Onsite Energy Technical Assistance Partnerships
U.S. DEPARTMENT OF ENERGY
New York-New Jersey

Data Centers and Greenhouses: How Combined Heat and Power can Unlock Reliability and Efficiency

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Onsite Energy Program

The U.S. Department of Energy's (DOE) Onsite Energy Program provides technical assistance, market analysis, and best practices to help industrial facilities and other large energy users increase the adoption of onsite energy technologies.

battery storage | combined heat and power | district energy | fuel cells | geothermal | industrial heat pumps

renewable fuels | solar PV | solar thermal | thermal storage | waste heat to power | wind

Onsite Energy Technical Assistance Partnerships (TAPs)

DOE's 10 regional Onsite Energy TAPs provide technical assistance to industrial facilities and other stakeholders about technology options for achieving onsite energy objectives. Key services include:

- **Technology screenings** and **data analysis** of economic and operational impacts of installing combined heat and power (CHP) and other onsite technologies.
- **Partnerships** and **engagements** with organizations representing industrial and other large energy users, such as data centers, to advance near-term solutions to energy needs and reduce costs with onsite energy.
- **Technical information** and **resources to educate** state and local government, industry, and other stakeholders to increase industrial competitiveness.

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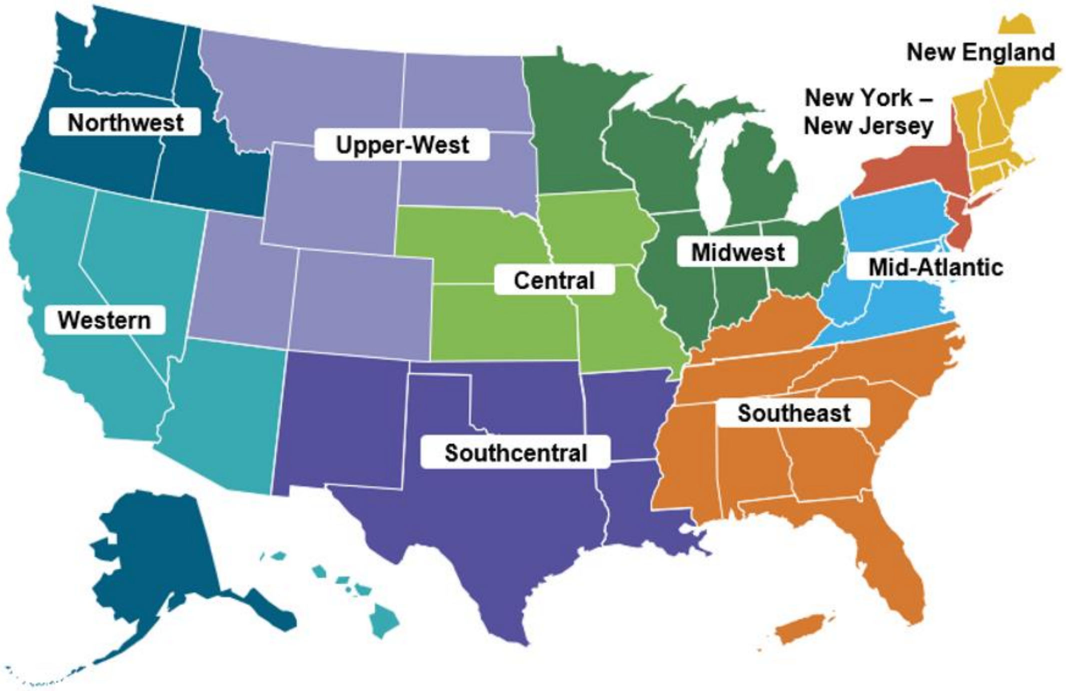
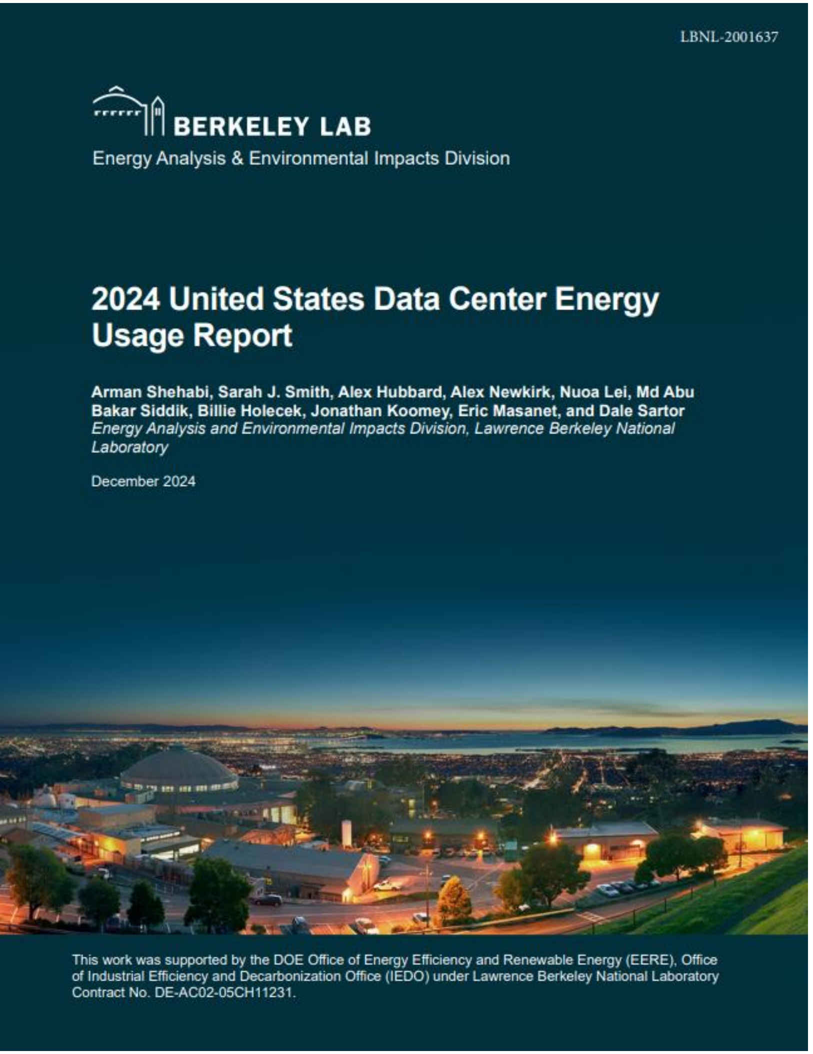




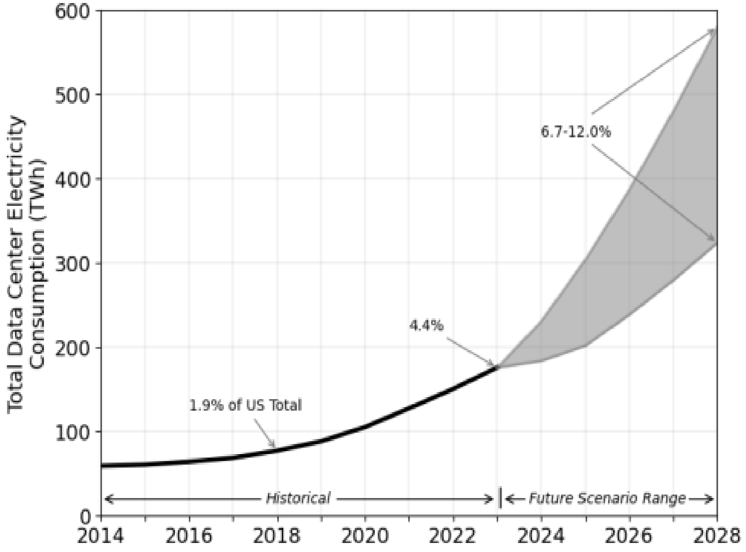


Figure ES-1. Total U.S. data center electricity use from 2014 through 2028.

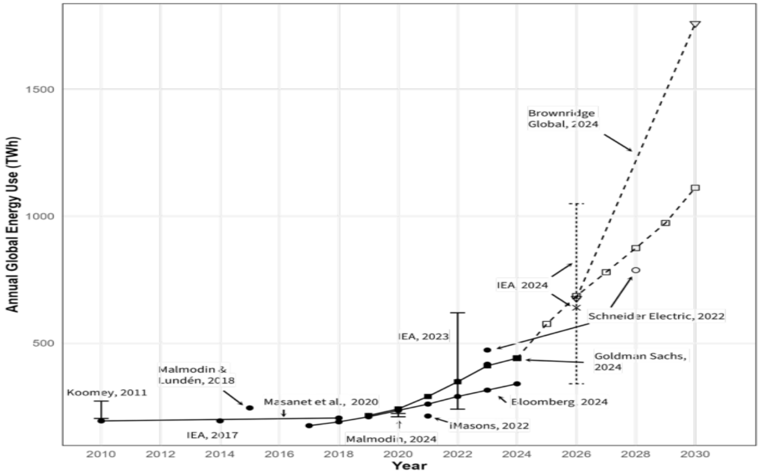
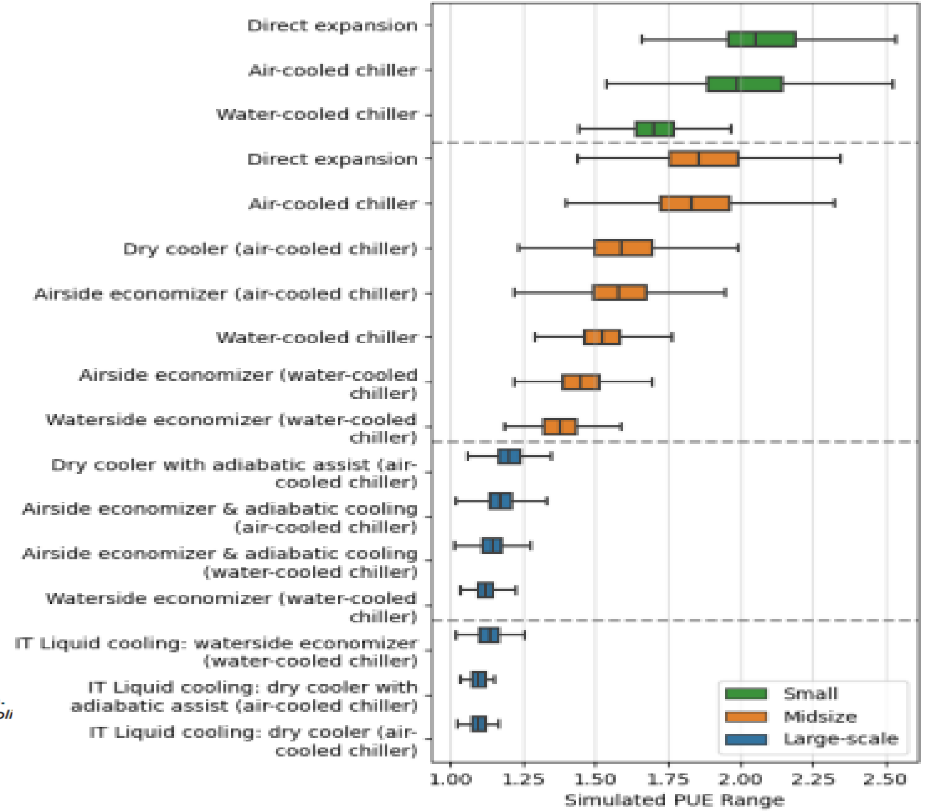


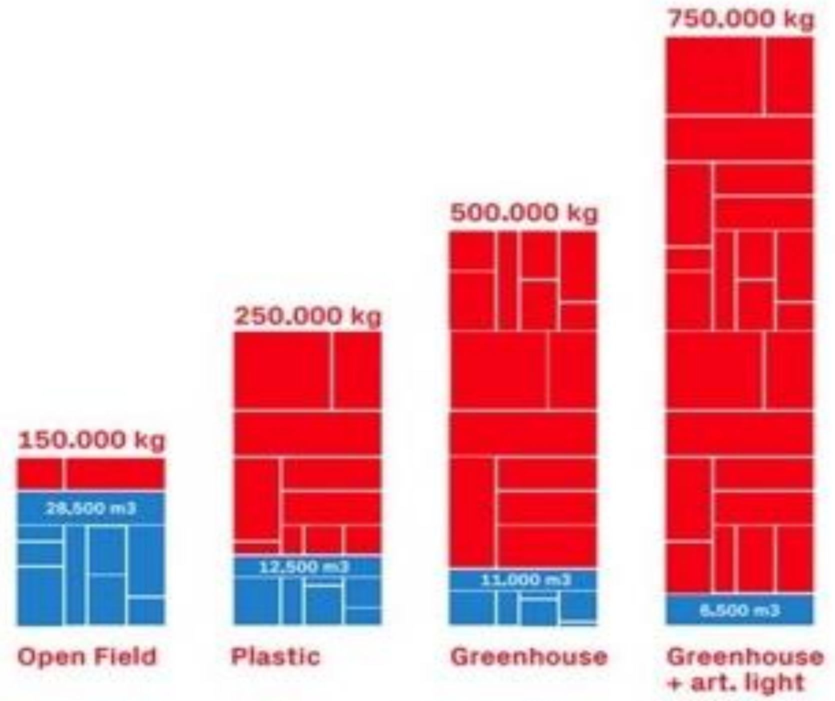
Figure 1.2. Academic and industry historical estimates of global data center energy use. *Plot also includes future projections from those sources. Historical estimates are shown with soli and projections are shown with dashed lines.*

- Rising demand, outpacing projections
- Constant demand
- ITE, cooling are main end-uses
- Efficiency focus



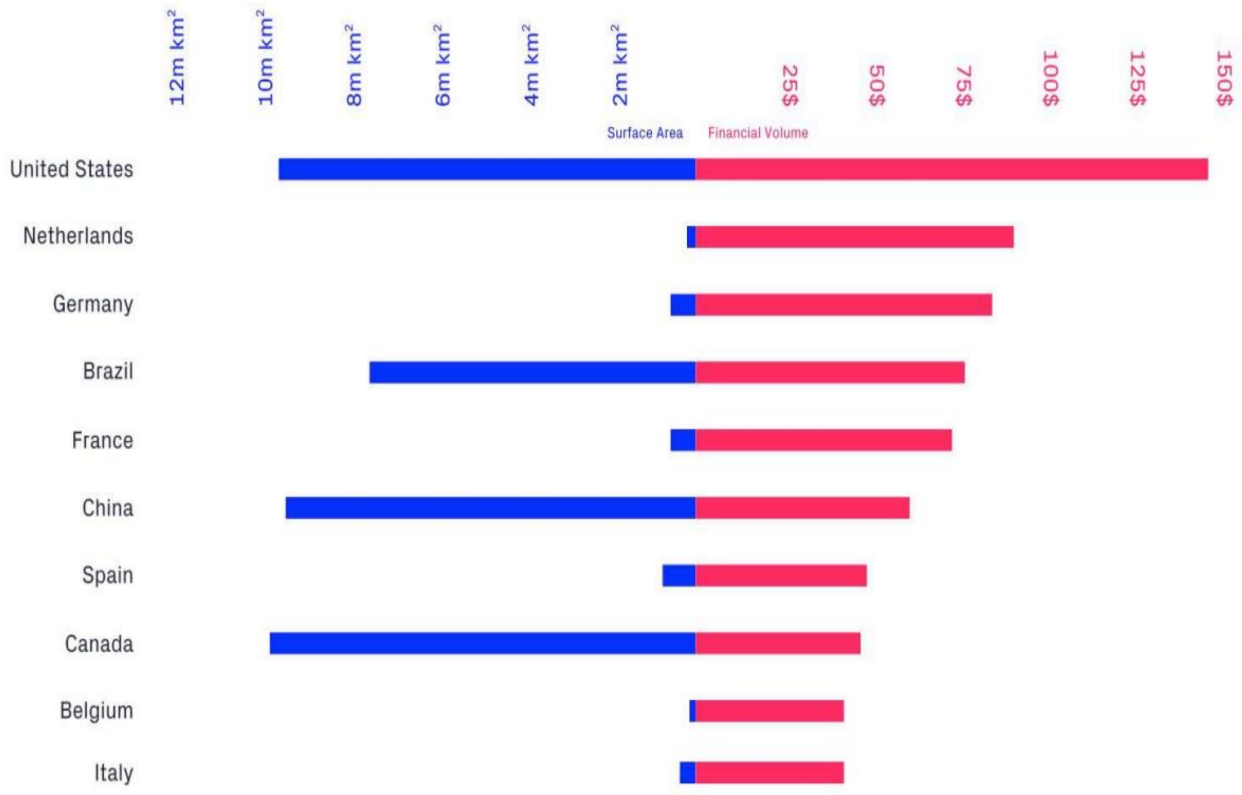
Energy, Water, Food Nexus

High-tech greenhouses deliver 5-7x crop production while consuming 60-90% less water



Tomato production on one hectare vs. water consumption (Dutch Greenhouse Delta 2021).

The Netherlands has proven this concept, becoming the world's 2nd largest exporter of food crops despite being smaller than 41 U.S. states



Project Need and Purpose

Energy

- Resiliency and Reliability in energy transition
- Distributed, Dispatchable Resources
- Efficient use of combustion byproducts

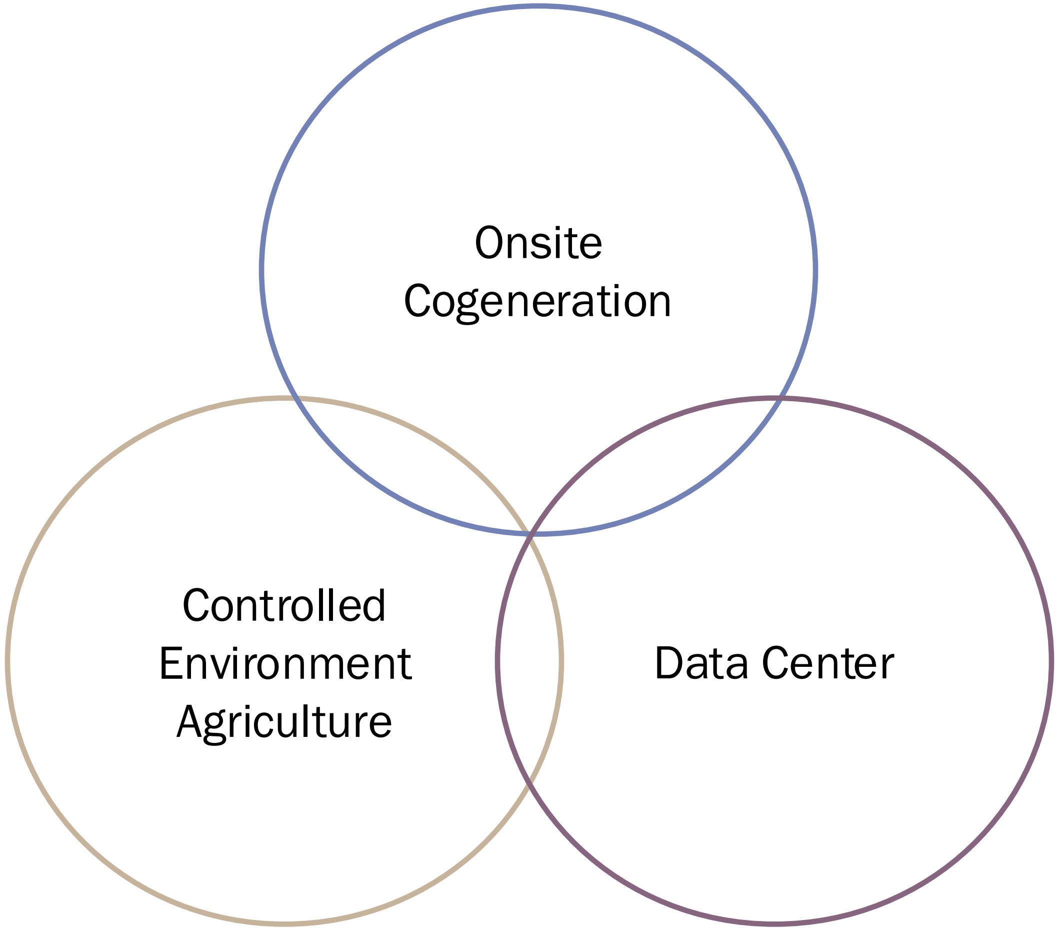
Food, Water, Energy Nexus

- 60% Increased food demand
- Food resiliency

Data Centers

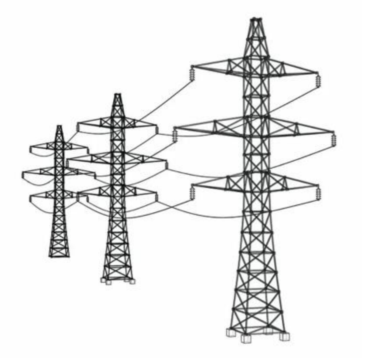
- Energy Availability
- Energy Efficiency
- Waste Heat

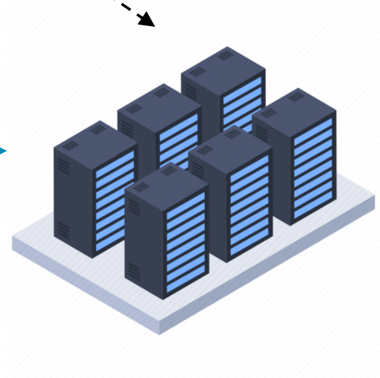
Context and Objective



Data Centers + CEA + Onsite Power

- Reliable Power
- Inexpensive CO2
- Efficient Power & Heating





- Reliable, Resilient Power
- Cleaner than diesel
- Efficient
- Potential for absorption cooling

Electricity Flexibility

Flexible Lighting: 3-day DLI average

Energy-Aware Job Scheduling
for AI Batch workloads

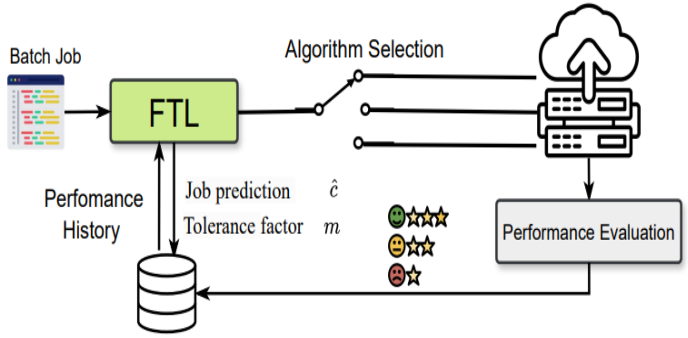
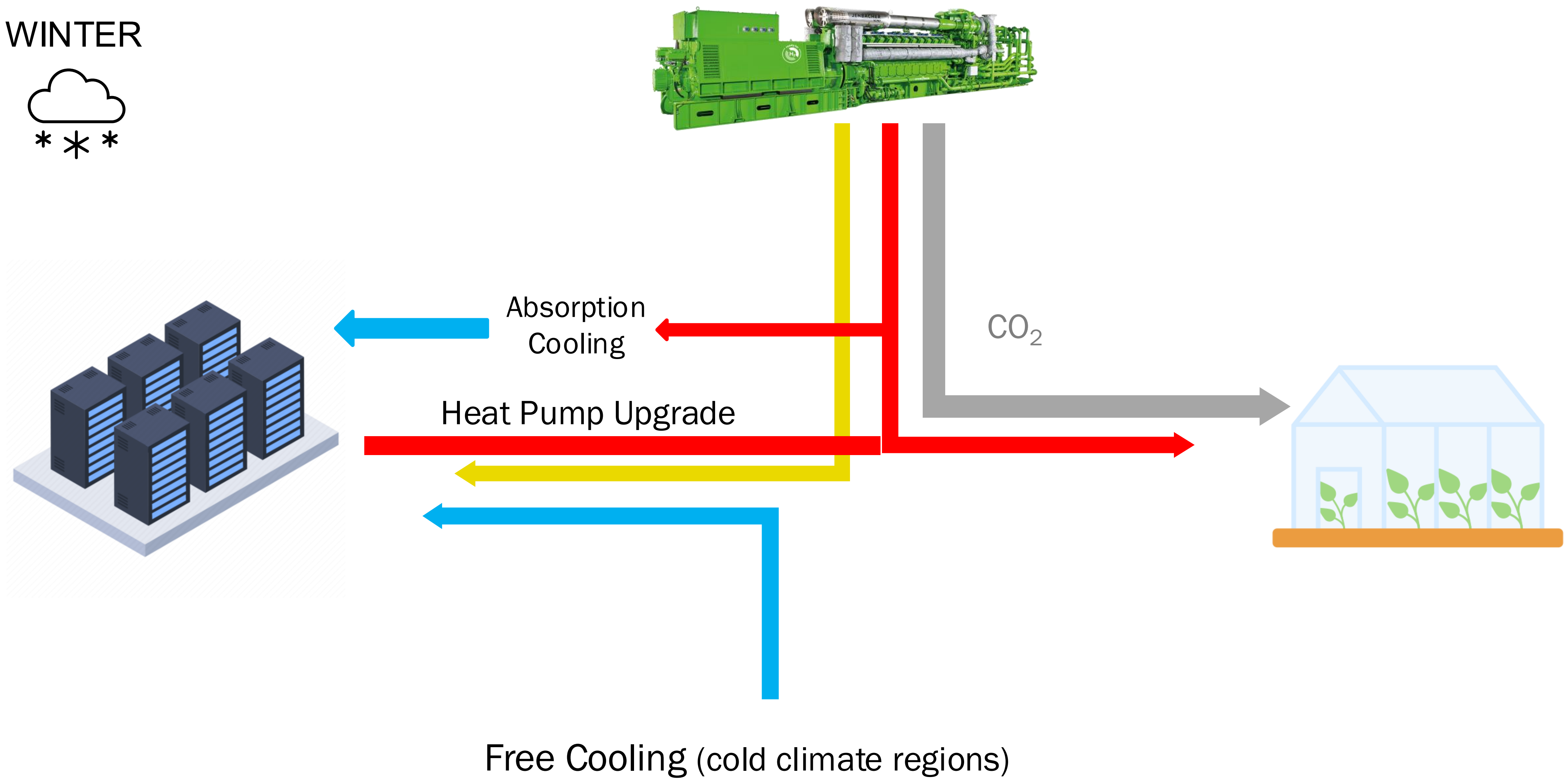


Fig. 1. FTL Design

Data-driven Algorithm Selection for Carbon-Aware Scheduling

High Efficiency Part-load, Quick Ramping

Thermal Combination of Data Centers & CEA



Integration of CHP w/ CEA
Biogas Power & Heat in Shared Systems (Districts)

HoSt's 2020 State-of-Art Biomass CHP Plant:
Produces 15 MW thermal + 3.4 MW electrical power

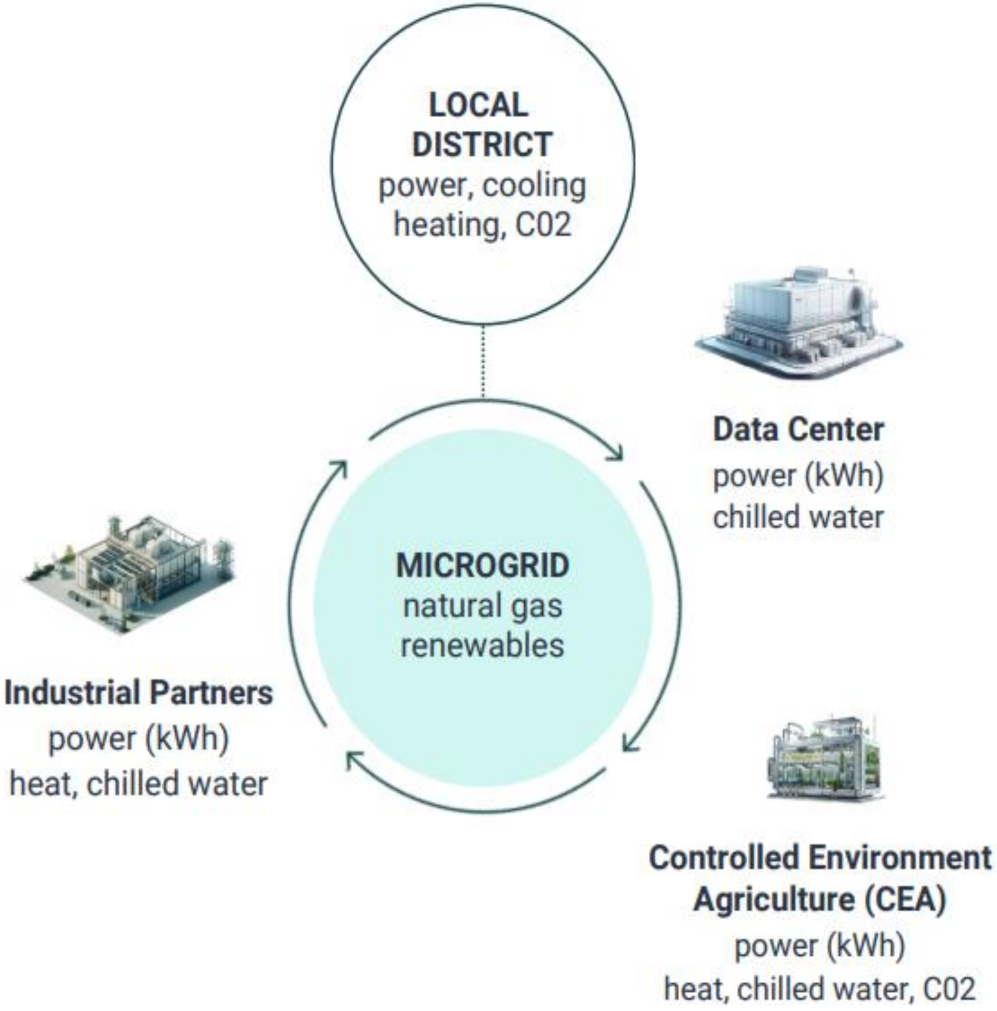
- Biomass-fired combined heat and power (CHP) plant in Andijk, Netherlands
- Produces heat and electricity delivered to six greenhouse companies.
- NOx emission reduction >99%
- CO_2 captured from flue gas
- Excess heat and electricity for district thermal or electric microgrids.

Q-Scale | Levis, Quebec

Awarded the "North American Data Center Project of the Year" at the DCD Global Awards 2023

Eco Datacenter &WA3RM | Sweden

Two data centers adjacent greenhouses using waste heat



Transformation from a decommissioned 2 GW coal-fired power plant to a state-of-the-art 4.5 GW natural gas-powered data center campus

The redevelopment project, led by Homer City Redevelopment (HCR) in partnership with Kiewit Power Constructors Co., plans to transform the 3,200-acre , decommissioned, coal-fired power plant brownfield site into the Homer City Energy Campus, via construction of a 4.5-gigawatt natural gas-fired power plant, making it the largest of its kind in the United States. This plant will utilize seven high-efficiency, hydrogen-enabled turbines.

This move is part of a broader trend in the data center industry to retrofit power plants and energy facilities to meet soaring digital infrastructure demand or co-locate data centers with industries having complementary energy demands.

Key Stakeholders and Involved Parties

- Energy Regulators and Policy Makers
- Grid Operator and Utilities
- Data Center Industry and developers
- State / Local Agencies managing organic waste initiatives
- Affected industries and trade associations
  - Greenhouse Lighting and Systems Engineering Consortium – GLASE
  - Onsite power companies and RNG industry
  - Farms - food waste generators – waste management enterprises

Onsite TAP Stakeholder Engagement

Intended Outcomes

- Accelerate pathways for integration of onsite energy technologies via the sharing of public tools, resources, and best practices.
- Build partnerships across the U.S. industrial sector to drive competitiveness for American manufacturers.
- Scope and develop requests for technical assistance.
- Remove barriers to adoption of onsite energy technologies through educational efforts, strategic meetings, workshops or webinars, presentations, or staffing of event booths.
- Provide technical analysis to inform the design and development of programs that encourage the adoption of onsite energy technologies.

Technical Challenges| Risk Management |Opportunities

Challenges

- Technical Integration
- The temperature of the waste heat (low grade)
- Managing the heat so as not to harm yields
- Moving the heat from data center to site

Risk Management

- Establishing contracts between unaffiliated business entities
- Operation Conflicts (data center needs vs greenhouse needs
- Indemnification, access and insurance

Opportunities

- Improves Energy Efficiency
- Lessons Environmental Impacts
- Enhances Food and Grid Resiliency
- Fosters Economic Synergies between Tech and Agriculture Sectors

Getting Started:
How to Work with Your Onsite Energy TAP

Contact Your Regional TAP

Contact the Onsite Energy TAP in your region to start exploring onsite energy opportunities.

Discuss Site Characteristics, Goals, Objectives

Meet with the Onsite Energy TAP to discuss preliminary interest in onsite energy and learn about the facility's needs and energy-related goals.

Collect Site Data

Work with the Onsite Energy TAP to collect data needed to perform technical assistance (e.g., facility size, operations, electric and gas usage, etc.).

Conduct Analysis

Onsite Energy TAP works with technical analysis team to perform initial screenings for multi-technology options or advanced analysis to support project installations.

Review Results

When the results are ready, meet with your Onsite Energy TAP to review and discuss next steps (e.g., options worth further analysis or additional support available)

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