



Districts on the Road to Achieving Efficient, Carbon Neutral Schools

Jackie Wilson Mueller

Superintendent EL7

- a. Address facility development, improvement, operation, and maintenance
- b. Identify objective short- and long-term measures for measuring efficacy and achievement of sustainability goals
- c. Ensure data-collection to enable annual reporting on progress toward goals



Creating a culture of stewardship and conservation through action and education

The Plan identifies 4 main focus areas with goals and strategies to meet the goals



EDUCATION GOALS

Educating Students and Staff
Modeling Sustainable Actions
Green Teams
Sustainability Action and Communication



TRANSPORTATION

Reducing Emissions
Active Transportation Options
Increasing Bus Ridership
Fuel Efficiency



BUILDING AND OPERATIONS

New and Existing Buildings
Efficiency and Conservation
Renewable Energy
Striving for Net Zero



MATERIALS MANAGEMENT

Recycling and Waste Reduction
Non-toxic
Reducing Food waste
Construction Waste Management



Building Development and Operations

BLS will develop and improve healthy built environments for learning. We will strive for net-zero energy through comprehensive integration of efficiency, renewable energy and optimal conservation strategies.



EUI Target of 25 for new and 35 for portfolio 2030

- Goal of increasing renewables 500 kW by 2035
- Caldera average 24, BSH average 68
- Review of building design standards to strive towards net zero—prioritizing envelope, HVAC, lighting, Equipment (Energy star and EPA WaterSense)



Net Zero Ready

- Sustainability Charrette at the outset of projects
- Review building envelope strategies: glazing, solar orientations, daylighting, roof reflectivity
- Design for LEED – Caldera LEED Silver equivalent



Materials Management

- Locations for waste, recycling and composting that can be removed by trucks
- Designing with waste stations in mind in hallways and common areas
- Construction Waste Management Plan – increasing diversion



Highway to Healthy Schools - New Building Institute

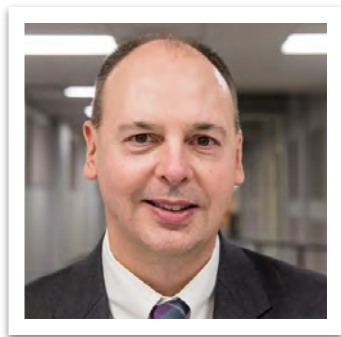
Forest Edge Elementary School - Oregon Wisconsin

Presented by:

ab Actively
Building
Competency, Character,
Culture & Community

OREGON SCHOOL DISTRICT

Findorff



ANDY WEILAND

Business Manager

OREGON SCHOOL DISTRICT

TODAY'S *Presenter*



Agenda

About Forest Edge

Key Topics

- What is NetZero?
- Acknowledgements and Bragging Rights
- How we got to Net Zero
- Net Zero Strategies
- Operational Impact
- Teaching & Learning Impact

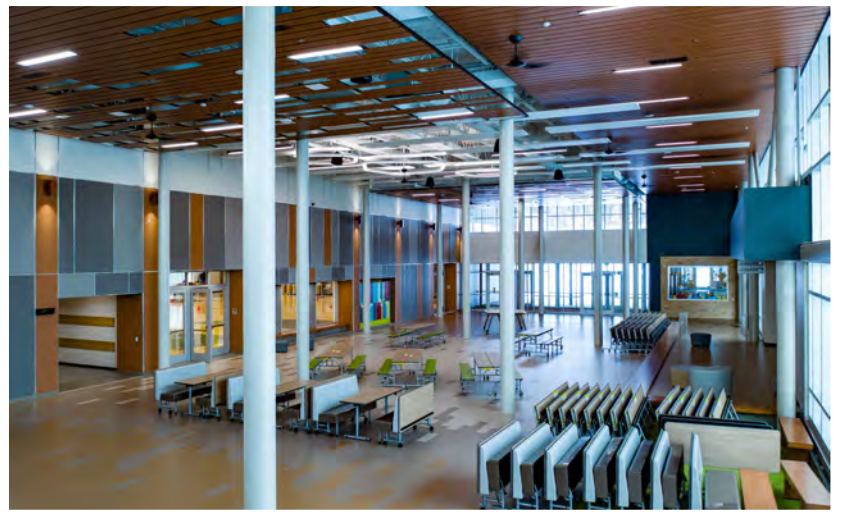
Q&A

NET ZERO

Net zero or zero-energy buildings produce at least as much energy as they consume on an annual basis.

They do this by incorporating state-of-the-art energy efficiency and renewable energy technologies.

- *The National Renewable Energy Laboratory*



**5th LARGEST
VERIFIED**

NET ZERO K-12 SCHOOL
IN THE U.S.

**FIRST NET
ZERO SCHOOL**

IN WISCONSIN

1,704

SOLAR PANELS

99

GEOHERMAL WELLS
THAT ARE
406 FEET DEEP

PROJECT TEAM



HGA



ABOUT FOREST EDGE

A photograph of a mechanical room with white cinder block walls and a grey tiled floor. Large yellow pipes are visible, with some labeled 'SUPPLY' and 'GEO LOOP RETURN'. A grey cylindrical tank is mounted on the wall. A central orange text box with a white border contains the text 'DISTRICT BACKGROUND'.

**DISTRICT
BACKGROUND**

BOARD POLICY

- Community and staff committee drafted a paper on sustainability in the OSD
- Paper became policy and provided direction
- The policy provides a platform for staff-led environmental initiatives



"The Oregon School District believes it is critical for the future of our planet to **develop learners who are ecologically literate and environmentally responsible citizens and stewards**. We believe it is important to model the District's commitment by establishing these values and developing practices consistent with them:

The District will **continue to develop building and operational practices and procedures** that reflect a commitment to environmental sustainability; and

The District will have an **aligned K-12 curriculum that integrates ecological and environmental sciences and issues into the curriculum**, including socio-economic aspects. This may include, but is not limited to, experiences outside the classroom, project-based learning, and environmental services projects."

OREGON'S VALUE STATEMENT

THE BEGINNING: ENERGY MANAGEMENT

eGauge Pro

- Cost effective (\$800)
- Easy to use and implement
- Helps to make data driven decisions





OREGON MIDDLE SCHOOL 2014



Original Solar Panel 

OREGON MIDDLE SCHOOL *Solar | 62 KWp*



BROOKLYN ELEMENTARY SCHOOL *Solar* | 36 KWp



OREGON HIGH SCHOOL *Solar* | 136 kWp

SOLAR PANEL 2014



Oregon Middle School

SOLAR ARRAYS *and* GEOTHERMAL 2014 Referendum

Oregon
High
School



Oregon
Middle
School



Brooklyn
Elementary



NET ZERO 2018 Referendum



Forest Edge Elementary

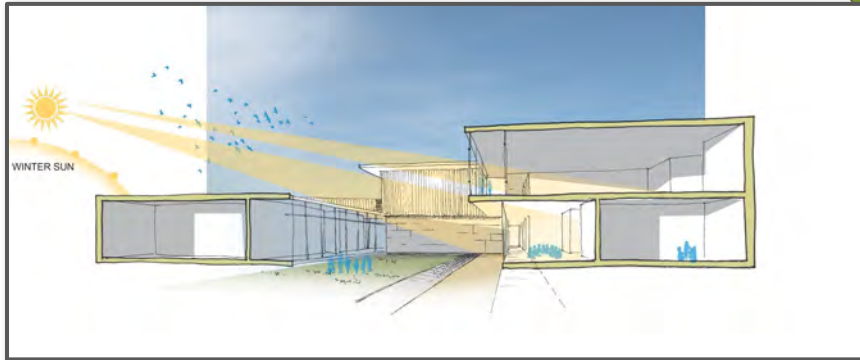
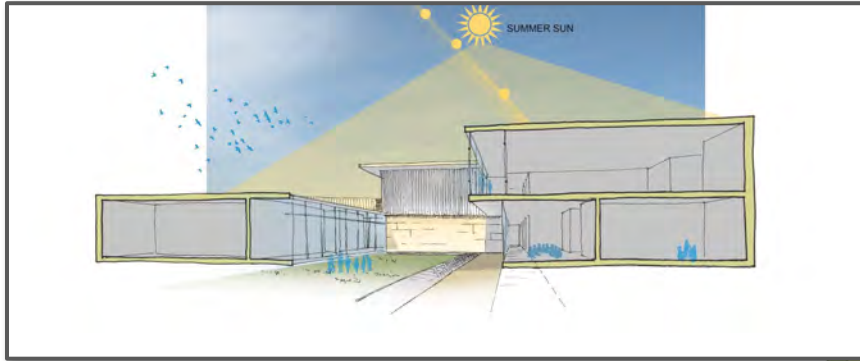
OREGON'S *Journey*

An aerial photograph of a large, multi-story building with a flat roof. The roof is covered with a dense array of solar panels. In the foreground, there is a parking lot with several yellow-painted parking spaces and a few cars. A road with a white crosswalk is visible near the building. The overall scene is set in a semi-arid environment with some dry grass and a paved area.

NET ZERO STRATEGIES

BUILDING ORIENTATION

SITE & SECTION



GEOHERMAL HEATING/COOLING



ROOFTOP SOLAR PHOTOVOLTAICS



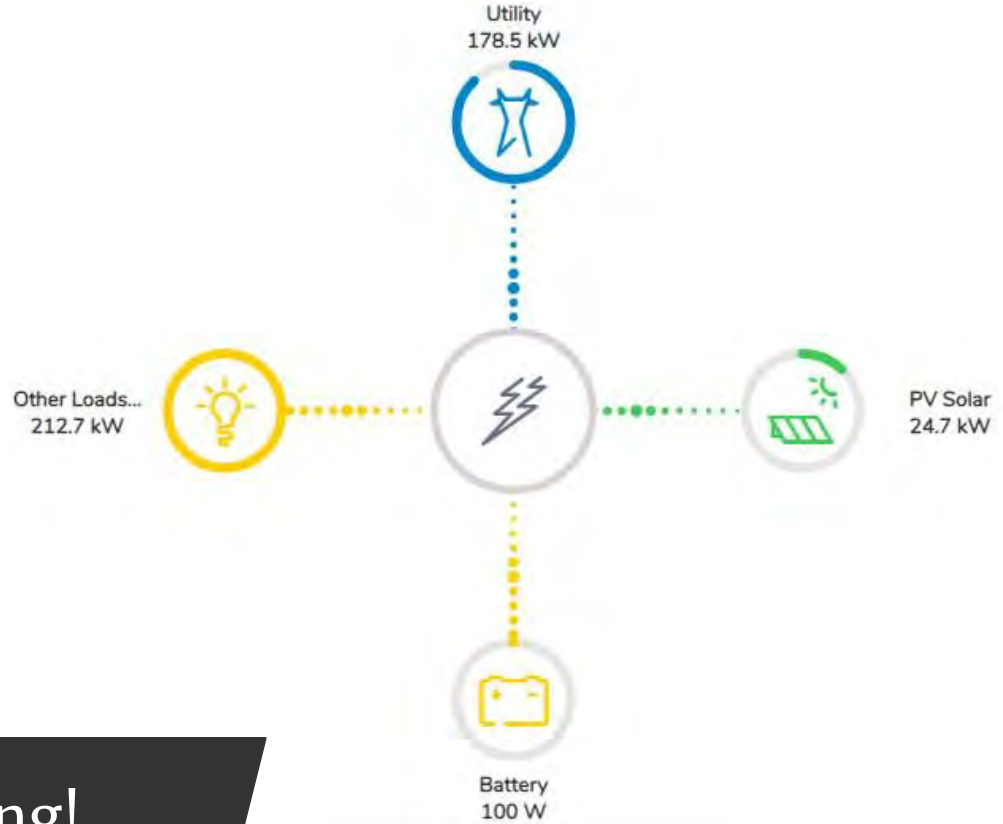
BATTERY STORAGE SYSTEM



AN ELECTRIC FUTURE

All Electrical Energy

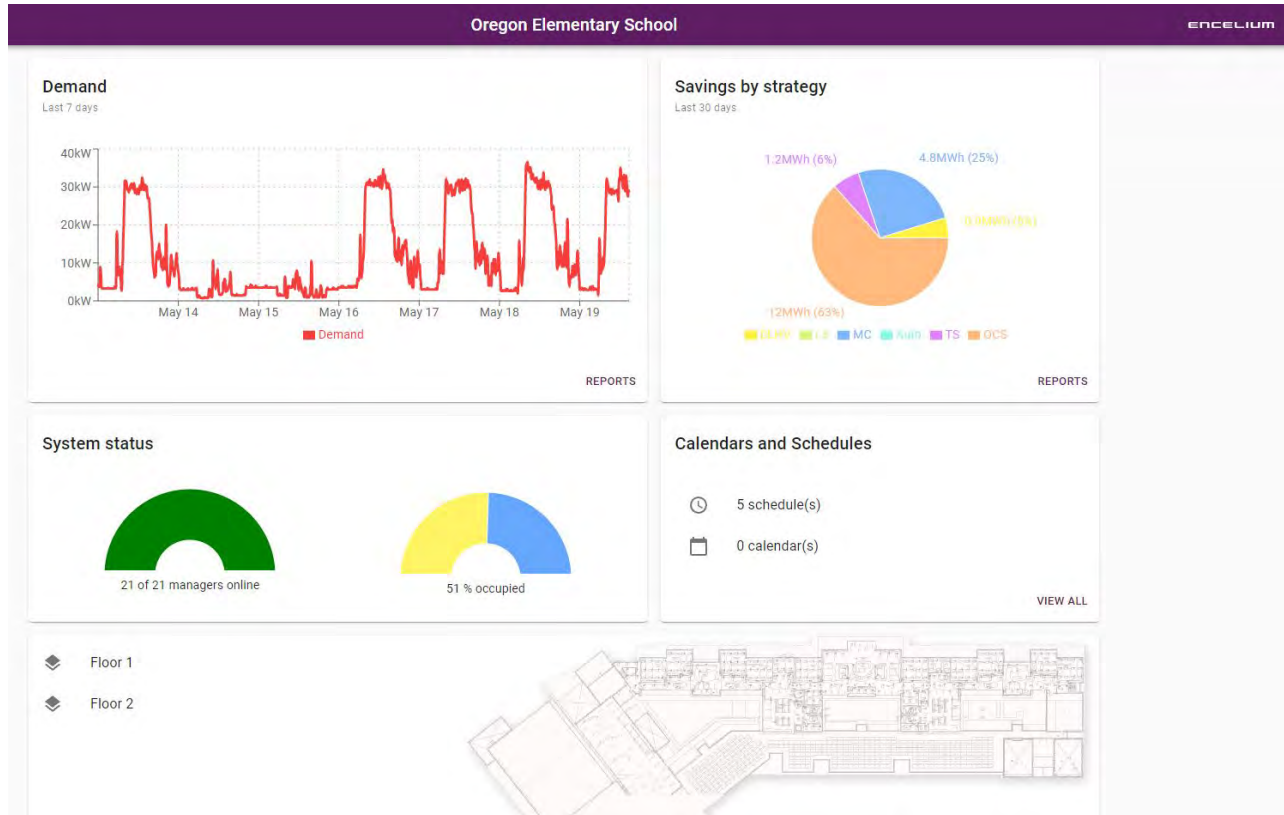
- Heating / cooling
- Hot water
- Renewable energy
- Battery storage



Zero natural gas to the building!

MINIMIZE ELECTRIC USE

NETWORKED LIGHTING SYSTEM

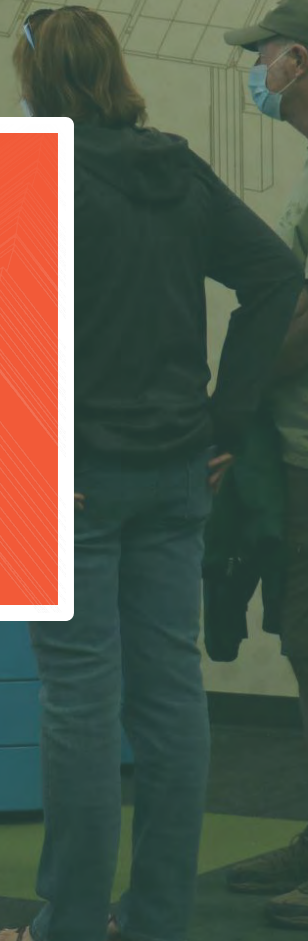


...ain source of light is
...es and even travels
...n the sun and use it
...basis. Almost all
...ry needs.

LIGHT

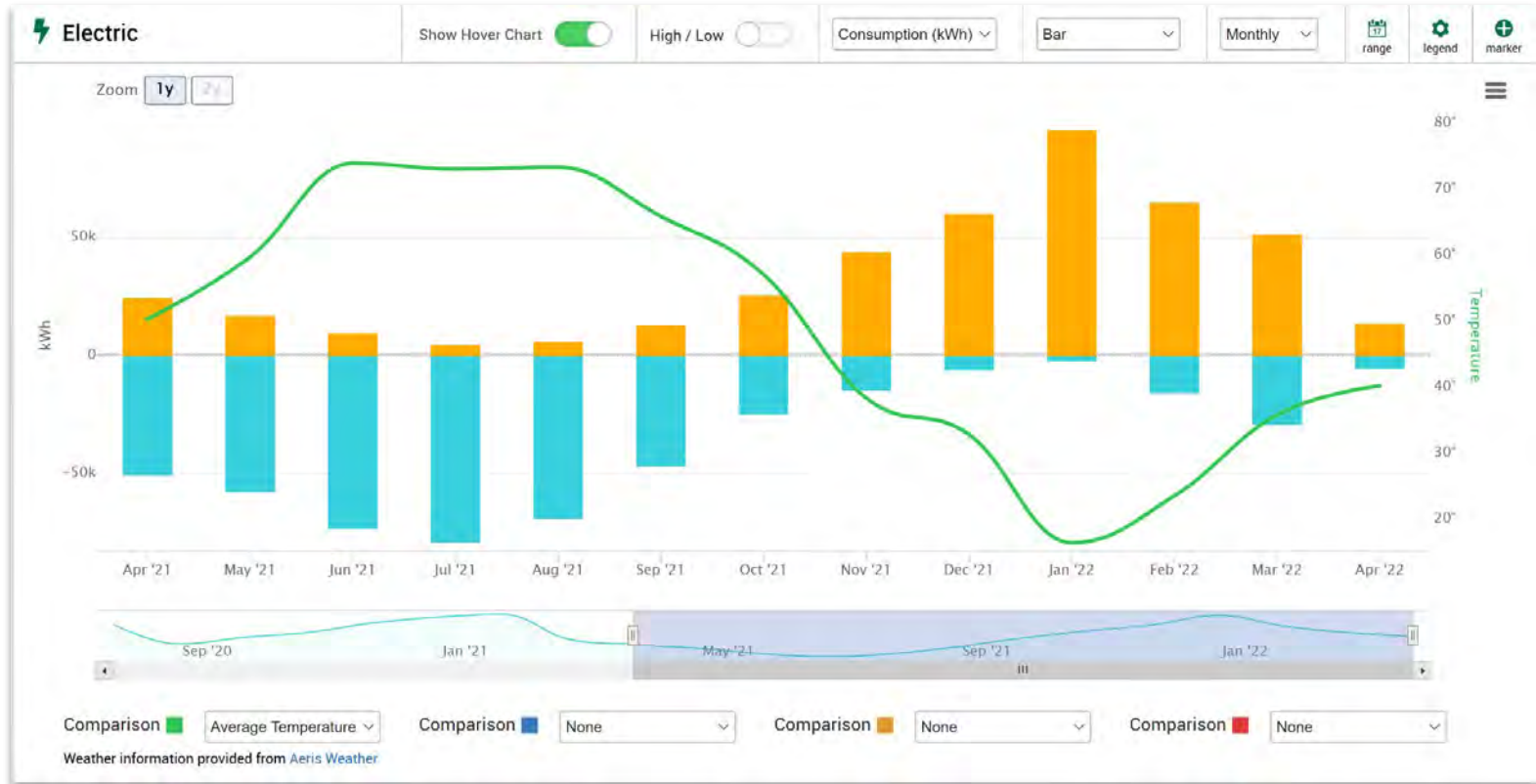


OPERATIONAL IMPACT



NET ZERO TRACKING

MONTH-BY-MONTH



ENERGY USAGE COMPARISON - 9/2021 to 8/2022

Building	Square Footage	Utility	Total by Utility	Total Energy Cost by Building	Cost sq/ft
Rome Corners Intermediate	110,000	Gas	\$24,417	\$145,692	\$1.15
		Electric	\$102,190		
Forest Edge Elementary	126,000	Gas	N/A	\$60,974**	\$0.48
		Electric	\$60,974		
Oregon Middle School*	132,000	Gas	\$31,047	\$131,132	\$1.04
		Electric	\$105,698		

*Oregon Middle School has a geothermal wing

** 69% of this cost was related to demand charges....not energy or transmission costs.

ENERGY USAGE COMPARISON - 2020-21 to 2021-22

Building	20-21 Cost Sq/Ft	21-22 Cost Sq/Ft	% Chg
Rome Corners Intermediate	\$1.04	\$1.15	10.53%
Forest Edge Elementary	\$0.45	\$0.48	7.21%
Oregon Middle School*	\$0.93	\$1.04	11.97%

- 4% to 5% less of an increase than the other two buildings in one year
- What do you think happens for 22-23?

*Oregon Middle School has a geothermal wing

Energy Bills Can Be Enjoyable!

Please return the top portion with payment.



Account Number: 8300452173
Customer Name: Oregon School District

Heating Degree Days: 356
Service Address: 4848 Brassica Rd, Fitchburg

Bill Date	Next Meter Read	Gas Meters	Gas Bill	Electric Meters	Electric Bill	Total Account Balance
05/22/23	06/21/23	0	\$0.00	3	\$39.50	\$39.50

Previous Account Balance **\$2,978.15**
05/05/23 Payment Received - Thank You \$2,978.15
Balance Forward **\$0.00**

Electric Service

Days	Billing Period	Current Read	Previous Read	Constant	kWh Used
29	04/20/23 - 05/19/23	4586	4525	300.000	18201
29	04/20/23 - 05/19/23	3837	3678	300.000	47847

Meter readings displayed are for validation purposes only; billing is based on actual interval usage through midnight on the read date.

Electric: Commercial & Industrial Time-of-Use (CG-2)

Grid Connection and Customer Service Charge 29 Days at \$14.50 \$420.50
Customer Maximum Demand 288.6 kW/Day at \$0.106 \$887.16
Distribution Charge 18,201 kWh at \$0.0147 \$267.55
Maximum On-Peak Demand 139.8 kW/Day at \$0.3923 \$1,590.46
Electricity Service 18,201 kWh at \$0.06894 \$1,254.78
On-Peak 1 Winter (10AM-1PM) 765 kWh at \$0.02154 \$16.48
On-Peak 2 Winter (1PM-6PM) 204 kWh at \$0.0188 \$3.84
On-Peak 3 Winter (6PM-9PM) 136 kWh at \$0.02294 \$3.12
State Low-Income Assistance Fee 29 Days at \$4.59724 \$133.32
Subtotal Electric Meter E351964 **\$4,577.21**

Days	Billing Period	Current Read	Previous Read	Constant	kWh Used
29	04/20/23 - 05/19/23	3837	3678	300.000	47847

Electric: Parallel Generation (PG-1)

On-Peak kWh Purchased 34,108 kWh at \$-0.1096 -\$3,738.24
Off-Peak kWh Purchased 13,739 kWh at \$-0.05819 -\$799.47
Subtotal Electric Meter E351964 **-\$4,537.71**



Total Current Charges **\$39.50**

Total Amount Due **\$39.50**



MAINTAINING A NET ZERO BUILDING

- Needs a willing advocate with some passion for sustainability
- Requires time to learn and trust the technology
- Include internal, building-level staff who have passion for sustainability



A modern office lounge area with a large window overlooking a cityscape. The room features a long, low-profile sofa with light wood and yellow accents. In the foreground, there is a light wood shelving unit. The background shows glass-walled offices and a green wall. A central orange text box with a white border contains the text "TEACHING & LEARNING IMPACT".

**TEACHING &
LEARNING IMPACT**

TEACHING TOOLS

WALL/WINDOW GRAPHICS



TEACHING TOOLS LEARNING OPPORTUNITIES



EDUCATIONAL ENVIRONMENT

COLLABORATIVE SPACES



EDUCATIONAL ENVIRONMENT

NATURAL LIGHT



EDUCATIONAL ENVIRONMENT

OUTDOOR CLASSROOMS

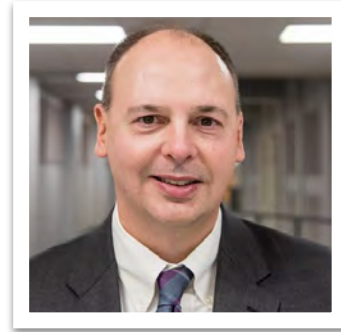


WHAT'S NEXT FOR OREGON?

- Continue to learn and share our journey with other school districts
- Develop long-term approach to energy consumption
- Leverage building as an educational tool
- Empower future sustainability champions



THANK
You!



ANDY WEILAND

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Climate Action

A STUDENT-LED INITIATIVE

FINANCIAL IMPACT
ASSESSMENT


LeeAnn Kittle, Director of Sustainability

Adam West, Energy Engineer



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Look at the news: extreme heat, extreme storms, and extreme weather patterns. The only thing that doesn't seem extreme is our response.

Mariah Rosensweig

East High School senior, Climate Activist,
co-Vice President of East Sustainability Club,
and co-leader of DPS Students for Climate Action



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Student Leadership



[Home](#) [Our Resolution](#) [About us](#) [Art Contest](#) [Sign Our petition](#) [More](#)

DPS STUDENTS FOR CLIMATE ACTION



CLEAN ENERGY

Use 100% clean electricity by 2030 in accordance with Denver's [100% Renewable Electricity Action Plan](#)

[Read More >](#)



DECREASE CARBON EMISSIONS

Reduce overall greenhouse gas emissions by at least 90% of the levels of district-wide greenhouse gas emissions that existed in 2010 by 2050, in line with [Colorado's Climate Action Plan](#)

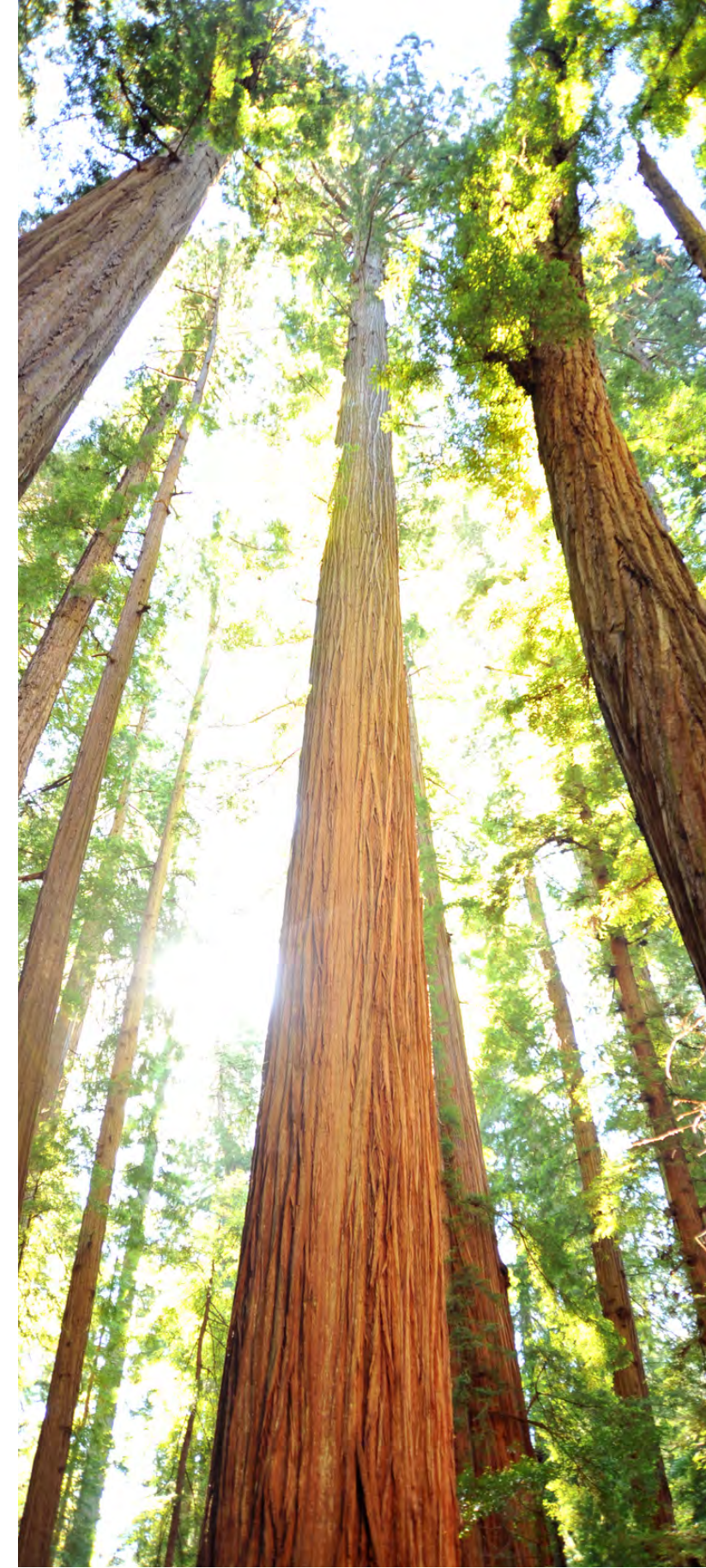
[Read More >](#)



ENVIRONMENTAL JUSTICE

Prioritize sustainability actions in schools and communities facing greater inequity and/or environmental injustice

[Read More >](#)



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Our Policy:

DPS shall be a national leader in establishing **an organizational culture anchored in sustainability, climate action, and environmental justice** in both the conservation of natural resources and in minimizing the carbon footprint of DPS' practices.



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Climate Action Plan



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North Star Goals:

Environmental Protection:

Reduce overall greenhouse gas emissions by at least 90%* by 2050.

*Of the levels of district-wide greenhouse gas emissions that existed in 2010 by 2050

Economic Prosperity:

Reduce natural resources consumption and waste year-over-year.

Social Development:

All students and staff are engaged in sustainability by 2050.

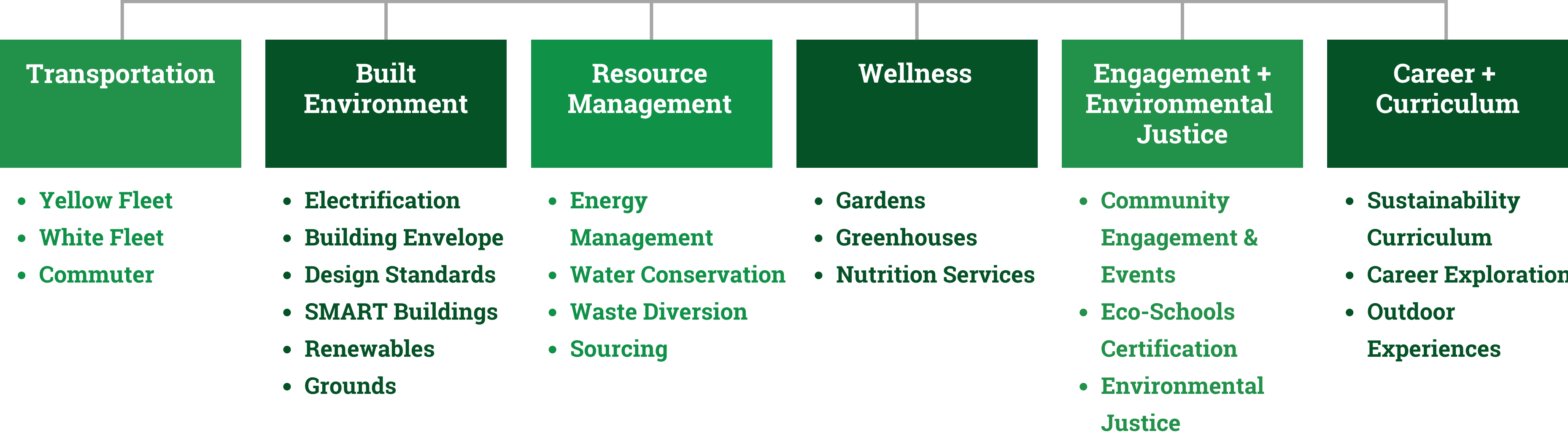


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North Star Goals

FRAMEWORKS



5 Year Goals:

BUILT ENVIRONMENT

5-YEAR GOALS

Electrification

Electrify 80% of the heating load for 10 buildings

Building Envelope

Commission two existing building envelopes and incorporate findings into future financial impact assessments

Design Standards

Require Sustainable Design Guidelines to be integrated into all capital improvement decisions

SMART Buildings

Implement one fully SMART building, perform a cost-benefit analysis, and create a funding plan for additional SMART buildings

Renewables

65% of electricity supplied to DPS is renewable

Grounds

Create Sustainable Landscape Standard & Implementation Plan

RESOURCE MANAGEMENT

5-YEAR GOALS

Energy Management

Reduce energy (MMBtu) consumption by 15% from 2021 baseline

Water Conservation

Reduce consumption by 15% from 2021 baseline

Waste Diversion

Ensure landfill diversion rate is at least 25%

Sourcing

Embed sustainable practices in all procurement policies including "end of life planning"



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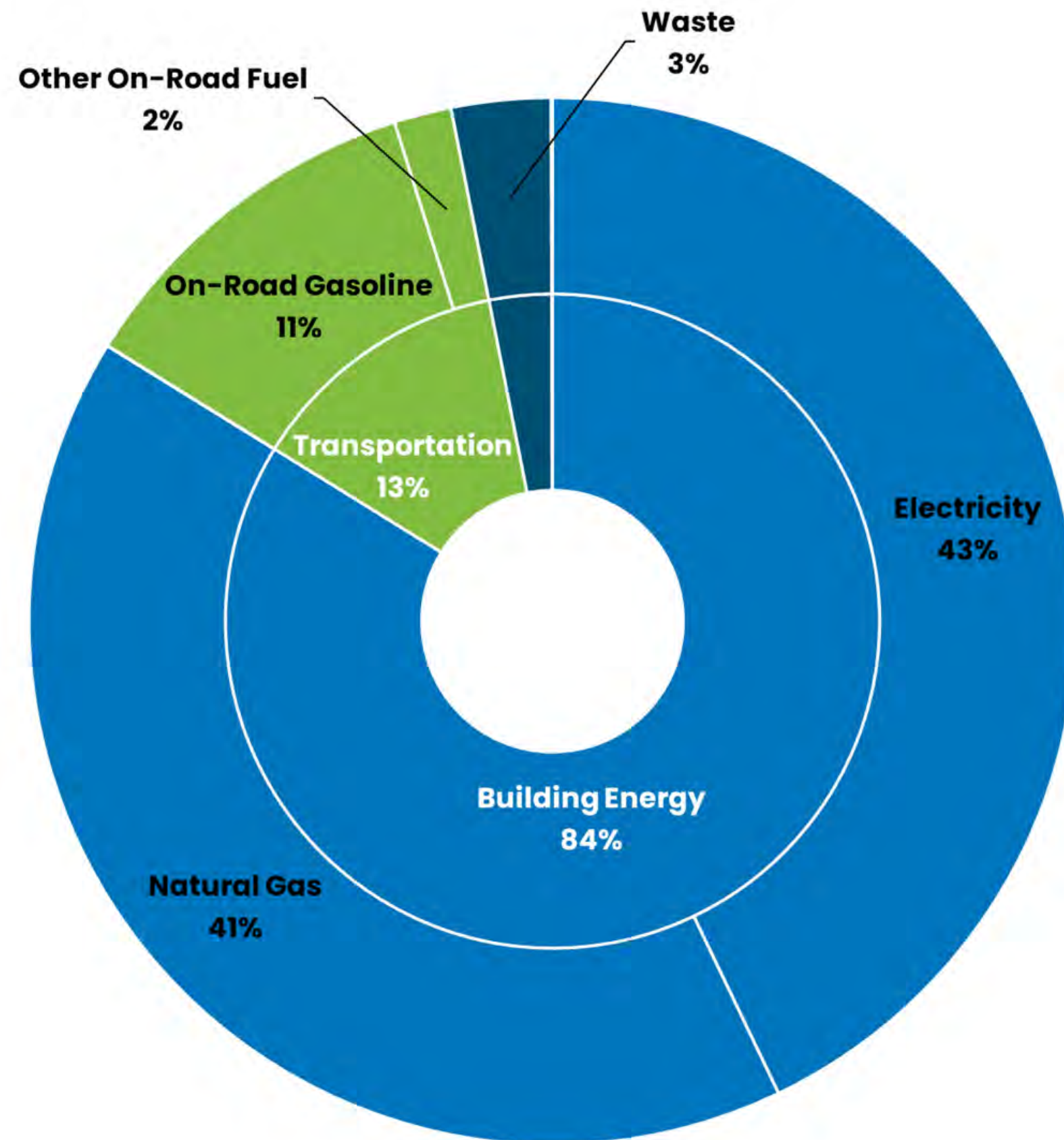
Greenhouse Gas Inventory



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2021 DPS Emissions by Sector and Source

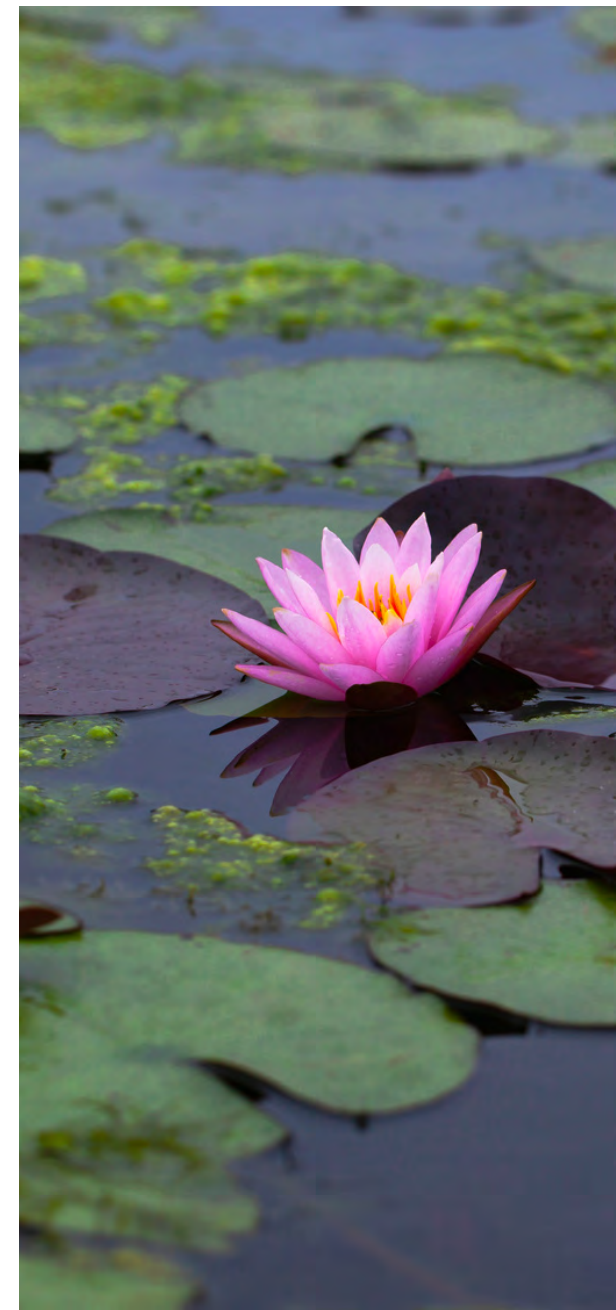
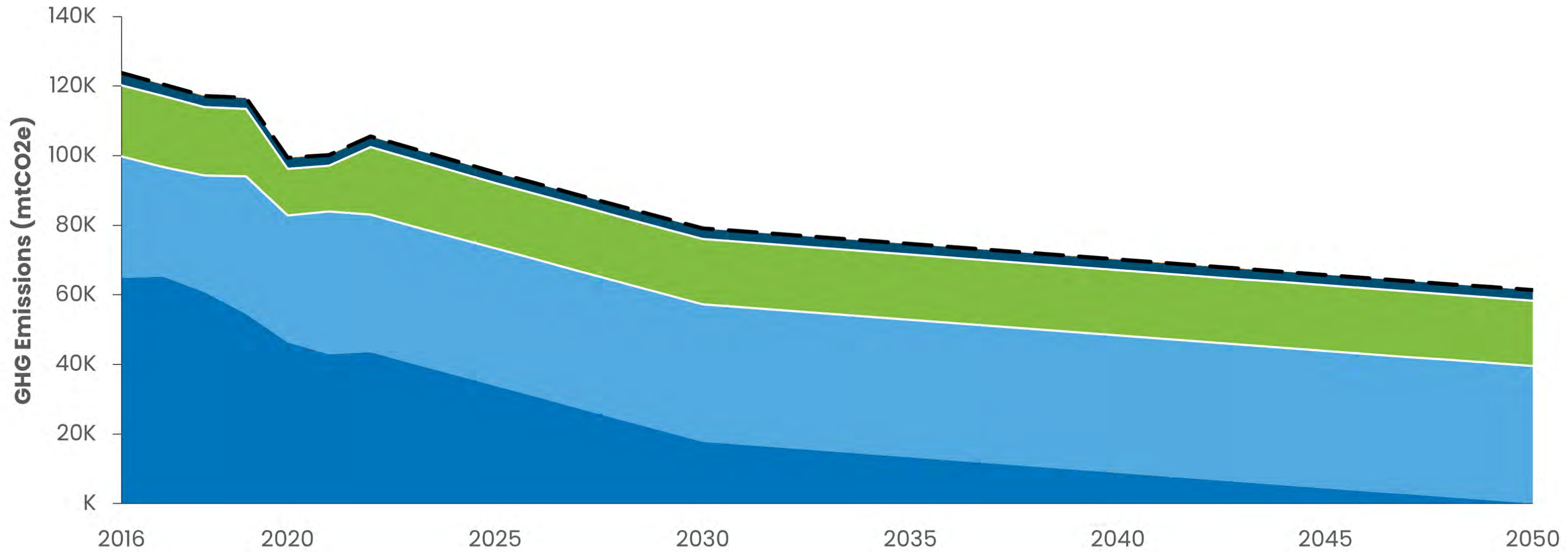


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- Consumption Emissions
- Waste Emissions
- Transportation Emissions
- Other Building Energy Emissions
- Electricity Emissions
- Total Emissions

DPS Business-As-Usual Emissions Projection



Financial Impact Assessment

SCOPE OF WORK

01	2020 Bond Electrification Evaluation	<ul style="list-style-type: none">● Consult on schools receiving new cooling or cooling upgrades● Recommend electrification, assess costs
02	2024 Capital Planning Electrification Evaluation	<ul style="list-style-type: none">● Plan ahead for next bond round to include electrification● Recommend electrification, assess costs
03	Renewable Energy Assessment	<ul style="list-style-type: none">● Analyze gap to achieve 100% renewable energy by 2030 considering Xcel Energy targets● Determine options and costs for new solar
04	Portfolio Level Analysis	<ul style="list-style-type: none">● Evaluate historic energy use and emissions● Assess impacts and costs for efficiency, electrification, and renewables across DPS



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Electrification - 2020 Bond Summary



14 school analyzed



42% reduction in natural gas use



20% reduction in 2030 carbon emissions



5% increase in Net Present Cost



4% reduction in operating costs



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Electrification - 2020 Bond

Economic & Emissions Summary

	Area	Status Quo Net Present Cost	Electrification Net Present Cost	NPC Diff.	Status Quo 2030 GHG	Electrification 2030 GHG	GHG Diff.
School	SF	\$	\$	%	mtCO ₂ e	mtCO ₂ e	%
Amesse	70,740	\$6,021,135	\$6,441,202	7%	286	227	-21%
Carson	51,756	\$6,399,716	\$6,625,469	4%	278	188	-32%
Cheltenham	80,590	\$7,810,754	\$8,393,953	7%	345	283	-18%
Cowell	57,795	\$6,844,594	\$5,604,998	-18%	261	178	-32%
Del Pueblo	65,199	\$5,661,449	\$6,570,969	16%	197	167	-15%
Denison	55,826	\$4,587,091	\$4,908,465	7%	174	136	-22%
East	316,745	\$3,859,216	\$3,906,325	1%	1,350	1,326	-2%
Ebert	55,250	\$6,813,621	\$7,991,892	17%	314	224	-29%
Fallis	53,370	\$3,826,788	\$4,254,298	11%	269	188	-30%
Sabin	91,311	\$9,649,503	\$7,900,517	-18%	328	233	-29%
Stedman	52,243	\$5,816,973	\$5,889,211	1%	354	234	-34%
Steele	64,265	\$6,524,419	\$5,631,216	-14%	271	227	-16%
TJ High	264,719	\$17,532,293	\$21,129,593	21%	998	728	-27%
Wyman	45,780	\$6,169,870	\$6,709,770	9%	226	192	-15%
Totals	1,325,589	\$97,517,421	\$101,957,880	5%	5,649	4,531	-20%



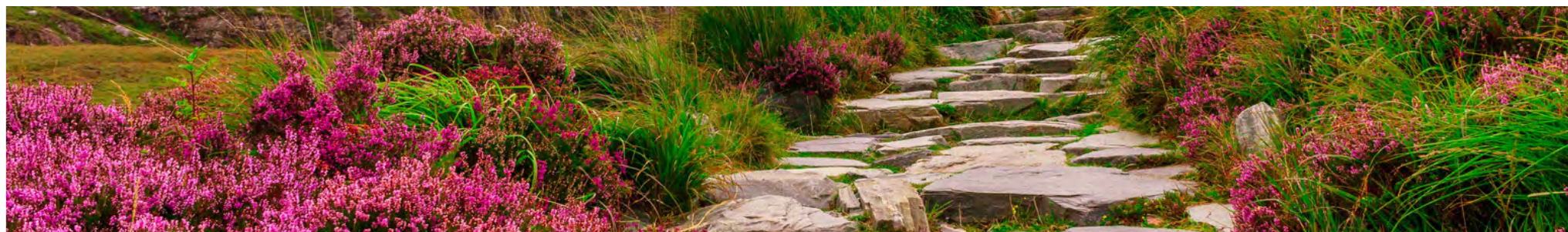
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Electrification - 2020 Bond

Example: Sabin Cost Results

System Type	First Cost	Operating Cost	Net Present Cost
	\$	\$/Yr	\$
Status Quo	\$8,726,081	\$98,140	\$9,649,503
Electrification Option #1	\$7,020,514	\$92,665	\$7,900,517
Difference (\$)	-\$1,705,567	-\$5,475	-\$1,748,986
Difference (%)	-20%	-6%	-18%
\$ / Total mtCO2e Saved	-\$1,323	—	—



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Electrification - 2024 Capital Planning Summary



27 school analyzed



36% reduction in natural gas use



20% reduction in 2030 carbon emissions



17% increase in Net Present Cost



9% reduction in operating costs



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Electrification - 2024 Capital Planning

Economic & Emissions Summary

School	Area	Status Quo Net Present Cost	Electrification Net Present Cost	NPC Diff.	Status Quo 2030 GHG	Electrification 2030 GHG	GHG Diff.
	SF	\$	\$	%	mtCO ₂ e	mtCO ₂ e	%
Asbury	43,468	\$5,055,065	\$4,741,102	-6%	246	165	-33%
Barrett	65,670	\$4,210,343	\$4,321,590	3%	138	98	-29%

...

Pioneer	44,199	\$4,656,771	\$4,238,149	-9%	271	191	-29%
Skinner	148,821	\$10,350,448	\$9,468,126	-9%	905	755	-17%
Steck	43,156	\$3,928,013	\$3,300,839	-16%	172	160	-7%
Teller	65,993	\$5,410,166	\$6,813,427	26%	241	183	-24%
Traylor	67,803	\$4,736,183	\$4,620,171	-2%	210	174	-17%
University Park	66,092	\$4,027,327	\$4,702,547	17%	239	221	-8%
Whiteman	71,376	\$3,773,968	\$5,821,749	54%	356	312	-12%
Totals	1,325,589	\$142,948,204	\$166,606,661	17%	9,189	7,422	-19%

*not all 27 schools shown



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Electrification Opportunities

EASY

The following systems **should be** electrified:

- Furnaces
- Roof top units under 25 tons
- Individual tank hot water heaters



MED

The following systems **should be considered** for electrification:

- Air Handling Units
- Unit Ventilators
- Instantaneous Hot Water Heaters



HARD

Central natural gas boilers



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Electrification Opportunities

Rooftop Unit (RTU)

Average Reduction in Natural Gas	Average Reduction in GHG Emissions	Difference in First Cost	Difference in Operating Cost
35%	15%	10%	-17%

- Include a heat pump in lieu of DX cooling
- Natural gas can remain as backup
 - Reduce peak electrical cost
 - Minimize or eliminate the need to increase the electrical supply
- Limited options above 25 tons



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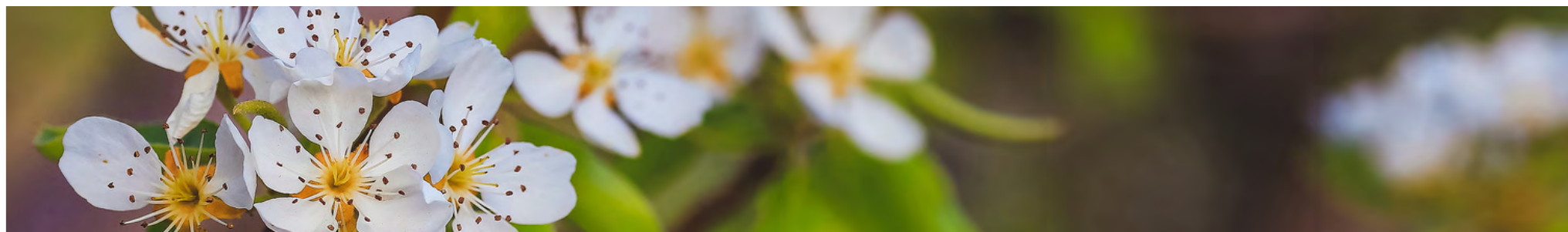
Electrification Opportunities



Air Handling Unit (AHU)

Average Reduction in Natural Gas	Average Reduction in GHG Emissions	Difference in First Cost	Difference in Operating Cost
30%	15%	5-40%	-16%

- Include a split system air source heat pump in lieu of DX cooling or CHW coil
- HW or steam coil can remain as back up
 - Reduce peak electrical cost
 - Minimize or eliminate the need to increase the electrical supply
- Refrigerant line length can be a concern



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Electrification Opportunities



Unit Ventilators

Average Reduction in Natural Gas	Average Reduction in GHG Emissions	Difference in First Cost	Difference in Operating Cost
50%	27%	0%	-17%

- Include a package air source heat pump in lieu of DX cooling or CHW coil
- HW or steam coil can remain as back up
 - Reduce peak electrical cost
 - Minimize or eliminate the need to increase the electrical supply
- Will require additional maintenance compared to a CHW system



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Electrification Opportunities

Central Steam or Hydronic Systems



- Typically high heat requirements
- Limited electrification options at this time
- Replacement options typically have high installation or operating costs
- Air source heat pumps are currently not a viable option



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Portfolio Assessment Summary



Energy Efficiency

27% Energy Cost Savings

Electrification

38% reduction in district natural gas

Onsite Solar

38% offset of district electricity

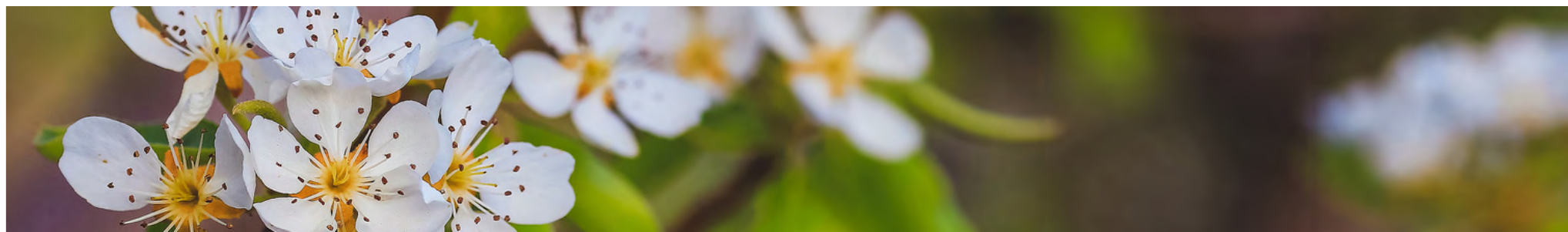


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Portfolio Assessment Summary

Strategy	First Cost	Energy Cost Savings	Energy Cost Savings	2030 GHG Savings	Investment per mtCO ₂ e Saved	GHG Difference
	\$	\$/yr	%	mtCO ₂ e	\$/mtCO ₂ e	%
Energy Efficiency	\$ 430,714,506	\$ 3,939,688	27%	11,983	\$ 35,945	21%
Electrification	\$ 91,203,583	\$ (68,442)	0%	11,866	\$ 7,686	20%
Renewable Energy	\$ 78,276,927	\$ 1,782,626	12%	6,232	\$ 12,560	11%
Totals	\$ 600,195,016	\$ 5,653,873	39%	30,081	\$ 19,953	52%



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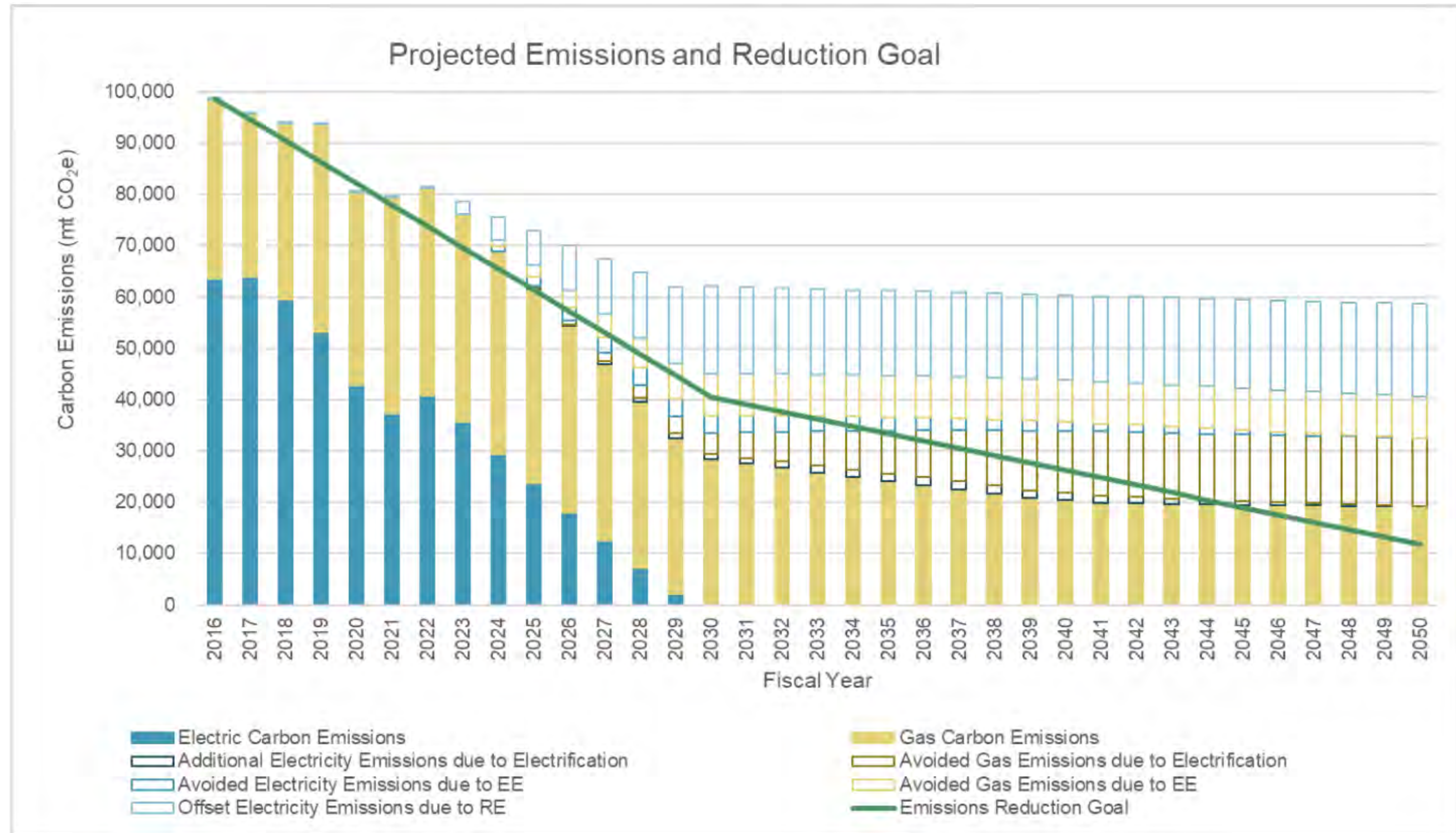
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Portfolio Assessment Summary

If we followed all recommendations:

DPS would have 100% renewable electricity by 2030

DPS would reduce emissions 84% by 2050



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Portfolio Assessment Summary

2028 Renewable Goal from CAP

Solar Gap	5%
Total Production Required	5,340,000 kWh
Required Area	650,000 SF
Available Roof Area across the District	6.8 million SF
Estimated Cost	\$11.4 million
Potential Solar Credit	\$3.4 million



Portfolio Assessment Summary

Solar Considerations



- There are limited offsite solar options available that allow the customer to retain the renewable energy credits (REC)
- The onsite system cannot be enrolled in Xcel Energy's Solar Reward program
- Although this is better economical, the program does not allow customers to retain the RECs



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Financial Impact Assessment

Key Takeaways

Electrification

- Electrification opportunities are available in EVERY school
- When possible consider electrification projects holistically
- When to consider electrification?
 - When cooling is being added to a school
 - When easy-to electrify or medium-to-electrify equipment is being replaced at the end of useful life
 - When a boiler is being replaced at the end of useful life
 - When an addition or major renovation is being planned

Solar

- 183 schools have solar potential
- Solar tax credits are available for tax exempt entities as part of the Infrastructure Reduction Act
- When to consider solar?
 - When a roof is being replaced at the end of useful life
 - When an addition or major renovation is being planned



DENVER
PUBLIC
SCHOOLS

Sustainability



NO TAGLINE. JUST ACTION.

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THANK YOU

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