Appendix 4. Integrated Scenario Scorecards

A Go slow, focus on large buildings

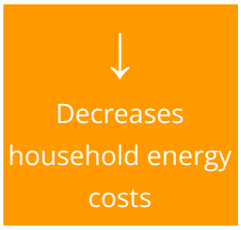
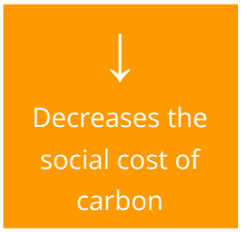
Policy 6a	Enact energy-efficient building codes
Policy 4a	Promote, incentivize, and/or subsidize heat pumps
Policy 3a	Decarbonise public buildings
Policy 5a	Assess and disclose material-related emissions

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	-2,150,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	↓ Saves money per ton of emissions reduced	-$173 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	↓ Decreases energy consumption	-54,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	↑ Increases resiliency	710 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	↓ Decreases health costs	-$159 million average annual avoided public health costs (2022-2050)

6. Household expenditures		-32.34% change household energy expenditures between 2022 and 2050
7. Economic impact-employment		5,657 average annual person years of employment created (2022-2050)
8. Social cost of carbon		-$164.4 million average annual avoided damage from climate change globally (2022-2050)
9. Embodied Carbon		-1,070,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)

Background

1. GHG Emissions

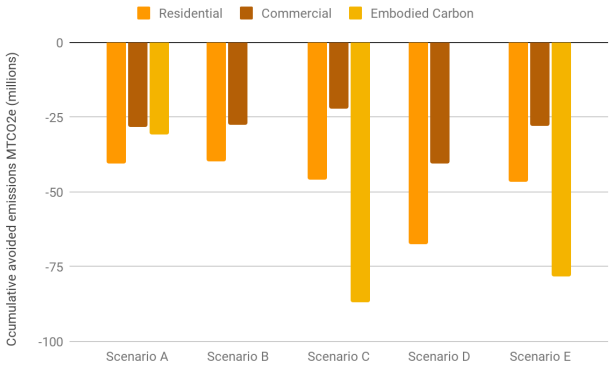


Figure 1: Integrated scenarios, cumulative GHG emissions reduction by sector, 2022-2050

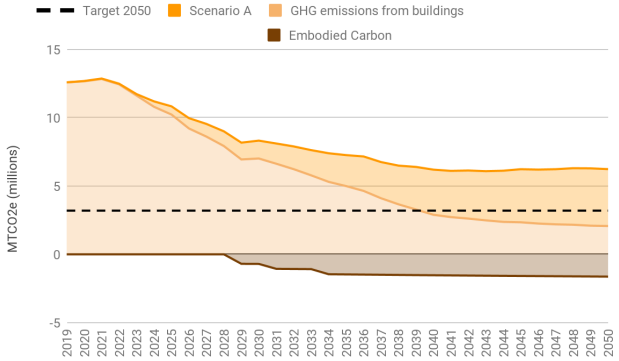


Figure 2: Integrated scenario A, annual GHG emissions reductions resulting from integrated scenario A relative to total projected GHG emissions from buildings in Oregon

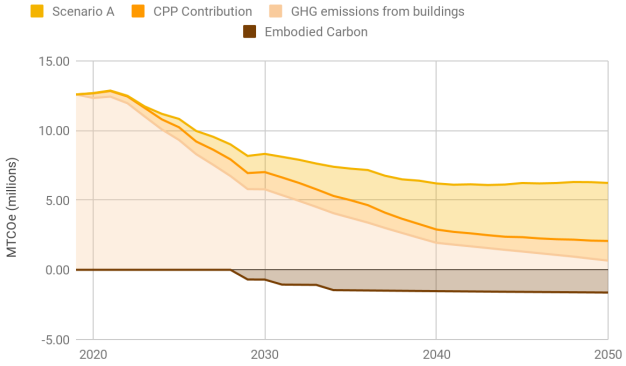


Figure 3: Integrated scenario A, annual GHG emissions reductions resulting from pntegrated scenario A relative to total projected GHG emissions from buildings in Oregon, with reductions from CPP

2. Economic Impact, Costs and Savings

Figure 4: Integrated scenario A, NPV over the study period

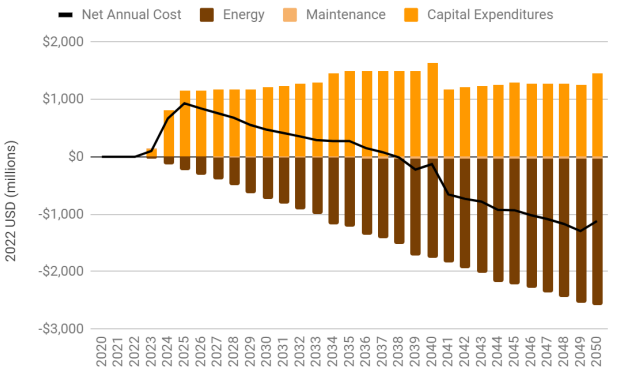


Figure 5: Integrated scenario A, net annual costs or savings

3. Energy Efficiency

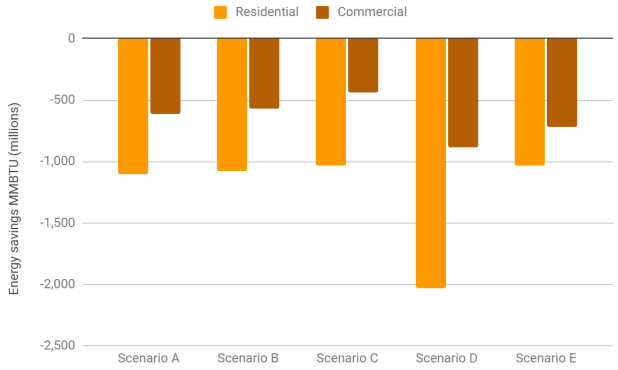


Figure 6: Integrated scenarios, cumulative energy savings by sector, relative to the reference scenario

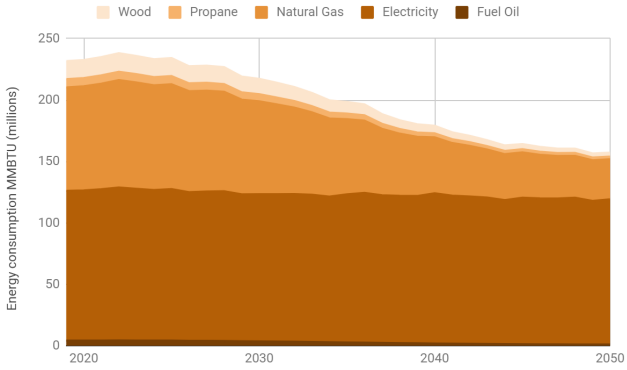


Figure 7: Integrated scenario A, energy consumption by energy source

4. Resiliency

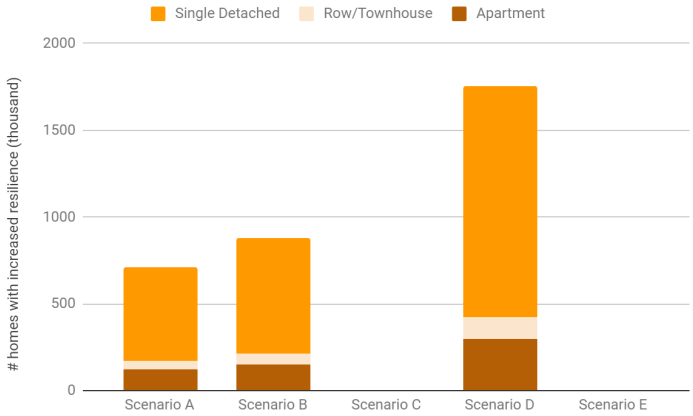


Figure 8: Integrated scenarios, # of homes with increased resilience by 2050

5. Public Health and Air Quality

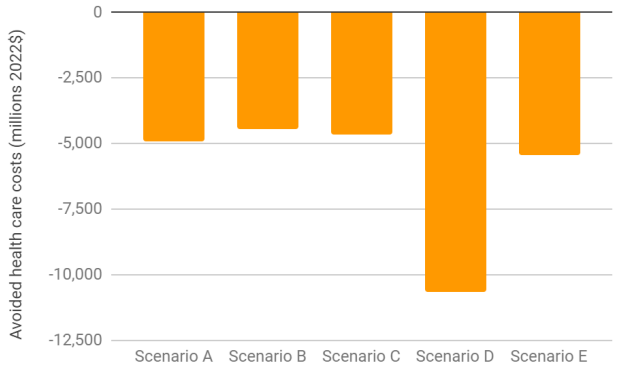


Figure 9: Integrated scenarios, avoided cumulative health costs

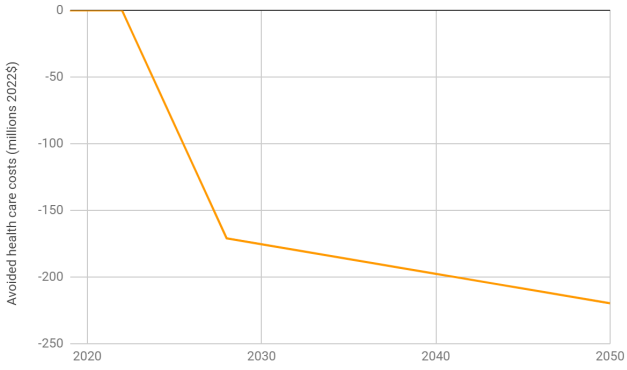


Figure 10: Integrated scenario A, avoided annual health costs

6. Household Expenditures

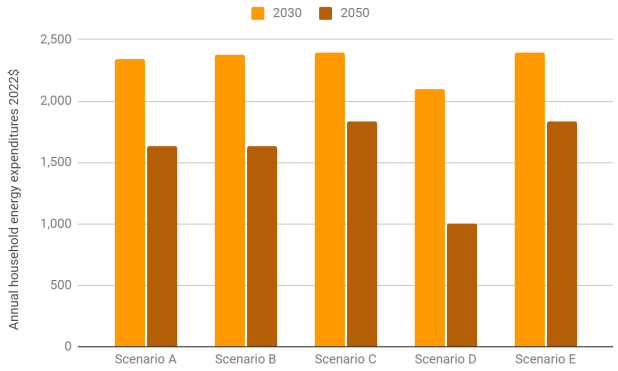


Figure 11: Integrated scenarios, annual household energy expenditures

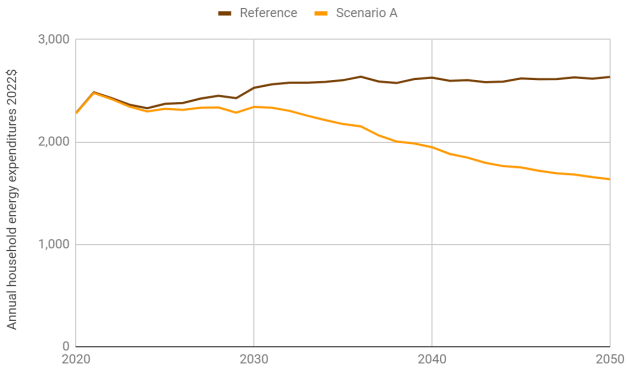


Figure 12: Integrated scenario A, annual household energy expenditures relative to the reference scenario

7. Economic Impact, Employment

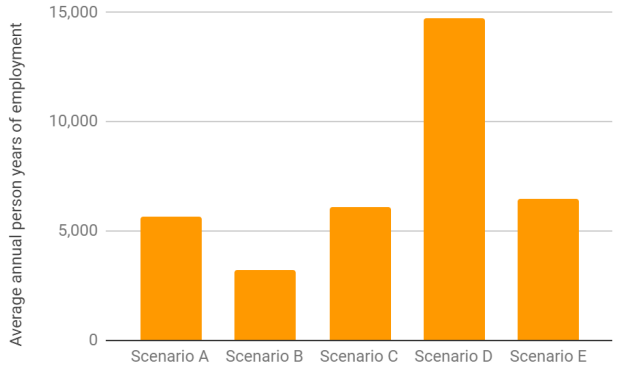


Figure 13: Integrated scenarios, cumulative person years of employment

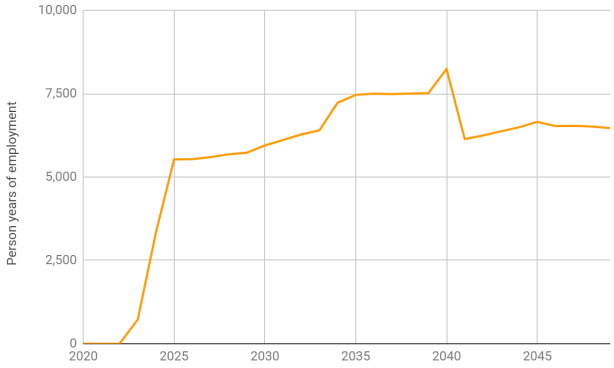


Figure 14: Integrated scenario A, annual person years of employment

8. Social Cost of Carbon

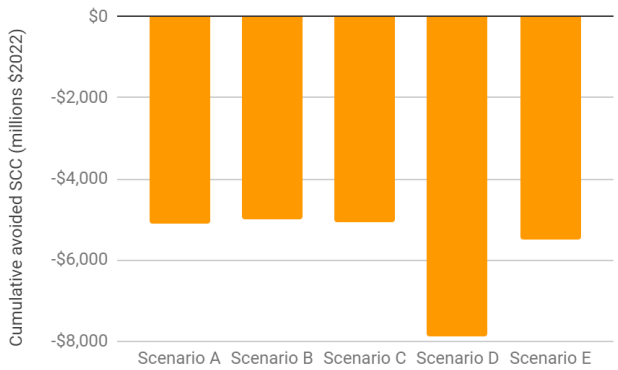


Figure 15: Integrated scenarios, cumulative avoided social cost of carbon

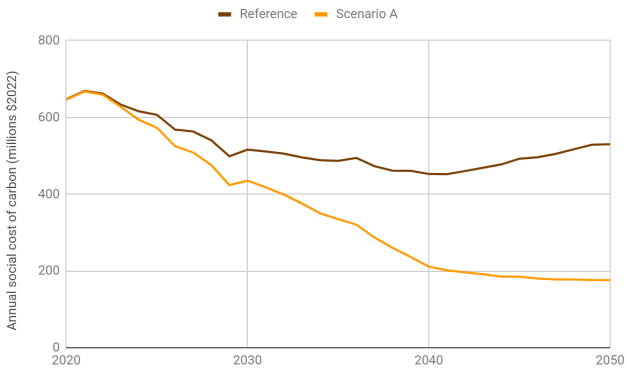


Figure 16: Integrated scenario A, annual avoided social cost of carbon relative to the reference scenario

B Medium efficiency, focus on large buildings

Policy 2a	Promote, incentivize and or subsidize energy efficiency and heating/cooling
Policy 4a	Promote, incentivize, and/or subsidize heat
Policy 6a	Enact energy-efficient building codes

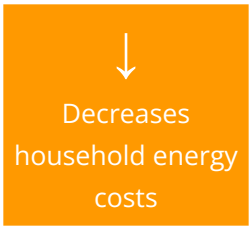
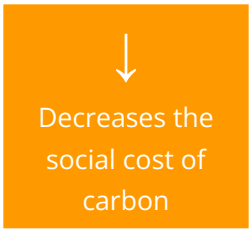
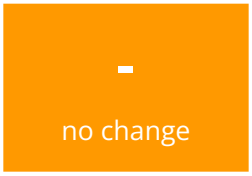
Impact on GHG Emissions Relative to All Building Policies Analysed

←Policy with the lowest reduction

Policy with the highest reduction→

Indicators

1. GHG emissions	↓ Decreases emissions	-2,100,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	↓ Saves money per ton of emissions reduced	-$184 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	↓ Decreases energy consumption	-51,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	↑ Increases resiliency	880 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	↓ Decreases health costs	-$143 million average annual avoided public health costs (2022-2050)

6. Household expenditures		-32.76% change household energy expenditures between 2022 and 2050
7. Economic impact-employment		3,210 average annual person years of employment created (2022-2050)
8. Social cost of carbon		-$161.3 million average annual avoided damage from climate change globally (2022-2050)
9. Embodied Carbon		0 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)

Background

1. GHG Emissions

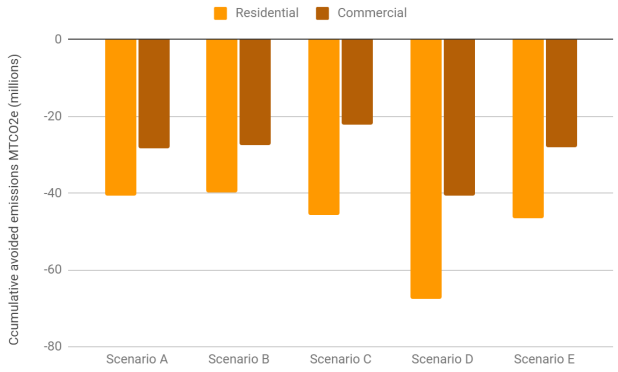


Figure 1: Integrated scenarios, cumulative GHG emissions reduction by sector, 2022-2050

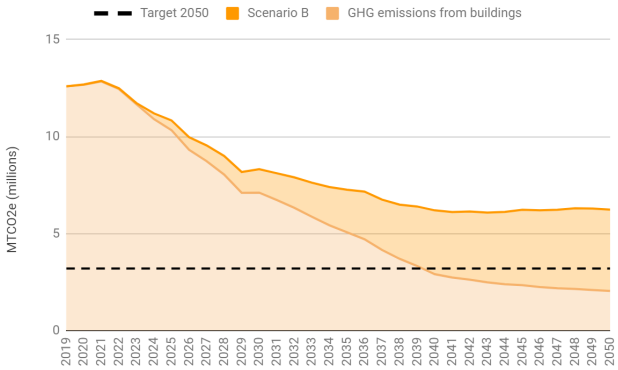


Figure 2: Integrated scenario B, annual GHG emissions reductions resulting from Integrated scenario B relative to total projected GHG emissions from buildings in Oregon

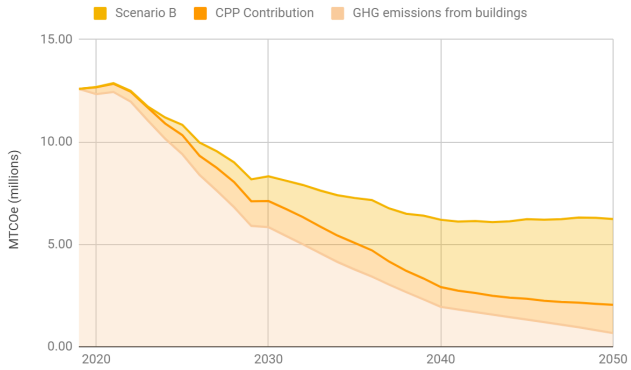


Figure 3: Integrated scenario B, annual GHG emissions reductions resulting from Integrated scenario B relative to total projected GHG emissions from buildings in Oregon, with reductions from CPP

2. Economic Impact, Costs and Savings

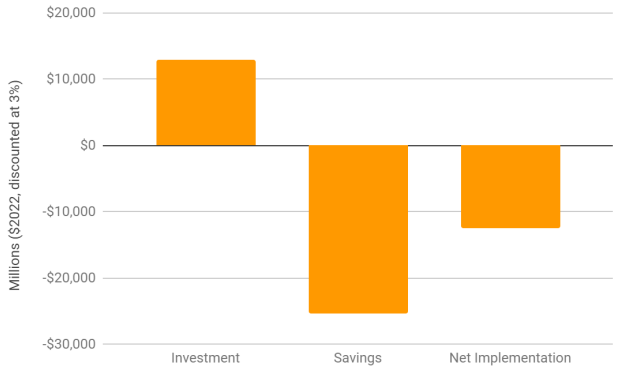


Figure 4: Integrated scenario B, NPV over the study period

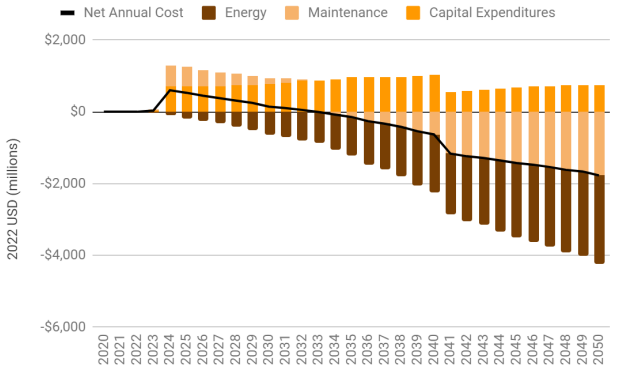


Figure 5: Integrated scenario B, net annual costs or savings

3. Energy Efficiency

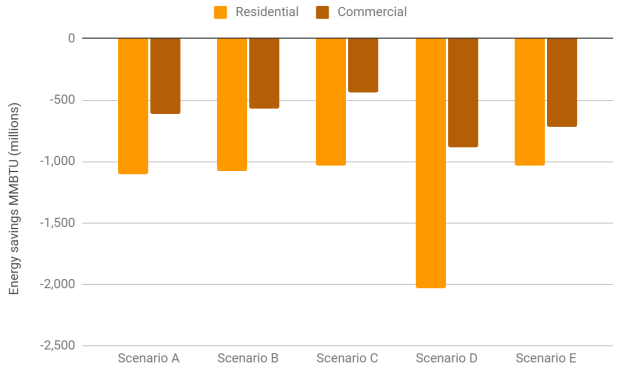


Figure 6: Integrated scenarios, cumulative energy savings by sector, relative to the reference scenario

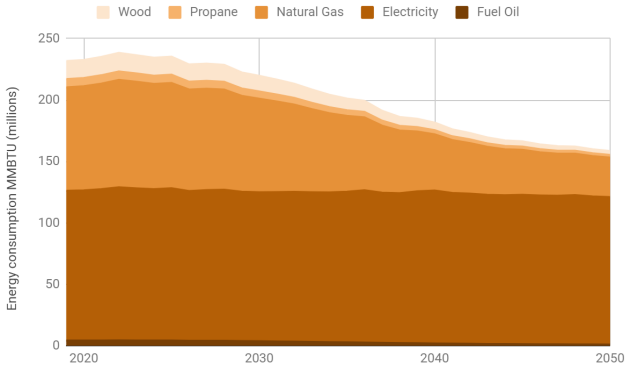


Figure 7: Integrated scenario B, energy consumption by energy source

4. Resiliency

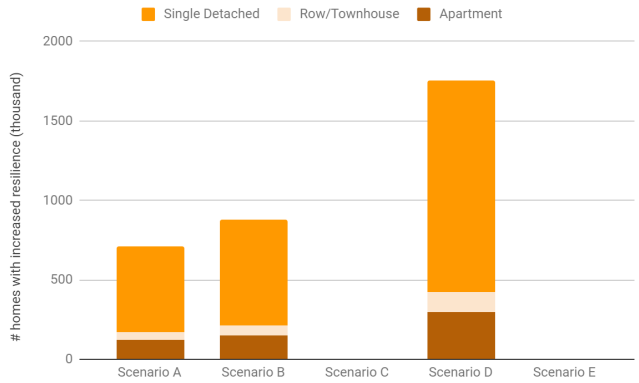


Figure 8: Integrated scenarios, # of homes with increased resilience by 2050

5. Public Health and Air Quality

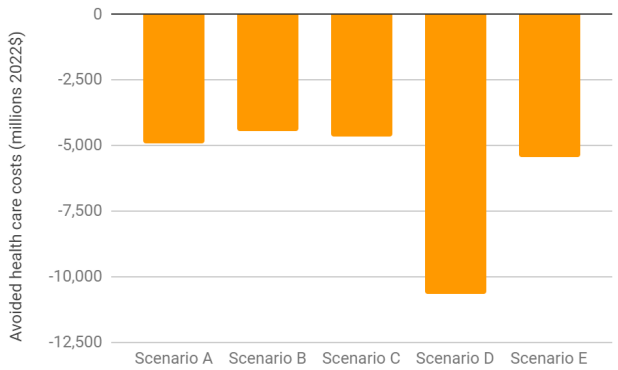


Figure 9: Integrated scenarios, avoided cumulative health costs

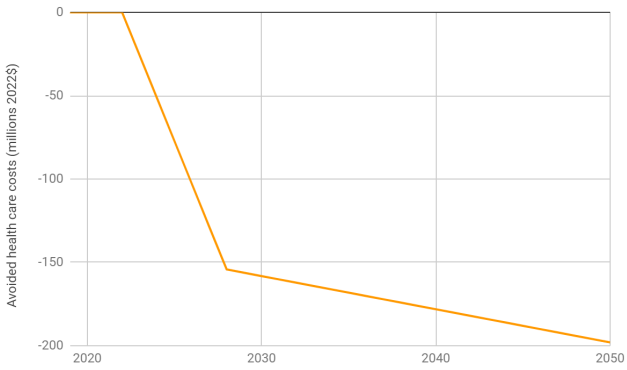


Figure 10: Integrated scenario B, avoided annual health costs

6. Household Expenditures

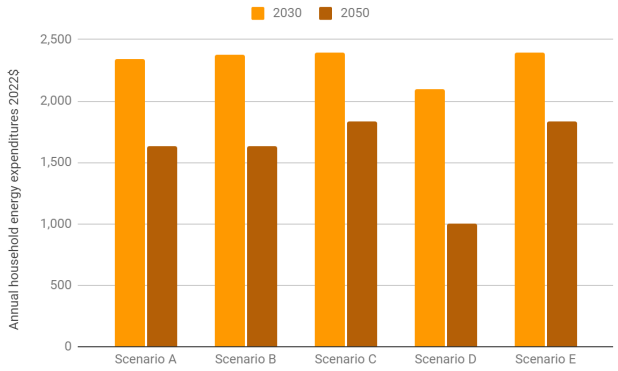


Figure 11: Integrated scenarios, annual household energy expenditures

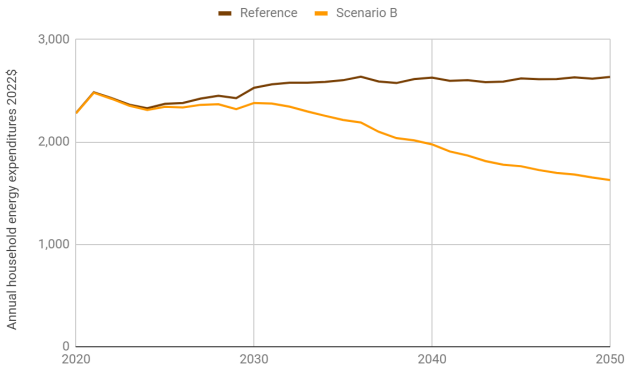


Figure 12: Integrated scenario B, annual household energy expenditures relative to the reference scenario

7. Economic Impact, Employment

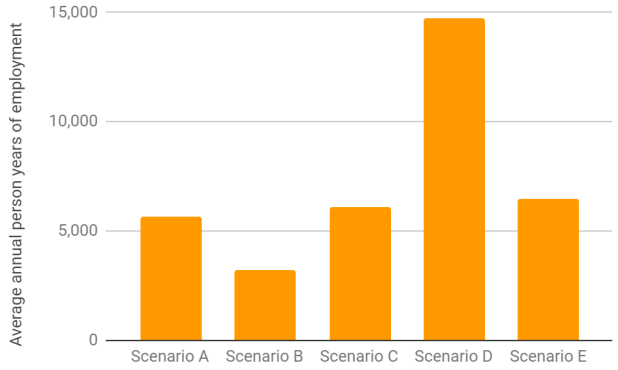


Figure 13: Integrated scenarios, cumulative person years of employment

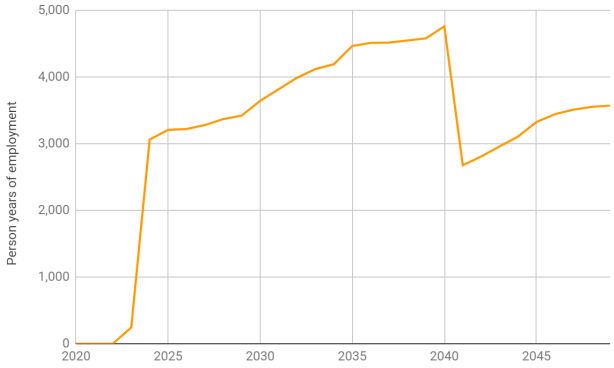


Figure 14: Integrated scenario B, annual person years of employment

8. Social Cost of Carbon

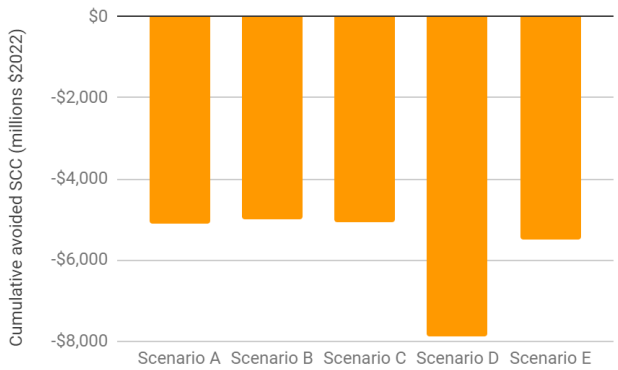


Figure 15: Integrated scenarios, cumulative avoided social cost of carbon

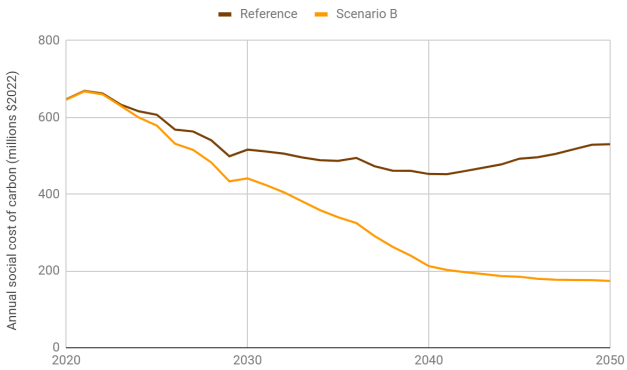


Figure 16: Integrated scenario B, annual avoided social cost of carbon relative to the reference scenario

C Medium GHG reductions, non-prescriptive

Policy 1d	Building Performance Standard
Policy 3b	Decarbonise public buildings
Policy 5b	Assess and disclose material-related emissions

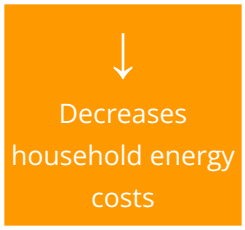
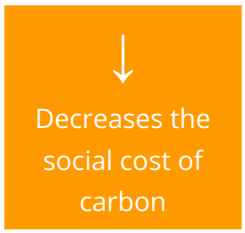
Impact on GHG Emissions Relative to All Building Policies Analysed

←Policy with the lowest reduction

Policy with the highest reduction→

Indicators

1. GHG emissions	↓ Decreases emissions	-2,130,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	↓ Saves money per ton of emissions reduced	-$60 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	↓ Decreases energy consumption	-46,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	↑ Increases resiliency	0 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	↓ Decreases health costs	-$150 million average annual avoided public health costs (2022-2050)

6. Household expenditures		-24.57% change household energy expenditures between 2022 and 2050
7. Economic impact-employment		6,094 average annual person years of employment created (2022-2050)
8. Social cost of carbon		-$163.2 million average annual avoided damage from climate change globally (2022-2050)
9. Embodied Carbon		-3,000,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)

Background

1. GHG Emissions

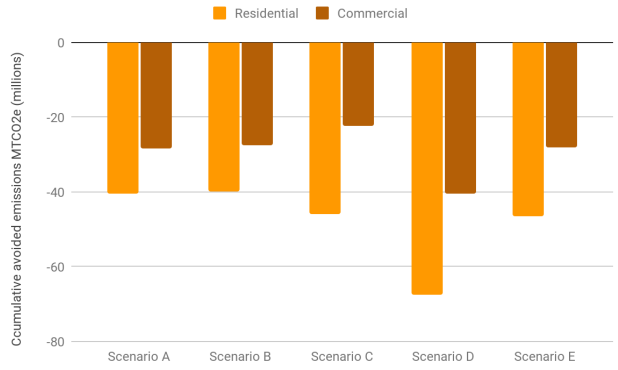


Figure 1: Integrated scenarios, cumulative GHG emissions reduction by sector, 2022-2050

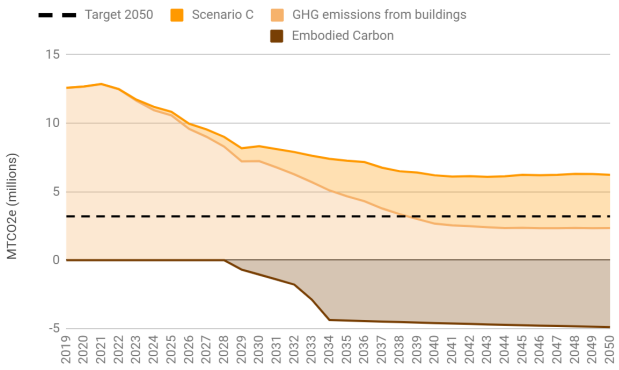


Figure 2: Integrated scenario C, annual GHG emissions reductions resulting from Integrated scenario C relative to total projected GHG emissions from buildings in Oregon

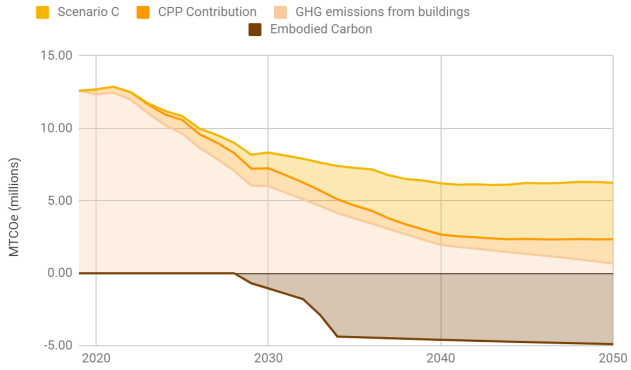


Figure 3: Integrated scenario C, annual GHG emissions reductions resulting from Integrated scenario C relative to total projected GHG emissions from buildings in Oregon, with reductions from CPP

2. Economic Impact, Costs and Savings

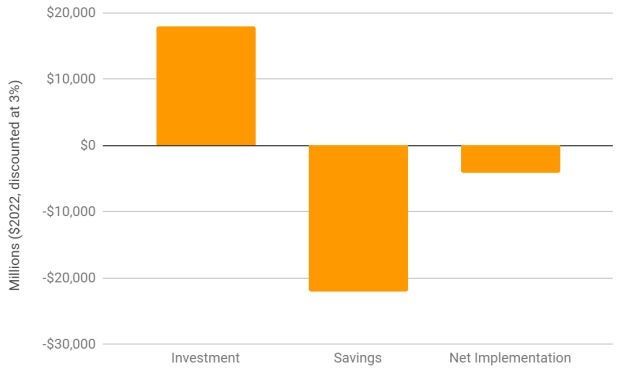


Figure 4: Integrated scenario C, NPV over the study period

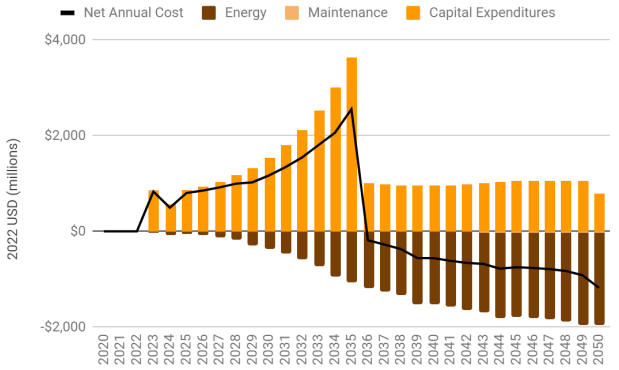


Figure 5: Integrated scenario C, net annual costs or savings

3. Energy Efficiency

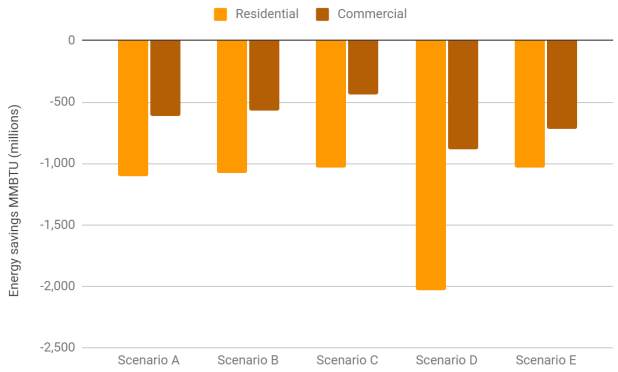


Figure 6: Integrated scenarios, cumulative energy savings by sector, relative to the reference scenario

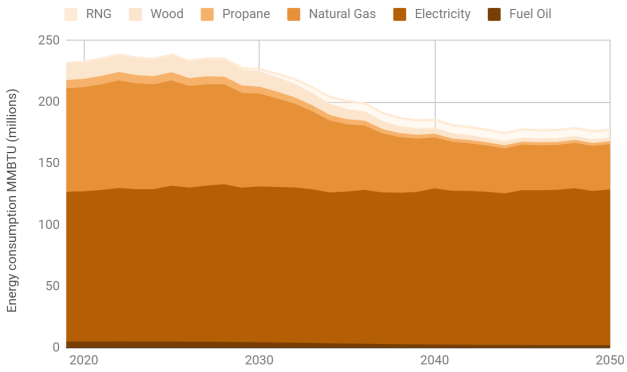


Figure 7: Integrated scenario C, energy consumption by energy source

4. Resiliency

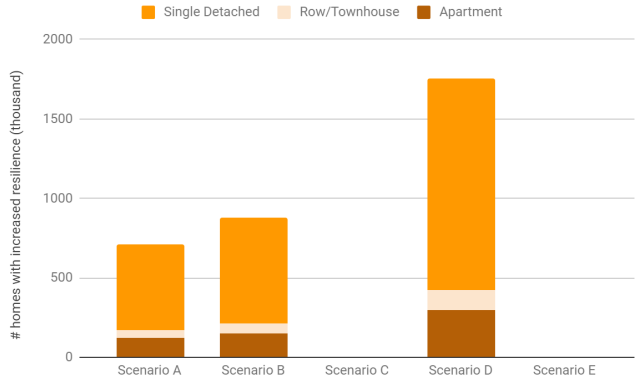


Figure 8: Integrated scenarios, # of homes with increased resilience by 2050

5. Public Health and Air Quality

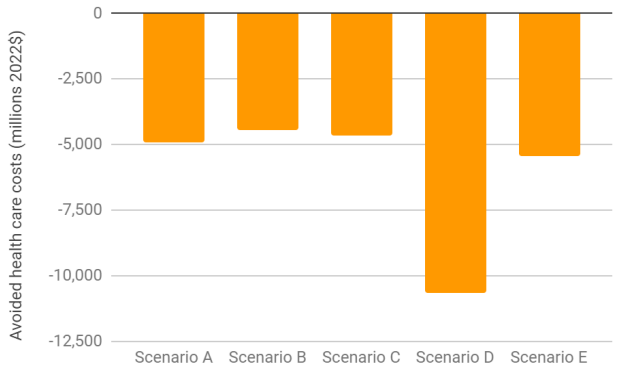


Figure 9: Integrated scenarios, avoided cumulative health costs

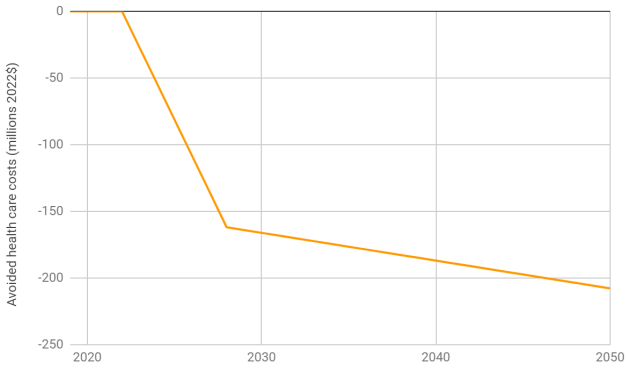


Figure 10: Integrated scenario C, avoided annual health costs

6. Household Expenditures

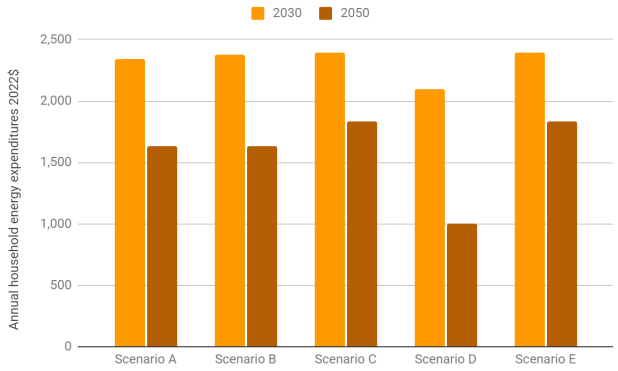


Figure 11: Integrated scenarios, annual household energy expenditures

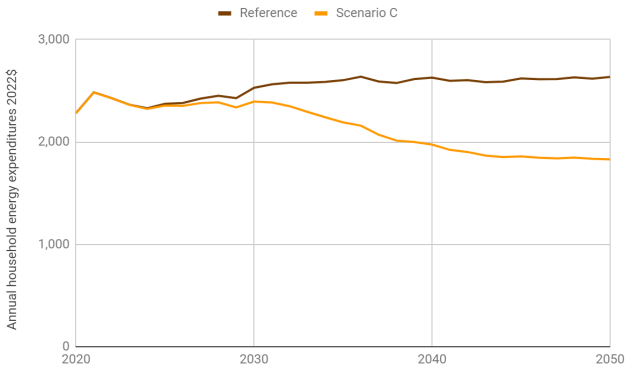


Figure 12: Integrated scenario C, annual household energy expenditures relative to the reference scenario

7. Economic Impact, Employment

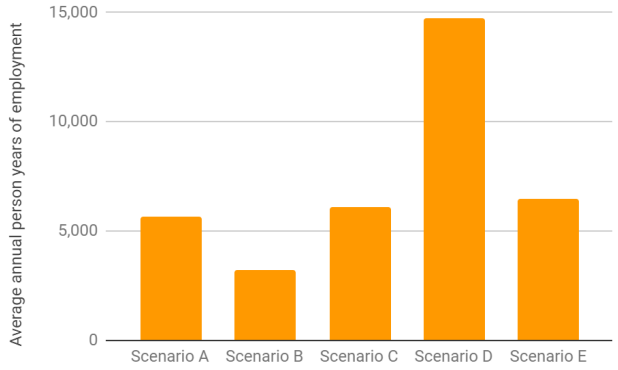


Figure 13: Integrated scenarios, cumulative person years of employment

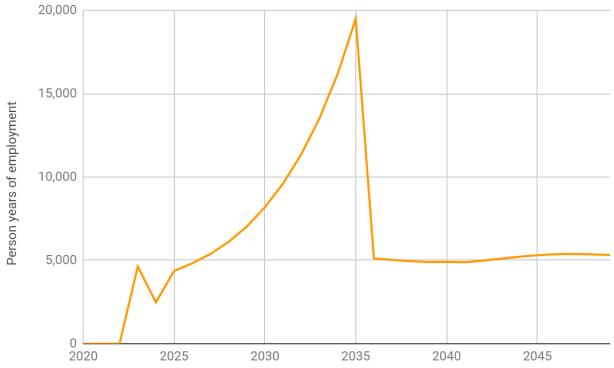


Figure 14: Integrated scenario C, annual person years of employment

8. Social Cost of Carbon

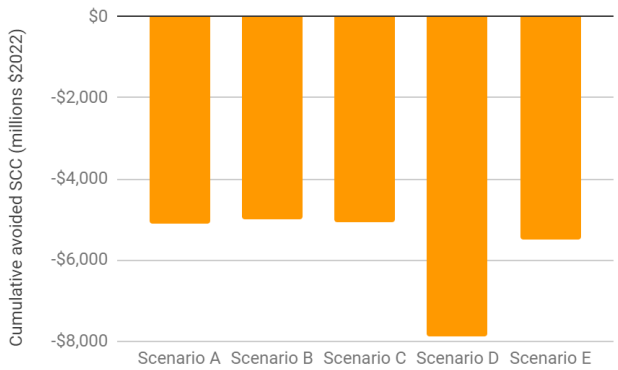


Figure 15: Integrated scenarios, cumulative avoided social cost of carbon

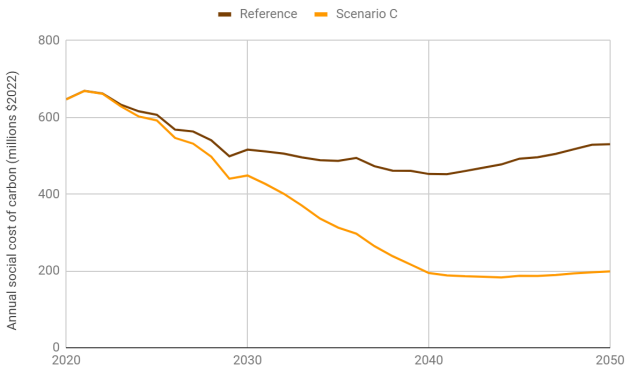


Figure 16: Integrated scenario C, annual avoided social cost of carbon relative to the reference scenario

D Maximum efficiency

Policy 2d	Promote, incentivize and or subsidize energy efficiency and heating/cooling
Policy 4b	Promote, incentivize, and/or subsidize heat pumps
Policy 6b	Enact energy-efficient building codes

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	-3,380,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)
2. Economic impact-lifecycle abatement cost	↑ Costs money per ton of emissions reduced	$42 net present value of a metric ton of avoided GHG emissions with a 3% discount rate
3. Energy efficiency	↓ Decreases energy consumption	-91,000,000 MMBTU average annual avoided energy consumption (2022-2050)
4. Resiliency	↑ Increases resiliency	1,750,000 homes with retrofits that increase resiliency against heat, cold and severe weather events
5. Public health and air quality	↓ Decreases health costs	-$343 million average annual avoided public health costs (2022-2050)

6. Household expenditures	↓ Decreases household energy costs	-58.49% change household energy expenditures between 2022 and 2050
7. Economic impact-employment	↑ Employment	14,738 average annual person years of employment created (2022-2050)
8. Social cost of carbon	↓ Decreases the social cost of carbon	-$254.7 million average annual avoided damage from climate change globally (2022-2050)
9. Embodied Carbon	- no change	0 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)

Background

1. GHG Emissions

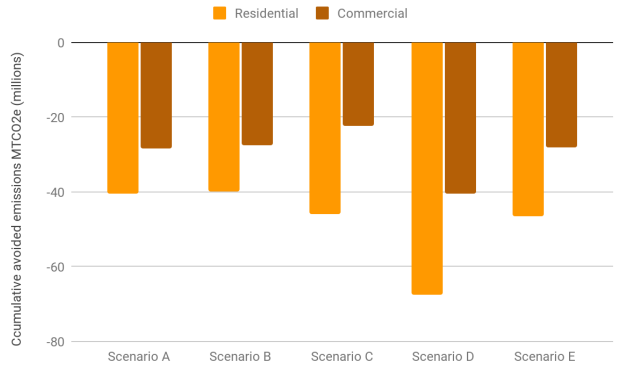


Figure 1: Integrated scenarios, cumulative GHG emissions reduction by sector, 2022-2050

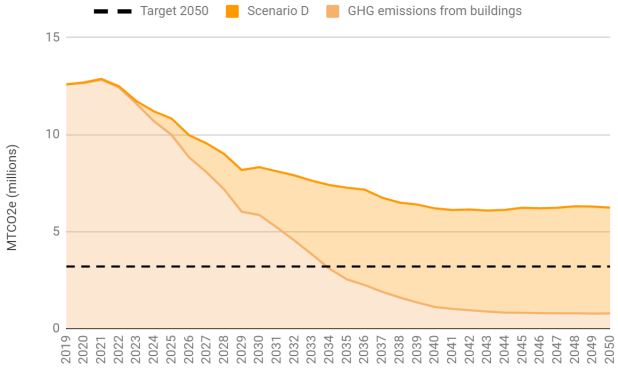


Figure 2: Integrated scenario D, annual GHG emissions reductions resulting from Integrated scenario D relative to total projected GHG emissions from buildings in Oregon

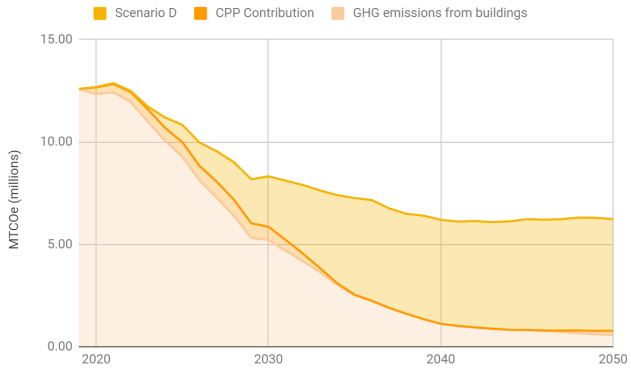


Figure 3: Integrated scenario D, annual GHG emissions reductions resulting from Integrated scenario D relative to total projected GHG emissions from buildings in Oregon, with reductions from CPP

2. Economic Impact, Costs and Savings

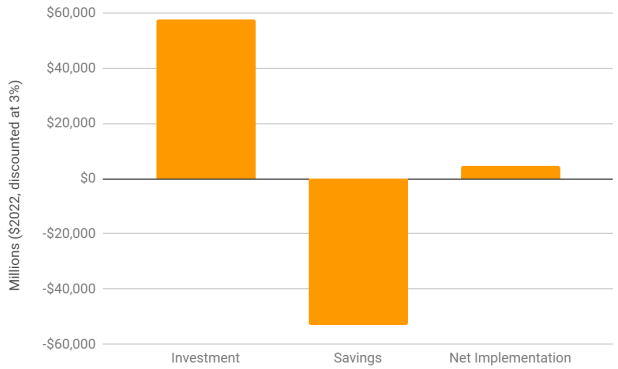


Figure 4: Integrated scenario D, NPV over the study period

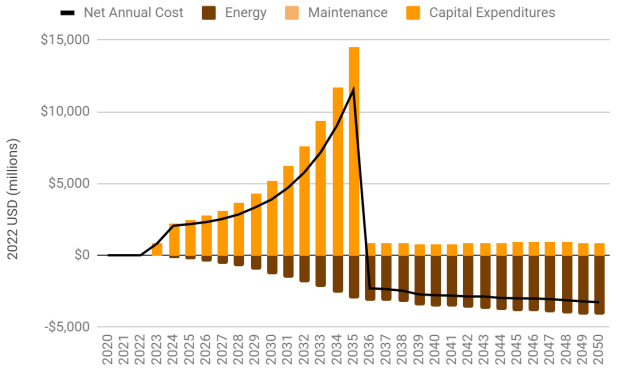


Figure 5: Integrated scenario D, net annual costs or savings

3. Energy Efficiency

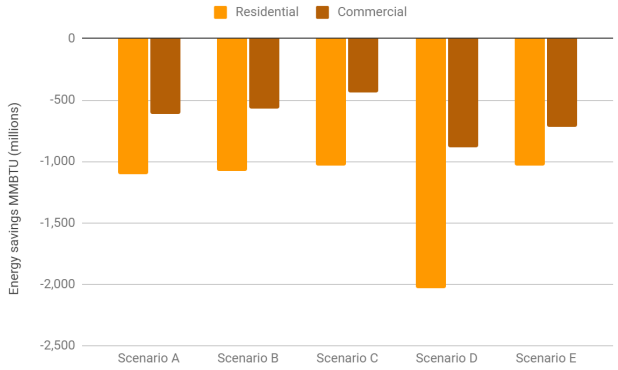


Figure 6: Integrated scenarios, cumulative energy savings by sector, relative to the reference scenario

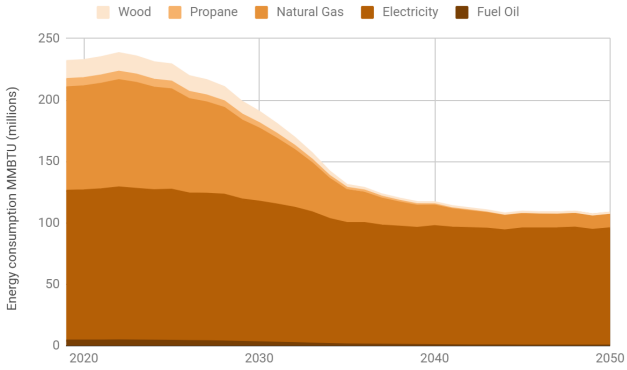


Figure 7: Integrated scenario D, energy consumption by energy source

4. Resiliency

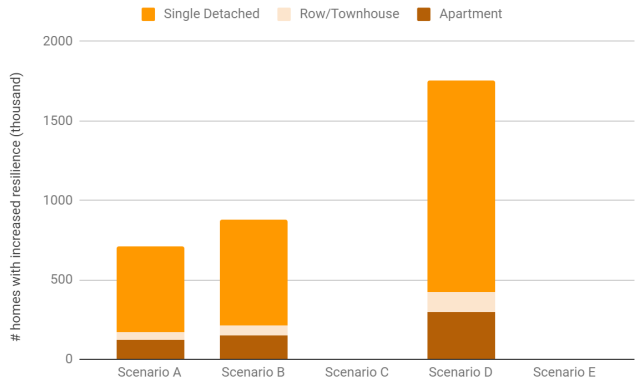


Figure 8: Integrated scenarios, # of homes with increased resilience by 2050

5. Public Health and Air Quality

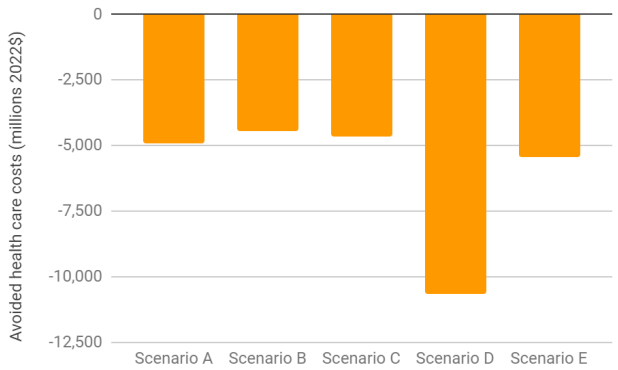


Figure 9: Integrated scenarios, avoided cumulative health costs

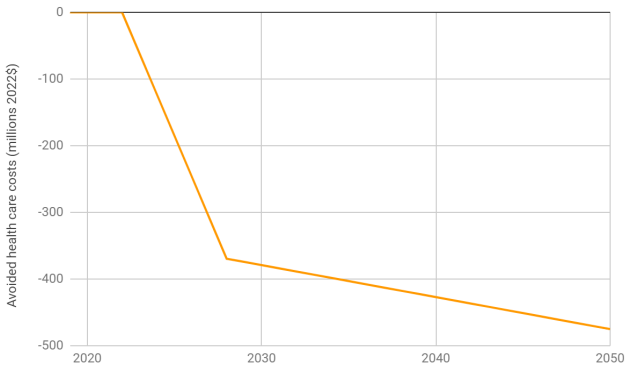


Figure 10: Integrated scenario D, avoided annual health costs

6. Household Expenditures

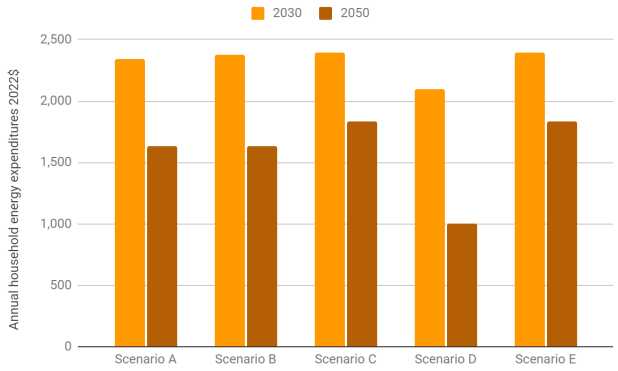


Figure 11: Integrated scenarios, annual household energy expenditures

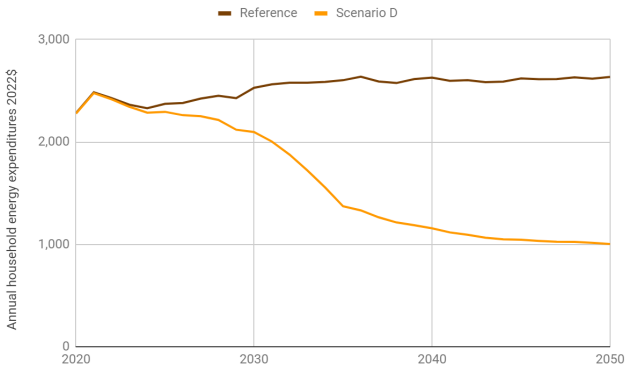


Figure 12: Integrated scenario D, annual household energy expenditures relative to the reference scenario

7. Economic Impact, Employment

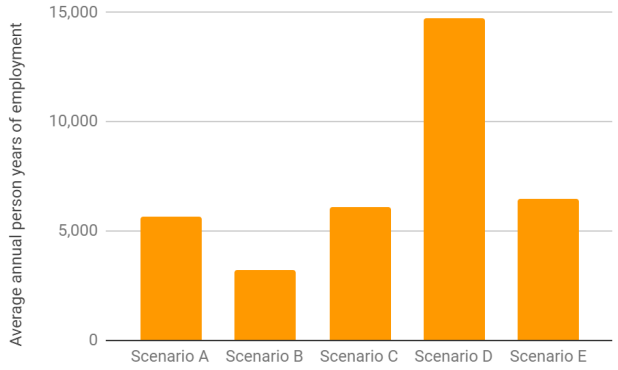


Figure 13: Integrated scenarios, cumulative person years of employment

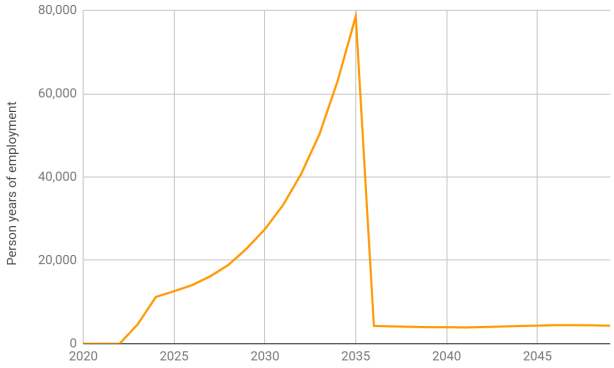


Figure 14: Integrated scenario D, annual person years of employment

8. Social Cost of Carbon

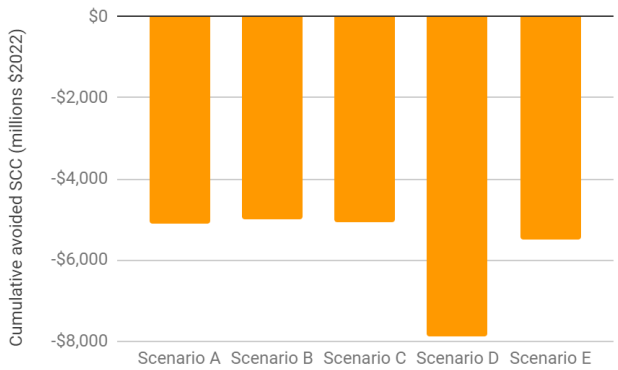


Figure 15: Integrated scenarios, cumulative avoided social cost of carbon

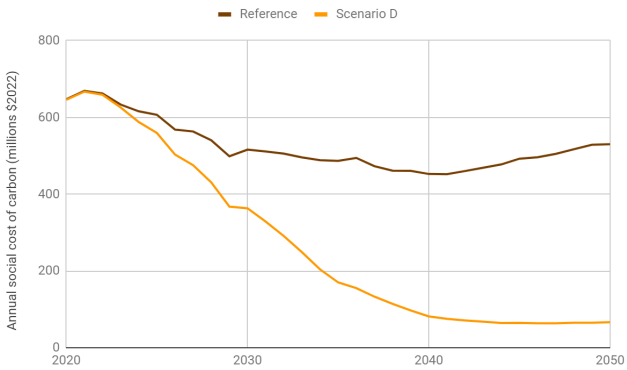
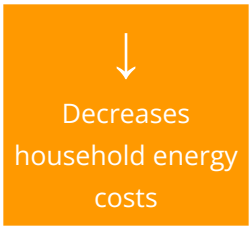
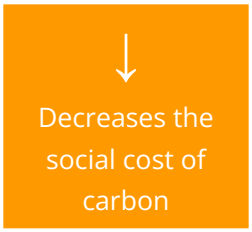


Figure 16: Integrated scenario D, annual avoided social cost of carbon relative to the reference scenario

6. Household expenditures		-24.57% change household energy expenditures between 2022 and 2050
7. Economic impact-employment		6,474 average annual person years of employment created (2022-2050)
8. Social cost of carbon		-$176.8 million average annual avoided damage from climate change globally (2022-2050)
9. Embodied Carbon		-2,690,000 metric ton CO2e average annual GHG emissions avoided emissions (2022-2050)

Background

1. GHG Emissions

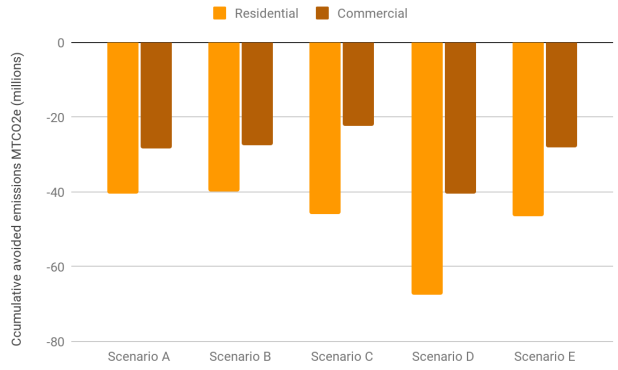


Figure 1: Integrated scenarios, cumulative GHG emissions reduction by sector, 2022-2050

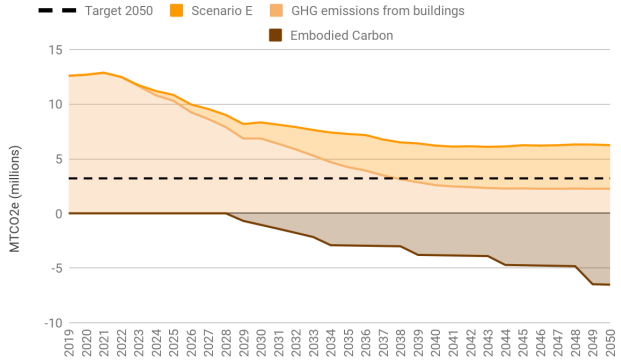


Figure 2: Integrated scenario E, annual GHG emissions reductions resulting from Integrated scenario E relative to total projected GHG emissions from buildings in Oregon

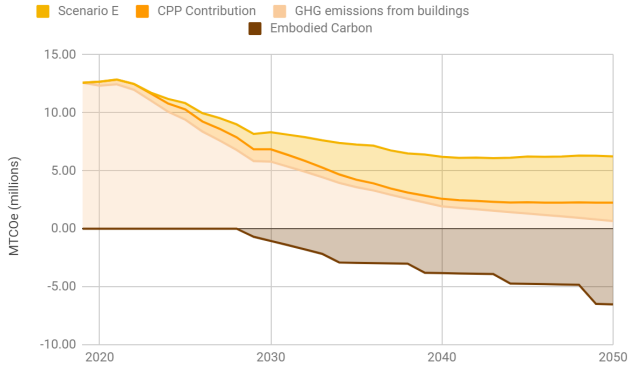


Figure 3: Integrated scenario E, annual GHG emissions reductions resulting from Integrated scenario E relative to total projected GHG emissions from buildings in Oregon, with reductions from CPP

2. Economic Impact, Costs and Savings

Figure 4: Integrated scenario E, NPV over the study period

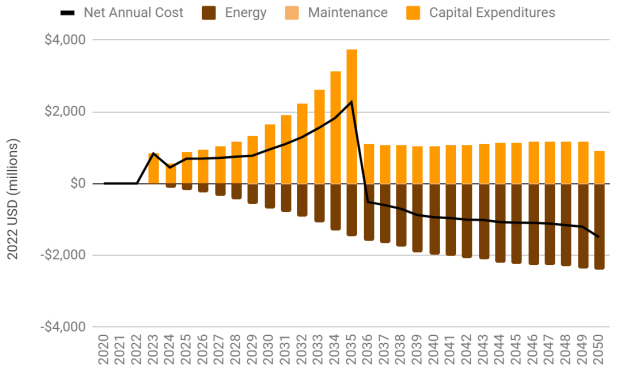


Figure 5: Integrated scenario E, net annual costs or savings

3. Energy Efficiency

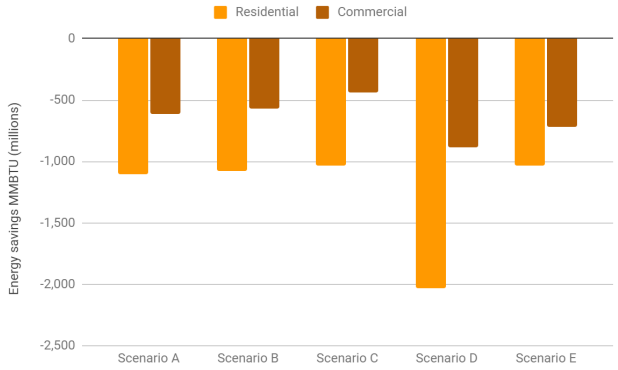


Figure 6: Integrated scenarios, cumulative energy savings by sector, relative to the reference scenario

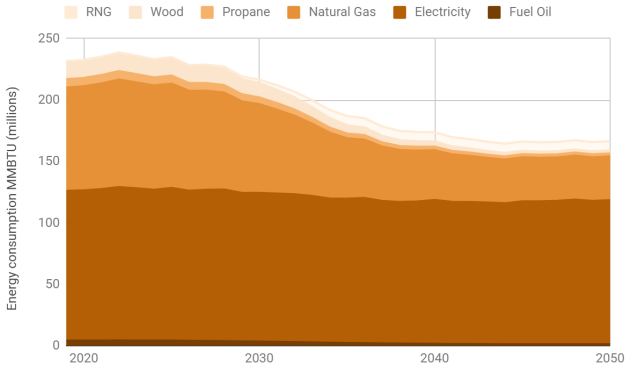


Figure 7: Integrated scenario E, energy consumption by energy source

4. Resiliency

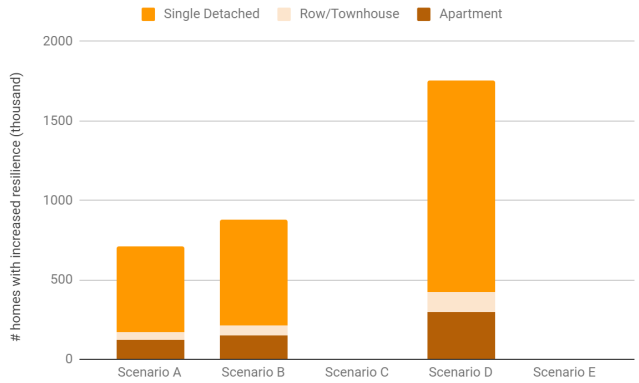


Figure 8: Integrated scenarios, # of homes with increased resilience by 2050

5. Public Health and Air Quality

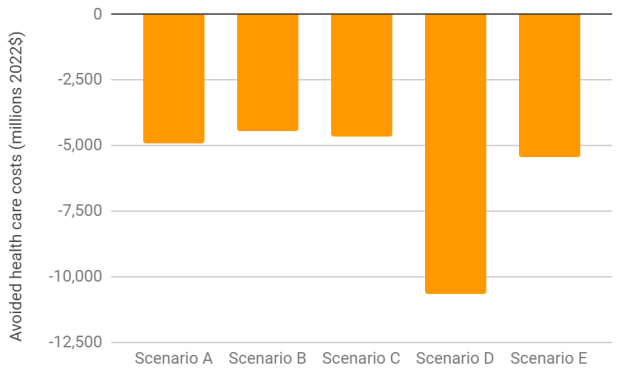


Figure 9: Integrated scenarios, avoided cumulative health costs

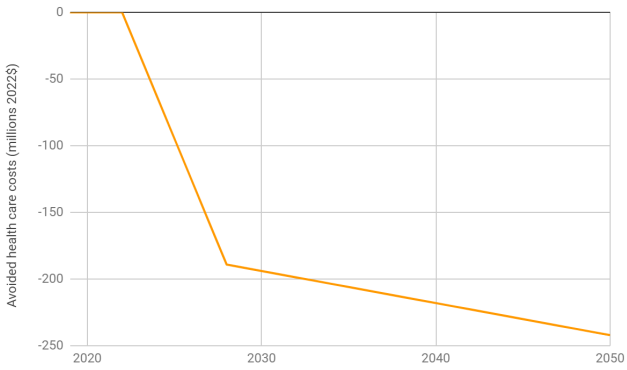


Figure 10: Integrated scenario E, avoided annual health costs

6. Household Expenditures

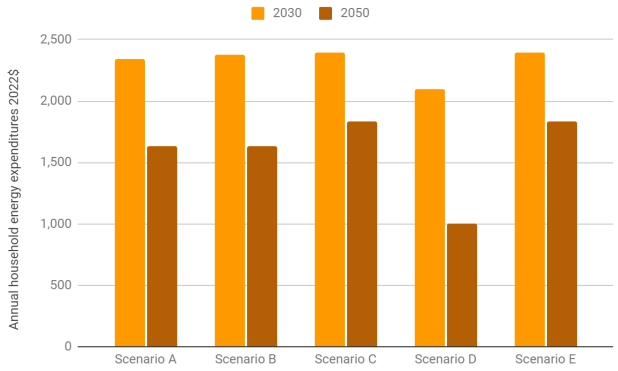


Figure 11: Integrated scenarios, annual household energy expenditures

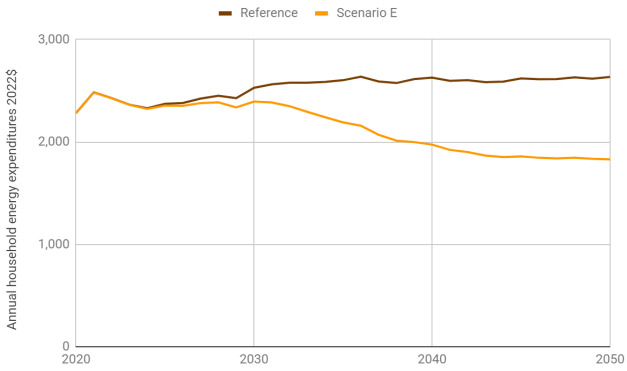


Figure 12: Integrated scenario E, annual household energy expenditures relative to the reference scenario

7. Economic Impact, Employment

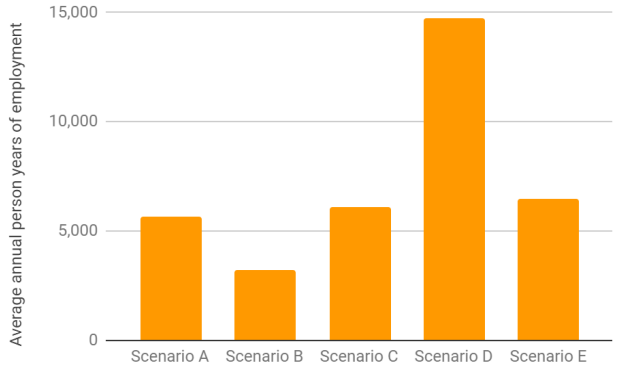


Figure 13: Integrated scenarios, cumulative person years of employment

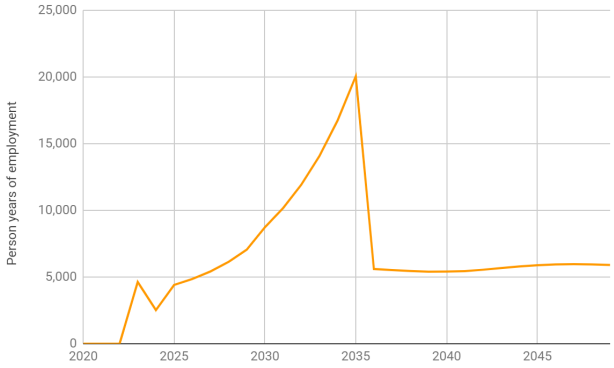


Figure 14: Integrated scenario E, annual person years of employment

8. Social Cost of Carbon

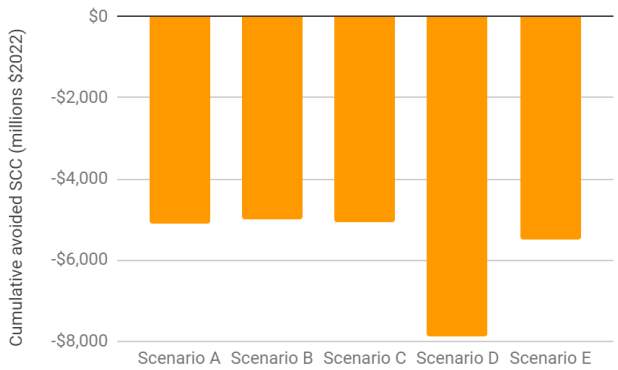


Figure 15: Integrated scenarios, cumulative avoided social cost of carbon

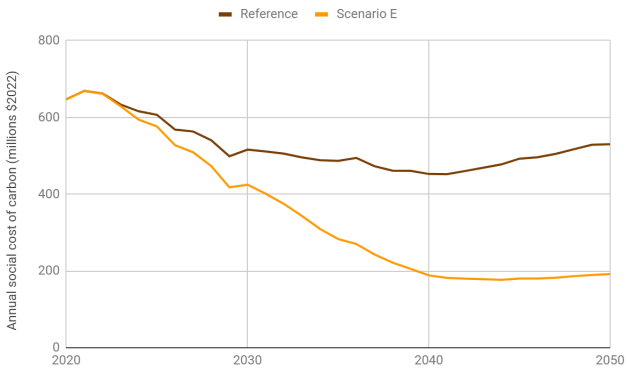


Figure 16: Integrated scenario E, annual avoided social cost of carbon relative to the reference scenario

Key

Term/Acronym	Definition	Additional information
CPP	Climate Protection Program	The Climate Protection Program sets a declining limit, or cap, on greenhouse gas emissions from fossil fuels used throughout Oregon, including diesel, gasoline, natural gas and propane, used in transportation, residential, commercial and industrial settings. The rate of reduction is applied to covered fuels in the residential and commercial sectors.
Cumulative		The sum of the annual costs or savings over the period. For example, if there were $40 of savings in 2022, $60 of savings in 2023 and $120 of costs in 2024, the cumulative value would be -$40+-$60+$120= $20.
GHG	Greenhouse gases	The three primary GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxides (NOX).
Household energy expenditures		Cost of energy used in a house, calculated by summing total expenditures on energy in houses in Oregon divided by number of houses.
MMBtu	Million british thermal units	A measure of energy. 1 kWh of electricity is equivalent to 3,400 Btu 1 gallon of gasoline is equivalent to 120,000 Btu
MtCO2e	Metric tons of carbon dioxide equivalent	A measure that combines CO_2, CH_4, NO_X into one measure. For example, 1 unit of CH4 is equivalent to 28 units of CO_2 over 100 years. In other words, 1 unit of CH4 causes 28 times more warming than 1 unit of CO_2 over 100 years, where the 28 is described as the Global Warming Potential (GWP). If a policy results in 2 Mt of CO_2 and 2 Mt of CH_4, the total would be 2 +(2*28)= 58 MtCO2e.
NPV	Net present value	A method used to determine the current value of all future cash flows generated by a project, including the initial capital investment. Based on the idea that a future dollar is worth less than a current dollar, future costs and savings are discounted back to current dollars. The net present value is sensitive to the discounting rate.
Person years of employment		One person working full time for a year. For example, a job which lasts 10 years is equivalent to 10 person years of employment.
Reference		The reference scenario includes: • Population growth • Employment growth • Heating and cooling degree days projections • Community Renewable Energy Program • Energy efficiency standards for appliances • HB2021 • Heat Pump Rebate Program • Implement Healthy Homes Repair Fund • Manufactured home replacement • Solar + Storage Rebate Program

Resilience		Residential building retrofits are assumed to increase the resilience of the home. By increasing the thermal performance of the home, the retrofit increases its passive survivability, the ability of a building to maintain critical life-support conditions for its occupants if services such as power, heating fuel are lost for an extended period.
SCC	Social cost of carbon	The SCC is a comprehensive estimate of climate change damages and includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning.