

Considerations for Austin Energy Resource, Generation, & Climate Protection Plan to 2035

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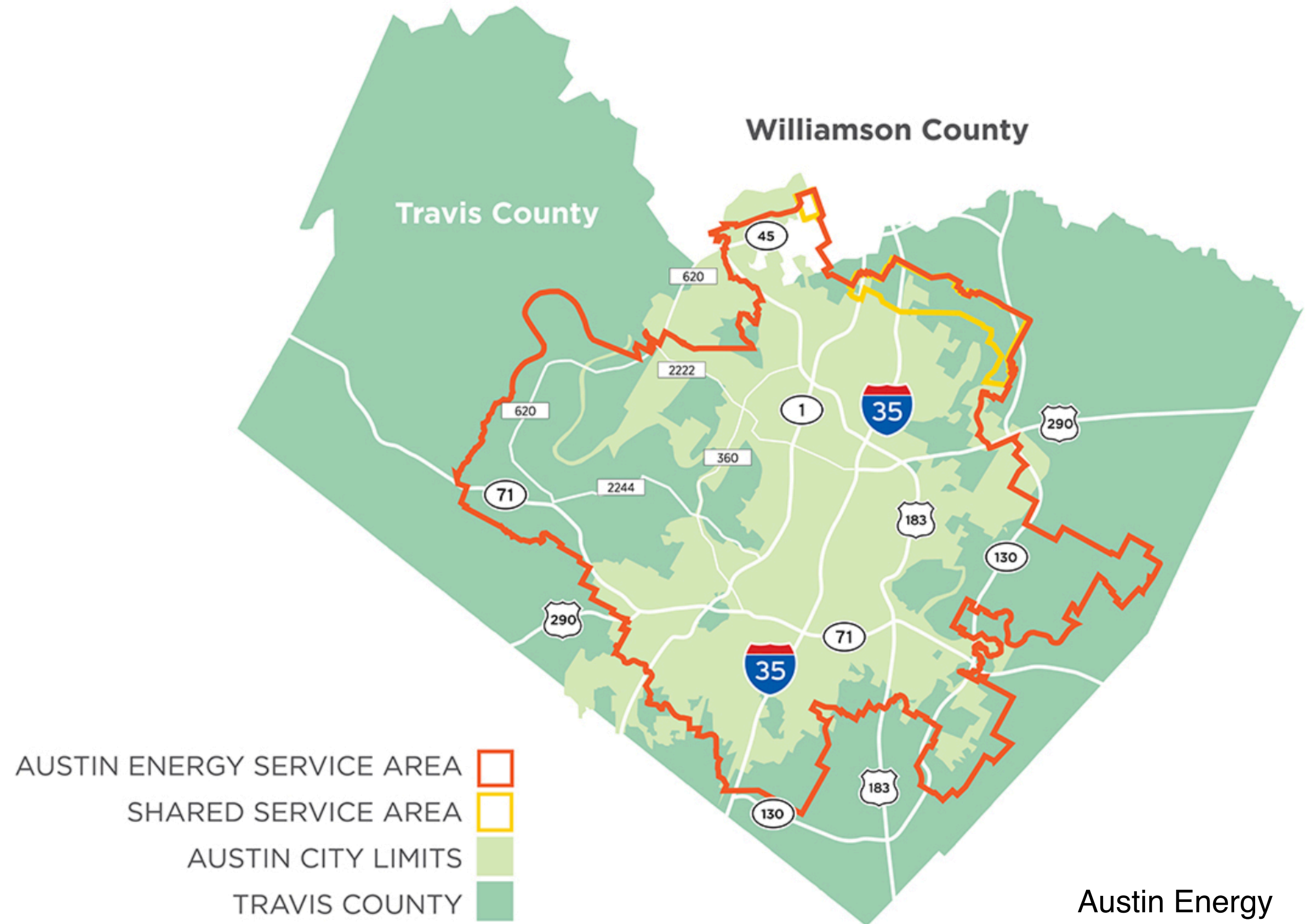
Austin Energy Basics

Austin Energy Is a Critical Part of the Local Community

- In FY2023, Austin Energy served 541,368 customers and earned \$1.5B in revenue
- Austin Energy has 1,897 full-time employees and an approved budget of \$1.72B
- Austin Energy's peak demand record was set in 2023 at 3,064 MW; total consumption was 14,263 GWh

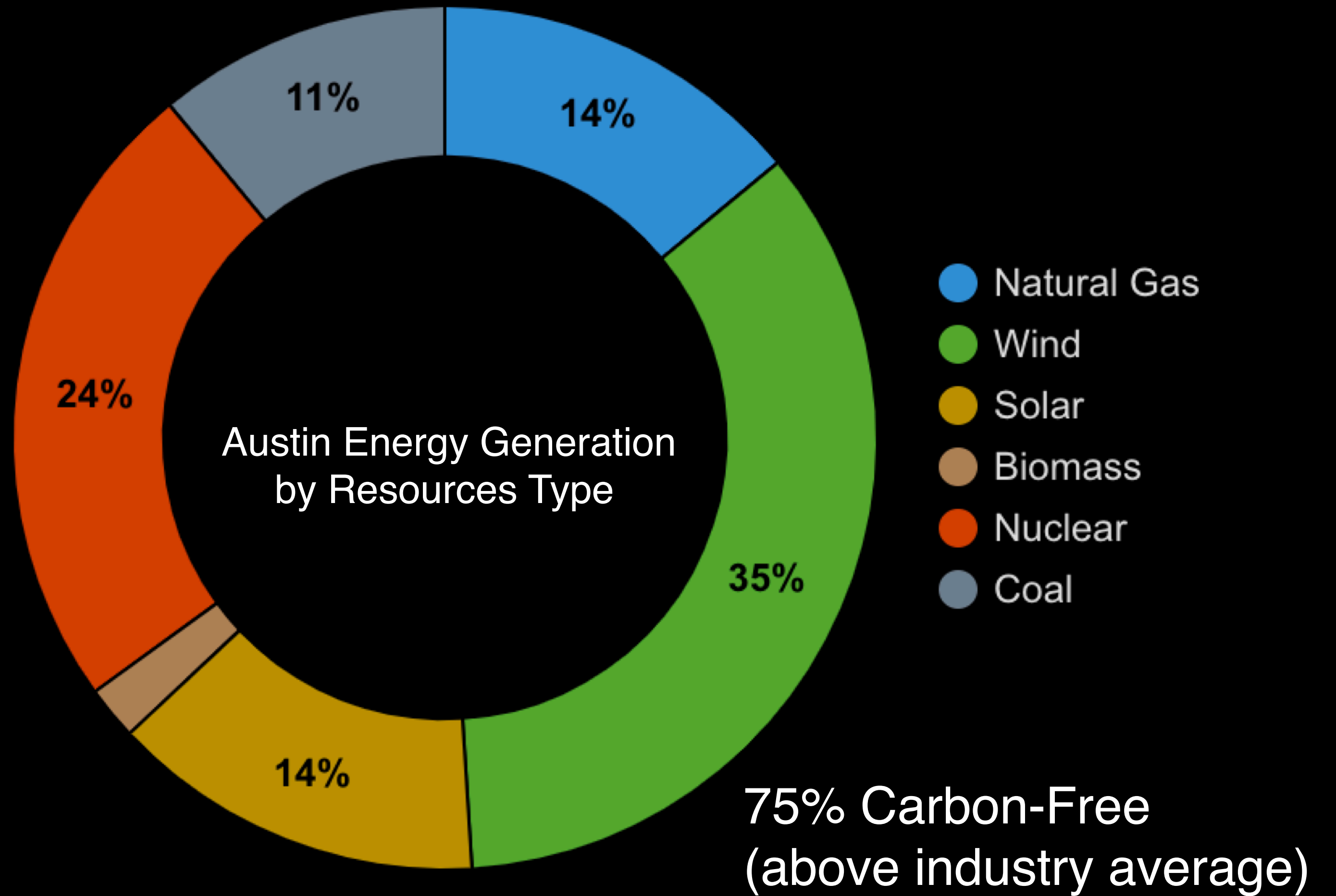
AUSTIN ENERGY SERVICE AREA

50% City of Austin • 50% Outside City of Austin



Austin Energy's Diverse Mix of Resources Generates Electricity for ERCOT and Provides Funds to the City

Texas Generation Map FY23



The Challenge Before Us

Simultaneously expand and decarbonize the grid while the world is warming

Energy transition

The Energy Transition Is Underway

- We're 10-15 years into a 30-40 year transition
- A variety of researchers have conducted studies on how to decarbonize the economy at the global, national, and state level
 - Princeton, UT Austin, Energy Information Administration, International Energy Agency,...
 - Decarbonization: to reduce CO2 emissions and/or remove CO2 from the atmosphere
- These studies have a variety of similar & overlapping conclusions and potential trade-offs
 - Carbon-neutral (e.g. “net-zero”) is cheaper, faster and more equitable than “carbon-free” (e.g. “zero-carbon”)
 - Net-zero: emissions from one location (e.g. from a smokestack) are removed in another location
 - Carbon-Free: there are no emissions

The Priority Order for Decarbonization Has 4 Steps: “Do your best, clean up the rest”

1. Efficiency

- AE has already done a lot on efficiency (good news!), but that means less remains (bad news)
- AE uniquely has prioritized efficiency over the last 2+ decades, which has saved us a lot of heartache (despite it undermining potential revenues)

2. Electrification:

- Electrifying light-duty vehicles and home heating/cooking is good environmentally, but requires expanding the grid to accommodate greater peak power demands (GW) and annual consumption (GWh)

3. Clean molecules

- Use clean molecules (biomethane, hydrogen, hydrogen carriers,...) for parts of the economy that are hard to electrify (aviation, shipping, industry,...) and for power generation when other options aren't available

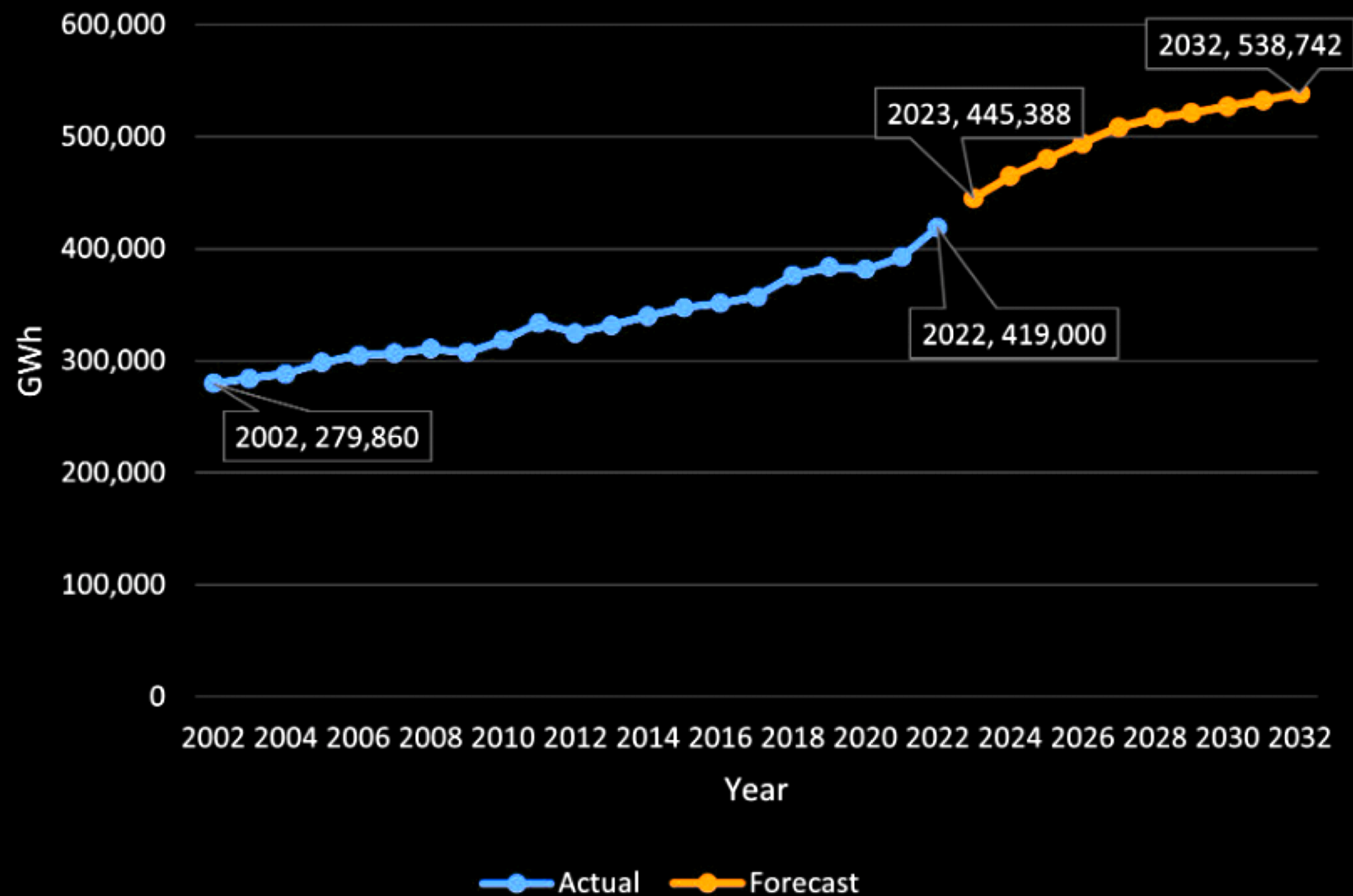
4. Carbon management

- Use carbon management such as point-source capture, direct air capture, and marine carbon dioxide removal to prevent releases of greenhouse gases to the atmosphere and to remove ambient CO₂

ERCOT Is Seeing Significant Growth In Demand (GW), Consumption (GWh) and Transmission Congestion

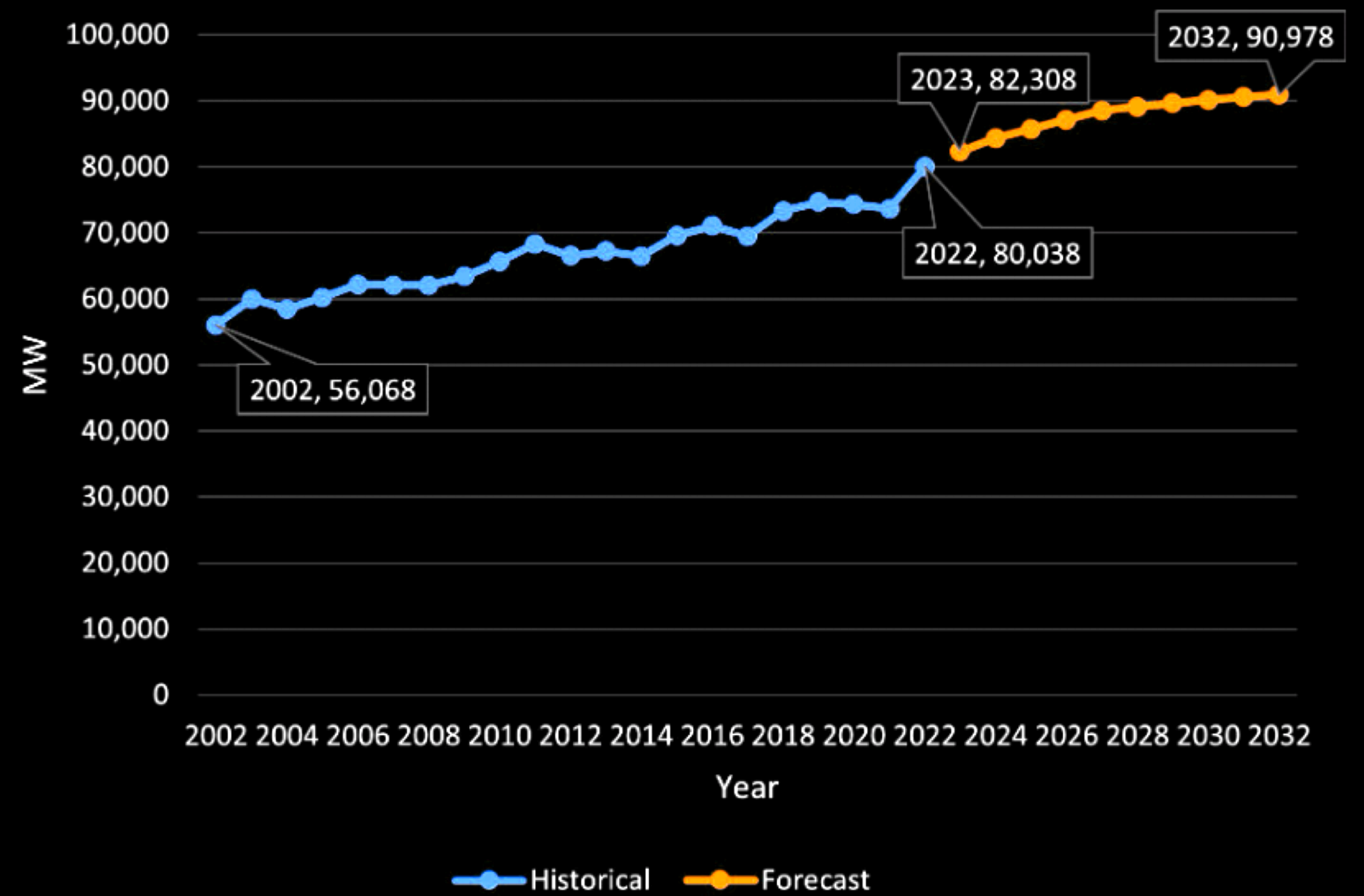
ERCOT, Governor Abbott, Elon Musk, and environmental groups agree: electricity demand is going up

ERCOT Annual Energy Forecast



source: <https://www.ercot.com/gridinfo/load/forecast>

ERCOT Summer Peak Demand Forecast



source: <https://www.ercot.com/gridinfo/load/forecast>

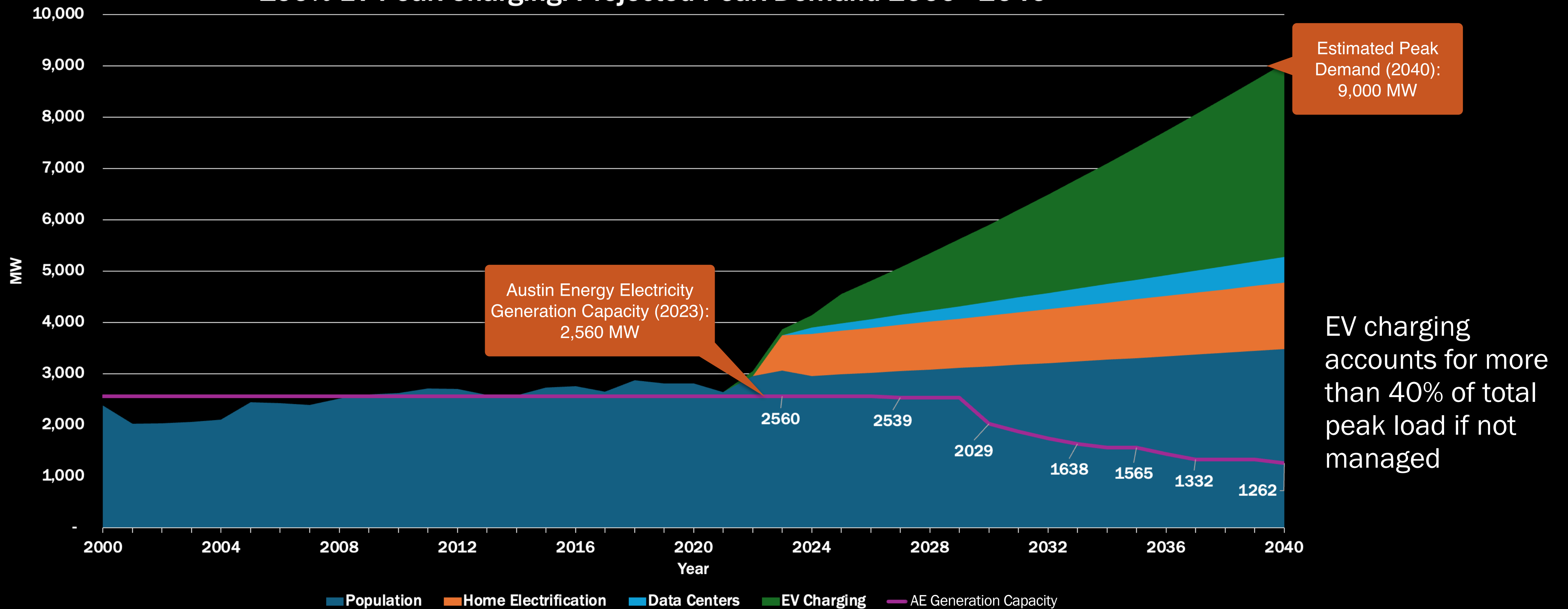
Load growth is on the way up for a few reasons

- Electrification of transportation
- Electrification of industrial loads (data centers, oil & gas, steel, etc.)
- Electrification of home heating and cooking
- Population and economic growth
- Heat Dome (+ Polar Vortices)
- Transmission capacity in ERCOT is scarce and getting scarcer
 - Renewable generation is typically located farther from load centers, leading to transmission congestion

A specific view of load growth in Austin Energy

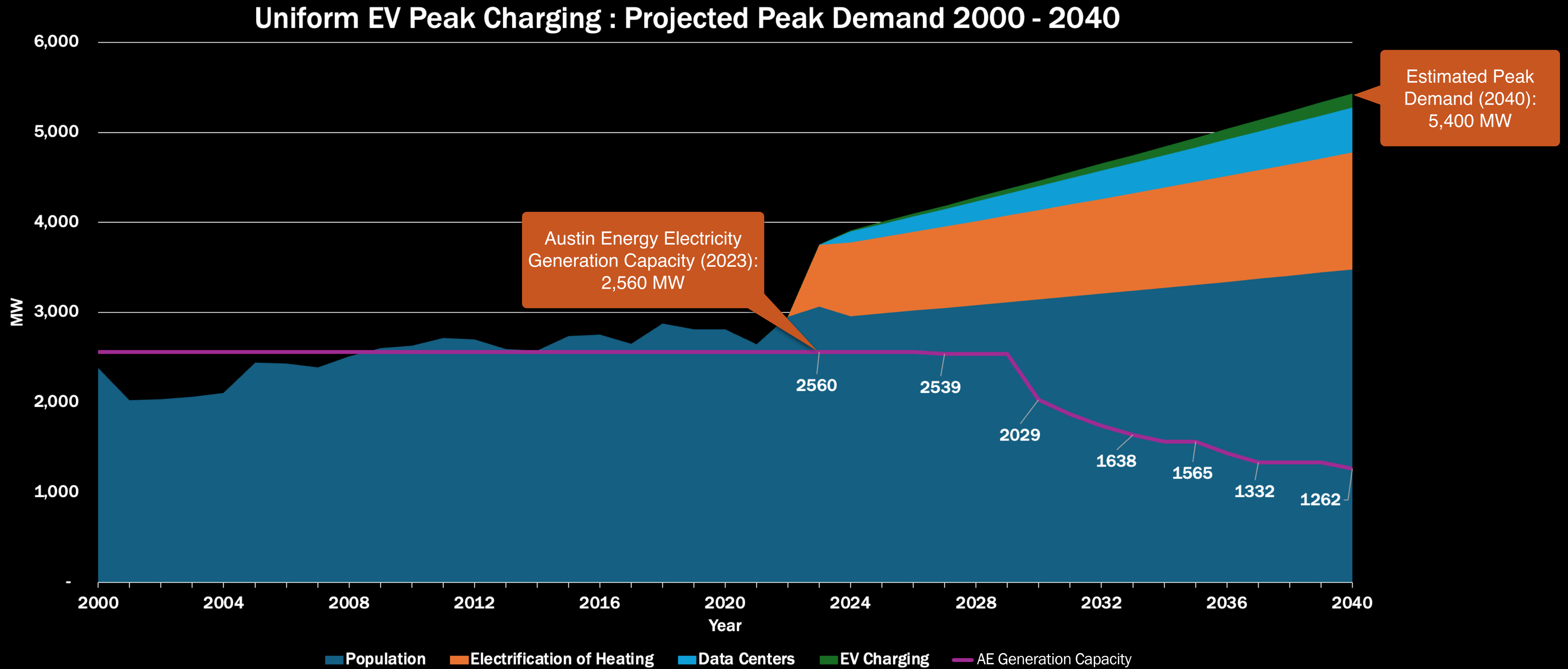
A specific view of load growth in Austin Energy: Scenario 1: No Charging Management for EVs

100% EV Peak Charging: Projected Peak Demand 2000 - 2040



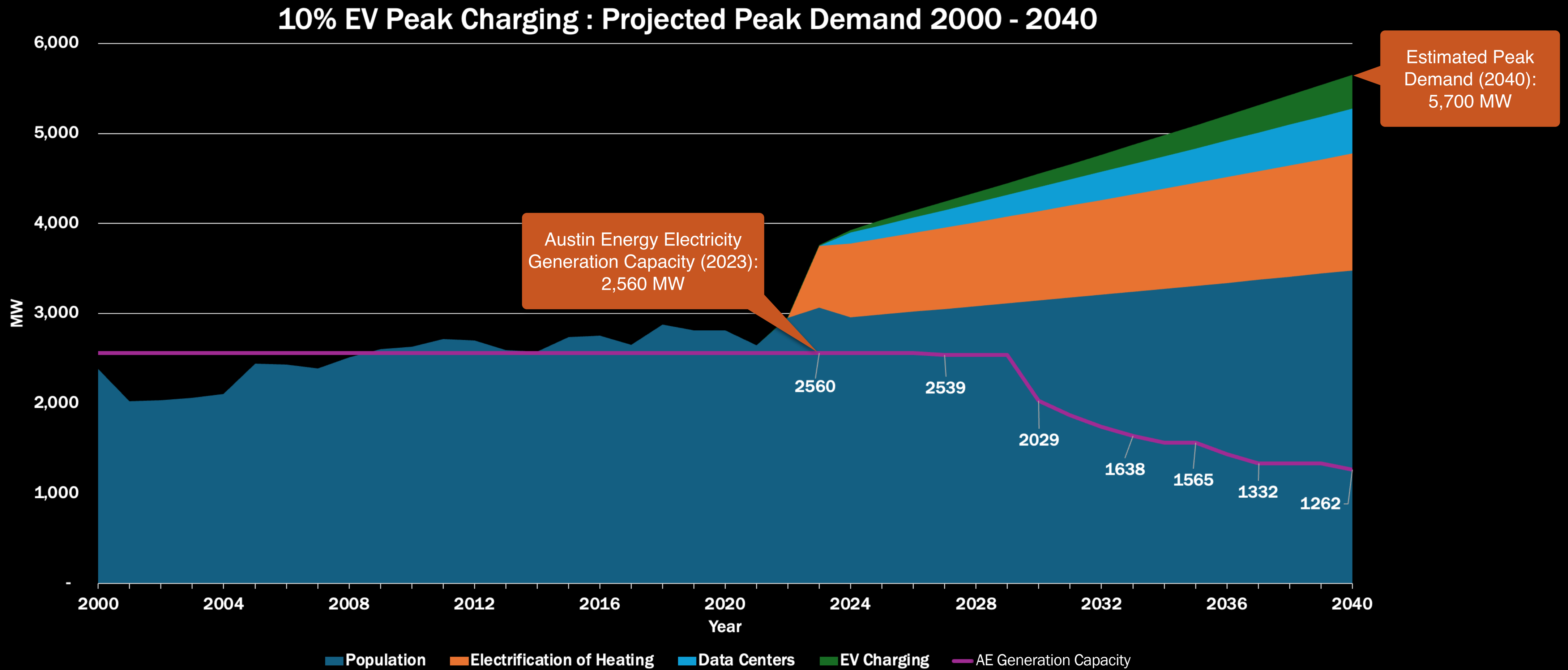
Source: Emily Arnim, WEG

A specific view of load growth in Austin Energy: Scenario 2: Round-the-clock charging management of EVs



Source: Emily Arnim, WEG

A specific view of load growth in Austin Energy: Scenario 3: 10% of EVs Charge at Peak Times (e.g. ERCOT's View)



Source: Emily Arnim, WEG

Are People Across a Wide Geographic Area Really Capable of Synchronous Behavior?

- Yes, especially for weather...
 - Power demand for heating spikes during cold snaps
 - Power demand for cooling spikes during heat waves
- But would they do so for non-weather related activities?
 - Yes

English Tea-Drinking Habits Strain The Grid

GEEK-CETERA ([HTTP://WWW.GEEK.COM/CATEGORY/GEEK-CETERA/](http://www.geek.com/category/geek-cetera/))

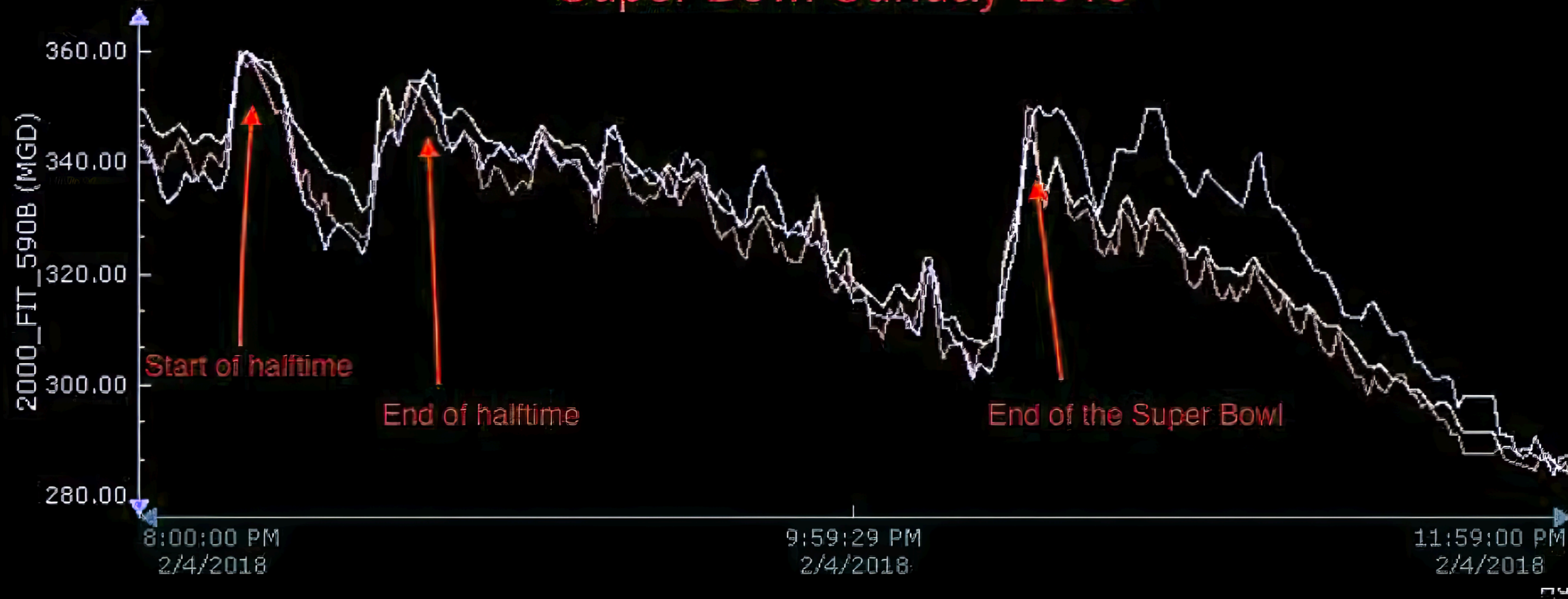
Tea time in Britain causes predictable, massive surge in electricity demand

BY MARK RABY
01.07.2013 :: 5:27PM EST

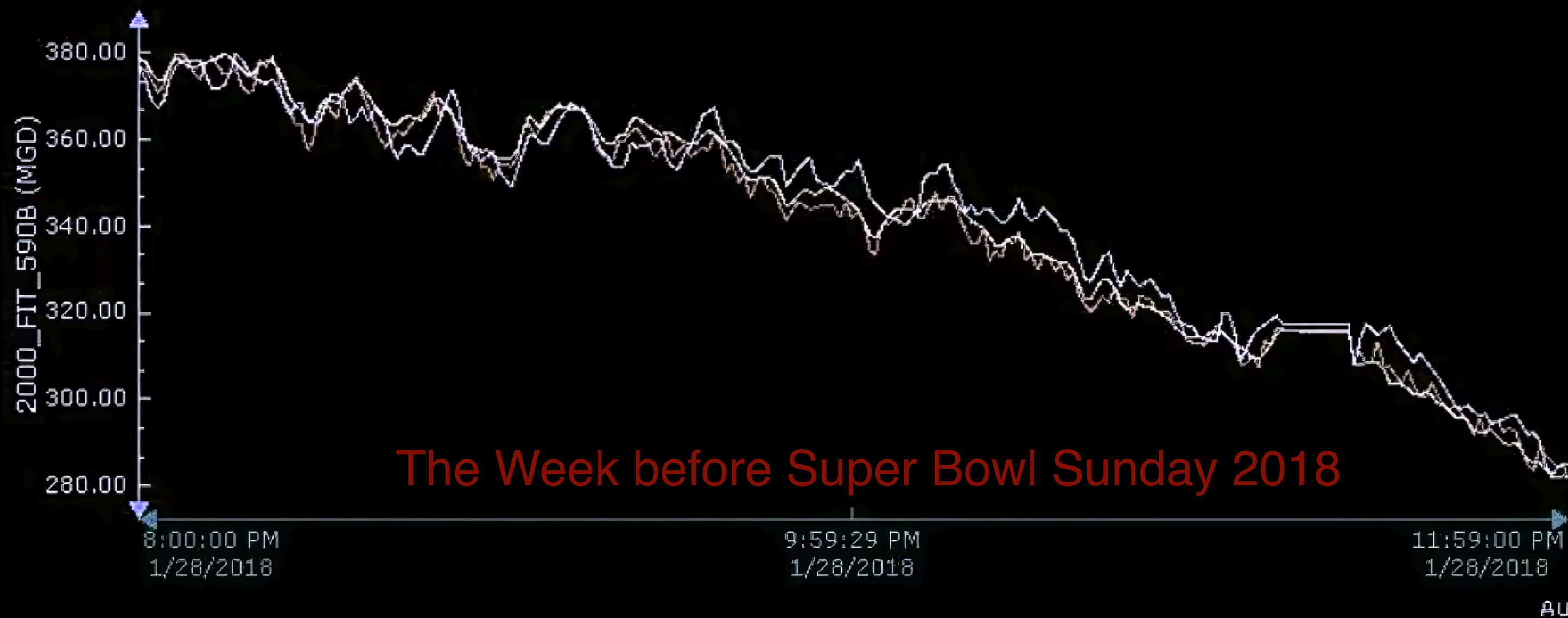
- After a popular soap opera ends, 1.75 million tea kettles are turned on almost simultaneously
- Power surge: 3 GW for 3-5 mins
- Standby power ready from grid in UK and France



Super Bowl Sunday 2018



The Week before Super Bowl Sunday 2018



Super Bowl Flush

- Millions of toilets in New York City are flushed nearly simultaneously
- Creates a wave of wastewater
- Causes a spike in demand from the water reservoir

Traffic Jams: Daily Rush Hour and Holidays

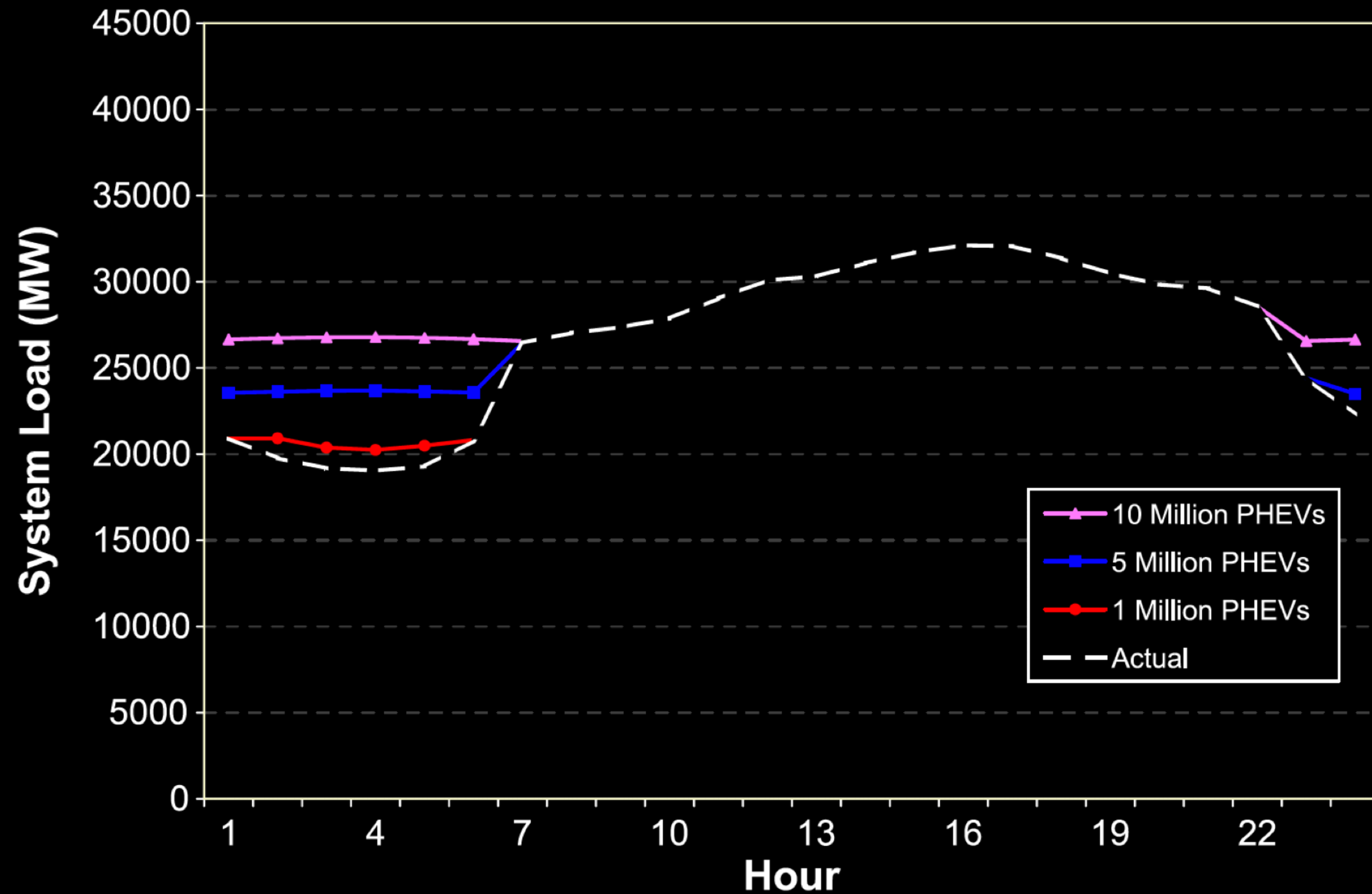


2017 Thanksgiving traffic, Los Angeles, CA

<https://www.latimes.com/local/lanow/la-me-thanksgiving-traffic-20171122-htmllstory.html>

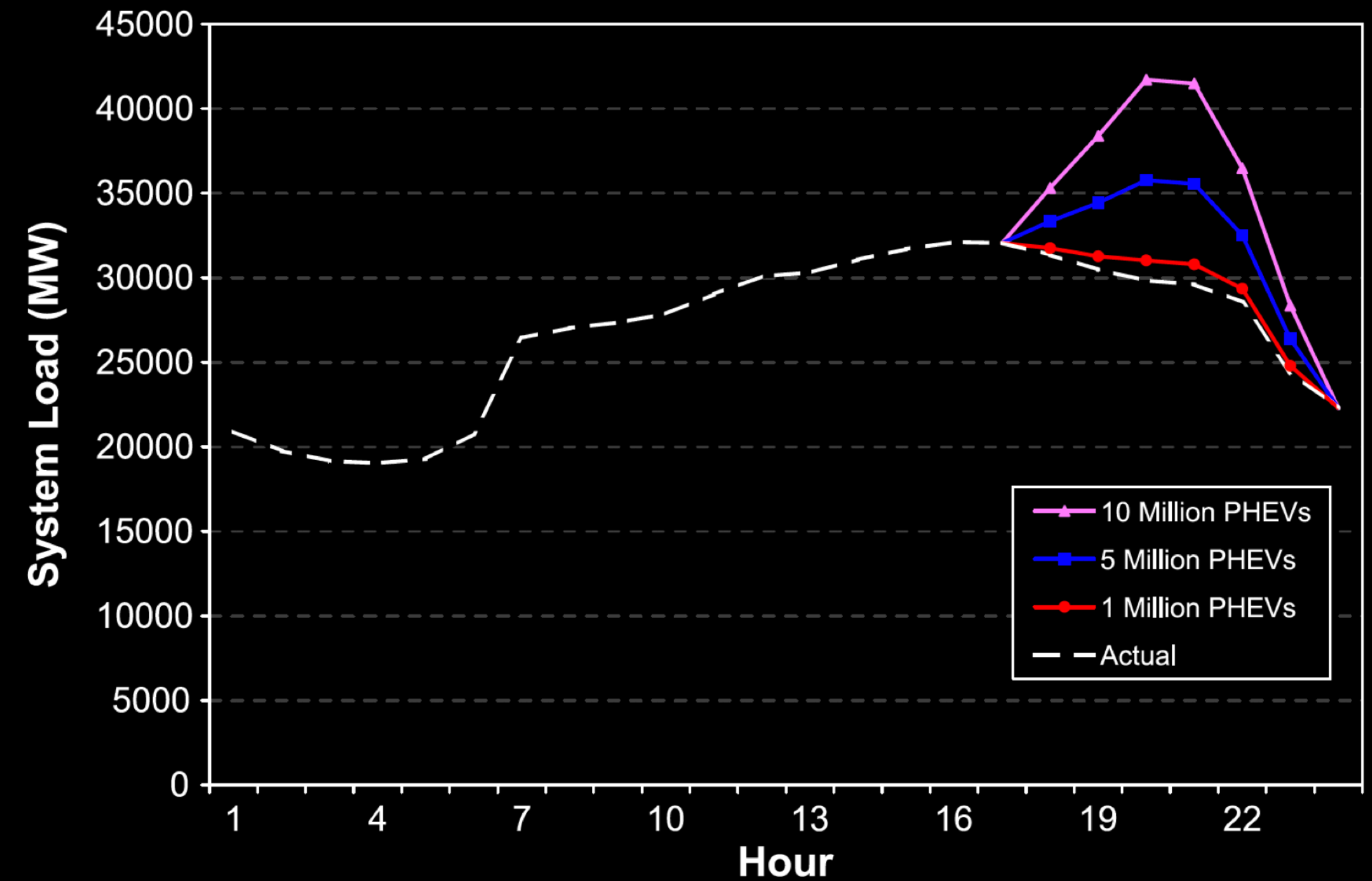
Whether EVs break or save the grid depends on what time of day you charge them (known risk since 2008)

Charging off-peak saves money for everyone



(a) Optimal Charging

Charging on-peak strains the grid for everyone

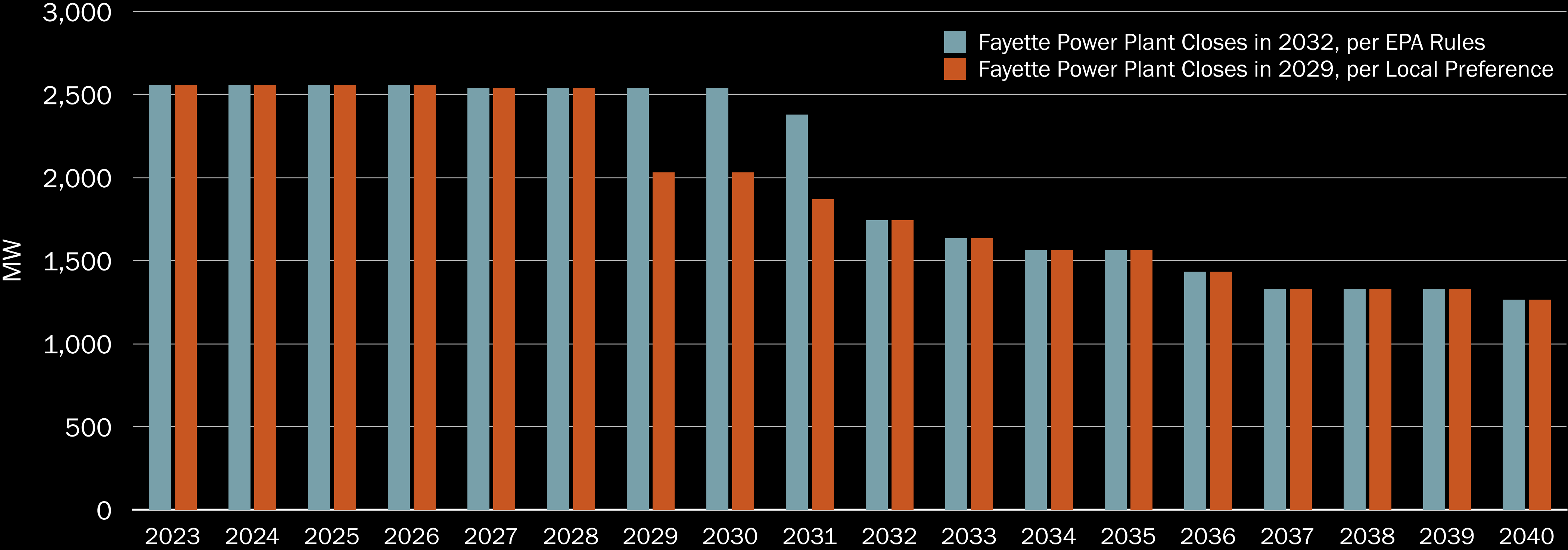


(b) Evening Charging

The Forecasted Shortfall in Generating Capacity Is Significant

Austin Energy's Power Supply Is Scheduled to Drop Significantly

Austin Energy Generating Capacity Based on PPI Contract Expiration



*Showing PPA rolloff for all generators except Decker, Mueller, Sand Hill, South TX, and Nacogdoches

AE Has Options To Meet Resource Adequacy Needs

Options to meet resource adequacy needs: Non-Generators

- Energy efficiency
 - Reduces the need for more electricity
 - Keeps homes at a safer and more comfortable temperature for longer if there is a power outage during a weather event
- Demand response at residences
 - Turning loads off is just as useful as turning power plants on
 - Non-essential loads (hot water heaters, pool pumps,...)
 - Essential loads (heating/cooling) but on a rotating basis
- Batteries and other storage systems
 - Very helpful, but limited in duration

Options to meet resource adequacy needs: Renewables

- Renew existing (out-of-service area) PPAs (power purchase agreements) for wind and solar
 - Possible increase through repowering
 - Because of new federal legislation, which offers tax transferability, PPAs are not nearly as attractive today as in the 2000s and 2010s
 - Does not alleviate concerns about transmission congestion
- Add new solar in the AE service area
 - Prioritize commercial locations, parking lots, warehouses, etc. (vs. rooftop solar) to reduce costs
- Consider expanding solar out of service area but nearby in less congested areas

Options to meet resource adequacy needs: Dispatchable Sources

- Dispatchable carbon-free generation still needed
 - Likely with low capacity factor to serve when wind/solar availability is low
- Near-term options
 - Gas (w/carbon removals at Nacogdoches or elsewhere)
 - Gas (w/carbon capture on site)
 - Gas (w/ flexible fuel)
 - Biomethane
 - Hydrogen
 - Ammonia
 - FPP but with wood pellet blending, carbon capture, etc.
- Longer-term options
 - Geothermal (hard to do in AE Service area)
 - Nuclear Fission (technology used at STP Nuclear):
 - slow to build
 - expensive
 - hard to do in AE Service area
 - could potentially install SMR or traditional Gen III or Gen IV plus-up at STP
 - Nuclear Fusion:
 - technically immature
 - hard to estimate construction times, cost, regulatory context, etc.

Special considerations for Austin Energy

Special considerations for Austin Energy

- Building dispatchable power within the AE service zone reduces exposure to significant financial risk from
 1. bulk grid price volatility
 2. transmission congestion pricing
 3. improves reliability
- Rotating machines are particularly valuable for voltage/frequency control (thermal power plants, synchronous condensers, etc.)
- PPAs still have a part to play but are no longer as desirable b/c of new tax transferability rules
- Munis are uniquely positioned to address this load growth b/c of the ability to reduce dependence on construction of new transmission

Special considerations for Austin Energy: Equity

- Fenceline pollution
- Other nuisances (noise, sight pollution, etc.)
- Jobs
- Electricity cost
- Electricity reliability

Special considerations for Austin Energy: Environment

- Using electricity to displace gasoline or diesel in vehicles or natural gas in home heating/cooking systems has distinct environmental benefits
- Using FPP to charge EVs is environmentally beneficial compared to gasoline or diesel engines
 - ICEs (internal combustion engines): daytime, urban, ground level tailpipes in heavily-populated urban areas
 - EVs (electric vehicles): night-time, rural, smokestacks
 - Reduces the formation of photochemical smog (because of no sunshine at night) and human exposure b/c of less populous areas around smokestacks and dilution from higher-altitude releases that spread more quickly

IOP PUBLISHING ENVIRONMENTAL RESEARCH LETTERS
Environ. Res. Lett. 4 (2009) 014002 (12pp) doi:10.1088/1748-9326/4/1/014002

Air quality impacts of using overnight electricity generation to charge plug-in hybrid electric vehicles for daytime use

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IOP PUBLISHING ENVIRONMENTAL RESEARCH LETTERS
Environ. Res. Lett. 6 (2011) 024004 (11pp) doi:10.1088/1748-9326/6/2/024004

Air quality impacts of plug-in hybrid electric vehicles in Texas: evaluating three battery charging scenarios

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Summary

- Utilities (including AE) need to prepare for an era of unprecedented growth in electricity
- AE should expedite the deployment of a variety of supply and demand options to ensure resource adequacy while minimizing exposure to out-of-service area price volatility and transmission congestion fees
 - These resources include a mix of generation options (thermal, etc.) + demand side controls and options (rooftop solar, batteries, demand response, efficiency, etc.)
 - Opportunity to improve overall system performance and lower costs for customers
 - Updated fuels mix + electrification of vehicles & heat will reduce emissions
 - Equity elements should also improve
- This is an opportunity to improve overall financial health of the utility (and therefore provide more benefit to the Austin community and customers)
- Key lens through which energy options should be considered: trade-offs

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