2022 Integrated Resource Plan

Building the Long-Term Plan

SCL Team and IRP Advisory Group

Seattle City Light

WE POWER SEATTLE

Today's Presenters, Contributors and Sponsors

Name	Title	Business Unit/ Organization
Ronda Strauch	Climate Change Research and Adaptation Advisor/ Science Policy	Environment, Land and Licensing
Guillaume Mauger	Research Scientist	UW Climate Impacts Group
John Rudolph	Principal Economist/ Financial Planning	Finance
Paul Nissley	Data Scientist/Resource Planning Forecasting & Analysis	Energy Innovation And Resources
Aliza Seelig	Manager, Resource Planning Forecasting & Analysis	Energy Innovation And Resources
Saul Villarreal	Data Scientist/Resource Planning Forecasting & Analysis	Energy Innovation And Resources
Stefanie Johnson	Strategic Advisor/ Electrification & Strategic Technology	Energy Innovation And Resources
David Logsdon	Director, Electrification & Strategic Technology	Energy Innovation And Resources
Emeka Anyanwu	Officer, Energy Innovation and Resources	Energy Innovation And Resources

Building the 2022 IRP: Agenda

- Welcome
- What we need to accomplish
- Resource Adequacy Refresher
- Climate Change and Electrification analysis
- EPRI Electrification Study
- Next 8 months

What we need to accomplish

Today:

- Develop insights from climate change and electrification scenario analysis
- Collect technical questions for follow up outside of today's meeting
- Level set about the need to complete analysis by March 2022 for finalizing the IRP product

For IRP completion:

- Establish regular meeting engagement
- Partner and agree on steps to IRP completion
- Support a community developed clean energy action plan

Resource Adequacy Needs

Building the 2022 IRP

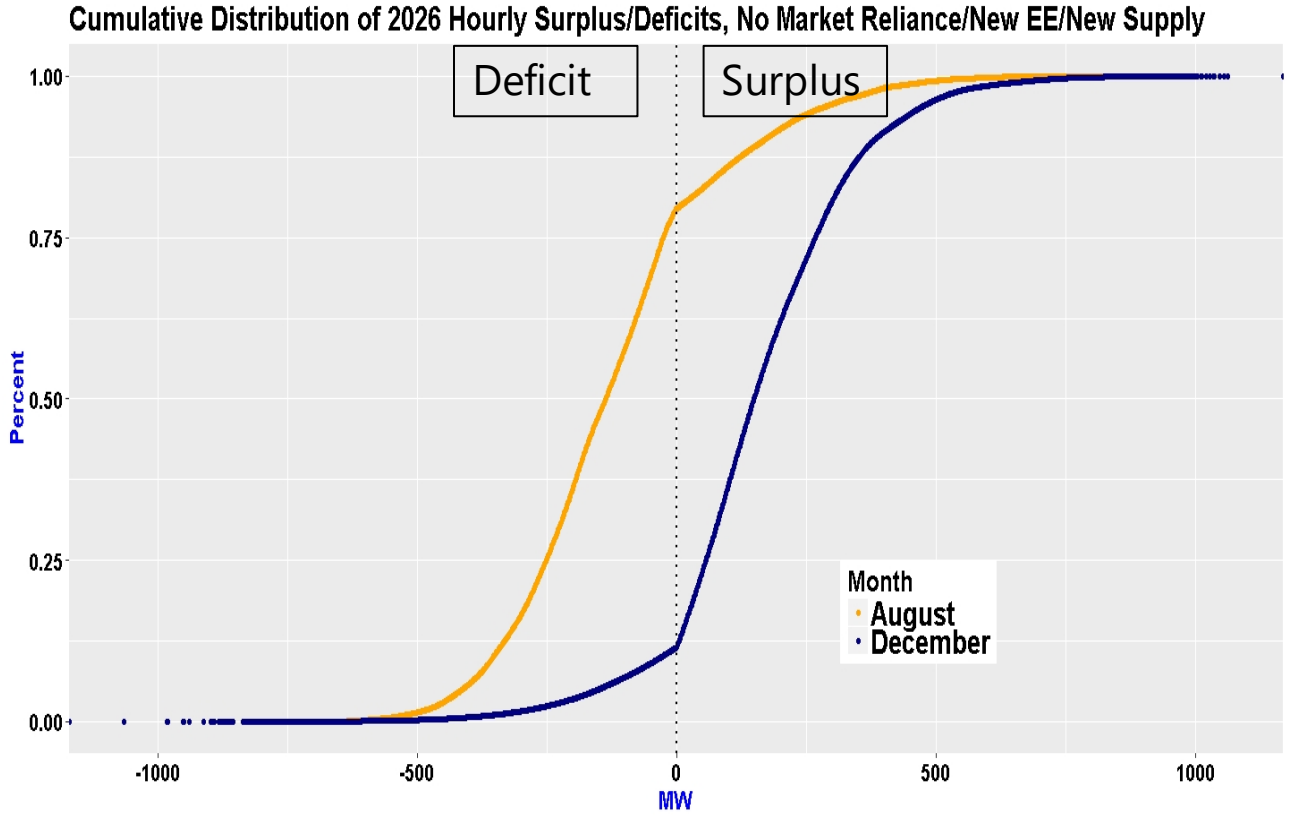
Seattle City Light

WE POWER SEATTLE

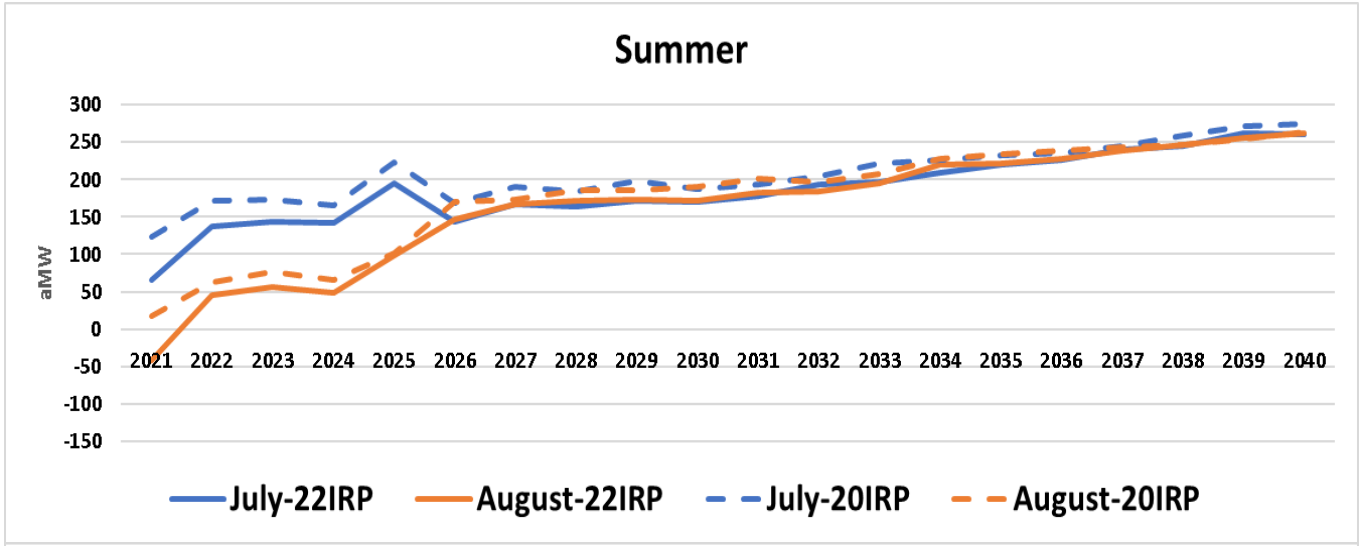
Resource Adequacy Needs Refresher

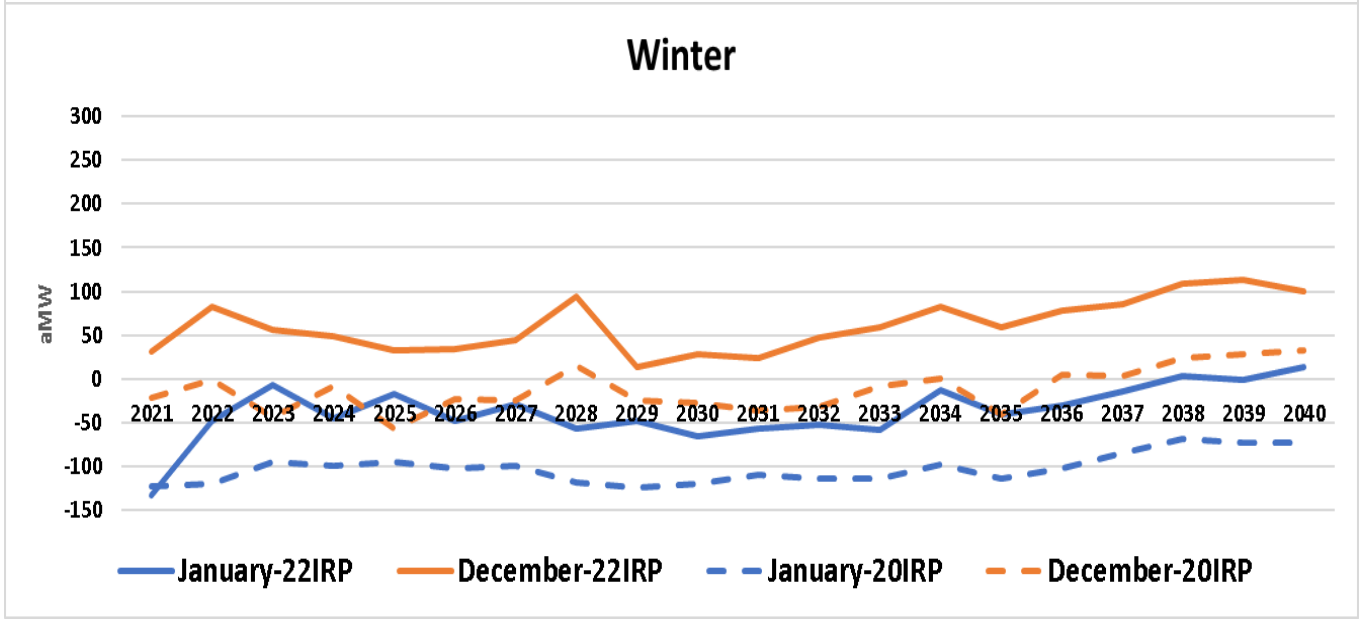
SCL's 2020 IRP established resource adequacy metric and standard are:

- A probabilistic energy adequacy model,
- Simulates future hourly load and hydro conditions using historical temperatures and hydro inflows,
- Looks at seasonal RA needs (July/August for Summer, December/January for Winter),
- Risk metric used is Loss of Load Events or LOLEV:
  - Target LOLEV = 0.2 events/year for the month
  - Market reliance= 200 aMW



Baseline Long-term Resource Adequacy need begins in 2026 as established in the 2020 IRP





RA needs for LOLEV =0.2
Market Reliance=200aMW
No new energy efficiency
No new supply

Key Conclusions compared to 2020 IRP Progress Report

- No significant changes in summer needs
- Winter needs are higher due to new load forecast and additional electrification from new codes and faster EV growth

IRP Climate Change and Electrification Resource Adequacy Impacts Review

Building the 2022 IRP

Seattle City Light

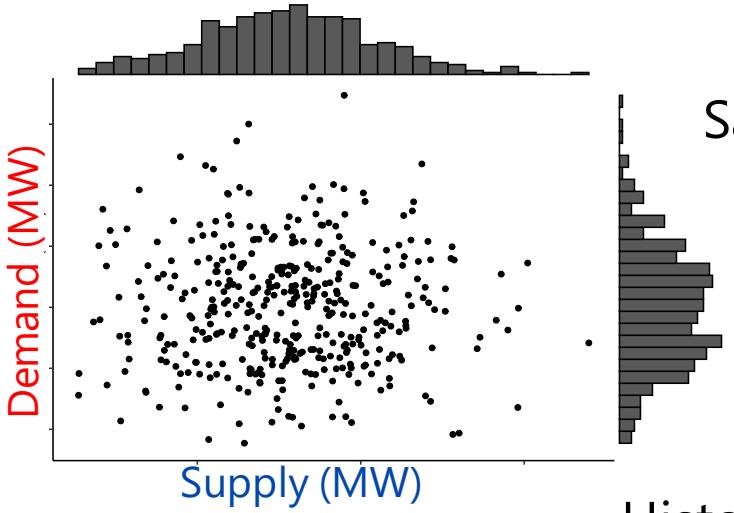
How were climate models selected?

+ **Criteria** for Global Climate Models(GCMs) selection:
  1. **Consistent GCMs** across SeaTac temperature and Skagit and Boundary stream flows
  2. Capture **warming trends** in average temperature/hydro conditions, as well as **extremes** temps/hydro conditions relative to history*

+ **Two GCMs** that meet these criteria:
  1. **CanESM2**: Skagit wetter in Winter/Spring and Drier Summer/Fall, Boundary wetter in 1st half of calendar year, Warmer Winters, Large extreme temperatures (winter and summer)
  2. **CCSM4**: Skagit drier overall, Boundary wetter in 1st half of calendar year, more February cold events

*Implemented a scoring method to capture variations. Other GCMS were considered but did not meet criteria.

Climate Change and RA Forecast Years



Sample for Simulations

Calculate RA Metrics

Today

IRP Planning Period

2022 - 2041

RA Forecast Year

2026

2017 - 2036

2030

2021 - 2040

2040

2031 - 2050

Historical Period

Load

1990 - 2019

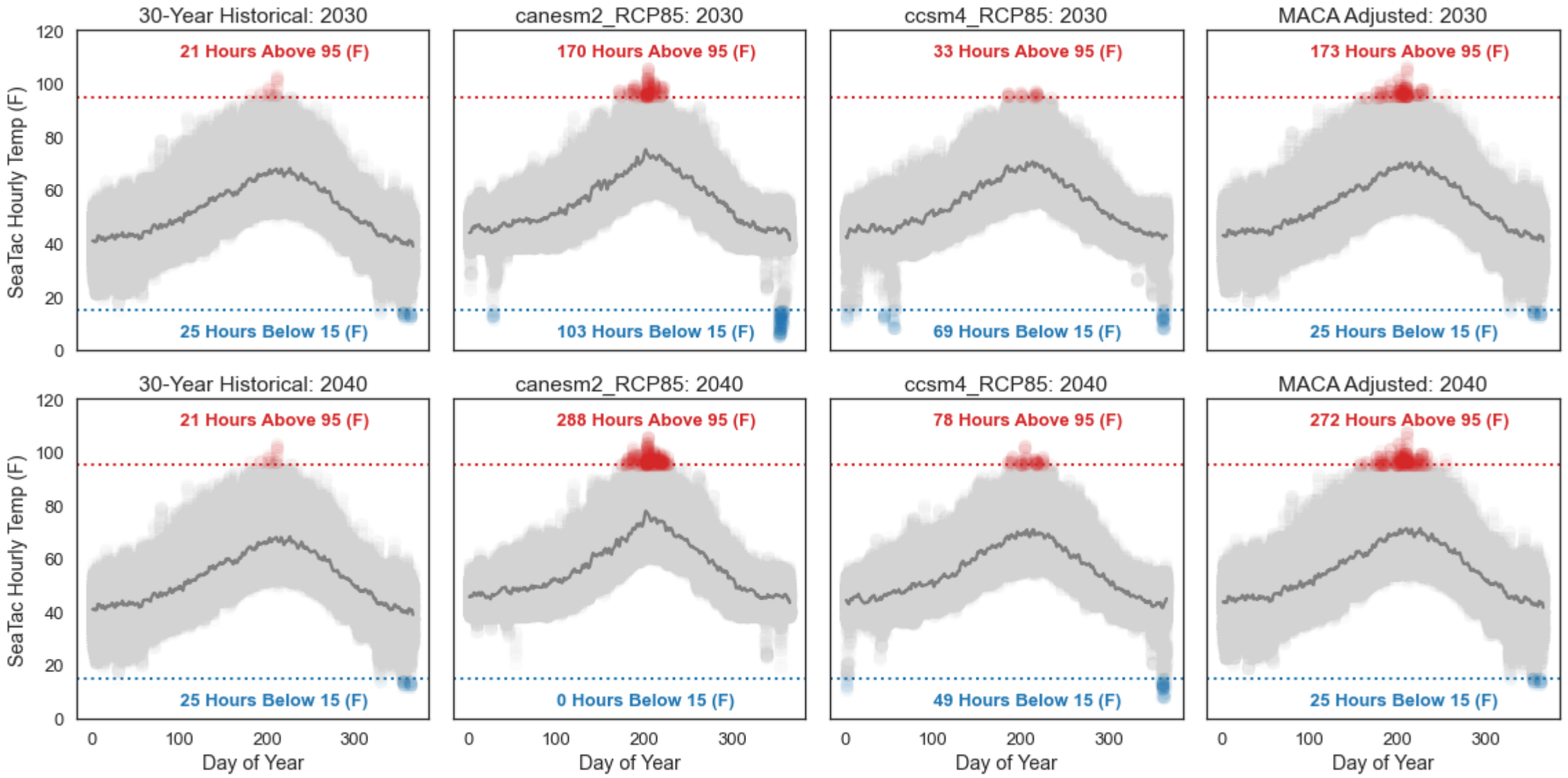
Hydro

1981 - 2019

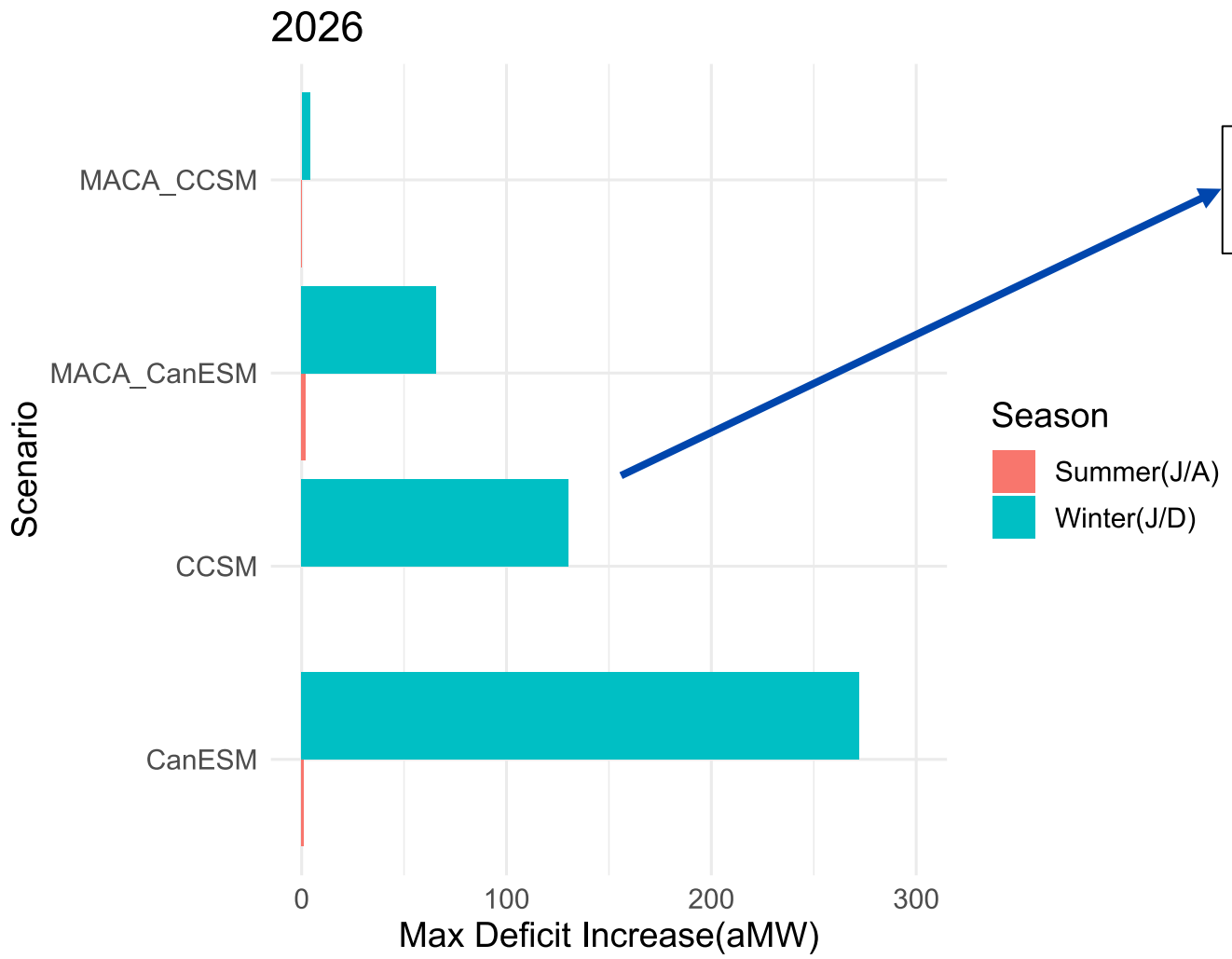
1980s | 1990s | 2000s | 2010s | 2020s | 2030s | 2040s

Time

Temperature Extremes in Climate Change Models



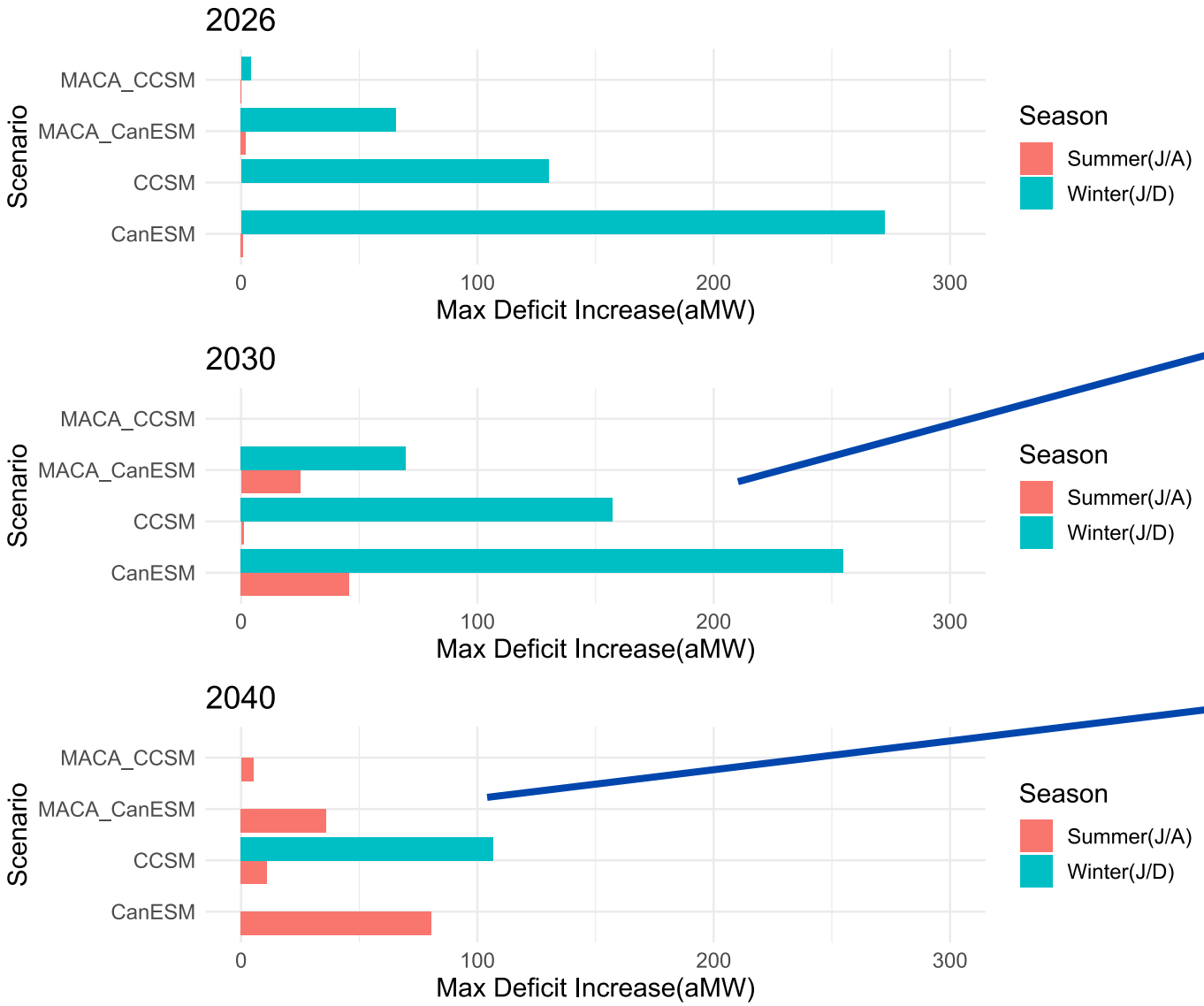
Increase in Resource Adequacy Need Compared to Baseline Scenario



Climate Change models showing more need in the winter

Cold bias significantly contributing to this need

Resource Adequacy Need Across Multiple Years

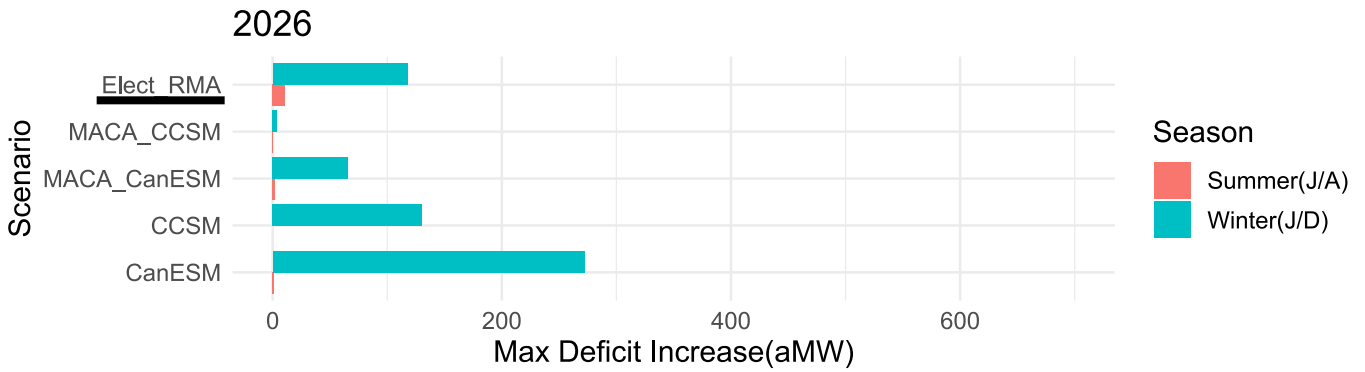


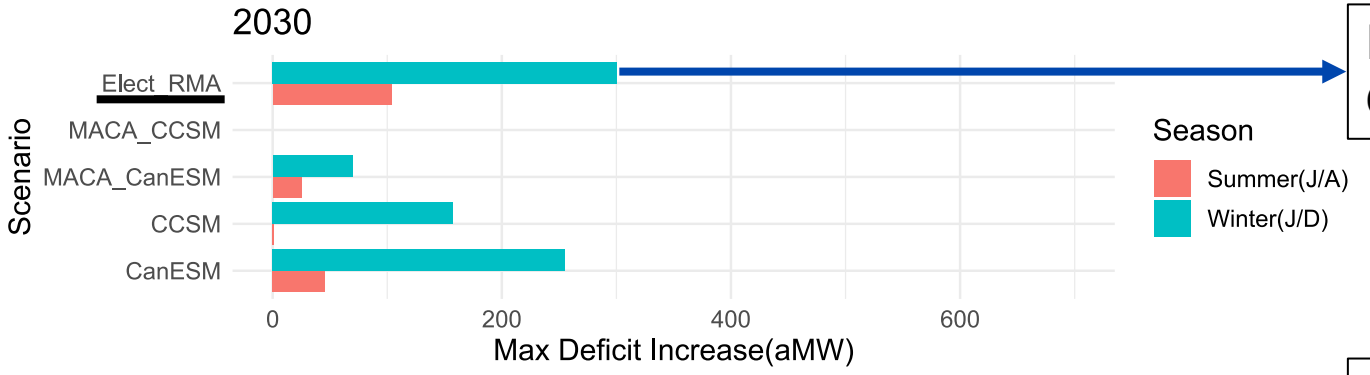
Climate Change winter needs still big in 2030

Climate change summer needs growing compared to baseline over time

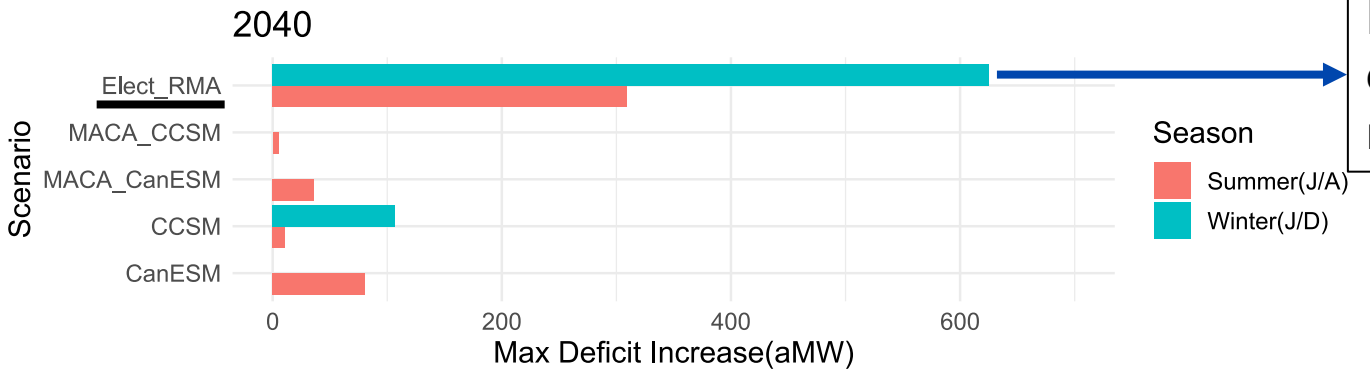
Cold bias is less significant by 2040

Including Resource Adequacy Need For Rapid Market Advancement Electrification Scenario





Electrification need higher than Climate Change models in winter



Electrification has “big” need in the winter compared to baseline and climate change models

Analysis shows electrification driving resource adequacy needs more than climate change

- Climate change is happening, but climate change scenario bookends present mixed signals (cold bias is a concern)
- Electrification may present more consequential resource needs: transportation across both summer and winter and buildings driving increased winter needs
- Electrification policy and technology drive timing and magnitude of resource adequacy need impacts.
- Portfolio analysis to come will support identifying information for partnering with customers, policy makers and stakeholders on electrification pace and solutions

Electrification Assessment

Building the 2022 IRP

Seattle City Light

SCL EPRI Electrification Assessment

Electric Power Research Institute
Seattle City Light

PM EPRI: Jamie Dunckley
PM SCL: Stefanie Johnson

Motivation and Scope

What are the high-level impacts of electrification to SCL's service territory?

<u>What is included in the Electrification Assessment?:</u>

- Scenario analysis to determine the energy and capacity needed for the electrification of:
  - Buildings
  - Transportation
  - Commercial and Industrial applications
- Analysis of SCL's current grid load and grid capacity,

Also:

- High-level overview of potential for flexibility of new electric loads due to technology advances, &
- Potential strategies to help tackle electrification adoption challenges.

<u>What is NOT included in the Electrification Assessment:</u>

- Conservation/energy efficiency (SCL does this in its Conservation Potential Assessment)
- Transmission system-level analysis and bulk resource needs
- Cost
- Climate change

Key Insights:

- Electrification provides a path to meet the City's climate goals.

- Electrification will increase SCL's load; impact to the distribution grid will vary based on time and location.
  - Without any energy efficiency or peak mitigation strategies, system peaks (driven primarily by changes in space heating, space cooling, and water heating consumption) are expected to increase significantly.

- This analysis is the beginning of a larger undertaking to understand how to plan for a decarbonized future.
  - Incorporate findings into our other planning processes.
  - "Phase 2" analysis for load forecasting, grid analysis, and medium duty/heavy duty EV fleet analysis.
  - Create and adopt new tools to meet changing circumstances, i.e. incorporating flexible loads, storage, demand response, identifying areas we can update our approaches, etc.

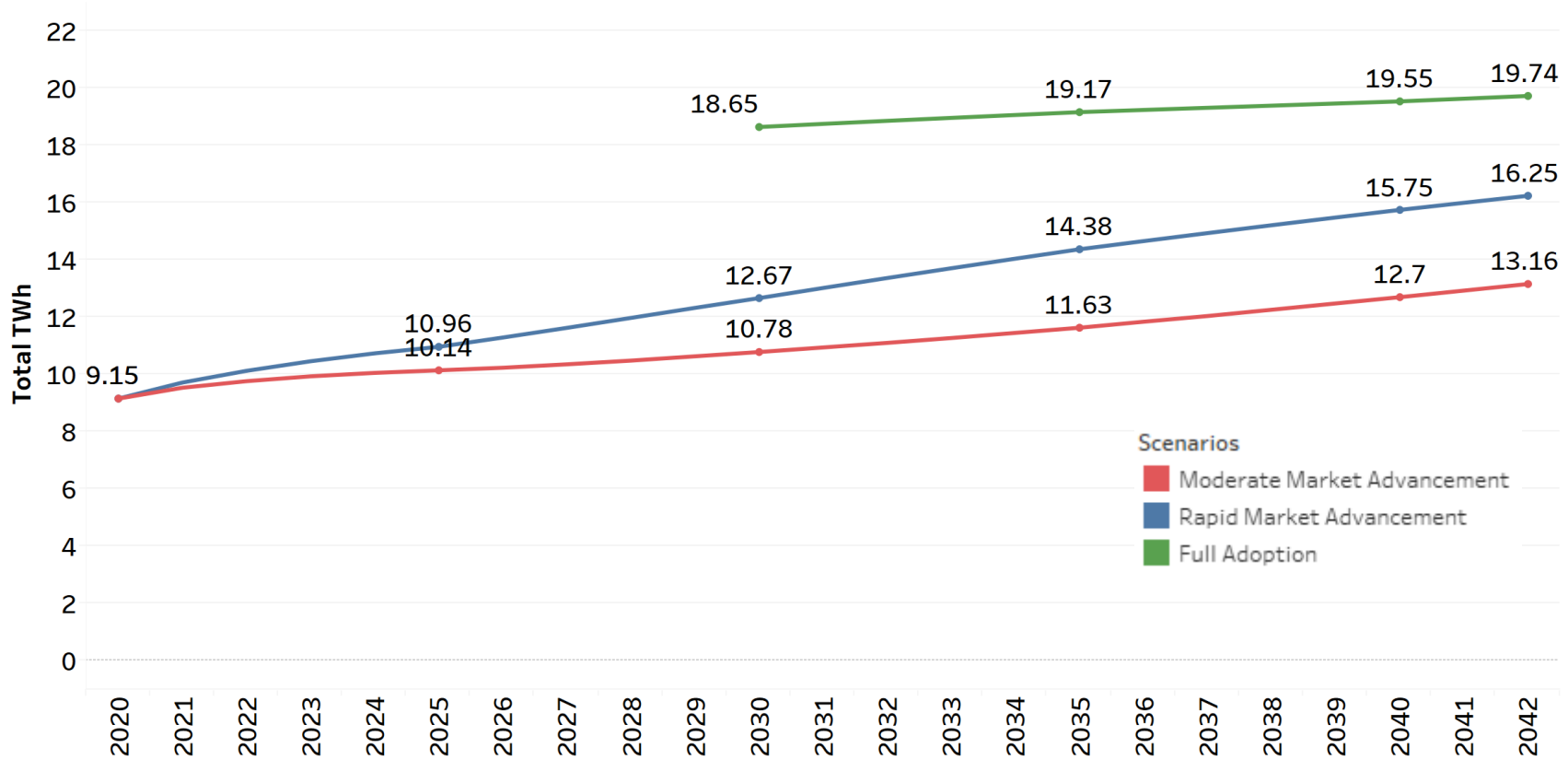
Study Overview

Scenarios

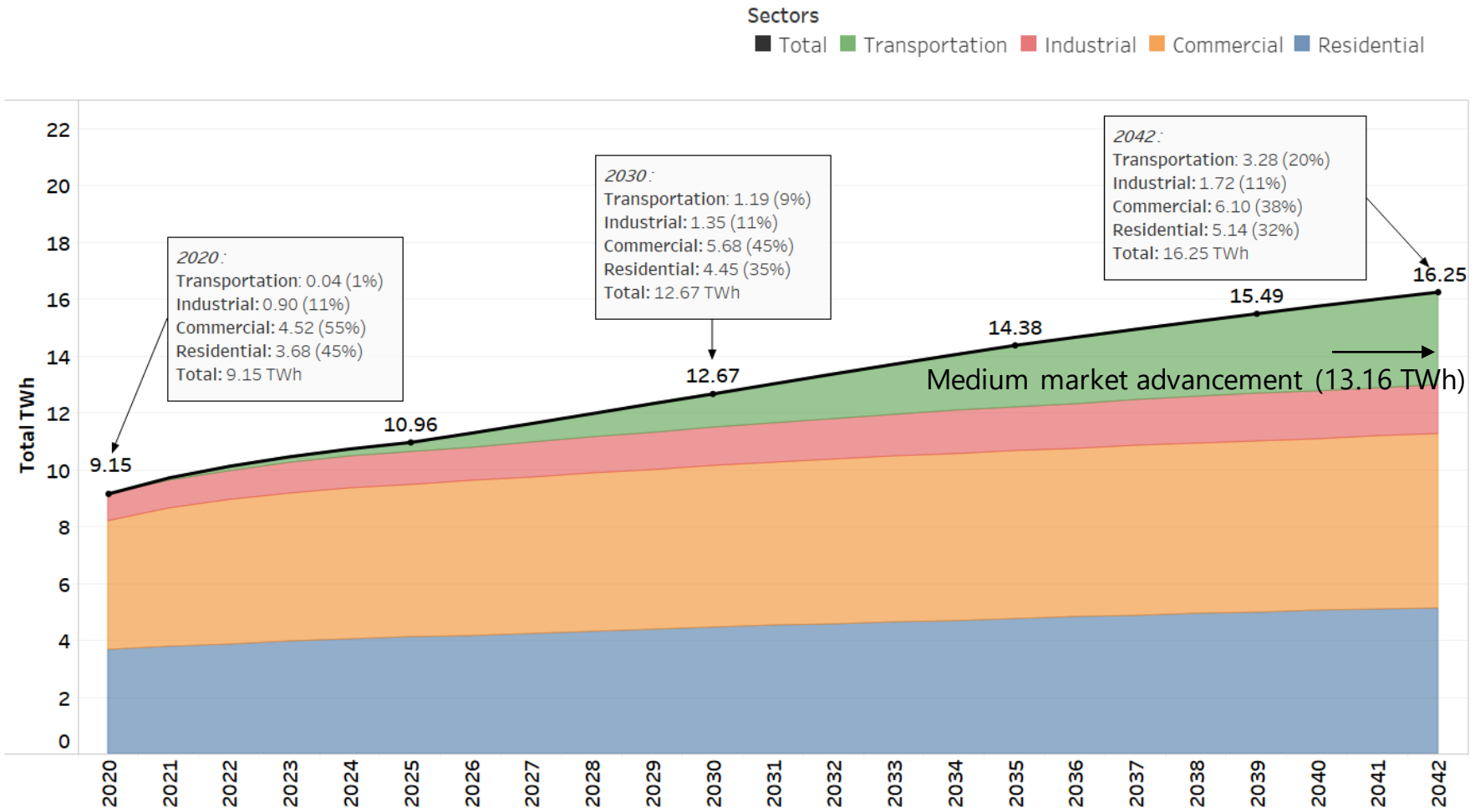
Scenario	Basis	**Electric Transportation Assumption** (in terms of electrified vehicle stock in 2030)	Buildings and Industry
01 **Moderate Market Advancement**	▪ Baseline trajectory based on external projection/research	▪ Passenger vehicles: 11% ▪ **Transit & school bus: 6-7%** ▪ Light commercial, refuse, short-haul trucks: 3-4% ▪ **Long-haul truck & intercity bus: 0-0.3%**	▪ Future years driven by market growth, energy efficiency, and customer choice based on relative economics
02 **Rapid Market Advancement (IRP Electrification Scenario)**	▪ Aggressive trajectory consistent with the Climate Action Plan, Drive Clean Seattle, Seattle's Clean Transportation Electrification Blueprint and ICCT	▪ Passenger vehicles: 30% ▪ **Transit & school bus: 82%** ▪ Light commercial, refuse, short-haul trucks: 27-30% ▪ **Long-haul truck & intercity bus: 0-1%**	▪ Increased electric adoption above and beyond moderate market advancement to align with 2017 CAP emissions targets
03 **Full Adoption of Electrification Technologies [single point estimation]**	▪ Green New Deal and reference scenario that underlines the requirements for full electrification	▪ Passenger vehicles and all MDHD vehicle classes: 100%	▪ Full adoption of available electric technologies by 2030

Total Load, Scenario Comparison

All three Scenarios plotted together

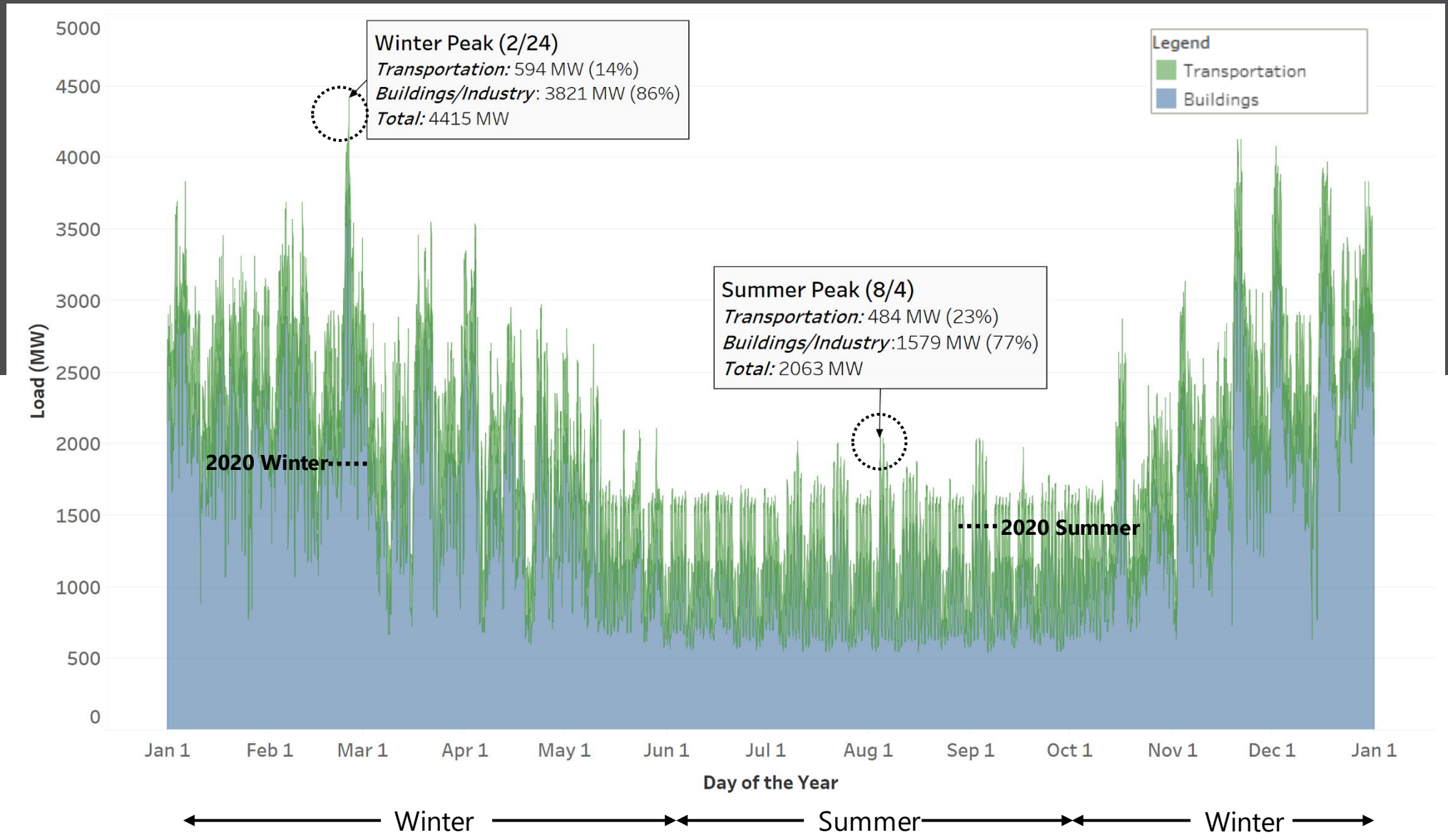


Total Load, Scenario 2: Rapid Market Advancement



Sector	% change from 2020-2030
Residential	20.8%
Commercial	25.5%
Industrial	49.6%
Transportation	2573%
Total	54.3%

Scenario 2: Rapid Advancement Scenario, 2042, yearly load



Grid Analysis Approach

Research question

- What capacity does the existing distribution grid have for additional electrified load?

Perform a detailed system-wide load hosting capacity assessment

- Capacity calculated from specific location level to feeder and substation levels
  - 2 load deployments considered, centralized and distributed
- Considers both voltage and thermal issues
- Time-specific to align with electrified load needs

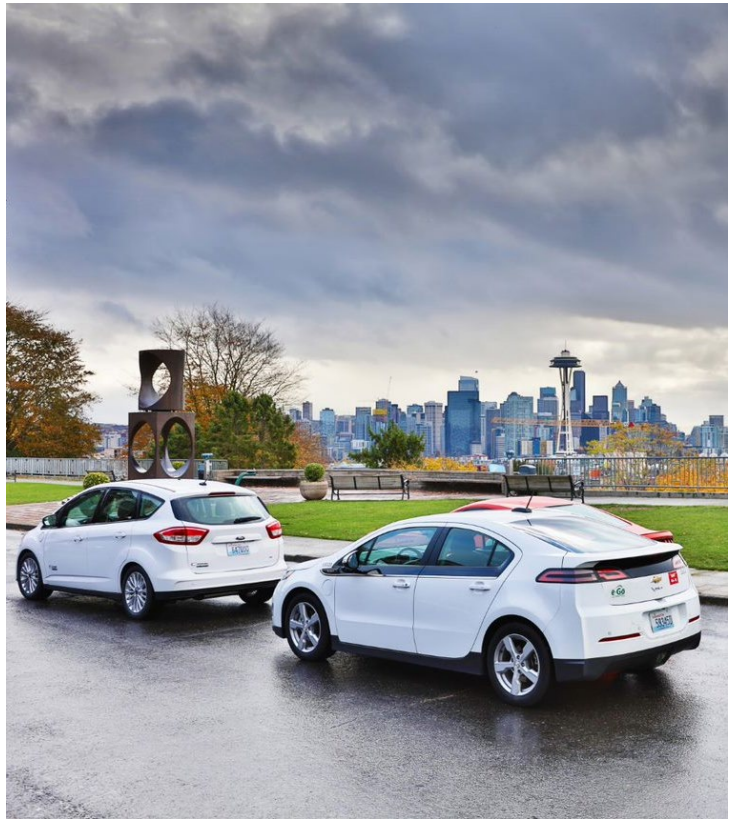
Hosting capacity results estimate the amount of load/generation that can be accommodated without adversely impacting power quality or reliability under current configurations and without requiring infrastructure upgrades

Conclusions and Insights

Conclusions

Electric Transportation

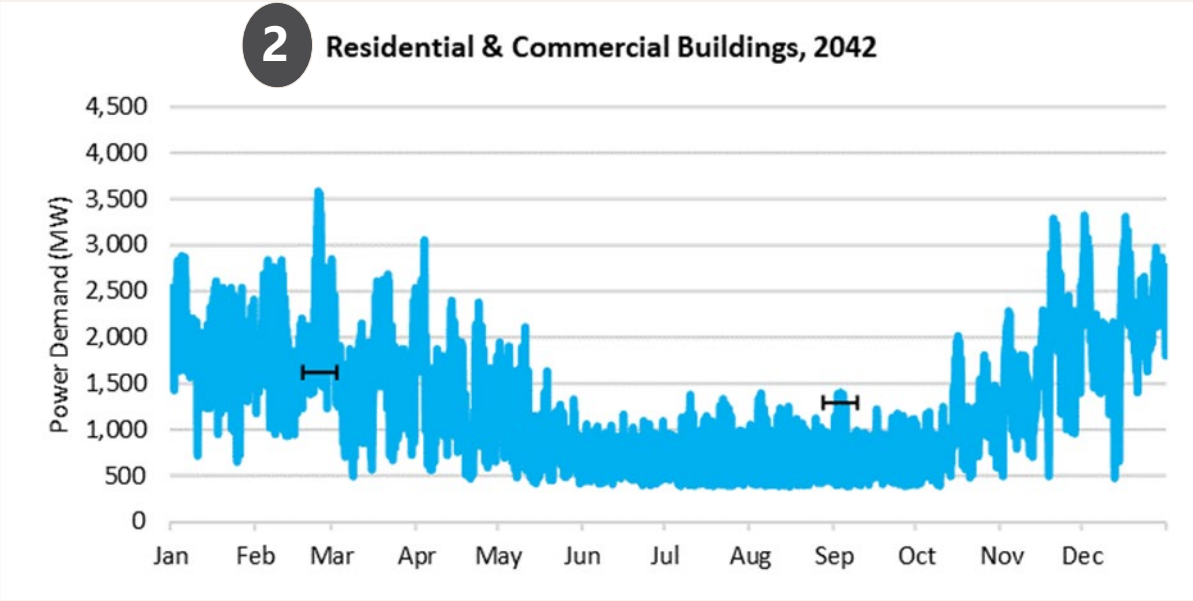
- Passenger vehicles are the main player in terms of total energy. Transit buses might be an early player – technology available now.
- Charging solutions for multi-unit dwellings/those without a dedicated charger need to be a priority.
- Long distance travel will require charging outside of Seattle
- Much of EV charging is flexible load; results highly dependent customer behavior.
- To meet targets in Scenario 2, requires:
  - +800K electric vehicles
  - +450K charging ports, including 23K public charging ports.



Conclusions

Buildings and Industry

- Buildings and industry account for most of the electrification-related increases in load.
- Increase driven primarily by space heating, space cooling, and water heating.
- Without any energy efficiency or peak mitigation strategies, expect significant increase in system peaks.
- Technology advancement and other strategies can help to offset peak demand increases.

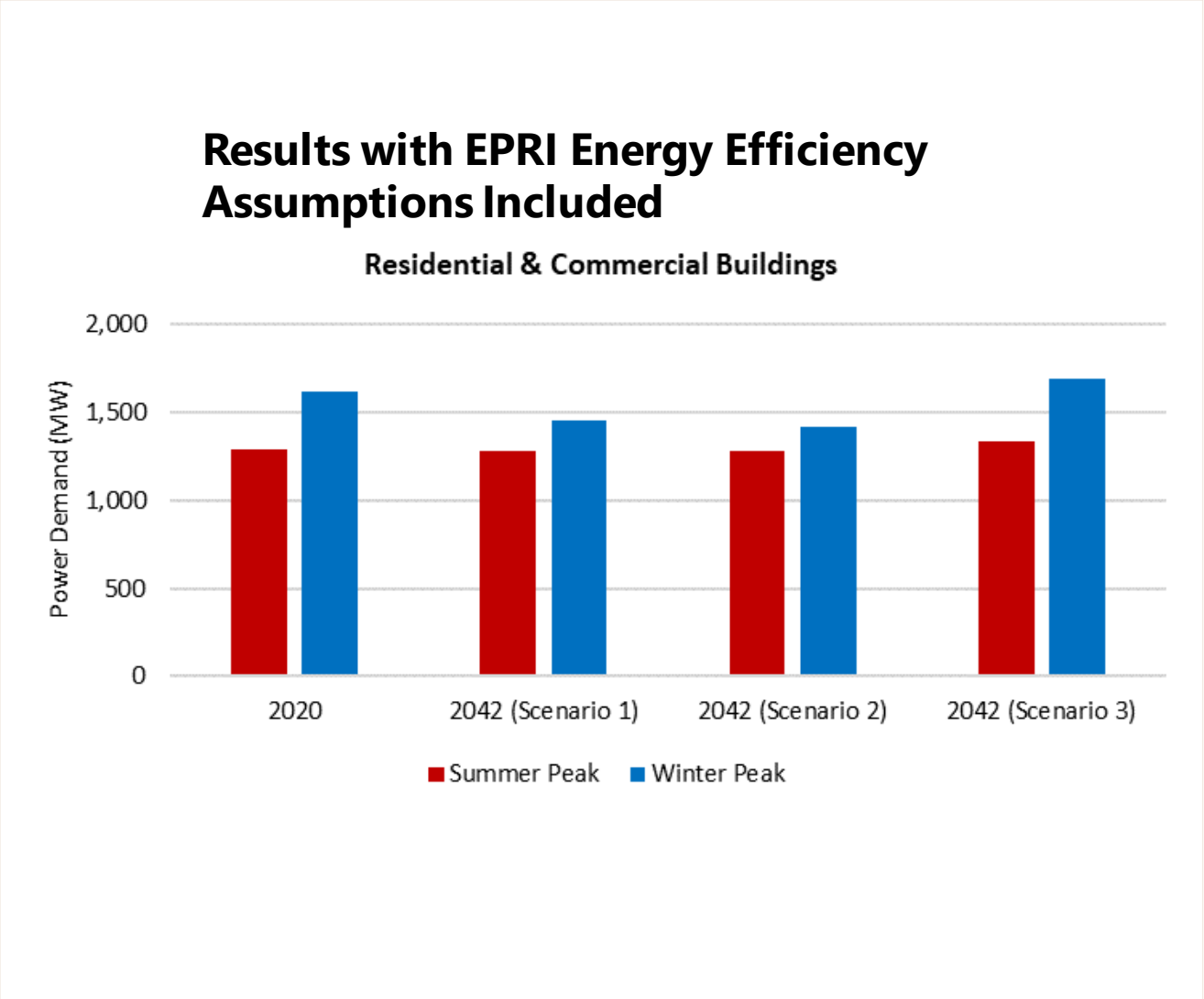


Conclusions

Buildings and Industry (cont.)

- EPRI's energy efficiency analysis found that conversions of resistance heat to heat pump technologies could potentially provide a significant offset to increases in peak.

- Use of dual-fuel space heating options can also greatly help limit impacts on system peak



Conclusions

Grid

- SCL's distribution grid has significant capacity available, however, areas of the grid and times of the day/year when the available capacity is limited.
- Awareness of when and where loads are emerging—and implementing strategies to impact how they align with grid capacity—is critical.
- Local monitoring together with flexible load strategies may prove key to ensuring that electrification is not limited anywhere on SCL's grid.

What's Next:

- Beginning of a larger undertaking to understand how to plan for a decarbonized future. Results will be used to inform:
  - Inform SCL planning processes
  - Policy and Program Decisions
  - Creation and adoption of new tools to meet changing circumstances, i.e. incorporating flexible loads, demand response, identifying areas we can update our approaches, etc.
- Follow-up efforts— "Phase 2"
  - Load forecasting, grid analysis (distribution and transmission), and medium duty/heavy duty EV fleet analysis.

- What does this mean for the IRP?

Electrification Scenario

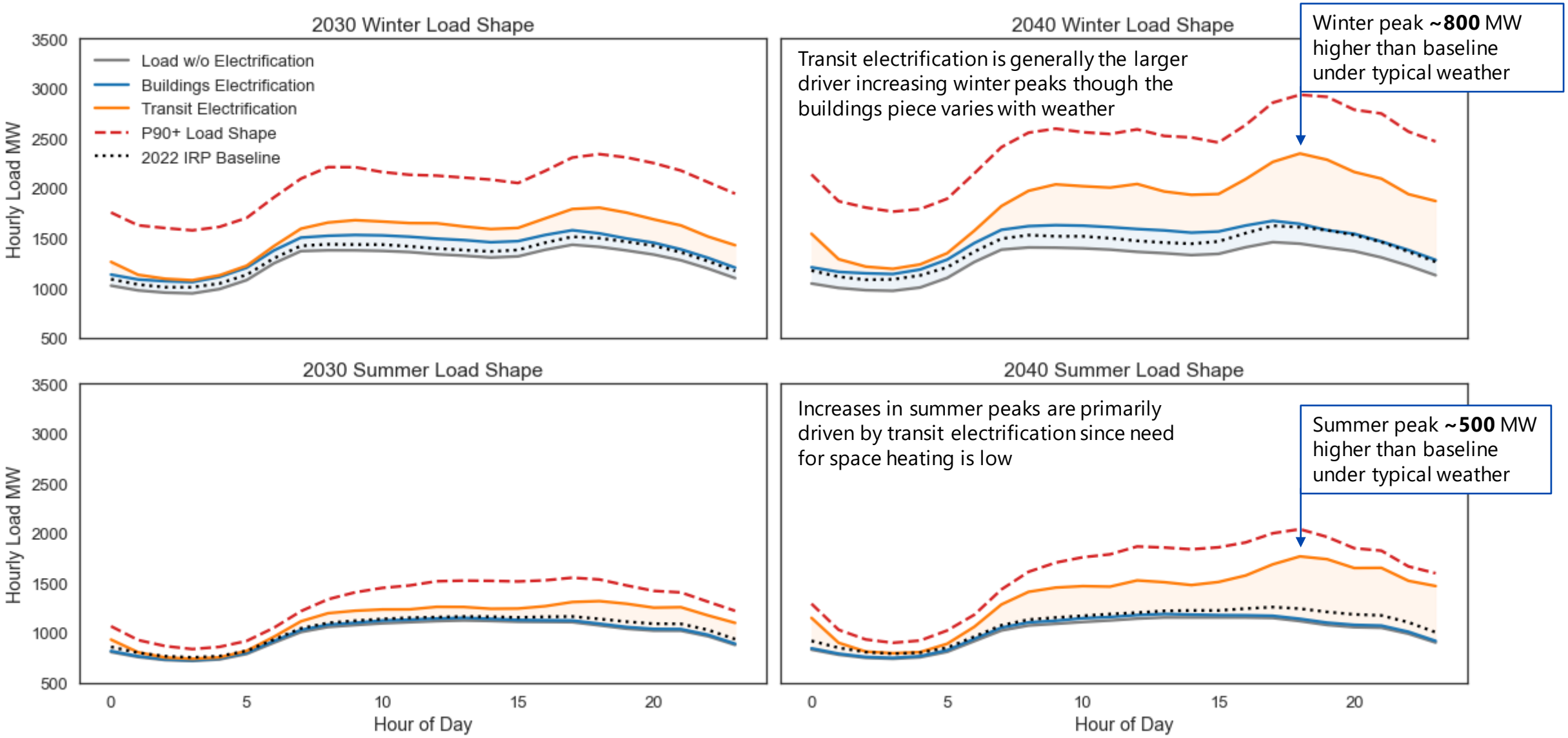
Building the 2022 IRP

Seattle City Light

Rapid Electrification Scenario Assumptions

+ Assumption informed by EPRI rapid scenario
+ Building electrification :
  - ~70% of existing residential & commercial fossil-based space heating electrified
  - ~85% of existing residential & commercial fossil-based water heating electrified
  - ~60% of heat pumps use natural gas for auxiliary
+ Transit Electrification:
  - Passenger vehicles, light commercial trucks, intercity buses, school buses, refuse trucks, short-haul trucks, long-haul trucks and motor homes

Rapid Electrification Load Impacts: 2030 & 2040



Next 8 months

Building the 2022 IRP

Seattle City Light

Analysis shows electrification driving resource adequacy needs more than climate change

- Climate change cold bias is a concern and needs more investigation temperature and supply must be considered equally
- Climate change is happening, but climate change scenario bookends studied present mixed signals, future SCL work should evaluate whether more scenarios can provide better information (beyond 2022 IRP timeline)
- Remaining analytic work is going to prioritize electrification scenario and portfolio considerations

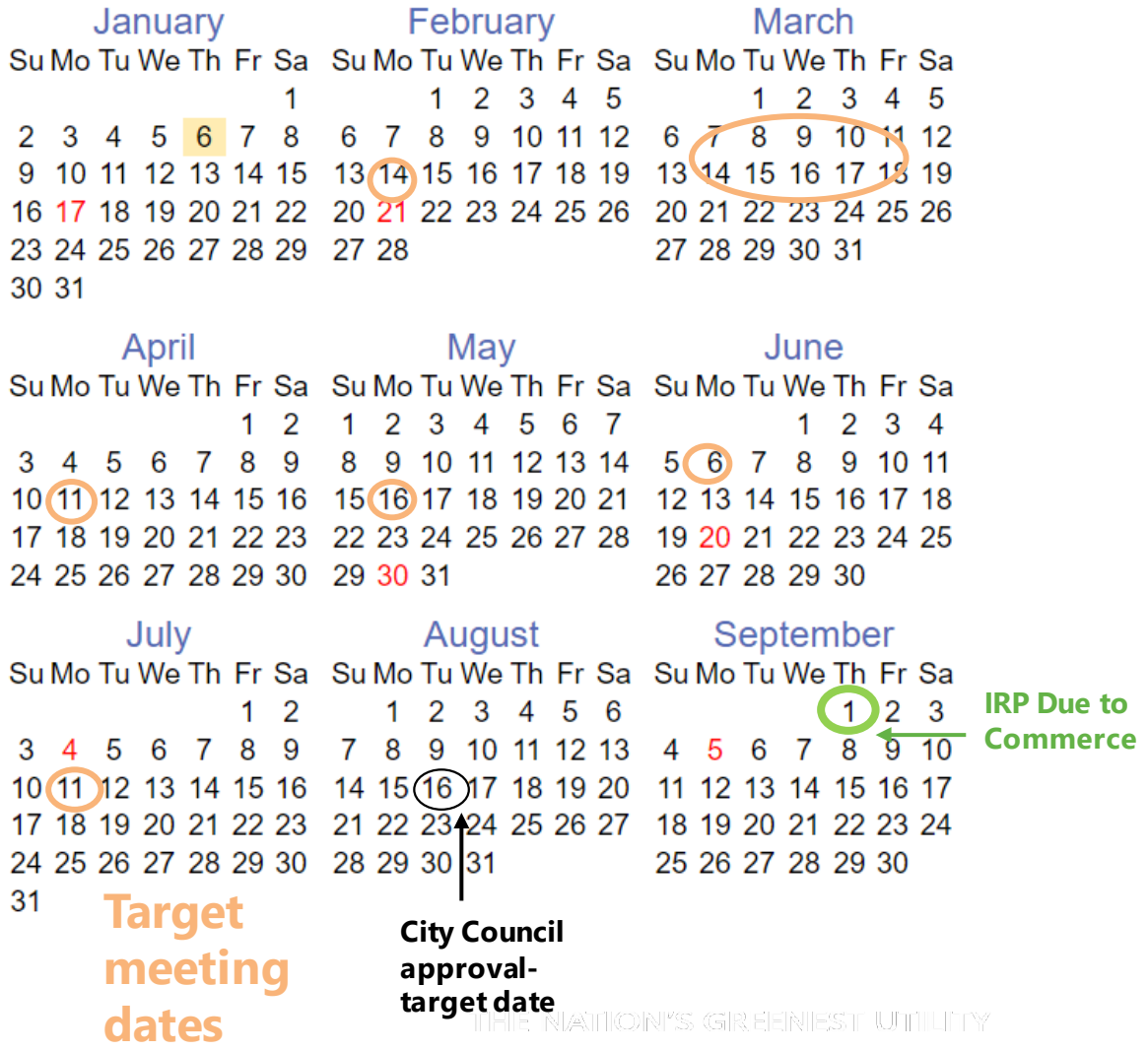
Regular IRP Advisory Group Engagement

Poll, enter question number and your response in the chat:

1. Mondays, 3 to 5 pm (Yes/No)

If needed, other times for short check ins

2. Lunch time: 12 to 1 pm (Yes/No)
3. Evening 4 to 5 pm (Yes/No)
4. Specific time to avoid? (example: Thursday afternoons thru March)



Partnering in IRP Completion

Advisor group support, how you can help

+ Technical review and input
+ Recommending IRP themes, messages and actions
+ Support with community engagement
+ IRP document drafting review
+ Advisory group letter
+ What else?

Did we accomplish these tasks?

Today:

- Develop insights from climate change and electrification scenario work
- Collect technical questions for follow up outside of today's meeting
- Level set about the need to complete analysis by March 2022 for finalizing the IRP product

For IRP completion:

- Establish regular meeting engagement (Monthly with possible one hour check ins)
- Partner and agree on steps to IRP Completion
- Support a community developed clean energy action plan

THANK YOU

Seattle City Light