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

October 8, 2019

MEMORANDUM

TO: **Power Committee**

FROM: **Ben Kujala**

SUBJECT: **Further Detail on Load Forecast**

BACKGROUND:

Presenter: Ben Kujala and Steve Simmons

Summary: At the September meeting, staff presented a proposed load forecast for the 2021 Power Plan. This will be a chance to answer questions raised both at that presentation and any subsequent questions received from the Power Committee Members.

Relevance: The Power Act requires a 20 year load forecast.

Workplan: A.3.1. Develop Base Load Forecast: Price Effects & Frozen Efficiency Forecast for 2021 Power Plan

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Further Detail on Load Forecast

October 15, 2019

Steve Simmons and Ben Kujala

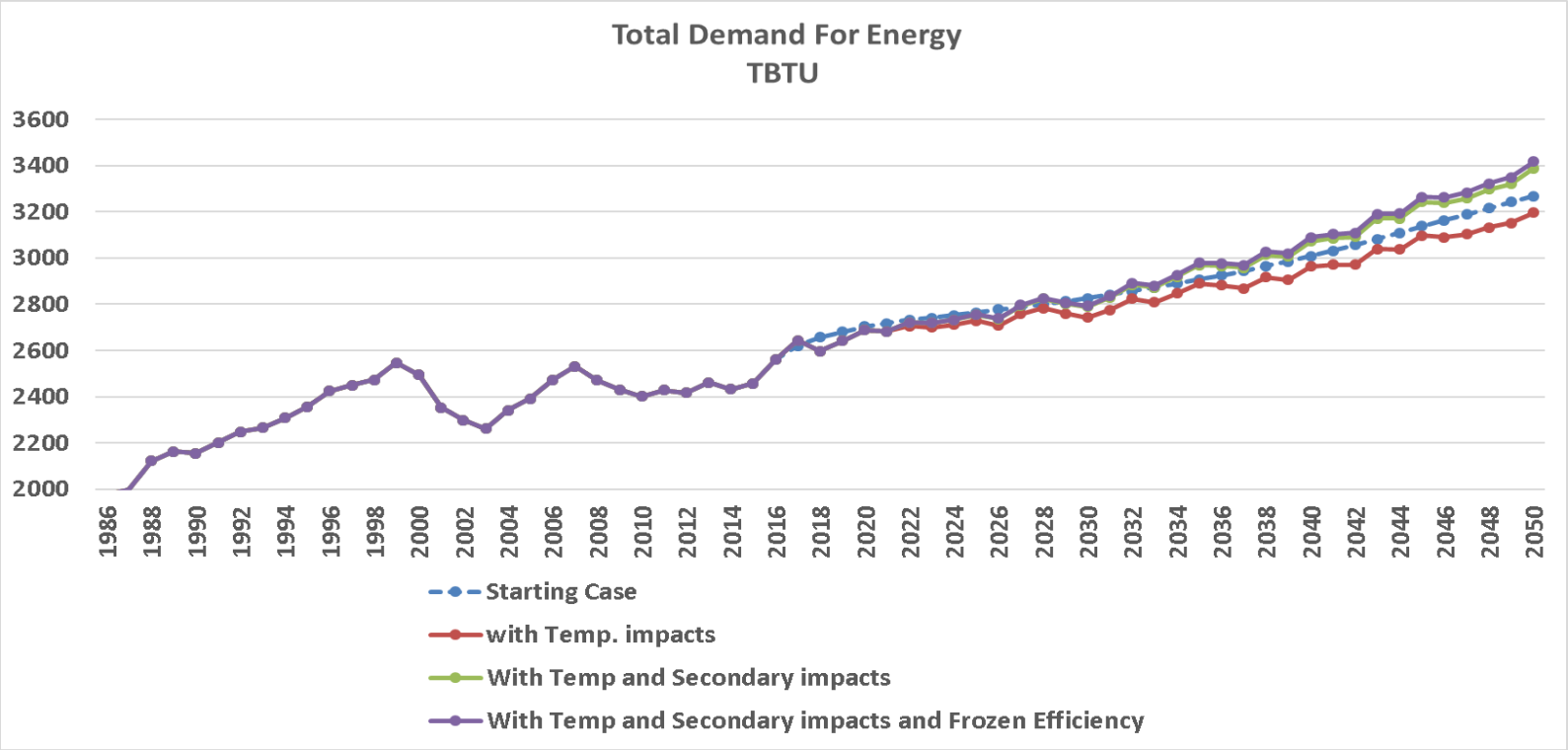
THE 2021
NORTHWEST
POWER PLAN

FOR A SECURE & AFFORDABLE
ENERGY FUTURE

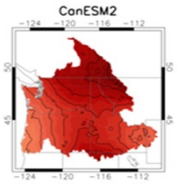
Follow-up on Questions and Concerns

- Population Forecast
- Transportation Forecast – EV penetration
- Behind The Meter Solar
- Review of Load Forecast

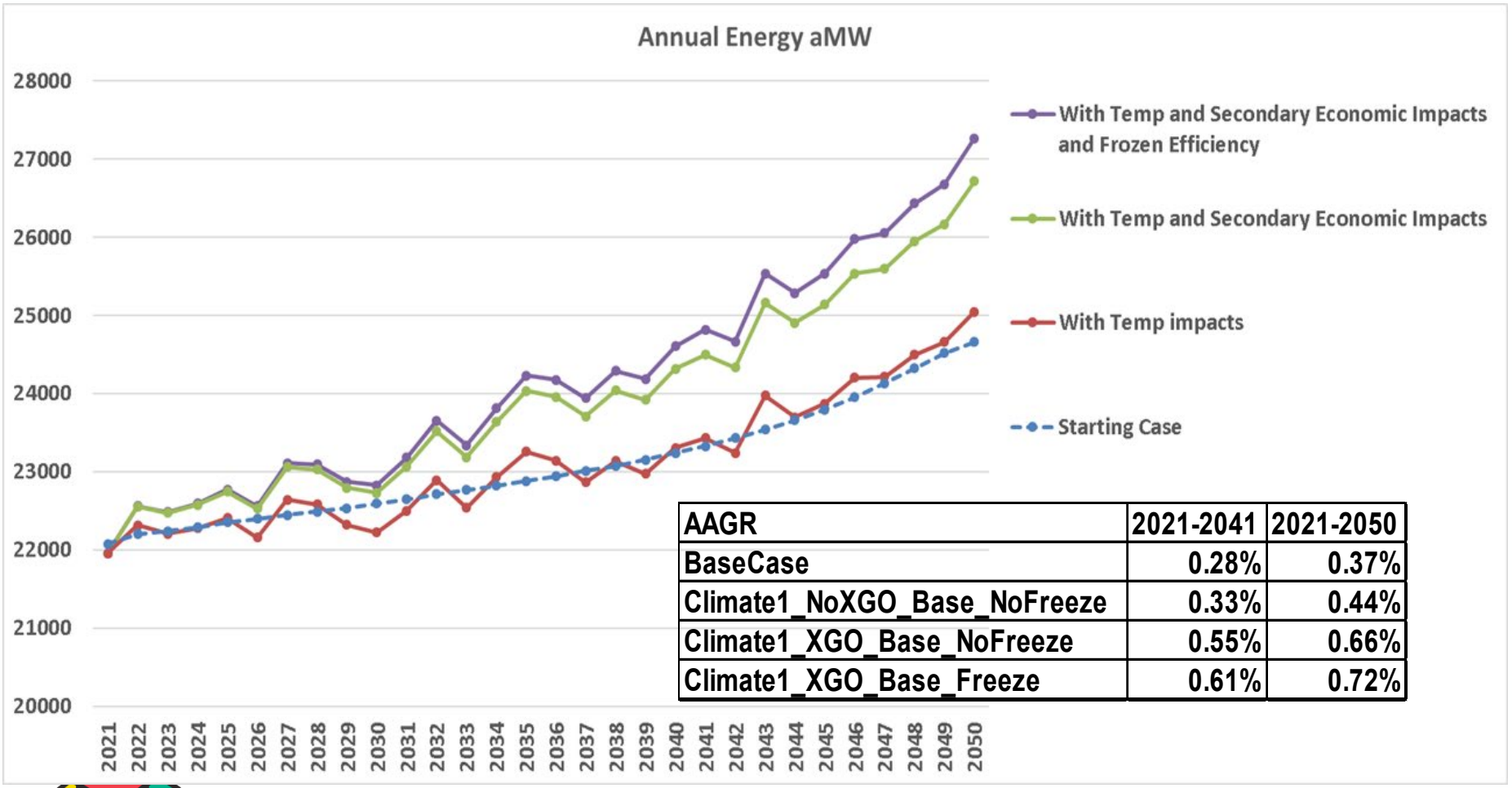
Staff Proposed Load Forecast



Medium Economic Growth and CanESM2 GCM	2000-2021	2021-2041	2041-2050
Starting Case	0.7%	0.55%	0.8%
with Temp. impacts	0.7%	0.51%	0.7%
With Temp and Secondary impacts	0.7%	0.71%	0.9%
With Temp and Secondary impacts and Frozen Efficiency	0.7%	0.73%	1.0%



Energy Load Forecast
medium economic growth and CanESM2 GCM



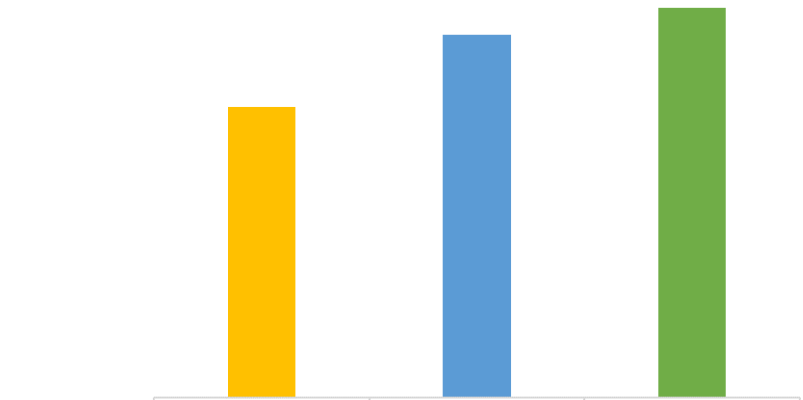
AAGR	2021-2041	2021-2050
BaseCase	0.28%	0.37%
Climate1_NoXGO_Base_NoFreeze	0.33%	0.44%
Climate1_XGO_Base_NoFreeze	0.55%	0.66%
Climate1_XGO_Base_Freeze	0.61%	0.72%

Population

How did we adjust the population?

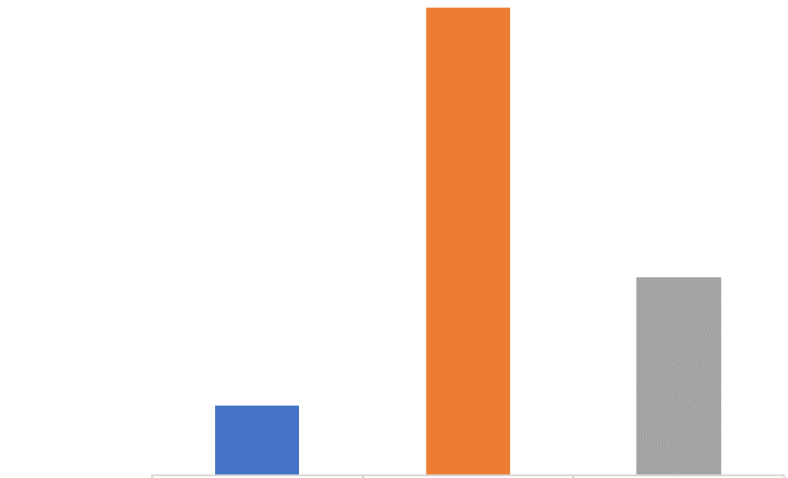
1. Take total population estimate by state
2. Apply state-to-state movement based on ACS data to estimate projected population flows to the Northwest
3. Isolate movement from Midwest and Southern states into the region – look at Global Insight baseline data
4. Project share of forecast 2040 population that would migrate based on climate change (reduce Midwest population consistent with a trajectory of 8.1% less by 2065 and similarly South population consistent with a trajectory of 4.5% less by 2065)
5. Use ACS based movement to proportion the population reduced in the Midwest and the South into the Northwest

Population of the Four Northwest States
Historic & Forecast



	2017	Base Forecast 2050	Base Forecast w/Climate Change Induced Migration 2050
4 State Region	14,366,659	17,959,136	19,285,491

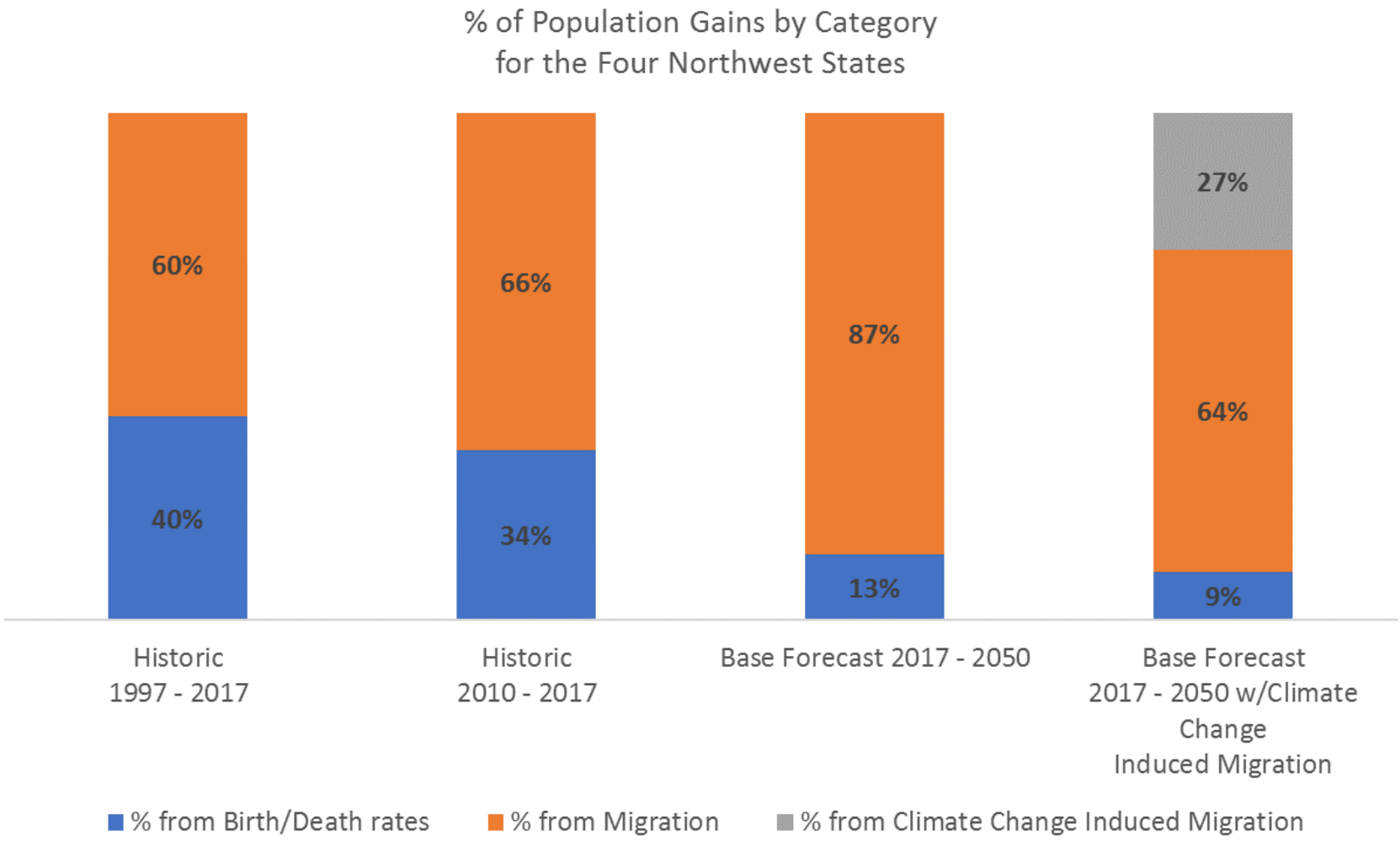
Forecast of Population Gains by Category by 2050
for the Four Northwest States

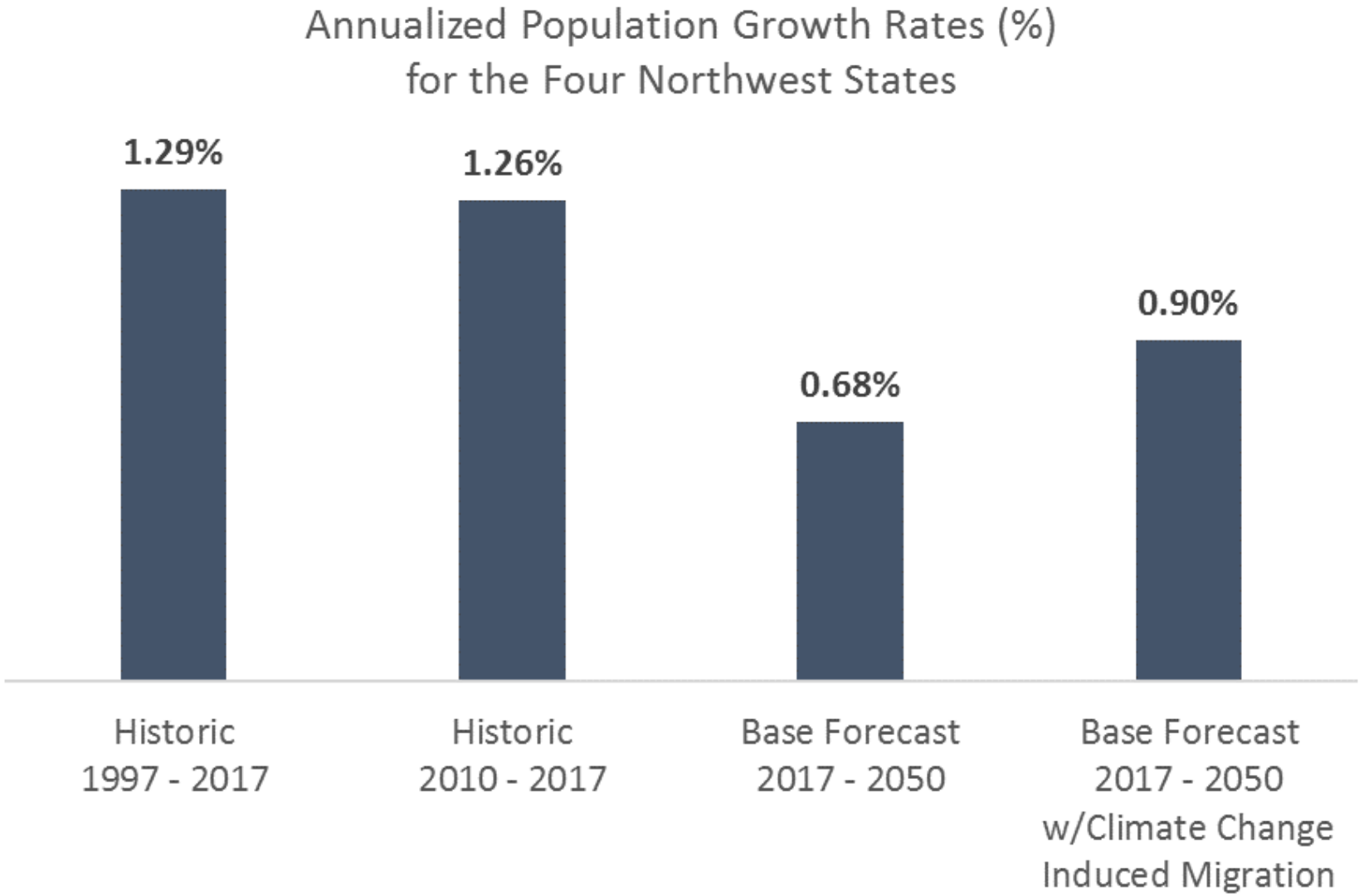


	Gains due to Birth/Death rates	Gains due to Migration	Gains due to climate change induced in-migration
4 State Region	464,669	3,127,808	1,326,355

By 2050 the base forecast projects a 25% growth in population from 2017

With additional climate change in-migration – the growth from 2017 is 34 %


% of Population Gains by Category
for the Four Northwest States
60%
40%
66%
34%
87%
13%
27%
64%
9%
Historic
1997 - 2017
Historic
2010 - 2017
Base Forecast 2017 - 2050
Base Forecast
2017 - 2050 w/Climate
Change
Induced Migration
% from Birth/Death rates
% from Migration
% from Climate Change Induced Migration


Annualized Population Growth Rates (%)
for the Four Northwest States
1.29%
1.26%
0.68%
0.90%
Historic
1997 - 2017
Historic
2010 - 2017
Base Forecast
2017 - 2050
Base Forecast
2017 - 2050
w/Climate Change
Induced Migration

Behind the Meter Solar Forecast

Summary

1. Costs of installing behind the meter solar (i.e. distributed solar, rooftop PV,…) systems have dropped significantly, and are expected to continue declining
2. Installed capacity of behind the meter solar in the residential, commercial and industrial sectors has been growing recently in the Northwest –though it is a relatively new phenomena
3. Our load forecast reflects this growth and expects this trend to continue

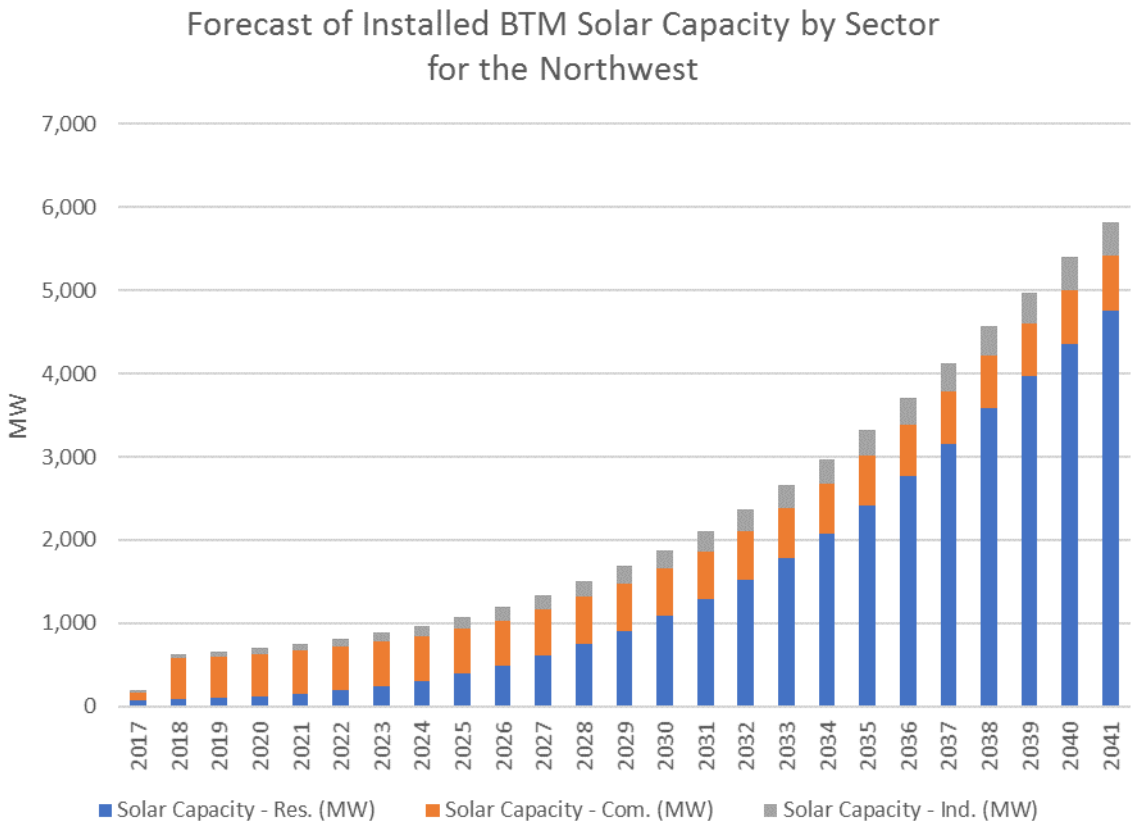
Key assumptions that inform our forecast

1. We rely on historic data time series for generation and capacity from the US Energy Information Administration (EIA)
    1. State Energy Data System (SEDS)
    2. EIA 861 report and related data query tools
2. We rely on our internal generating resource expertise to estimate behind the meter solar costs – both historic; and a forecast of future costs
3. We developed a suite of solar profiles (hourly rooftop generation) across 60 geographic sites in the Northwest – by running the National Renewable Energy Lab (NREL) System Advisory Model

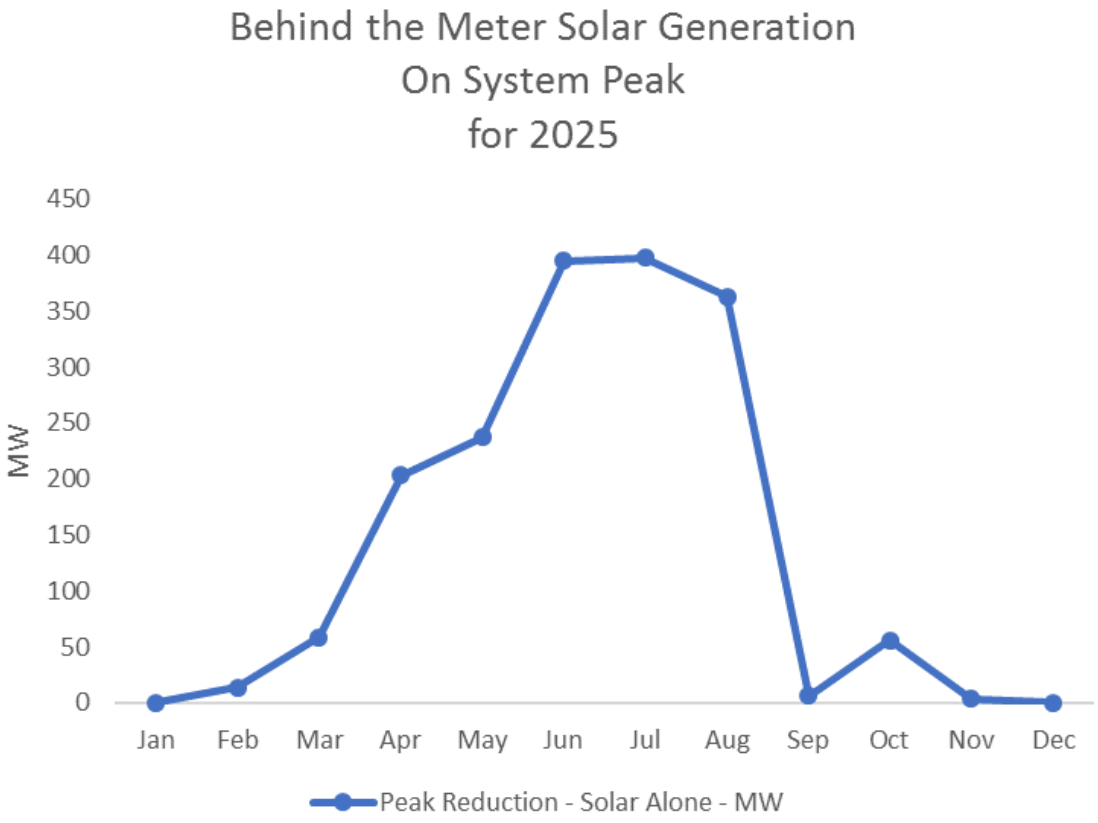
Forecast mechanics

1. Energy2020 (Load Forecasting Tool) – uses historic information to calibrate consumer choice parameters
   a. Installed capacity (and generation)
   b. Solar costs
2. Moving forward - our forecast of solar costs & retail electricity rates – along with solar generation profiles – inform the future consumer choices
3. The forecast of capacity from behind the meter solar – is classified as "Cogen" in the forecast model – and reduces the overall load forecast and affects:
   a. Energy (aMW)
   b. Peak (MW)

Forecast model is showing strong growth in solar capacity over time – especially in residential rooftop



Year	Capacity (MW)	Annual Energy (aMW)
2025	1,072	175
2035	3,330	595
2041	5,820	1032



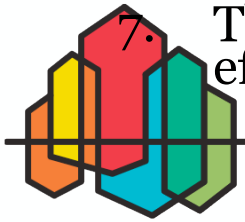
Much of solar generation is during the spring and summer months

Solar generation profiles are superimposed on the system load profile to estimate peak load reductions – which primarily occur in late afternoon in the summer

Transportation Forecast

Summary

1. Electric passenger vehicles are relatively new to the Northwest and the load forecast
2. Sales of electric vehicles began around 2011 – and have been growing – in 2017 there were around 11,500 new electric vehicle sales – which corresponds to a 1.9% market share of sales
3. We forecast growth in overall vehicle sales, and in electric vehicle sales – with electric gaining market share from gasoline vehicles – resulting in electrical load growth
4. Passenger vehicle stock has a slow turnover rate – limiting the velocity that electric vehicles can gain market share
5. With limited initial data – load profiles for electric vehicles exhibit a sharp late afternoon peak –as commuters arrive home and plug-in for the next day
6. Electric vehicles tend to have slightly higher capital costs than gasoline counterparts, but have much better operating efficiency
7. The overall vehicle fleet – all technologies - is becoming more efficient over time



Key assumptions that inform our forecast

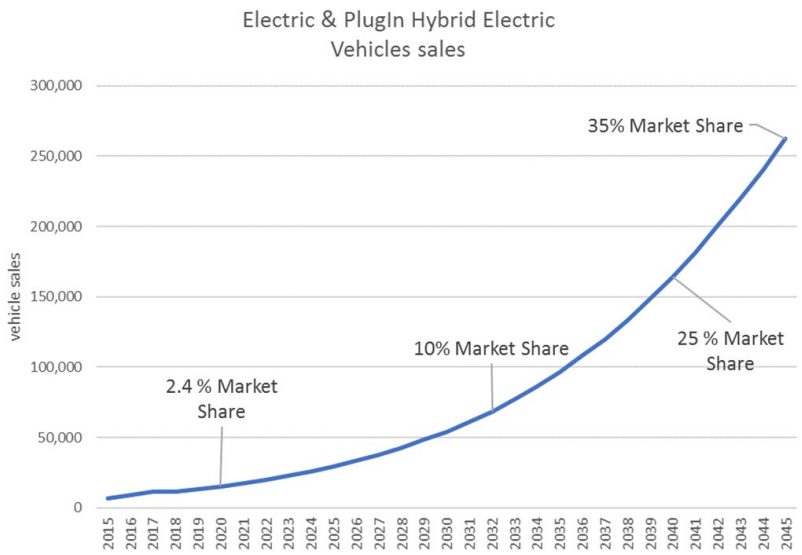
1. Growth in energy demand for transportation driven from our economic forecast from IHS-Global Insights population growth
2. Vehicle capital cost estimates by technology from EIA Annual Energy Outlook (AEO)

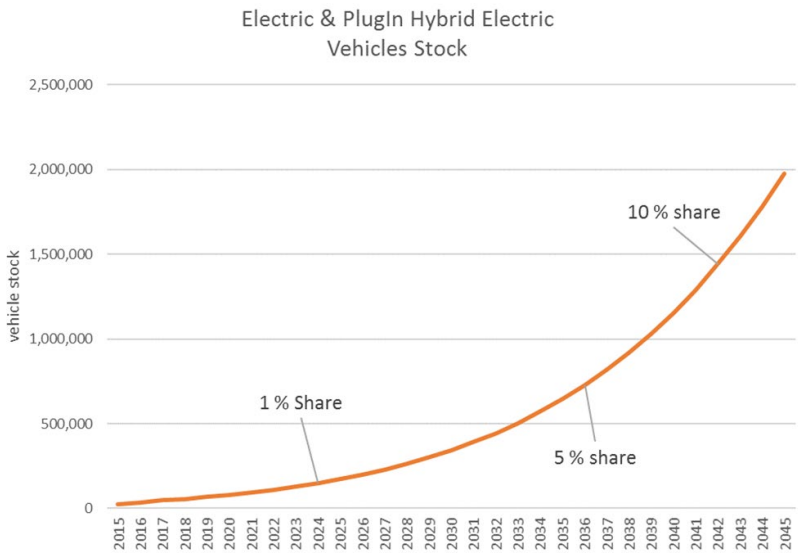
   * Note: we will be making adjustments downward – current electric vehicle capital costs in the model are weighted heavily towards high end models such as Telsa – which are significantly more expensive than the typical gasoline car on the market. More lower price electric models will be coming on the market
3. Fuel prices including retail $/gal gasoline (from EIA AEO), and our retail electric price
4. New vehicle efficiency – mpg – based on federal Café standards
5. Vehicle Stock turnover rate – using an average vehicle life span of around 17 years – but this may be adjusted
6. Charging profiles were developed based on a raw data from an Avista Electric Vehicle Supply Equipment pilot

Forecast mechanics

1. Energy2020 (Load Forecasting Tool) – uses historic information to calibrate consumer choice parameters
   a. Historic demand for electric vehicles over time relative to other technologies
   b. Capital and operating costs of electric vehicles relative to other technologies
   c. Very limited history with electric vehicles
2. Moving forward – the growth in transportation demand is estimated from population growth, vehicle stock retirement, and vehicle efficiency
3. The market share of electric vehicles results from past preferences, adjustments, and future costs
4. The demand for electricity from vehicles is new load growth which affects
   a. Energy (aMW)
   b. Peak (MW)

Draft Forecast -subject to change

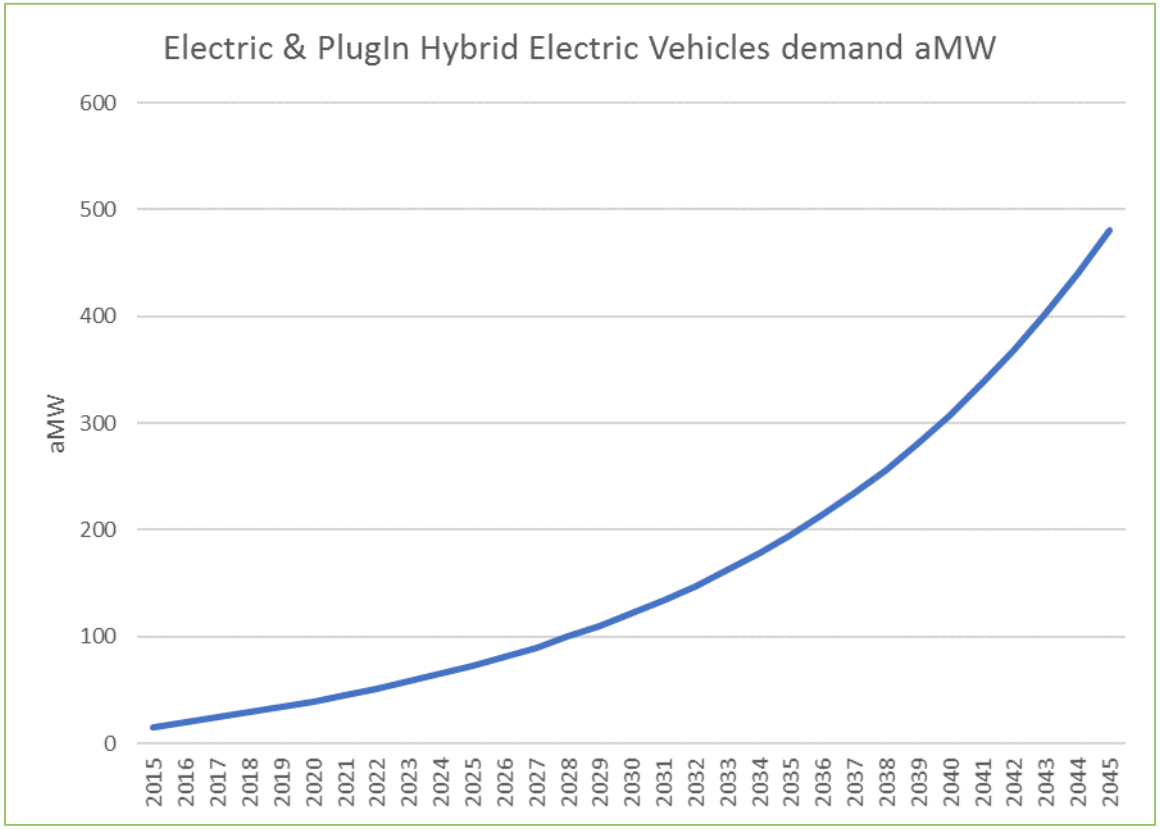




Electricity Demand – annual aMW

Cars and light duty trucks
Battery Electric (BEV) and Plug In Hybrid Electric (PHEV)

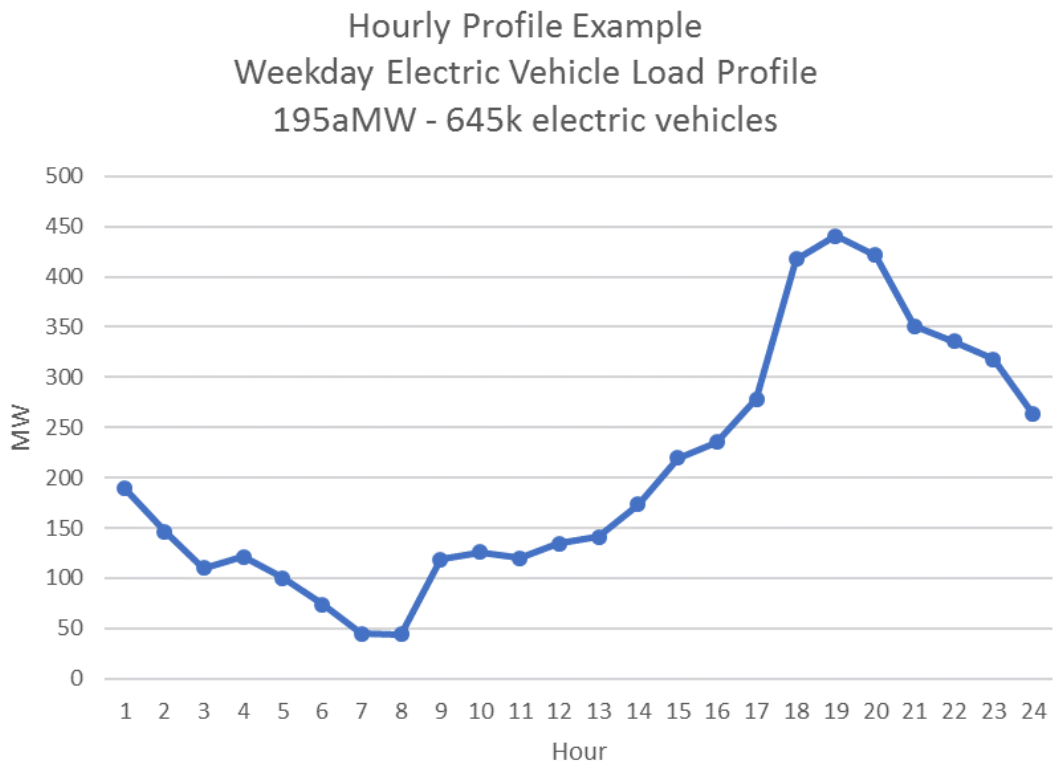
Draft Forecast -subject to change



Annual electricity consumption per electric vehicle in stock declines over time - the average is around 2,800 kWh per vehicle per year

Electricity Demand – load profile for electric vehicles

Draft Forecast -subject to change



Current load profiles indicate a large late afternoon peak – this assumes mostly home charging.

As charging stations are added to workplace and retail locations – profile is expected to level out, along with utilty programs to incent smart charging