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Electrification Futures Study Summary of Findings

January 10, 2024 Study Session

Background

What is electrification?

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Powering things with electricity – replacing an existing nonelectric fuel

Buildings

- Heating/cooling
- Water heating
- Cooking
- Clothes drying

Commerce & Industry

- Heating/cooling
- Water heating
- Drying
- Curing
- Specific machinery
- Cooking

Transportation

- Cars
- Busses
- Trucks
- Fleets
- Port operations

Trends suggest potential for major load growth from electrification

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ELECTRIC VEHICLES

Buckle up: Climate law to turbocharge sales of electric trucks and buses

The Inflation Reduction Act's tax credits, grants and loans could accelerate commercial EV adoption and boost U.S. manufacturing.

Climate law could spur 'market transformation' in home electrification

The Inflation Reduction Act has tax credits, rebates and loans to make homes more efficient and move them from fossil fuels to electricity.

Washington legislators again mandate 100% electric new car sales by 2030

Published March 14, 2022

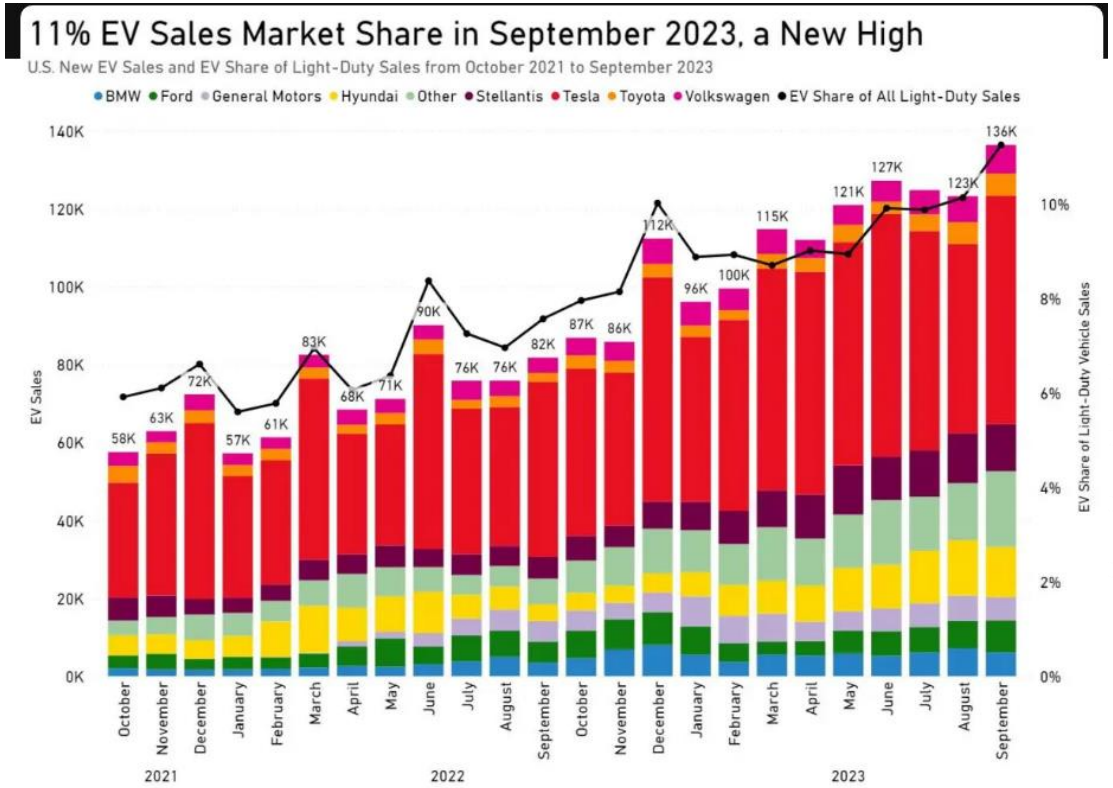
11/21/2023

U.S. EV Sales Are Slowing: Implications for the Auto Industry

DIVE BRIEF

US residential heat pump sales pass gas furnaces for first time as interest in efficiency tech surges: IEA

Published June 7, 2023



What did we do?

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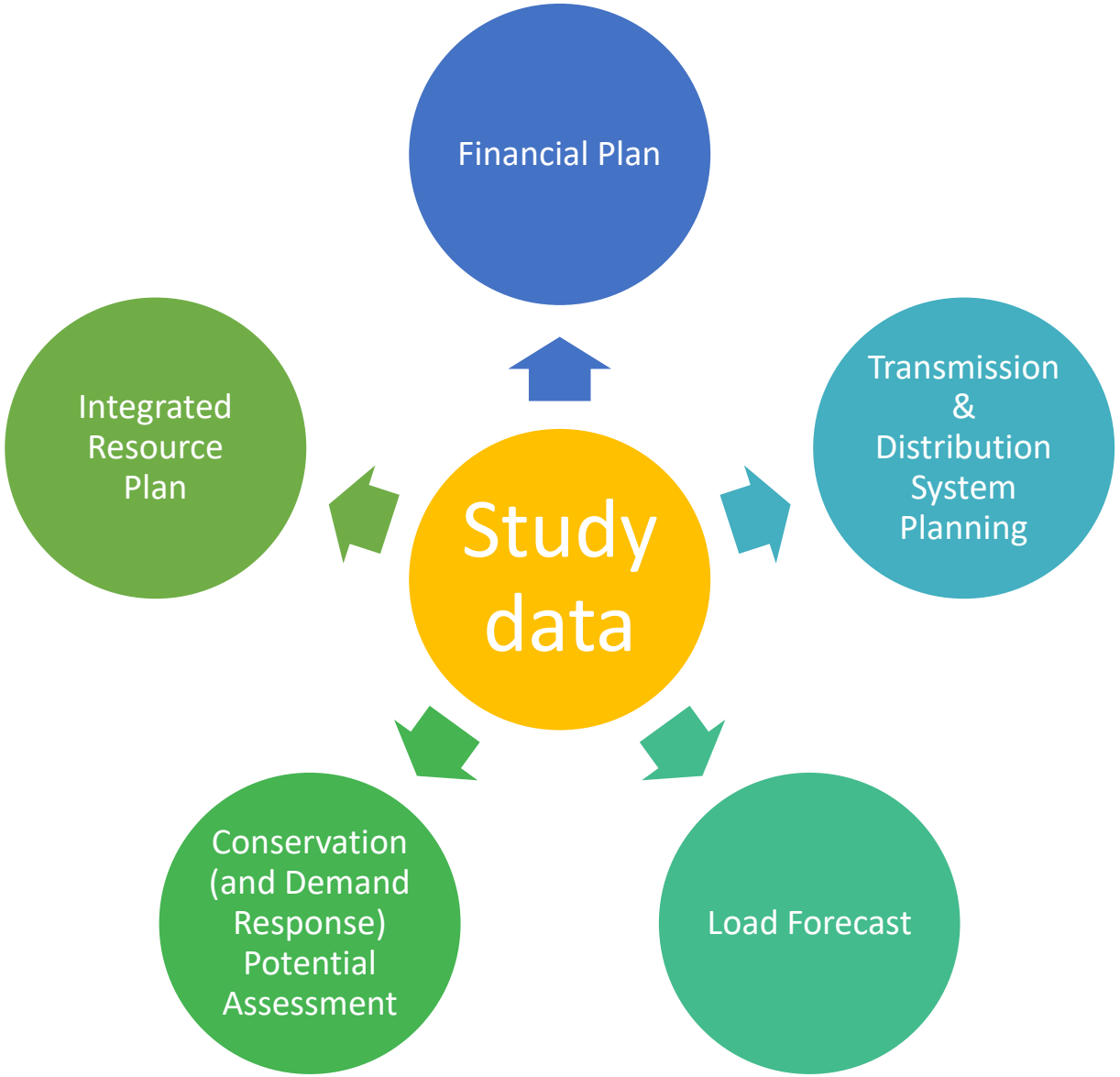
- Worked with a consultant to develop a set of realistic forecasts of how electrification might affect customer demand over the next 20 years using complex modeling.

- Study addresses:
  - **Multiple segments:** Buildings, transportation, & industrial electrification (including Port)
  - **Multiple scenarios:** policies, technologies, and adoption
  - **Multiple dimensions:** Locational, time & weather impacts
  - ***Some* other forces that affect load:** Interaction with solar and (at a high level) energy efficiency and demand response

Data will be incorporated into our planning processes



Study Overview

High level modeling process

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Input development

- Conservation Potential Assessment (CPA) dataset
- TPU customer forecast
- Etc.

Scenario adoption curves

- Narrative assumptions turned into assumptions about adoption of various technologies

Adoption model ("AdopDER")

- Probabilistic model of customer choices
- Takes into account customer characteristics

Load impacts

- Apply incremental load impacts based on modeled customer decisions

Study Scenarios

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Core Scenarios

Current Landscape

- Reflect only policies in place today. Do not assume additional action taken by policymakers to ensure stated goals are achieved. Market trends consistent with trajectories we're seeing now.
- ***Possible low level of electrification***

Anticipated Electrification

- Reflect what we believe to be the likely trajectory of policy expansion and market trends. Market trends fairly similar to the previous scenario.
- ***Possible high level of electrification***

Policy Regression

- Reflect a policy backslide and lower market adoption.
- ***Unlikely low level of electrification***

Expansive Policy

- Reflect an acceleration of electrification policy and market adoption.
- ***Unlikely high level of electrification***

Scenario Variants

Anticipated Electrification with Mitigation

- Same narrative as "Anticipated Electrification" scenario above but with aggressive demand-side management

Expansive Policy with Mitigation

- Same narrative as "Expansive Policy" scenario above but with aggressive demand-side management

Allows to estimate realistic locational load impacts

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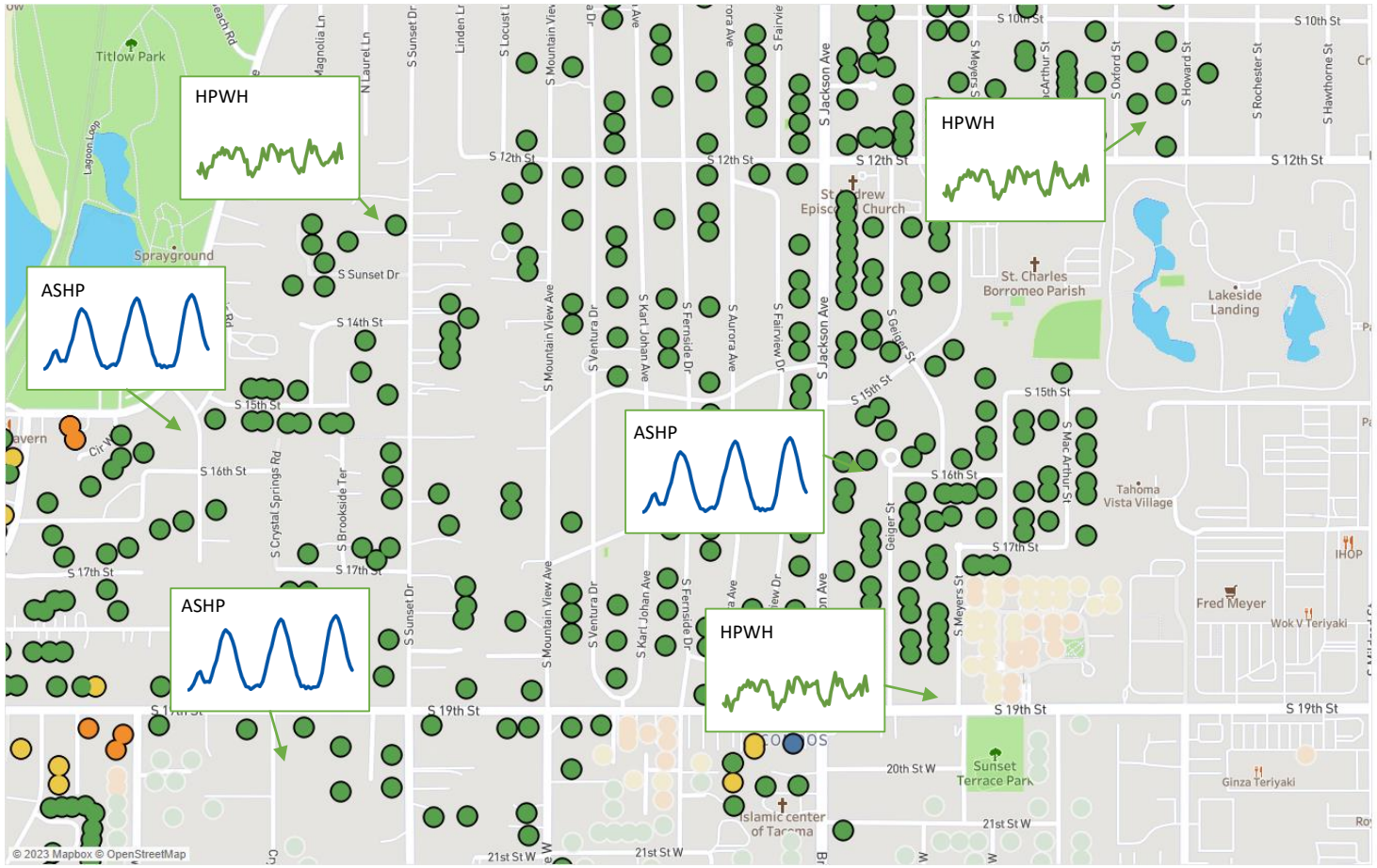
Illustrative look at one specific feeder



Building Type (CPA Data)

- Single Family
- Single Family 2-4 Unit
- Low-Rise Multifamily
- High-rise Multifamily

Impacts aggregated to feeder level

- For every hour of the 20-year study period
- For each separate electrification “measure” (heat pump, water heater, level 2 fleet charger, etc.)
- For each scenario

This is a lot of data!

Summary Findings

Important note on summary findings reported in study

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This study's focus is on how electrification might affect customer demand and ***does not account*** for all factors that may increase or decrease total demand on our system.

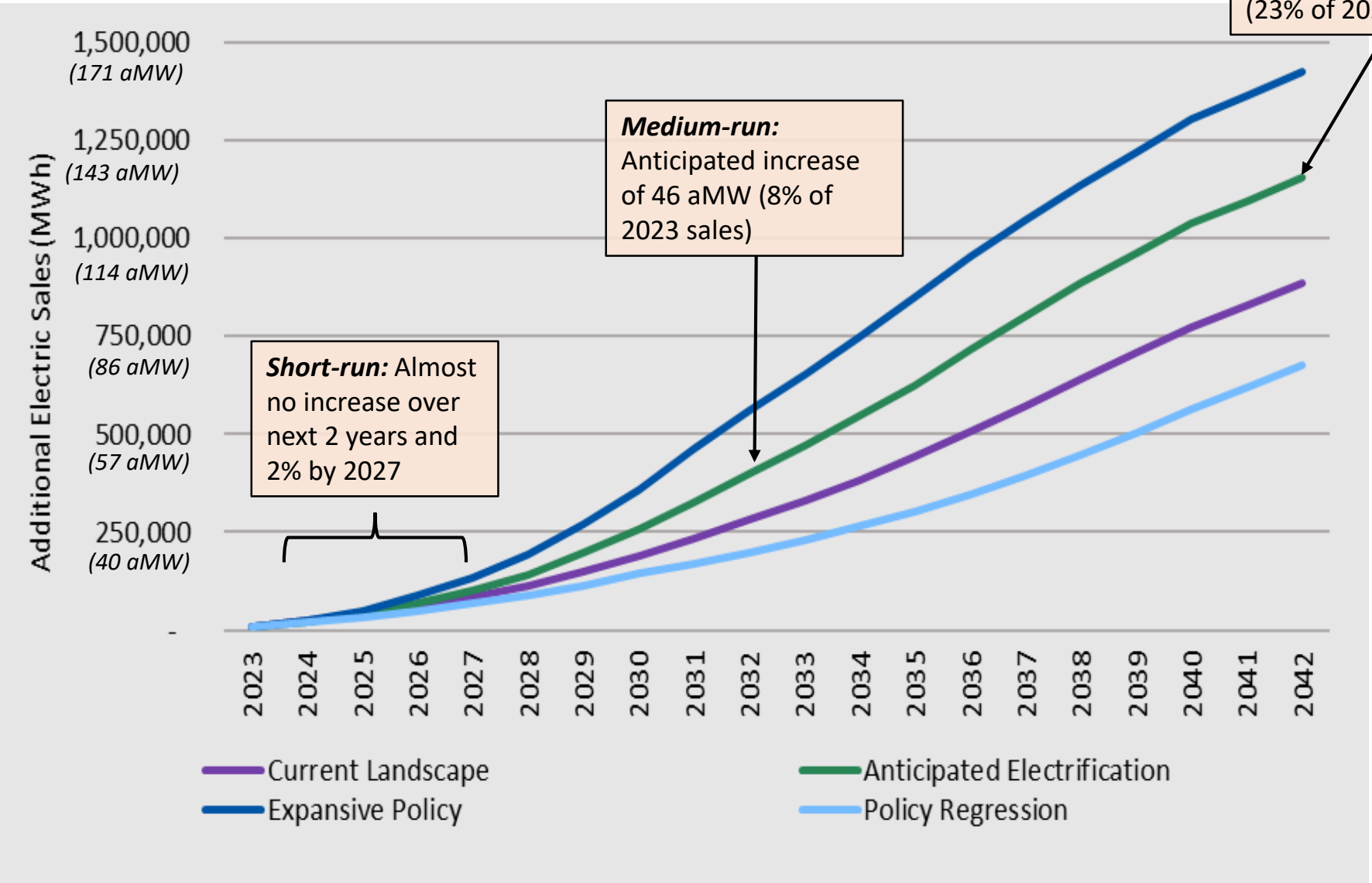
Included

- Load increases from electrification of buildings, vehicles, industry and Port
- Load decreases from possible growth of rooftop solar

Excluded

- Load reductions due to energy efficiency
- Other changes to industrial loads (data centers, additional plant closures, etc.)
- Rail electrification
- A portion of increased A/C adoption

Impacts on average annual consumption



Key takeaways:

1. Electrification is likely to put significant (but not catastrophic) upward pressure on annual energy consumption
2. There is time to prepare!

Reminder!

- ***Included:*** Reductions in consumption from rooftop solar
- ***Excluded:*** Reductions due to energy efficiency

What about energy efficiency?

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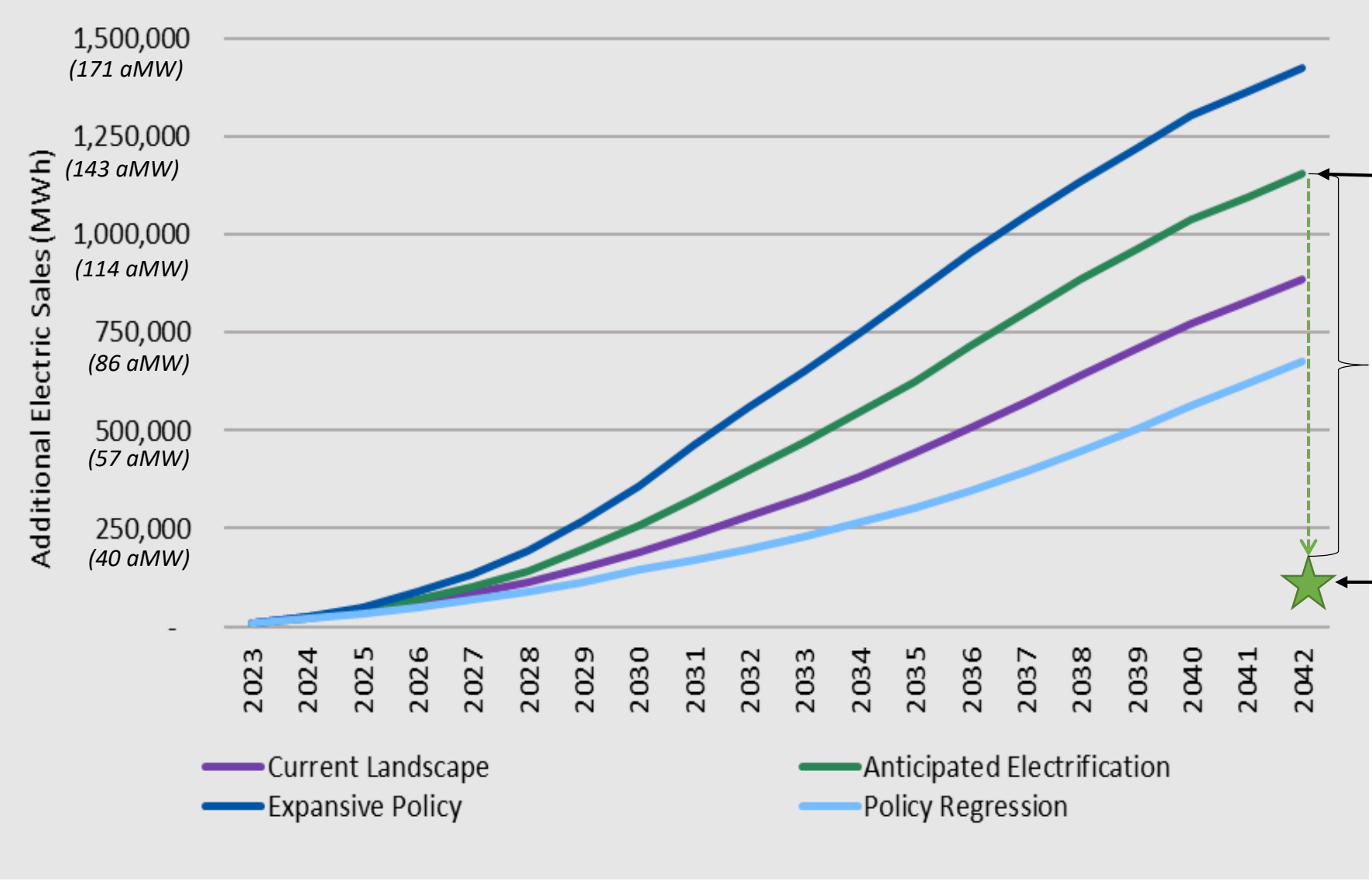
Key takeaway: Energy efficiency can substantially mitigate impacts electrification and could completely offset them in some scenarios.

2042 Energy Increases & Decreases (aMW)	Increase from Electrification by 2042	Decrease from Solar by 2042	Decrease from Energy Efficiency by 2042	Net Load Impact by 2042
Current Landscape	110	(9)	(119)	(18)
Anticipated Electrification	**146**	**(14)**	**(119)**	**13**
Expansive Policy	182	(20)	(119)	44
Policy Regression	85	(8)	(119)	(42)

Important caveats:

- Table above does not account for all factors affecting load growth/decline
- Summary results do not address monthly energy impacts
- Additional efficiency opportunities possible as homes and businesses convert to electric & as technologies continue to improve

Energy efficiency can substantially mitigate growth in average annual consumption



Anticipated increase of **132 aMW** (23% of 2023 sales) by 2042 ***before accounting for energy efficiency***

Likely impact of energy efficiency from codes, standards and continued investment in cost-effective conservation

Anticipated increase of **13 aMW** (2% of 2023 sales) by 2042 ***after accounting for energy efficiency***

Peak impacts – 1 in 2 (“normal”) peak

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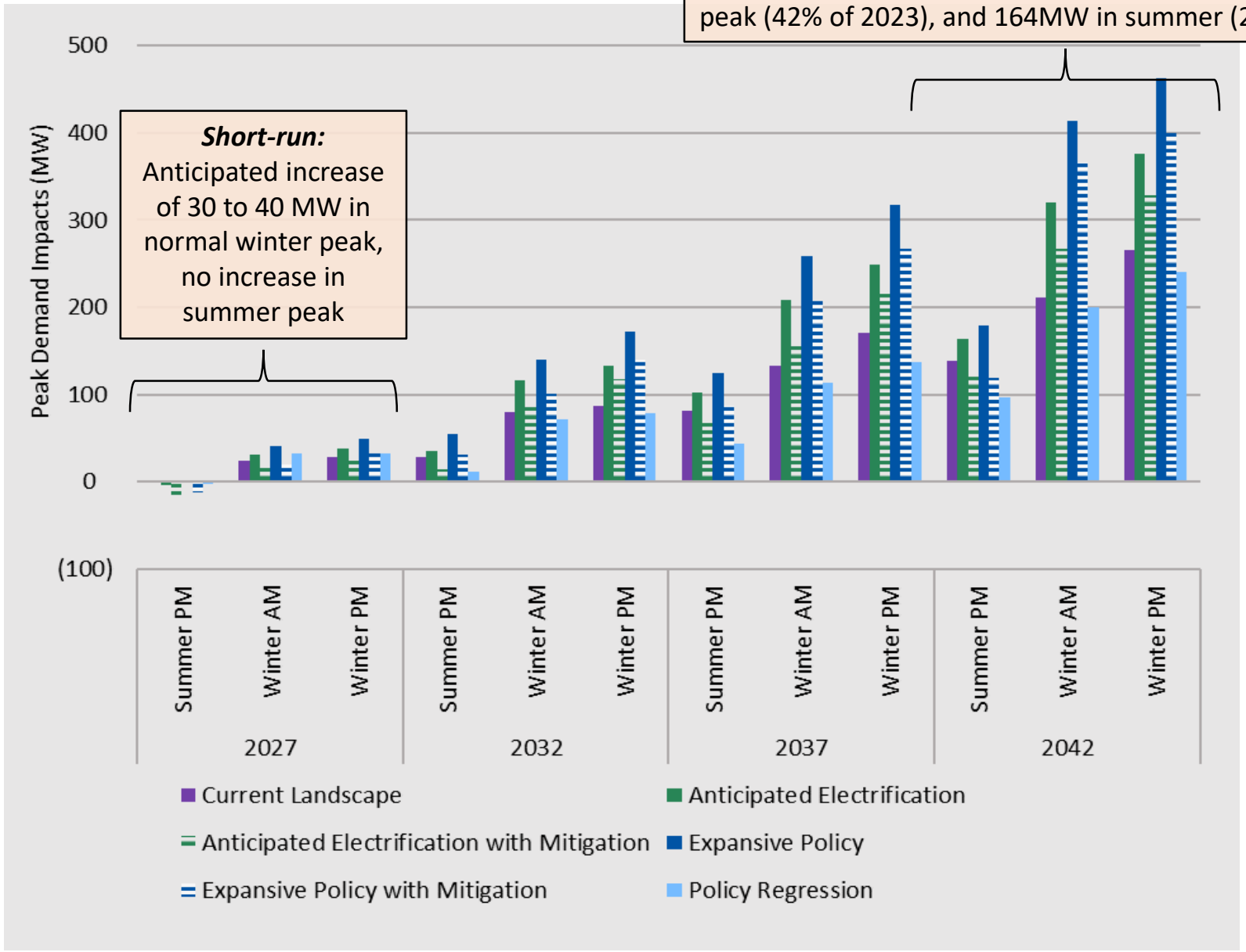
Long-run: Anticipated increase of 376 MW in normal winter peak (42% of 2023), and 164MW in summer (26% of 2023)



Key takeaways:

1. Electrification is likely to put significant upward pressure on peak demand, especially in winter when peaks are already highest
2. Demand response (if cost-effective) could play important role in reducing peak impacts but won’t eliminate them.
3. There is time to prepare!

Reminder!

- ***Included:*** Reductions in consumption from rooftop solar
- ***Excluded:*** Reductions due to energy efficiency

How much *might* we be able to mitigate peak impacts with demand-side resources?

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Preliminary takeaway: Energy efficiency and aggressive demand response could substantially mitigate (but not eliminate) increases in peak demand.

"Anticipated Electrification" Scenario	Summer PM Peak Impact by 2042	Winter AM Peak Impact by 2042	Winter PM Peak Impact by 2042
Projected increase from electrification	241 MW	327 MW	376 MW
Projected decrease from customer solar adoption	-77 MW	-7 MW	0 MW
Possible "mitigation" from energy efficiency in buildings currently using electric heating and/or water heating	2 MW	-177 MW	-110 MW
Possible mitigation from aggressive DR	2 MW	-177 MW	-44 MW
Net peak increase	**130 MW**	**98 MW**	**222 MW**
Additional mitigation from energy efficiency in electrifying homes & businesses	????	????	????

Important caveats:

- Table above does not account for all factors affecting load growth/decline
- Estimates for peak mitigation are rough and do not address ability to mitigate 1 in 10 peak impacts
- Not all new demand-side opportunities will be cheaper than a supply-side resource
- Summary results do not address locational impacts

Peak impacts across Census tracts

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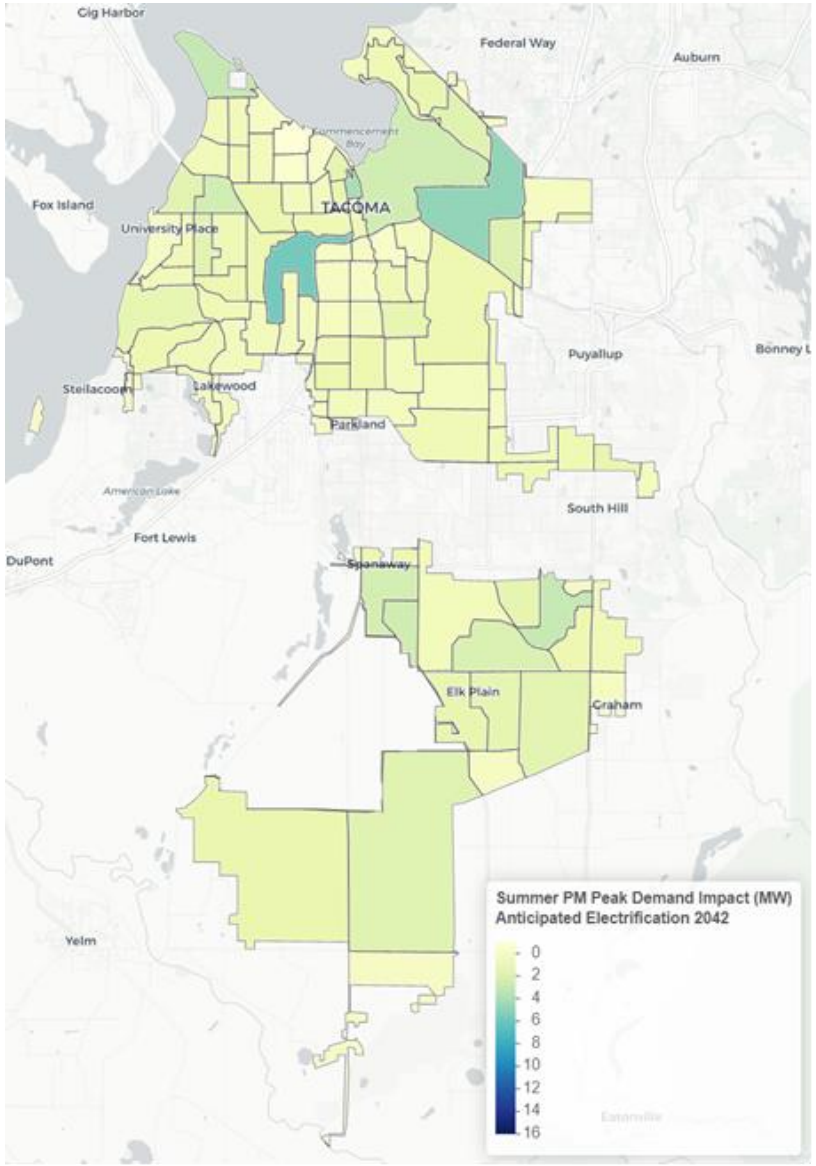
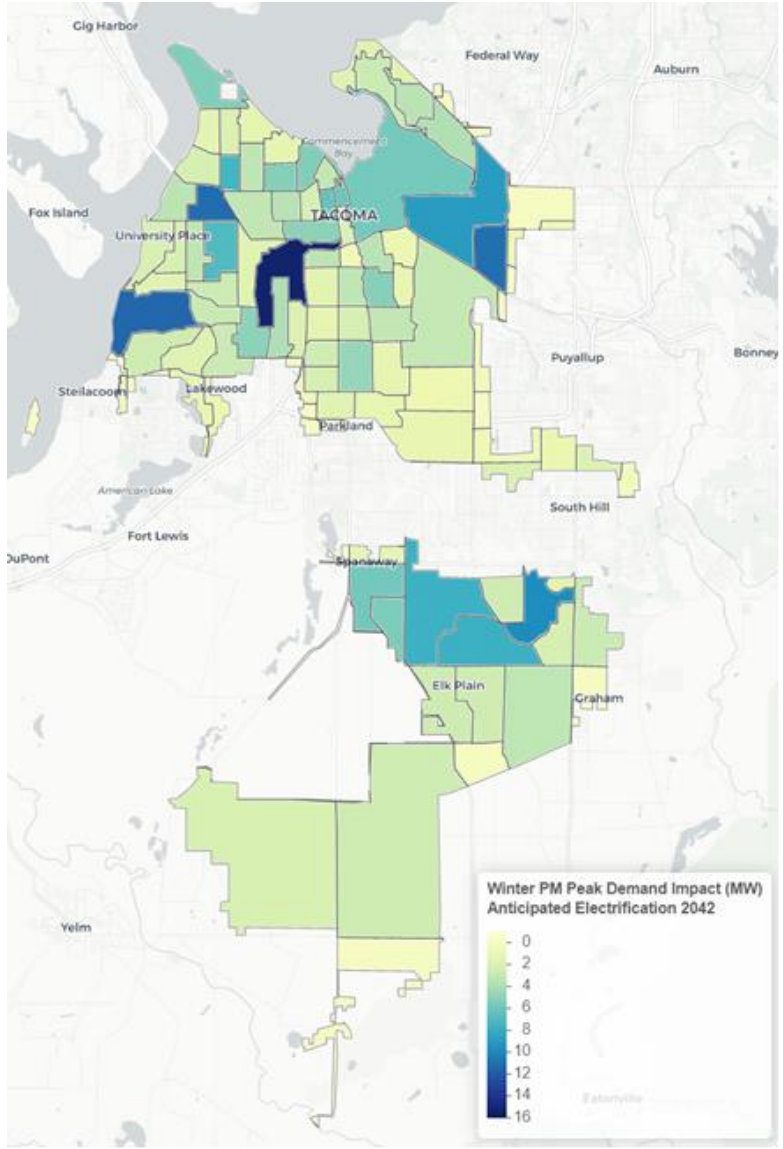
Summer PM peak impact



Winter PM peak impact



Key takeaways:

- Demand impacts likely to be concentrated in certain areas & on certain feeders
- More analysis will follow to better understand specific system upgrades needs

Summary of takeaways

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Electrification likely to put significant upward pressure on customer consumption, but rigorous efficiency codes and standards coupled with continued investment in cost-effective energy efficiency could largely mitigate average annual consumption increases

There is likely to be a more notable impact on peak loads, especially in the winter (when demand on our system is already higher)

Mitigation will likely require new investments in capacity resources and distribution-system upgrades.

There is time to prepare!

We have more analysis to do to determine the best way to prepare

Next Steps

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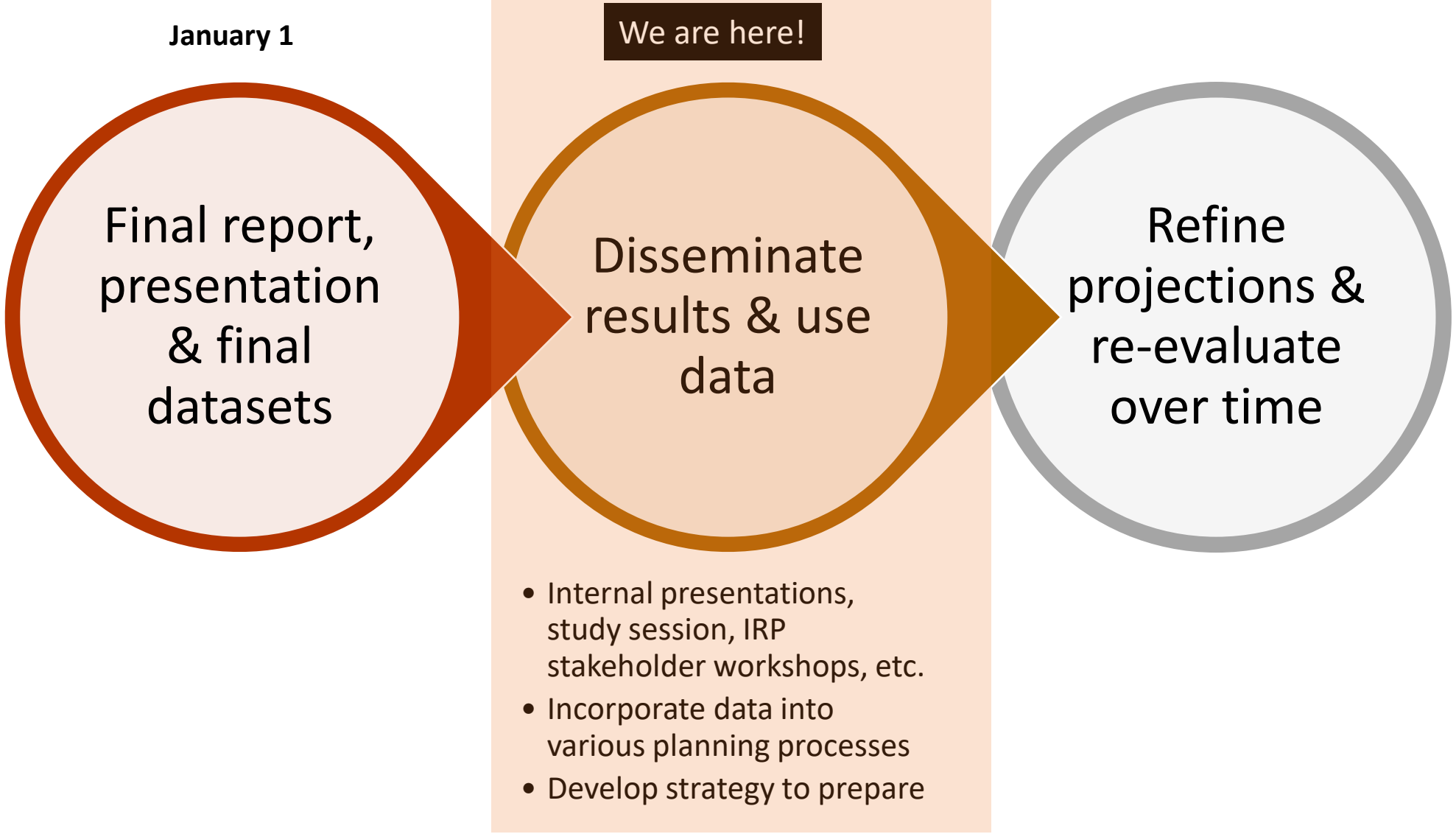

Questions

(and hopefully a few answers…)