



Economic, Load, and Customer Forecasts

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Technical Advisory Committee Meeting

August 18, 2020

Main Topic Areas

- **Service Area Economy**
- **Long-run Energy Forecast**
- **Peak Load Forecast**
- **Long-run Gas Customer Forecast**

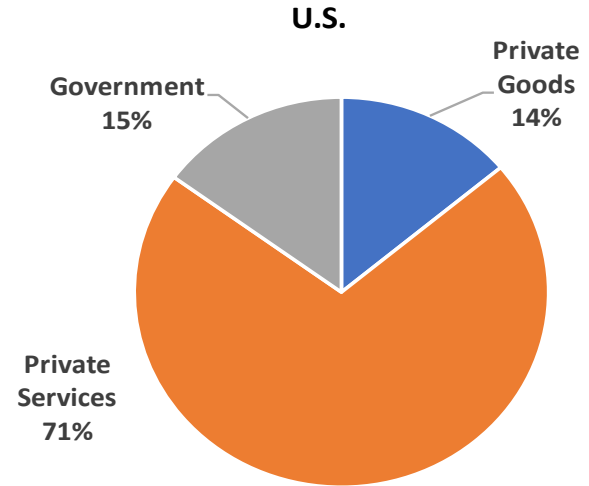
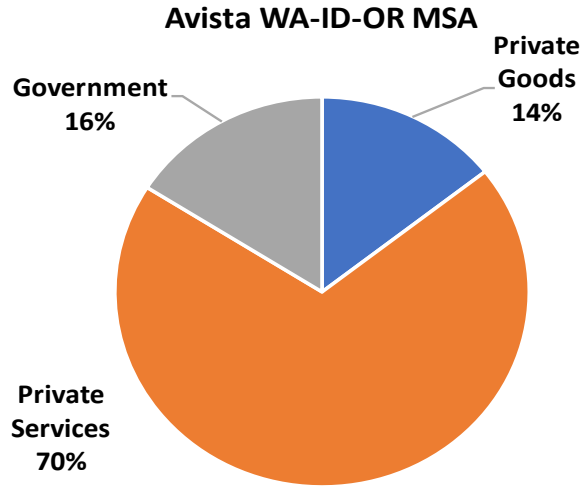




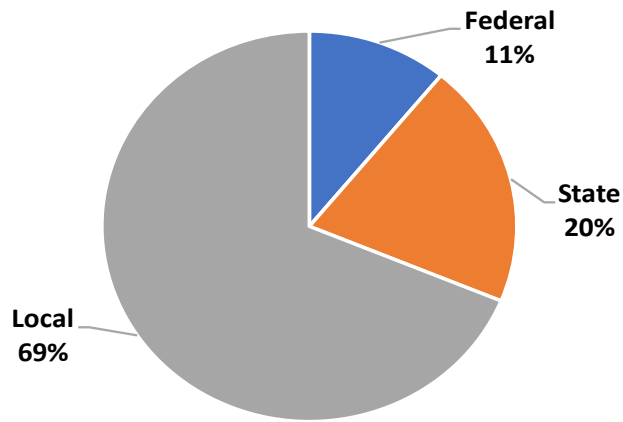
Service Area Economy

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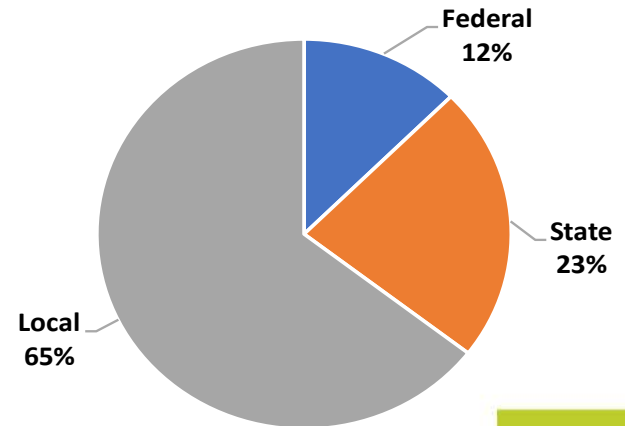
Distribution of Employment, 2019



Avista WA-ID-OR MSA Government



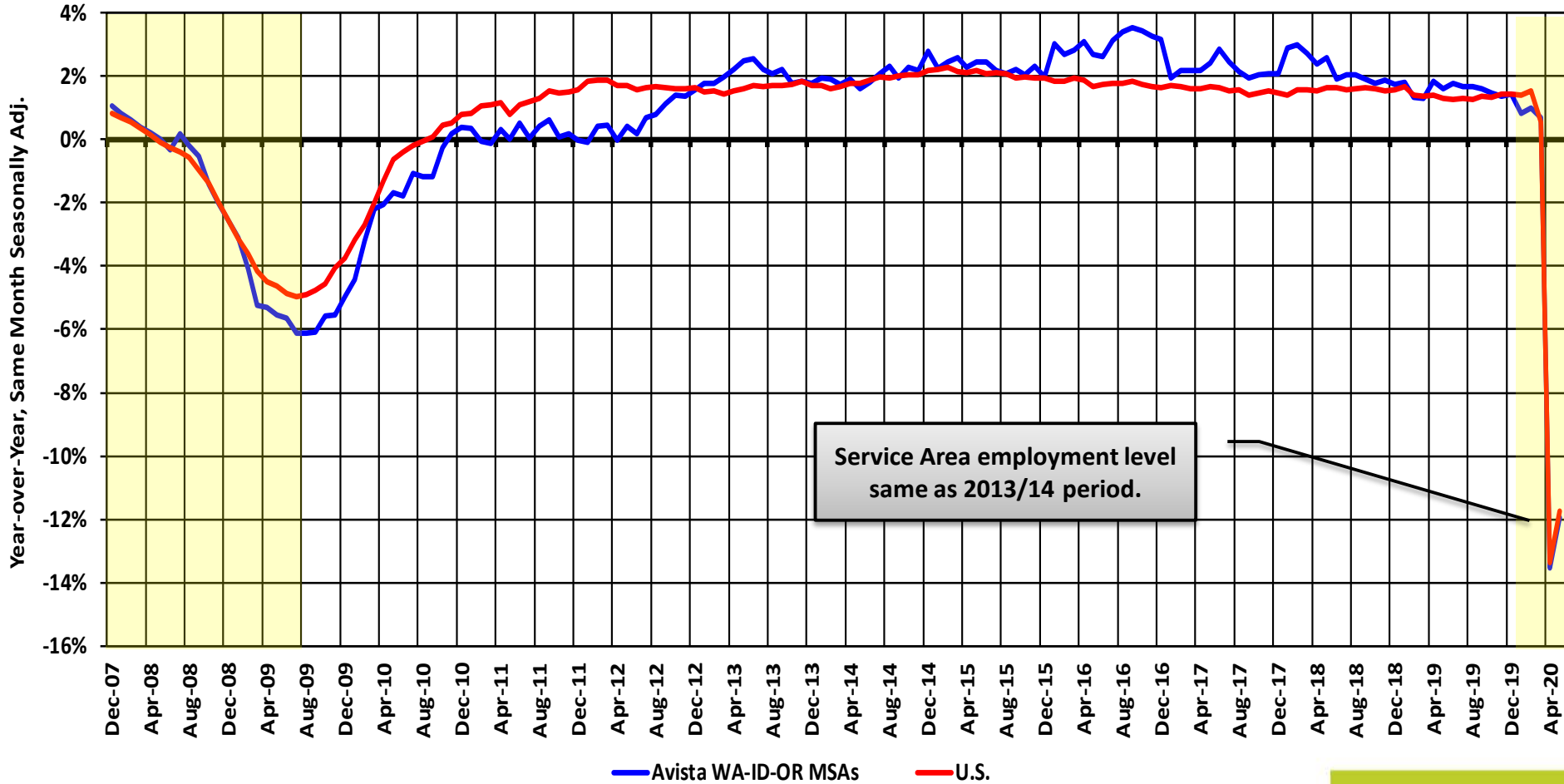
U.S. Government



Source: BLS and author's calculations.

Non-Farm Employment Growth, 2009-2020

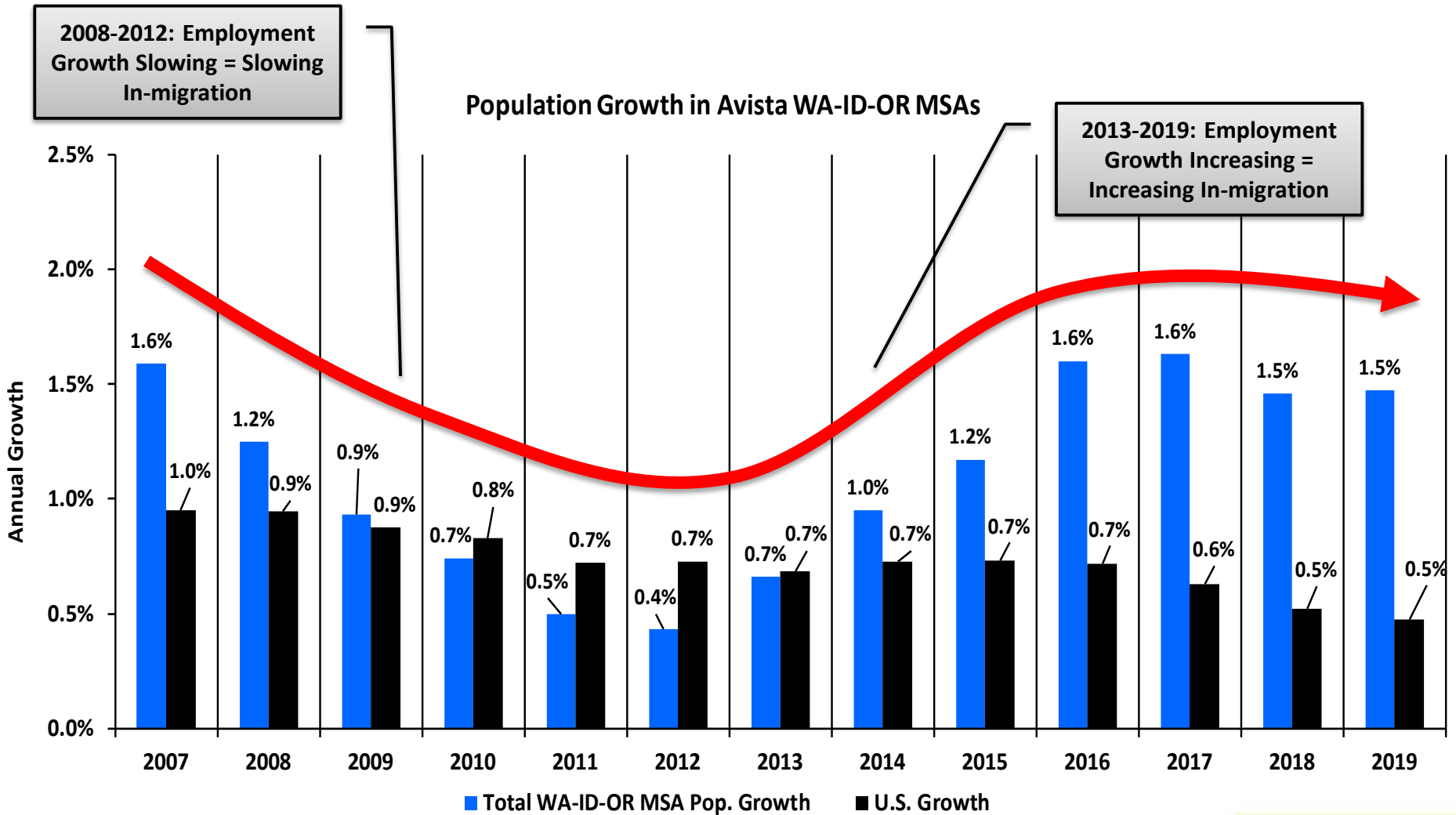
Non-Farm Employment Growth (Dashed Shaded Box = Recession Period)



Source: BLS, WA ESD, OR ED and author's calculations.



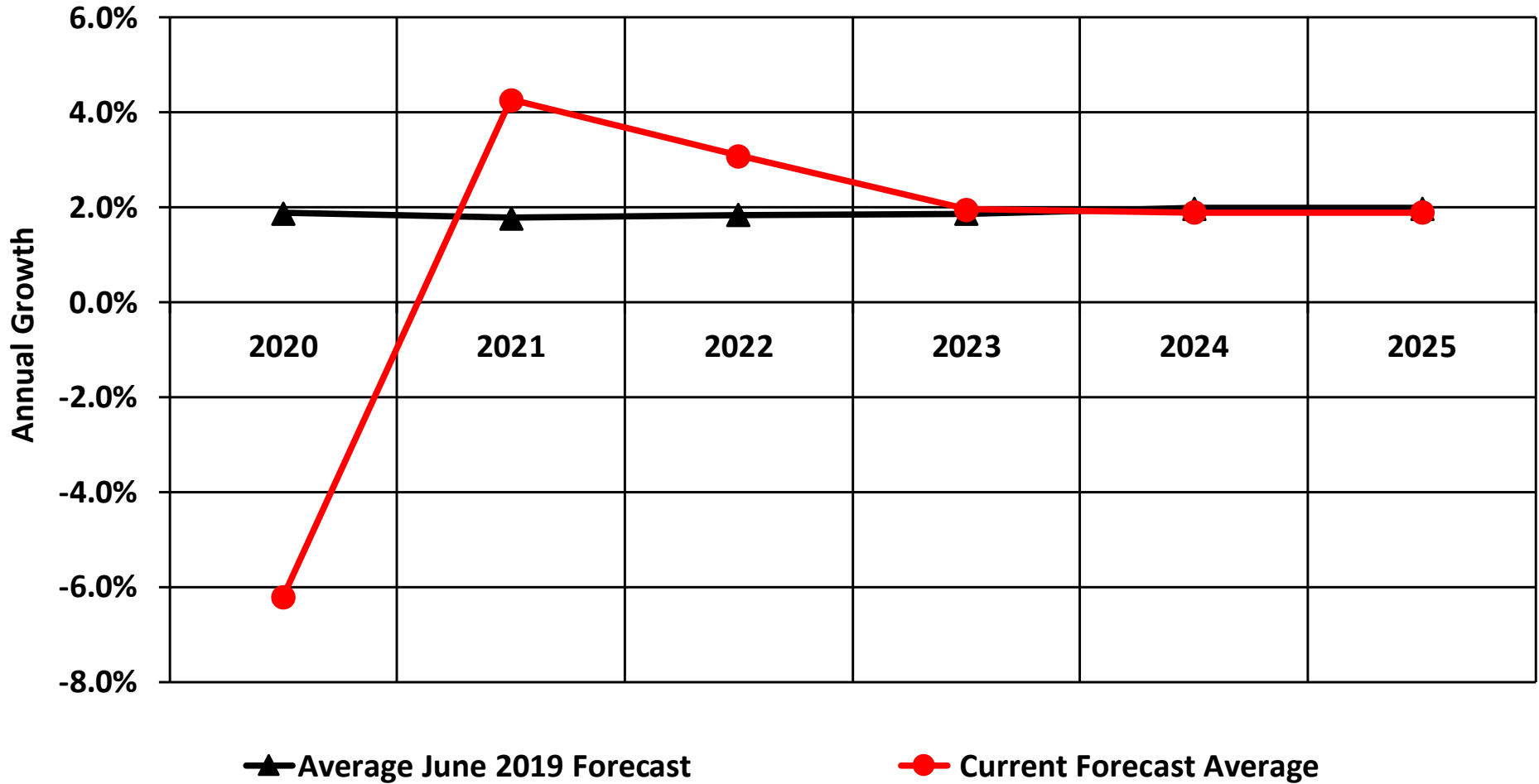
MSA Population Growth, 2007-2019



Source: BEA, U.S. Census, and author's calculations.



GDP Growth Assumptions: 2021 IRP vs. 2020 IRP



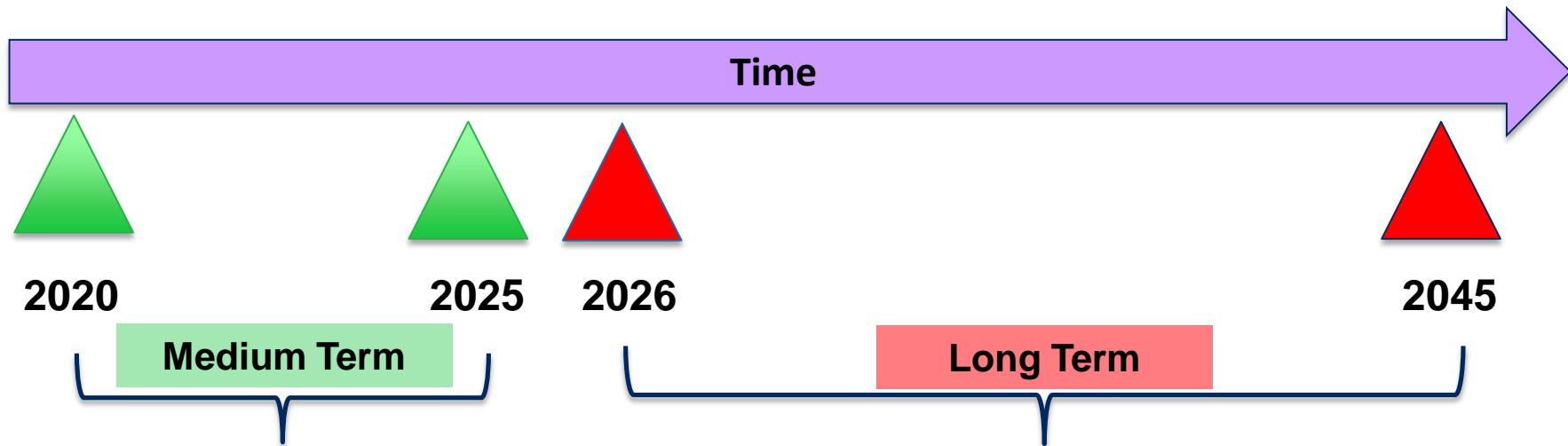
Source: Various and author's calculations.



Long-Term Energy Load Forecast

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Basic Forecast Approach

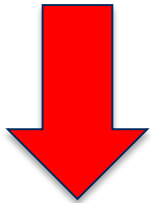


- 1) Monthly econometric model by schedule for each class.
- 2) Customer and UPC forecasts.
- 3) 20-year moving average for “normal weather.”
- 4) Economic drivers: GDP, industrial production, employment growth, population, price, natural gas penetration, and ARIMA error correction.
- 5) Native load (energy) forecast derived from retail load forecast.
- 6) Current forecast is the “Summer/Fall Forecast” done in June.

- 1) Boot strap off medium term forecast.
- 2) Apply long-run load growth relationships to develop simulation model for high/low scenarios.
- 3) Include different scenarios for renewable penetration with controls for price elasticity, EV/PHEVs, and natural gas penetration.

The Long-Term Relationship, 2021-2045

Load = Customers X Use Per Customer (UPC)



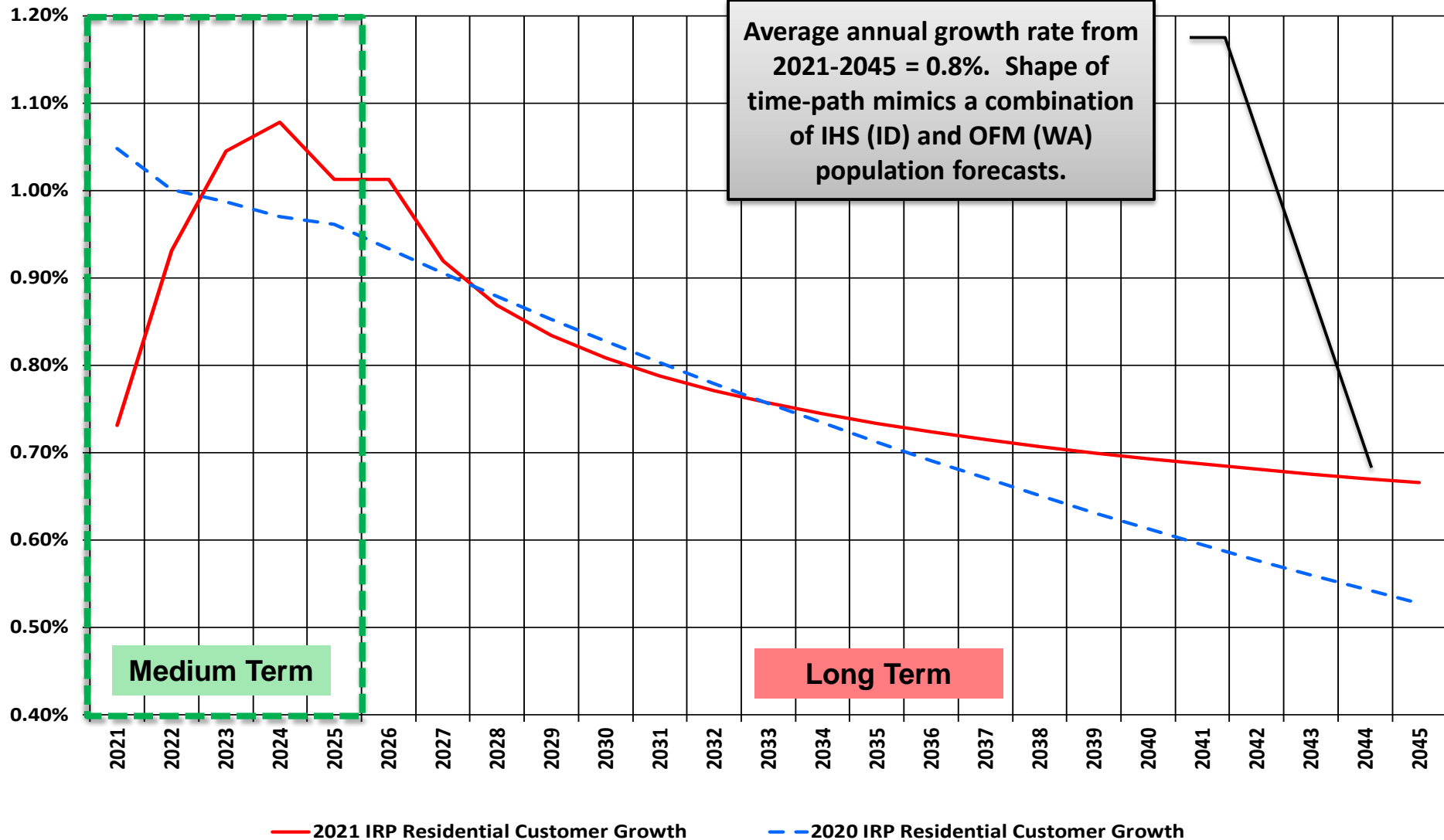
Load Growth \approx Customer Growth + UPC Growth

Assumed to be same as population growth for residential after 2025, commercial growth will follow residential, and slow decline in industrial.

Assumed to be a function of multiple factors including renewable penetration, gas penetration, and EVs/PHEVs.

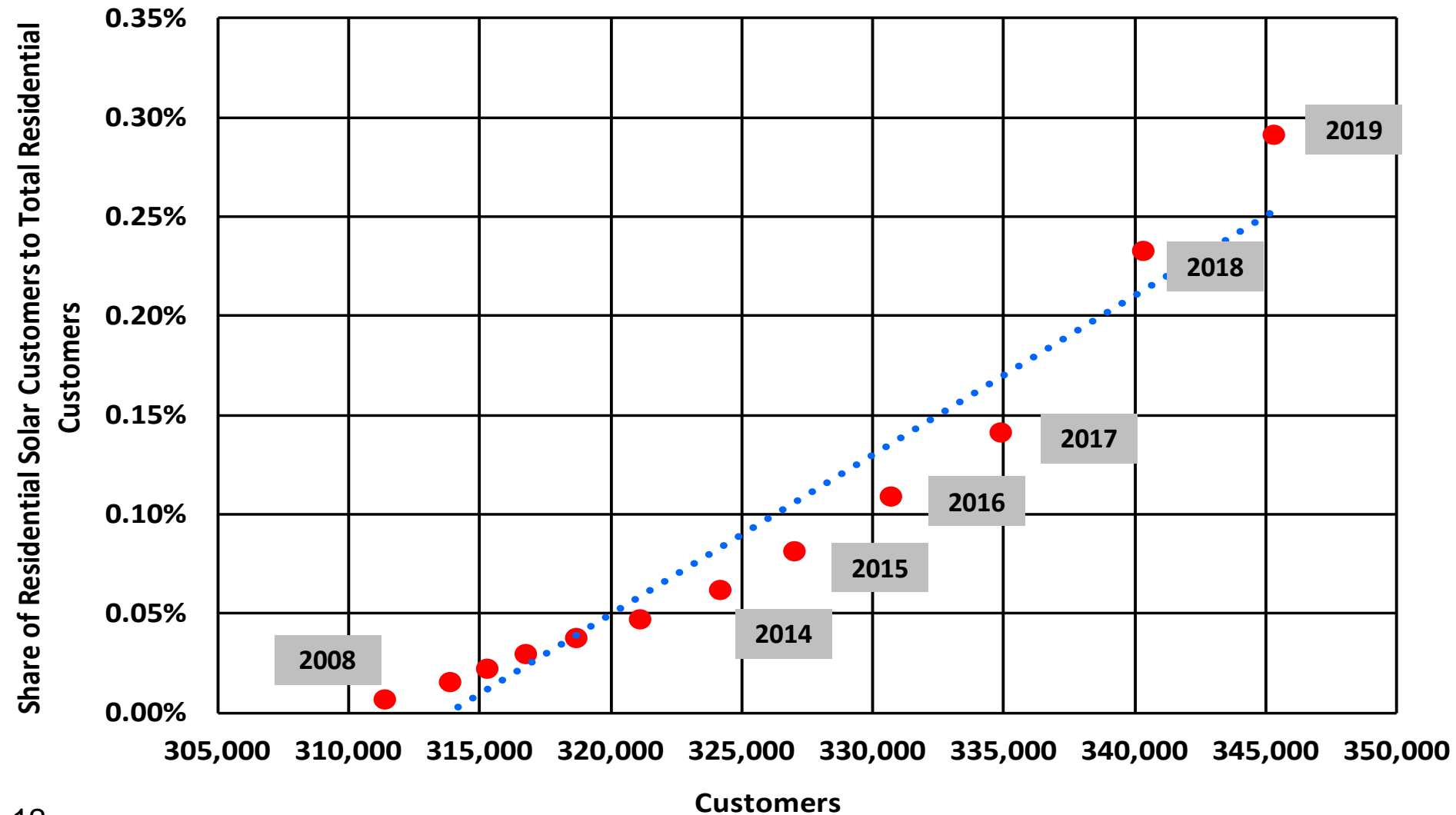
Residential Customer Growth, 2020-2045

Annual Residential Customer Growth Rates



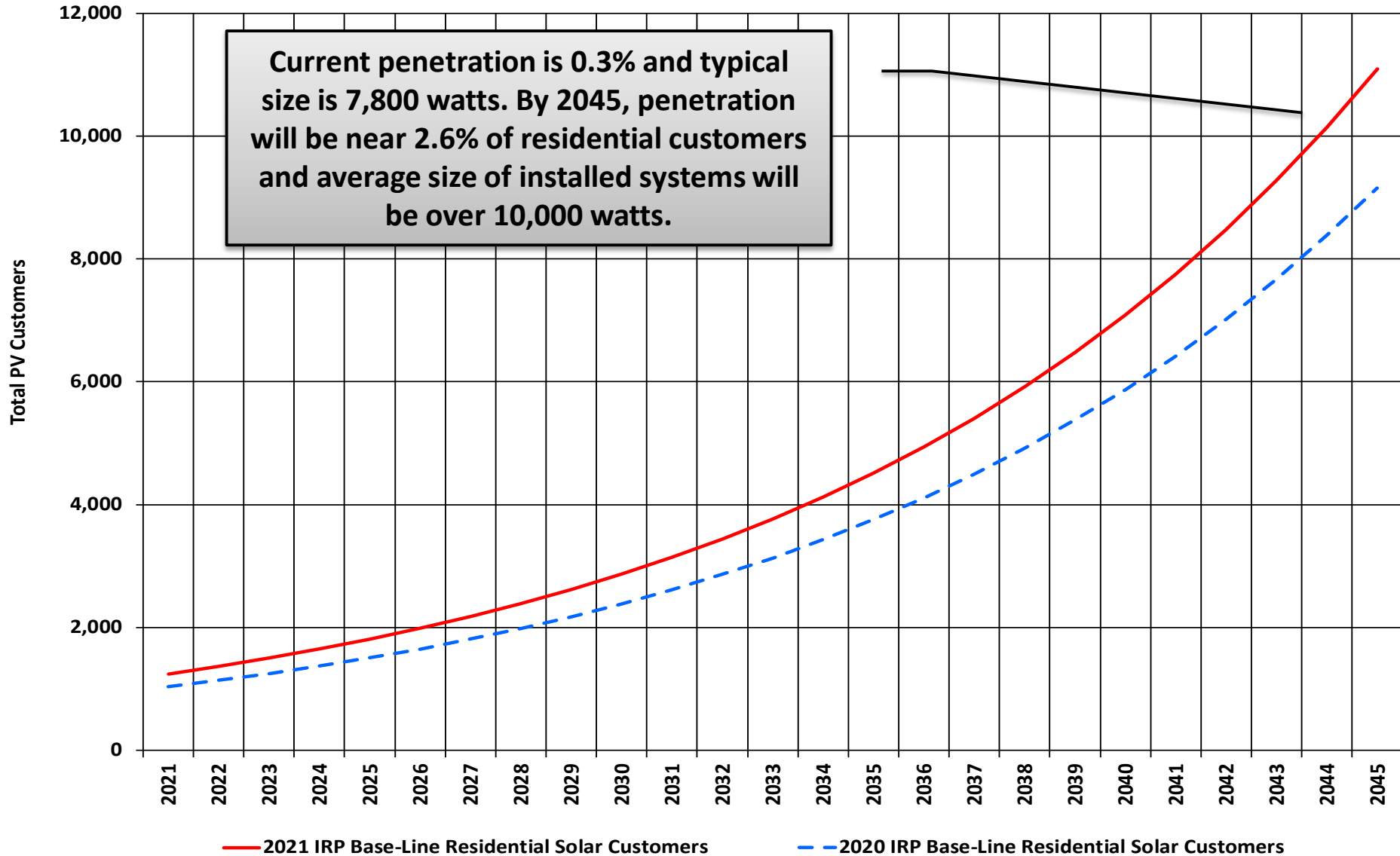
Residential Solar Penetration, 2008-2019

Customer Penetration vs. Customers Since 2008



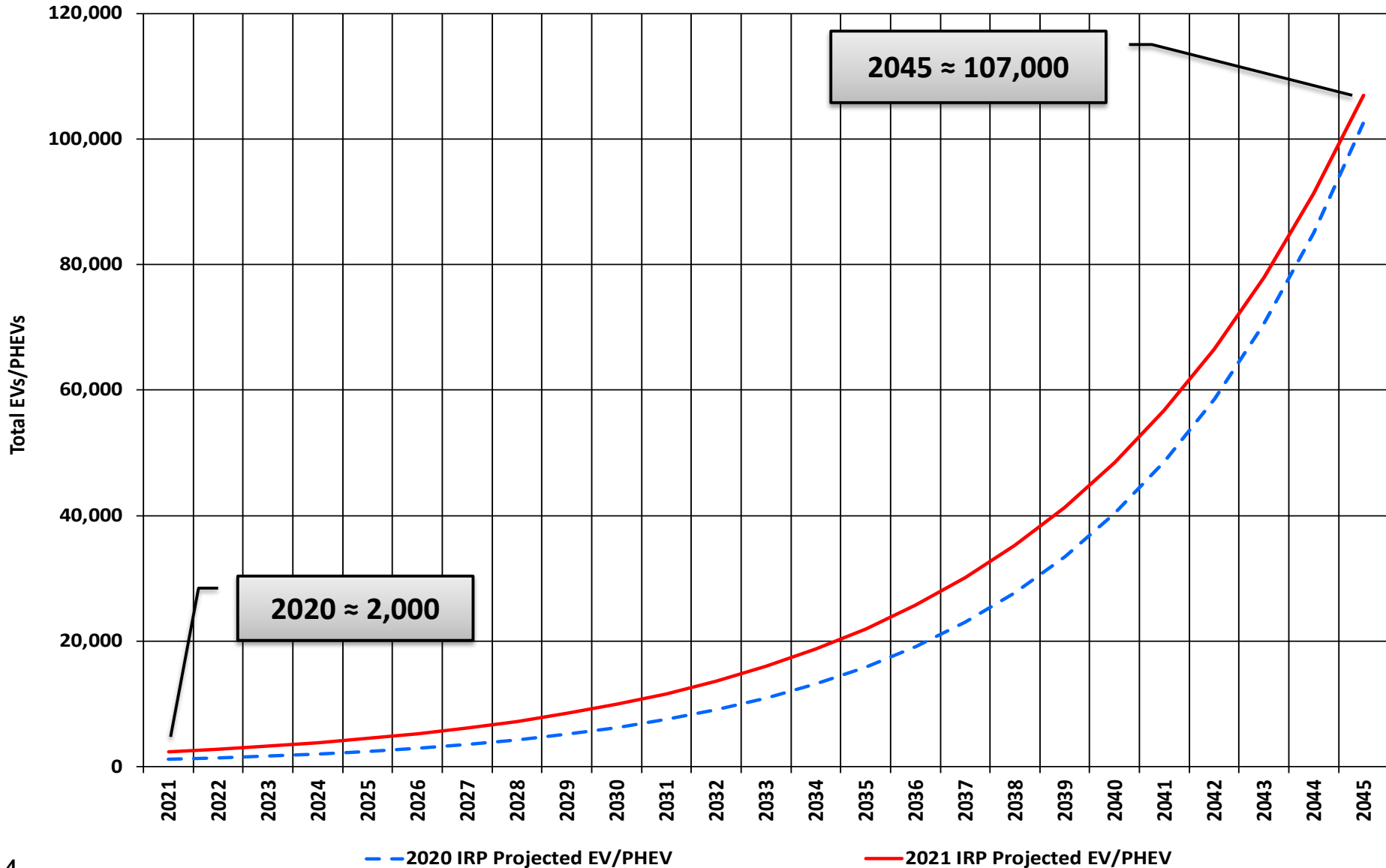
Residential Solar Penetration, 2021-2045

Projected Base-Line Residential Solar Customers



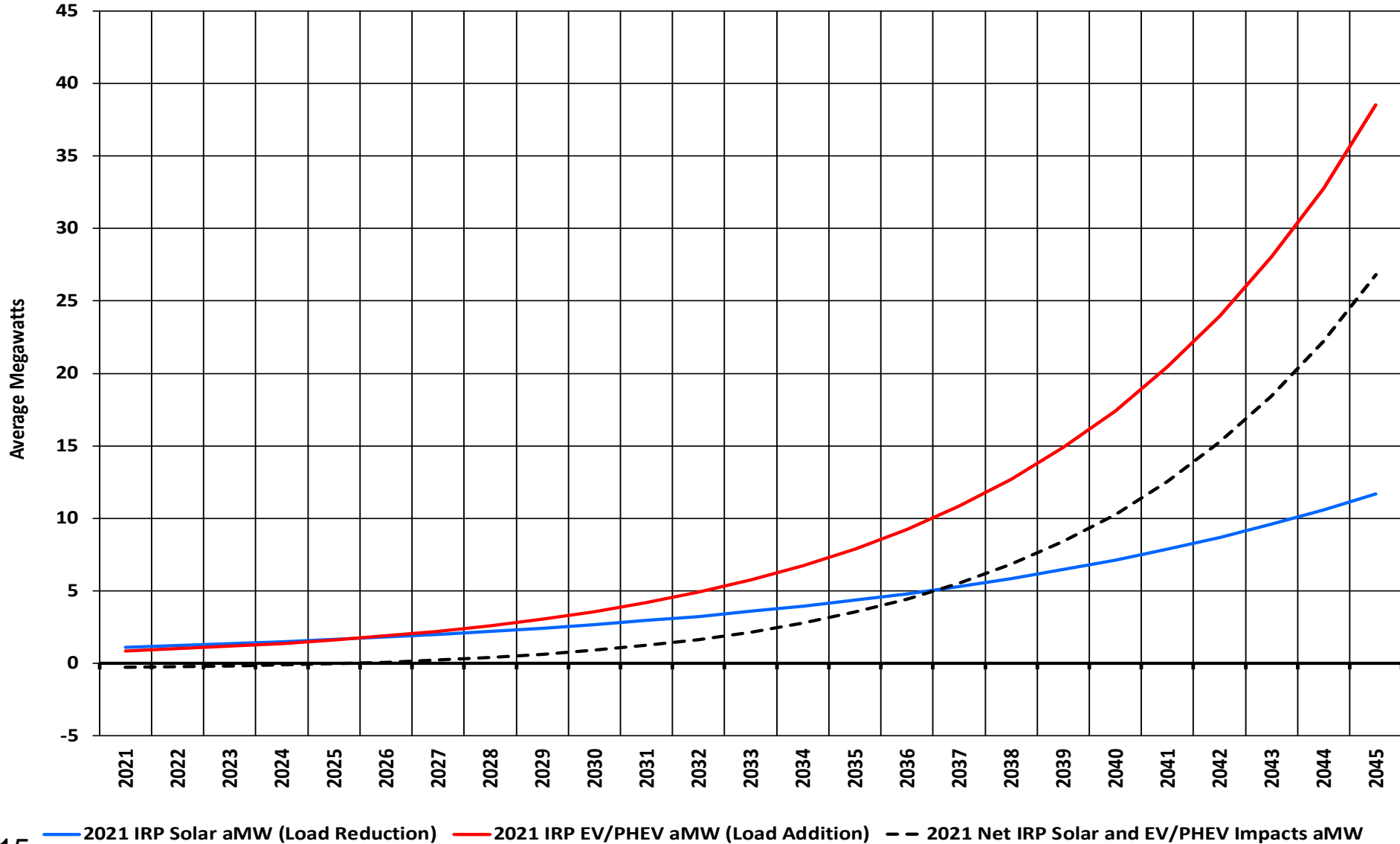
Residential EVs/PHEVs, 2021-2045

Projected Residential EVs/PHEVs



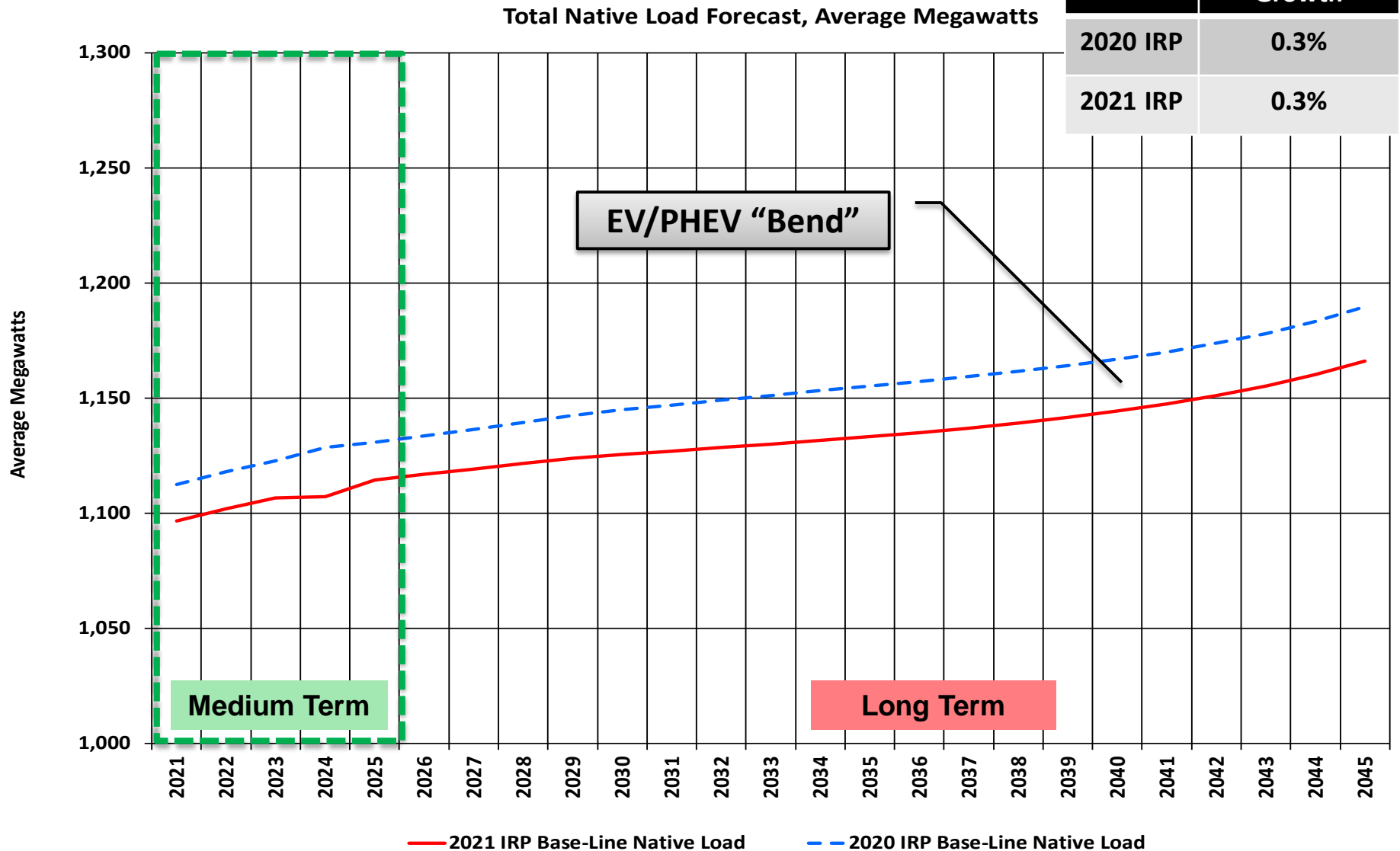
Net Solar and EV/PHEV Impact, 2021-2045

Average Megawatt Impact of Solar and EV/PHEV



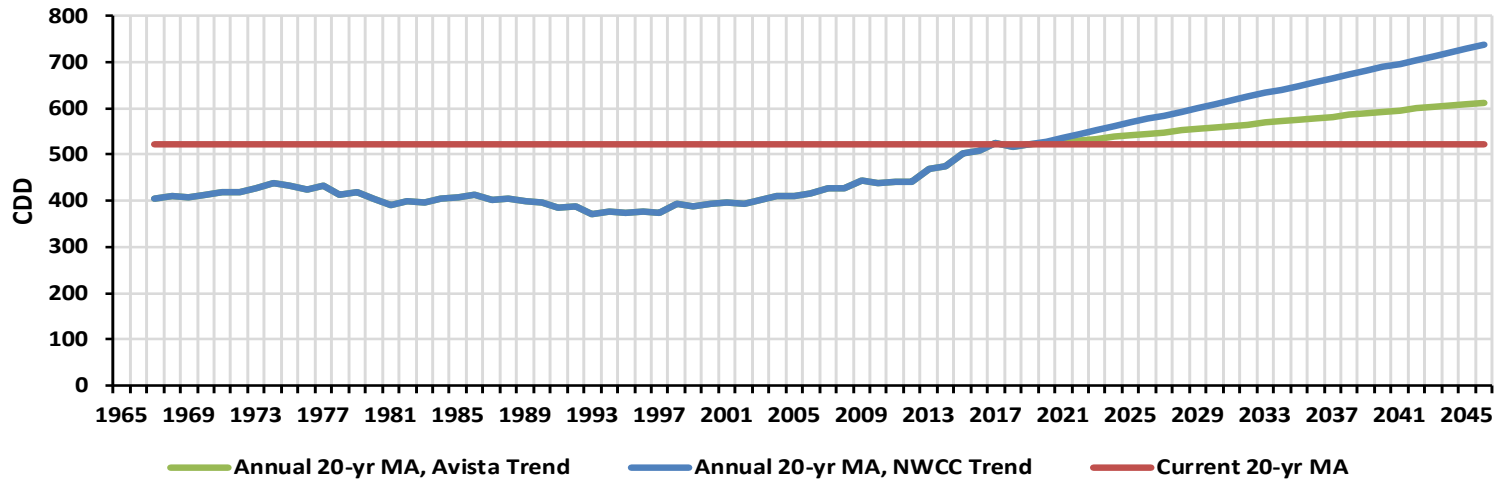
Native Load Forecast, 2021-2045

IRP	Avg. Annual Growth
2020 IRP	0.3%
2021 IRP	0.3%

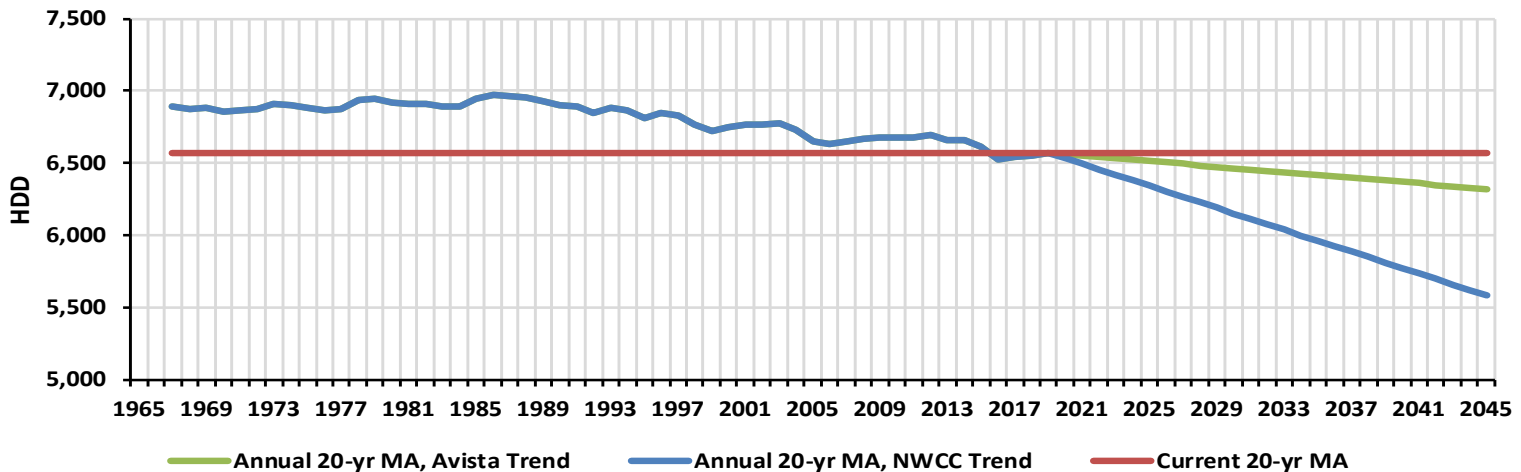


Climate Change: A Trended 20-year Moving Average (Preliminary!)

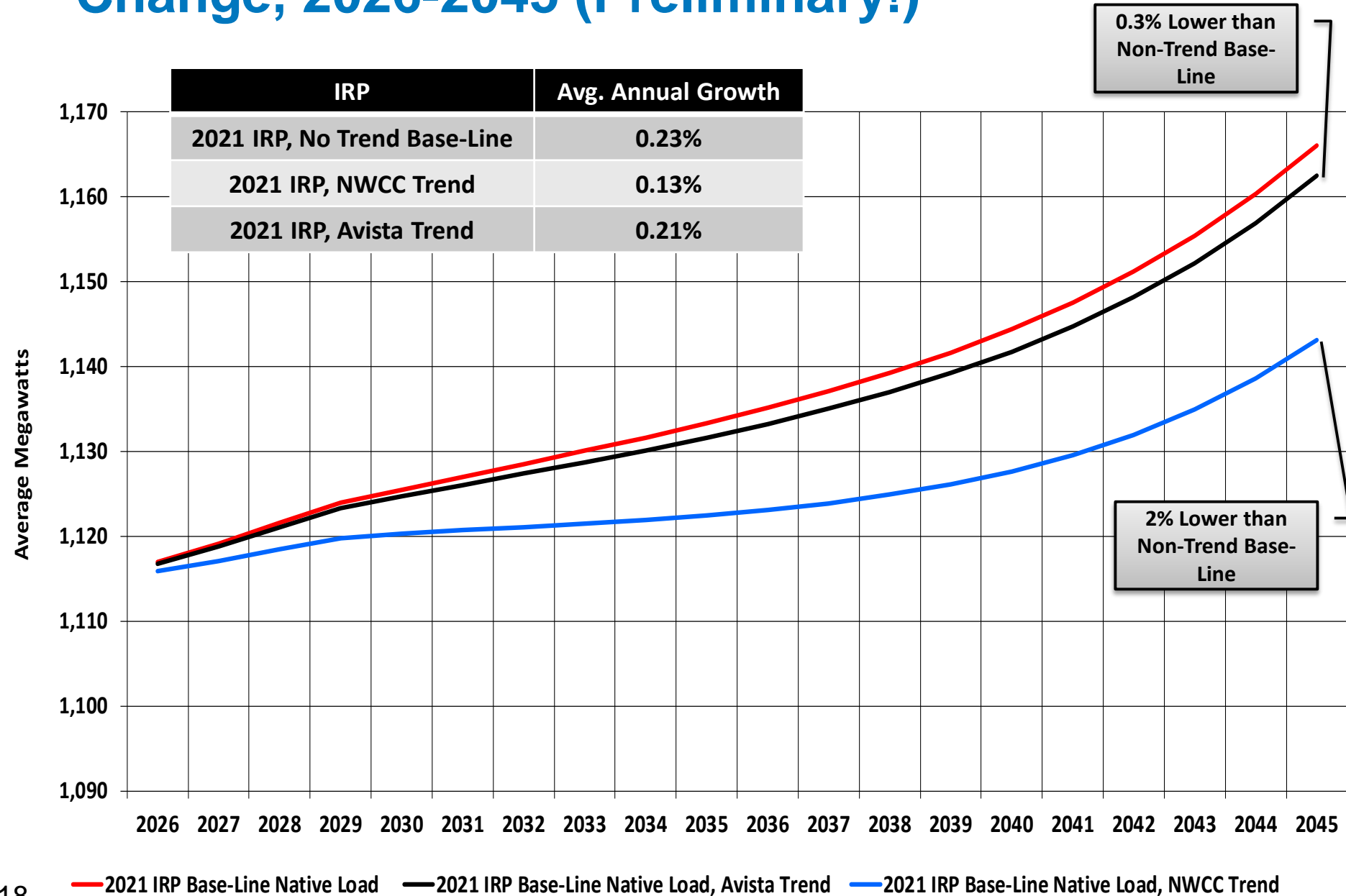
20-yr MA CDD



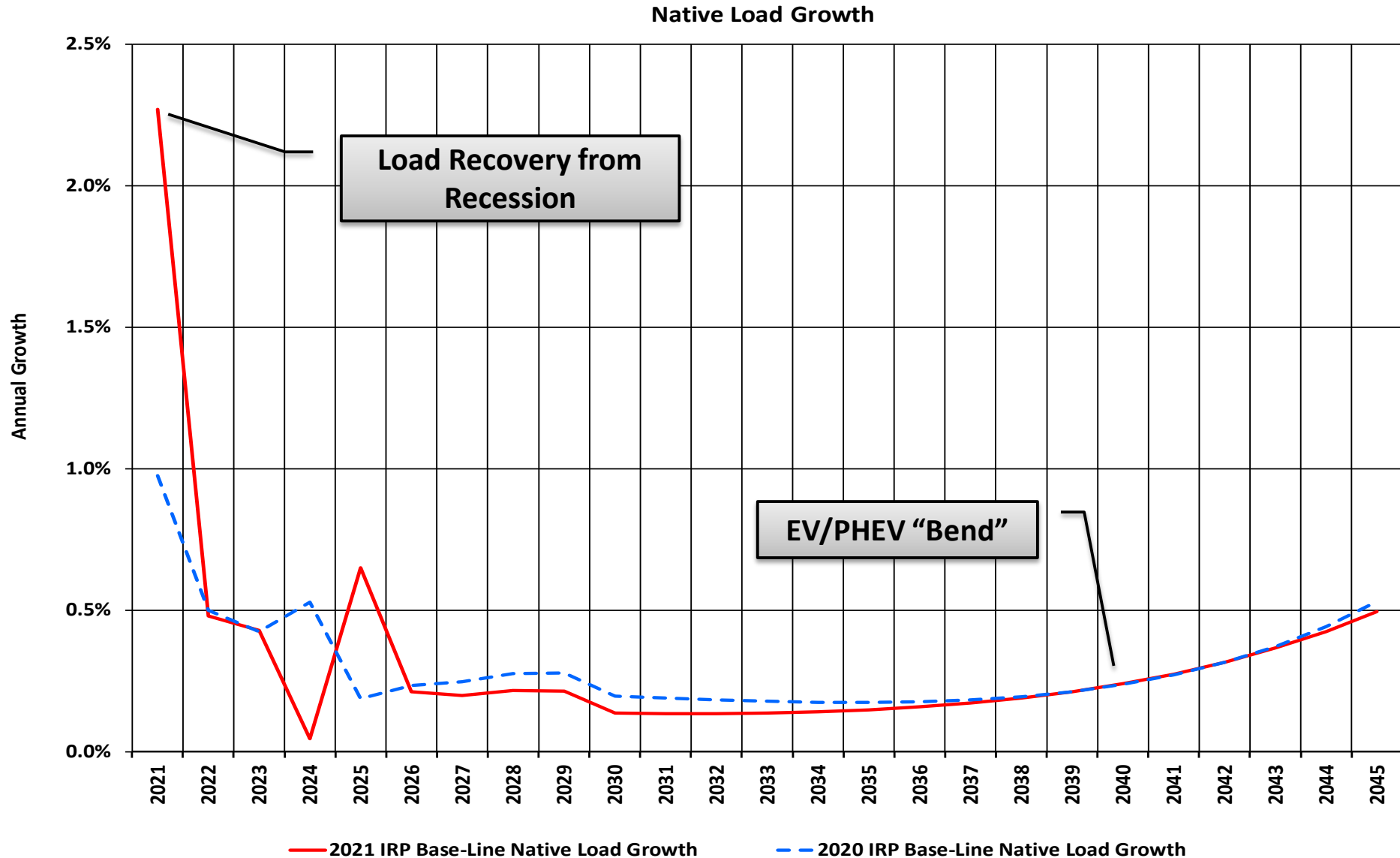
20-yr MA HDD



Annual Native Load Forecast with Climate Change, 2026-2045 (Preliminary!)

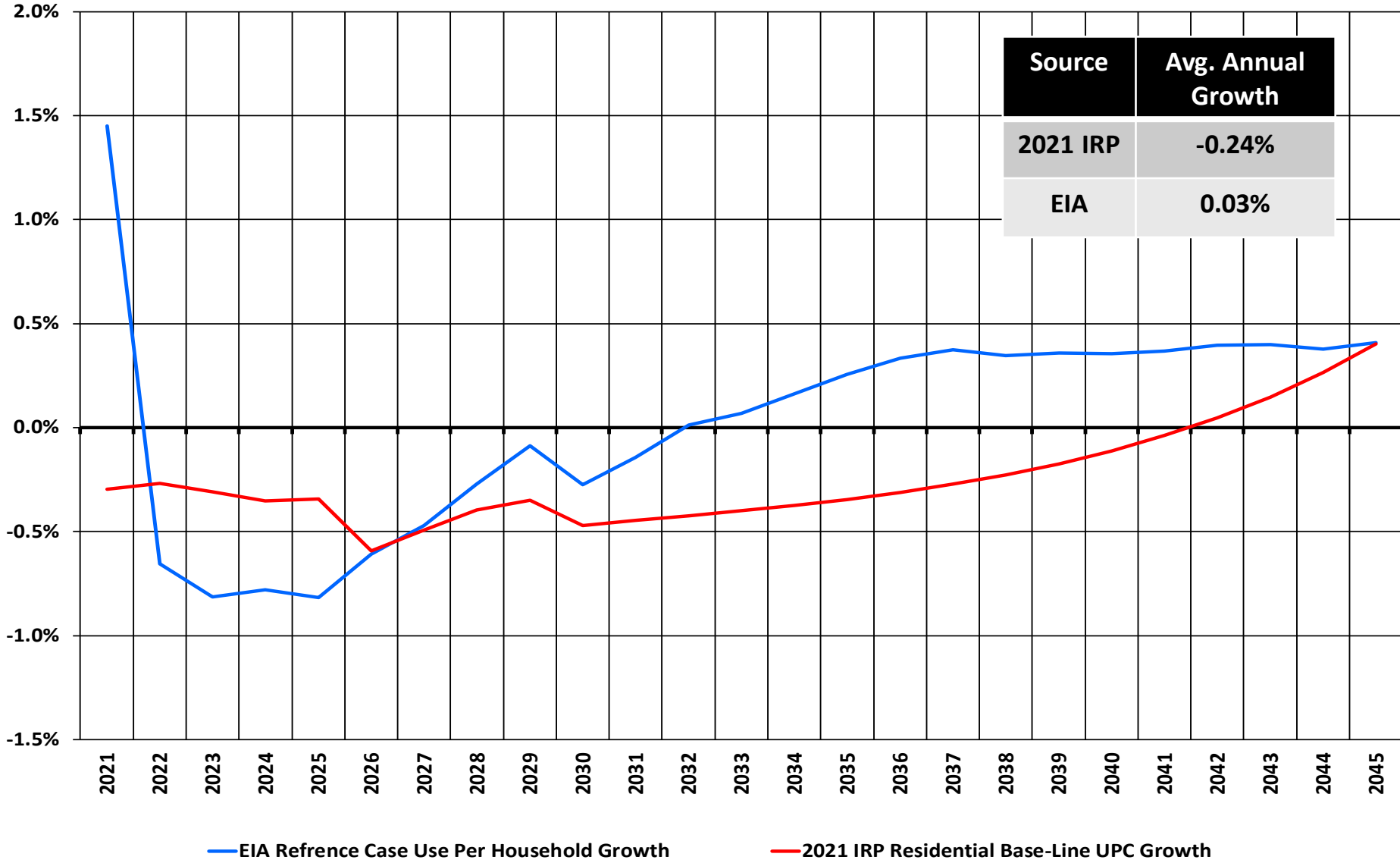


Native Load Growth Forecast, 2021-2045



Residential UPC Growth: 2021-2045

Base-Line Scenario: Residential UPC Growth Rate



— EIA Refrence Case Use Per Household Growth

— 2021 IRP Residential Base-Line UPC Growth

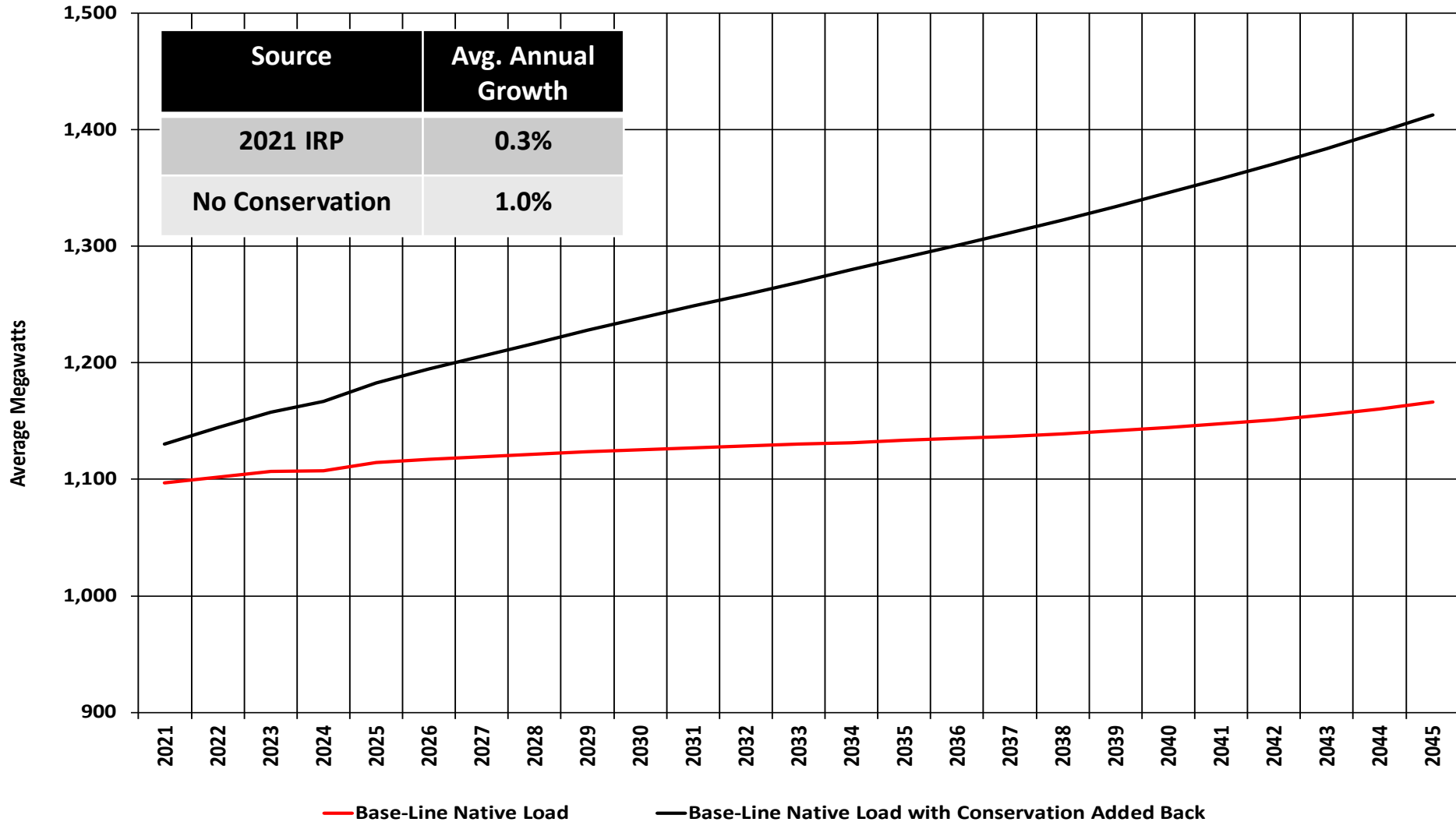


Long-Run Load Forecast: Conservation Adjustment

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Comparison of Native Load Forecasts, 2021-2045

Average Megawatts Load Comparison with Conservation Adjustment





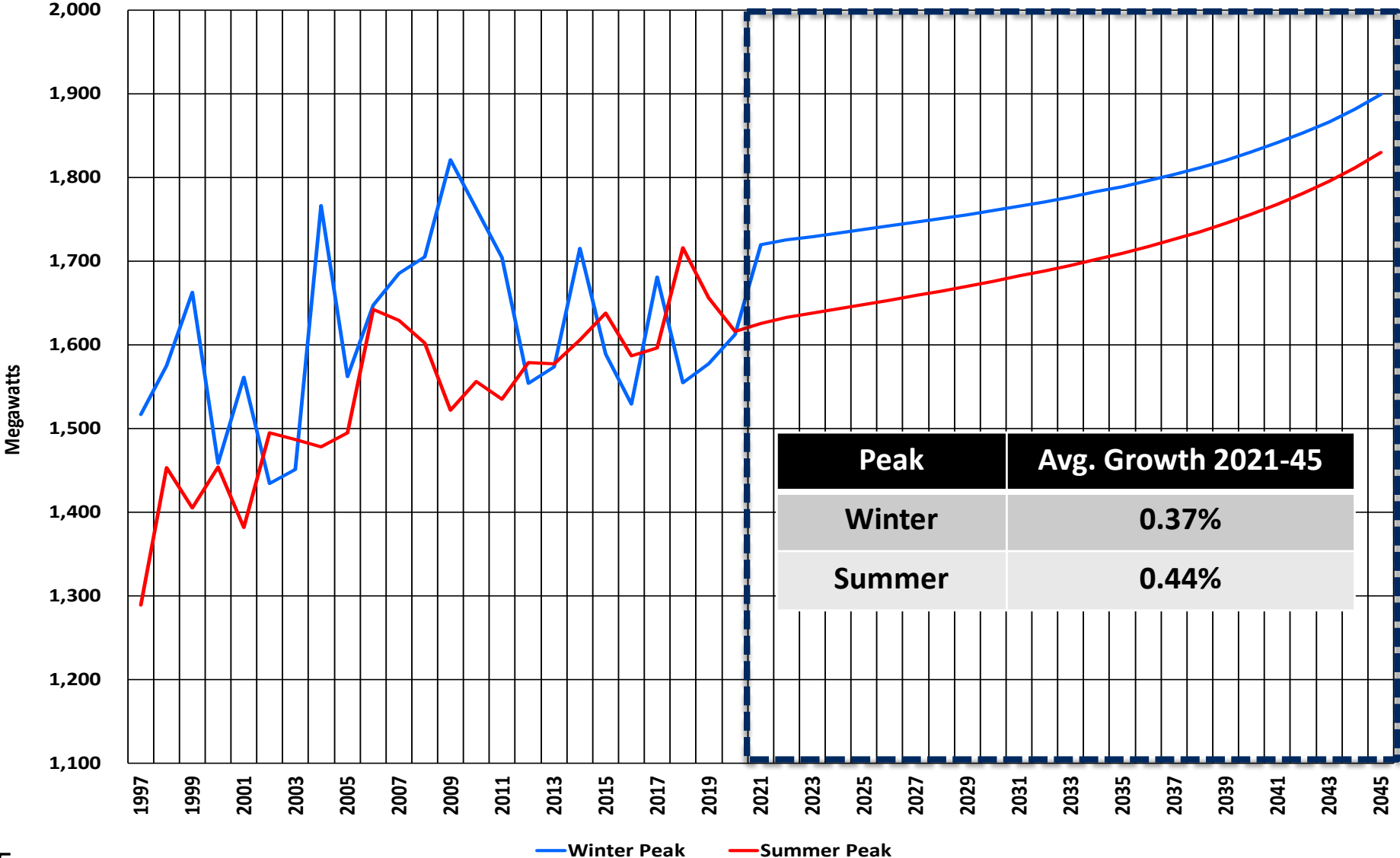
Peak Load Forecast

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The Basic Model

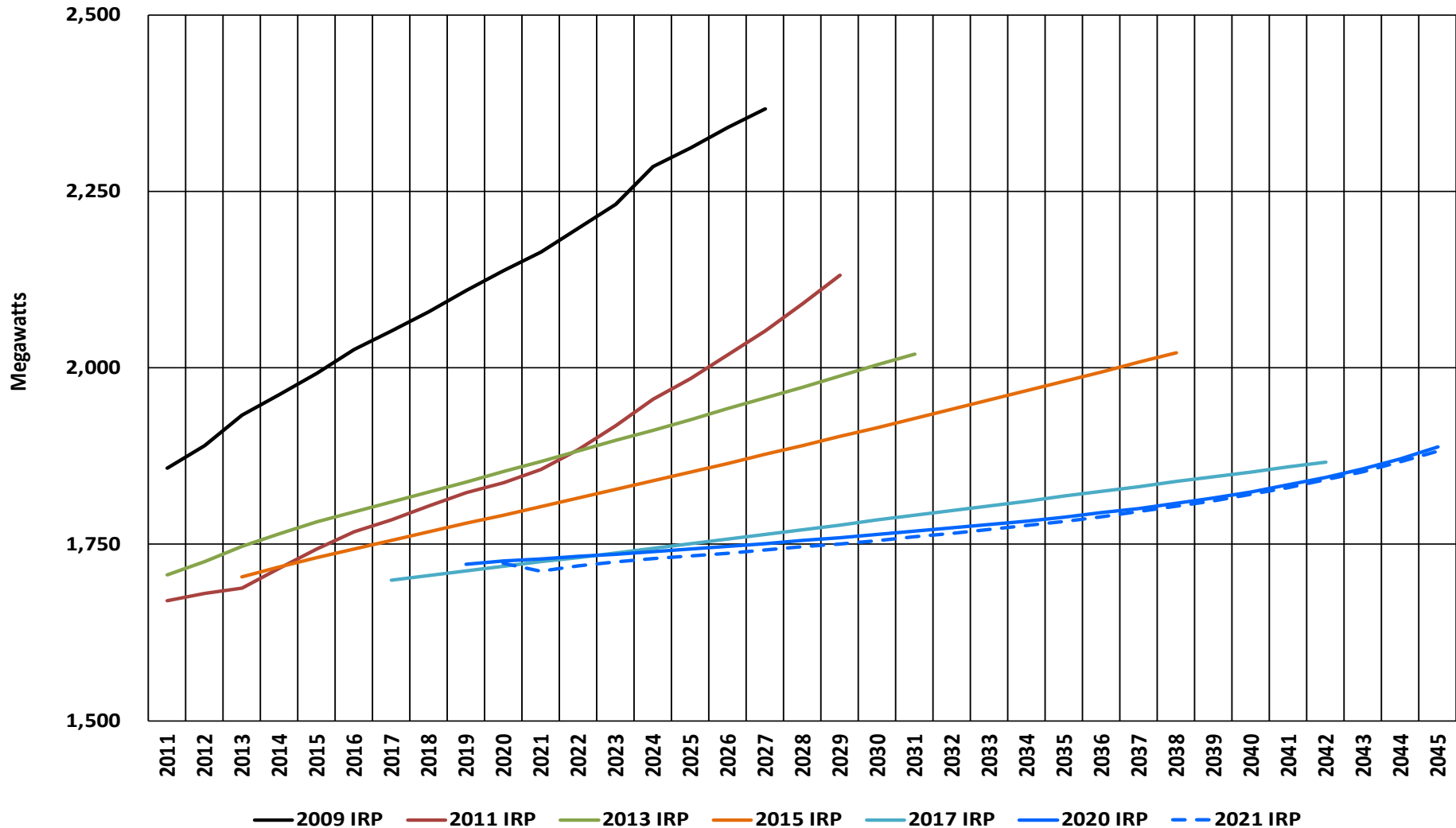
- **Monthly time-series regression model that initially excludes certain industrial loads and EVs (but those are added back in for the final forecast).**
- **Based on monthly peak MW loads since 2004. The peak is pulled from hourly load data for each day for each month.**
- **Explanatory variables include HDD-CDD and monthly and day-of-week dummy variables. The level of real U.S. GDP is the primary economic driver in the model—the higher GDP, the higher peak loads. *Model allows GDP impact to differ between winter and summer.***
- **The coefficients of the model are used to generate a distribution of peak loads by month based on historical max/min temperatures since 1890, holding GDP constant. A starting expected peak load is then calculated using the average peak load simulated for that month going back to 1890. Model shows Avista is a winter peaking utility for the forecast period; however, the summer peak is growing at a faster than the winter peak.**
- **For comparison in the 2021 IRP, peak load is also calculated by averaging simulated peak loads over the last 30 years and 20 years.**
- **The model is also used to calculate the long-run growth rate of peak loads for summer and winter using a forecast of GDP growth under the “*ceteris paribus*” assumption for weather and other factors.**

Peak Forecasts for Winter and Summer, 2021-2045



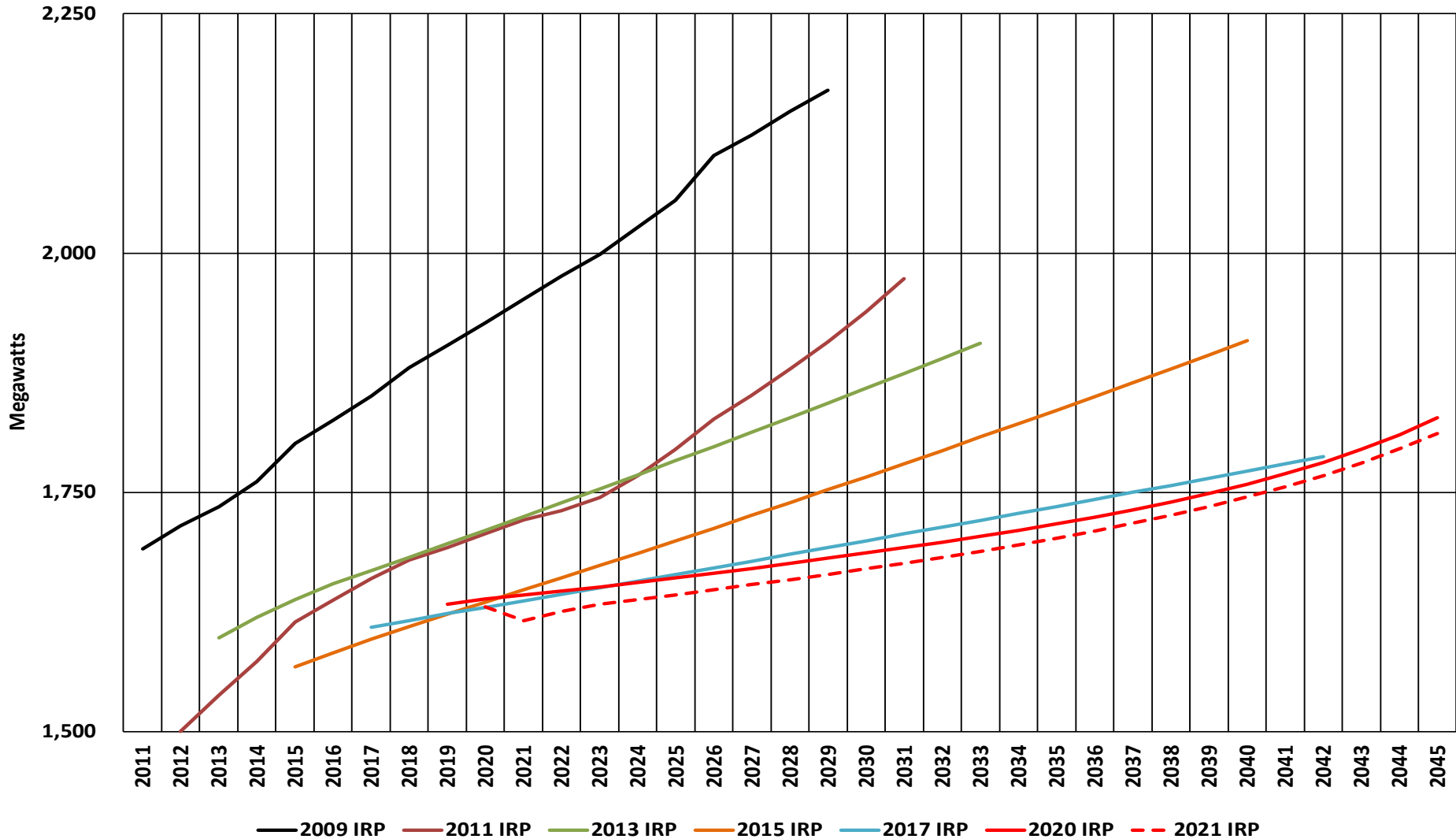
Load Forecasts for Winter Peak, 2011-2043

Winter Peak Forecast: Current and Past

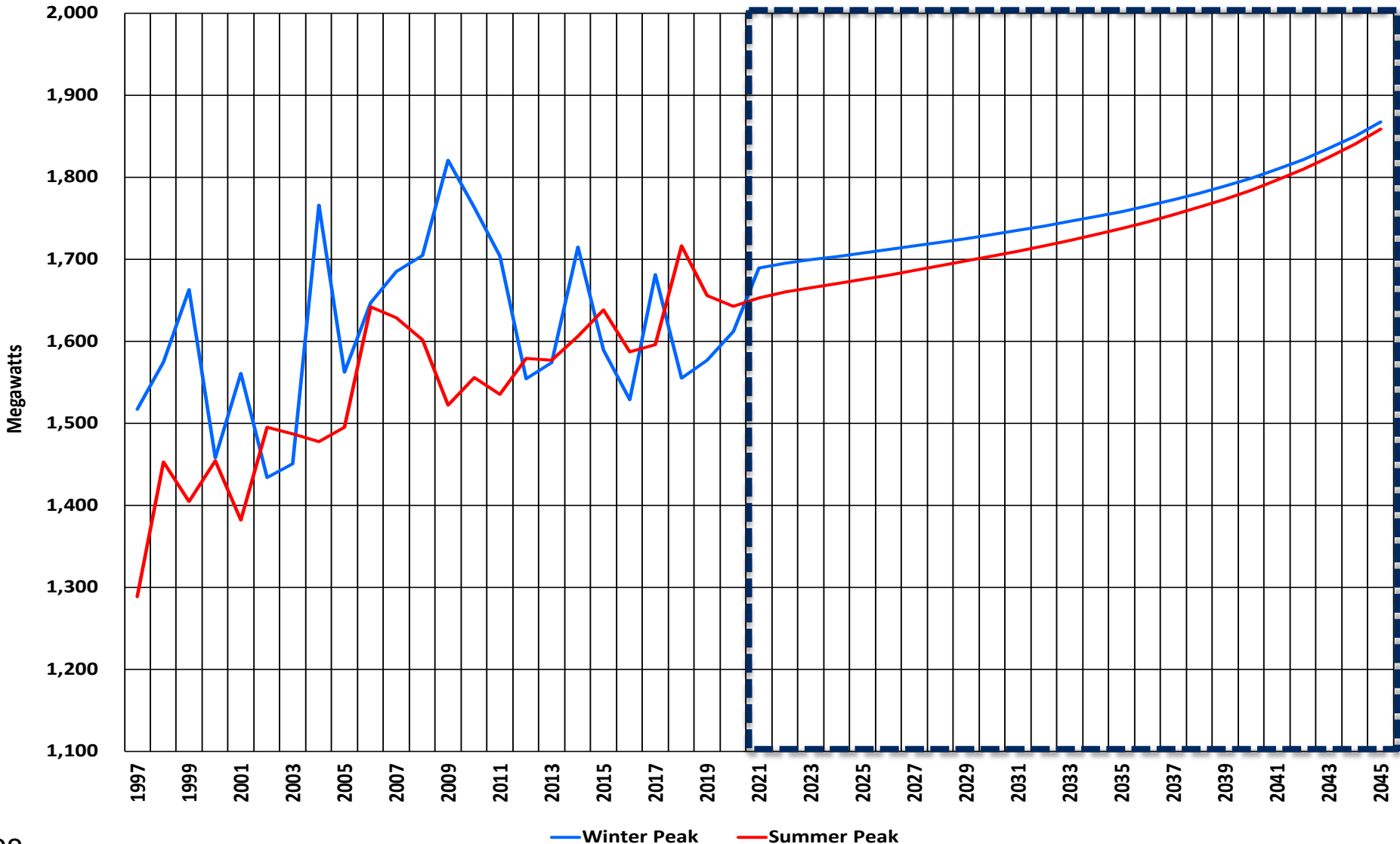


Load Forecasts for Summer Peak, 2011-2045

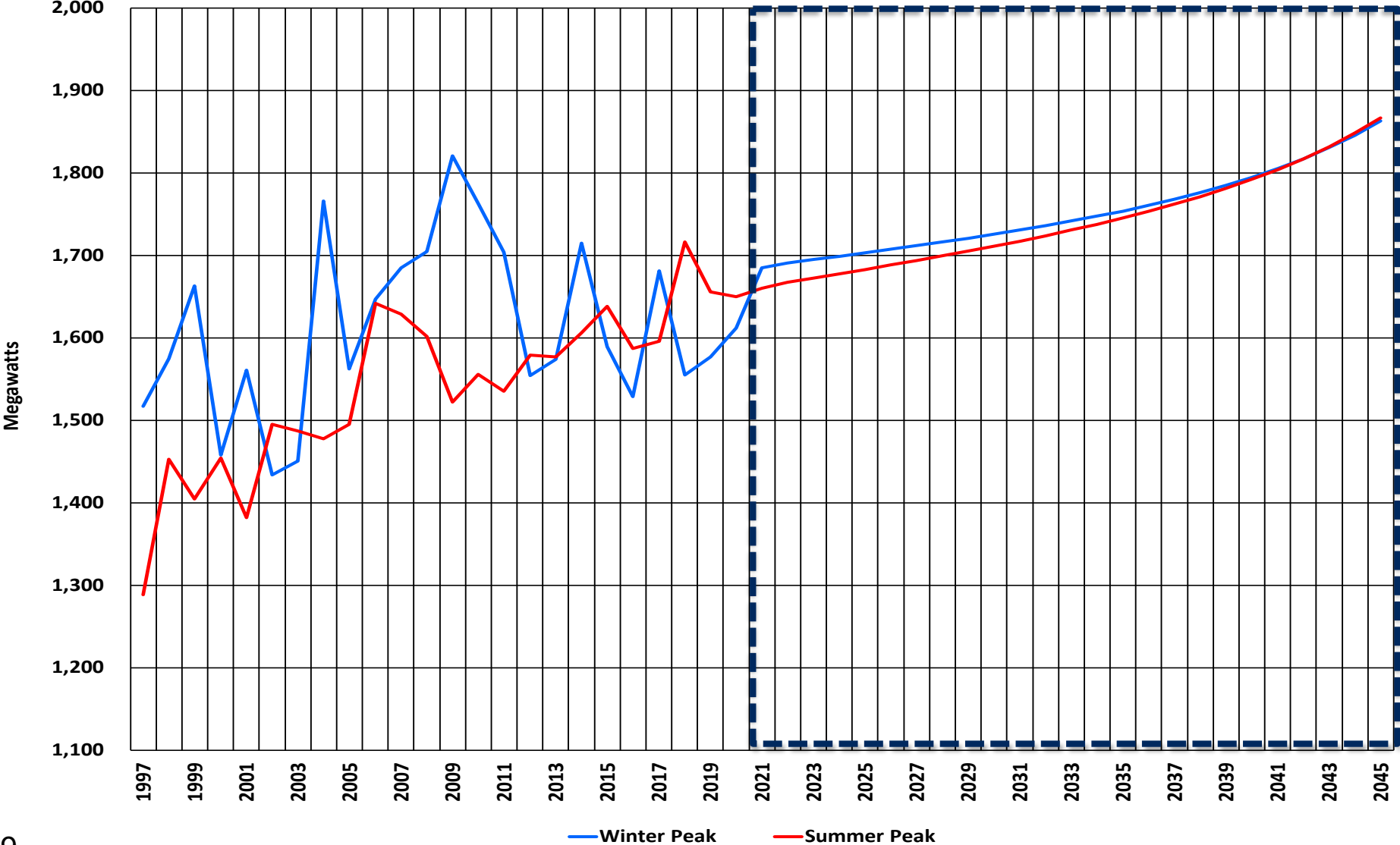
Summer Peak Forecast: Current and Past



Peak Forecasts for Winter and Summer 30-Year Average Weather, 2021-2045



Peak Forecasts for Winter and Summer 20-Year Average Weather, 2021-2045



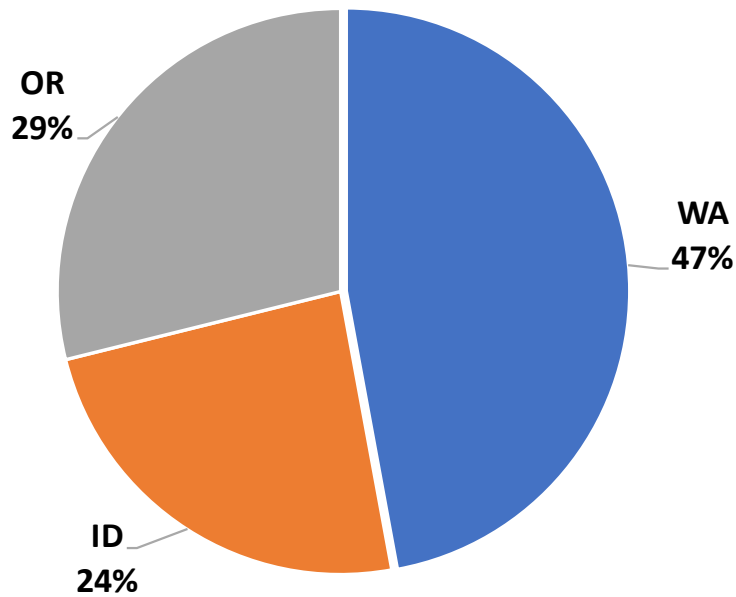


Long-Run Customer Forecast: Natural Gas

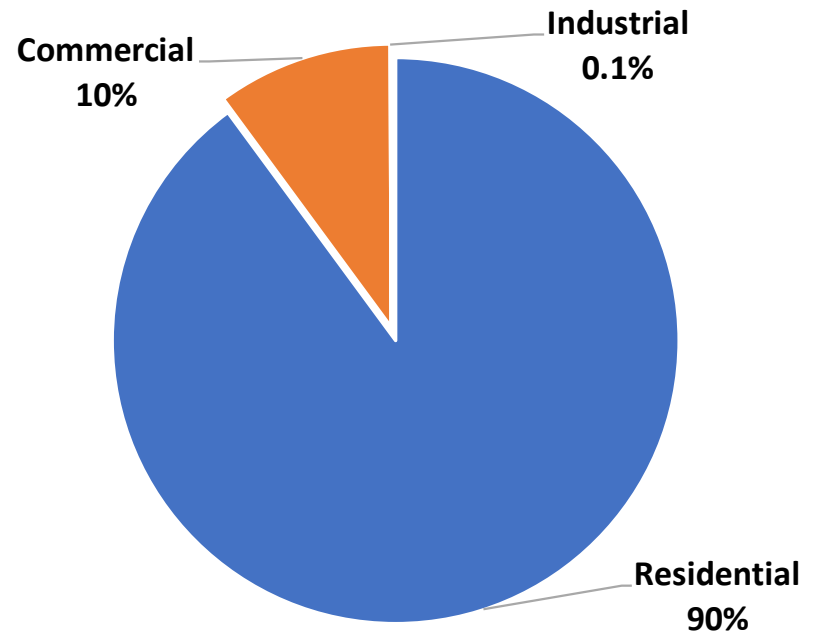
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Firm Customers (Meters) by State and Class, 2019

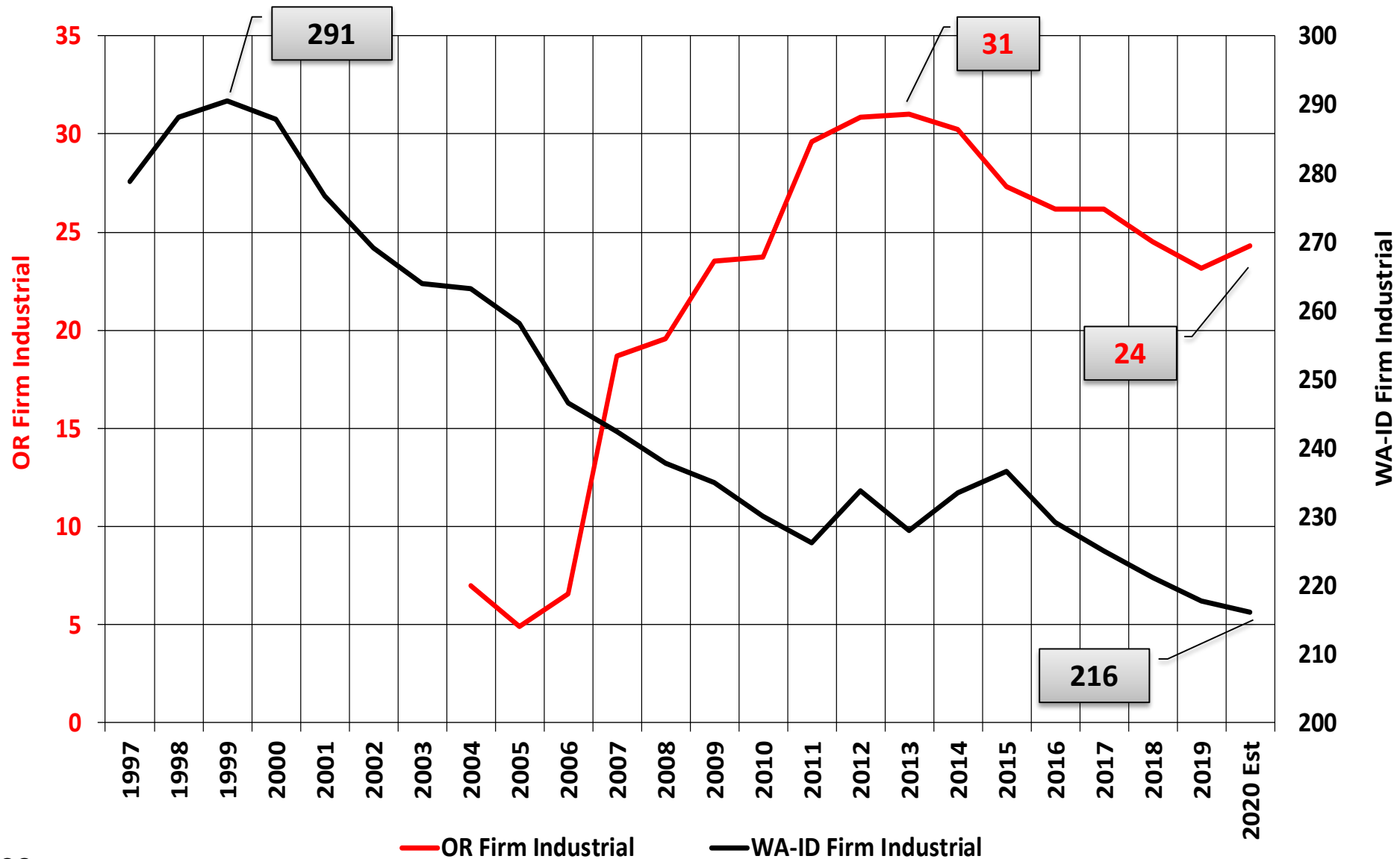
Firm Customers by State



Firm Customers by Class



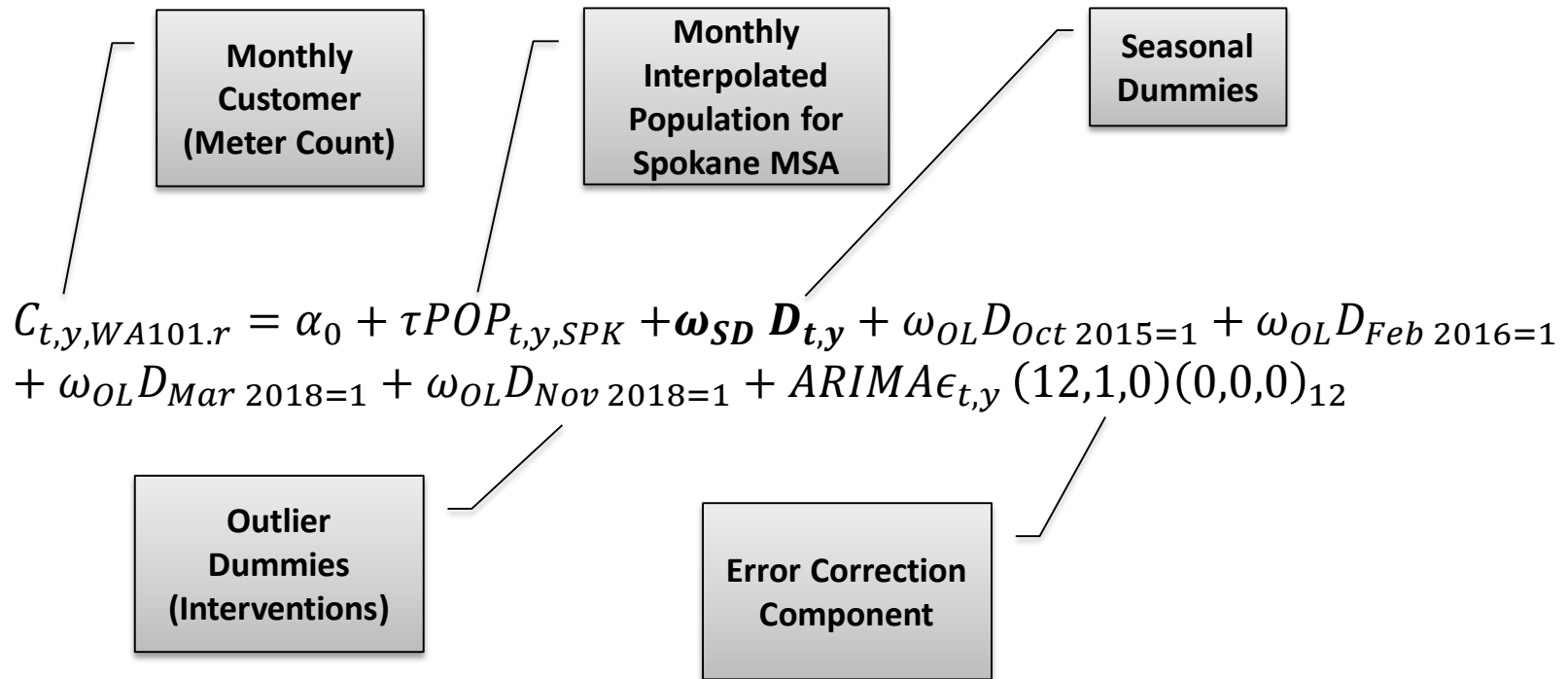
System All Types of Industrial Customers, 1997-2020



Customer Forecast Models

- Forecast models are structured around each schedule, in each class, by jurisdiction. In the case of OR, this is done individually for each of Avista's service islands.
- Time series transfer function models (models with regressions drivers and ARIMA error terms).
- Simple time series smoothing models (for schedules with little customer variation).
- Same models used for the bi-annual revenue model forecast pushed out to 2045. The forecasts for this IRP were generated from the "Summer/Fall 2020" forecast completed in June.
- Customer forecasts are sent to Gas Supply for inclusion in the SENDOUT model.
- Example of transfer function model: WA sch. 101 residential customers...

Transfer Function Model Example



Getting to Population as a Driver, 2020-2025 & 2026-2045

2020-2025 For Spokane, WA; Kootenai, ID, and Jackson+Josephine, OR

Average GDP Growth Forecasts:
•WSJ, FOMC, Bloomberg, etc.
•Average forecasts out 5 full calendar years.

GDP

Non-farm Employment Growth Model:
•Model links year y, y-1, and y-2 GDP growth to year y regional employment growth.
•Forecast out 5 full calendar years.
•Averaged with IHS employment growth forecasts.

EMP

Regional Population Growth Models:
•Model links regional, U.S., and CA year y-1 employment growth to year y county population growth.
•Forecast out 5 full calendar years for Spokane, WA; Kootenai, ID; and Jackson+Josephine, OR.
•Averaged with IHS growth forecasts.
•Growth rates used to generate population forecasts for use in regression models—important driver for main residential and commercial schedules.

Deviation in the most recent forecast!

Kootenai and Jackson: IHS population growth forecasts for 2026-2045

Spokane: OFM population growth forecasts for 2026-2045

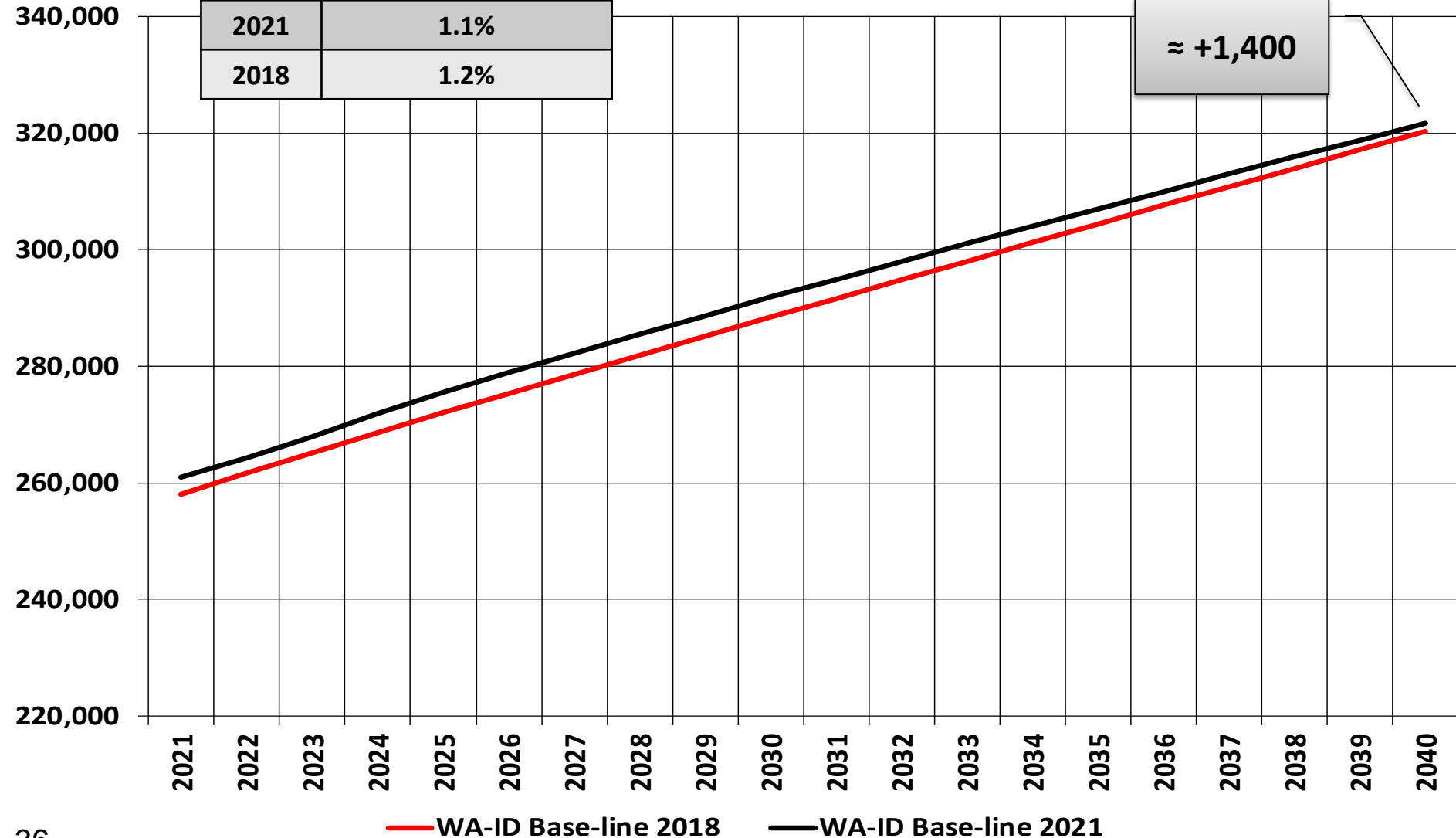
OR Douglas, Klamath, and Union counties: IHS population growth forecasts for 2020-2045

Monthly Interpolation assumes: $P_N = P_0 e^{rN}$

WA-ID Region Firm Customers, 2021-2040 (2018 IRP)

IRP	Avg. Annual Growth 2021-2040
2021	1.1%
2018	1.2%

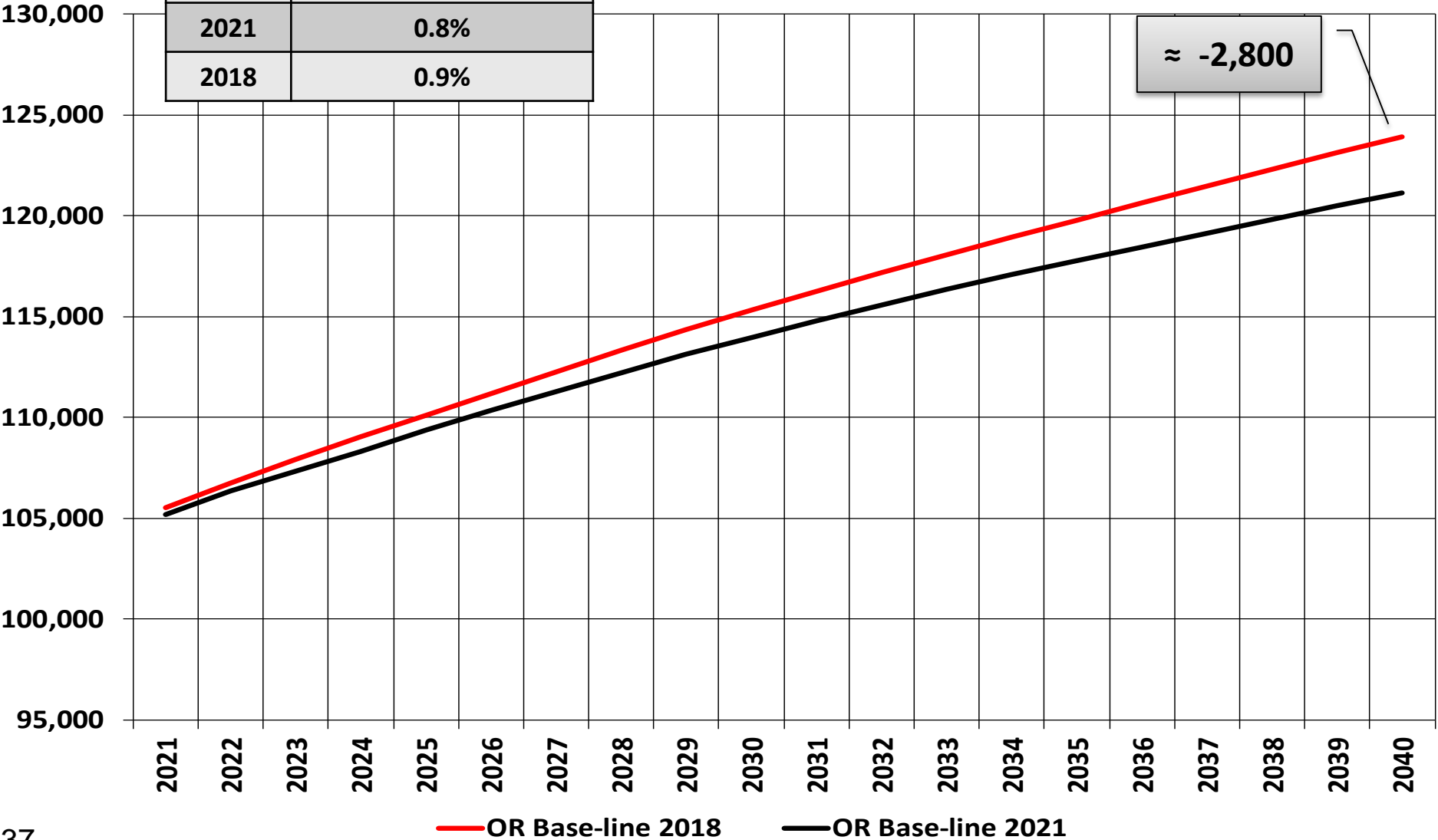
≈ +1,400



OR Region Firm Customers, 2021-2040 (2018 IRP)

IRP	Avg. Annual Growth 2021-2040
2021	0.8%
2018	0.9%

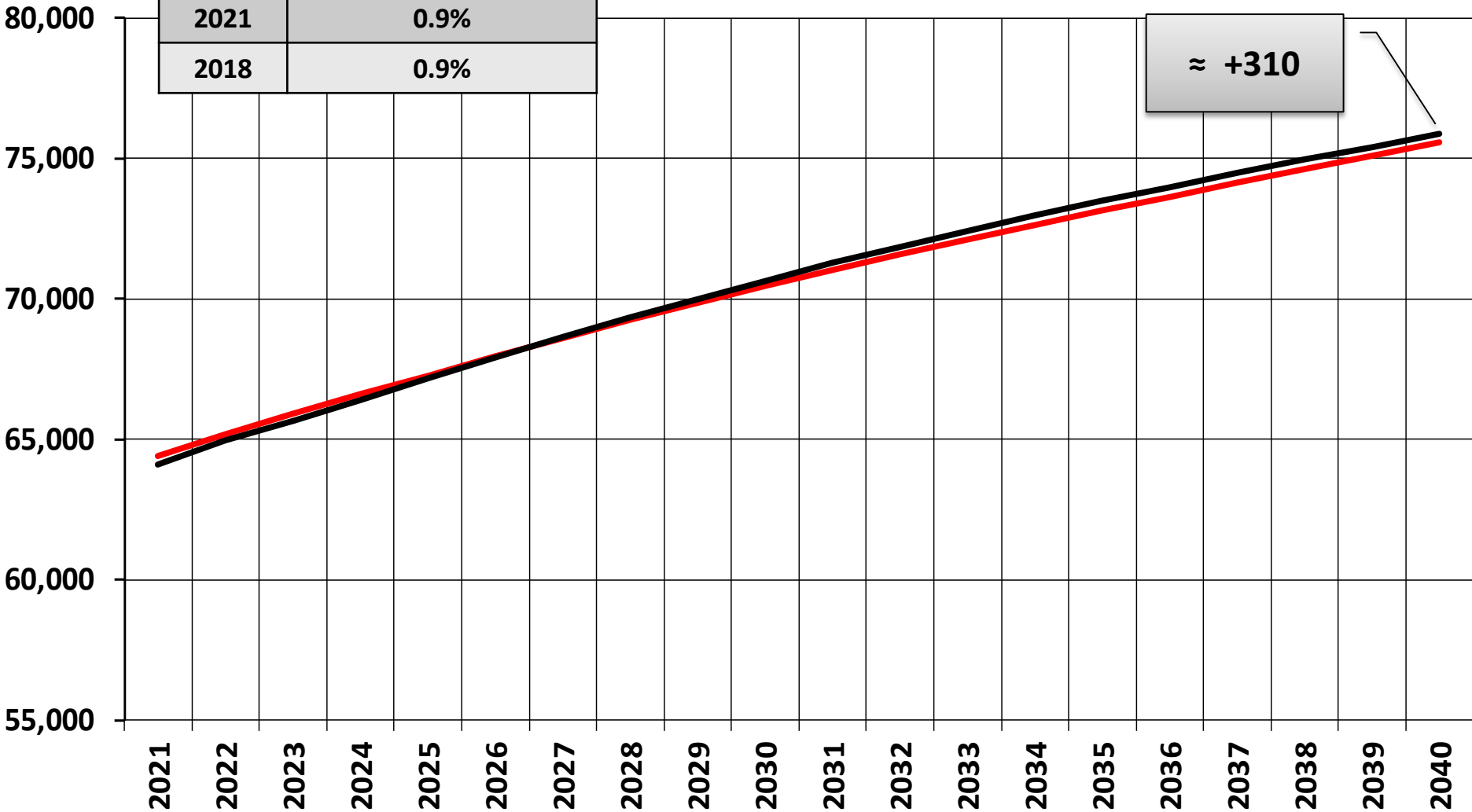
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Medford, OR Region Firm Customers, 2021-2040 (2018 IRP)

IRP	Avg. Annual Growth 2021-2037
2021	0.9%
2018	0.9%

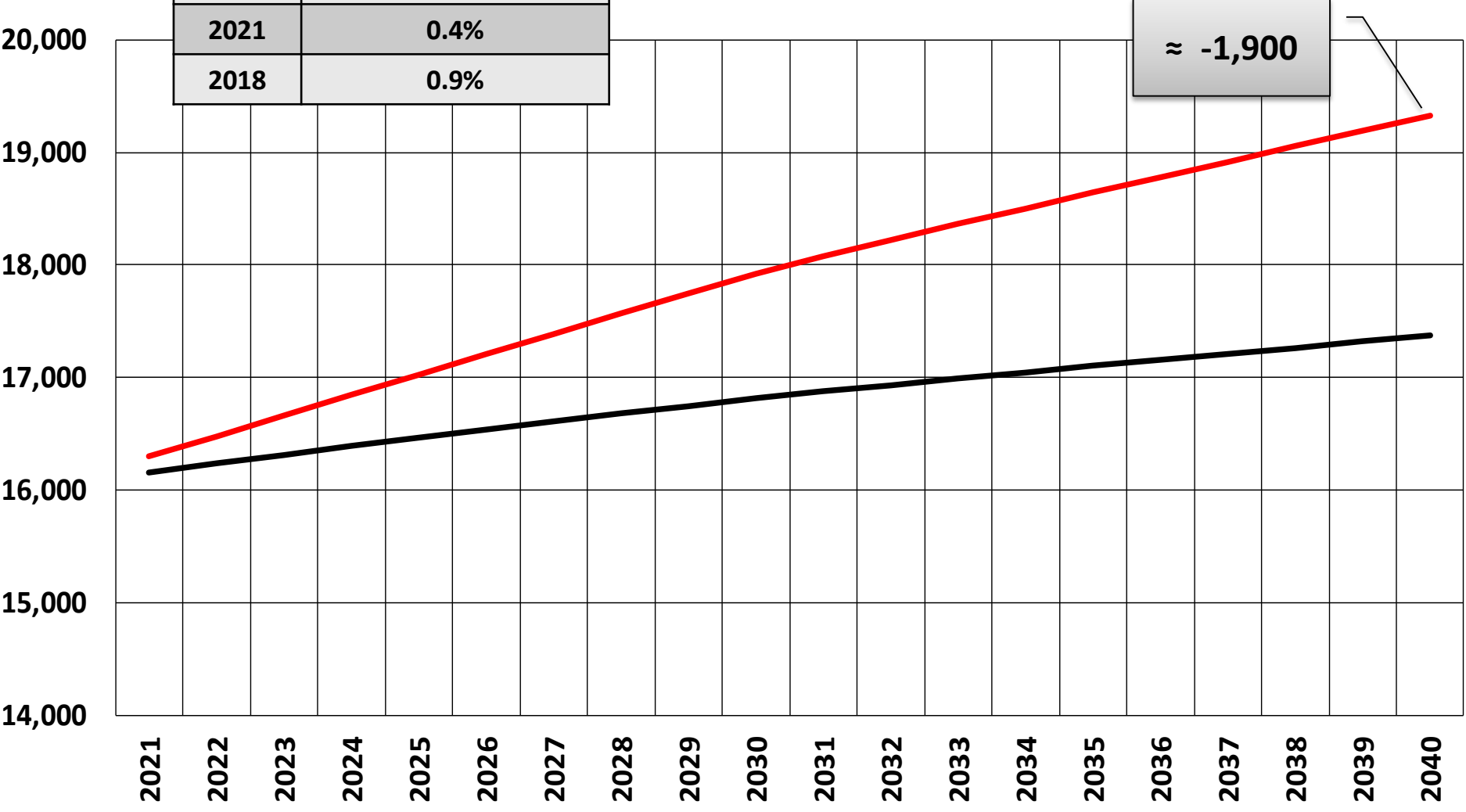
≈ +310



— Medford Base-line 2018 — Medford Base-line 2021

Roseburg, OR Region Firm Customers, 2021-2040 (2018 IRP)

IRP	Avg. Annual Growth 2021-2040
2021	0.4%
2018	0.9%

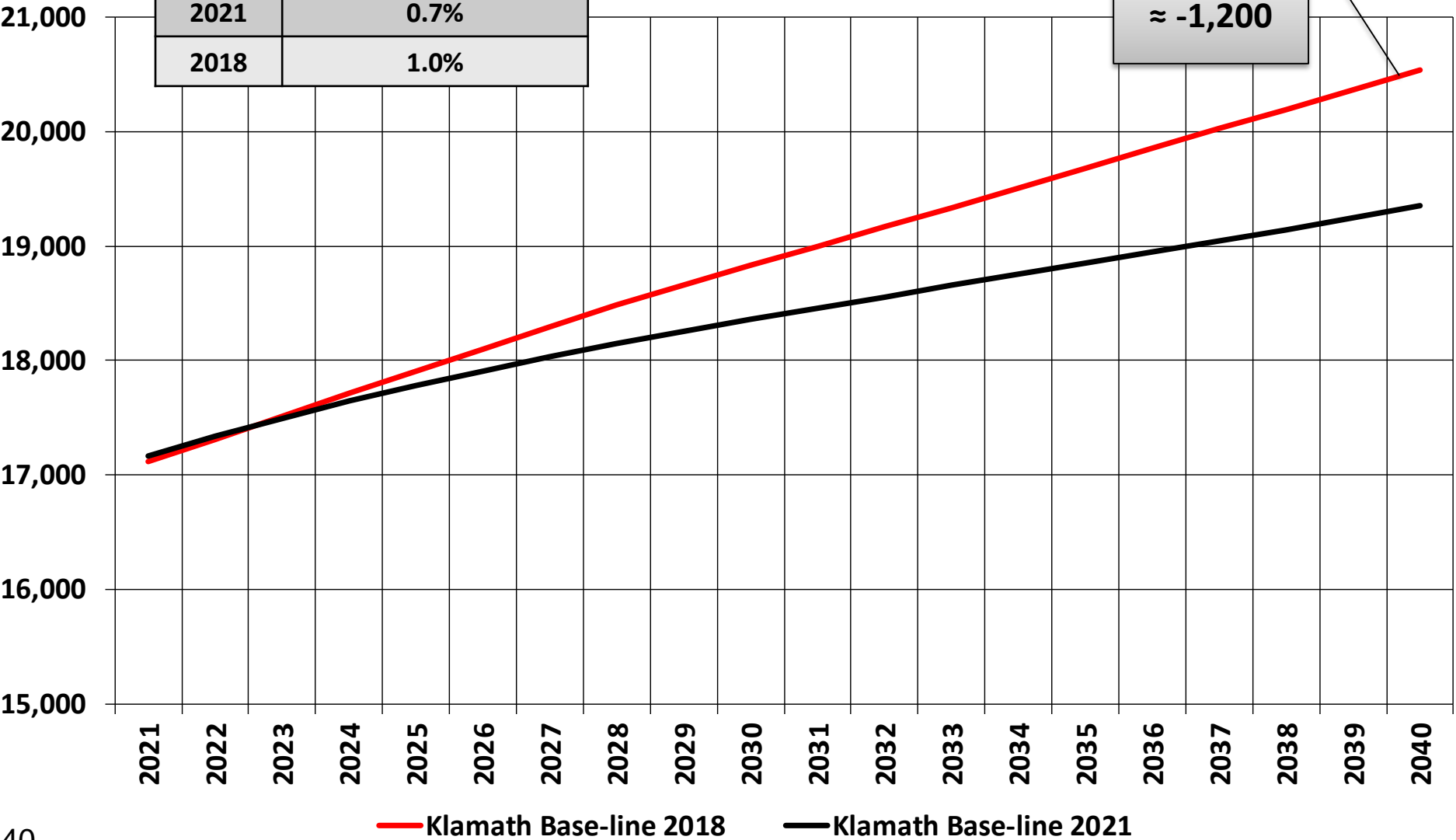


— Roseburg Base-line 2018 — Roseburg Base-line 2021

Klamath, OR Region Firm Customers, 2021-2040 (2018 IRP)

IRP	Avg. Annual Growth 2021-2040
2021	0.7%
2018	1.0%

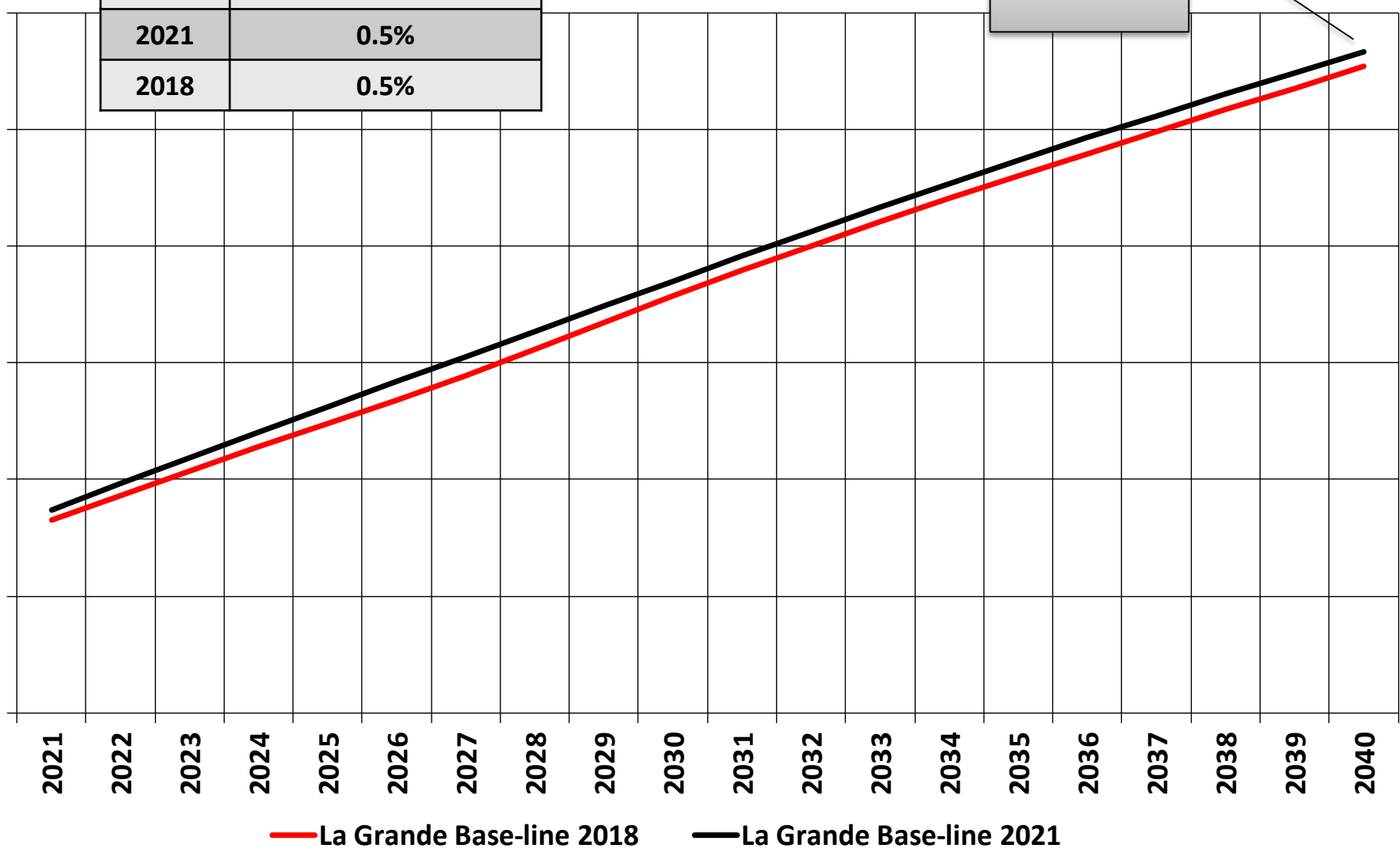
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La Grande, OR Region Firm Customers, 2021-2040 (2018 IRP)

IRP	Avg. Annual Growth 2021-2040
2021	0.5%
2018	0.5%

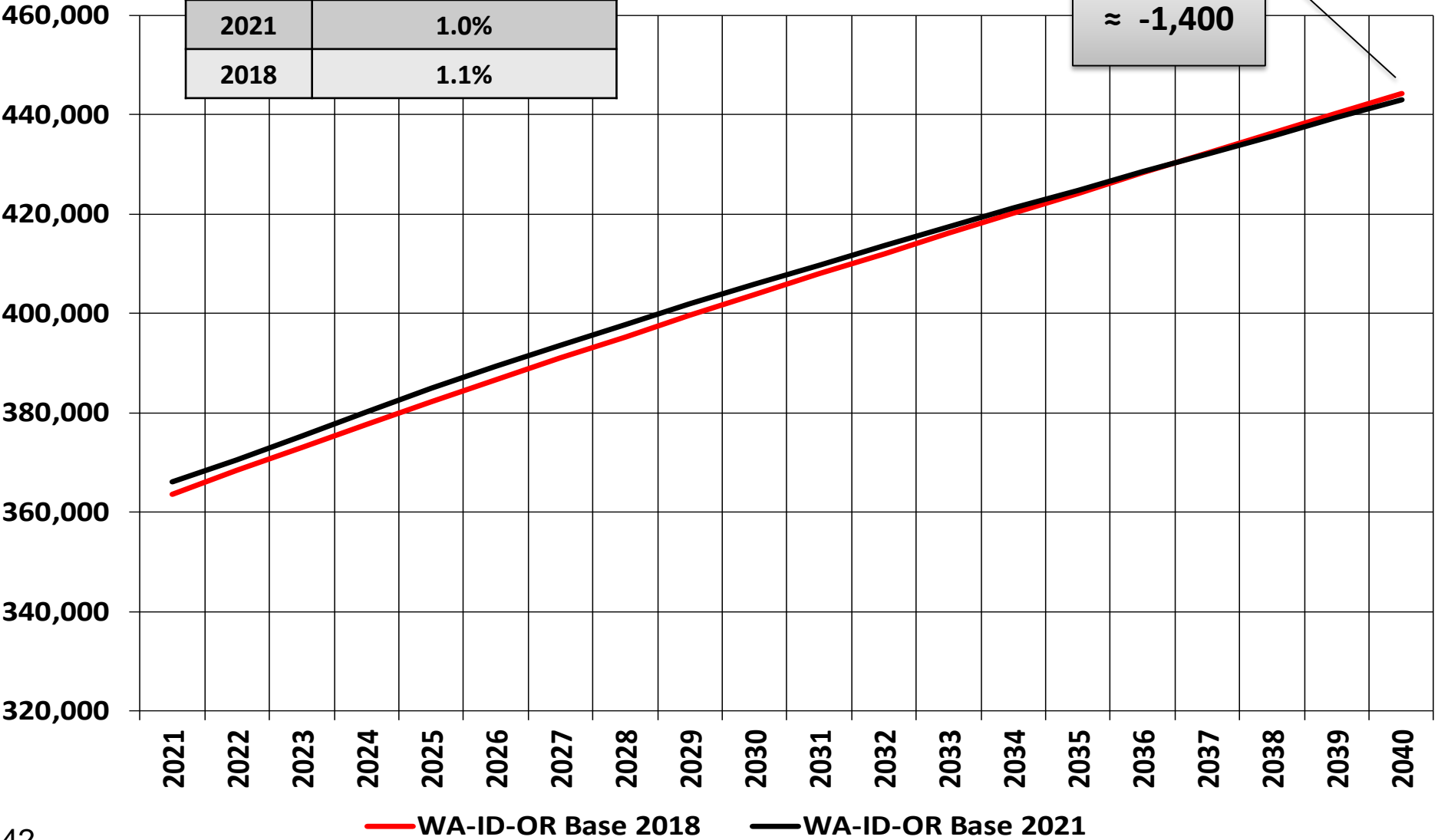
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System Firm Customers, 2021-2040 (2018 IRP)

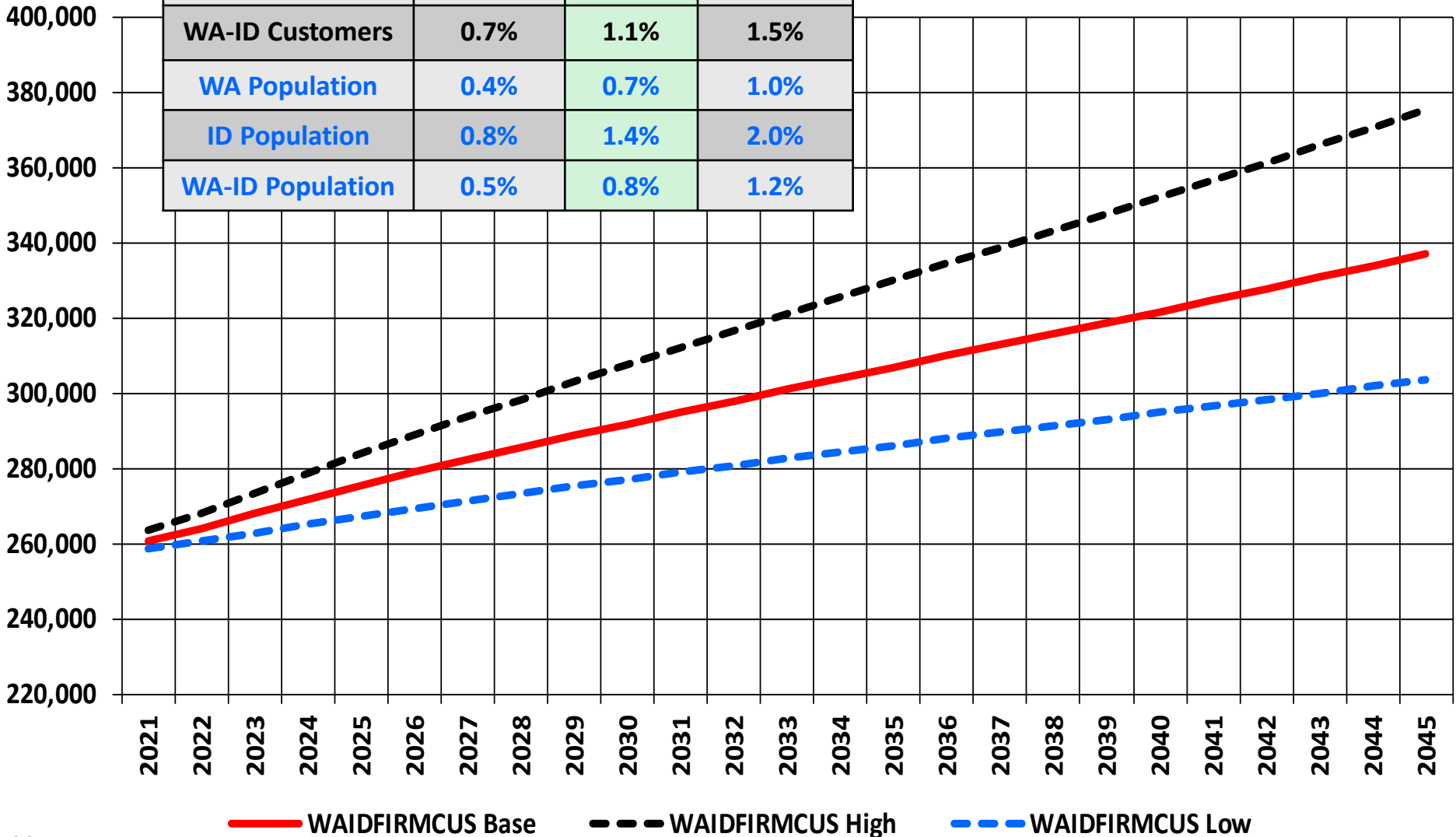
IRP	Avg. Annual Growth 2021-2040
2021	1.0%
2018	1.1%

≈ -1,400



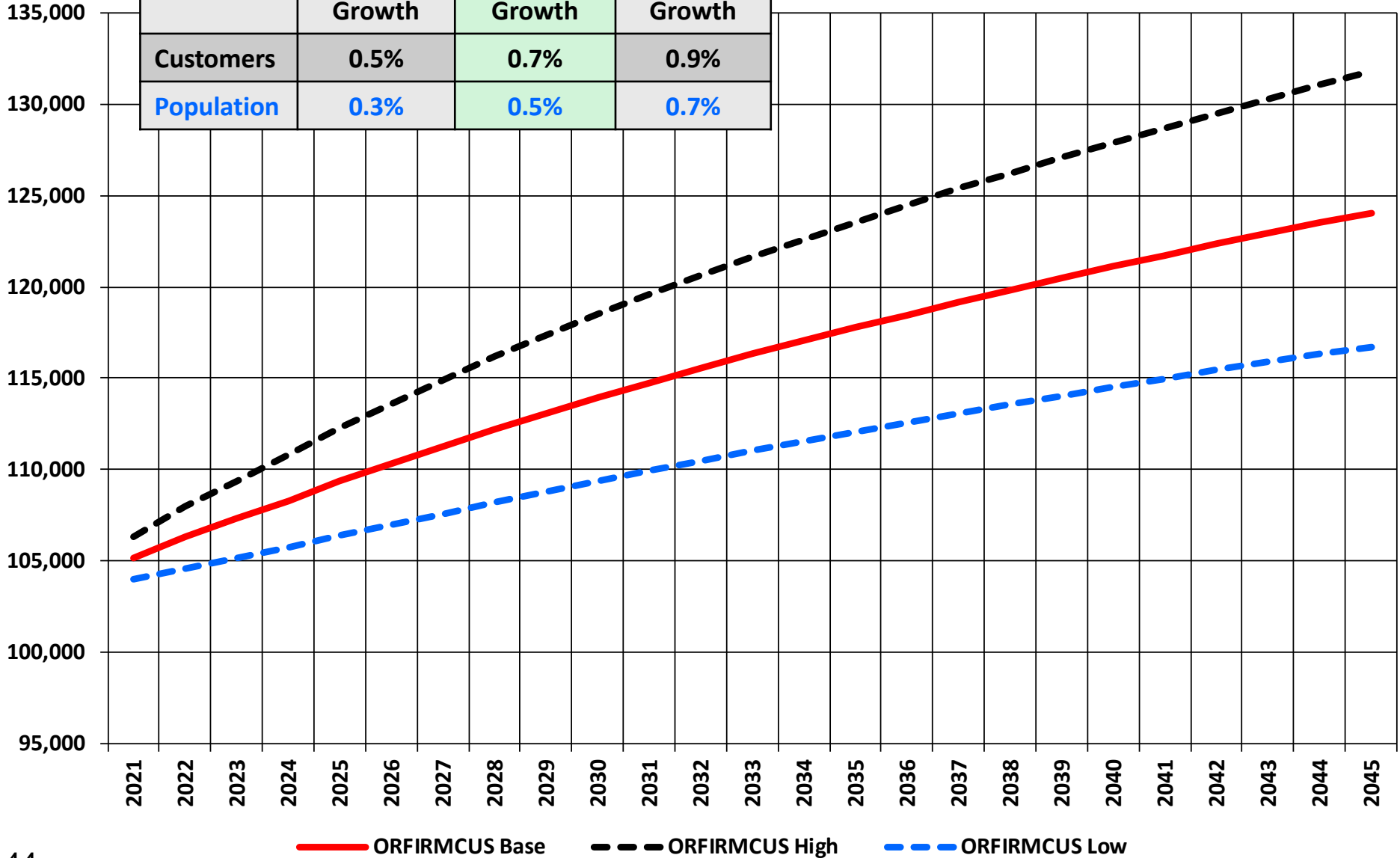
WA-ID Region Firm Customer Range, 2021-2045

Variable	Low Growth	Base Growth	High Growth
WA-ID Customers	0.7%	1.1%	1.5%
WA Population	0.4%	0.7%	1.0%
ID Population	0.8%	1.4%	2.0%
WA-ID Population	0.5%	0.8%	1.2%



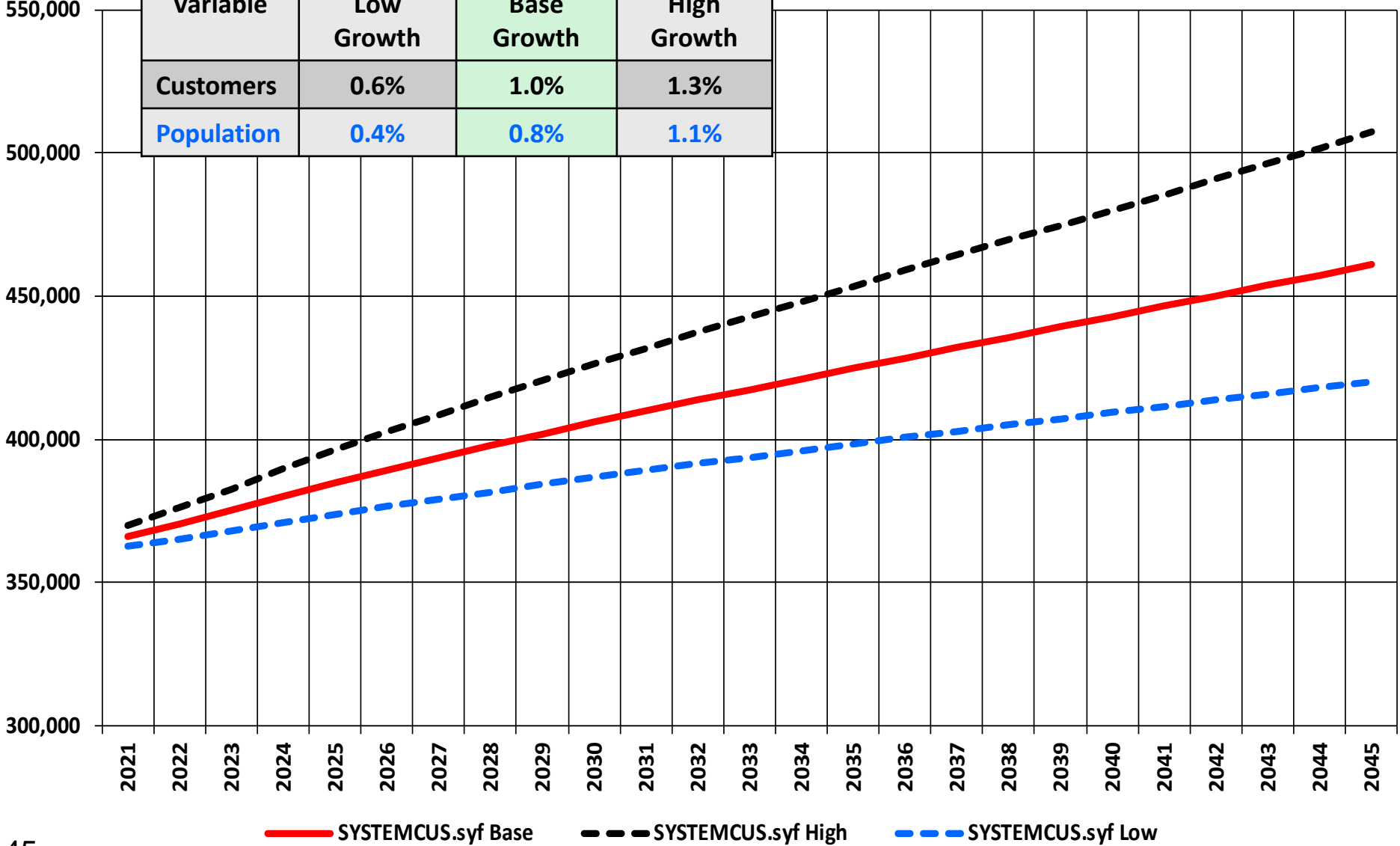
OR Region Firm Customer Range, 2021-2045

Variable	Low Growth	Base Growth	High Growth
Customers	0.5%	0.7%	0.9%
Population	0.3%	0.5%	0.7%



System Firm Customer Range, 2021-2045

Variable	Low Growth	Base Growth	High Growth
Customers	0.6%	1.0%	1.3%
Population	0.4%	0.8%	1.1%



Summary of Growth Rates

System	Base-Case	High	Low
Residential	1.0%	1.4%	0.7%
Commercial	0.5%	0.8%	0.1%
Industrial	-0.8%	2.2%	-3.8%
Total	1.0%	1.3%	0.6%
WA			
System	Base-Case	High	Low
Residential	1.0%	1.3%	0.7%
Commercial	0.4%	0.7%	0.1%
Industrial	-0.8%	1.9%	-3.6%
Total	1.0%	1.3%	0.7%
ID			
System	Base-Case	High	Low
Residential	1.4%	2.0%	0.8%
Commercial	0.4%	1.0%	-0.2%
Industrial	-1.0%	1.8%	-3.4%
Total	1.3%	1.9%	0.7%
OR			
System	Base-Case	High	Low
Residential	0.7%	0.9%	0.5%
Commercial	0.6%	0.8%	0.4%
Industrial	0.0%	4.5%	-10.6%
Total	0.7%	0.9%	0.5%