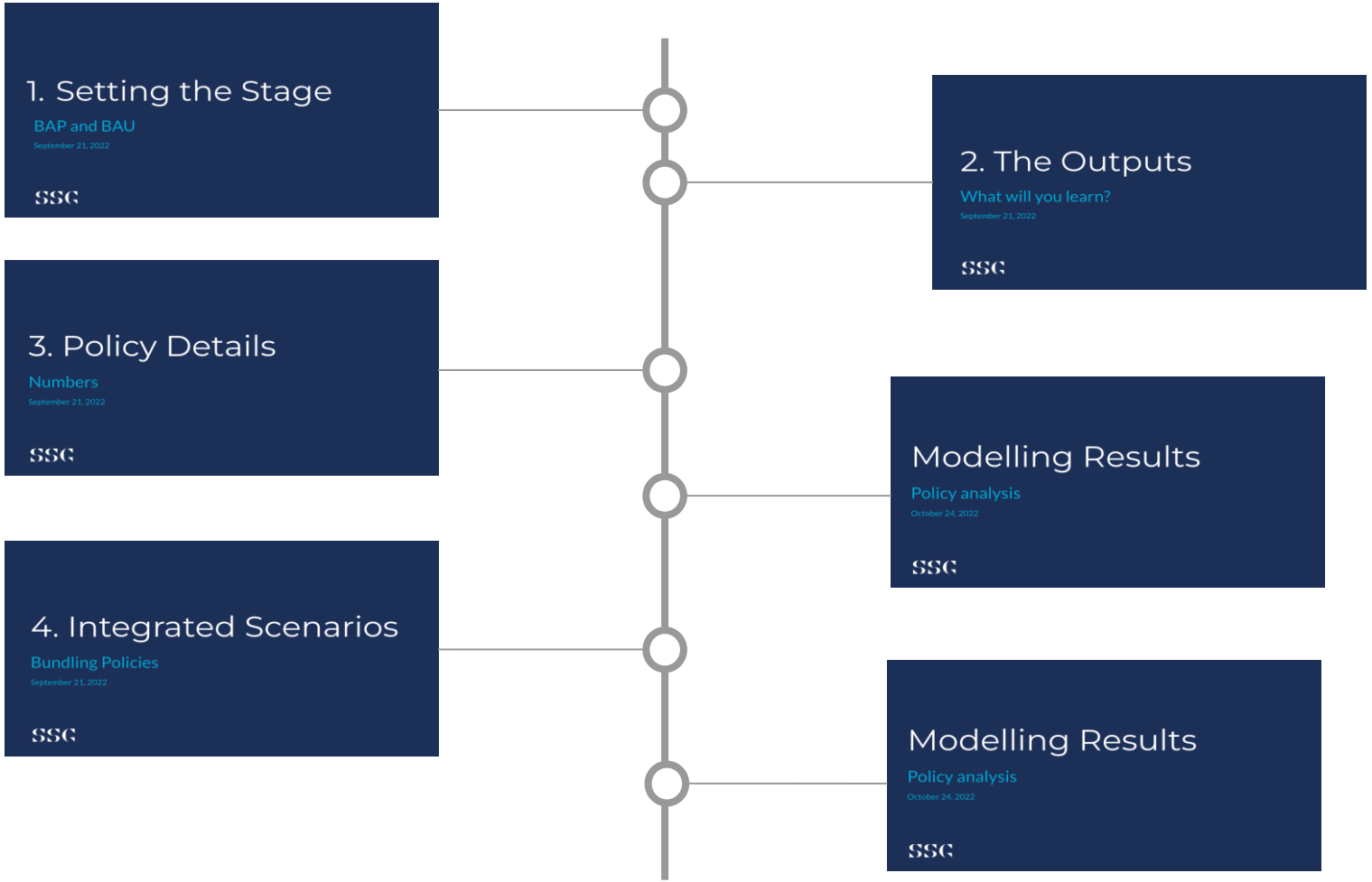
Modelling Wrap Up

Policy analysis

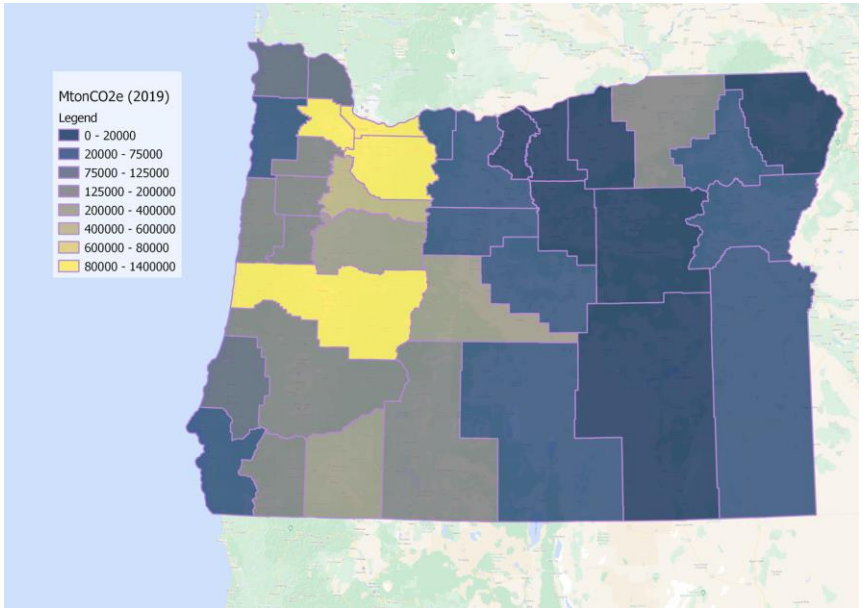
November 15, 2022

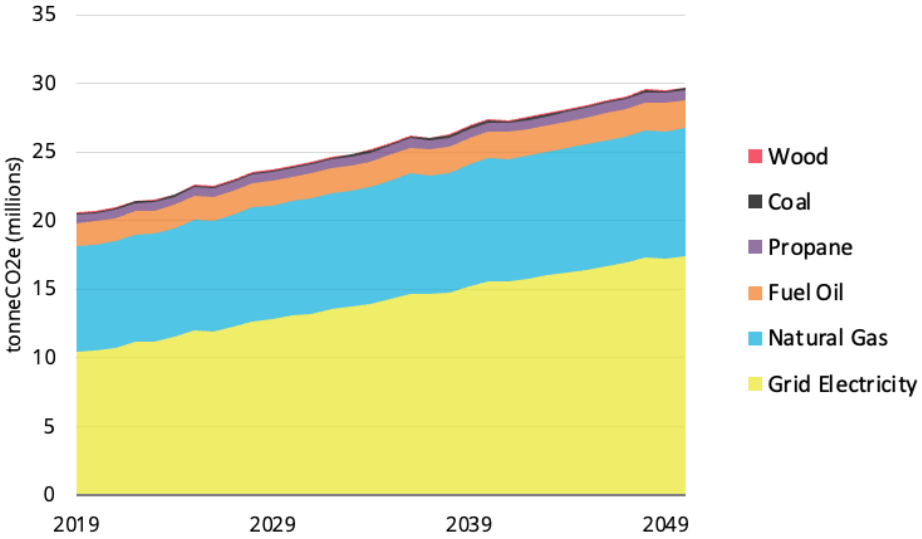
SSG

Recap


1. Setting the Stage
BAP and BAU
September 21, 2022
SSG
2. The Outputs
What will you learn?
September 21, 2022
SSG
3. Policy Details
Numbers
September 21, 2022
SSG
Modelling Results
Policy analysis
October 24, 2022
SSG
4. Integrated Scenarios
Bundling Policies
September 21, 2022
SSG
Modelling Results
Policy analysis
October 24, 2022
SSG

A Calibrated Model





Policies

1	**Building performance standards**	*1a*	*1b*	*1c*	*1d*
		Direct emissions need to reach 5% below 2035 levels in the BAP by 2035		Direct emissions need to reach 40% below 2035 levels in the BAP by 2035	
		Existing residential, commercial and multi-family buildings			
		All building sizes	Buildings ≥ 35,000 ft2	All building sizes	Buildings ≥ 35,000 ft2
2	**Promote, incentivize and or subsidize energy efficiency and heating/cooling**	*2a*	*2b*	*2c*	*2d*
		50% of buildings are retrofitted by 2050, thermal energy requirements reduced by 15%		100% of buildings are retrofitted by 2035, thermal energy requirements reduced by 50%	
		All building types			
		Buildings ≥ 50,000 ft2	Buildings ≥ 30,000 ft2	Buildings ≥ 50,000 ft2	Buildings ≥ 30,000 ft2
3	**Decarbonize institutional/public buildings**	*3a*	*3b*		
		New buildings after 2035 are carbon neutral	New buildings after 2023 are carbon neutral		
		50% of buildings are retrofitted by 2045; thermal energy requirements reduced by 15%; plug load reduced by 15%	100% of buildings are retrofitted by 2035: thermal energy requirements reduced by 50%; Plug load reduced by 50%		
4	**Promote, incentivize, and/or subsidize heat pumps**	*4a*	*4b*		
		80% of covered buildings have a heat pump installed by 2040	100% of buildings that are covered have a heat pump installed by 2035		
		New and existing residential and commercial buildings			
5	**Assess and disclose material-related emissions**	*5a*	*5b*	*5c*	
		Reduce embodied carbon from construction by 20% by 2030, compared to 2015	Reduce embodied carbon from construction by 60% by 2030, compared to 2015	Reduce embodied carbon from construction by 100% by 2050, compared to 2015	
		Residential and commercial buildings			
6	**Enact energy-efficient building codes- Existing**	*6a*	*6b*	*6c*	*6d*
		50% of existing buildings are retrofitted by 2050, thermal energy requirements reduced by 15%, plug load reduced by 15%		100% of existing buildings are retrofitted by 2035, thermal energy requirements reduced by 50%, plug load reduced by 50%	
		Existing residential and commercial buildings			
		Buildings ≥ 50,000 ft2	Buildings ≥ 30,000 ft2	Buildings ≥ 50,000 ft2	Buildings ≥ 30,000 ft2
	Enact energy-efficient building codes- New	A 40% reduction in new building energy consumption from the 2006 Oregon codes		A 80% reduction in new building energy consumption from the 2006 Oregon codes	
		New residential and commercial buildings			
		Buildings ≥ 50,000 ft2	All buildings	Buildings ≥ 50,000 ft2	All buildings

1a Building Performance Standard

Target	Direct emissions need to reach 5% below 2035 levels in the BAP by 2035
Building types	Existing residential, commercial and multi-family buildings
Building sizes	All building sizes

Impact on GHG Emissions Relative to All Building Policies Analysed

Policy with the lowest reduction — Policy with the highest reduction

Indicators

1. GHG emissions	Decreases emissions	-550,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	Saves money per ton of emissions reduced	-$141 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	Decreases energy consumption	-10,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	no change	0 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	Decreases health costs	-$36 million average annual avoided public health costs (2022-2050)

5b Assess and cite/cover material-related emissions

Target	Reduce embodied carbon from construction by 60% by 2030, compared to 2019
Building types	Residential and commercial buildings

Impact on GHG Emissions Relative to All Building Policies Analysed

Policy with the lowest reduction — Policy with the highest reduction

Indicators

1. GHG emissions	Decreases emissions	-3,340,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	Costs money per ton of emissions reduced	$37 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	Decreases energy consumption	0 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	no change	0 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	No change	$0 million average annual avoided public health costs (2022-2050)

3b Decarbonize institutional/public buildings

Target	New buildings after 2020 are carbon neutral
Retrofits	100% of buildings are retrofitted by 2035: thermal energy requirements reduced by 30%; Plug load reduced by 50%

Impact on GHG Emissions Relative to All Building Policies Analysed

Policy with the lowest reduction — Policy with the highest reduction

Indicators

1. GHG emissions	Decreases emissions	-180,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	Costs money per ton of emissions reduced	$558 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	Decreases energy consumption	-7,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	no change	0 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	Decreases health costs	-$7 million average annual avoided public health costs (2022-2050)

2a Promote, incentivize and or subsidize energy efficiency and heating/cooling

Target	50% of buildings are retrofitted by 2050, thermal energy requirements reduced by 30%
Building types	All building types
Building sizes	Buildings > 10,000 ft2

Impact on GHG Emissions Relative to All Building Policies Analysed

Policy with the lowest reduction — Policy with the highest reduction

Indicators

1. GHG emissions	Decreases emissions	-70,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	Saves money per ton of emissions reduced	-$591 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	Decreases energy consumption	-2,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	Increases resiliency	877,000 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	Decreases health costs	-$9 million average annual avoided public health costs (2022-2050)

6b Enact energy-efficient building codes

Target	100% of existing buildings are retrofitted by 2050, thermal energy requirements reduced by 10%, plug load reduced by 10%
Building types	Existing residential and commercial buildings
Building sizes	Buildings > 50,000 ft2

Impact on GHG Emissions Relative to All Building Policies Analysed

Policy with the lowest reduction — Policy with the highest reduction

Indicators

1. GHG emissions	Decreases emissions	-320,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	Saves money per ton of emissions reduced	-$258 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	Decreases energy consumption	-10,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	Increases resiliency	877,000 homes with retrofits that increase resiliency against heat, cold and severe weather events

U2 Modify Energy Trust of Oregon's Mission

Target	• Change Energy Trust of Oregon's (ETO) mission to lead with greenhouse gas (GHG) emissions reductions and equity instead of leading with fuel-neutral energy efficiency • Direct the PUC to consider GHG reduction in Energy Trust's utility conservation programs • Remove barriers to customer choice through ETO funds and other programs that provide efficiency incentives to replace bulk fuels with a more efficient electric system (rather than a forced switch). • ETO programs should be made available statewide.

Note: This policy was not assessed quantitatively; a qualitative assessment of the policy has been undertaken using the same framework. This assessment is based on our understanding of the policy intension and our best assessment of its impacts.

Indicators

1. GHG emissions	Aligning ETO's mission with GHG emissions reductions will reduce emissions
2. Economic impact-lifecycle abatement cost	ETO can bundle measures which cost money with measures that save money to ensure average per ton of emissions reductions
3. Energy efficiency	ETO programs will reduce energy consumption and increase efficiency under this policy.
4. Resiliency	ETO programs which save energy and address equity will increase resilience
5. Public health and air quality	ETO programs that reduce GHG emissions will improve health outcomes and decrease health costs.

Summary Charts

Table of Contents

Response to Questions from the Task Force

Task Force members have raised questions with respect to the modelling approach. The response of the modelling team to each of the questions or comments is detailed in the following table.

Comment/ question from the Task Force	Adjustment to the modelling approach	Details
What is the definition of "plug load"? How will the reductions be accomplished?	No change	Plug loads are energy used by equipment that is usually plugged into an outlet. These sources would include equipment such as appliances, computer equipment and AV equipment. Plug loads are not related to general building lighting, heating, ventilation, cooling, and water heating, and typically do not provide comfort to the occupants. Modern technology usually incorporates a variety of power modes with most electronic devices (computers, stereos, tvs) drawing power even when they are turned off. Some strategies involved in reducing plug load include • Upgrading equipment • Turning equipment off when not in use • Employing plug-load automation and controls • Promoting beneficial occupant behaviour The following source is a good resource for commercial buildings but many of these strategies can be applied to residential buildings as well. Plug Load Frequently Asked Questions (FAQ)	GSA
The use of the AVERT tool	No change	EPA's AVERT tool calculates the change in air pollutants as a result of electricity generation on an hourly basis. The change in outputs is calculated within the model used by the modelling team. While AVERT has a higher temporal resolution, it does not include the full energy system. Additionally, the AVERT tool doesn't project future emissions as the generation mix changes.
The inclusion of Renewable Natural Gas (RNG)	RNG is included in Policy 1	RNG is included in Policy 1. Policy 1 is a Building Performance Standard that applies GHG targets, but does not specify how those GHG targets will be achieved. The amount of RNG available to Oregon is based on the current state of the RNG supply for the US. The total RNG supply in 2040 in the US is assumed to be 3,750 trillion BTUs. Power to gas/Methanation was excluded from this total. This total was shared out to Oregon according to the population of Oregon relative to the total US population, resulting in a total of 47.5 trillion BTUs of RNG available to Oregon by 2040. RNG was distributed to the residential building sector based on the share of natural gas left in this sector after the policy mechanism was implemented. "Best use"

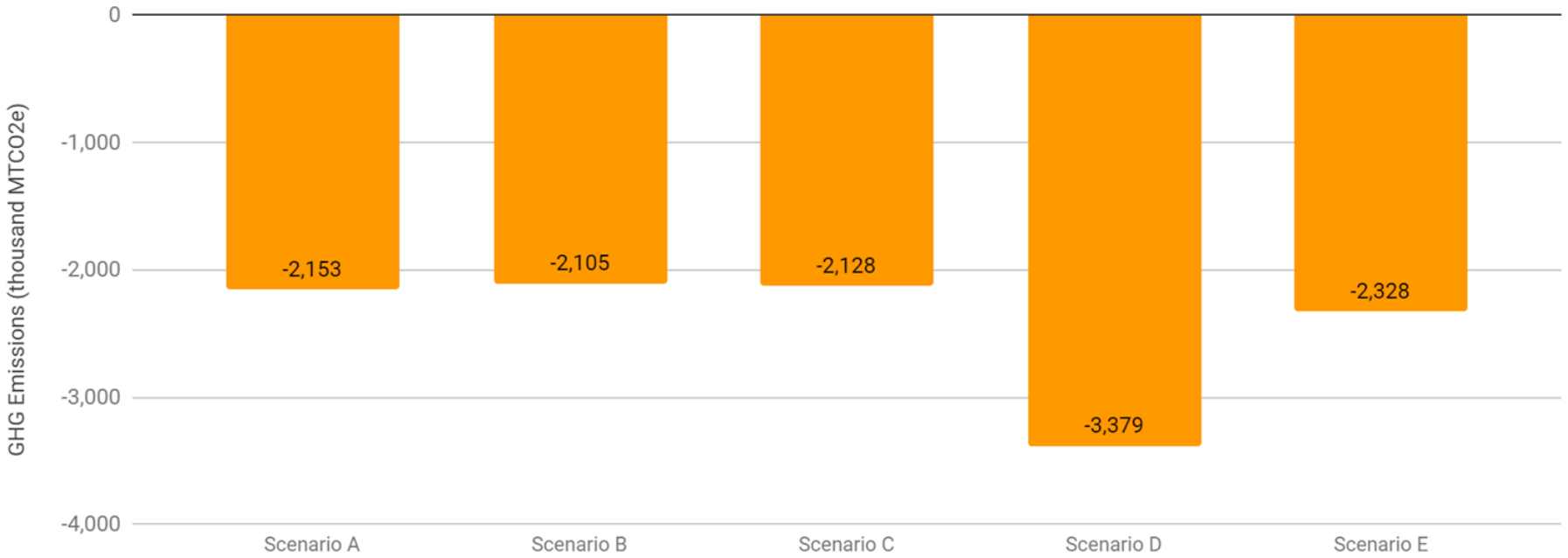
Integrated Scenarios

Integrated Scenarios

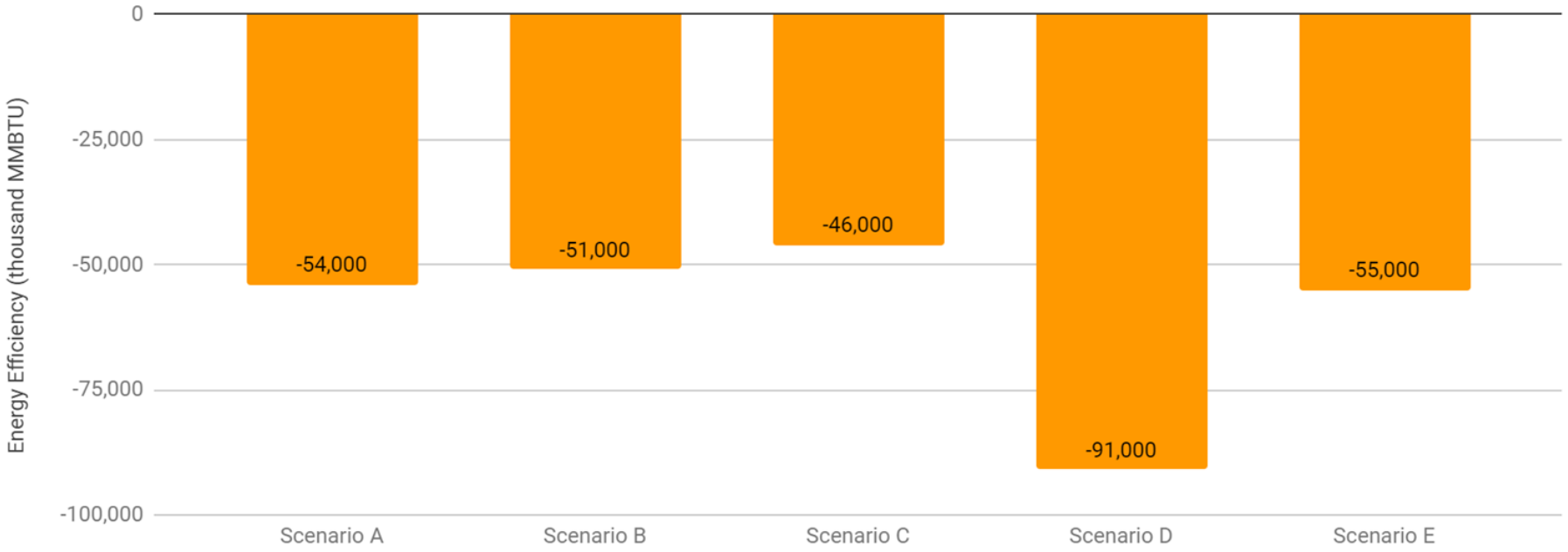
A	B	C	D	E
Go slow, focus on large buildings	Medium efficiency, focus on large buildings	Medium GHG reductions, non-prescriptive	Maximum efficiency	Maximum GHG reductions, non-prescriptive
• Enact energy-efficient building codes 6a • Promote, incentivize, and/or subsidize heat pumps 4a • Decarbonise public buildings 3a • Assess and disclose material-related emissions 5a*	• Promote, incentivize and or subsidize energy efficiency and heating/cooling 2a • Promote, incentivize, and/or subsidize heat pumps 4a • Enact energy-efficient building codes 6a	• Building Performance Standard 1d • Decarbonise public buildings 3b • Assess and disclose material-related emissions 5b*	• Promote, incentivize and or subsidize energy efficiency and heating/cooling 2d • Promote, incentivize, and/or subsidize heat pumps 4b • Enact energy-efficient building codes 6d	• Building Performance Standard 1c • Decarbonise public buildings 3b • Assess and disclose material-related emissions 5c*

*Embodied emissions reductions require a different accounting approach

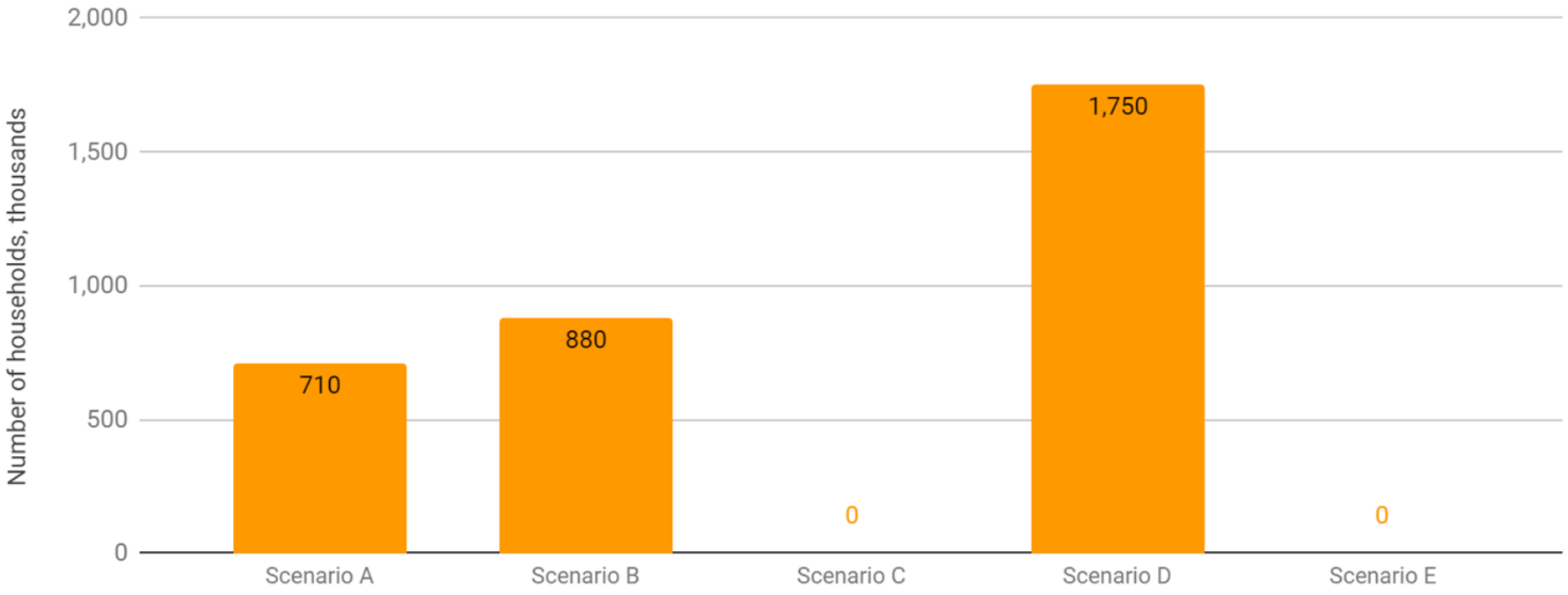
GHG Emissions



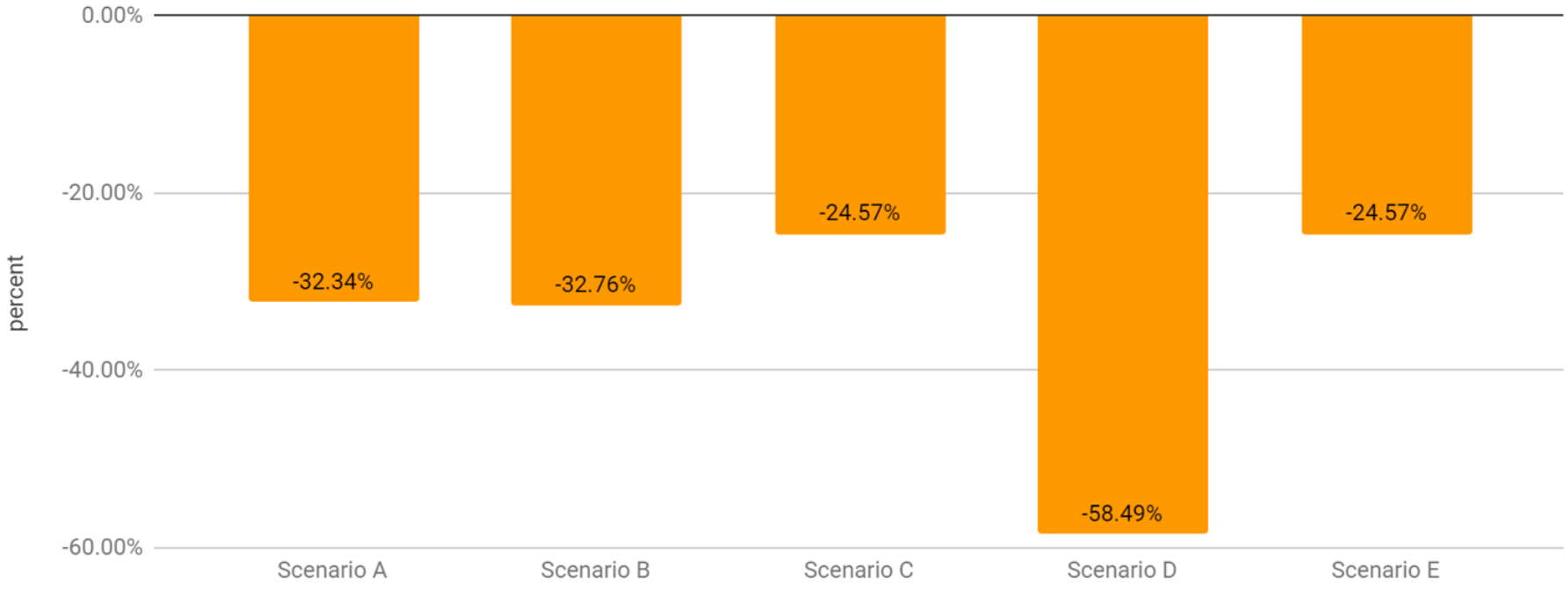
Avoided Energy Consumption



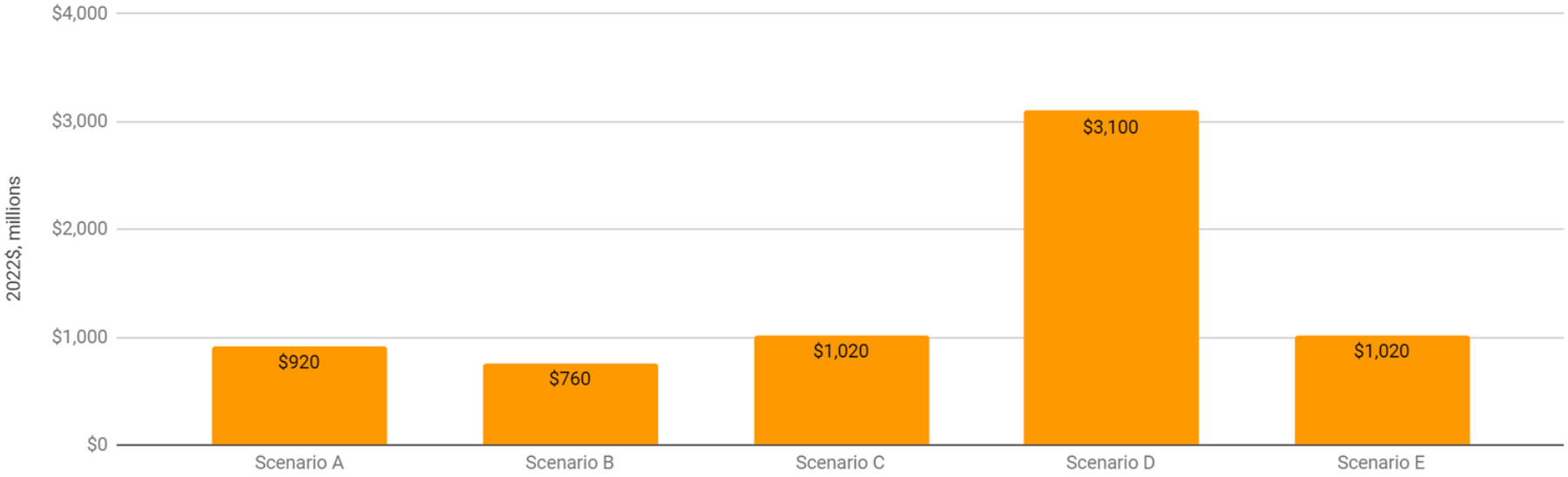
Resiliency


2,000
1,500
1,000
500
0
Number of households, thousands
710
880
0
1,750
0
Scenario A
Scenario B
Scenario C
Scenario D
Scenario E

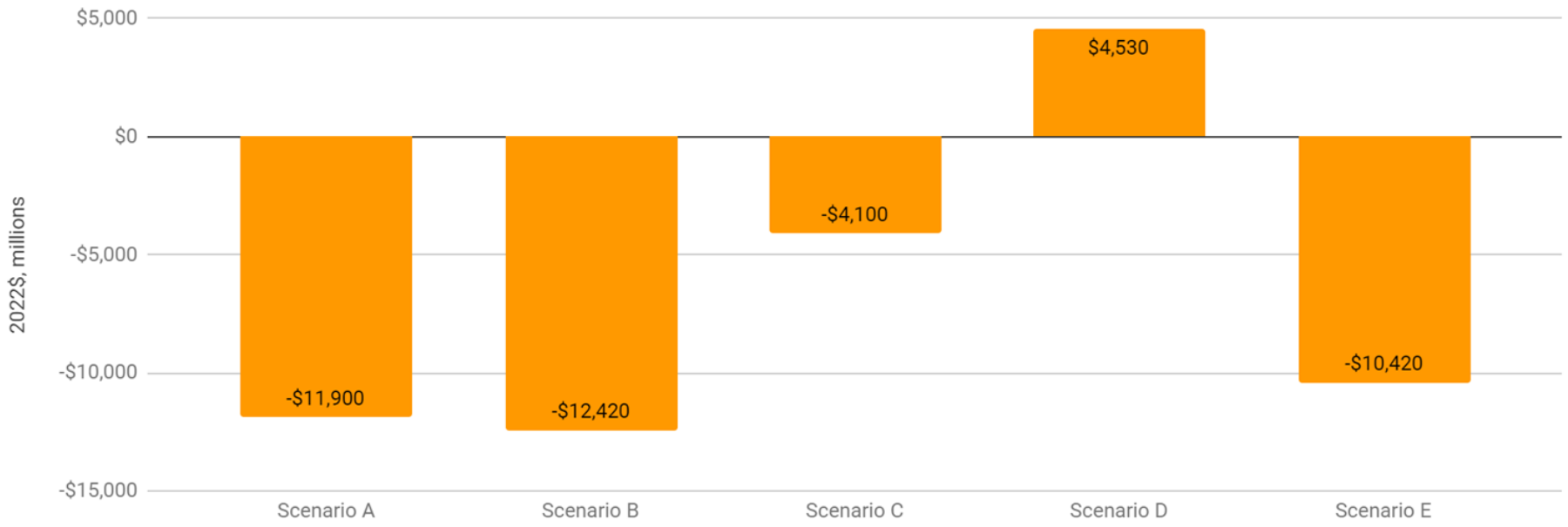
Change in Household Energy Costs



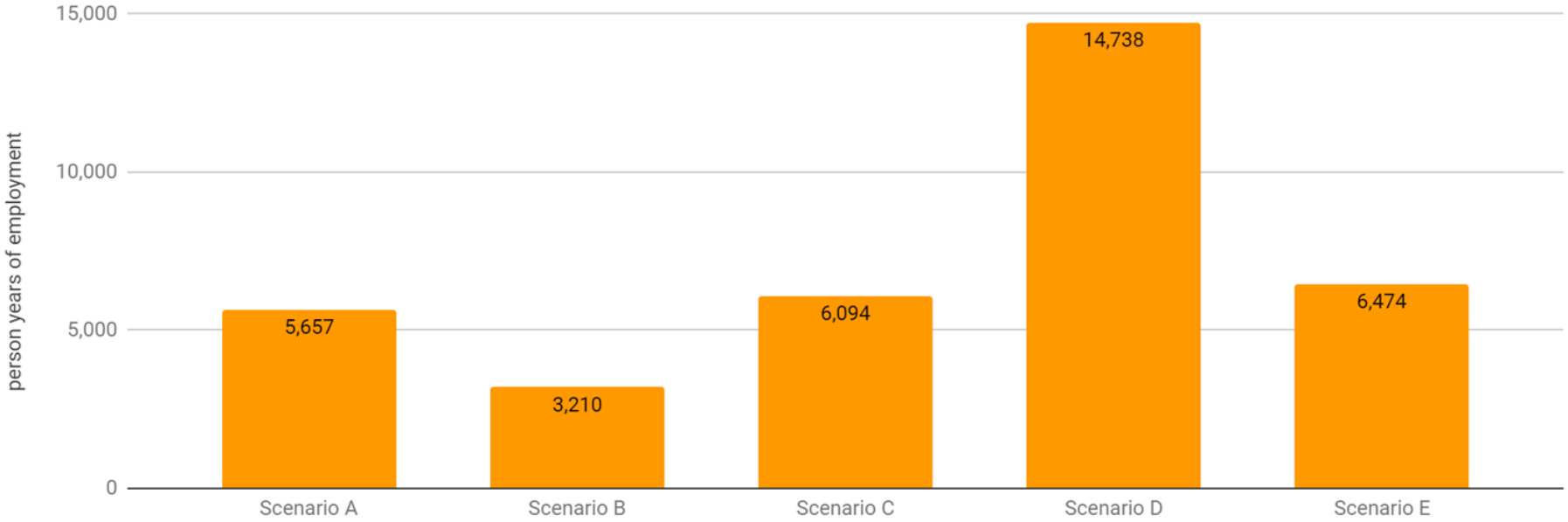
Average Annual Capital Costs



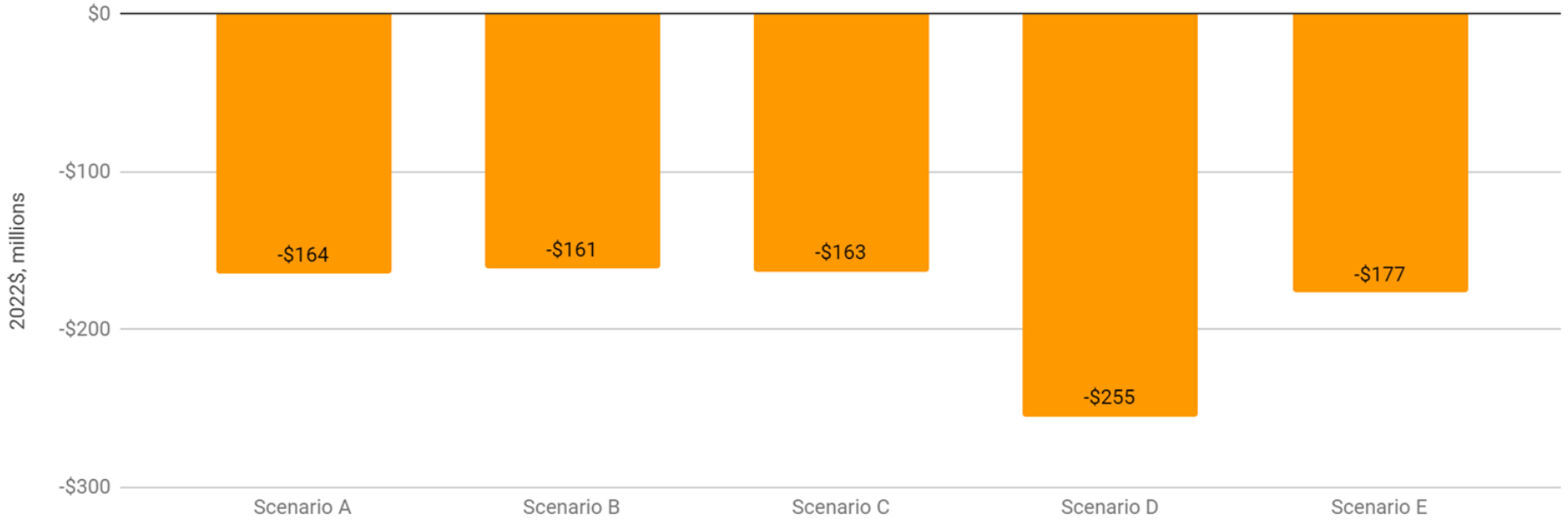
Net Costs/Savings



Employment

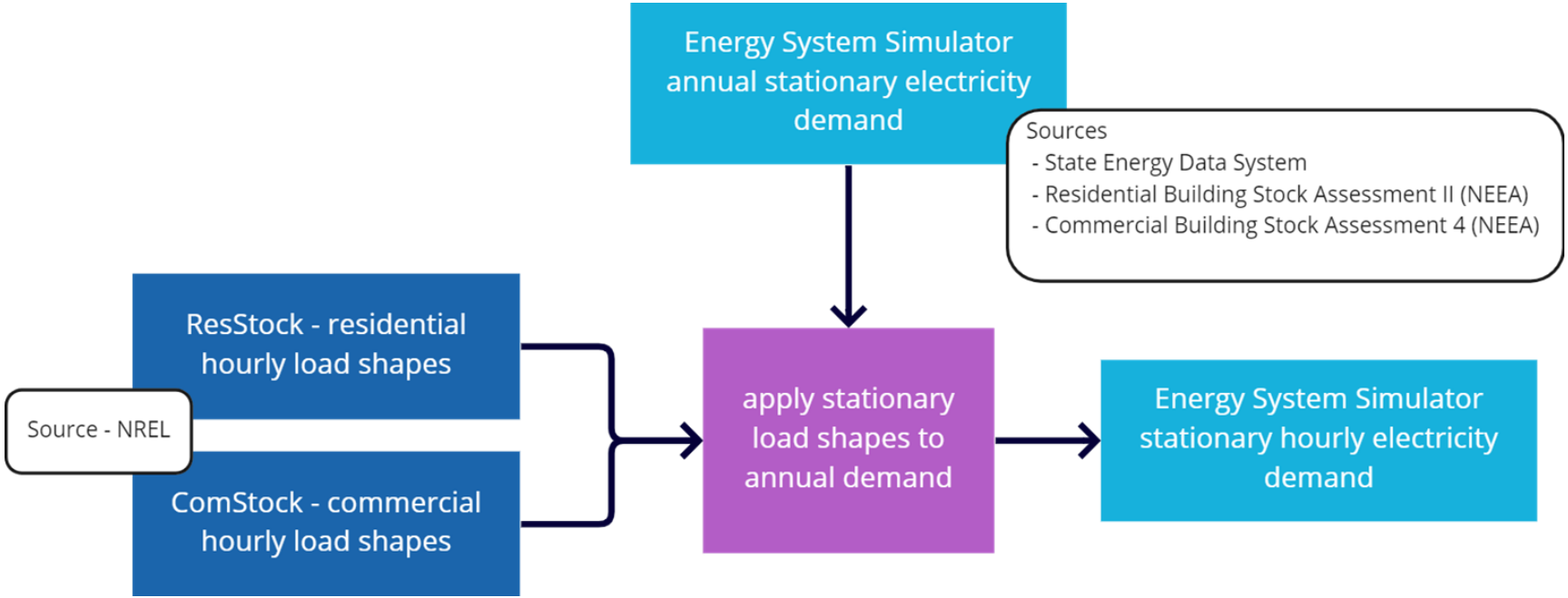

15,000
10,000
5,000
0
person years of employment
5,657
3,210
6,094
14,738
6,474
Scenario A
Scenario B
Scenario C
Scenario D
Scenario E

Avoided Climate Damage

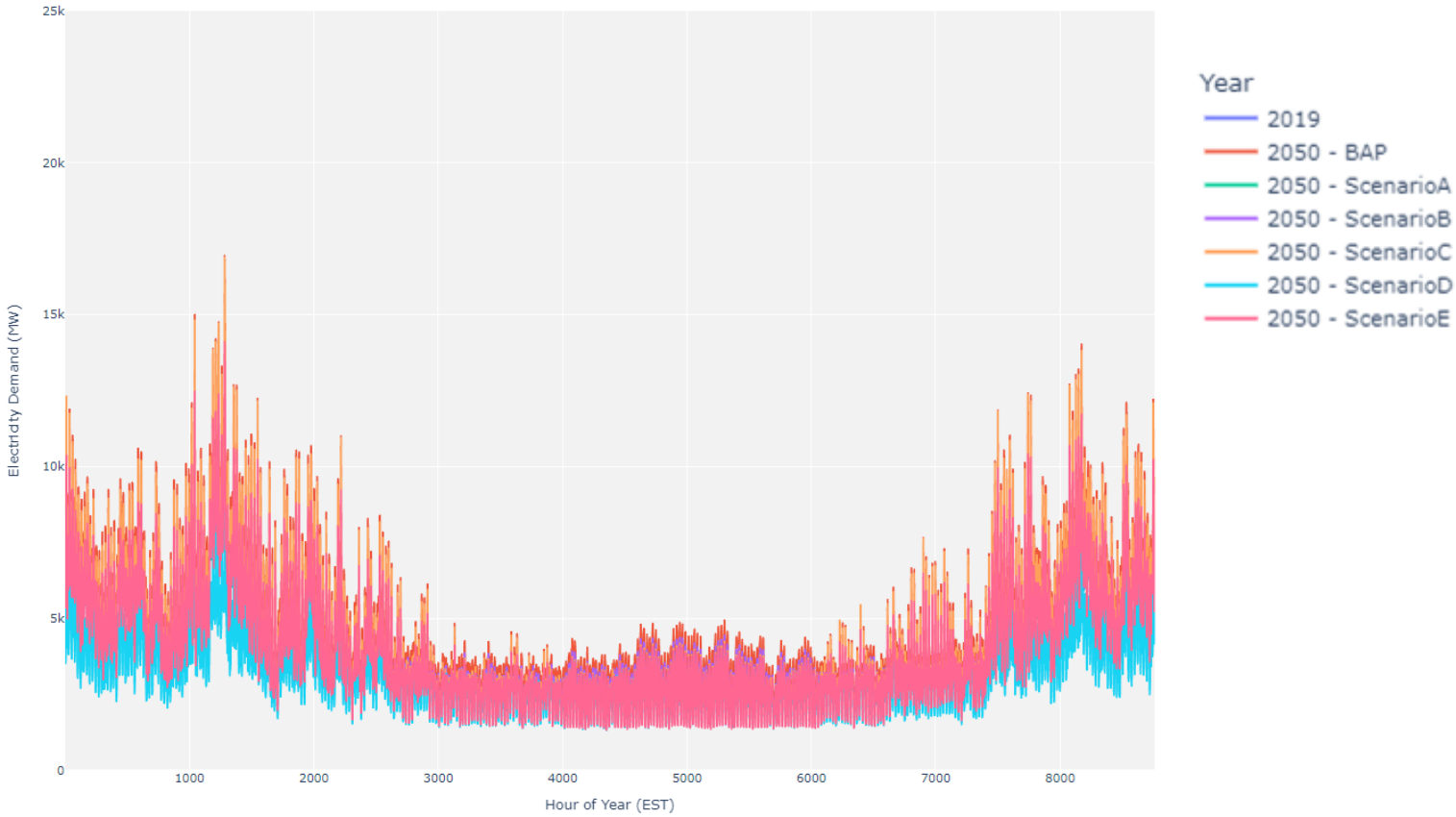


Peak Analysis

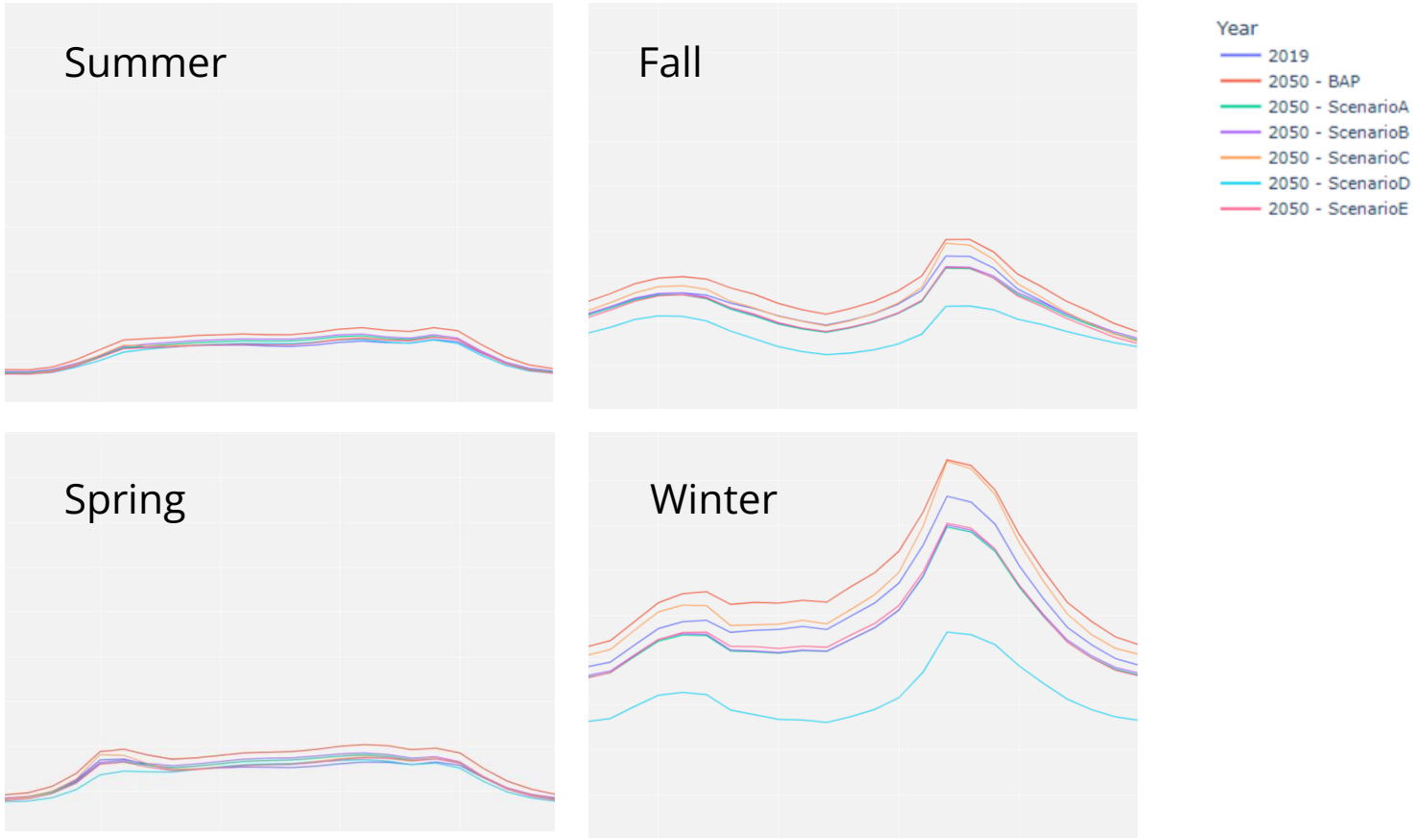
Hourly Analysis

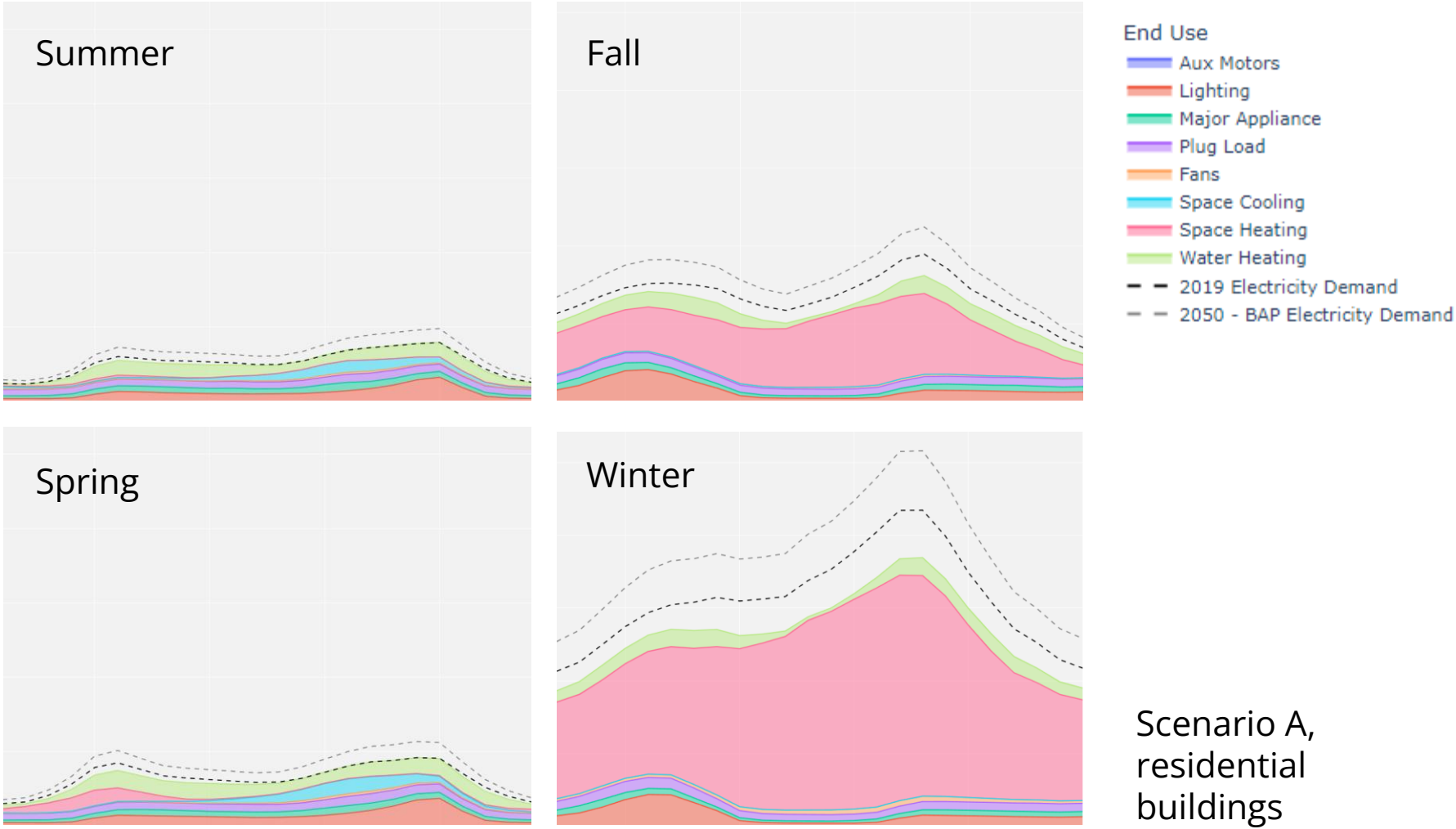


Electricity Demand Curves



Hourly Analysis





Scenario A, residential buildings

Hourly Analysis

Winter