Delivering the Promise of Geothermal District Energy

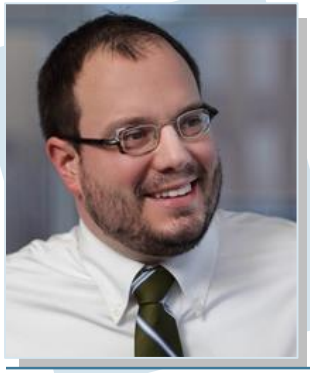
MEP Associates & GI Energy IDEA 2017

gi energy

Presenters

Dave Yanni

Chief Development Officer,
GI Energy



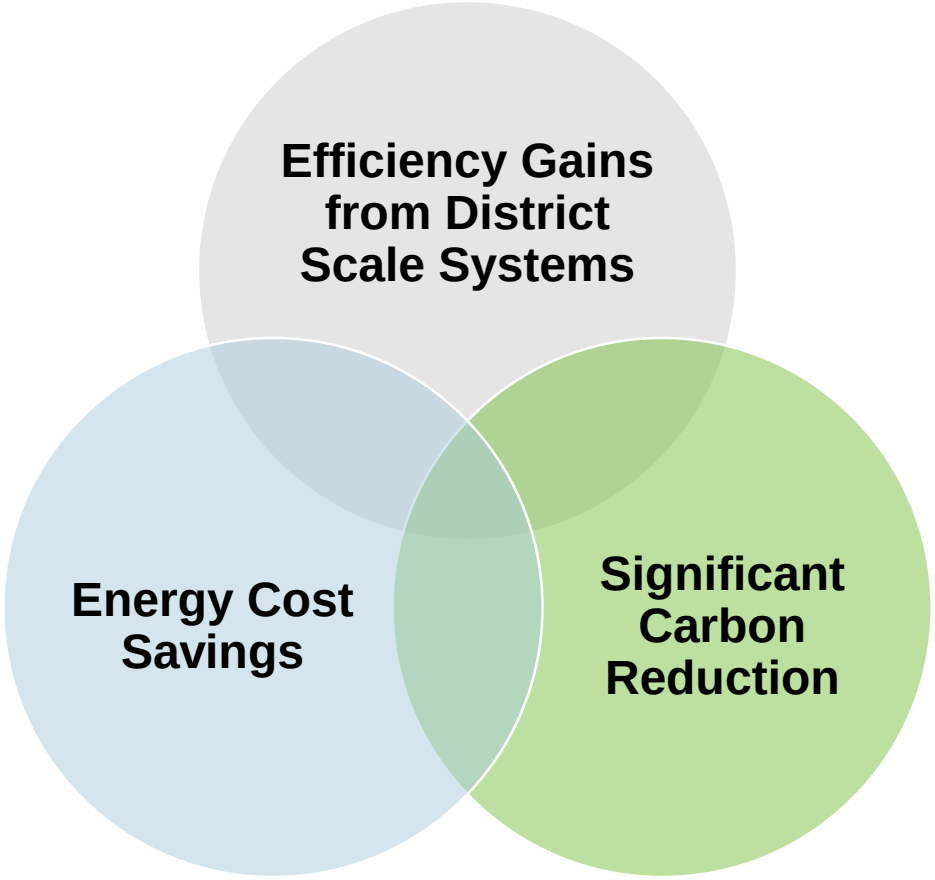
Mike Walters

Principal & Campus
Energy Market Leader,
MEP Associates

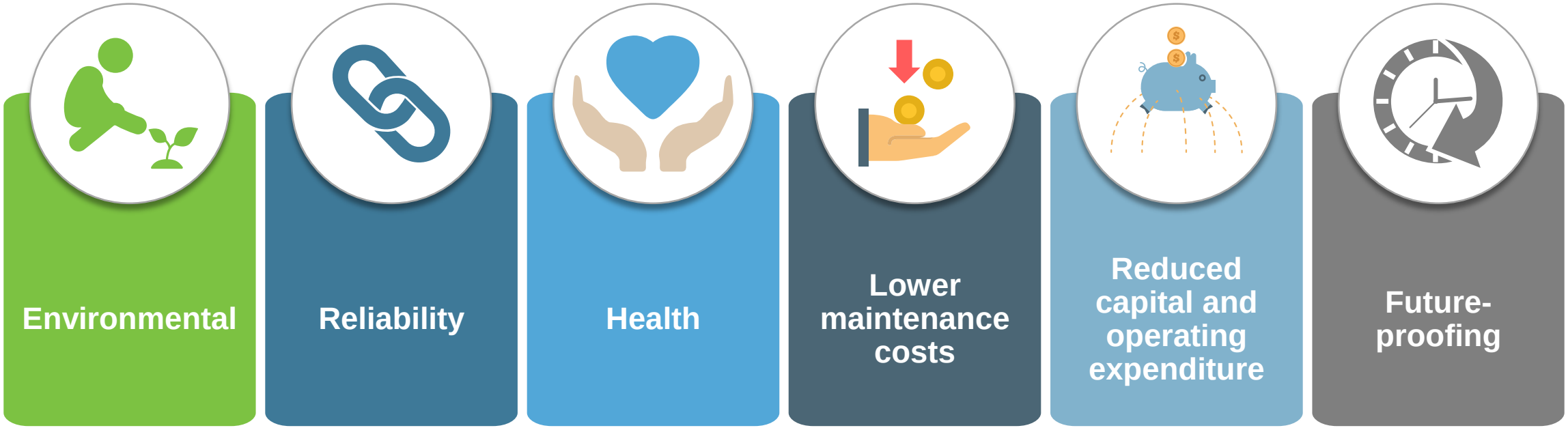
Today's Topics

- What is a Geo-District?
- Technology Overview
- Case Studies
- …the Money
- Questions?

What can a Geo-District deliver?



Benefits


Environmental
Reliability
Health
Lower maintenance costs
Reduced capital and operating expenditure
Future-proofing

Characteristics of a Geo-District

Clean, reliable, renewable energy

- Uses constant temperature of the earth as a heat source in winter and heat sink in summer
- Able to supply some or all of a building's space heating and cooling needs
- Geo-Districts may incorporate one or more geothermal resources (open loop, closed loop, lake, or hybrid systems) to satisfy heating and cooling loads
- Geo-Districts may also move thermal energy between buildings, further improving efficiency

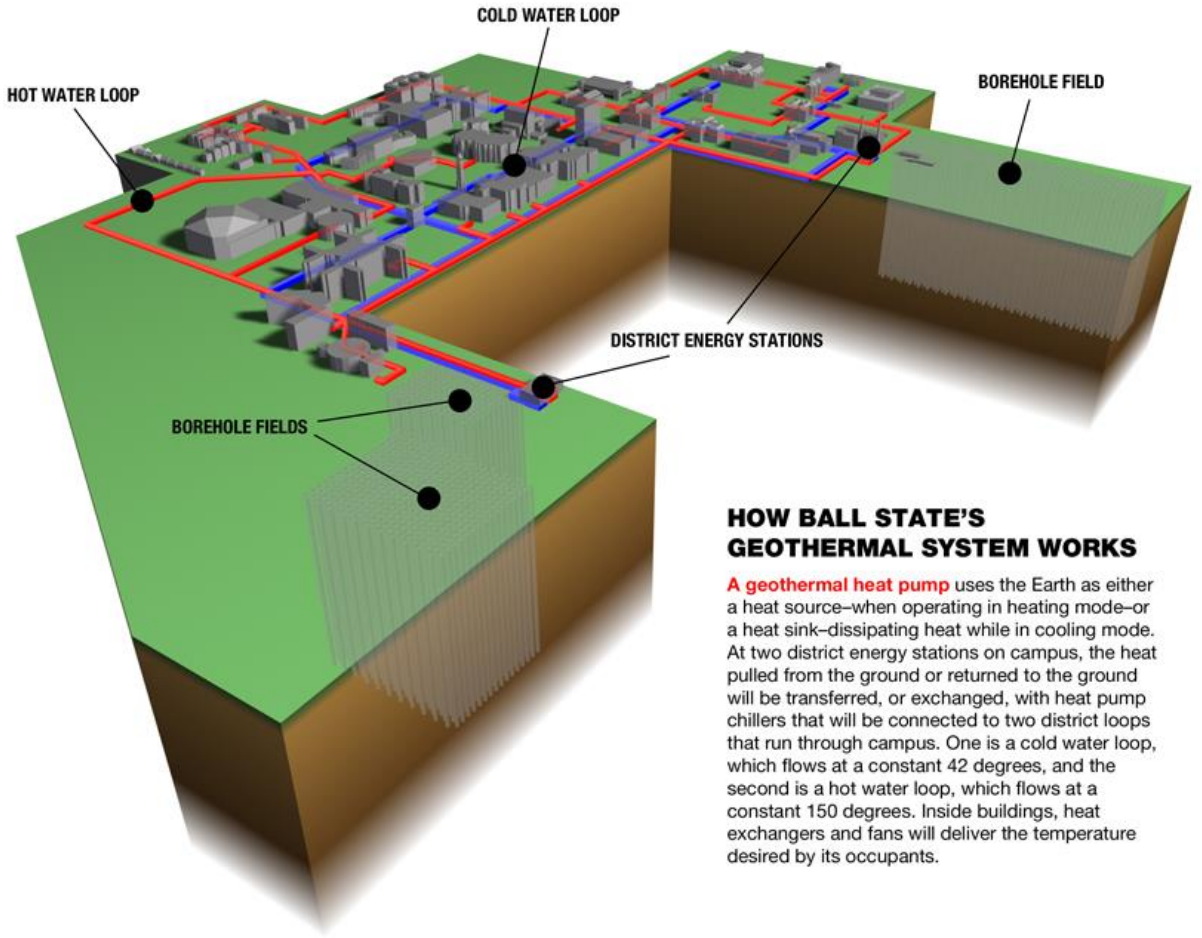


Image Credit: Ball State University

Case Studies

Epic Systems, Madison, WI

Carleton College, Northfield, MN

Ford Motor Company, Dearborn, MI

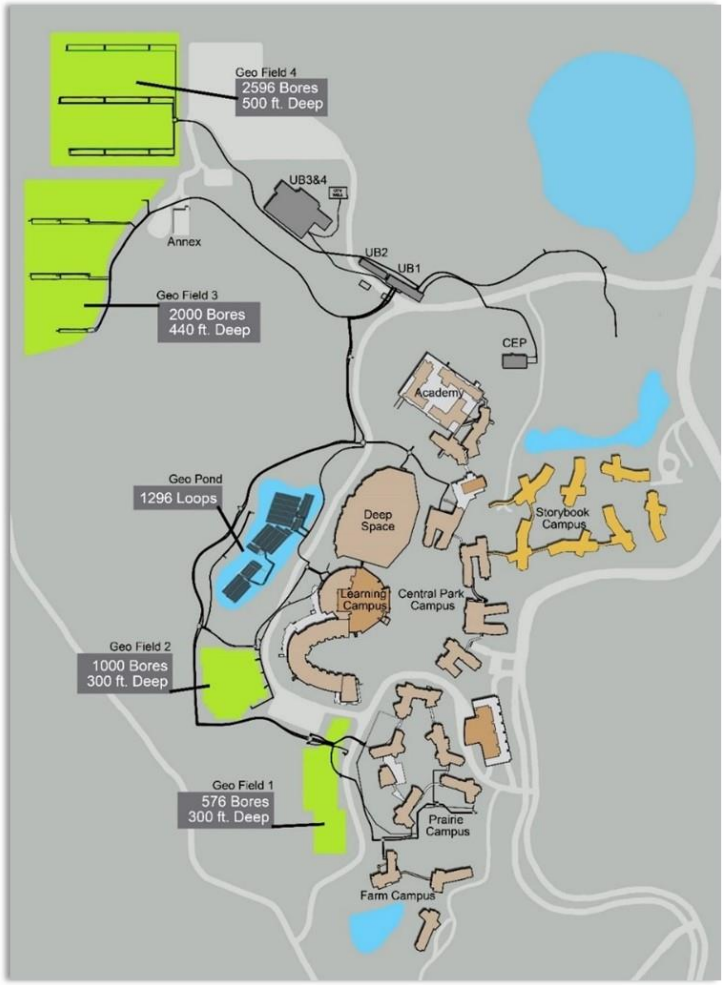
Cornell University Tech Campus, New York NY

Bay Area Eco-District, San Francisco, CA

Epic Systems – Healthcare Tech Campus

- Entire campus approximately 1,051 Acres
- 9,000+ employees in 27 buildings, with 12 more under construction
- Over 7 Million sq ft occupied space including 7,338 underground parking stalls
- 1.5 MW Solar PV
- 10 MW Wind Generation

Epic Systems – Eco-District Scope



- Water-to-air & water-to-water heat pumps
- Distributed Central Energy Plants
- Geothermal bore fields and pond system
- Open lake water system
- Domestic water heating system utilizing geothermal water
- Snow/ice melt systems
- Photovoltaic solar panels
- Wind farm

Epic Systems – Impacts

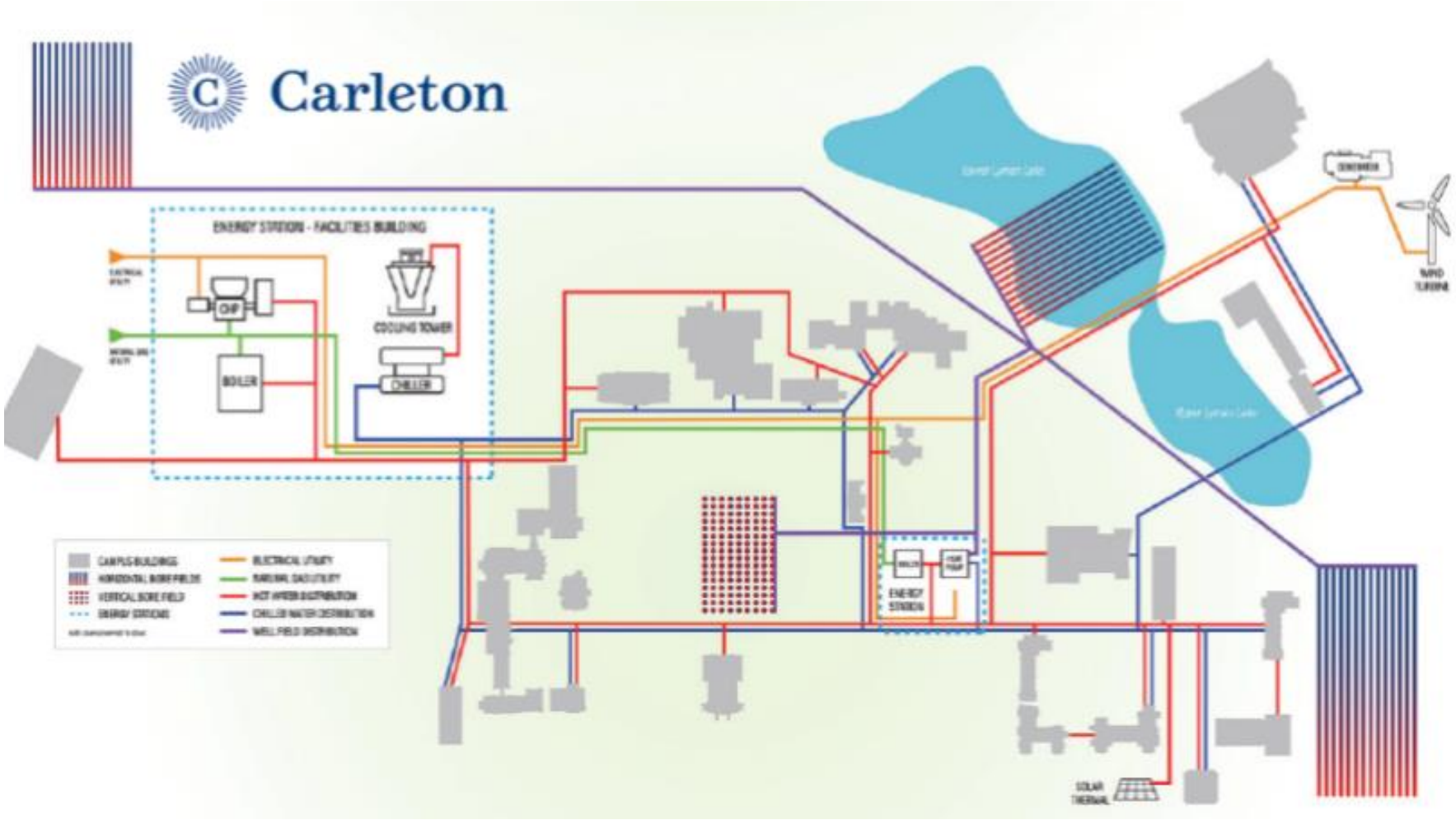
EPIC SYSTEMS – VERONA, WI PHOTO CREDIT: KATIE WHEELER

Carleton College

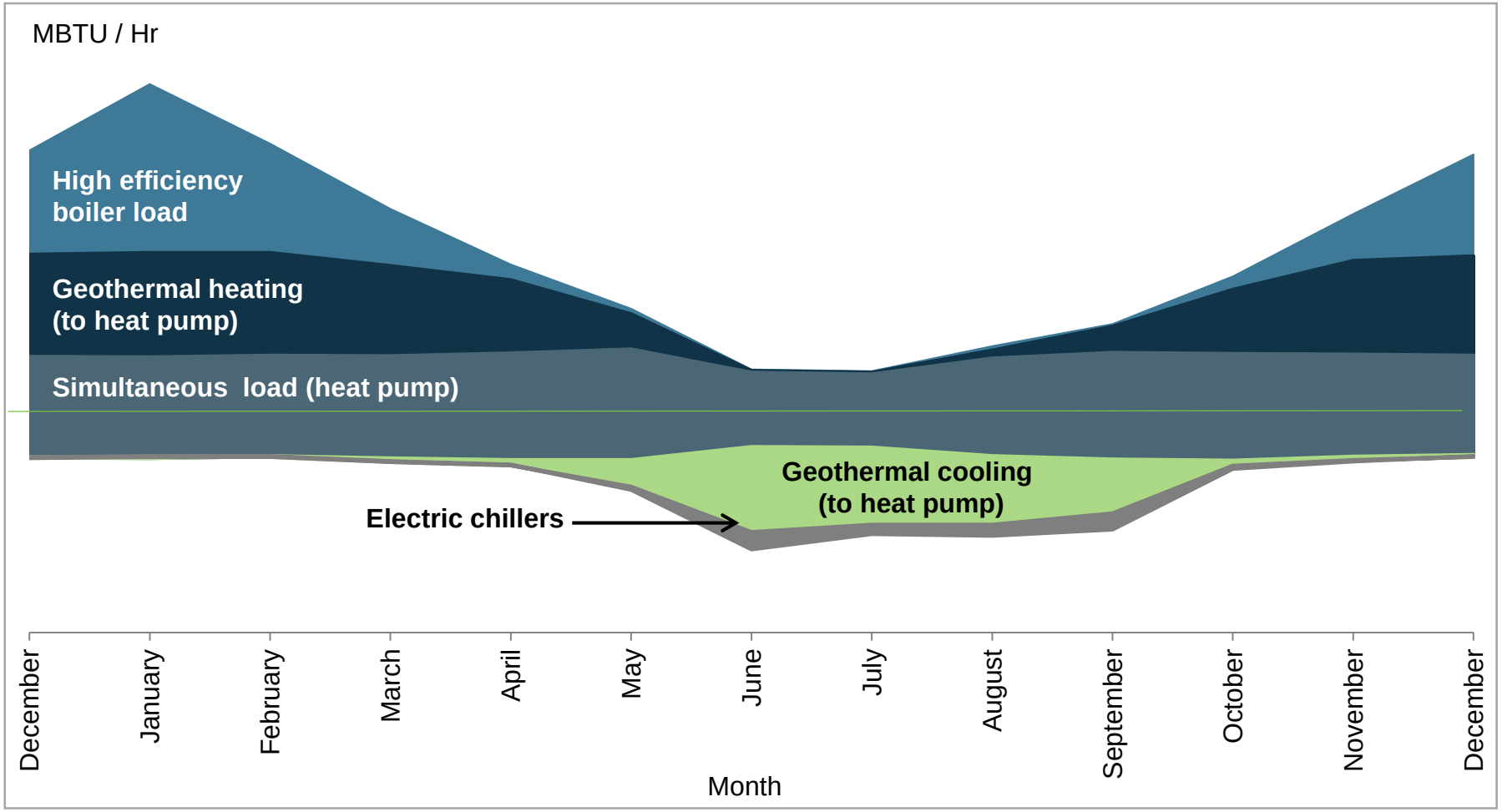
Highly selective undergraduate college, 2,100 students and 250 staff on 1,040 acre campus.

With a focus on **replacement** and **renovation**, Carleton anticipates only **3% net growth** in total campus square footage over the next 25 years.

Carleton College – Project Scope

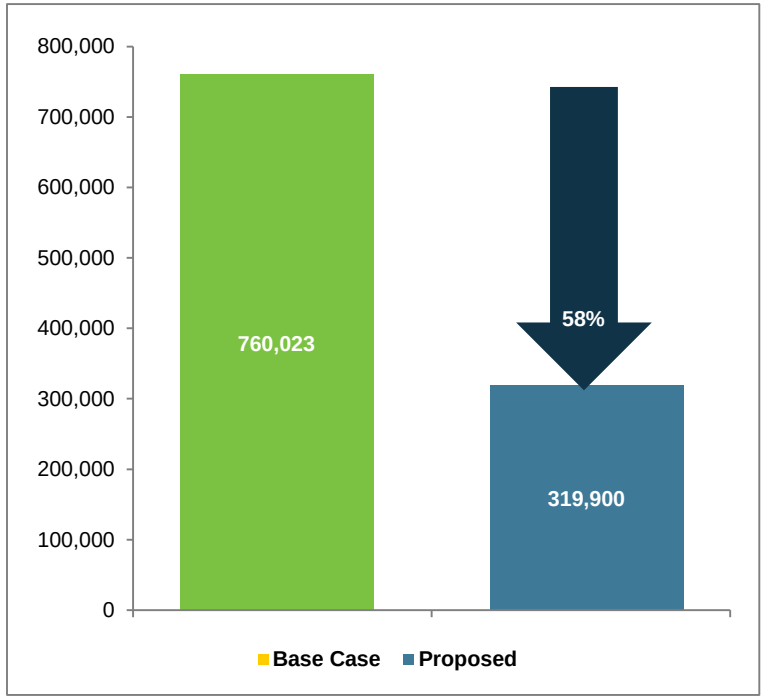


Carleton College – Seasonal Load Profile

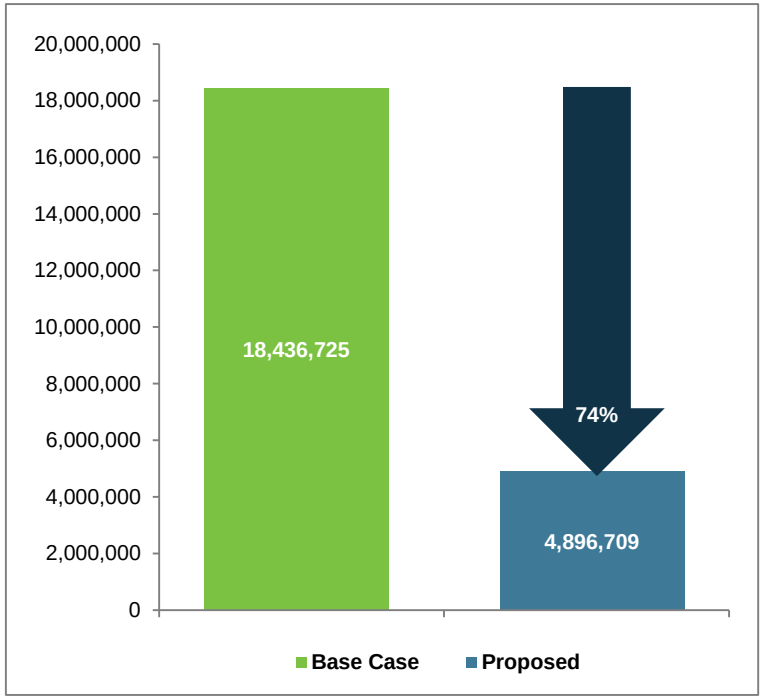


Carleton College – Impacts

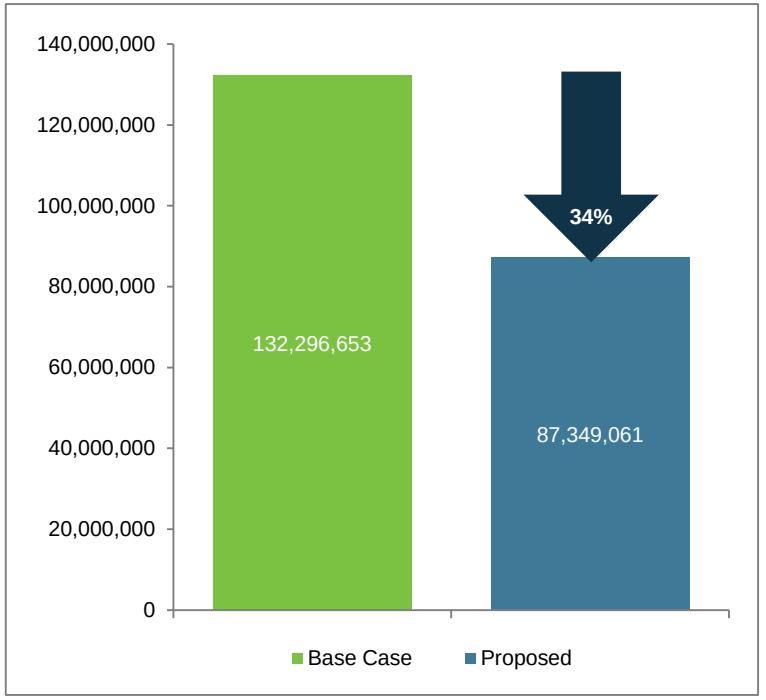
Utility Cost ($/yr)



Carbon Emissions (lb C02/yr)



Energy (MBtu/yr)



Ford Low Entropy Campus Transformation - R&E Center

Low Entropy Campus

Design Goals encompass building heating, cooling, and ventilation systems:

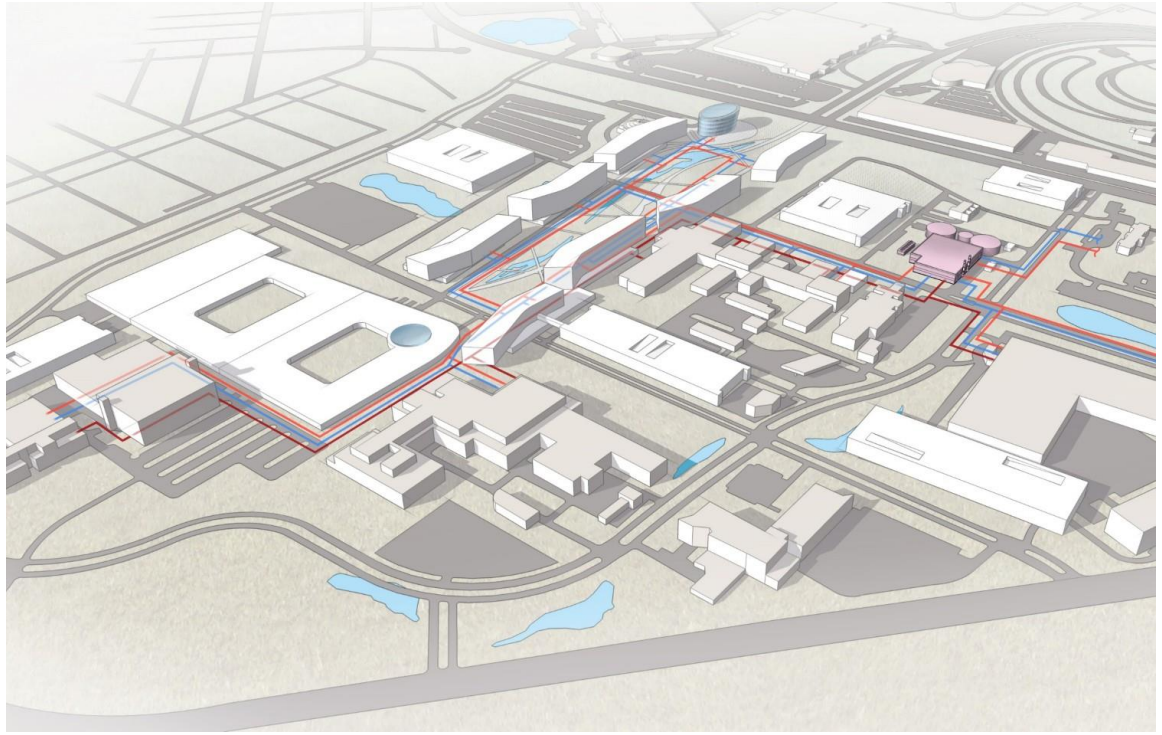
1. Provide comfortable, effective, well-connected work environments
2. Heat and cool with energy streams as close to room temperature as possible
3. Recycle energy streams effectively and introduces new ones judiciously
4. Minimize energy system distribution losses
5. Bank and retrieve energy flows over time

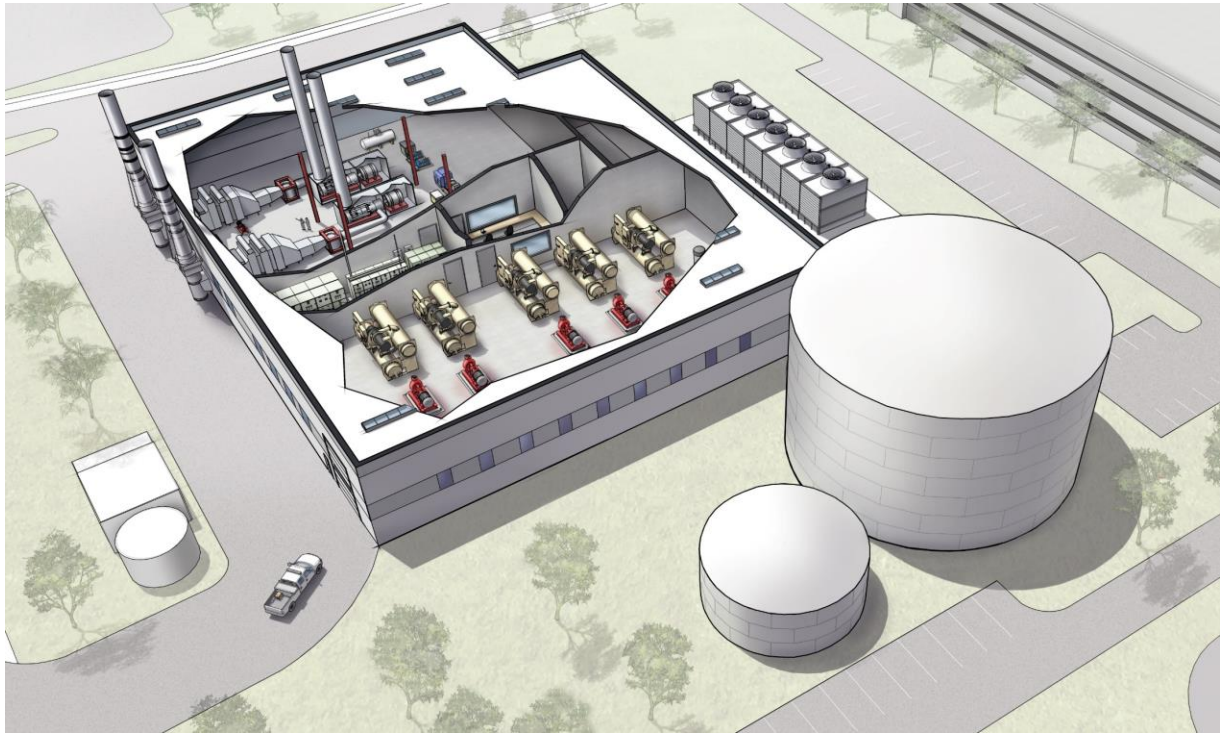
Led to

- Central heat pumps, chillers, cooling towers, geothermal heat exchange, thermal storage, cogeneration, and photovoltaics

Ford Campus Transformation – 2025 Master Plan

Ford Campus – Energy Infrastructure & Central Plant





Ford Campus – Impacts

Cornell University

- Ground Source Heat Pump technology for 150,000sq ft Bloomberg Center, the campus' first academic center
- 80 Bores – 350 ft deep
- Modelled peak load on 265 tons of cooling
- Originally designed to support Bloomberg Center to be one of largest Net Zero buildings in USA

Cornell University

Design includes unique annulus pumping system to increase efficiency of each bore and utilize local geological features

- Highly fractured bedrock allows river water to infiltrate boreholes
- Pumping system circulates water around the loops to increase thermal dissipation

Hunters Point Shipyard, San Francisco Redevelopment & Eco-District

- 8,000,000+ square feet of new residential, commercial and R&D development
- New Master Utility Plan designed along with street grid and development blocks
- Third party funded systems: Solar PV & energy storage, geo-exchange HVAC, recycled water, automated waste collection, EV charging and self-sustaining street lights
- Mix of direct-use third party offtake contracts, and partnerships with local municipal utilities

Hunters Point Eco-District – Details

- ~450,000 GPD water recycling system
- 10-15MW of rooftop PV planned
- 2,200 bore,15,000 ton capacity geothermal heating & cooling system
- When fully completed, system will reduce energy usage by 60% and save 150,000,000 gallons of water annually

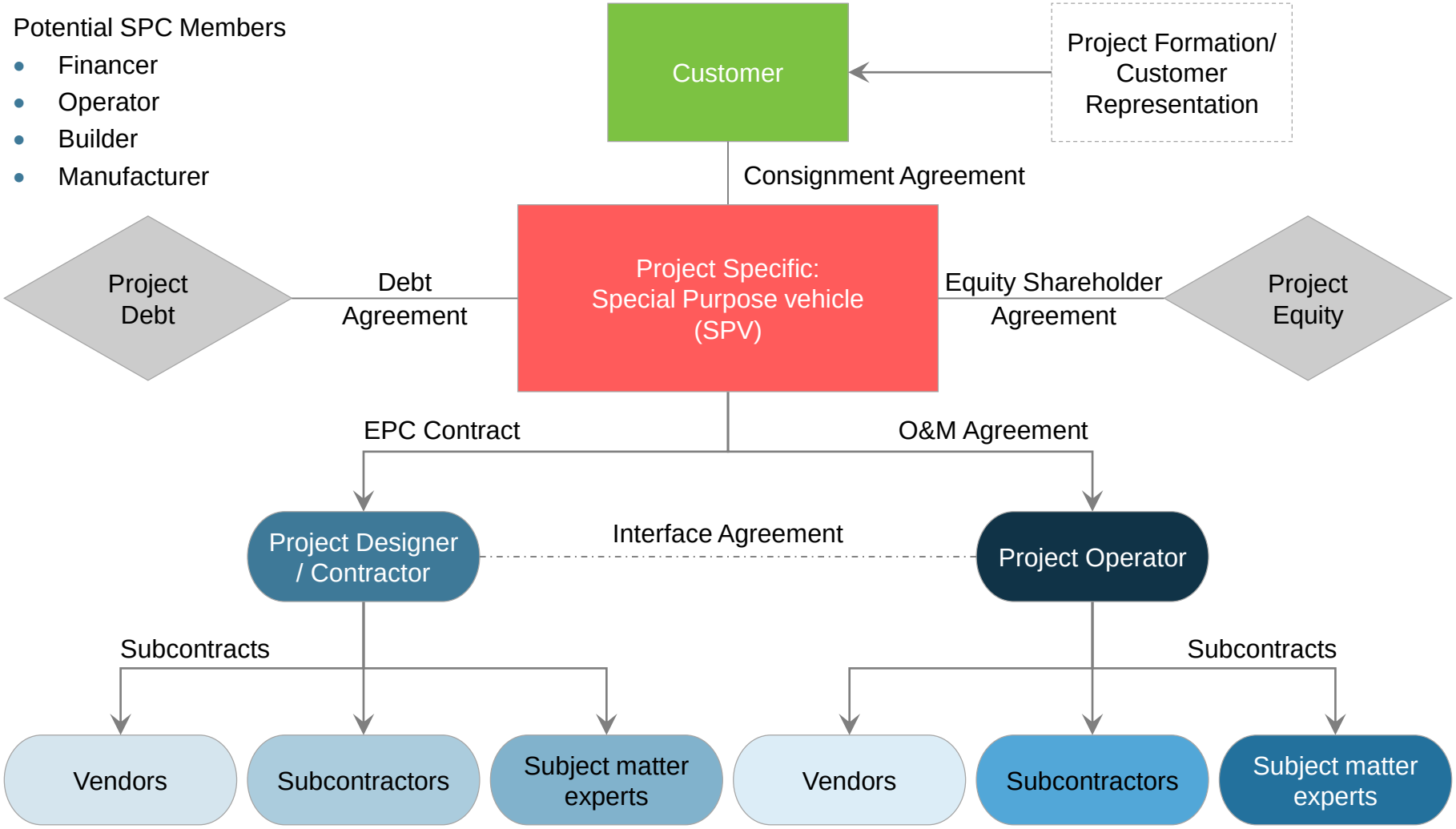
Financing – Third Parties

What	Capital Markets are chasing investment opportunities in renewable and sustainable energy
Who	Private equity, infrastructure funds, venture capital and institutional investors are all interested
Why	Mix of revenue types create diversified portfolio in single project
So…	No longer as reliant on tax credits to unlock financing

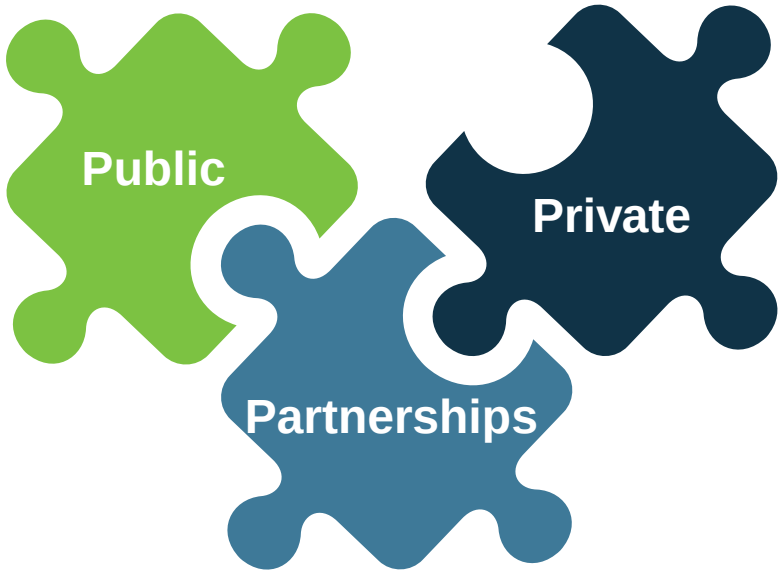
Typical D-BOOM Structure

Potential SPC Members

- Financer
- Operator
- Builder
- Manufacturer



Public Private Partnerships (PPP)



- Tool to help pay for infrastructure that maintains competitive energy prices
- Third party finance + municipalities and local agencies (+ developer) = sustainability services to end users
- Limited public investment in infrastructure

Any questions?

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