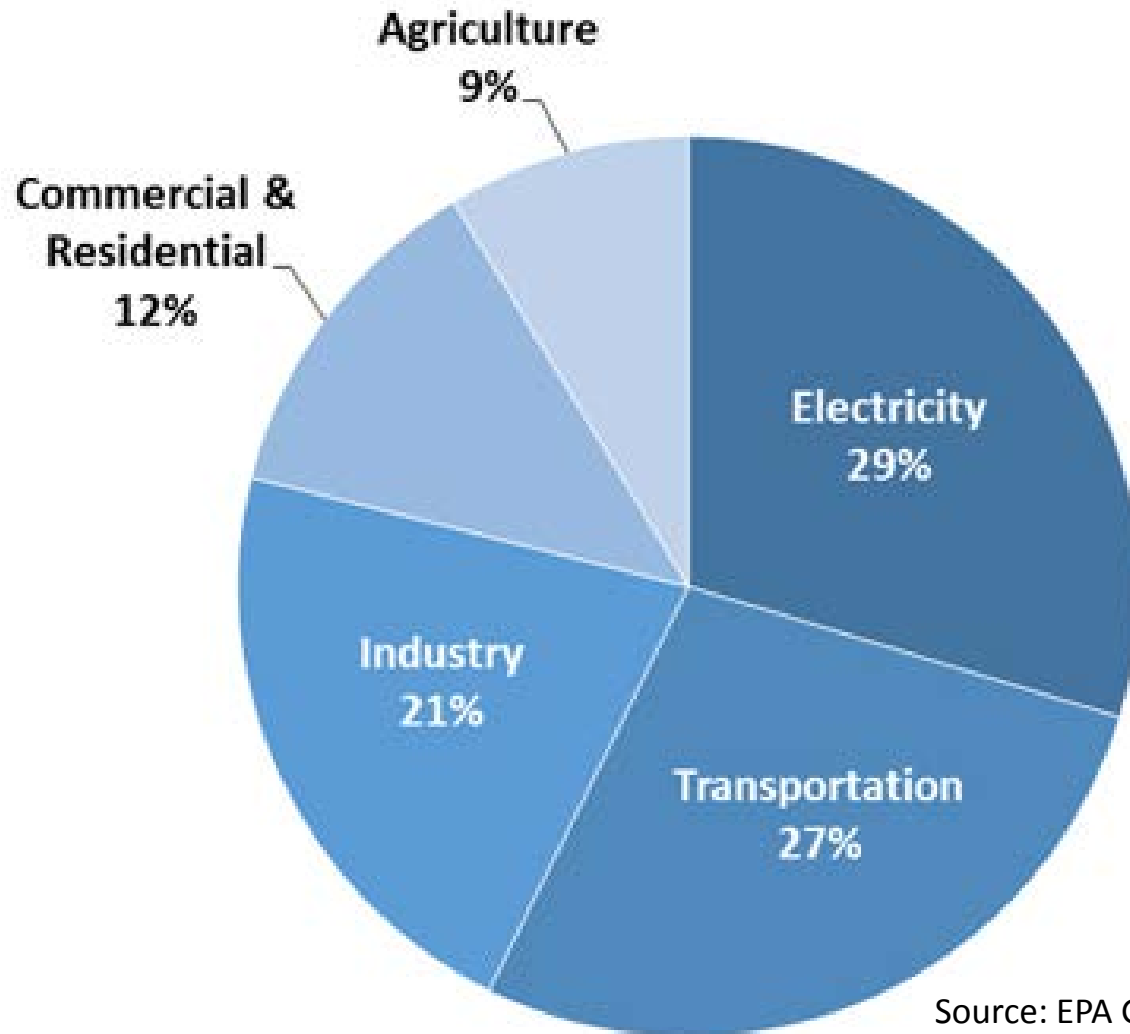


*“Everybody talks about the weather
but nobody does anything about it.”*

- Mark Twain



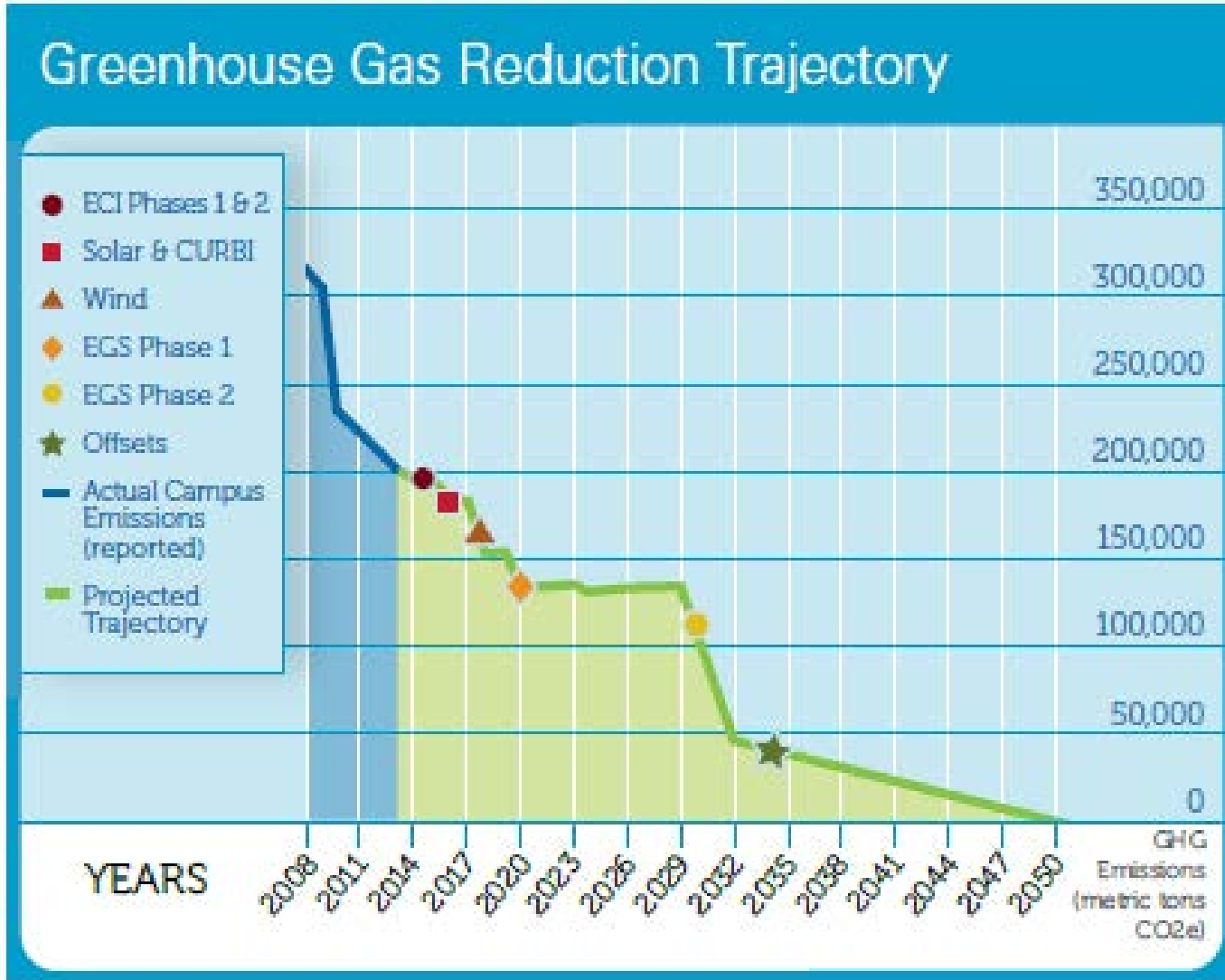
WHAT WE KNOW



- Greenhouse Gasses Trap Heat and Make the Planet Warmer
- Human Activity is Mostly Responsible
- Largest Source is Fossil Fuel Combustion

**Total US Greenhouse Gas Emissions
By Economic Sector in 2015**

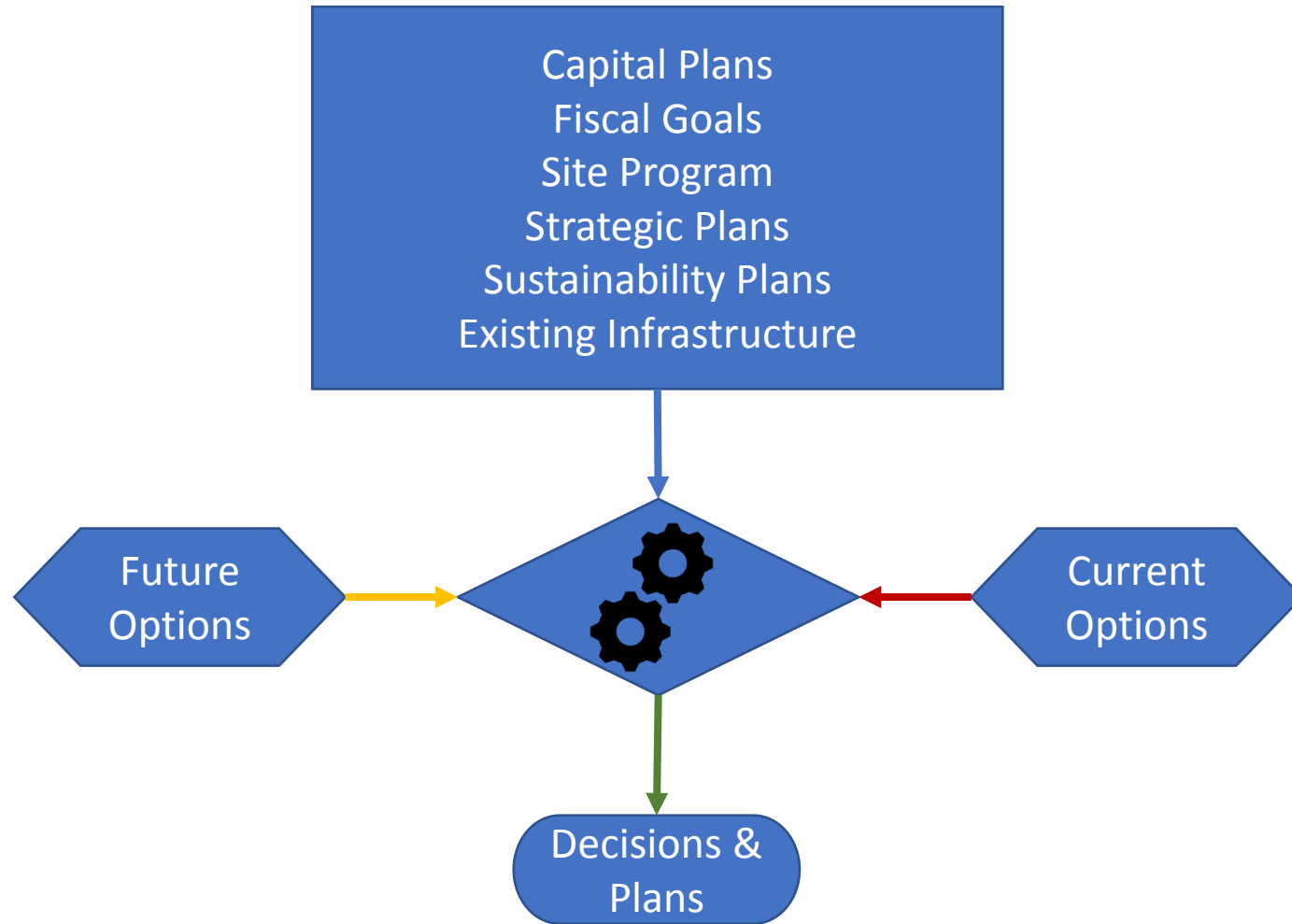
HOW ARE WE REACTING?



Source: Cornell University Climate Action Plan

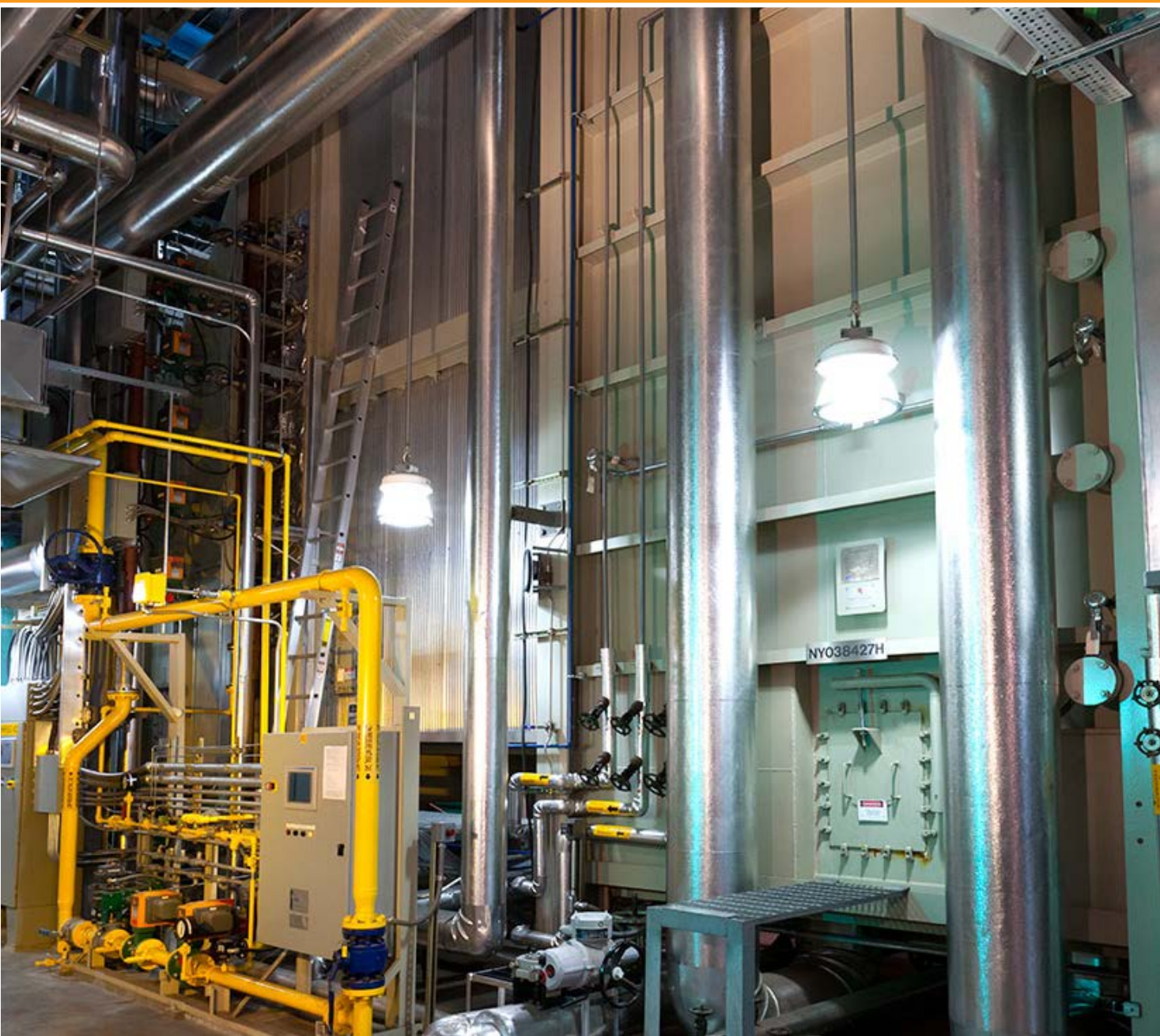
- **Grid Decarbonization**
 - NYS Clean Energy Standard
 - MA Bill H.4568
- **Resiliency Initiatives**
 - NYS REV
 - HUD Sandy Recovery Grants
- **Explicit Carbon Neutrality Goals**
 - ACUPCC – Climate Action Plans
- **Fossil Fuel Resistance**
 - Sierra Club – Beyond Natural Gas

NORTHEAST FOCUS



- Use Less
- Obtain Low Emission Energy
 - Heating
 - Cooling
 - Power
- Build In System Resiliency

GRID DECARBONIZATION



*“The road to success
is always under construction.”*

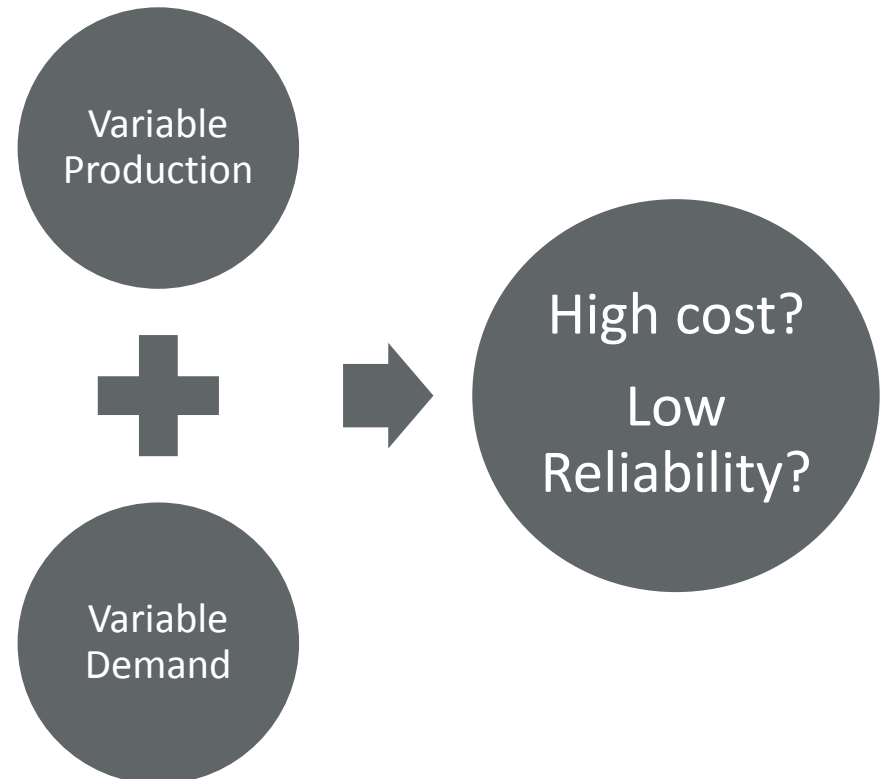
- Arnold Palmer

SEEMS SIMPLE

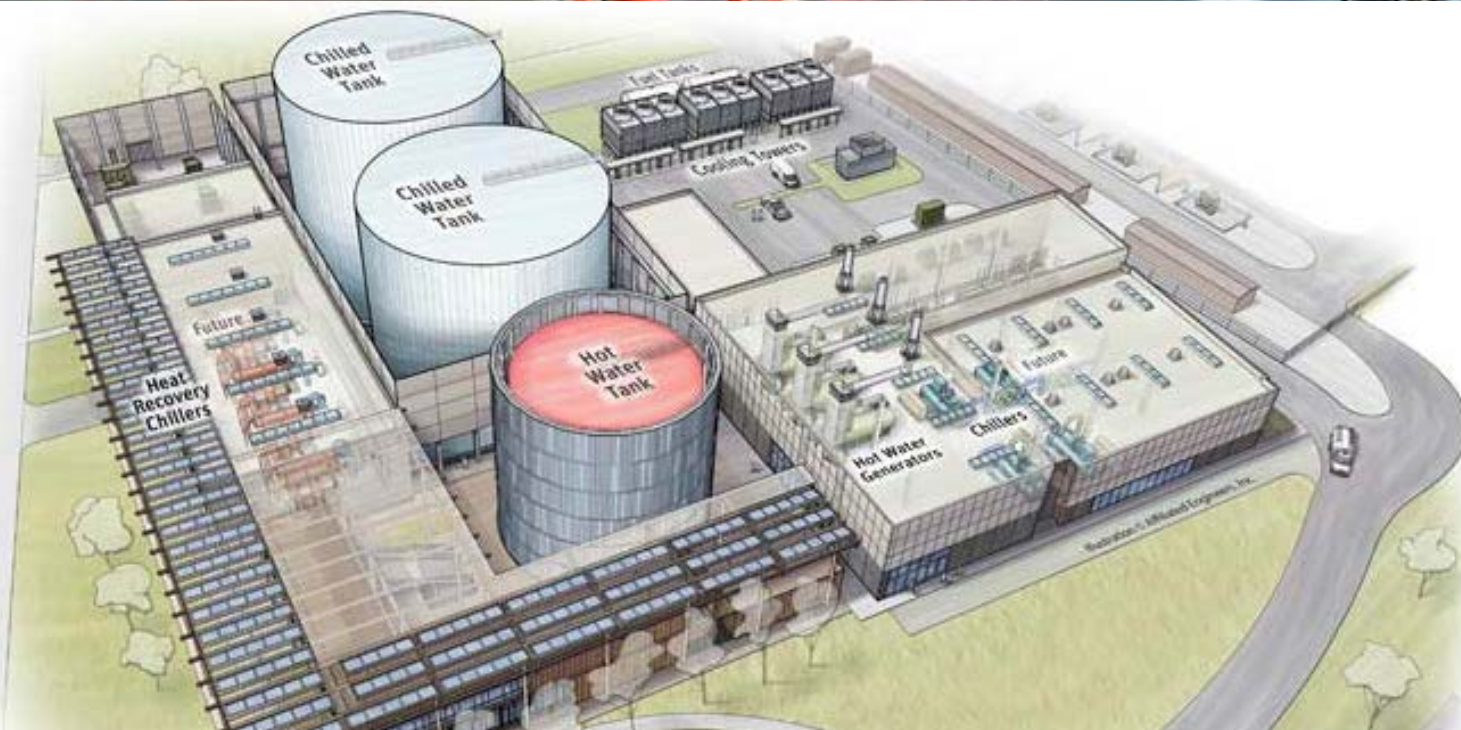


"Don't let perfection be the enemy of doing the right thing."

- Bruce Anders, Markham District Energy



ELECTRIFICATION

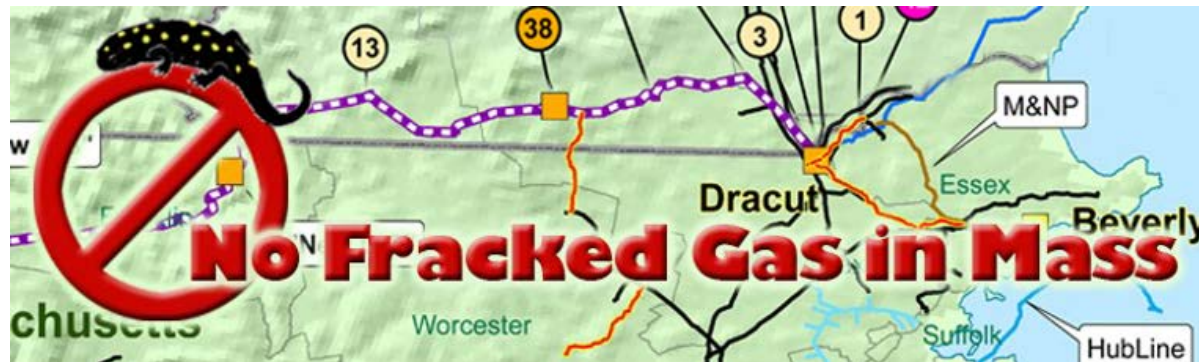


- **PROS**
 - Clean (future)
 - Simple (depends on scale)
 - Technology (exists)
- **CONS**
 - Conversion & Operating Costs
 - Logistics Challenges
 - Seasonal Thermal Imbalance
 - Low Resiliency
 - Grid Constraints

STOPPING FOSSIL FUEL DEVELOPMENT

Environmental activists want all renewable now, and have a simple strategy:
Stop Fossil Fuel Development, In Particular Natural Gas Infrastructure.

* Fossil fuel infrastructure prevents future renewable development?



All potential solutions have technical, environmental, and land use impacts





“District Energy is a platform based solution.”

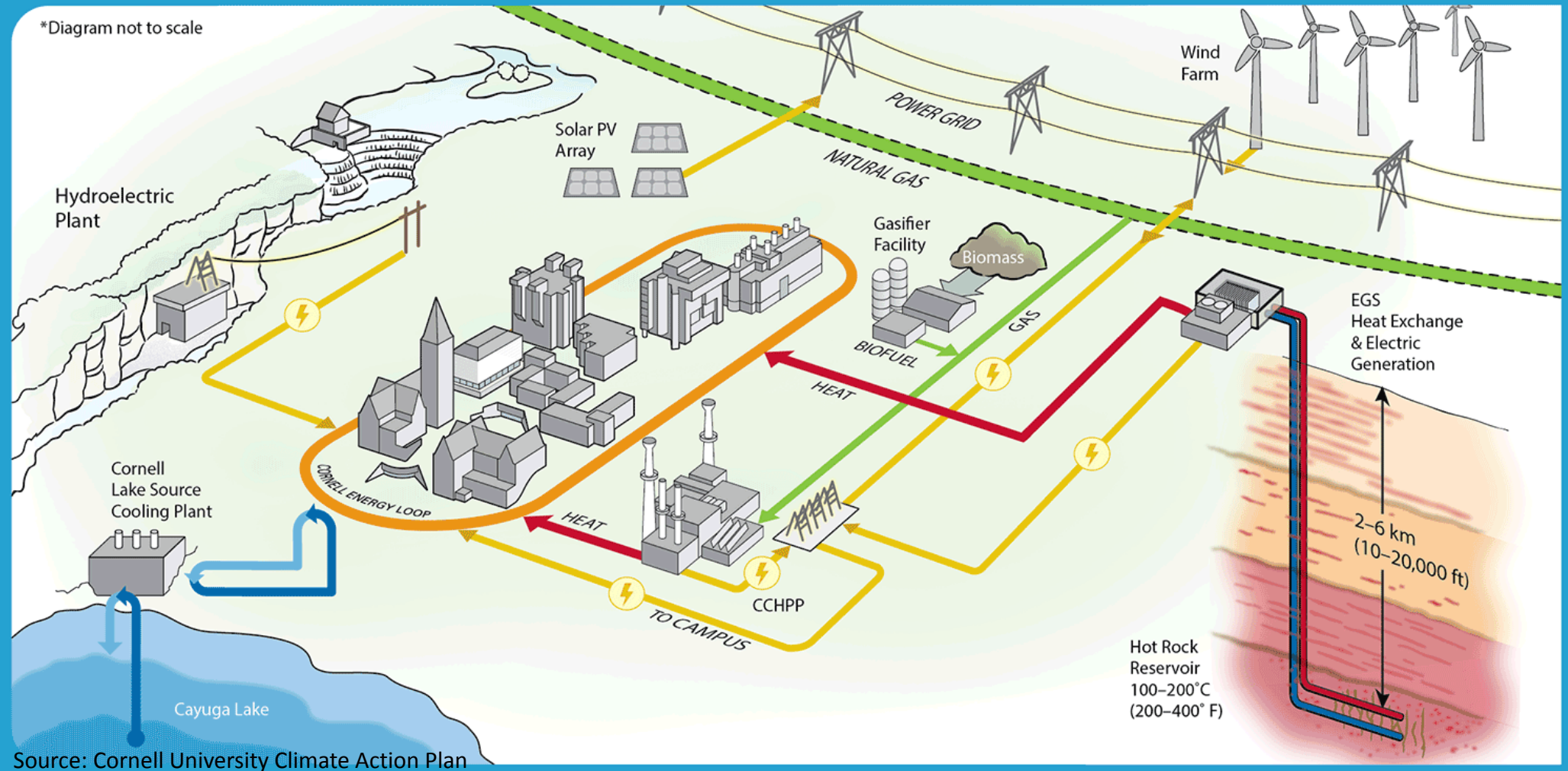
- Brian Deese

PORTFOLIO APPROACH

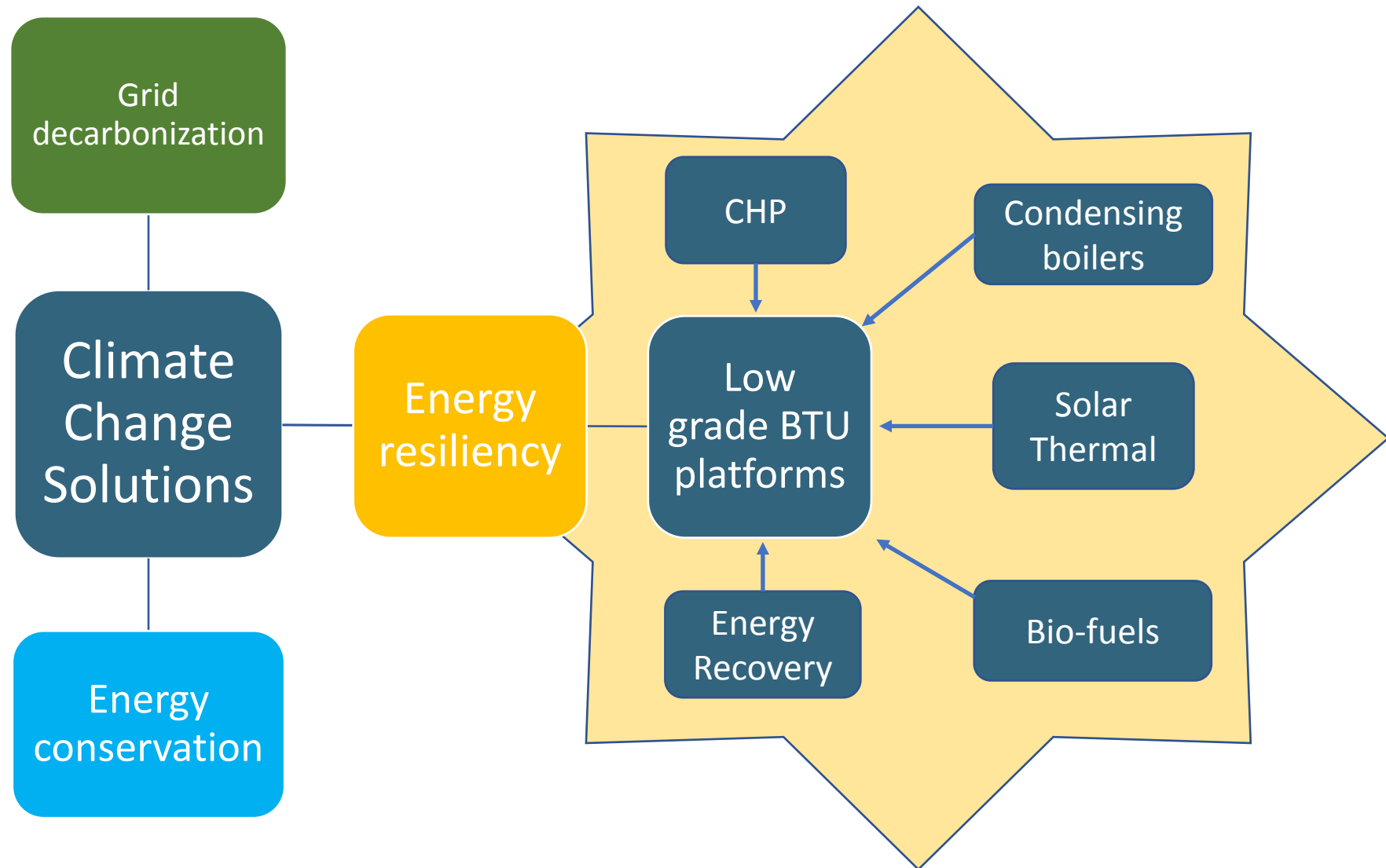
100% renewables are not in our immediate future

Campus Energy Infrastructure

*Diagram not to scale



MICROGRID DECARBONIZATION



DISTRICT ENERGY IN THE FUTURE

- The Value of District Energy Platforms Will Increase
- The Low Carbon Future Will and Should Include Natural Gas



WHERE IS THIS ALL GOING?



“Knowing what’s right doesn’t mean much unless you do what’s right.”

- Theodore Roosevelt

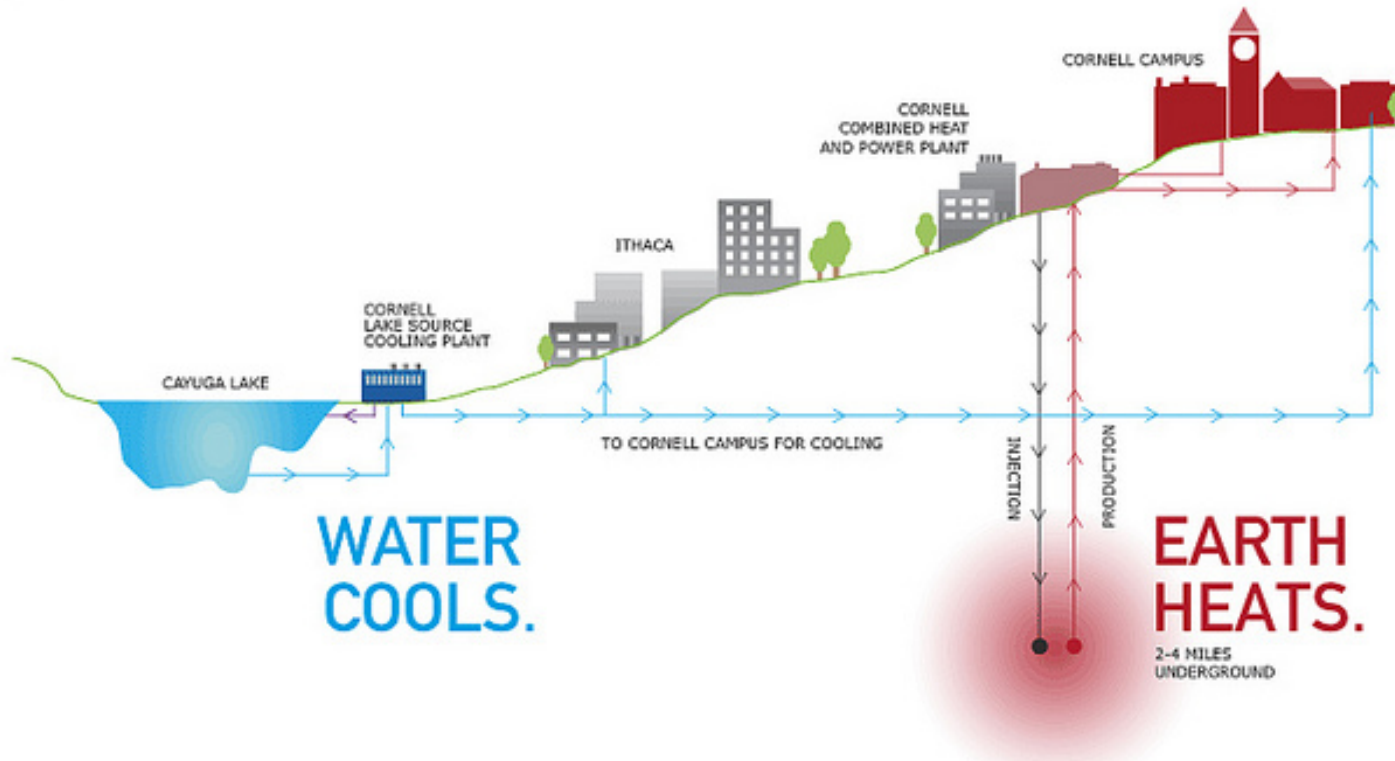
ISSUES TO PONDER



- Electrify - Give up on resiliency? Long term goal may not materialize?
- CHP - Long term commitment to fossil fuels or bridge to future?
 - Can demonstrate a regional methane reduction with CHP
 - CHP provides a future platform for biologically derived fuels
- Wait and See – business as usual can still couple with low grade BTU platform
 - Can't lose with this near term decision as it provides optimal future optionality
- Unique, Location Based Solutions

LOCATION BASED SOLUTIONS

HYBRID EGS SYSTEM: UTILIZING EARTH'S NATURAL ENERGY



Source: Cornell University Climate Action Plan

- Stanford University - Large Scale Energy Recovery Chillers
- Ball State College - Ground Source Geothermal
- Dartmouth College - Biomass (Under Consideration)
- Cornell University – Enhanced Geothermal System (Under Consideration)

System Commonality?
Low Grade BTU Platform

(low / medium temperature hot water)

Building a better society through enduring relationships

The logo consists of a solid orange square. Inside the square, the word "BOND" is written in white, uppercase, sans-serif font, positioned in the lower right corner of the square.

BOND