

MAY
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2022



Better Buildings, Better Plants SUMMIT

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U.S. DEPARTMENT OF
ENERGY



Decarbonizing the Public Sector: Options for Cities and States

Thursday, May 19th 2022

1:30 PM – 2:30 PM

Nathaniel Allen

Weatherization and Intergovernmental Programs Office
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

Agenda

1

Introductions, Session Housekeeping

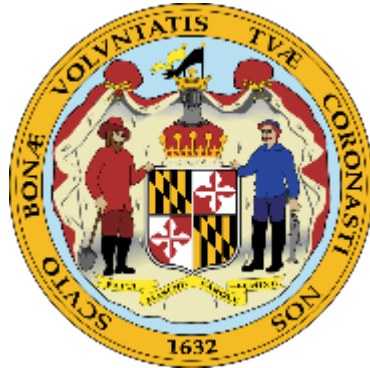
2

Case Studies from State of Maryland, District of Columbia Sustainable Energy Utility, and State of Massachusetts

3

Q&A Session

Better Climate Challenge Inaugural Partners



CITY OF HILLSBORO



City of Dallas



City of Philadelphia



CITY OF CHULA VISTA

VILLAGE OF MONTOUR FALLS



River Trails

School District 26

Inspire to Excel



GLENS FALLS
NEW YORK

Today's Presenters



David St. Jean
Director of Energy



Crystal McDonald
Director Account Management &
Workforce Development



Ryan Kingston
Sustainability Project Coordinator

David St. Jean
State of Maryland

Maryland Department of General Services Office of Energy and Sustainability



Staff of 12
Budget of \$5M

- Energy database,
- Power purchases,
- Statewide ESPC program,
- Statewide EV infrastructure,
- Green Purchasing Program,
- Energy audit program,
- Retrocommissioning,
- Lighting upgrades,
- Submetering.

Maryland's GHG Reduction Goals



SB 0528 Climate Solutions Now Act of 2022

Net zero statewide GHG emissions by 2045

- Specifically for State agencies:
 - Before January 1, 2030, must purchase 75% of electricity supply from no – or low –carbon sources.
 - By 2031, passenger cars in the State fleet must be zero-emission vehicles.
 - By 2030, a 20% reduction in net direct GHG emissions and net zero direct GHG emissions by 2040.
 - Pertains to buildings over 35,000 square feet.

Strategies

To-Do List:

- Develop a GHG baseline and percent reduction interim goals
- Purchase 75% renewable energy
- Convert the fleet to EVs
- Facility energy use reduction
 - 2019 Executive Order
- Electrification

Develop a GHG Baseline

Electricity:

<i>Purchase strategy</i>	<i>MWH</i>	<i>Number of accounts</i>
<i>Wholesale (B&I)</i>	835,872	68
<i>Retail</i>	255,363	1900+
<i>Renewable PPAs (incl. RECs)</i>	170,455	3
<i>Total</i>	1,261,690	

Transportation fuels: statewide fuels contract

Chilled water and steam: individual supplier contracts

Natural gas and fuel oil: statewide energy database

Develop a GHG Baseline

	<i>MT CO2 Emissions</i>	<i>Percent of Total</i>	<i>MT CO2 Emissions</i>
	2018		2030
<i>Scope 1 Emissions</i>			
<i>Stationary Emissions (NG, fuel oil)</i>	309,409	40%	196,537
<i>Mobile Emissions (Fleet)</i>	108,311	14%	6,769
<i>Scope 2 Emissions (Electricity, steam, CW)</i>	353,044	46%	92,903
<i>Total Emissions</i>	770,764		296,209

We can potentially achieve a 61% reduction in GHG emissions by complying with statute.

State Agency Engagement



DGS is well-positioned to engage with State agencies

- Quarterly meetings of a Working Group on reducing the energy use of State facilities. Attendees include representatives of:
 - the 20 agencies and campuses that use 90%+ of State government energy,
 - the Governor's Office,
 - Dept. of Budget and Management,
 - State Treasurer's Office.

State Agency Engagement

- DGS is responsible for facilities' engineering for approx. 30M sq. ft. of State-owned buildings.
- DGS chairs the Green Purchasing Committee.
- DGS is the supporting agency for the Maryland Green Building Council.
- DGS partners with USM on energy purchasing.
- DGS holds the statewide fuels contract.
- DGS employs a Facilities Assessment Unit that evaluates buildings for capital improvements.

Thank you!

David St. Jean

Director

Office of Energy and Sustainability

Maryland Department of General Services

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Crystal McDonald

District of Columbia Sustainable Energy Utility

Preparing DC's Workforce for a Clean Energy Economy

Crystal McDonald, Director of Account Management &
Workforce Development



DC
SUSTAINABLE ENERGY
UTILITY



DC
SUSTAINABLE ENERGY
UTILITY



About the DCSEU

The District of Columbia Sustainable Energy Utility (DCSEU) helps DC residents and businesses use less energy and save money. Since 2011, the DCSEU has delivered financial incentives, technical assistance, and information to tens of thousands of District residents and businesses, helping them to save millions of dollars on their energy costs. Our work is building a brighter economic, environmental, and energy future for the District.

DCSEU Goals

Combined Source Energy Savings, MMBtu



Greenhouse Gas Savings, MTCO₂e



Green Jobs



Local Economic Development



Low-Income Spending



Renewables with EE



Deep Energy Retrofits



Workforce Capacity Building

Workforce Development Program (Extern)

- ▶ Connect District residents over 18 years of age who are new to the workforce, between jobs, or looking for a career change with local contractors in the green economy
- ▶ Provide training and certification opportunities aimed at helping workers to obtain green careers
- ▶ Enhance economic stability by focusing on a worker's marketable skills
- ▶ Reduce unemployment and underemployment in the District

Train Green Sustainable Energy Infrastructure and Capacity Building Pipeline (SEICBP) Program

- ▶ Grow staff capacity at CBEs and CBE-eligible contractors at no cost to meet growing demand
- ▶ Help building owners train staff to build internal capacity and incorporate efficiency into normal maintenance routines
- ▶ Participants learn new skills and gain new certifications that provide access to high-paying jobs in a rapidly growing sector

Train Green: The Sustainable Energy Infrastructure Capacity Build & Pipeline Program



The SEICBP program was created in response to Section 402 of the D.C. Law 22-257. Clean Energy DC Omnibus Amendment Act of 2018, whereby DOEE is under obligation with the DLSBD for at least a **five-year period to provide training, credentialing, and certification to District Certified Business Enterprises (CBEs) and/or CBE-eligible firms.**

The DCSEU launched this program in 2020, and it is designed to **assist CBEs and CBE-eligible firms in acquiring new or enhanced skills and knowledge around energy efficiency and renewable energy design, construction, inspection, and maintenance.**

Year 3 of the SEICBP Program started January 2022.

New in FY22! Train Green SEICBP Pathways

Once introductory courses are completed, students choose a specialization pathway that will enable them to reach an advanced level of knowledge through the Train Green program. Each Pathway contains both Basic and Advanced courses.



Energy Efficiency

This pathway includes courses that focus on growing knowledge of auditing, benchmarking, modeling, and optimizing energy use within commercial and residential buildings.

Sustainability & Health

Courses will examine Leadership in Energy and Environmental Design (LEED) rating systems and other building standards that focus on how the built environment impacts human health and wellbeing.

Building Operations

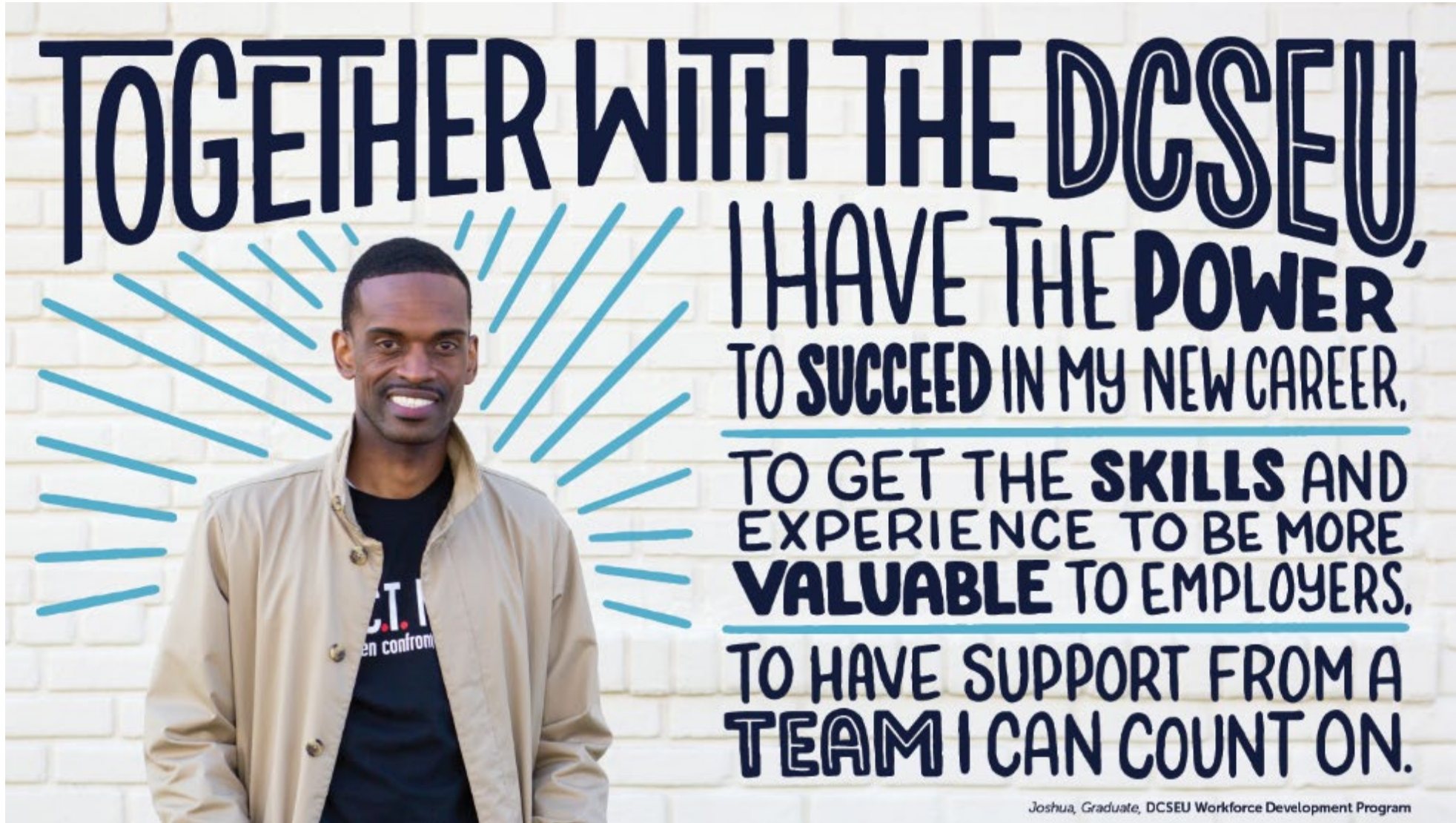
Topics will explore best practices for whole building automatization, maintenance, operations, and green property management.

Heating, Ventilation, & Air Conditioning (HVAC)

This pathway will specifically focus on HVAC system automation, operation, and maintenance.

Renewables + Solar

Courses will cover solar safety, installation and maintenance of battery/grid based solar systems.



Joshua, Graduate, DCSEU Workforce Development Program



DC
SUSTAINABLE ENERGY
UTILITY

Thank You!

DCSEU.com

 facebook.com/dcseu

 twitter.com/dcseu

Director of Account Management &
Workforce Development
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Training Coordinator
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Mark Bryan

Trade Ally Manager
Rick Fleury

Ryan Kingston
State of Massachusetts



COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENERGY RESOURCES
Patrick Woodcock, Commissioner

Decarbonizing Massachusetts State Facilities

Better Buildings Summit
May 2022

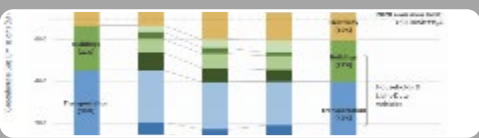
Ryan Kingston
Ryan.Kingston@mass.gov
Sustainability Project Coordinator
Leading by Example Program

Commonwealth Climate Leadership

Massachusetts expected to achieve 25% emissions reduction target by 2020 (from 1990 baseline). This trend expected to continue with advancements in clean energy policy.



2021 Climate Law set aggressive GHG reduction targets: 50% by 2030, 75% by 2040, net zero by 2050, as well as sector-specific and 5-year interim targets



2050 Decarbonization Roadmap and 2025/2030 Clean Energy and Climate Plan prioritizing electrification of heating and transportation to meet climate goals



Three-Year Energy Efficiency Plan sets emissions reduction goals and incentivizes electrification



Over 3600 MW of solar PV installed, with SMART program furthering growth



3200 MW of offshore wind already procured, with authorization for another 1400 MW



179 MWh of energy storage installed (up from 0 in 2015), 874 MWh in the pipeline



LBE accomplishments are the result of the collective efforts of all state entities, who strive to meet the goals of applicable executive orders while supporting long-term statewide policies and goals

Mission Statement

The LBE program aims to substantially reduce GHG emissions and environmental impacts of state owned and managed buildings, facilities, and campuses

State Footprint

Buildings

- 80 million square feet
- 29 college and university campuses
- 18 prisons, hundreds of armories
- 50+ state owned courthouses
- State hospitals, youth detention centers, office buildings, visitor centers, garages, parks

Vehicles

- 7,500+ light, medium, heavy duty

Impacts

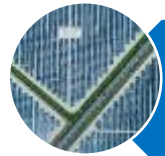
- Over 1 billion kWh electricity
- 8 million gallons gasoline + diesel
- 870,000 tons GHG emissions



Key Portfolio Accomplishments



35% overall GHG emissions reductions*



30+ MW of solar PV at state facilities



85% reduction in heating fuel oil use*



97 LEED buildings, 65% at highest certification levels

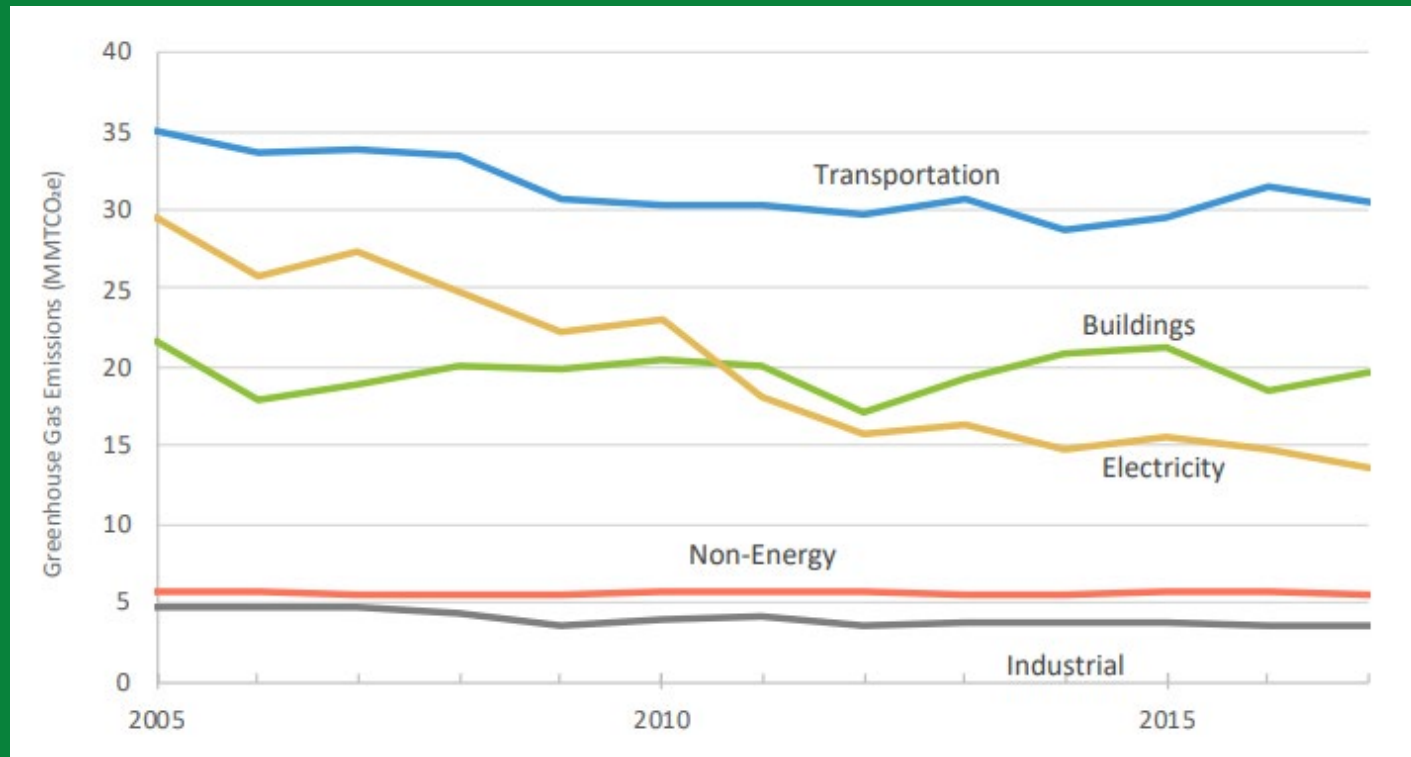


14% reduction in energy use intensity (EUI)*

*Over 2004 baseline

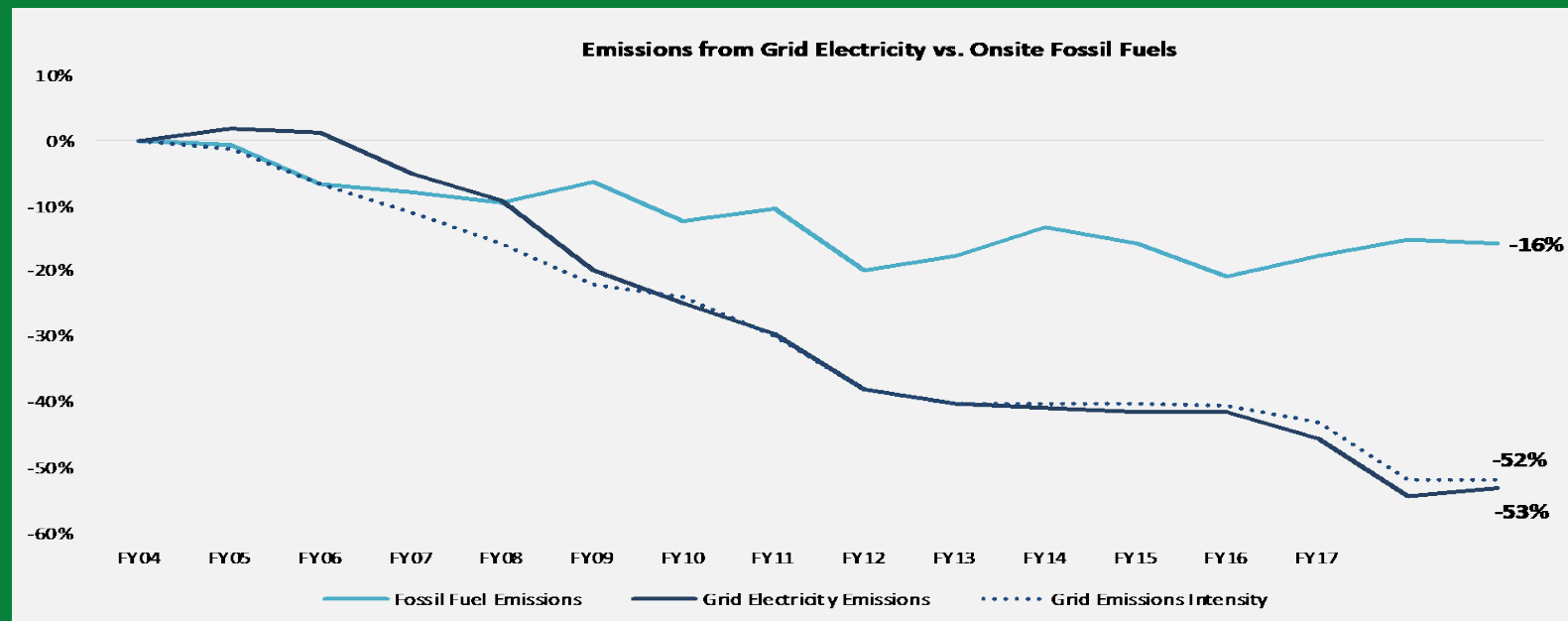
Setting the Context for Decarbonization Targets

- ❖ The grid is getting greener, while emissions from transportation and building sectors have seen smaller reductions in emissions



Setting the Context for Decarbonization Targets

- ❖ 75% of current state government emissions reductions can be attributed to changes in the grid emissions intensity
- ❖ Onsite fossil fuel emissions are most challenging to address, under the direct control of state action, and constitute the majority (and growing) portion of emissions within the state portfolio



2021: A Climate Odyssey



Executive Order No.594

*Leading by Example:
Decarbonizing and Minimizing
Environmental Impacts of State
Government*

Signed by Governor Baker on Earth Day,
April 22, 2021

Effective date: July 1, 2021

Supersedes LBE Executive Order 484

New targets focus
on onsite fossil fuels
at state facilities

New sector-specific
targets and
programs to support
implementation



New Climate Law

*An Act Creating a Next Generation
Roadmap for Massachusetts
Climate Policy*

Signed by Governor Baker on
March 26, 2021

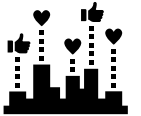
Targeting the Top: Campus Decarbonization Study Background



Four campuses, varying in size from 685,000 sq ft to 12.8 million sq ft



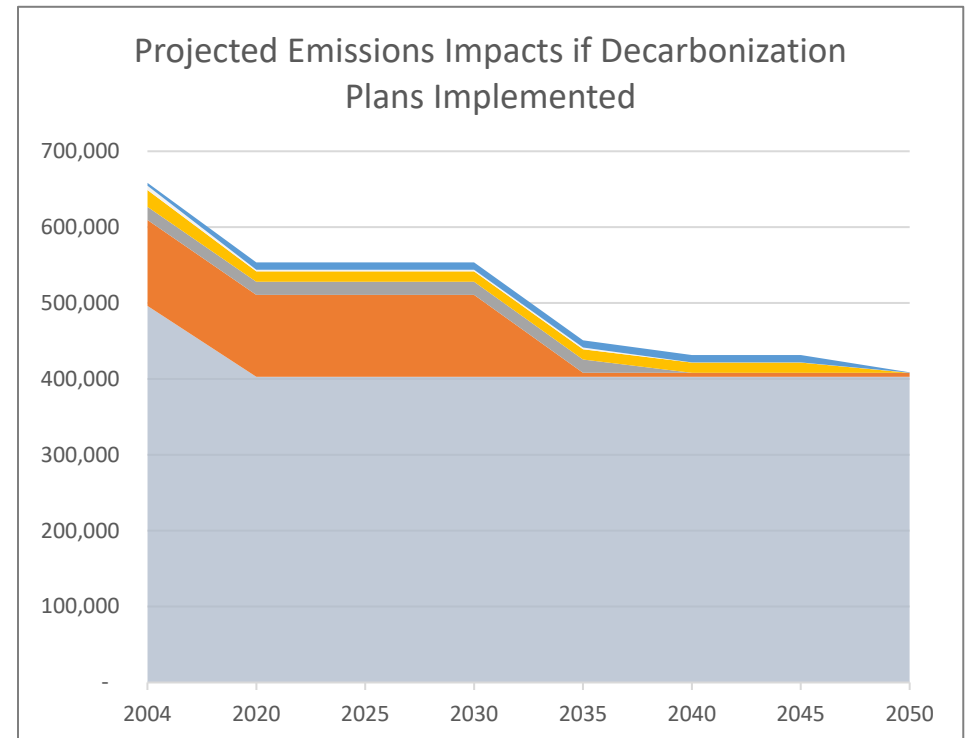
Responsible for ~25% of state portfolio emissions



Buildings vary in age, condition, and type



Heat and power provided by CHP, consumed combined 5 million therms of natural gas in FY21

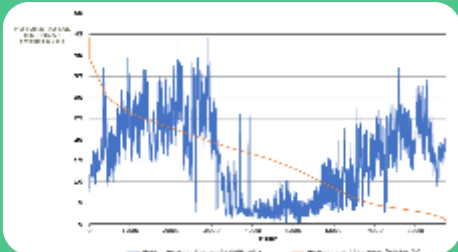


Getting Started: Convening the People and the Data



Identify the Working Group

- Facilities, operations, fiscal, DOER, DCAMM
- Ensure leadership/stakeholder buy-in and support
- Incorporate into existing master planning efforts
- Some studies included extensive stakeholder outreach



Collect and Share Data

- Campus-wide and building-specific energy load and performance
- Seasonal and peak loads
- Forecasting through 2040 and beyond

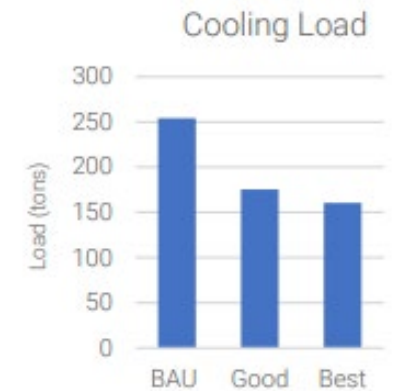
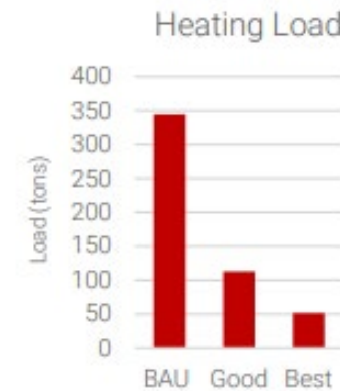
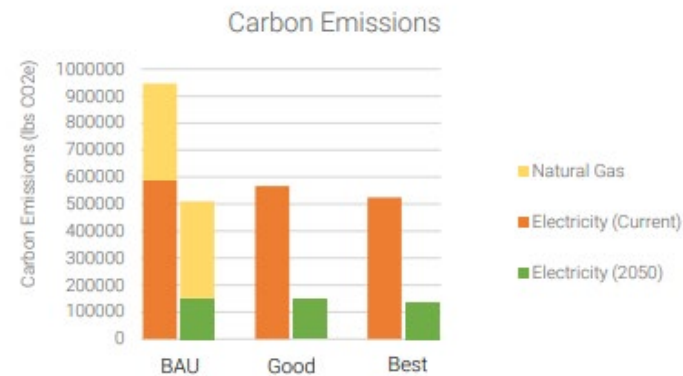
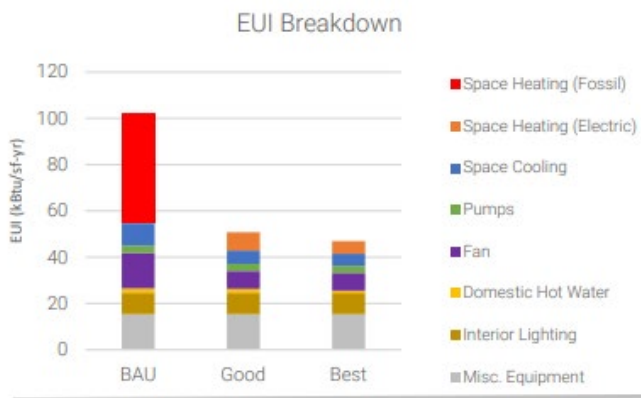


Identify Solutions

- Energy conservation measures
- Renewable technologies
- Phasing and cost-effectiveness

Energy Conservation Measures

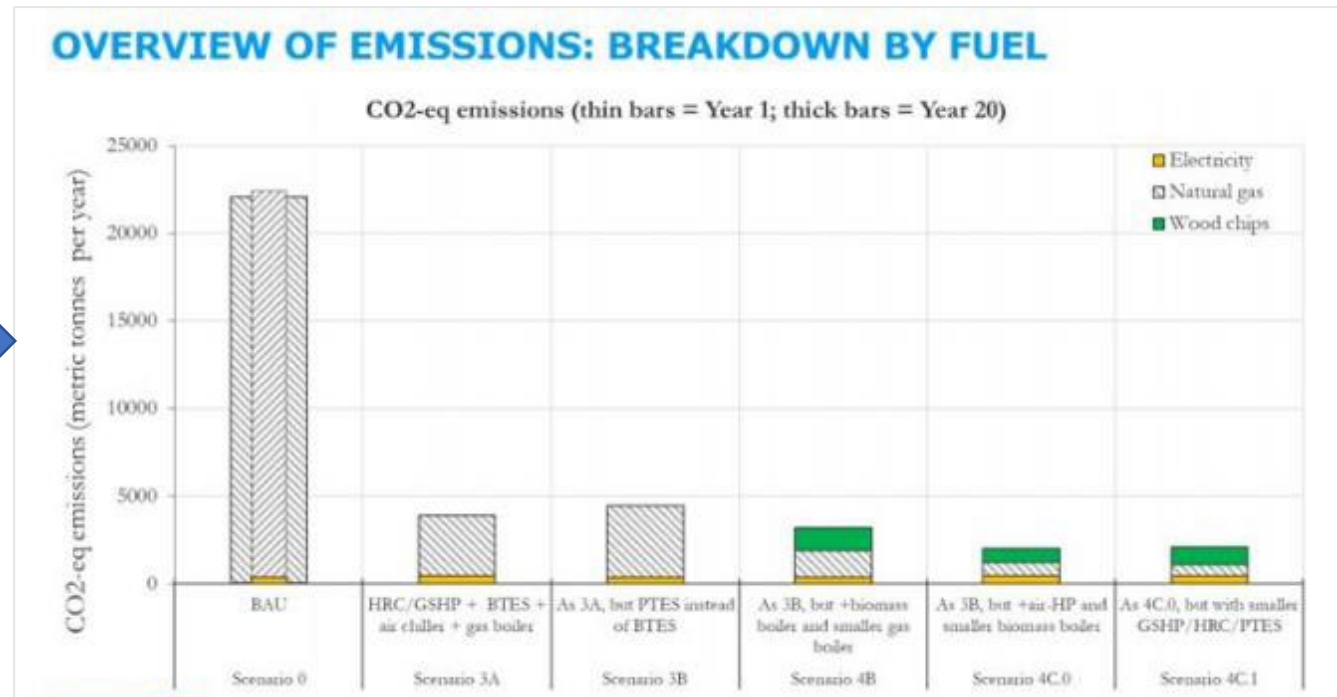
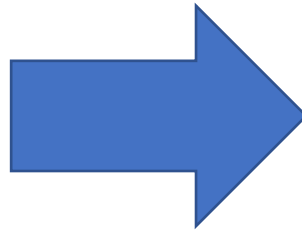
- Multiple ECMs were considered with varying degrees of detail
 - Improve wall and roof insulation
 - Replace windows to achieve high U-value
 - Improve building controls
 - Upgrade air handling units
- ALL studies recommended conversion from steam to low temperature hot water for district heating system



One study provided portfolio of options for every building based on energy demand modeling

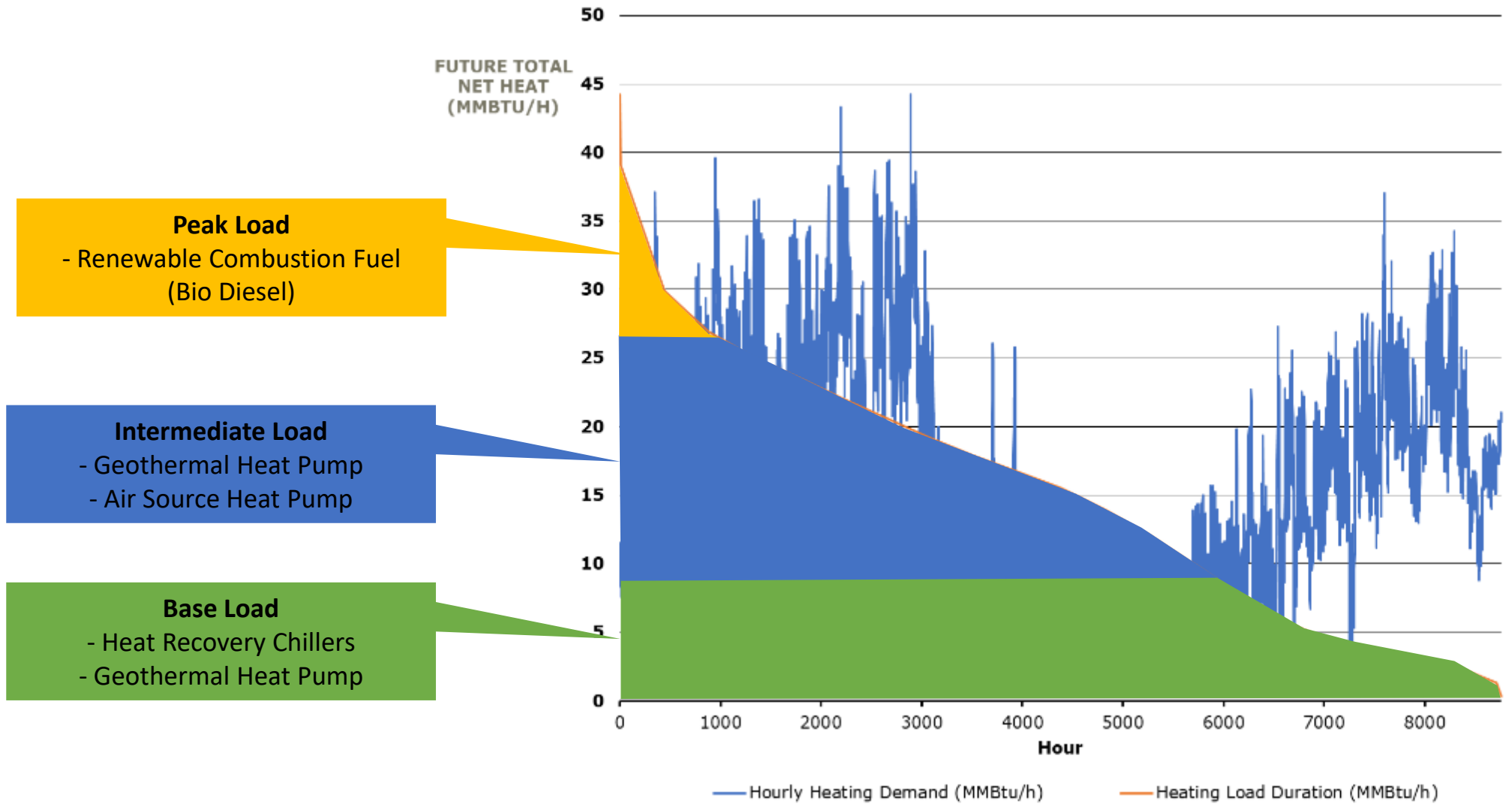
Proposed Renewable Thermal Technologies

- Ground-source heat pumps
- Air-to-water heat pumps
- Solar thermal
- Wastewater heat recovery
- Heat recovery chillers
- Thermal energy storage
- Modern wood heating systems
- Renewable fuel oil boilers



Various combinations of technologies assessed to determine GHG impact, cost, and overall feasibility

Meeting Demand with Multiple Technologies



Meeting Demand with Multiple Technologies

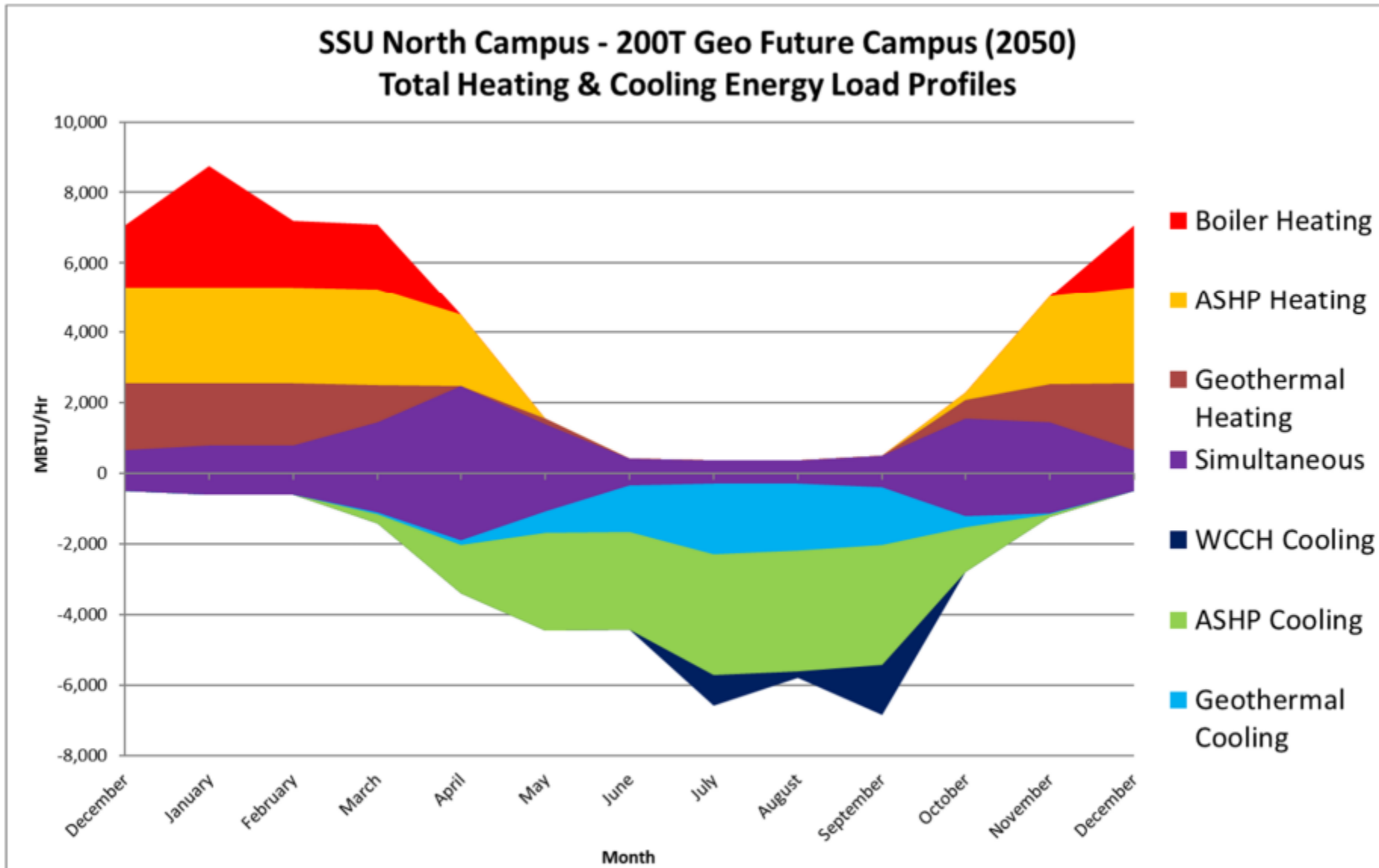
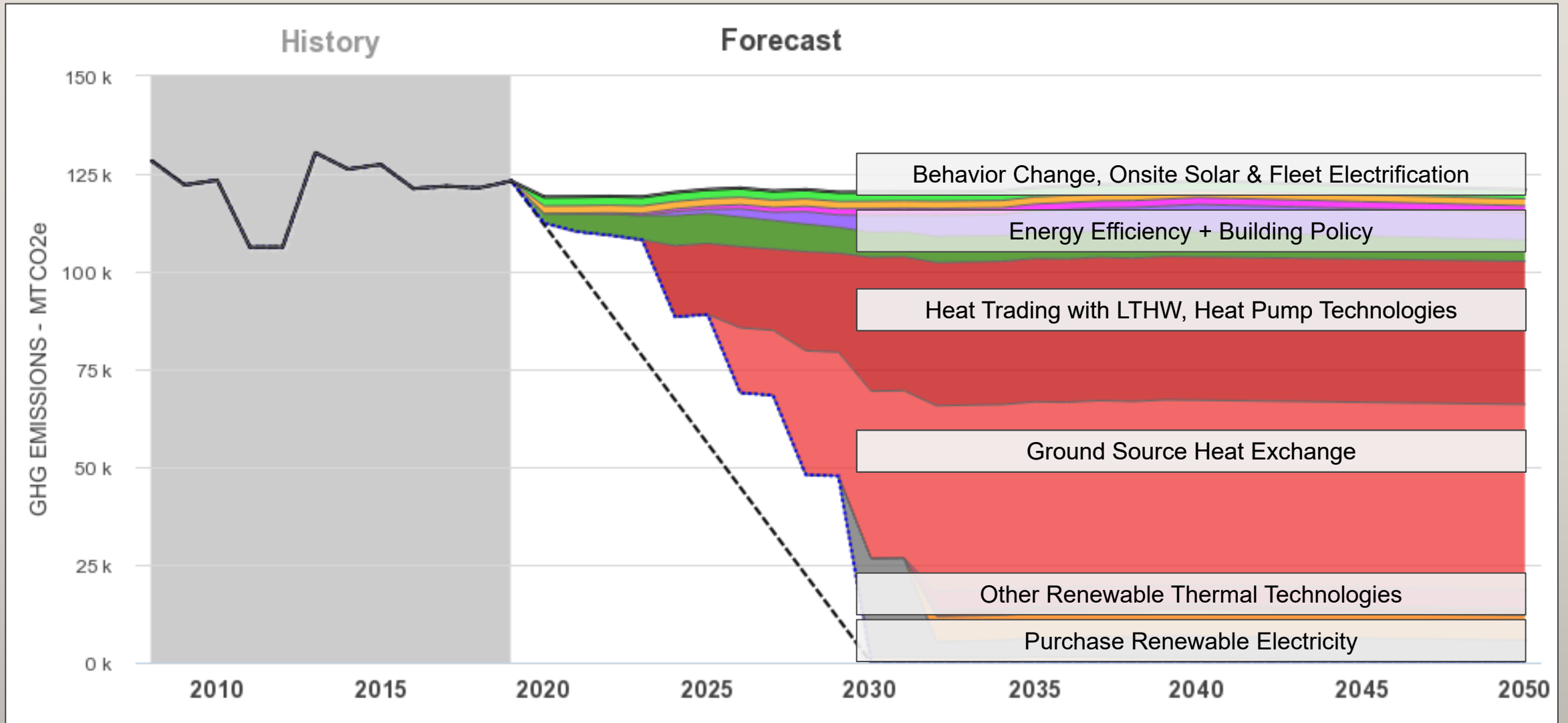
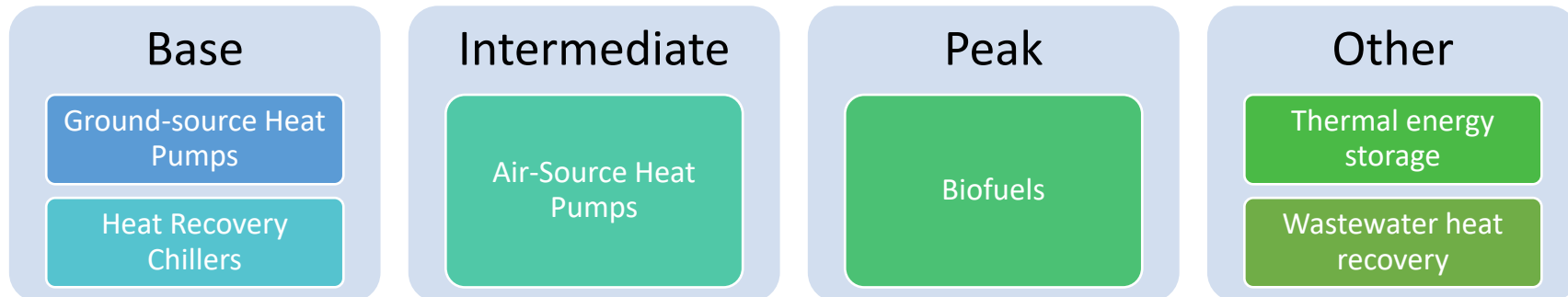
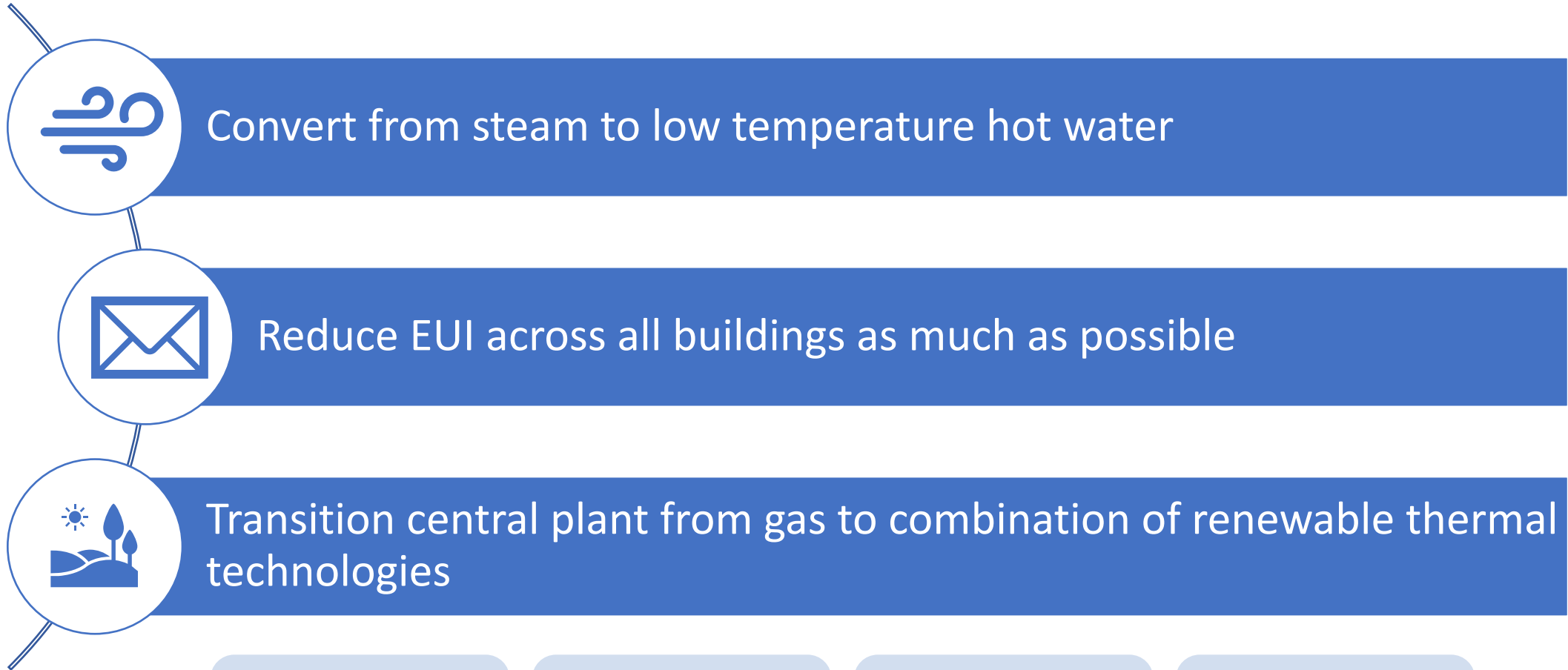


Figure 9: Centralized Option Thermal Profile

Projecting Impact of Multiple Technologies/Strategies



Key Solutions



Phases for Implementation

- Dividing work into phases provides guidance on work that needs to be done first
- Phase schedules intended to align with other plan schedules (e.g., master plan, energy retrofits, deferred maintenance)

Initiative Year	Phase 1	Phase 2	Phase 3	TOTAL
	(2025 – 2030)	(2030 – 2035)	(2035 – 2040)	-
Central Heating Plant Upgrades and Demolition/Replacement	\$ 792,162	\$ 954,000	\$ -	\$ 1,746,162
Distribution Network	\$ 5,959,392	\$ -	\$ -	\$ 5,959,392
NetZero Energy Plant	\$ 14,474,445	\$ 8,390,814	\$ 408,875	\$ 23,274,134
Geothermal Borings and BTES	\$ -	\$ 18,026,338	\$ -	\$ 18,026,338
Thermal Tank Energy Storage Installation	\$ 2,108,026	\$ -	\$ -	\$ 2,108,026
Building Upgrades and Conversions	\$ 6,303,023	\$ -	\$ -	\$ 6,303,023
Emergency Backup Generation	\$ 1,861,364	\$ -	\$ -	\$ 1,861,364
Solar PV Car Canopies	\$ -	\$ -	\$ 10,625,000	\$ 10,625,000
SubTotal	\$ 31,498,412	\$ 27,371,151	\$ 11,033,875	\$ 69,903,438
General Conditions	\$ 1,522,498	\$ 1,555,057	\$ 31,451	\$ 3,109,006
Contractor OH&P	\$ 1,903,122	\$ 1,943,821	\$ 39,314	\$ 3,886,257
Design Contingency	\$ 6,984,806	\$ 6,174,006	\$ 78,628	\$ 13,237,440
Change Order Contingency	\$ 2,793,923	\$ 2,469,602	\$ 31,451	\$ 5,294,976
GM Contingency	\$ 873,101	\$ 771,751	\$ 9,828	\$ 1,654,680
Engineering	\$ 3,492,403	\$ 3,087,003	\$ 39,314	\$ 6,618,720
Construction Management	\$ 1,047,721	\$ 926,101	\$ 11,794	\$ 1,985,616
Escalation	\$ 12,328,532	\$ 24,497,066	\$ 10,542,737	\$ 47,368,335
Total	\$ 62,444,518	\$ 68,795,558	\$ 21,818,392	\$153,058,468

*Costs here are high-level estimates, included for demonstrative purposes only

Lifecycle Cost Assessment: BAU vs Alternate Case

- NOT decarbonizing (business as usual) has a cost – fuel, maintenance, equipment replacement, etc
- Alternative case not always most cost-effective over lifetime, but there is other added value (e.g., adding cooling to new buildings, modernizing systems, full decarbonization...)

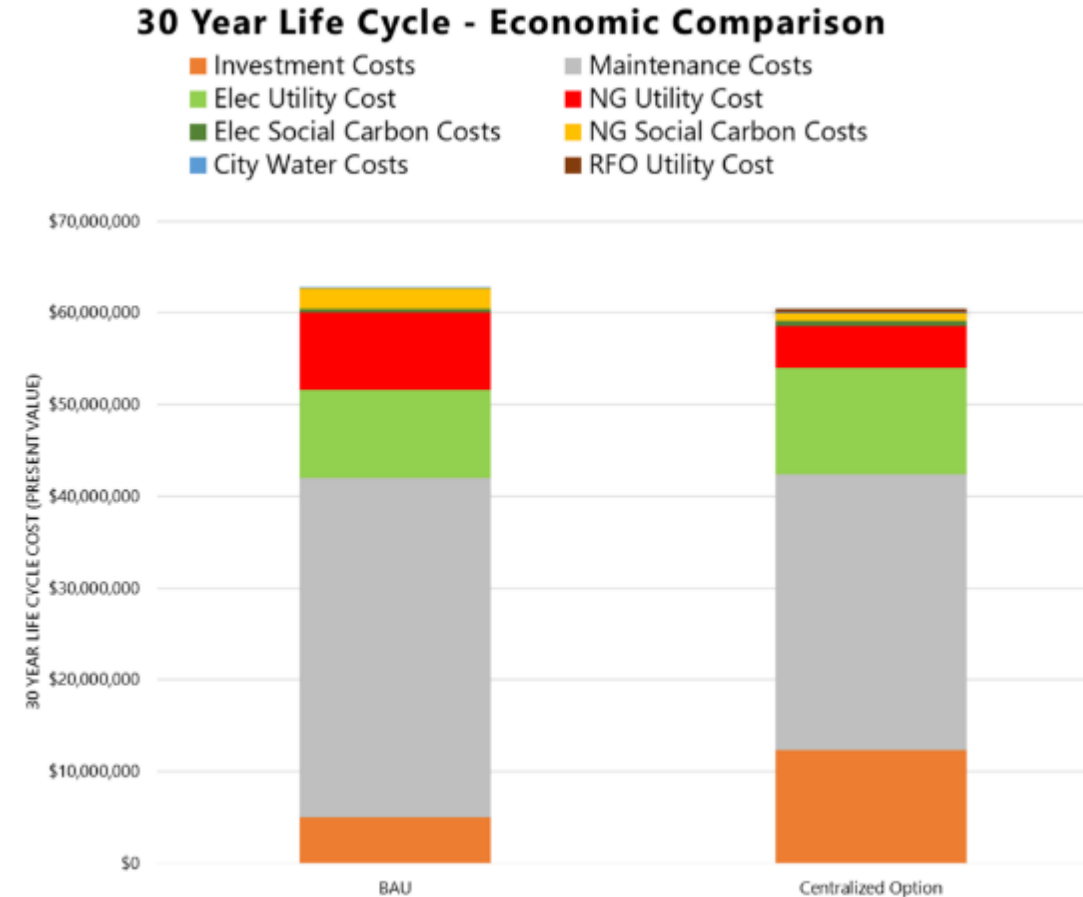
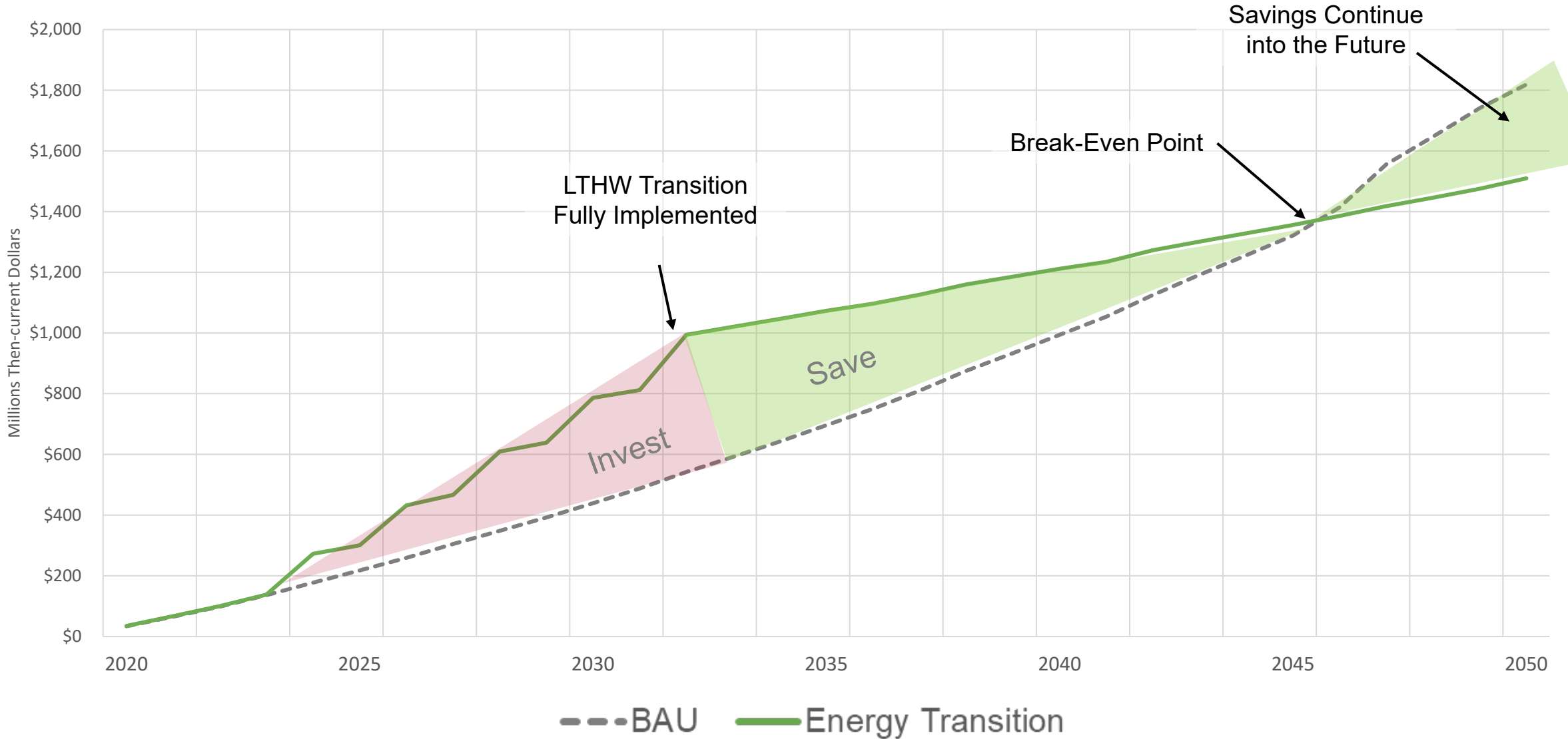


Figure 24: LCCA Present Value Comparison

Financial Implications

Cashflow - BAU vs Energy Transition Through 2050





To Recap...



Convert to low-temperature hot water



Reduce EUI



Heat and cool with a combination of renewable thermal technologies



Meet electric demand with onsite renewables and a grid powered primarily by renewables



Implement across phases; conduct further study on technologies and financing

Implementation Challenges



Investments will range from tens of millions to over \$1 billion (~\$128/sq ft on average)



Recommended measures don't always pay for themselves under current financial models



Systems will require substantial, disruptive infrastructure improvements



Some technologies (e.g., air-to-water heat pumps, wastewater heat recovery systems) not yet commercially, cost-effectively available

Lessons Learned



Value of multi-level buy-in for support of study and eventual implementation



Reinforce goals by integrating 'roadmaps' into existing processes



ECMs to downsize scale of proposed low-carbon technologies may or may not be cost-effective

Lessons Learned

These plans provide robust long-term roadmaps to decarbonization, equipping campuses with an understanding of the work and investments required to achieve our climate goals



What Comes Next?



Integrate roadmaps into existing plans and protocols



Granular feasibility studies for specific technologies



Conduct similar studies at additional facilities, applying lessons learned



Re-think and reframe financing challenge

Decarbonization is an investment to modernize our heating and cooling infrastructure, does it need a payback period?



**COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENERGY RESOURCES**

Patrick Woodcock, Commissioner

Thank you!

Ryan Kingston

Ryan.Kingston@mass.gov

Sustainability Project Coordinator

Leading by Example Program

Q & A

Additional Public Sector DOE Resources

For State and Local Governments

- [Better Buildings Local Government Sector Page](#)
- [State and Local Solution Center](#) and [Popular Resources](#)
- [Energy Efficiency and Renewable Energy Resources for State and Local Leaders](#)

For K-12 Schools

- [A Guide to Zero Energy and Zero Energy Ready K-12 Schools](#)
- [Advanced Energy Retrofit Guide for K-12 Schools](#)
- [ESPC Primer for K-12 Schools](#)
- [Toolkit: K-12 Lighting](#)
- [Rural K-12 School Facility Workforce Development and Training](#)

Financing Resources

- [Better Buildings Financing Navigator](#)
- [Achieving Energy Savings in Small- and Medium-Sized Public Facilities: A Strategic Approach to Prioritizing and Financing](#)
- [Toolkit: Green Revolving Funds](#)
- [Toolkit: Commercial Property-Assessed Clean Energy \(PACE\)](#)
- [Toolkit: Energy Savings Performance Contracting \(ESPC\)](#)
- [Energy Savings Performance Contracting for Small Projects Primer](#)

Addressing Energy Burden

- [Low Income Energy Affordability Data \(LEAD\) Tool](#)
- [Toolkit: Clean Energy for Low-Income Communities Accelerator \(CELICA\)](#)

Infrastructure, Resilience, and Energy Planning

- [State and Local Planning for Energy \(SLOPE\) Platform](#)
- [Better Buildings Sustainable Wastewater Infrastructure of the Future \(SWIFt\) Accelerator 2.0](#)
- [Toolkit: Low Carbon Technology Strategies](#)
- [Street Lighting Acquisition Evaluation Tool](#)
- [Energy Efficiency and Distributed Generation for Resilience: Withstanding Grid Outages for Less](#)
- [How DERs Can Improve Resilience in Public Buildings: Three Case Studies & Step-by-Step Guide](#)

Implementing Data Management

- [Energy Data Management Guide](#)
- [Benchmarking & Transparency: Resources for State and Local Leaders](#)
- [Smart Energy Analytics Campaign Toolkit](#)
- [Building Technologies Office Building Energy Data subprogram](#)

Bipartisan Infrastructure Law Resources

- [White House Fact Sheet: Bipartisan Infrastructure Investment and Jobs Act](#)
- [Bipartisan Infrastructure Law Programs](#)

Stay Connected

State and Local Solution Center

- More than 400 tools, resources, and best practices

State and Local Spotlight

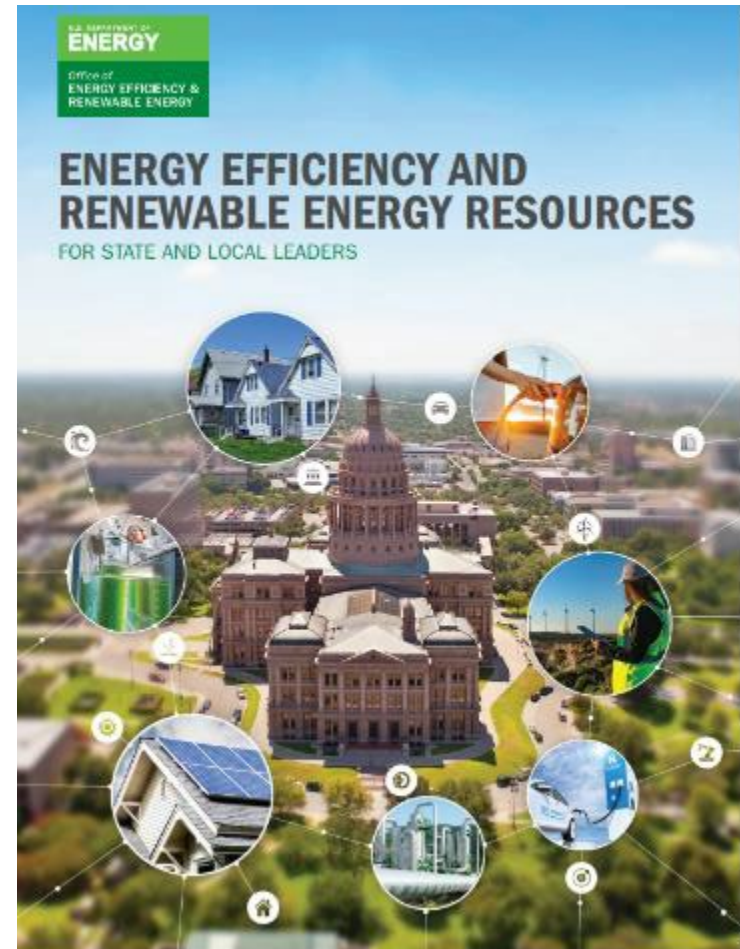
- Monthly newsletter with ~30,000 subscribers

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[Energy Efficiency and Renewable Energy Resources for State and Local Leaders](#)

Thank You!

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