Northwest **Power** and **Conservation** Council

December 7, 2021

MEMORANDUM

TO: **Power Committee**
FROM: **Massoud Jourabchi**
SUBJECT: **Update on Key Economic Drivers of Long-Term Load Forecast used in development of the 2021 Plan**

BACKGROUND:

Presenter: Massoud Jourabchi

Summary: Review of key economic drivers of the draft Power Plan shows that 2021 vintage of demographic and economic drivers of the Plan are projected to be lower than 2018 vintage of drivers used in development of draft Plan. Incorporating impact of these lower trajectories suggest that Base forecast of loads would be about 5% lower compared to the draft forecast. Staff analyses show the magnitude of change in loads are well within the range of load uncertainty modeled through RPM.

Relevance: Demographic and economic data going into the draft 2021 Power Plan are about 3 years old.

Workplan: Review and evaluation of key economic drivers are part of the workplan for the 2021 Resource Plan.

Background: Creating a regional long-term,20-years, load forecast is a requirement of the Northwest Power Act and a necessary starting step in development of Council's resource plan. There is a lag between when the economic drivers were developed and when the power plan is released. During the period between release draft and final plan any data update to the plan are evaluated and if significant variation in economic drivers are observed, load forecasts are revisited. The key economic drivers include projections of regional population, number of new residential units and commercial square footage additions as well as industrial and agricultural outputs.

How Do Changes in Economic Drivers for the 2021 Power Plan Impact Forecast of Loads?

Massoud Jourabchi

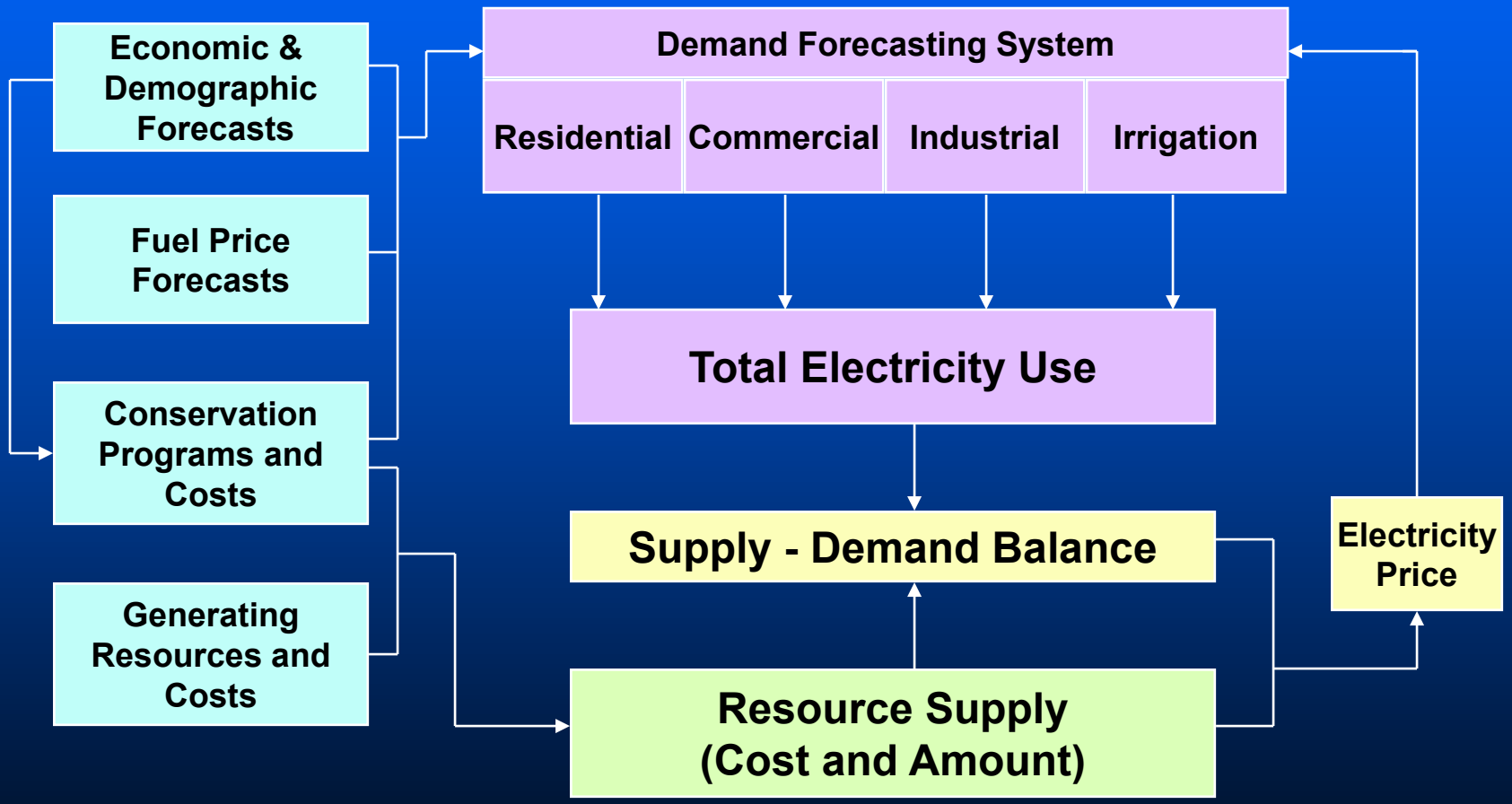
January 2022

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

In this presentation

- Overview of load forecasting process
- ABCs of load forecasting
- Uses of load forecasts at Council
- Why we need to keep track of key drivers
- Comparison of 2018 and 2021 Drivers
- Brief discussion of recent rise in inflation rates

Overview of Council's Power Planning Process



Northwest Power and Conservation Council

Very Basic Building Blocks of Long-term Forecasting Model

For each enduse in each sector consumption is determined in part by:

- **Number of Units (A)**
- **Fuel Choice (B)**
- **Efficiency Choices (C)**

Energy use by an enduse = A * B * C

Simplified Illustrative Example Demand from Water Heating in New Homes

Electric water heaters demand in new homes is calculated as:

- Number of new single family homes: 20,000/yr
- Baseline Electricity Efficiency: 0.90 Energy Factor = 3600 kWh/yr
- Market share of electric: 69%
- Electricity Demand for water heating added per year
- 20,000*.69*3600 ~ 49,680 MWH ~ 5.67 MWa

Similar approach is used for existing homes. Existing homes are tracked over-time and the energy use is reduced each year based on the physical life of the device (i.e., as existing units fail, they are replaced units meeting federal minimum efficiency standards).

Major Factors Influencing Demand

- Long-term factors
  - Economic Activity
  - Energy Prices
  - Technology choices
  - Socio-economic changes
  - Climatic Factors
- Short-term factors
  - Weather
  - Income

Tracking Energy Demand

Investments

Production Capacity

Process Energy Requirements

Device Energy Requirements

Energy Demand

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Applications of Long-Term Demand Forecast in Conservation Assessment Model as well as Regional Portfolio Model

- Frozen-efficiency Forecast and the Conservation supply curves consistent with the forecast is provided to Portfolio model
- In the portfolio model, load forecast is subjected to many different futures and optimum level of conservation acquisition as well as other resource options is determined.
- The optimum conservation level is fed back to the demand forecast model
- A new Sales forecast reflecting impact of conservation targets and costs is produced.

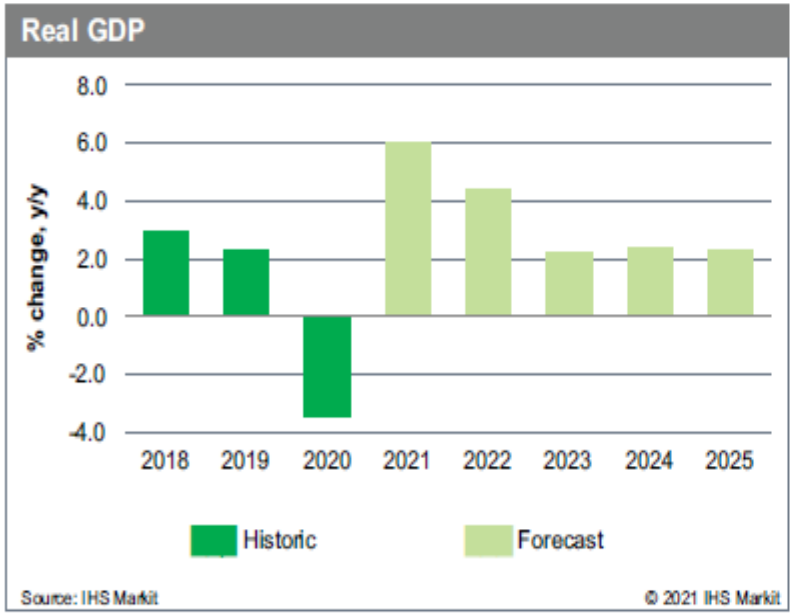
Why a Comparison Is Needed?

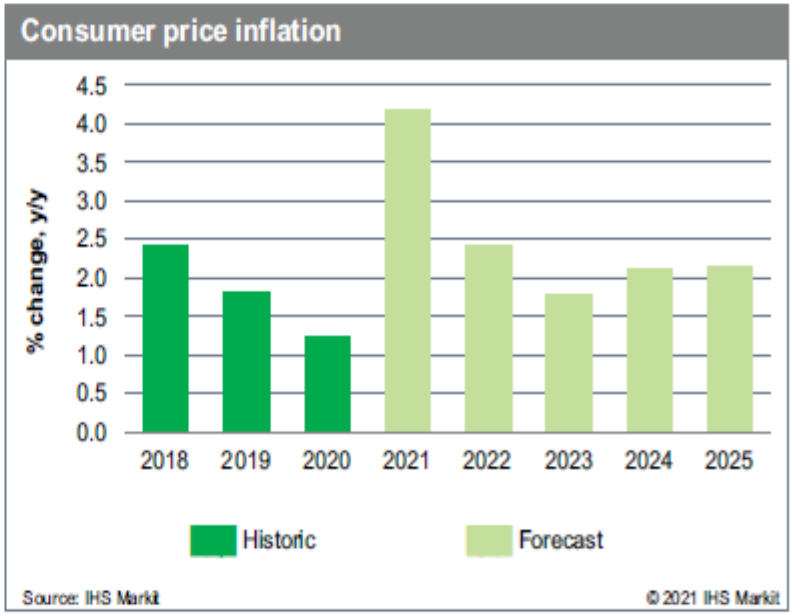
- As Key economic drivers change, we need to compare vintages of forecasts to evaluate if a revision to the load forecast is needed.
- Council's Long-term load forecasting model uses forecast of economic drivers based on Global Insights annual forecast of economic activities in each state.
- Current (draft) forecast of economic drivers were of Oct. 2018 vintage.
- Latest available forecast is of July 2021 vintage.
- In the past three years there has been many changes in the drivers
- We need to answer if the change in economic drivers make a material difference in load forecasts used in the plan.

- We will be comparing 2018 vintage Base case against 2021 vintage.
- These forecasts are prior to incorporation of climate change impacts.

What is not in the 2021 vintage of Economic Drivers?

- Slower near-term growth in economy due to supply bottlenecks and slower personal consumption expenditures.
- Higher CPI in 2021, with return to 2% in medium term.
- Impact of Infrastructure and Jobs Act is not included in this forecast.
- Primary/secondary and financial impacts of climate change are not explicitly included.

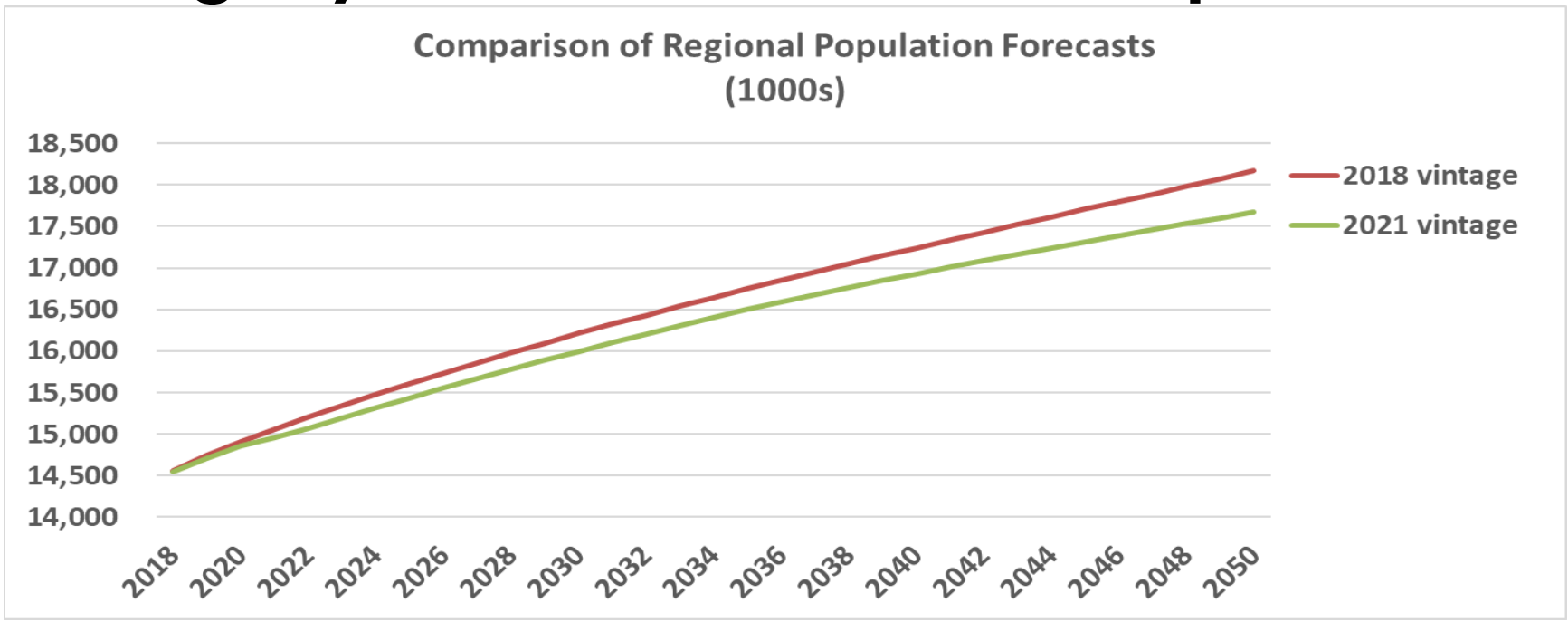




What are Key Demographic and Economic Drivers

- Population is key driver for residential new additions, transportation, Streetlighting, Public fresh and wastewater facilities.
- Employment is key driver for commercial sector floorspace requirements.
- Output is key drivers for manufacturing and Agricultural sectors

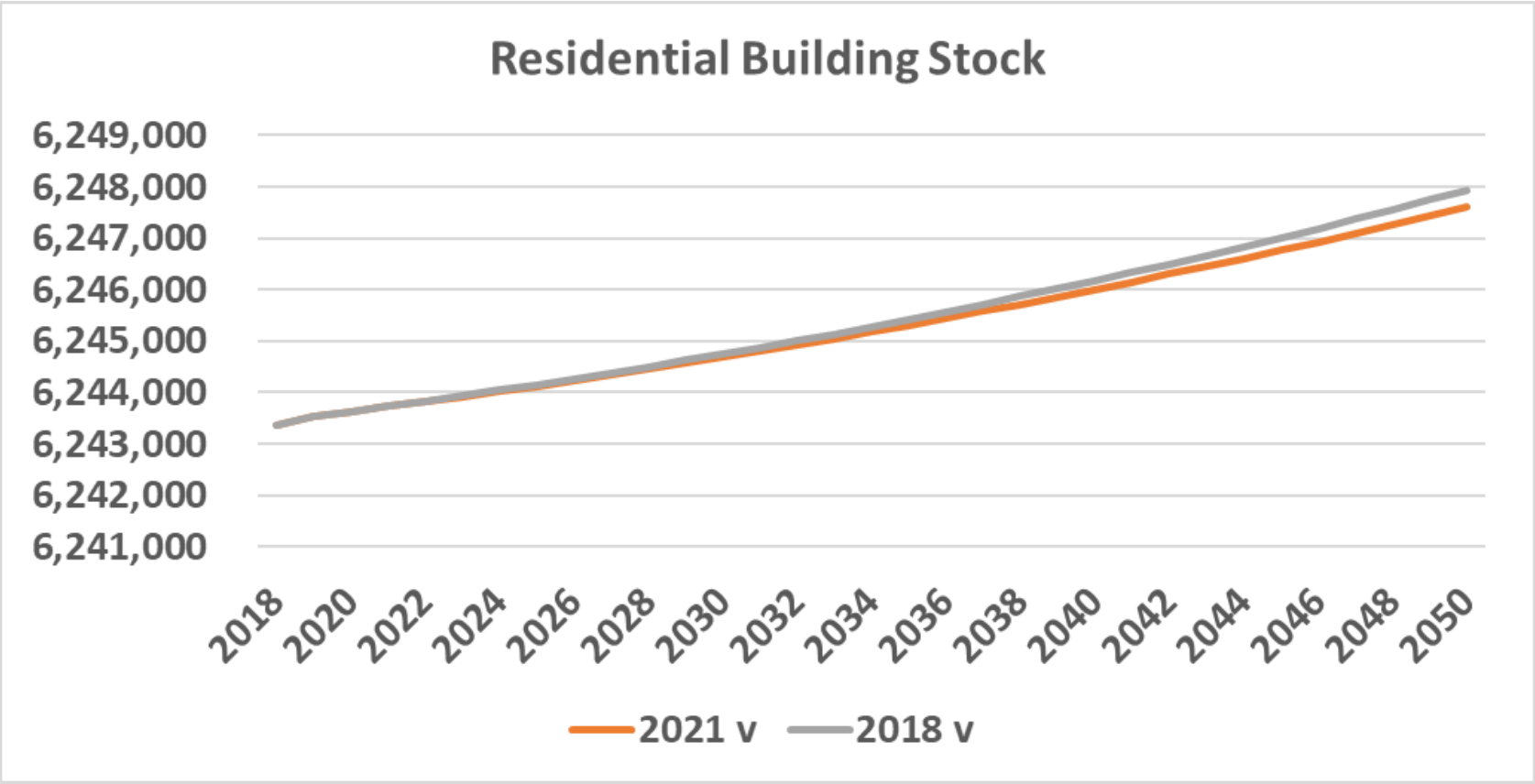
Slightly Lower Forecast for Population



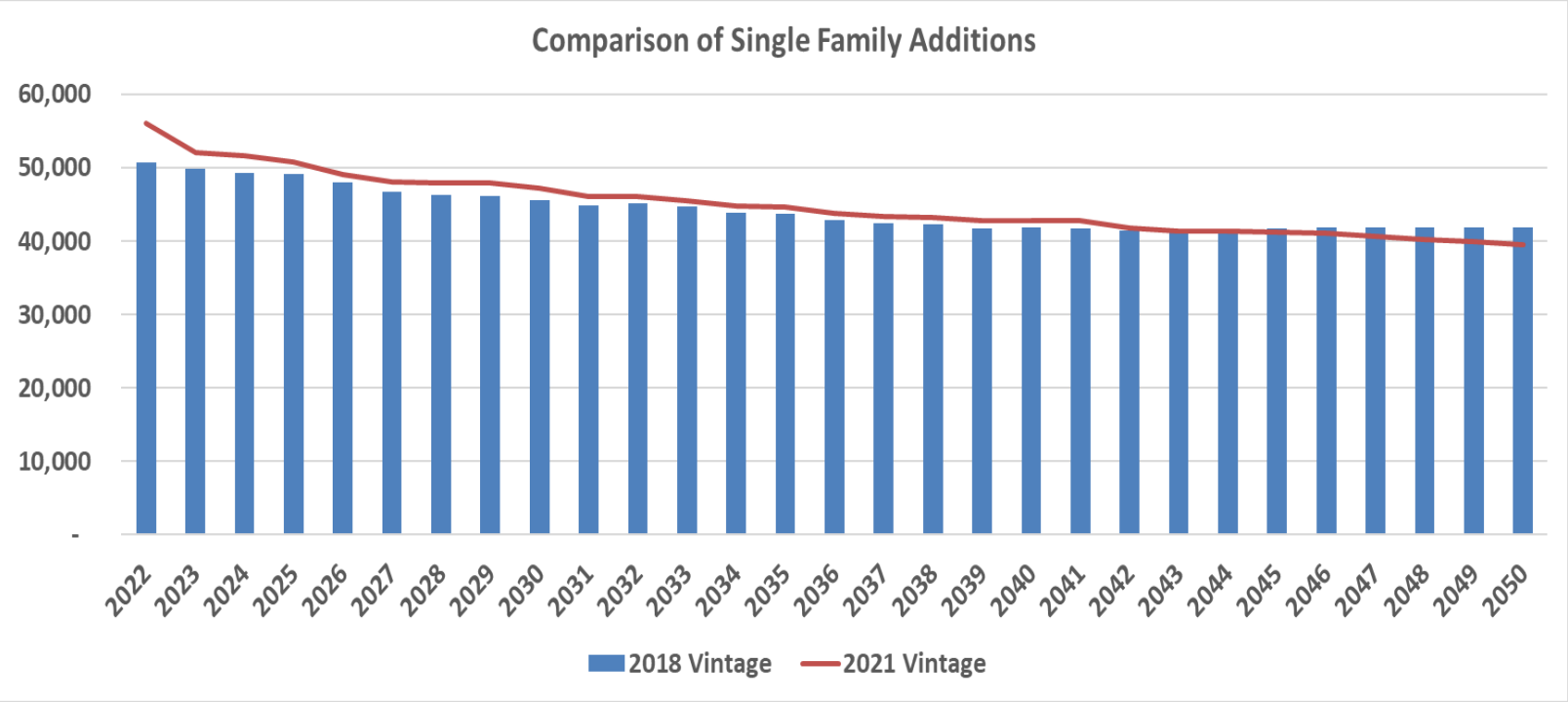
AAGR	2022-2027	2022-2041	2022-2050
2018 vintage	0.84%	0.73%	0.64%
2021 vintage	0.77%	0.67%	0.57%

Population level	by 2027	by 2041	by 2050
2018 vintage	15,856	17,335	18,166
2021 vintage	15,666	17,009	17,675
Delta	(189)	(327)	(491)
Delta %	-1.2%	-1.9%	-2.7%

Residential Building Stock is Slightly Lower

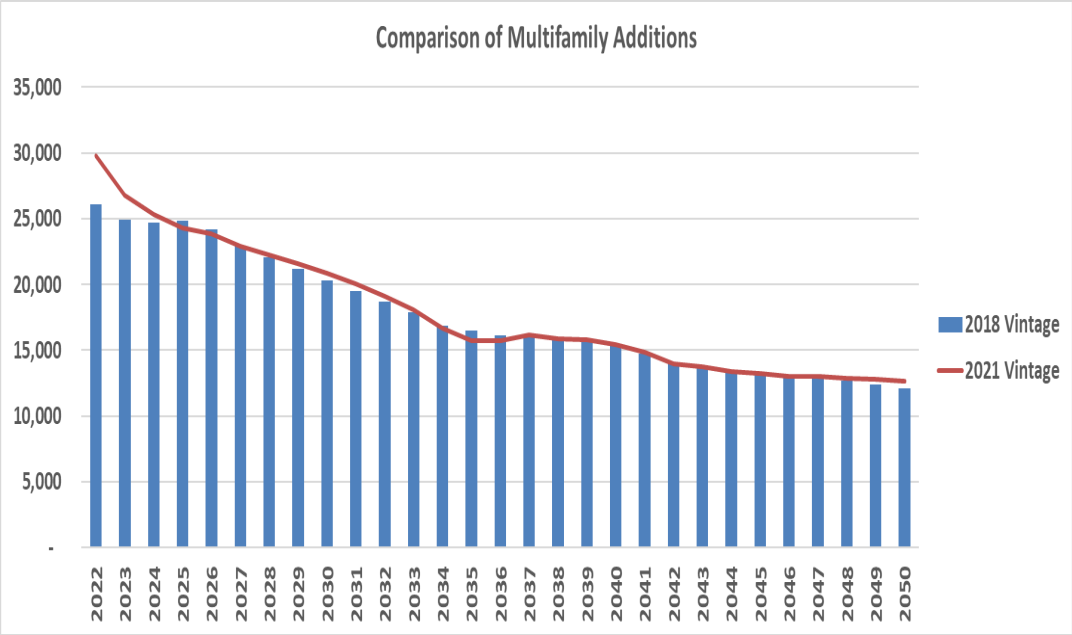


Slightly lower Forecast for Single Family Additions



AAGR	2022-2027	2022-2041	2022-2050
2018 vintage	-1.62%	-1.07%	-0.68%
2021 vintage	-3.03%	-1.49%	-1.24%
Cumulative Additions	by 2027	by 2041	by 2050
2018 vintage	293,684	906,691	1,281,336
2021 vintage	307,405	935,803	1,302,756
Delta	13,721	29,112	21,420
Delta %	4.7%	3.2%	1.7%

Change in Trend Forecasts of Multi-Family Starts

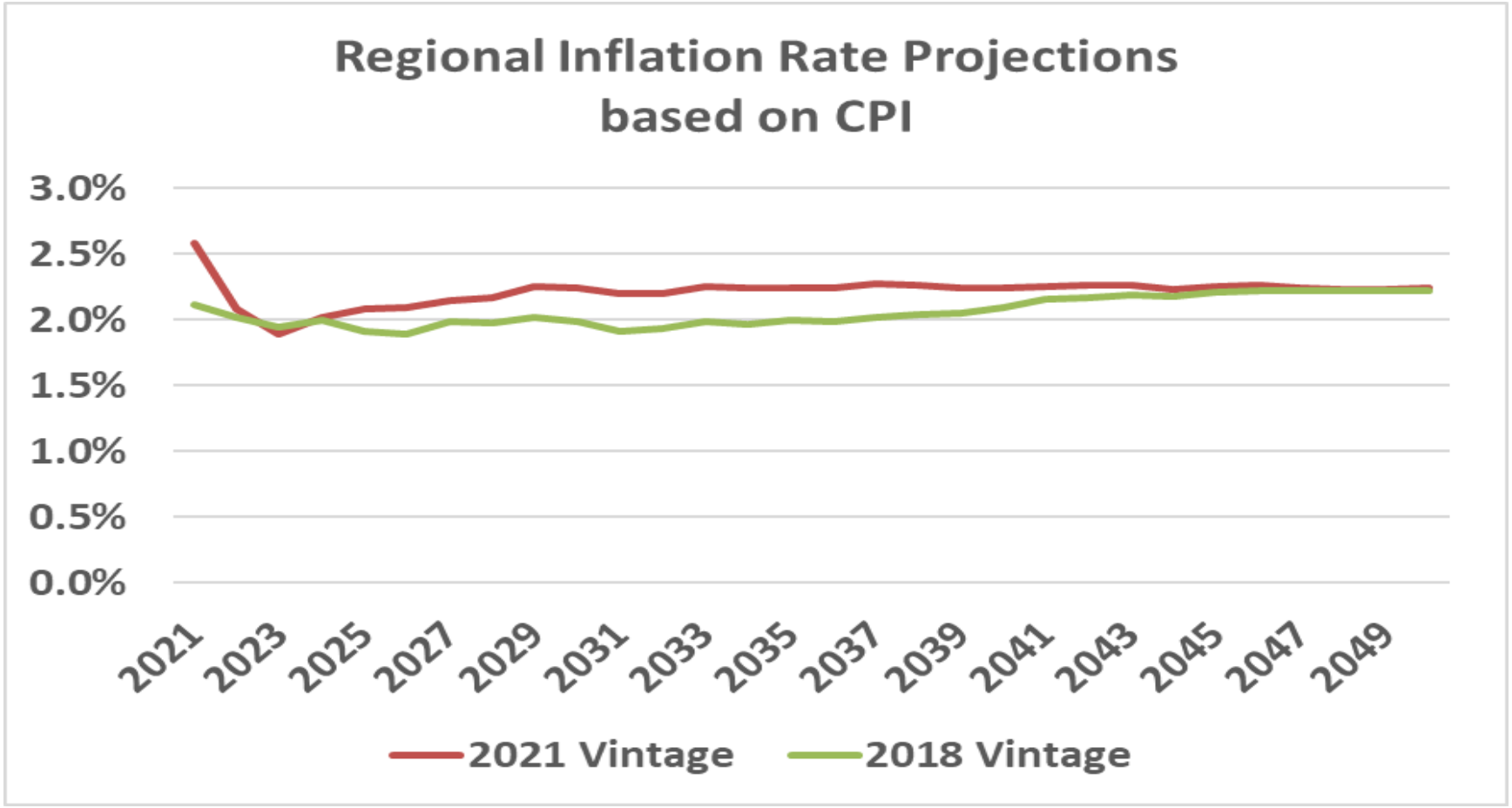


- Except for 2022-2025 Multifamily housing additions are expected to be slightly higher than 2018 vintage of forecast.
- Long-term forecasts shows slightly higher number of additions.

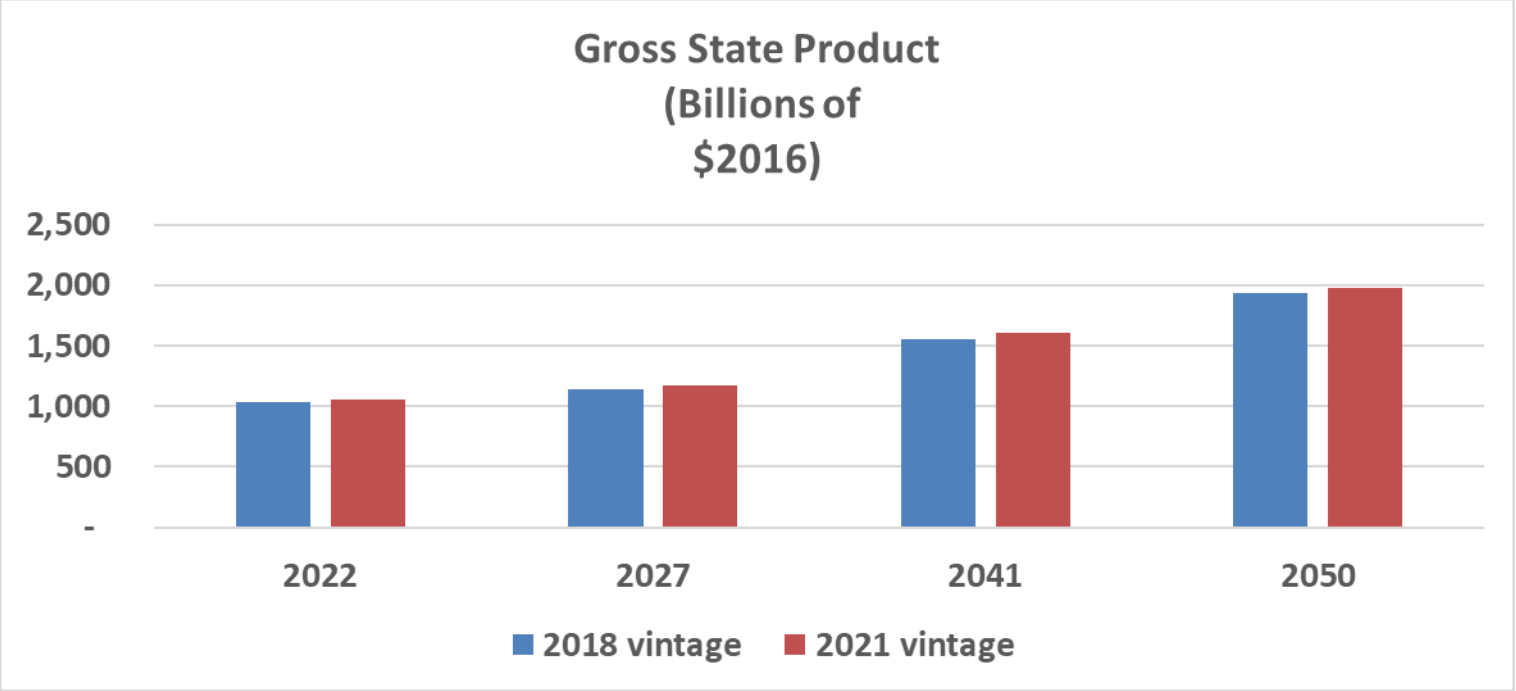
AAGR	2022-2027	2022-2041	2022-2050
2018 vintage	-2.52%	-3.12%	-2.71%
2021 vintage	-5.12%	-3.80%	-3.00%

Cumulative Additions	by 2027	by 2041	by 2050
2018 vintage	147,623	394,268	511,704
2021 vintage	152,863	400,709	519,319
Delta	5,240	6,441	7,615
Delta %	3.5%	1.6%	1.5%

Inflation Rates are expected to be slightly higher in the medium-term

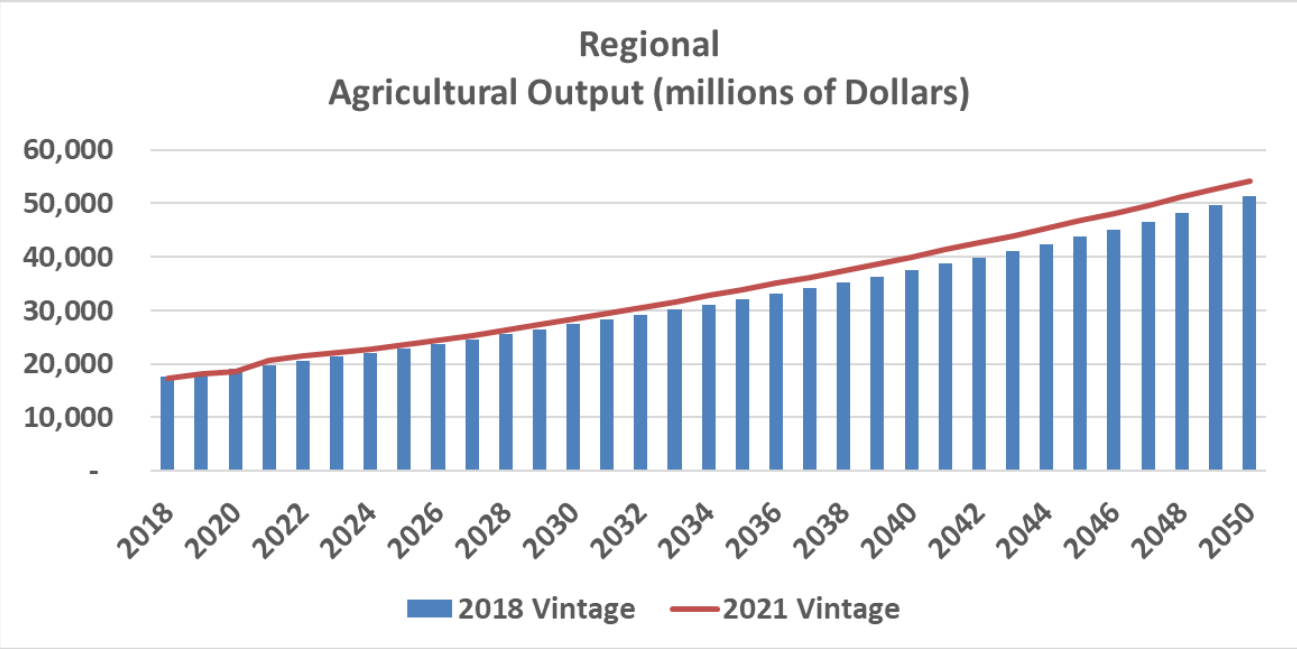


Slight Increase in Total Gross State Product



	2022	2027	2041	2050
% difference	2.0%	2.5%	3.6%	1.9%

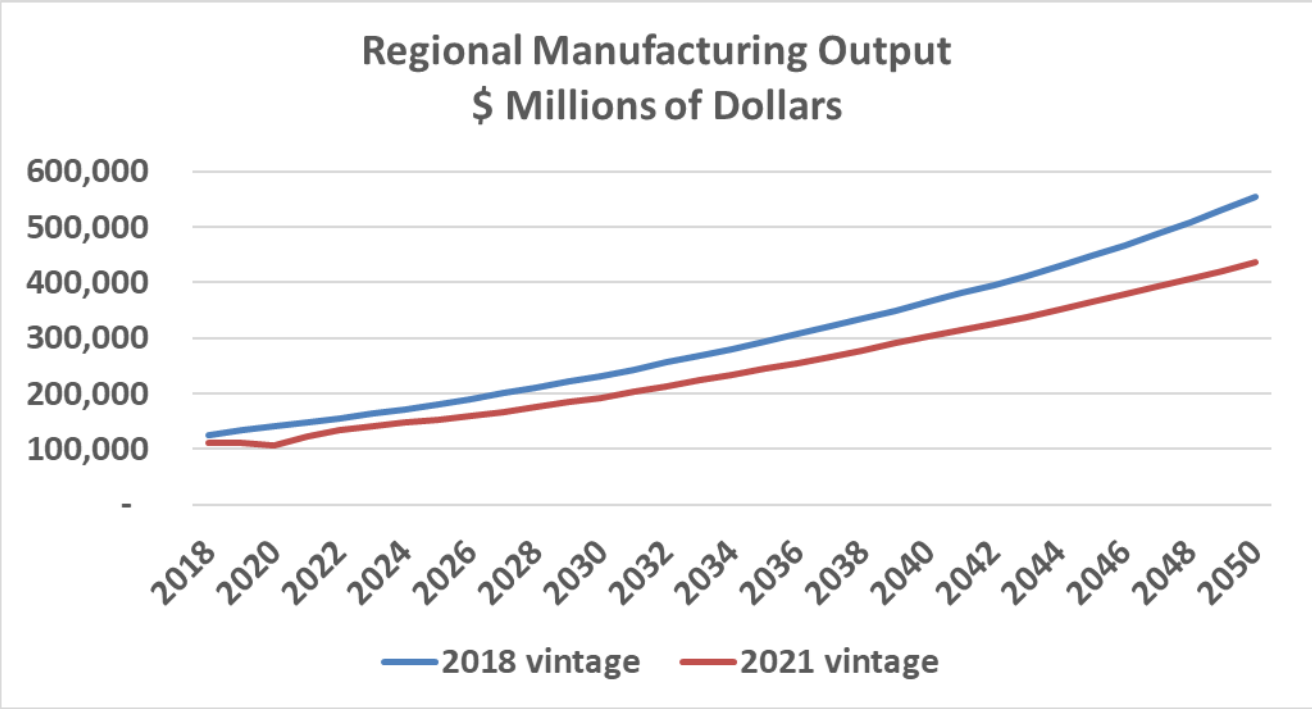
Increase in Forecast of Agricultural Output



AAGR	2022-2027	2022-2041	2022-2050
2018 vintage	3.63%	3.57%	3.33%
2021 vintage	3.35%	3.69%	3.36%

Cumulative Agricultural Output level ($Millions)	by 2027	by 2041	by 2050
2018 vintage	135,175	580,466	988,629
2021 vintage	139,851	608,523	1,043,059
Delta	4,677	28,057	54,430
Delta %	3.5%	4.8%	5.5%

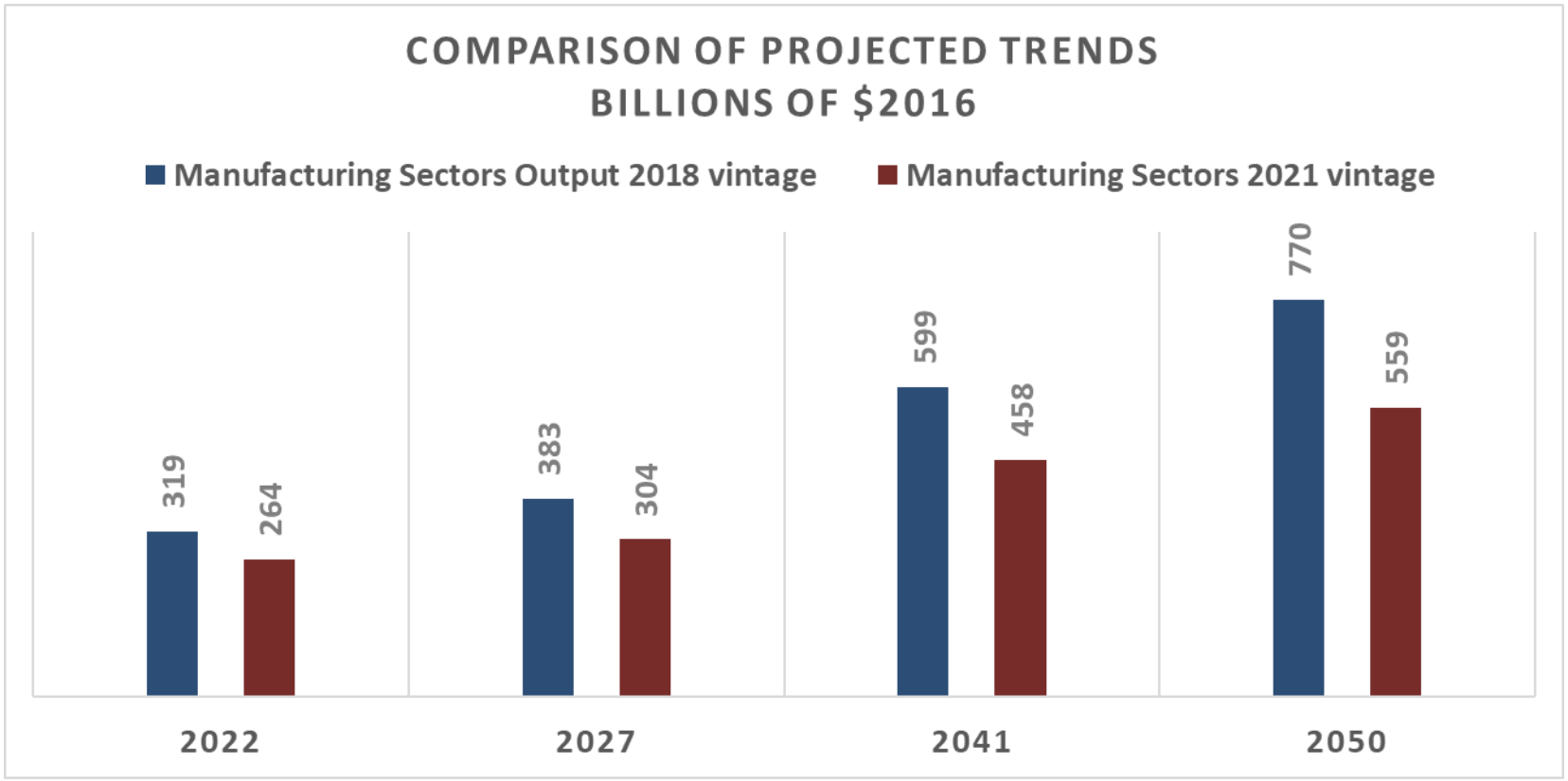
Decline in Forecast of Manufacturing Output



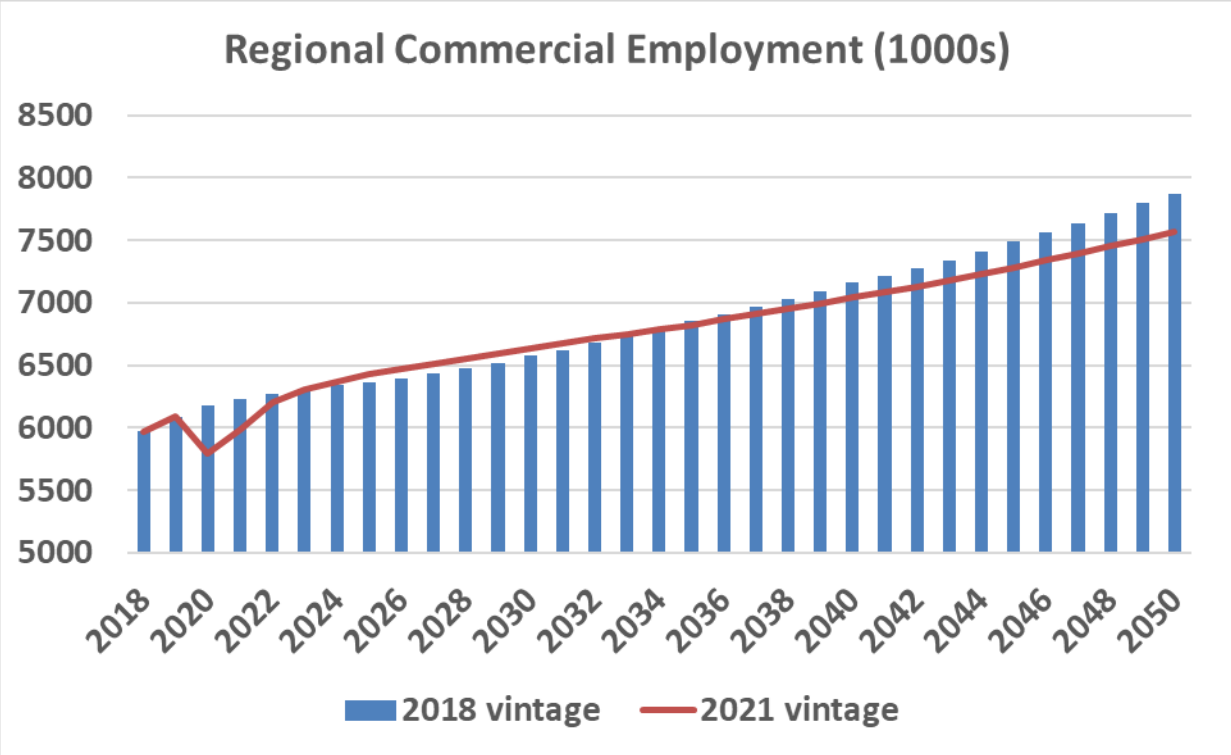
AAGR	2022-2027	2022-2041	2022-2050
2018 vintage	5.27%	5.10%	4.65%
2021 vintage	4.64%	4.89%	4.32%

Cumulative Manufacturing Output ($ millions)	by 2027	by 2041	by 2050
2018 vintage	1,062,507	5,121,256	9,349,613
2021 vintage	901,161	4,278,730	7,692,149
Delta	(161,345)	(842,526)	(1,657,464)
Delta %	-15.2%	-16.5%	-17.7%

Manufacturing sector Output is expected to decline further



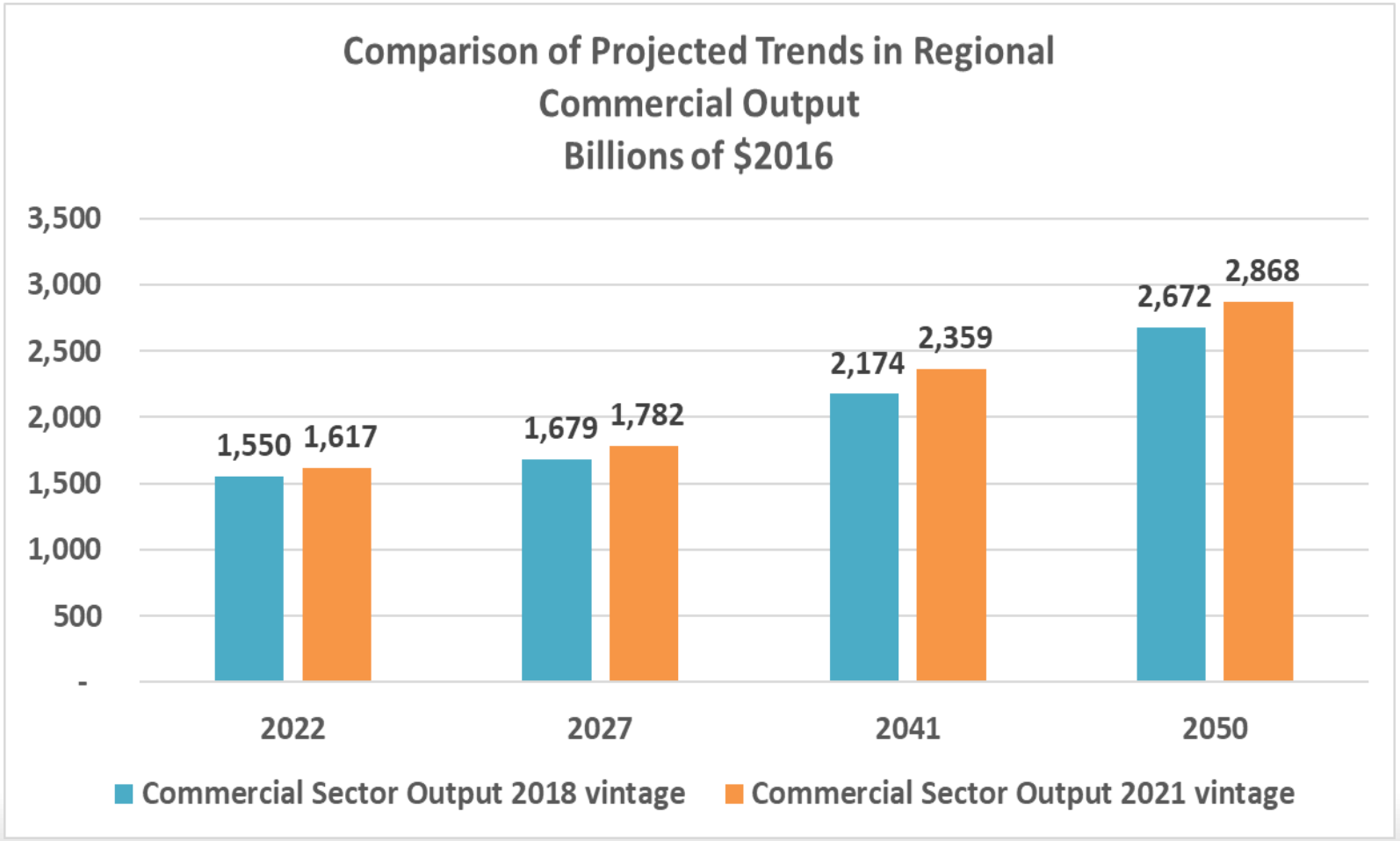
Decrease in Forecast of Commercial Employment



AAGR	2022-2027	2022-2041	2022-2050
2018 vintage	0.51%	0.78%	0.82%
2021 vintage	0.97%	0.74%	0.71%

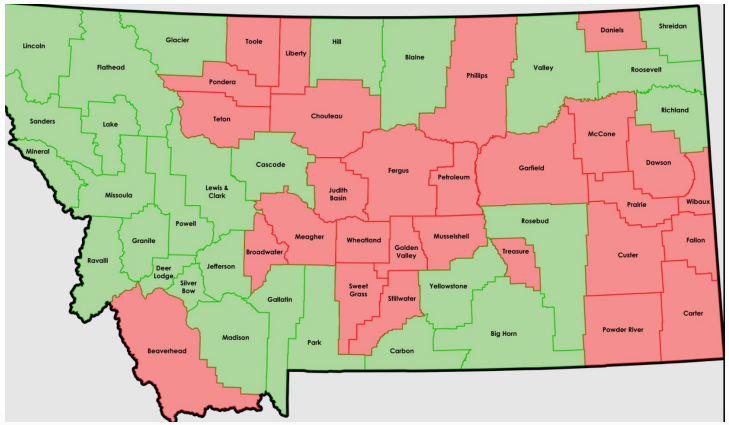
Cumulative Commercial Employment level (1000s)	by 2027	by 2041	by 2050
2018 vintage	38,116	133,727	201,834
2021 vintage	38,294	133,678	199,751
Delta	178	(49)	(2,083)
Delta %	0.5%	0.0%	-1.0%

Commercial Sector output is projected to increase even though Commercial Sector Employment is Expected to Decline



Other Changes Since 2018

- Decline in DSI loads ~400 aMW flat load
- Montana Recreational Cannabis ~ 10-15 aMW long-term



What Do Changes in Economic Drivers Imply?

- Forecast of Population , Gross State Product and Commercial Employment suggest small change between Oct 2018 and Oct 2020 vintage forecasts.

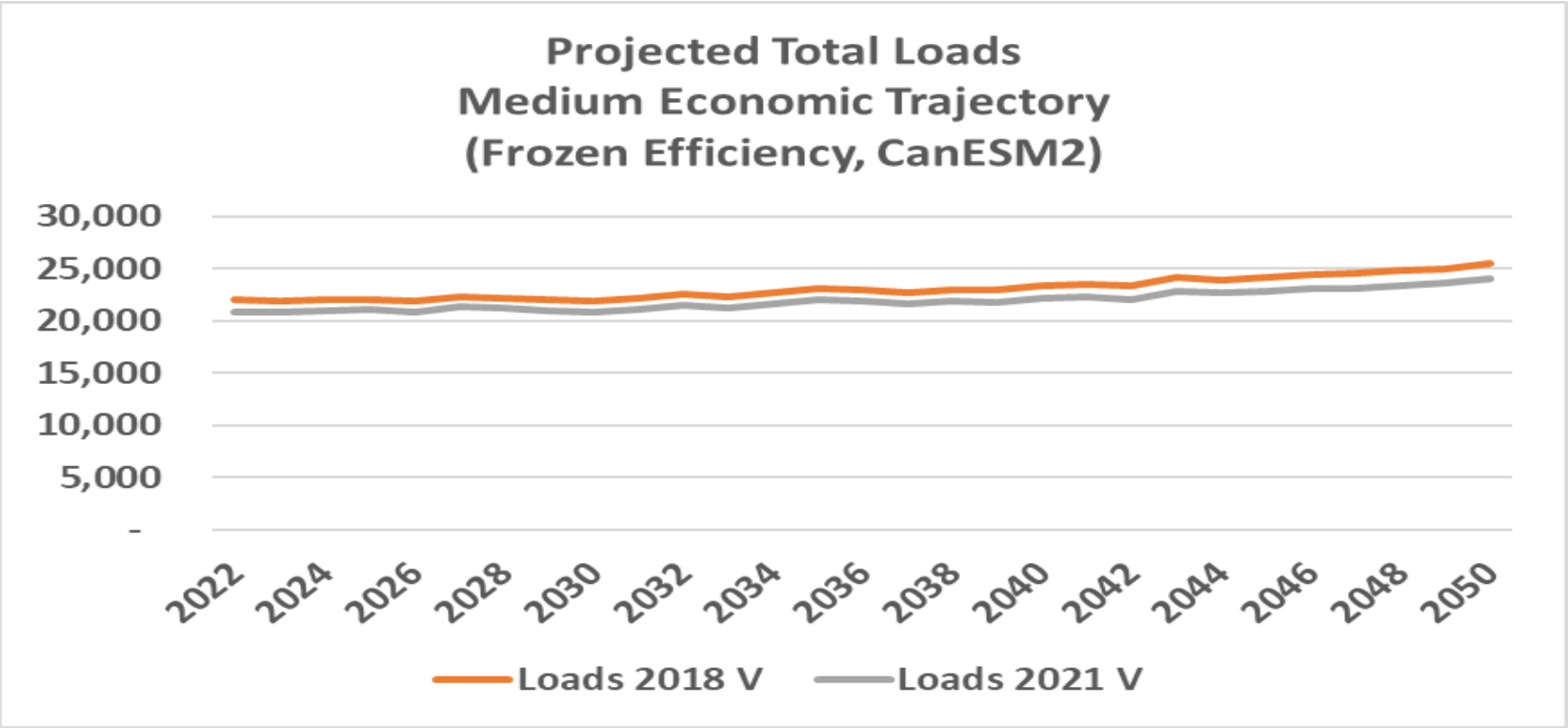
- Population which is key driver for Residential, Transportation, Streetlighting as well as public fresh and waste-water pumping is lower by 1-2% by 2050

- Gross state product which is key driver for manufacturing shows 17% decline by 2050.

- Commercial Sector employment which is key driver for Commercial floorspace requirement shows less than 1% decline by 2050.

- Residential single and multi-family new housing starts show 1.5% and 1.7% increase, respectively, by 2050.

Base case loads are expected to be lower by 5%



Delta in Average Loads (aMW)	2022	2041	2050
Residential	(0.0)	(0.3)	(0.5)
Commercial	(104)	66	(75)
Industrial	(965)	(1,130)	(1,169)
Transportation	(1)	(15)	(43)
Irrigation	(125)	(103)	(158)
SL&PF	(3)	(6)	(8)
Total	(1,197)	(1,188)	(1,454)

How Does Council's Planning Reflect Range of Economic Forecast

- Council's resource planning incorporates range of uncertainty in economic drivers by including a set of optimistic and pessimistic views of the future.
- Typically, optimistic and pessimistic views of the future are within ± 10%-15% of base forecast.
- Percent change in Base forecast (± 10% to 15%) is larger than percent change in 2021 vintage of key drivers.

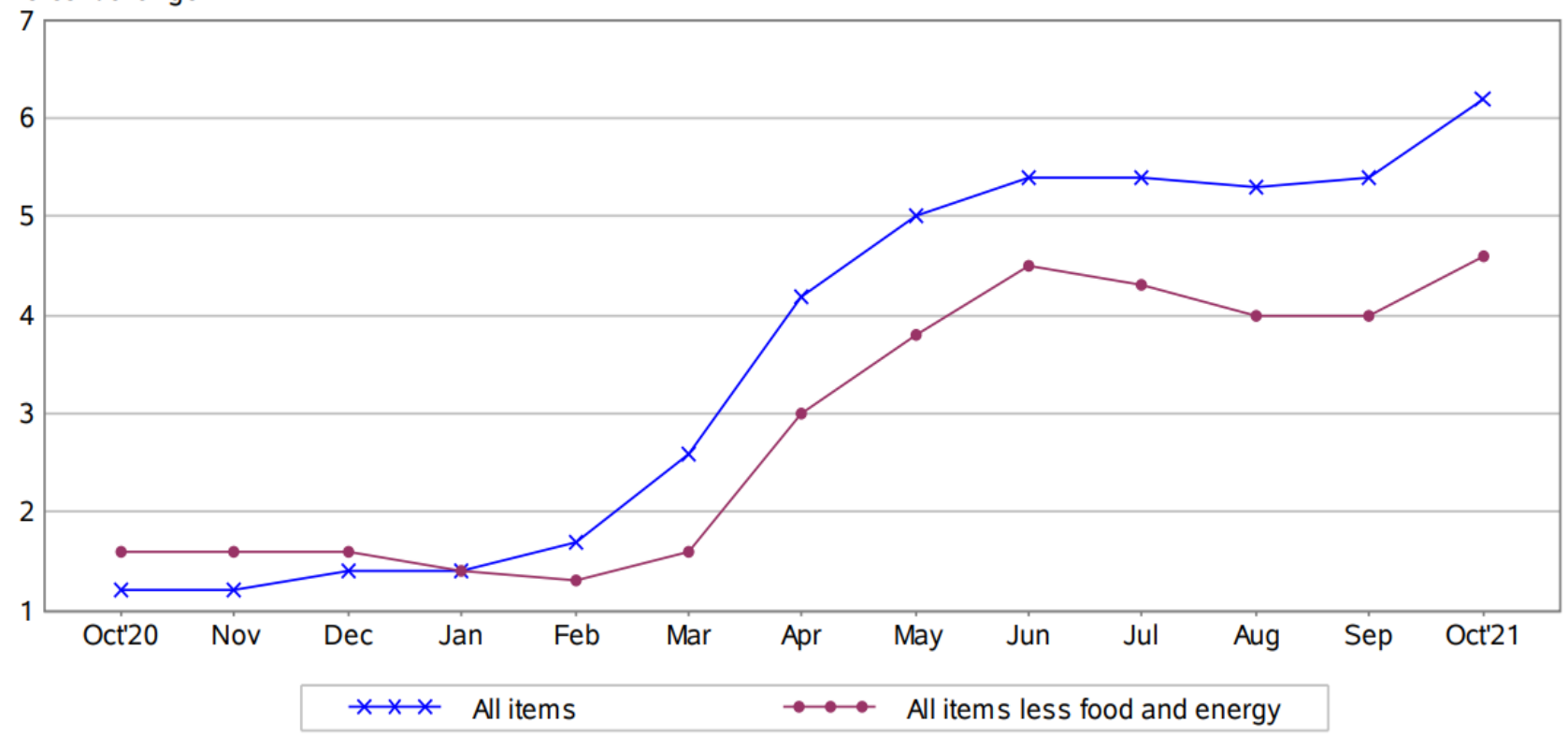
A Brief overview of Reasons behind Recent Rise in CPI

Supply and Demand Imbalance

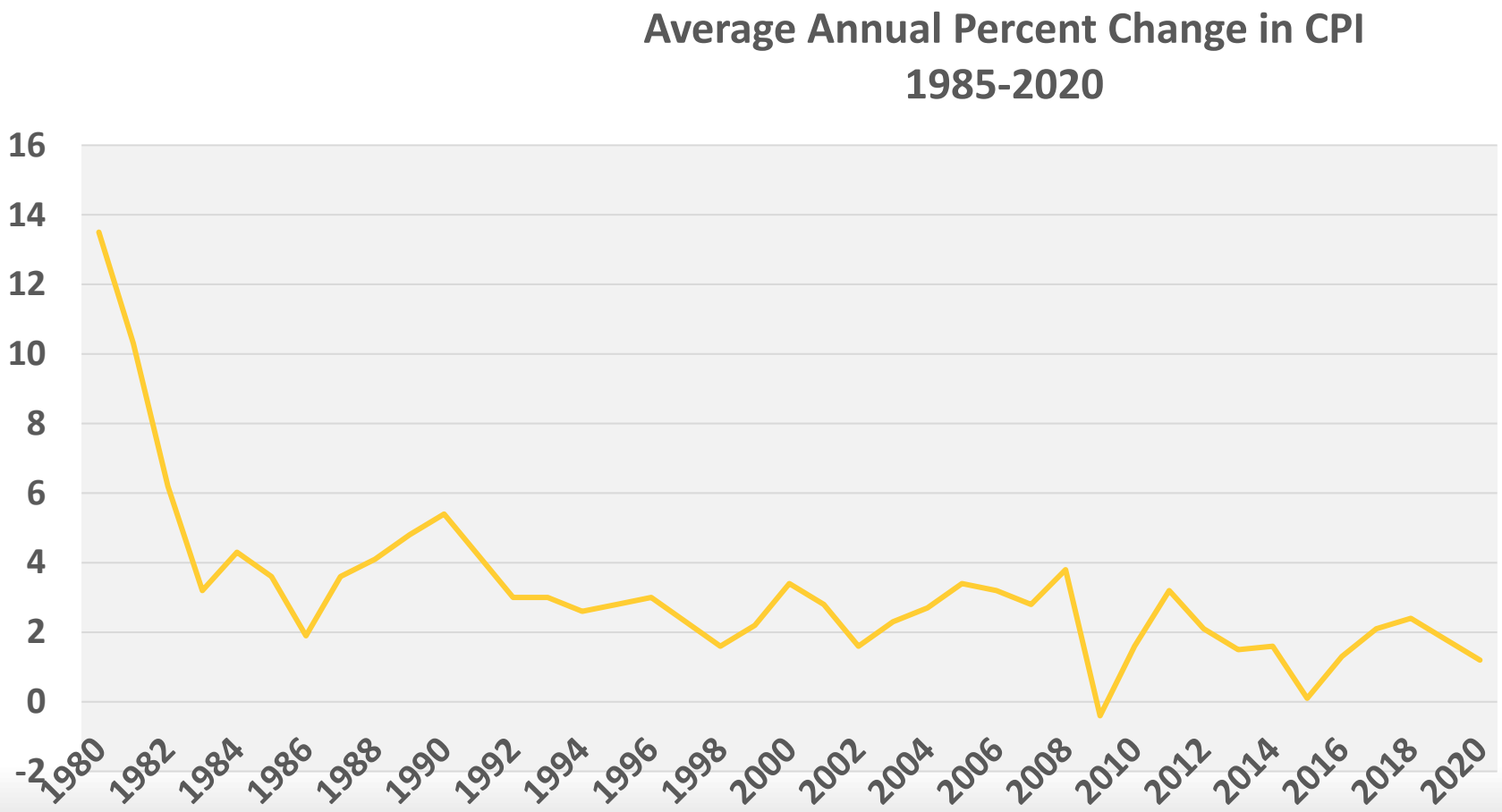
- Increase in pent-up Demand for goods
  - Unprecedented push to E-Commerce (closure of stores)
- Decrease in Supply
- Supply Chain (connection between demand and supply)
  - Global pandemic reduced exporting capacity of Asian Countries
  - Trends in larger & larger container ships
  - Multi-modal transportation networks suffer from shortage of capacity and labor for unloading, transportation and warehousing.
  - Demand for products has significantly outstripped the market's capacity to produce or ship what is ordered

Recent Monthly CPI-U

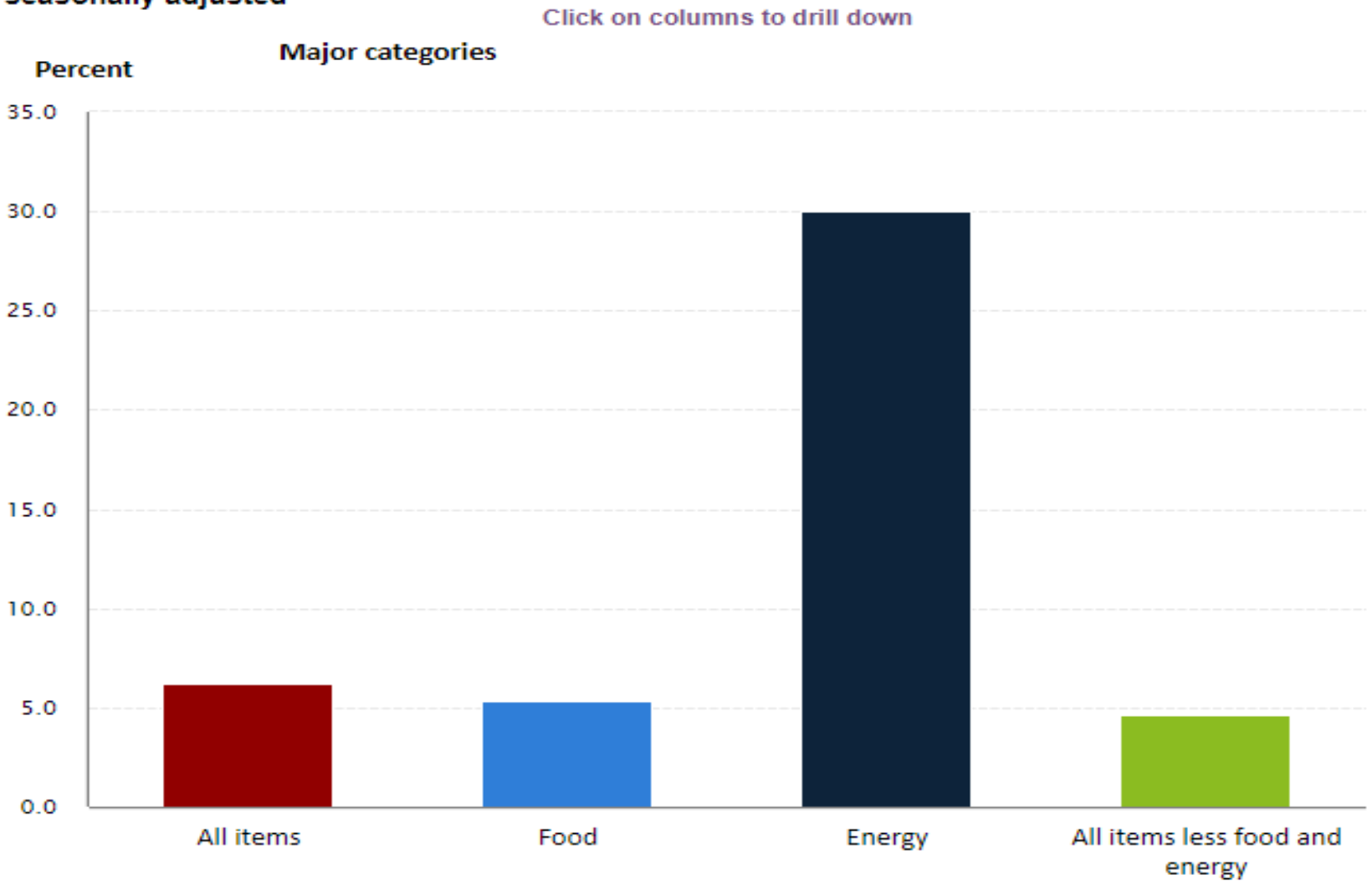
Chart 2. 12-month percent change in CPI for All Urban Consumers (CPI-U), not seasonally adjusted, Oct. 2020 - Oct. 2021



CPI in the past 40 years

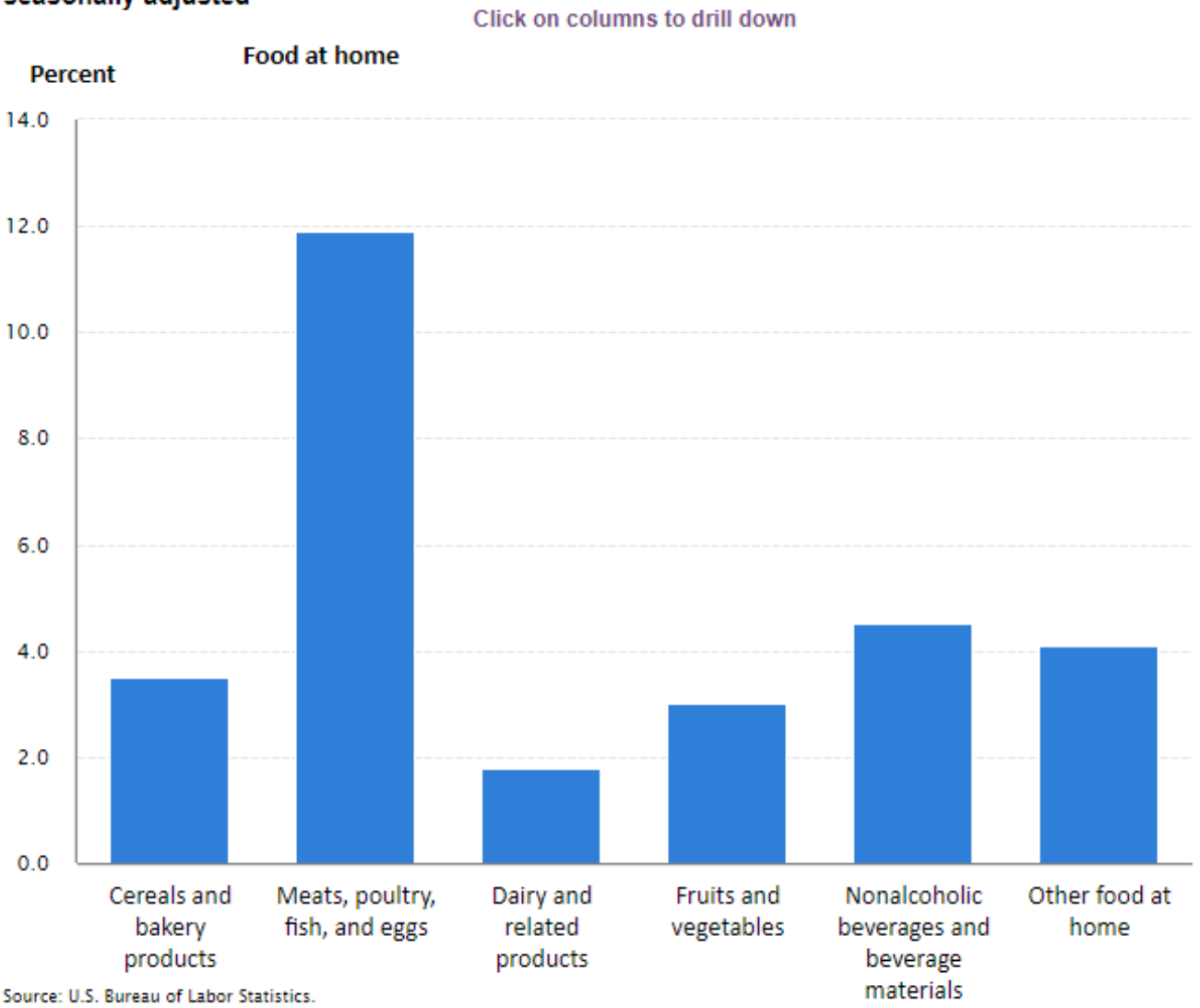


12-month percentage change, Consumer Price Index, selected categories, October 2021, not seasonally adjusted

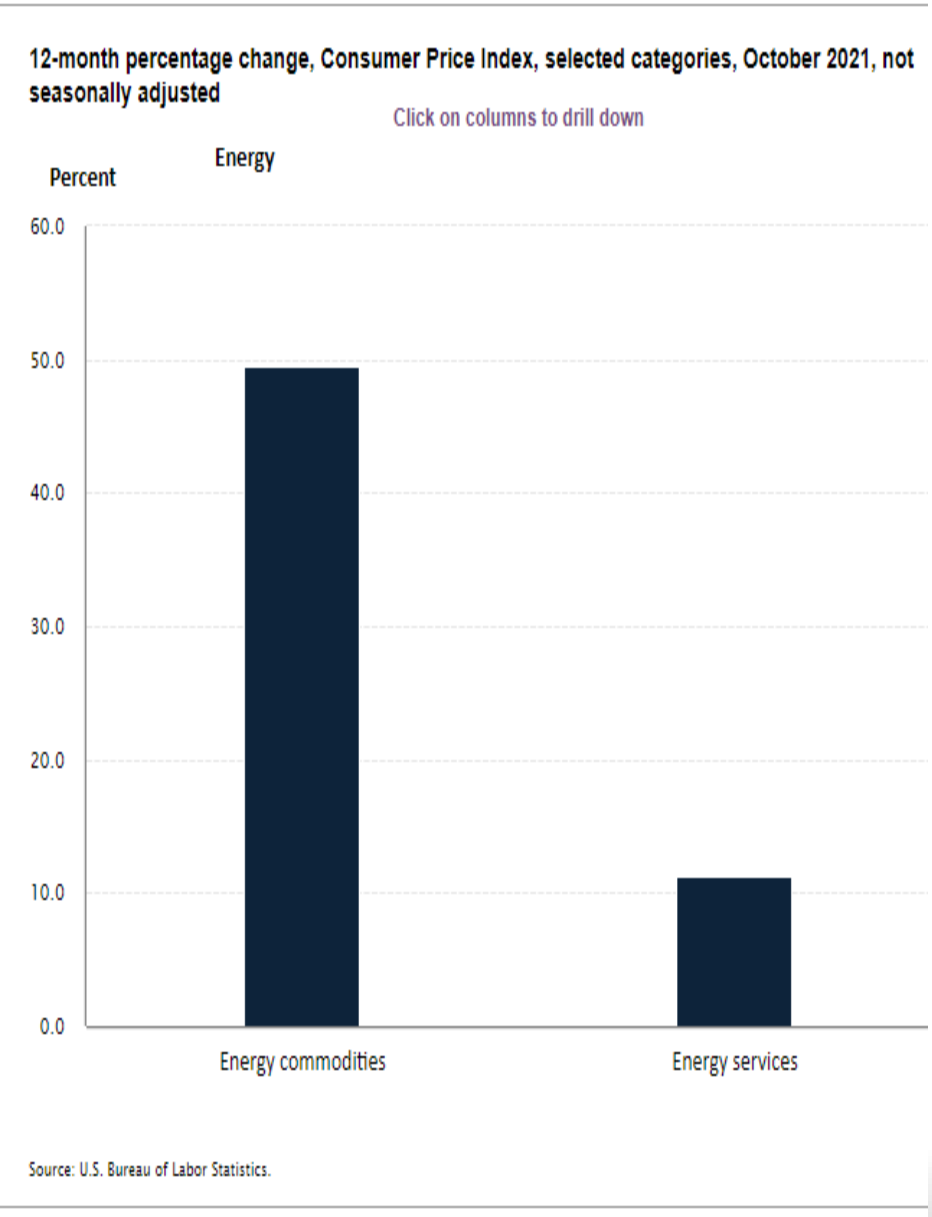


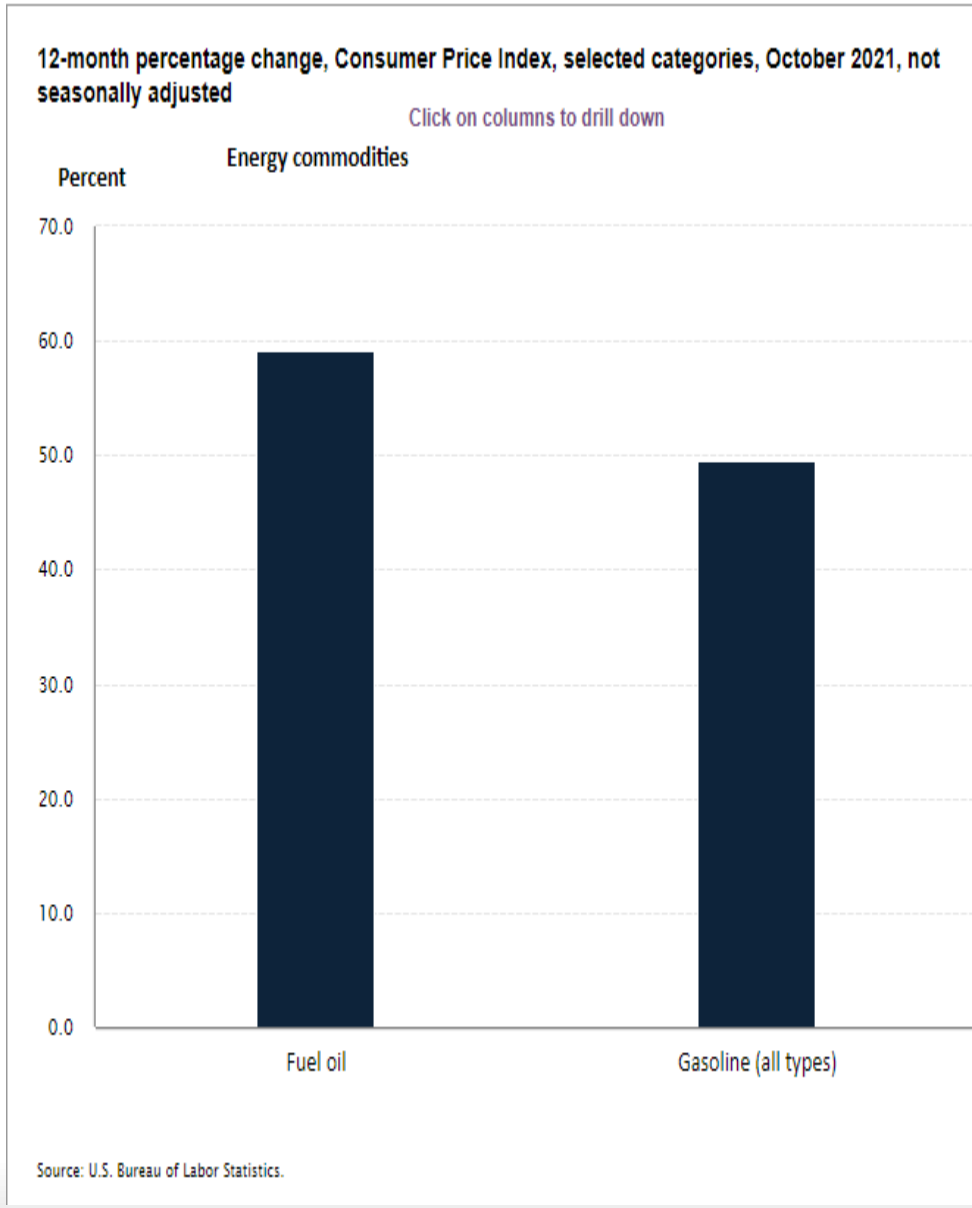
Source: U.S. Bureau of Labor Statistics. https://www.bls.gov/charts/consumer-price-index/consumer-price-index-by-category.htm

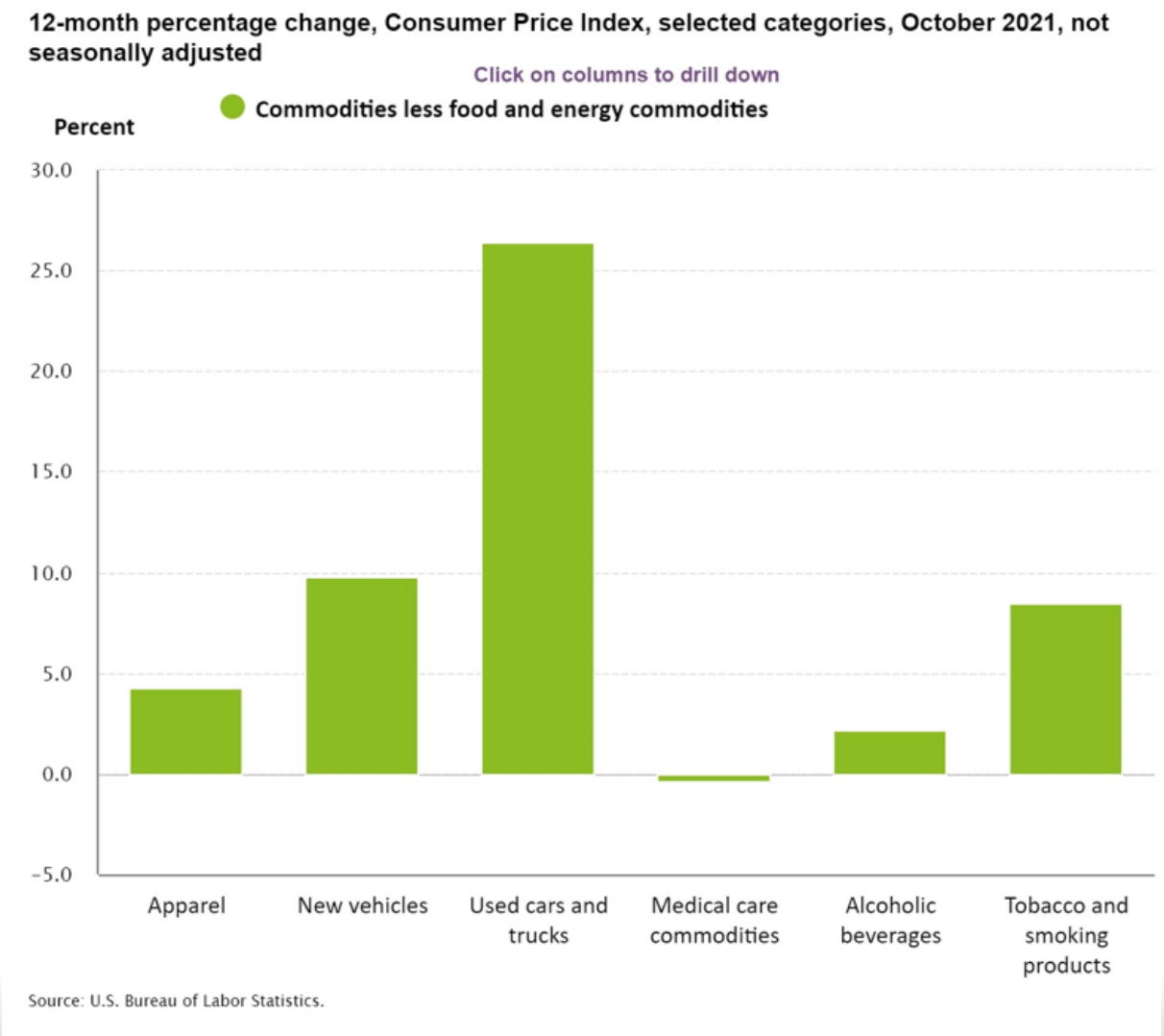
12-month percentage change, Consumer Price Index, selected categories, October 2021, not seasonally adjusted



Source: U.S. Bureau of Labor Statistics.


12-month percentage change, Consumer Price Index, selected categories, October 2021, not seasonally adjusted
Click on columns to drill down
Energy
Percent
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Energy commodities
Energy services
Source: U.S. Bureau of Labor Statistics.


12-month percentage change, Consumer Price Index, selected categories, October 2021, not seasonally adjusted
Click on columns to drill down
Energy commodities
Percent
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Fuel oil
Gasoline (all types)
Source: U.S. Bureau of Labor Statistics.


12-month percentage change, Consumer Price Index, selected categories, October 2021, not seasonally adjusted
Click on columns to drill down
Commodities less food and energy commodities
Percent
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
Apparel
New vehicles
Used cars and trucks
Medical care commodities
Alcoholic beverages
Tobacco and smoking products
Source: U.S. Bureau of Labor Statistics.

Summary and Recommendation

- Review of latest demographic and economic forecasts indicates region is on a slightly slower growth trajectory.
- Long-term loads are expected to be lower by about 5% compared to the Draft Plan.

- Staff recommendation is to use draft plan load forecasts.