June 2, 2021

MEMORANDUM

TO: **Council Members**

FROM: **Ben Kujala**

SUBJECT: Pathways to Decarbonization Scenario Findings

BACKGROUND:

Presenter: Ben Kujala

Summary: This scenario looks at the greenhouse gas emissions associated with the use of energy in our region and at the approaches to reducing these emissions. This power plan is the first plan where the Council has expanded our forecasting to include the use of fuels for transportation, the home, the business, and industry. State targets in Oregon and Washington for reducing emissions are cross-sector. And many of the approaches for reducing emissions involve increasing load on the electric system. This scenario looks at what it takes in the broader energy sector to move toward these goals and examines the implications for the electric system.

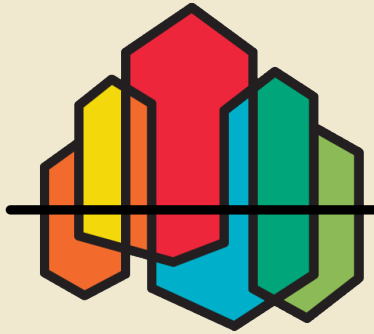
Relevance: Decarbonization goals and the resulting policies and activities to pursue those goals have broad-ranging implications for the amount of electricity used in the region.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Bill Edmonds
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

Pathways to Decarbonization Scenario Findings



THE 2021
NORTHWEST
POWER PLAN
FOR A SECURE & AFFORDABLE
ENERGY FUTURE

Introduction

To combat climate change - the states of Oregon and Washington have set goals and limits on future greenhouse gas emissions from their respective states

Oregon

45 % below 1990 levels by 2035

80 % below 1990 levels by 2050

Washington

45 % below 1990 levels by 2030

70 % below 1990 levels by 2040

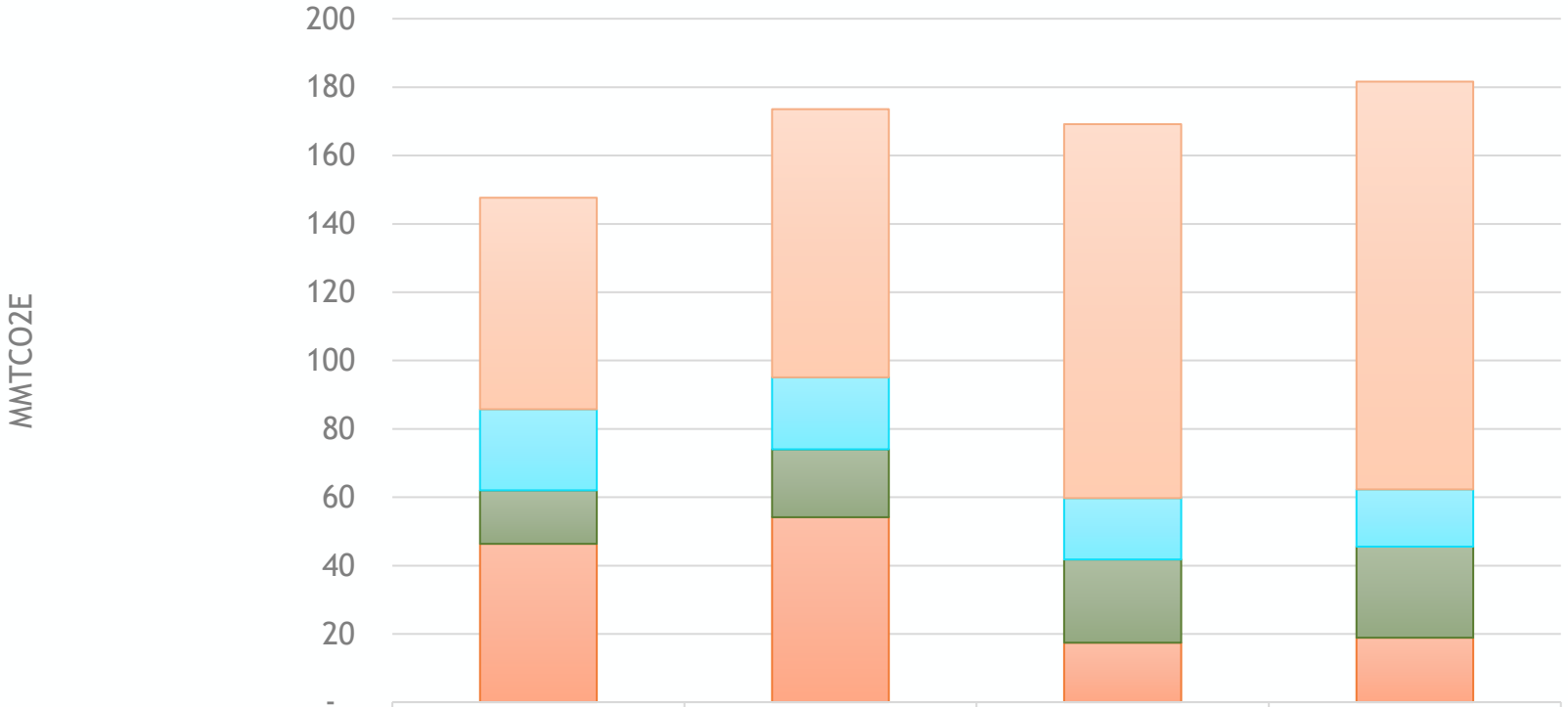
95 % below 1990 levels by 2050

and net zero emissions

For the **2021 Power Plan** – in order to form a more comprehensive understanding of expected regional emissions - we expanded our forecasting out past the power sector to include the use of fuels for transportation, the home, the business and industry

The **Paths to Decarbonization Scenario** is an investigation into methods that can reduce greenhouse gas emissions from the **entire economy** – both energy related & non-energy related

Baseline Conditions Emissions

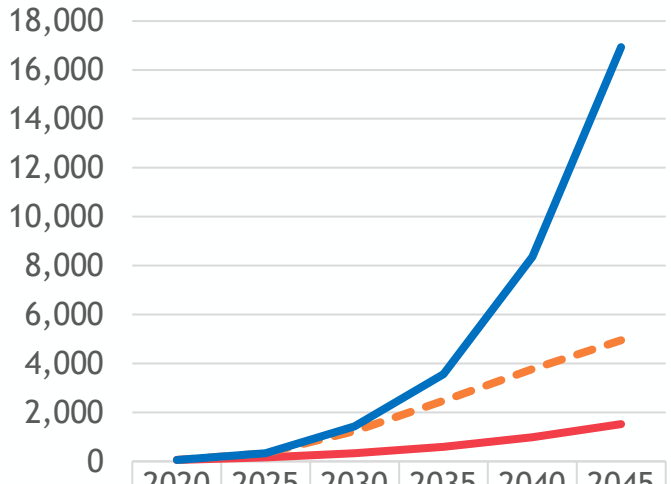


	1990	2005	2041	2050
Transportation	62	78	109	119
Industrial, w/o Agric	24	21	18	17
Residential/Commercial	16	20	24	27
Electric Sector	46	54	17	19

Results

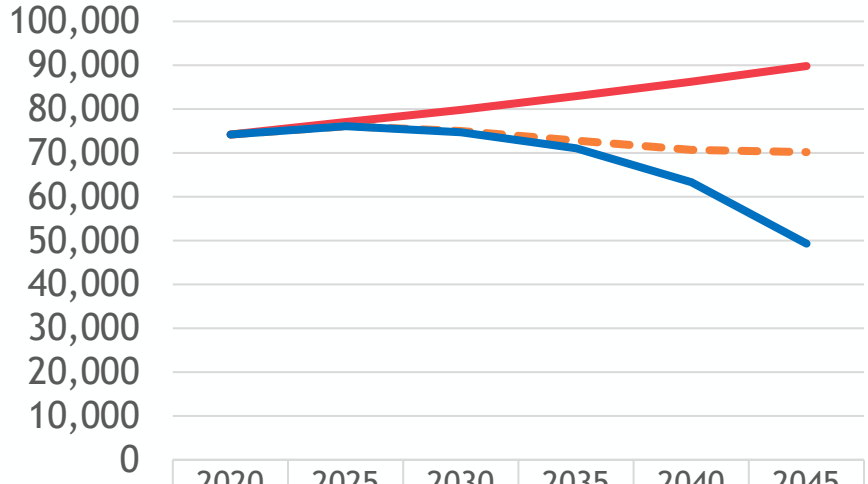
ELEC Only - electrification changes only - no H_2

Demand for Electricity
aMW



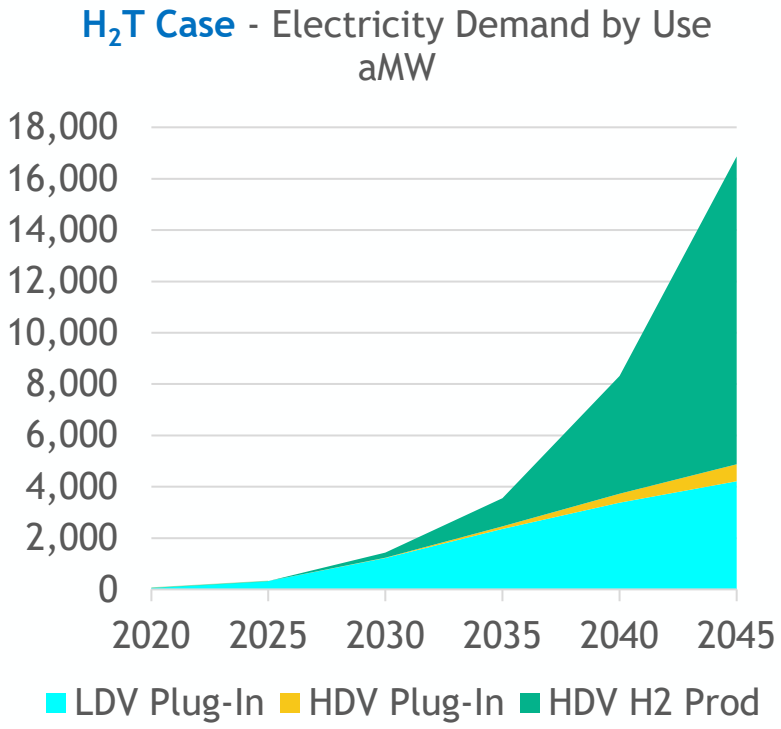
	2020	2025	2030	2035	2040	2045
REF	60	161	336	603	993	1,524
ELEC Only	63	332	1,246	2,475	3,771	4,954
H2T	63	332	1,436	3,570	8,367	16,934

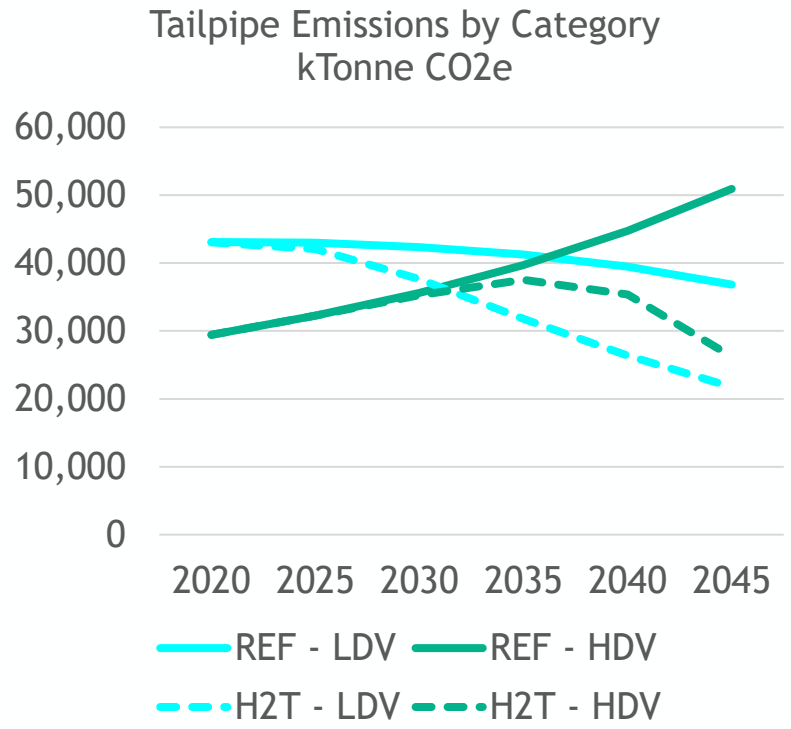
Tailpipe Emmissions
kTonne CO2e



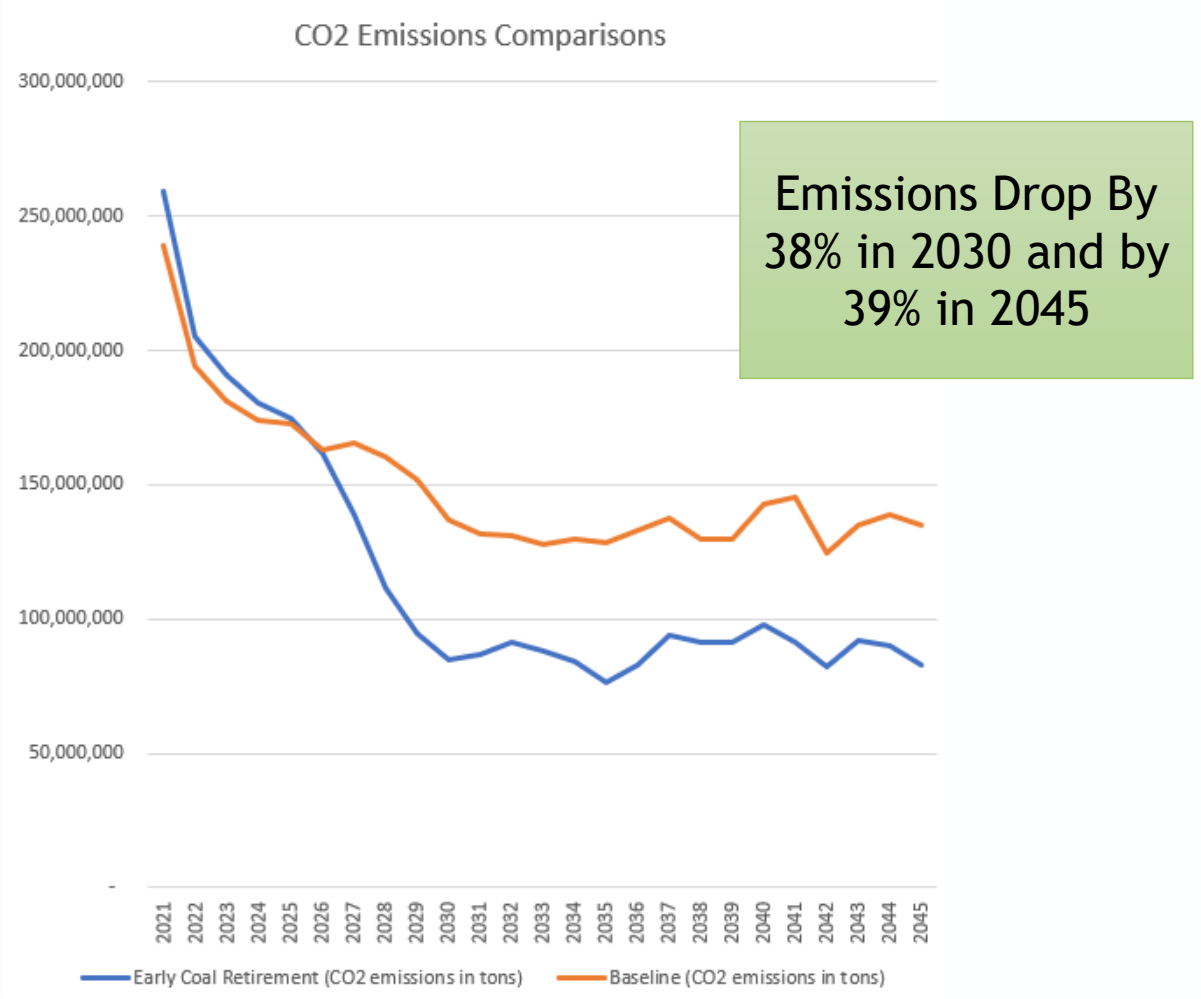
	2020	2025	2030	2035	2040	2045
REF	74,257	77,084	79,874	82,964	86,256	89,879
ELEC Only	74,232	76,156	75,034	72,803	70,756	70,240
H2T	74,232	76,156	74,750	71,112	63,325	49,332

More Results



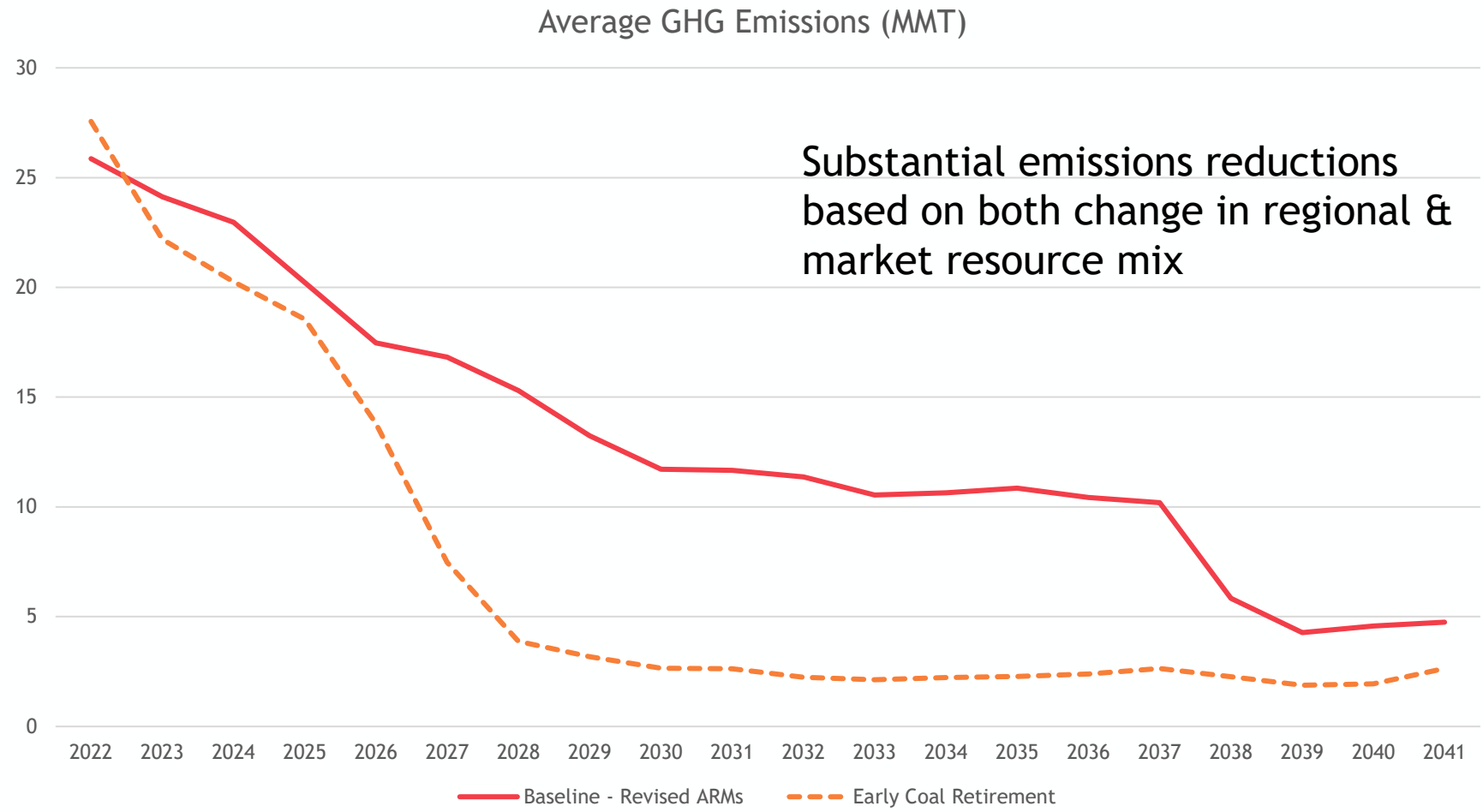


WECC-wide Emissions Based on Early Coal Retirement

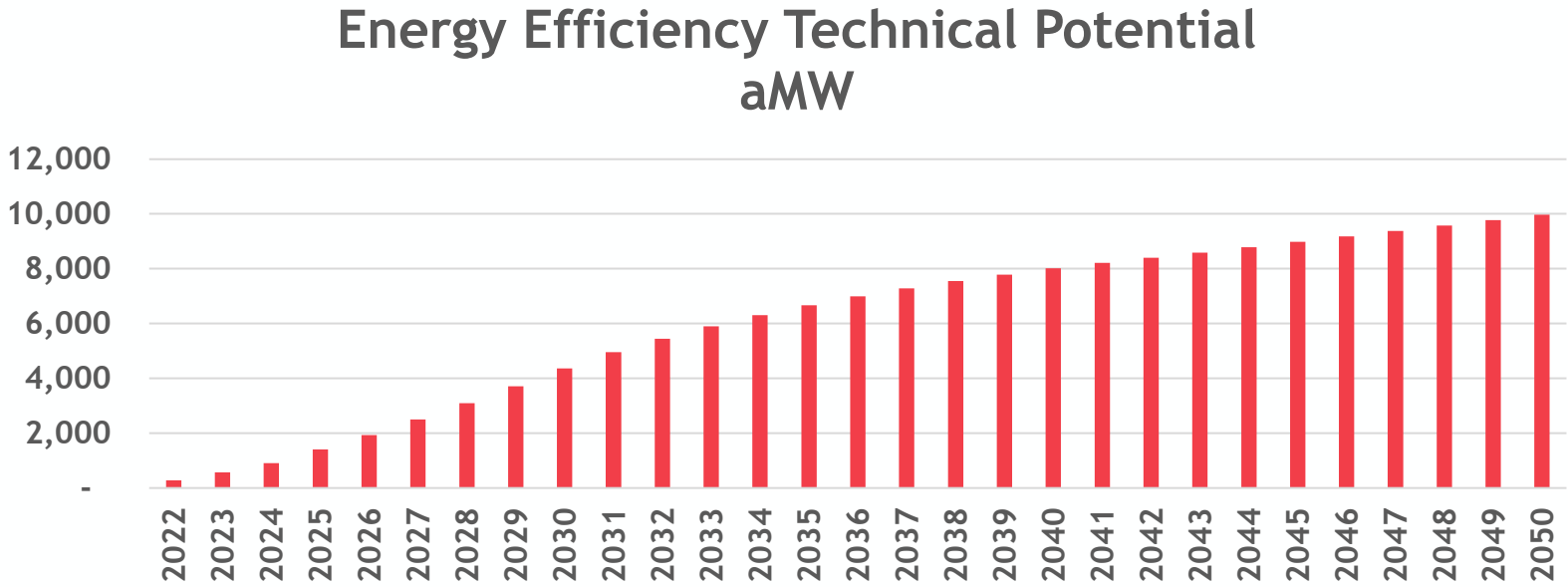


Emissions Drop By 38% in 2030 and by 39% in 2045

Regional Emissions Based on Early Coal Retirement



Substantial emissions reductions based on both change in regional & market resource mix



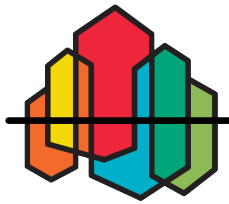
- Assumes 100 percent of EE technical potential acquired
- Leads to low to moderate emissions reduction (emissions go down by 4%) - power system has very low emissions by 2050, so reduction in electric load does not significantly lower 2050 emissions

Transportation Assumptions

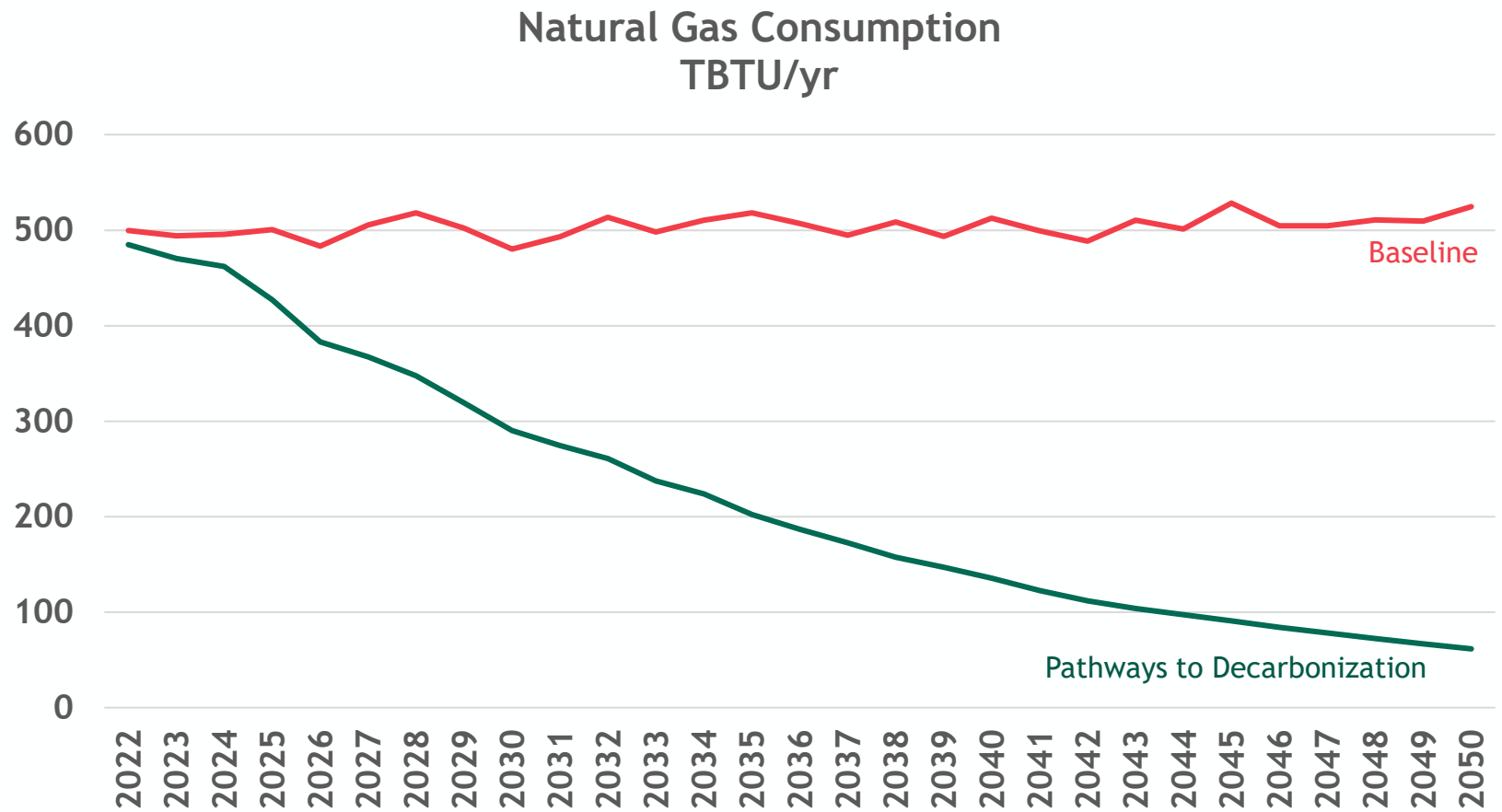
- All air travel has a 2% reduction in CO2 emissions per year starting in 2025
- New City buses sold in 2050 are 94% electric in Idaho & Montana and 100% electric in Oregon and Washington
- CAFE standards increase to 80 MPG by 2040 (from 25 MPG today)
- Forced early retirement of older passenger vehicles and light duty trucks
- Sales of Heavy Duty Vehicles in 2050 are either 94% or 100% Hydrogen or Electric by 2050 (depending on application)
- Light Duty Vehicles are 100% electric by 2030 for Oregon and Washington, 2035 for Idaho, and 2040 for Montana
- Electric marine vehicles go to 50% of new vehicles sold in 2050
- Electric freight trains go to 50% of new vehicles sold in 2050
- Total vehicle miles traveled per capita reduces by 1% per year starting in 2020

Other assumptions

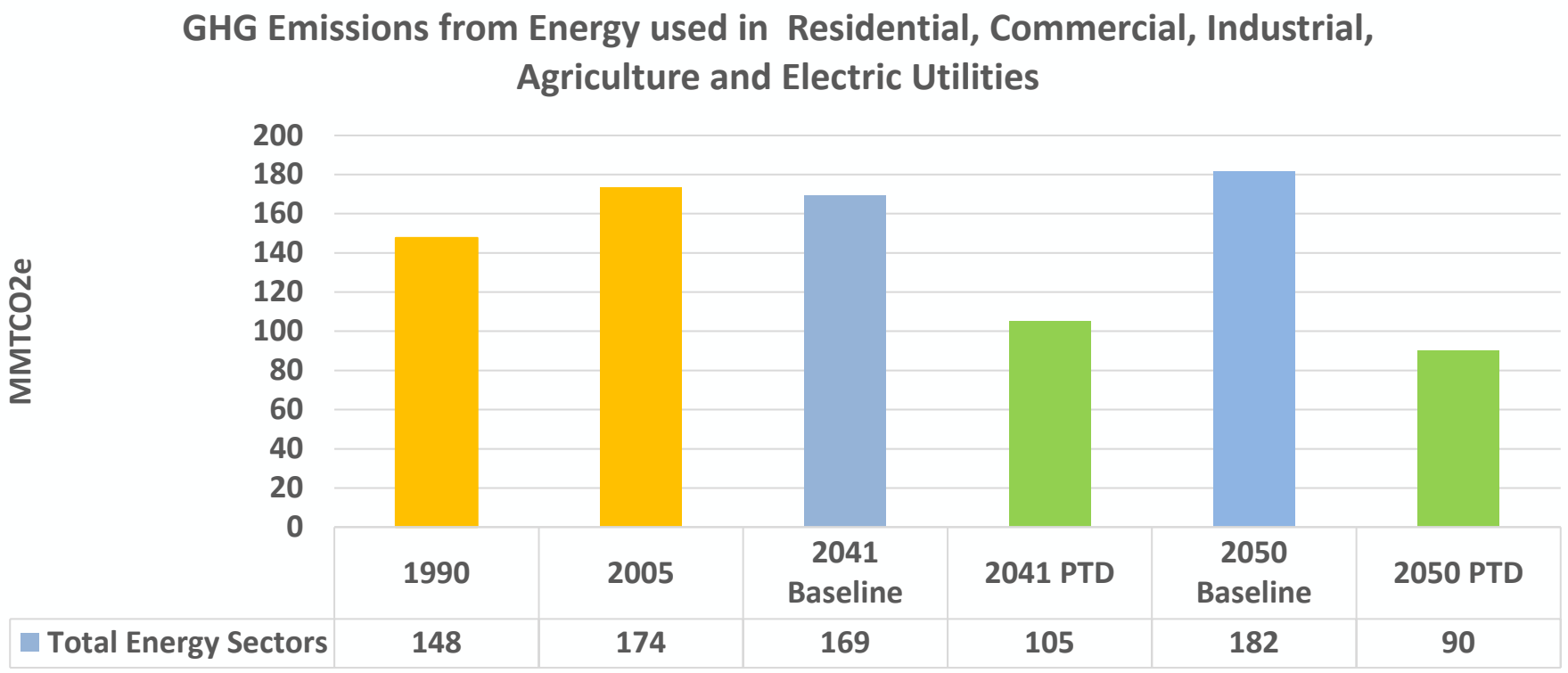
- Reduction in appliance life to increase replacements with more efficient appliances
- Increased Renewable Natural Gas penetration
- Industrial fuel demands shift to electric or hydrogen
- Decrease solar costs for rooftop (75% lower than 2022)
- Increase residential battery installation
- Increase and extend investment tax credits for residential solar installations
- Added $100 tax per ton of CO2 equivalent emissions



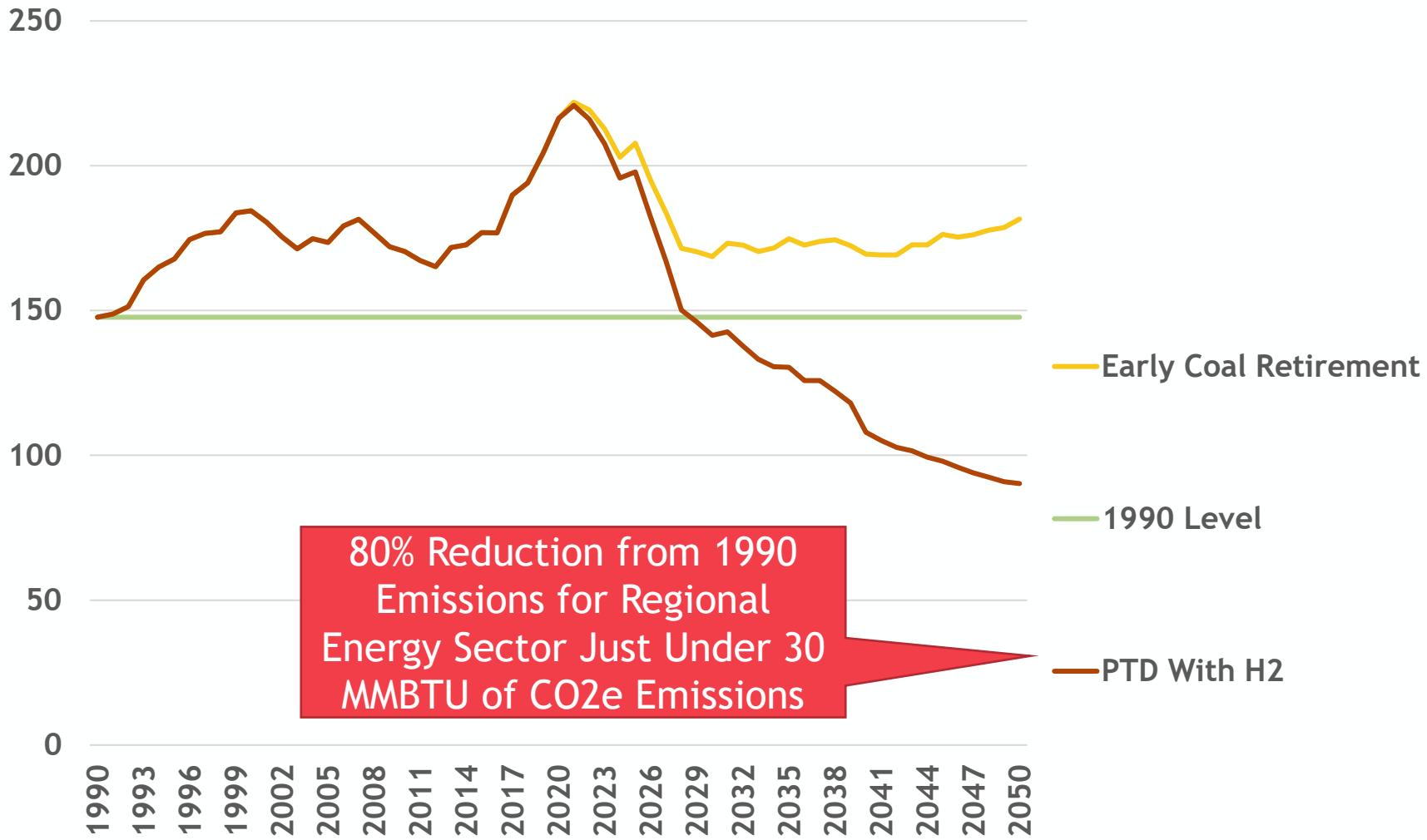
Natural Gas Consumption (Excludes Electric Utility Demand)



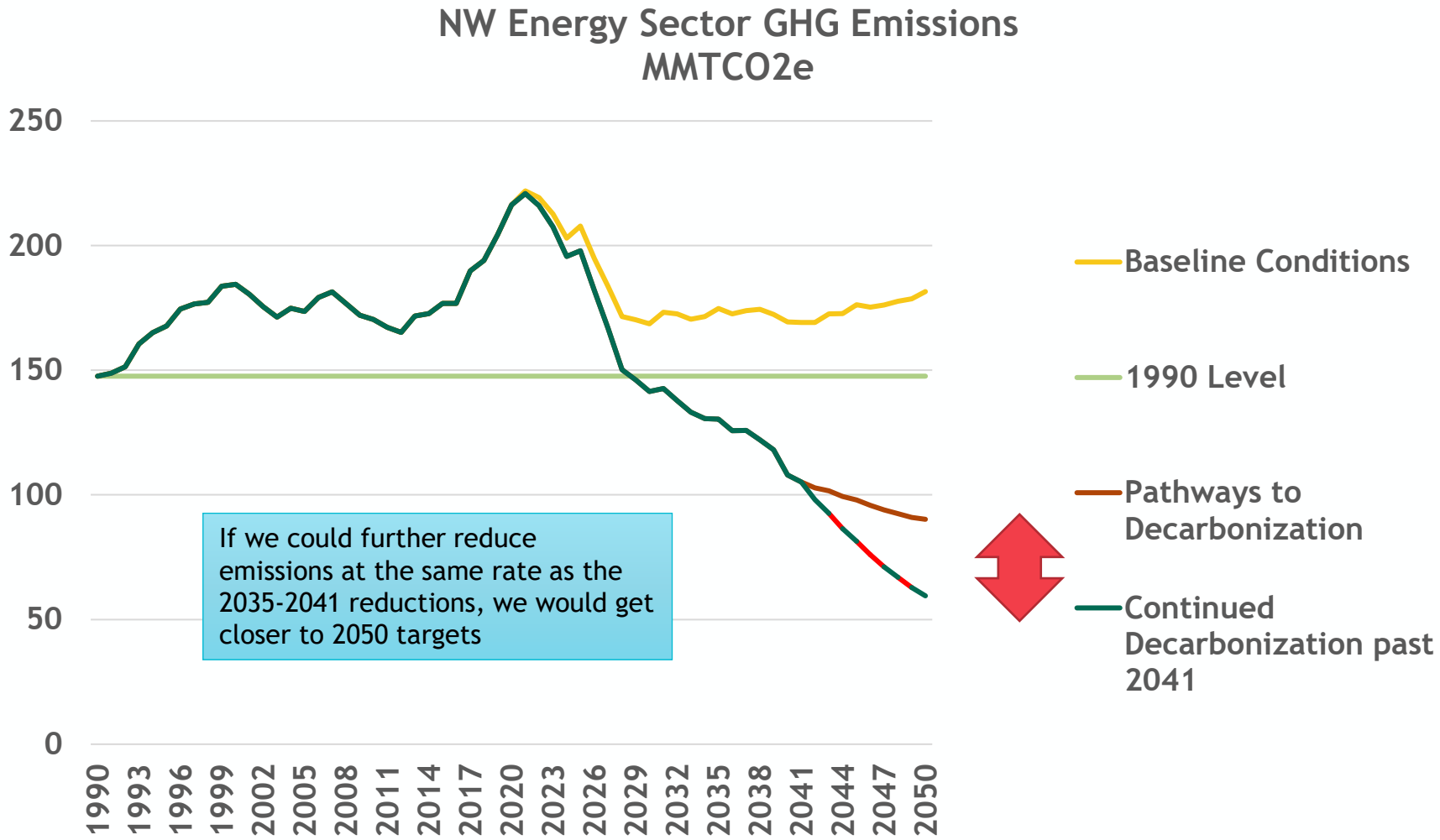
Where Does This Leave Us for Emissions from Energy Use in the Northwest?



Decarbonization Looking at Energy Sector Falls Short of Targets

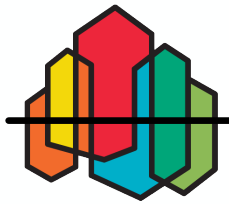


Limits on Our View of Emissions in 2050



Energy is Only Part of the Decarbonization Picture

MMTCO2E	1990	2050 PTD
Energy	148	90
Coal Mining & Abandoned Mines	2	0.4
Natural Gas and Oil Systems	3	0.3
Industrial Processes	7	9
Agriculture	32	24
Municipal Solid Waste	4	2
CH4 From Reserviours	7	6.5
Emissions from Foreast fires	-	13
Aggregate Sources	203	145
Aggregate Sinks	(101)	(103)
Net Emissions	101	42



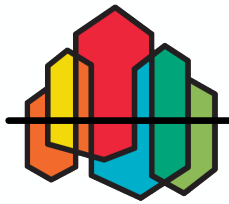
RPM Analysis

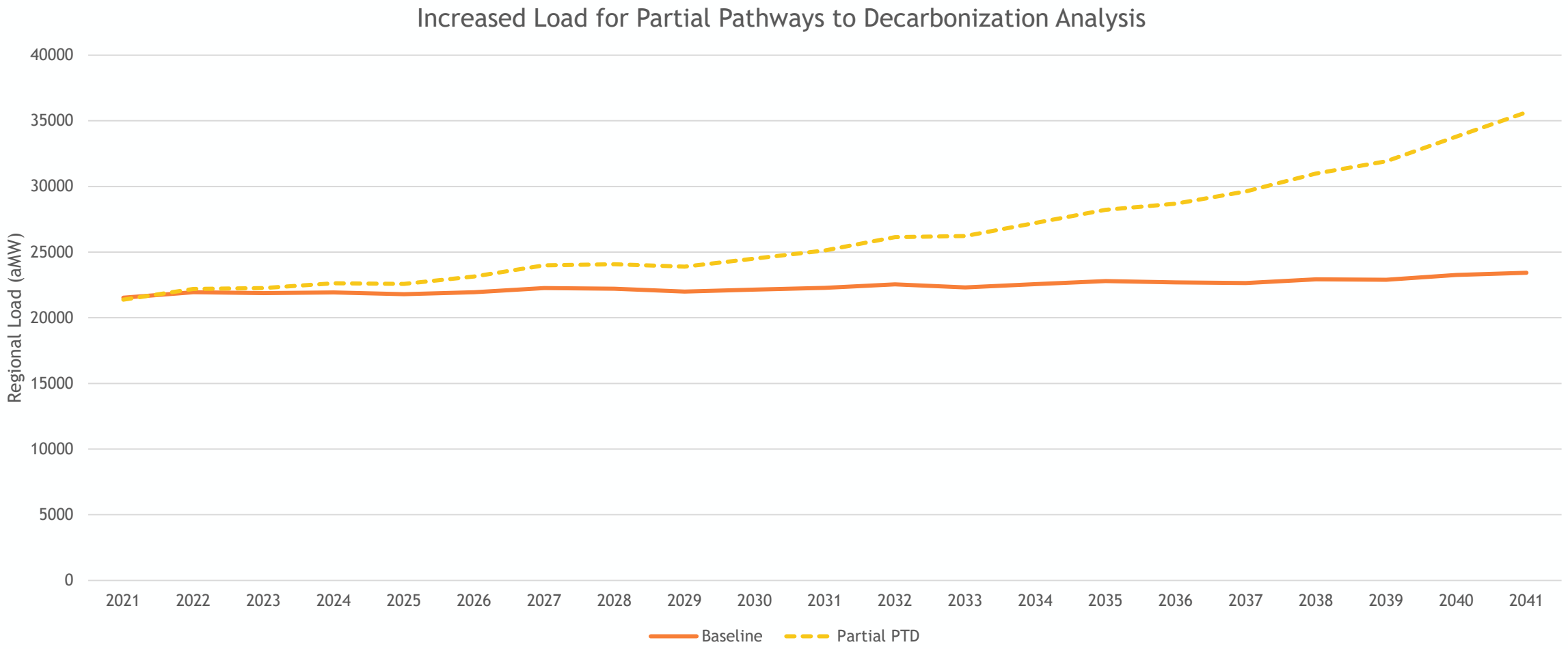
Partial Decarbonization

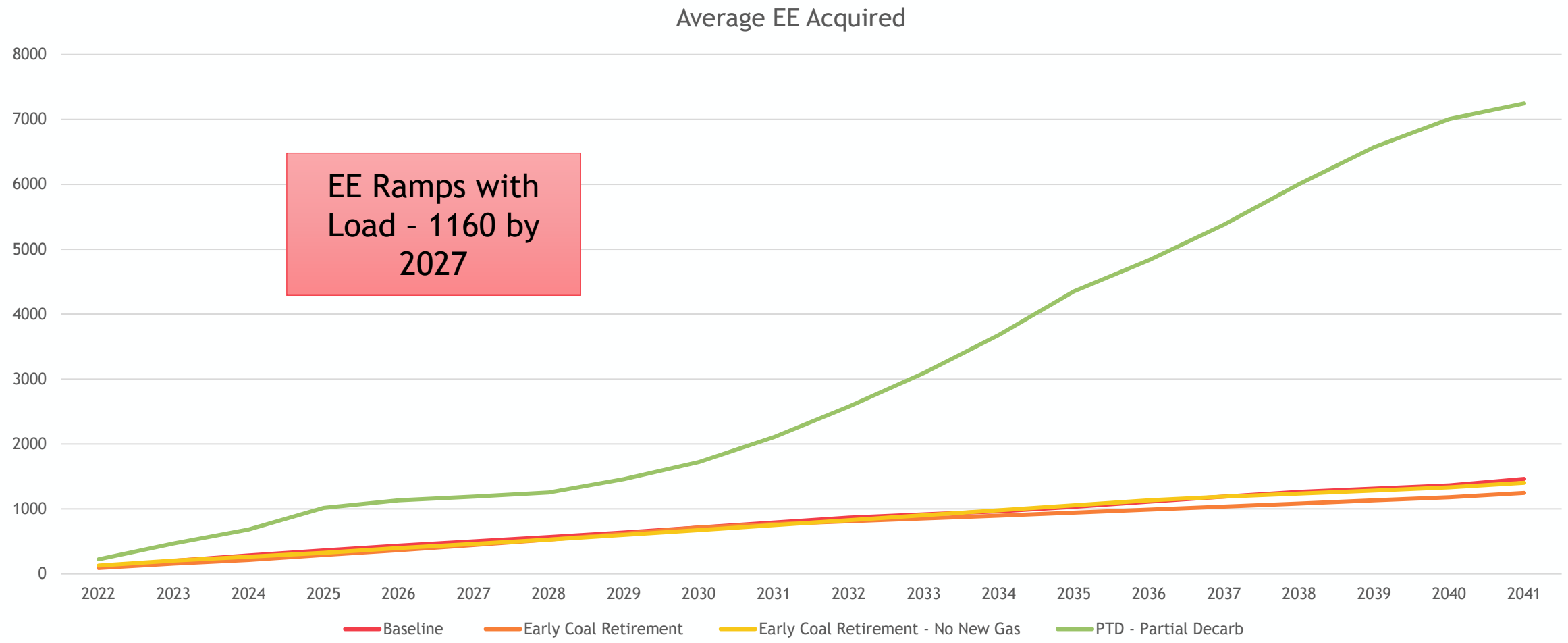
What if we see some but not all impacts on the electric sector?

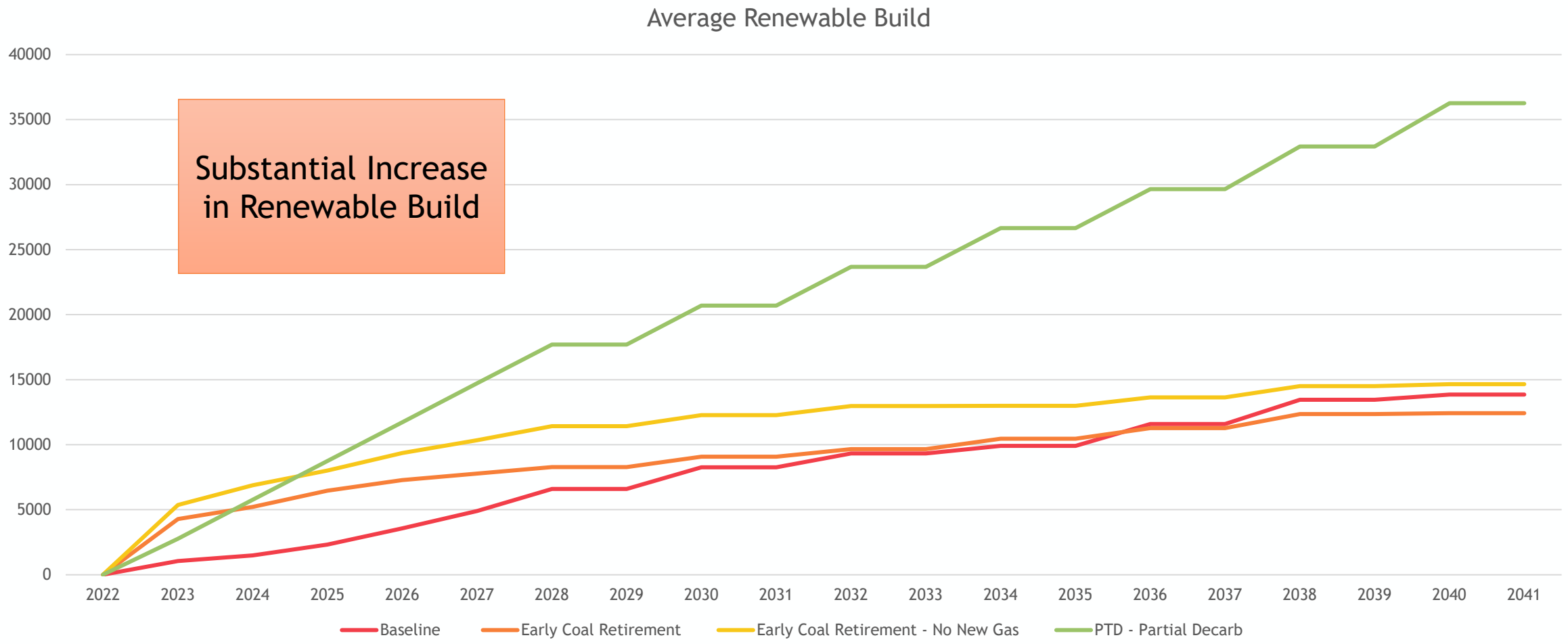
1. Started with Early Coal Retirement Scenario
2. Removed all natural gas resource options
3. Added SMRs as an option
4. Increased loads consistent with electrification of new buildings and light-duty EV reaching 100 percent of sales by 2030
5. Run through RPM

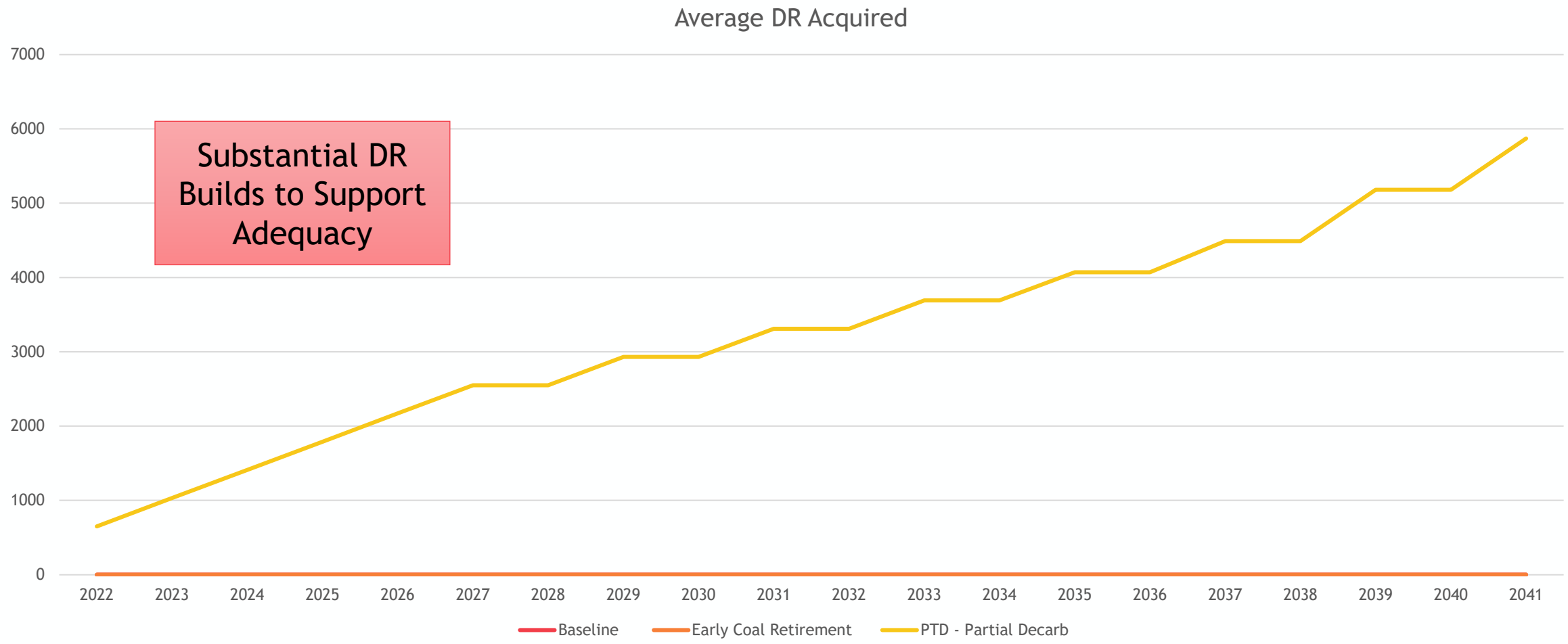
NOTE: this does **not** represent a system that meets current state goals

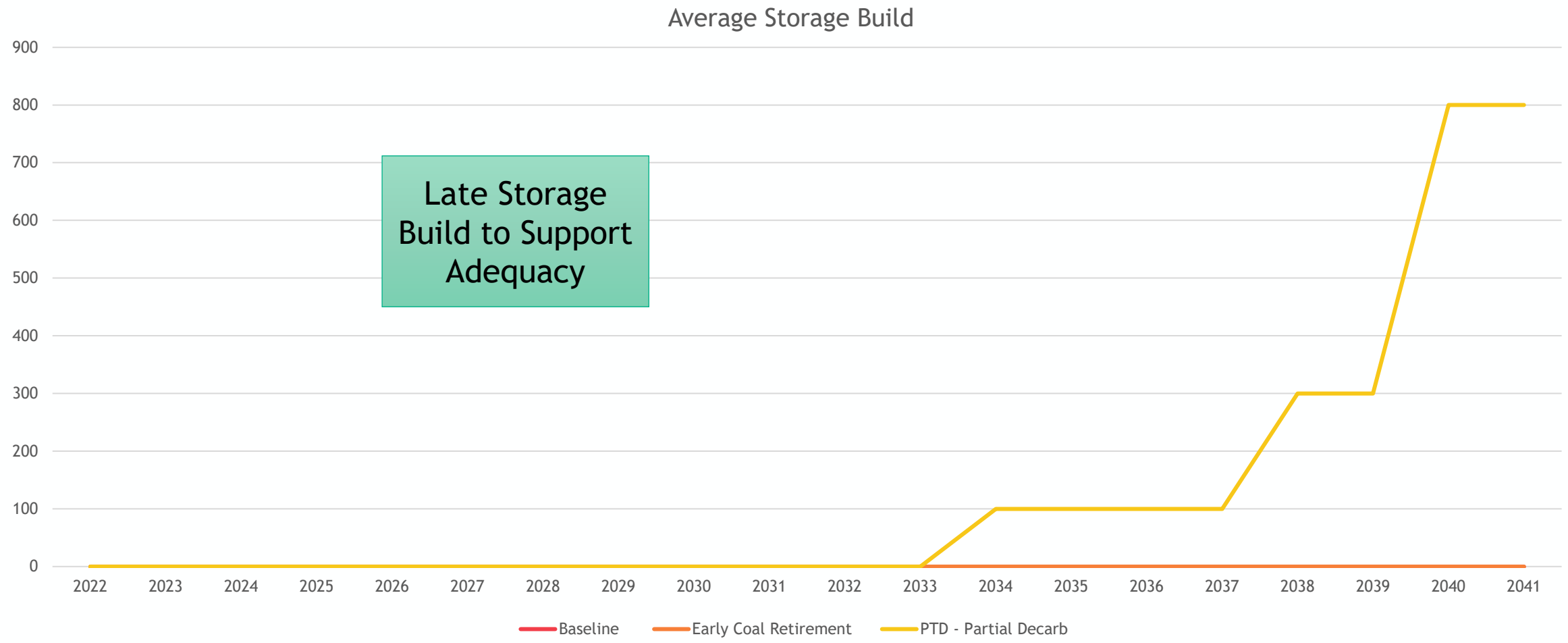


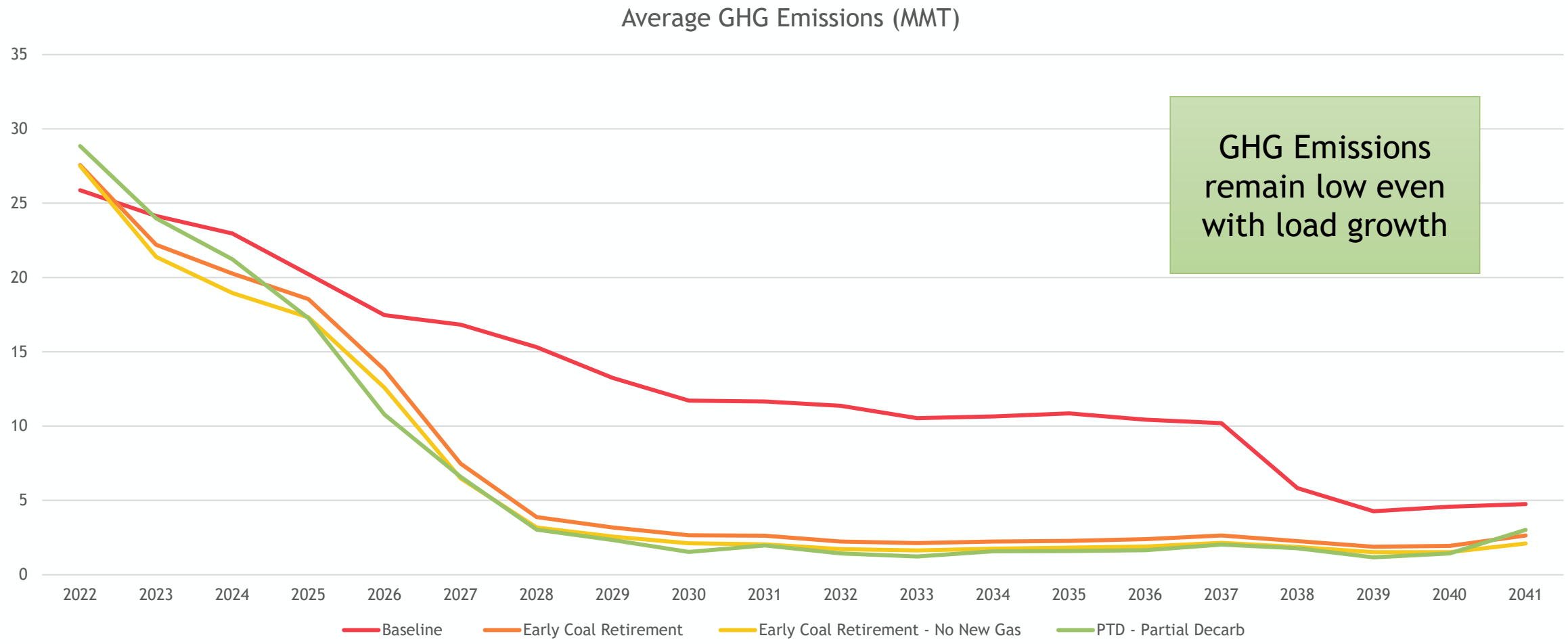

Increased Load for Partial Pathways to Decarbonization Analysis
Regional Load (aMW)
40000
35000
30000
25000
20000
15000
10000
5000
0
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
Baseline
Partial PTD

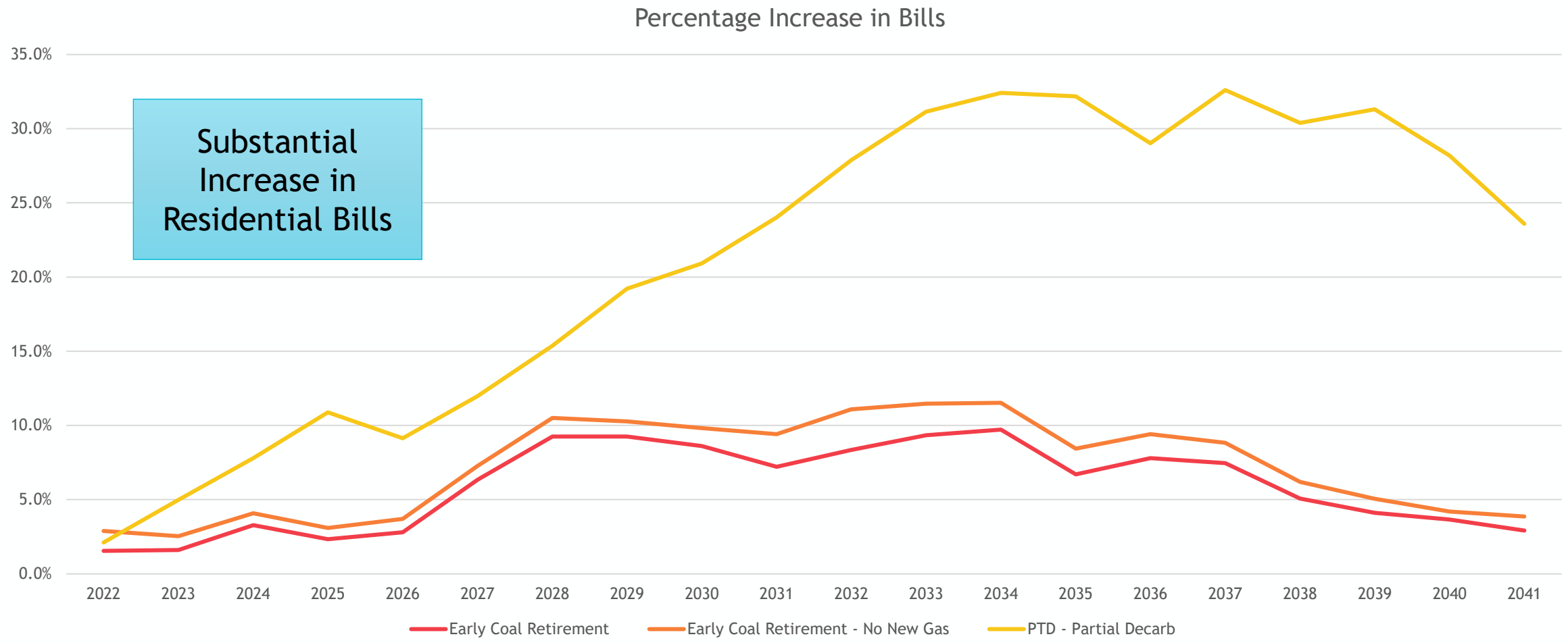

Average EE Acquired
8000
7000
6000
5000
4000
3000
2000
1000
0
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
EE Ramps with Load – 1160 by 2027
Baseline
Early Coal Retirement
Early Coal Retirement - No New Gas
PTD - Partial Decarb

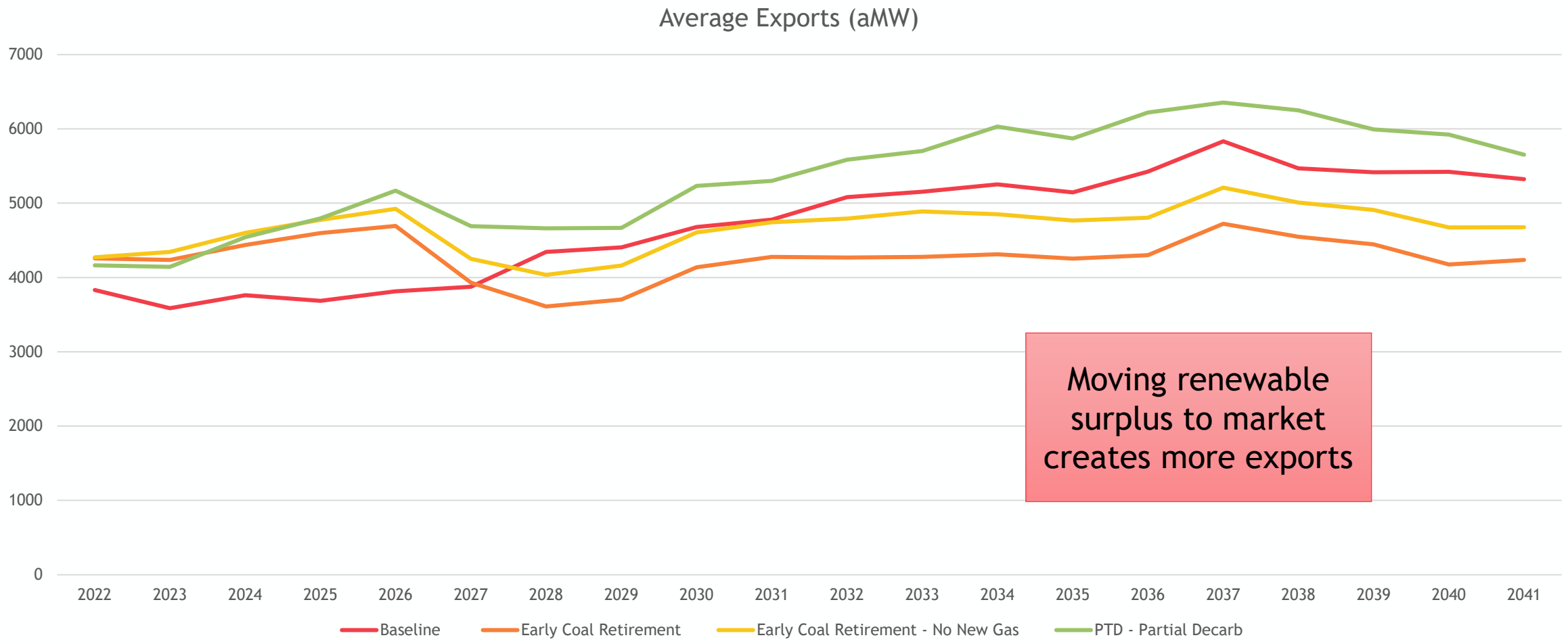

Average Renewable Build
Substantial Increase in Renewable Build
40000
35000
30000
25000
20000
15000
10000
5000
0
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
Baseline
Early Coal Retirement
Early Coal Retirement - No New Gas
PTD - Partial Decarb


Average DR Acquired
Substantial DR Builds to Support Adequacy
7000
6000
5000
4000
3000
2000
1000
0
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
Baseline
Early Coal Retirement
PTD - Partial Decarb


Average Storage Build
900
800
700
600
500
400
300
200
100
0
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
Late Storage Build to Support Adequacy
Baseline
Early Coal Retirement
PTD - Partial Decarb

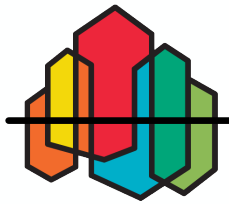

Average GHG Emissions (MMT)
35
30
25
20
15
10
5
0
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
Baseline
Early Coal Retirement
Early Coal Retirement - No New Gas
PTD - Partial Decarb
GHG Emissions remain low even with load growth


Percentage Increase in Bills
Substantial Increase in Residential Bills
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
Early Coal Retirement
Early Coal Retirement - No New Gas
PTD - Partial Decarb


Average Exports (aMW)
7000
6000
5000
4000
3000
2000
1000
0
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
Baseline
Early Coal Retirement
Early Coal Retirement - No New Gas
PTD - Partial Decarb
Moving renewable surplus to market creates more exports

Conclusions

- Increased EE tends to be really aggressive after the first decade
- Increasing load pushes renewables up
- No options for natural gas pushes storage and DR and a single geothermal plant into resulting strategy
- Reserves likely need to be adjusted to account for additional renewables – operability of the system is unclear




Questions?