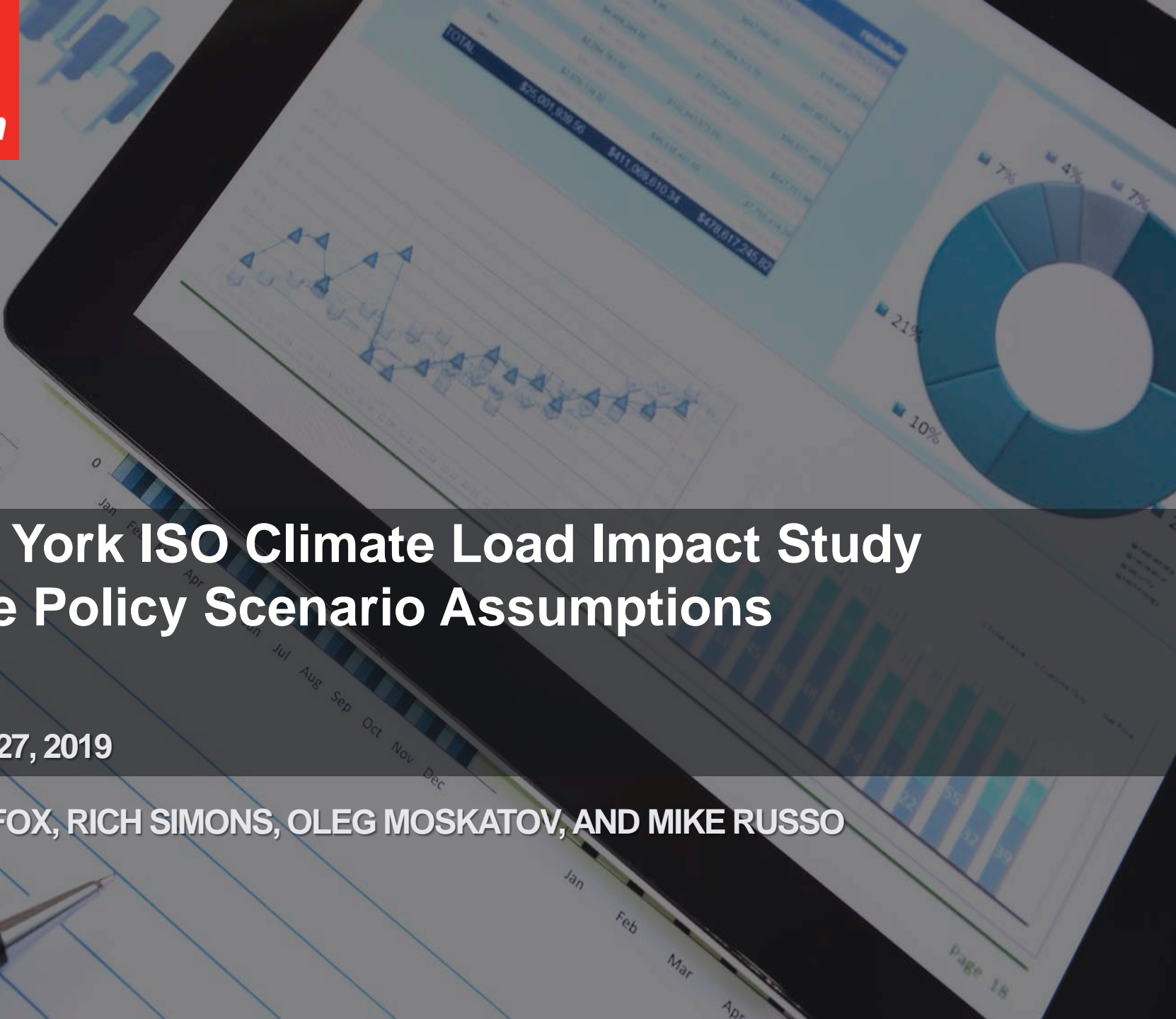




New York ISO Climate Load Impact Study State Policy Scenario Assumptions

SEPT 27, 2019

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AGENDA

» State Policy Scenario

- Identification and Discussion on State and Regional Policy Assumptions
 - Energy Efficiency
 - Electric Vehicles
 - Electrification – Residential Heating, Water Heating, Dryers, Cooking
 - Behind the Meter Solar
 - Battery storage

» Discussion of Climate Trends

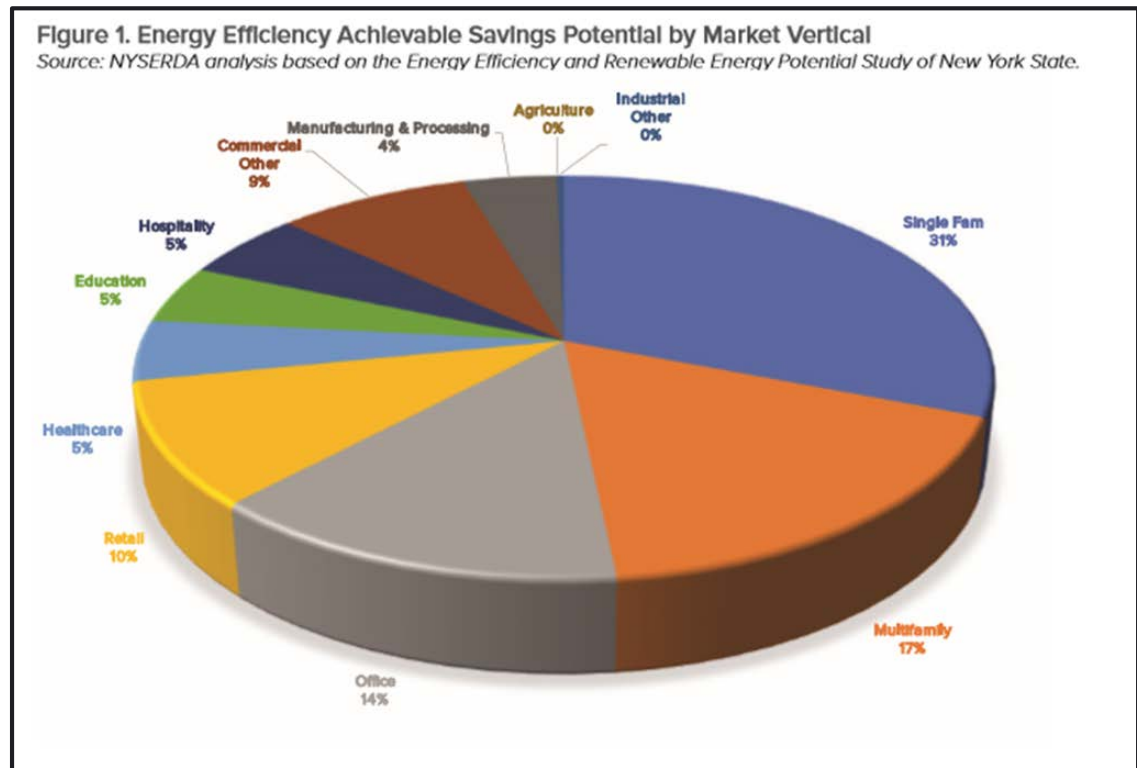
- Climate Impact
 - Historical Trend – 0.7 degrees per decade
 - Extreme Trend – 1.4 degrees per decade

EFFICIENCY

ENERGY EFFICIENCY

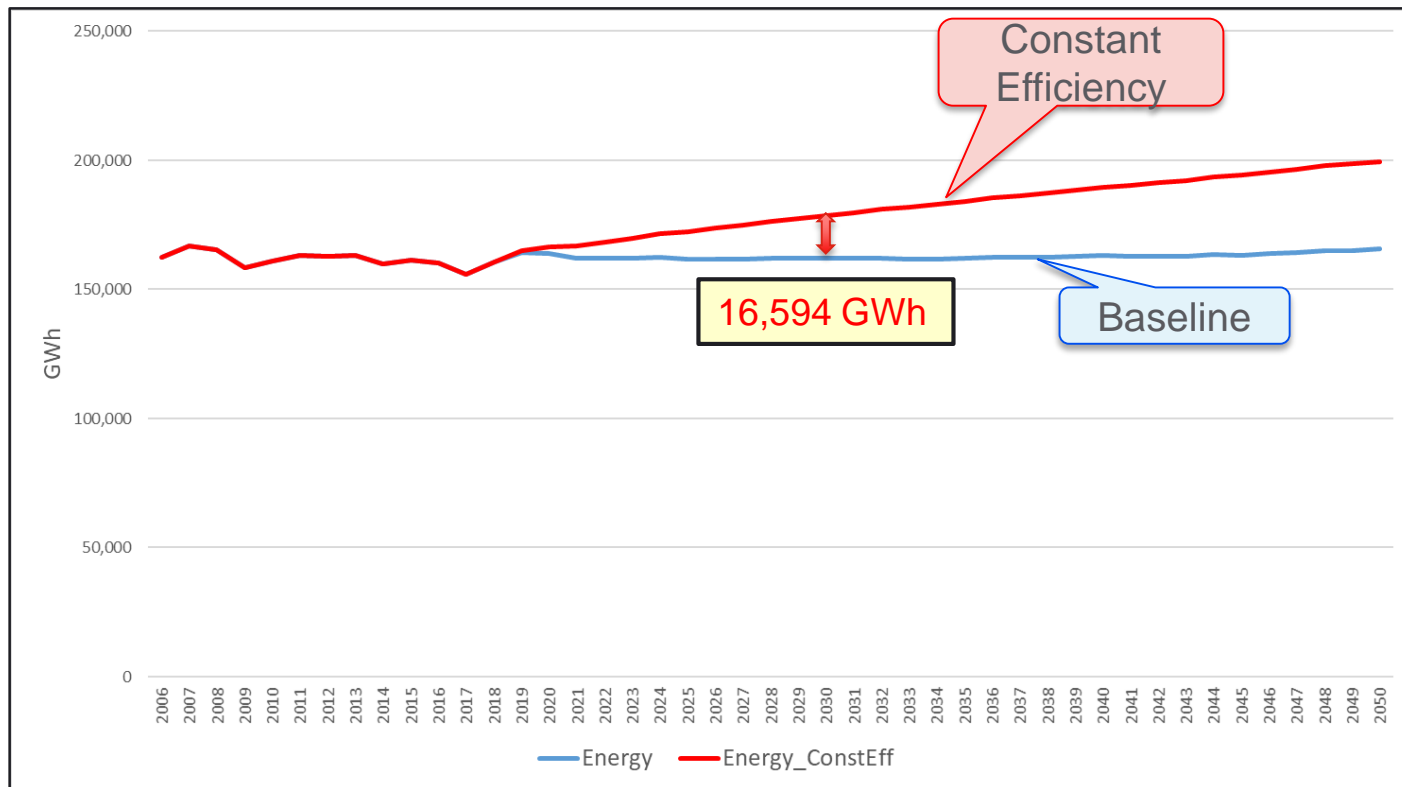
» Statewide Efficiency Goal

- 30,000 GWh of new energy savings by 2030
 - 48% residential
 - 48% commercial
 - 4% industrial

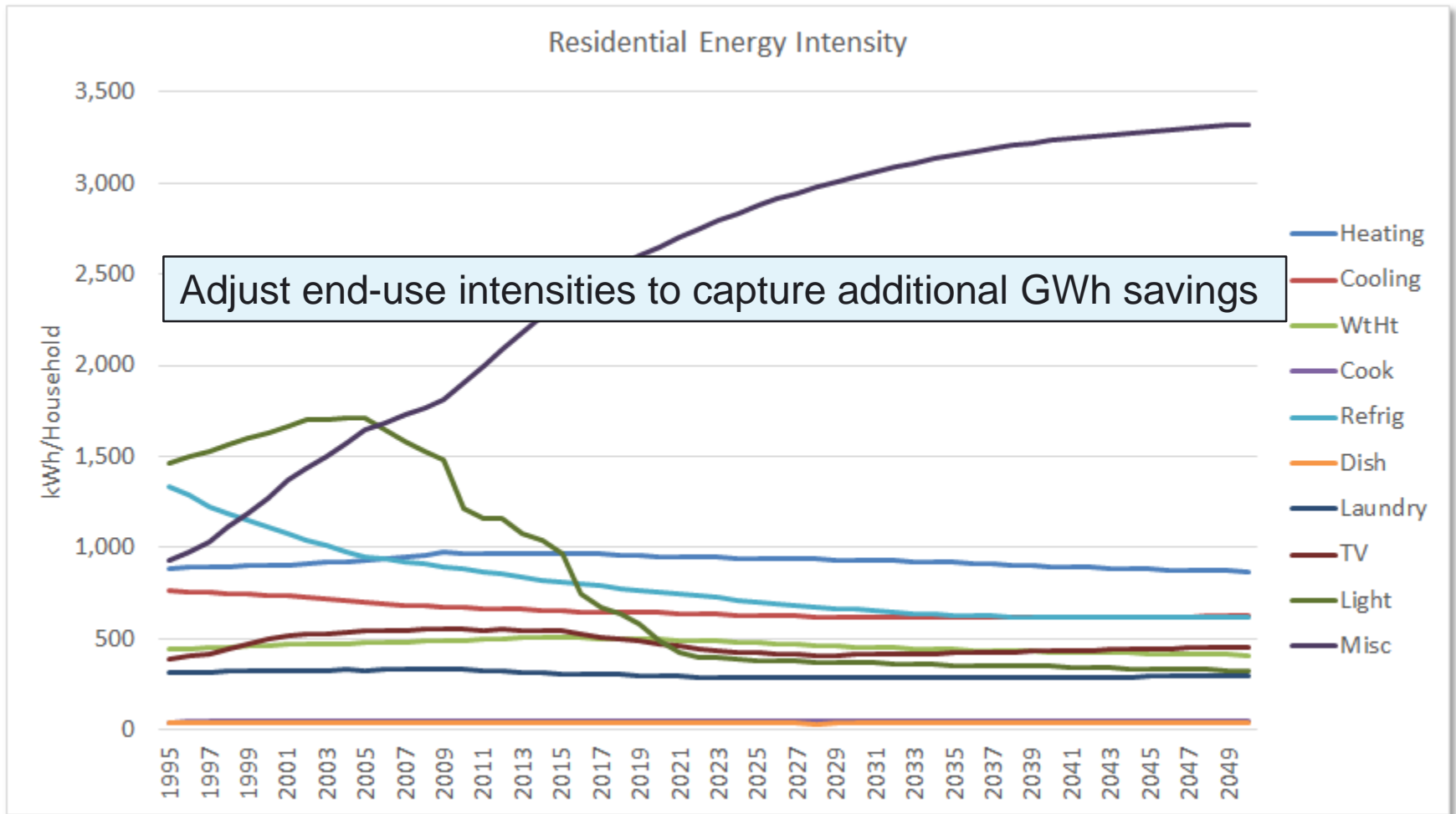


CAPTURING END-USE EFFICIENCY

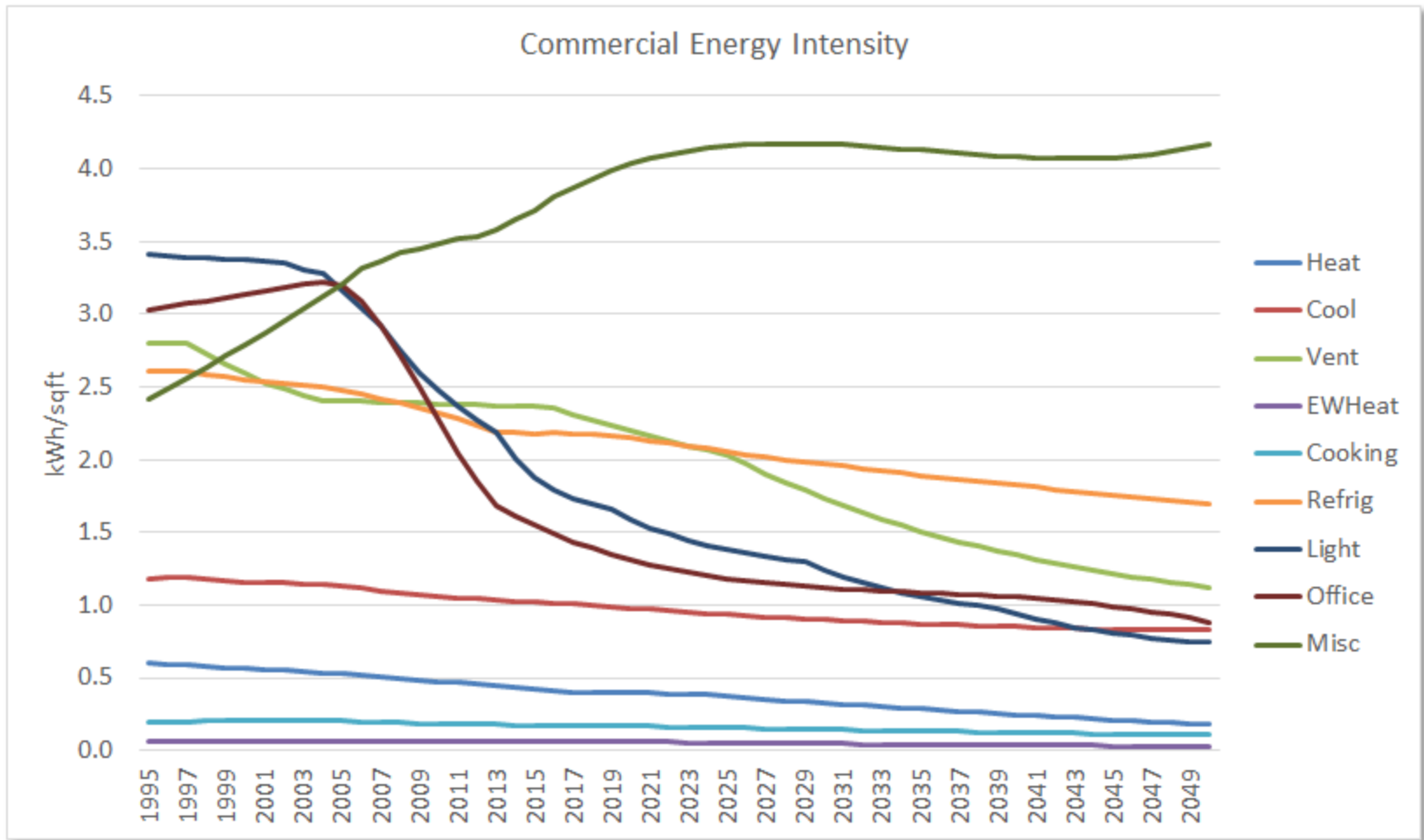
- » Baseline model captures little over half of the savings goal
 - Driven by EIA end-use efficiency and thermal shell integrity projections calibrated to New York end-use saturation data



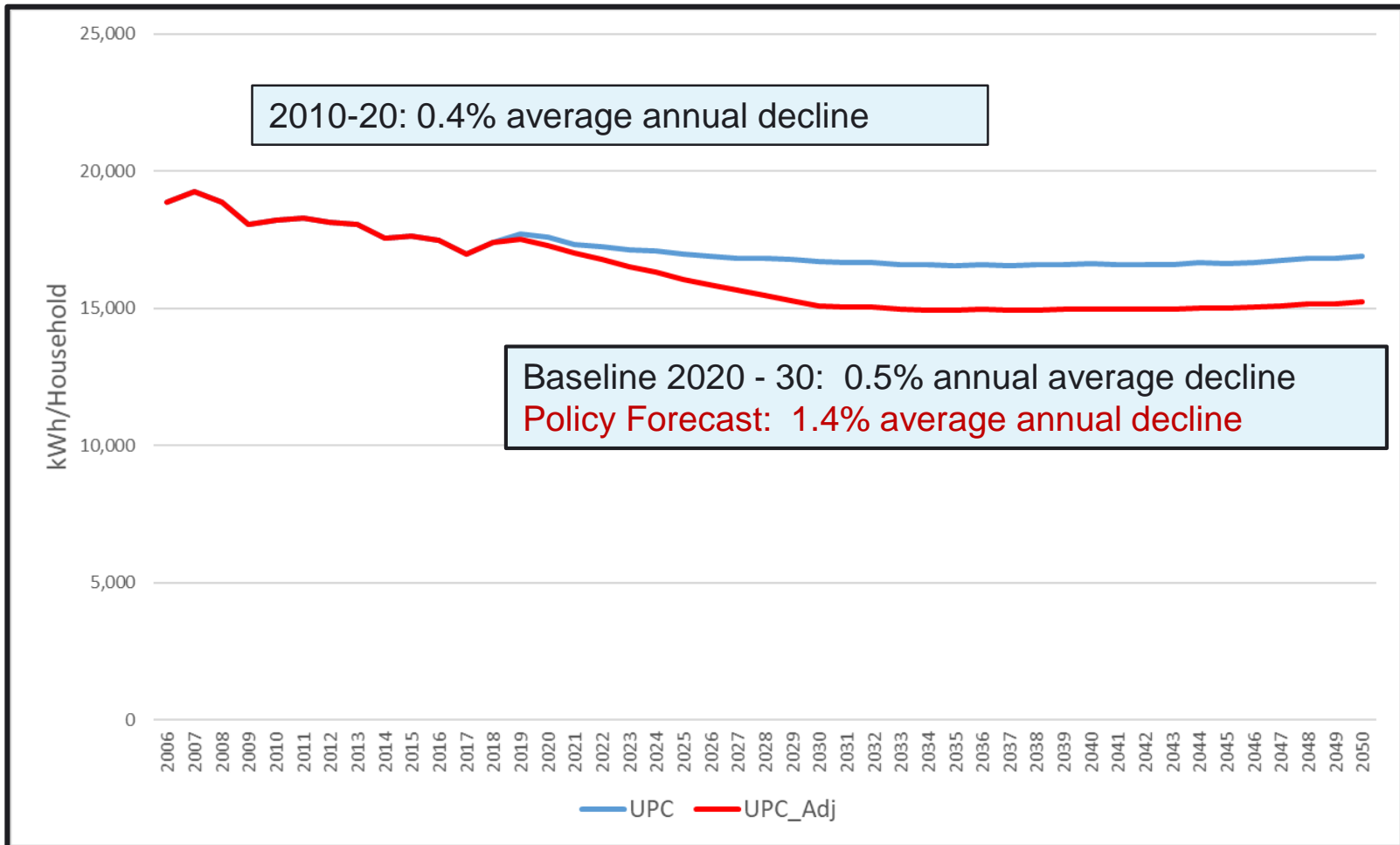
HOW WE CAPTURE EFFICIENCY: RESIDENTIAL



COMMERCIAL END-USE INTENSITIES



NY SYSTEM ENERGY USE PER HOUSEHOLD



* comparison with normal temperature

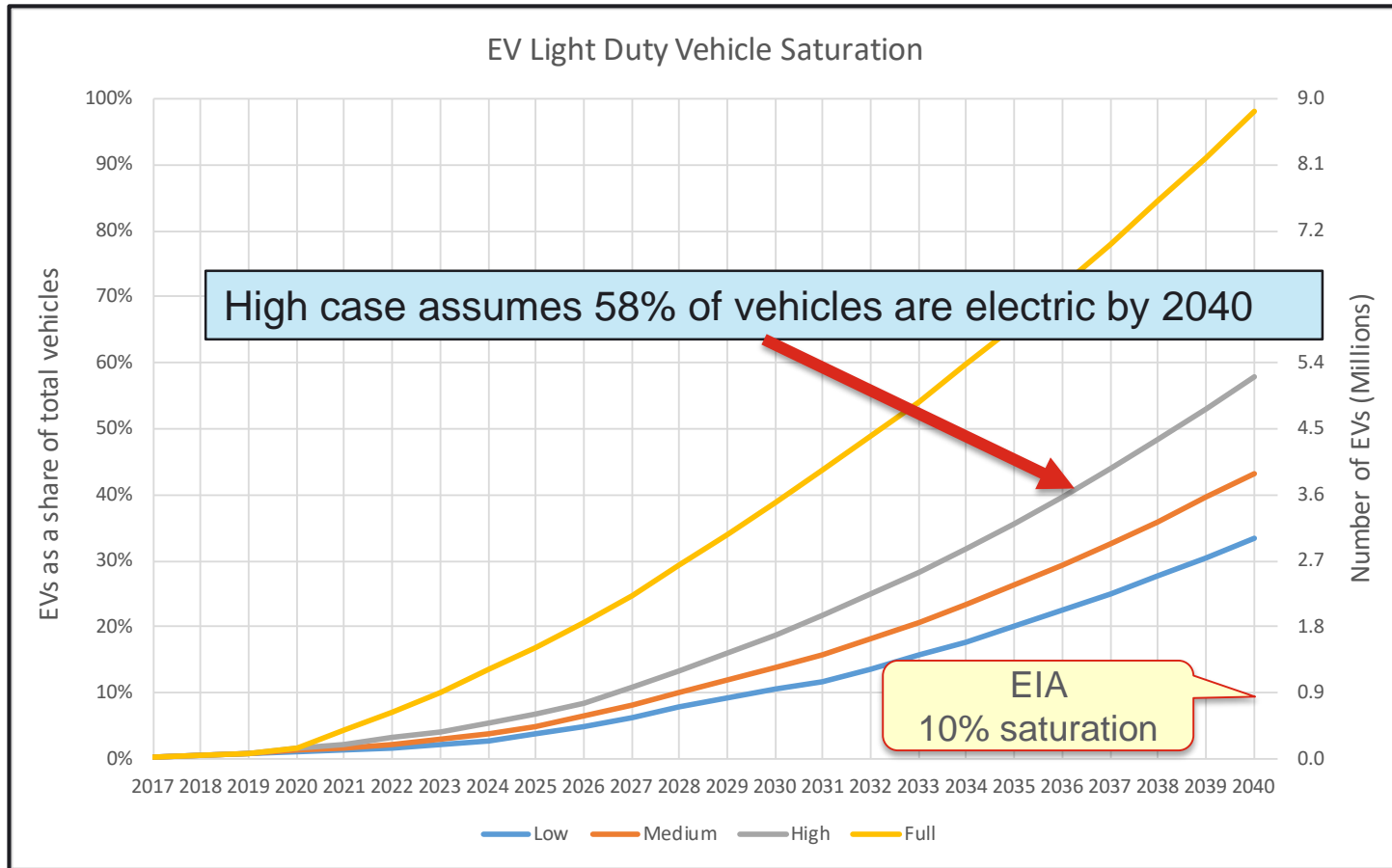
ELECTRIFICATION

CLIMATE LEGISLATION

- » *NY Climate Leadership and Community Protection Act (CLCPA)*
 - Signed into law in July 2019
 - Reduce greenhouse gas emissions 40% over 1990 levels by 2030, and 85% by 2050
 - 1990: 230 million short tons of CO2 equivalent green house gasses¹
 - 2016: 190 million short tons (17% reduction)
 - 2030: 138 million short tons (40% reduction)
 - 2050: 35 million short tons (85% reduction)
 - Annual reductions obtained by:
 - 2016: 40 million short tons
 - 2030: 92 million short tons
 - 2050: 195 million short tons
- » Electrification efforts will have a significant role in achieving these goals
 - Electric vehicles: Cars, Commercial Vehicles, Mass transit
 - Heat pumps: cold climate heat pumps, heat pump water heaters
 - All electric homes

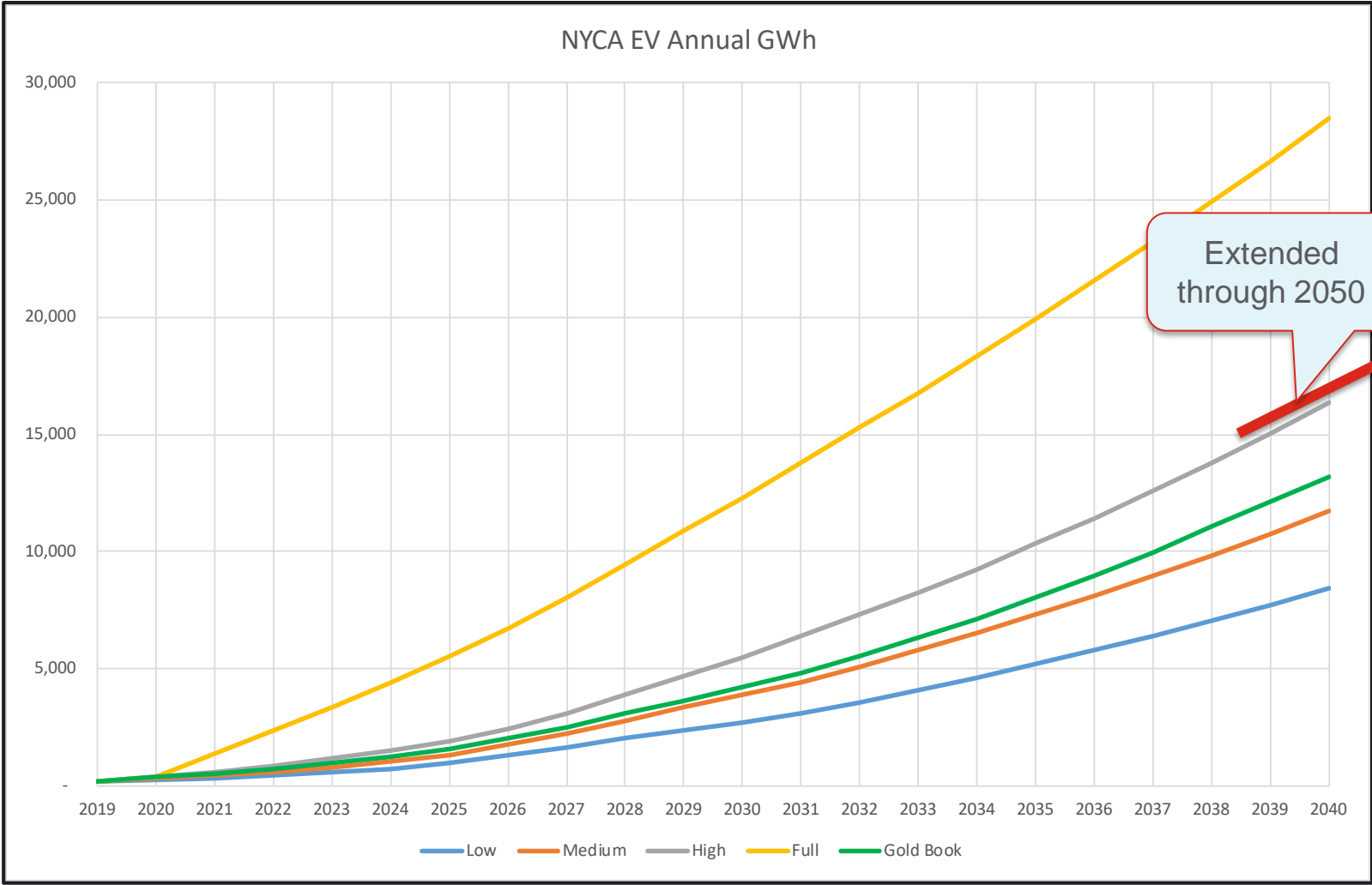
¹ New York State Greenhouse Gas Inventory: 1990 – 2016 NYSERDA, July 2019

NY ISO ELECTRIC VEHICLE FORECAST



Gold Book forecast is based on Medium Case Forecast.
Electrification Scenario based on High Case Forecast.

NY ISO ELECTRIC VEHICLE ENERGY FORECAST



DRIVING ELECTRIC VEHICLE SALES

- » Average fleet standard 54.5 miles per gallon by 2026
 - The only way to get there is with EV sales
 - Small SUVs – average around 30 miles per gallon
 - Pickup trucks average around 23 miles per gallon
 - Though Trump is pushing for a less strenuous target (SAFE)

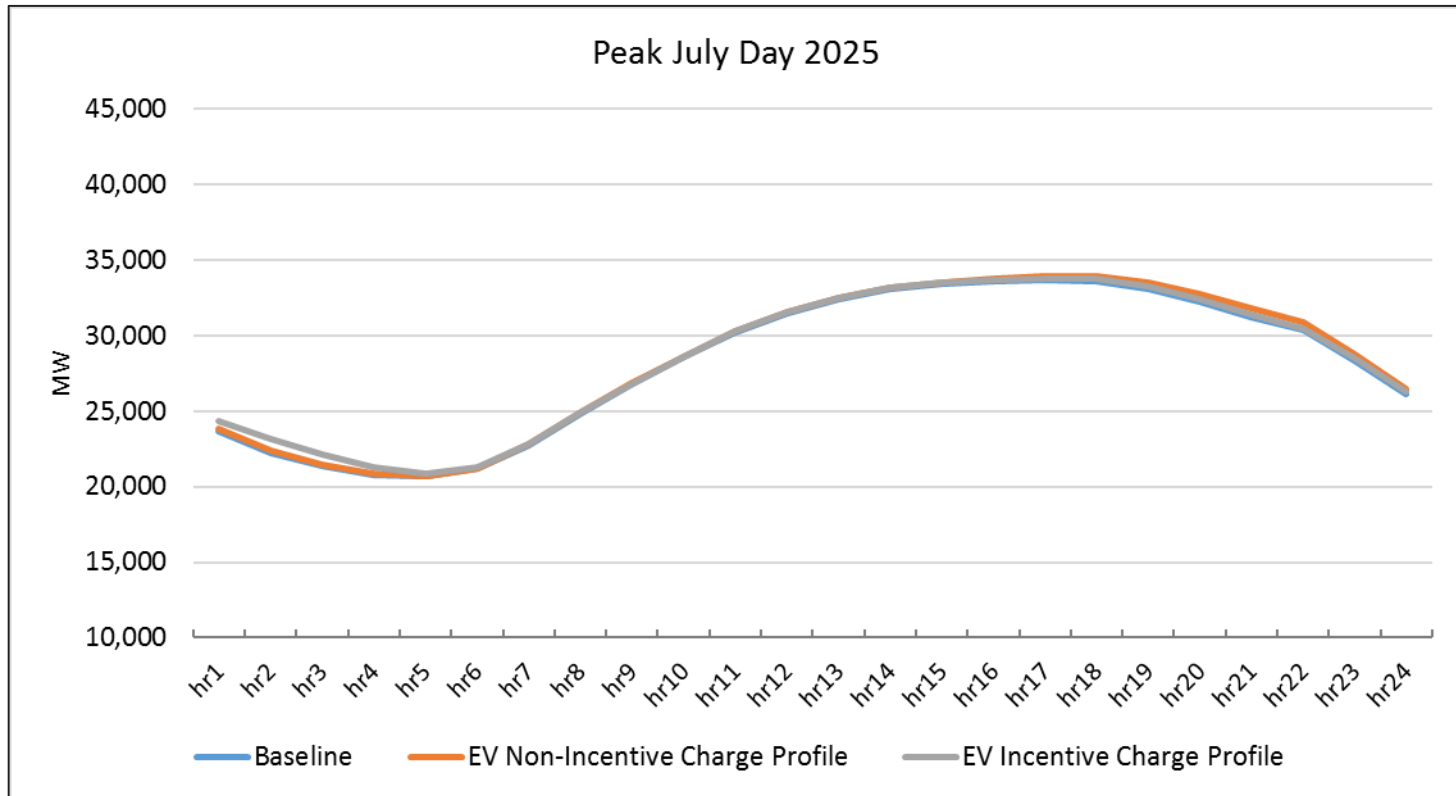
- » Costs continue to decline and \$7,500 tax credit results in price parity with several equivalent gasoline models
 - Tax credit phases out after 200,000 units are sold
 - Tesla and GM have exceeded the cap

- » Improving range with more vehicles over 200 miles per charge

- » Major manufacturers are committed to developing EV technology
 - Over a \$100 billion per year

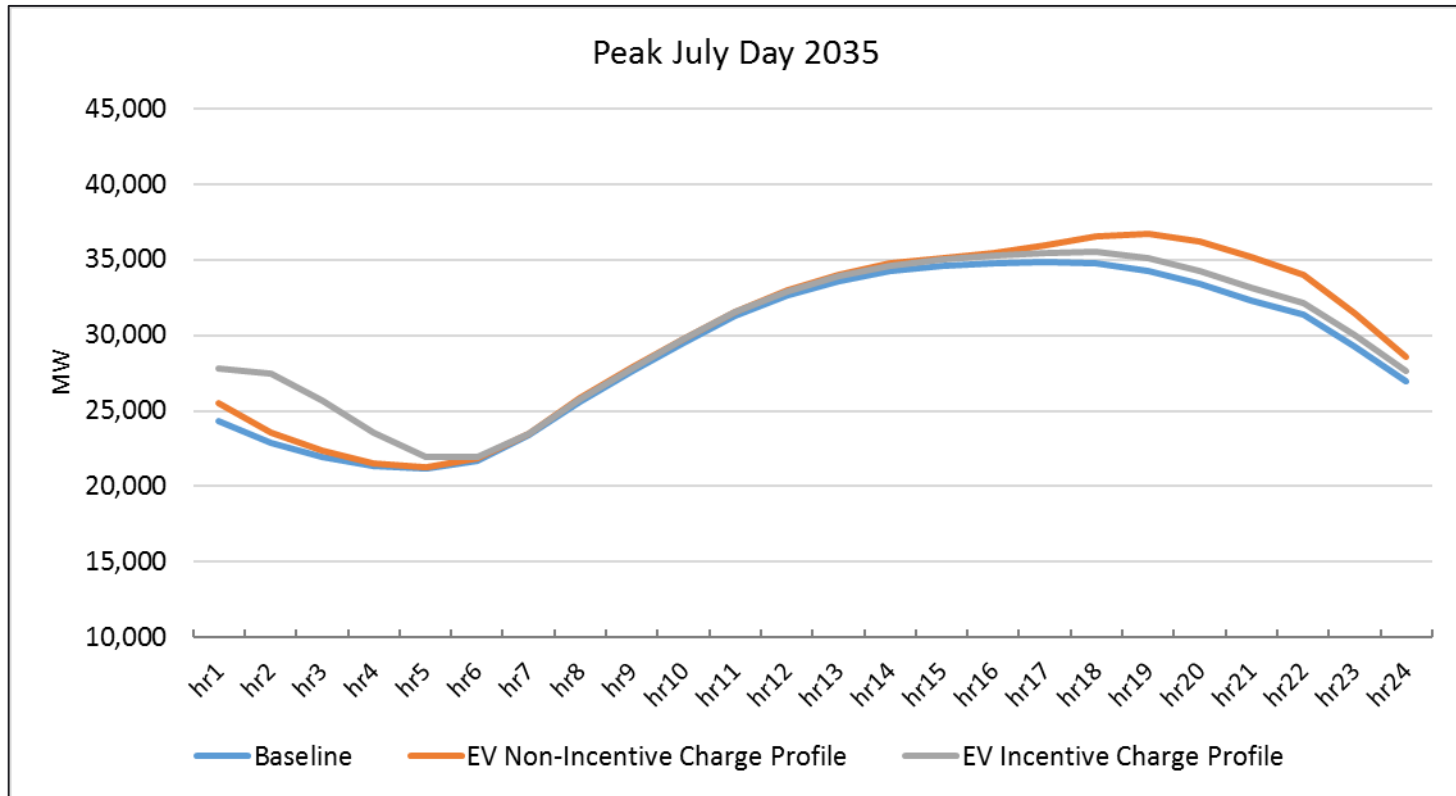
- » Increase in infrastructure support and utility incentives

EV IMPACT ON LOAD



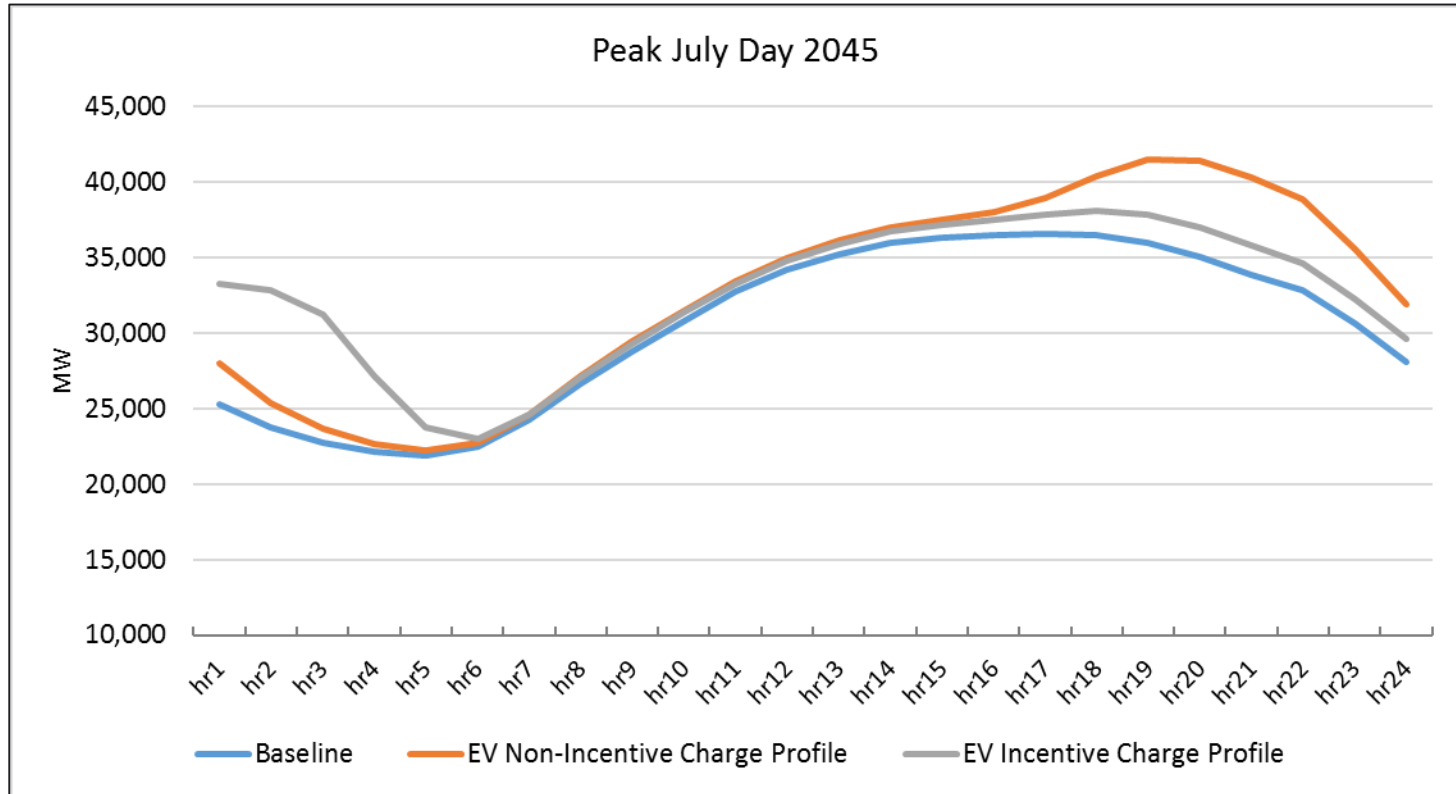
Profile	Timing	Load (MW)
Baseline	Hour 17	33,689
Non-Incentive	Hour 18	33,947
Incentive	Hour 17	33,802

EV IMPACT ON LOAD



Profile	Timing	Load (MW)
Baseline	Hour 17	34,872
Non-Incentive	Hour 19	36,681
Incentive	Hour 18	35,501

EV IMPACT ON LOAD



Profile	Timing	Load (MW)
Baseline	Hour 17	36,543
Non-Incentive	Hour 19	41,468
Incentive	Hour 18	38,079

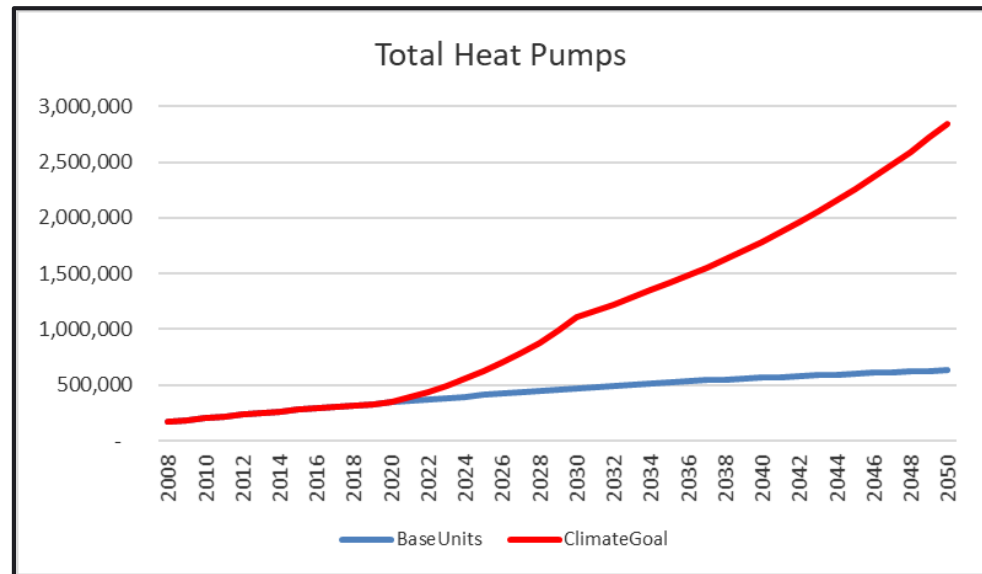
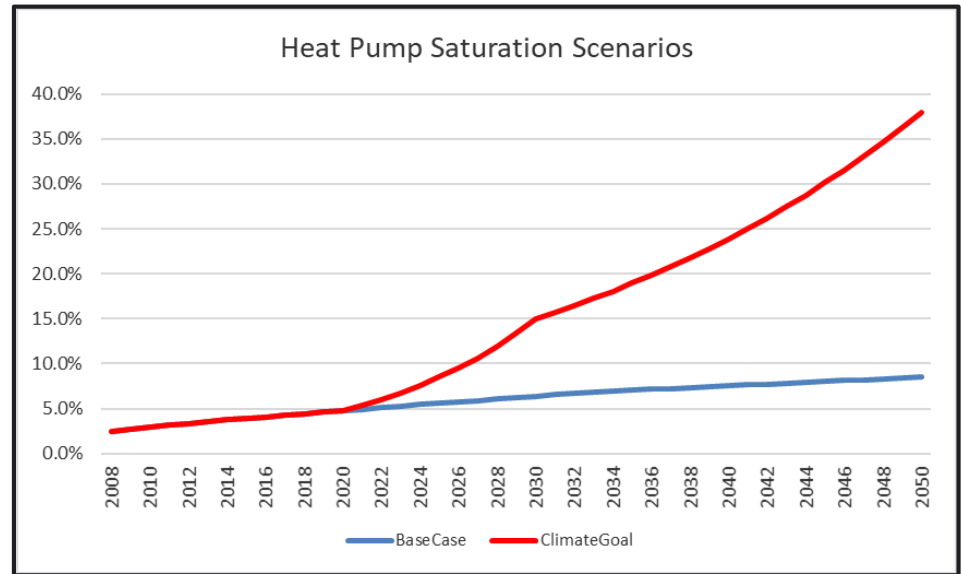
COLD CLIMATE HEAT PUMPS

- » Residential heating will likely be targeted to achieve CO2 goals
 - Approximately 89% of households heat with fossil fuels – natural gas is the dominate heating fuel in NY
- » While heat pumps are not new, heat pumps that operate in sub-freezing weather are new – cold climate heat pumps (CCHP)
 - Operates efficiently with temperatures down to 5 degrees F.
- » Strong adoption in Vermont, Maine, and Massachusetts as result of system promotion and incentives
 - Mini-splits with oil and propane backup
 - Replacing room AC with more efficient cooling

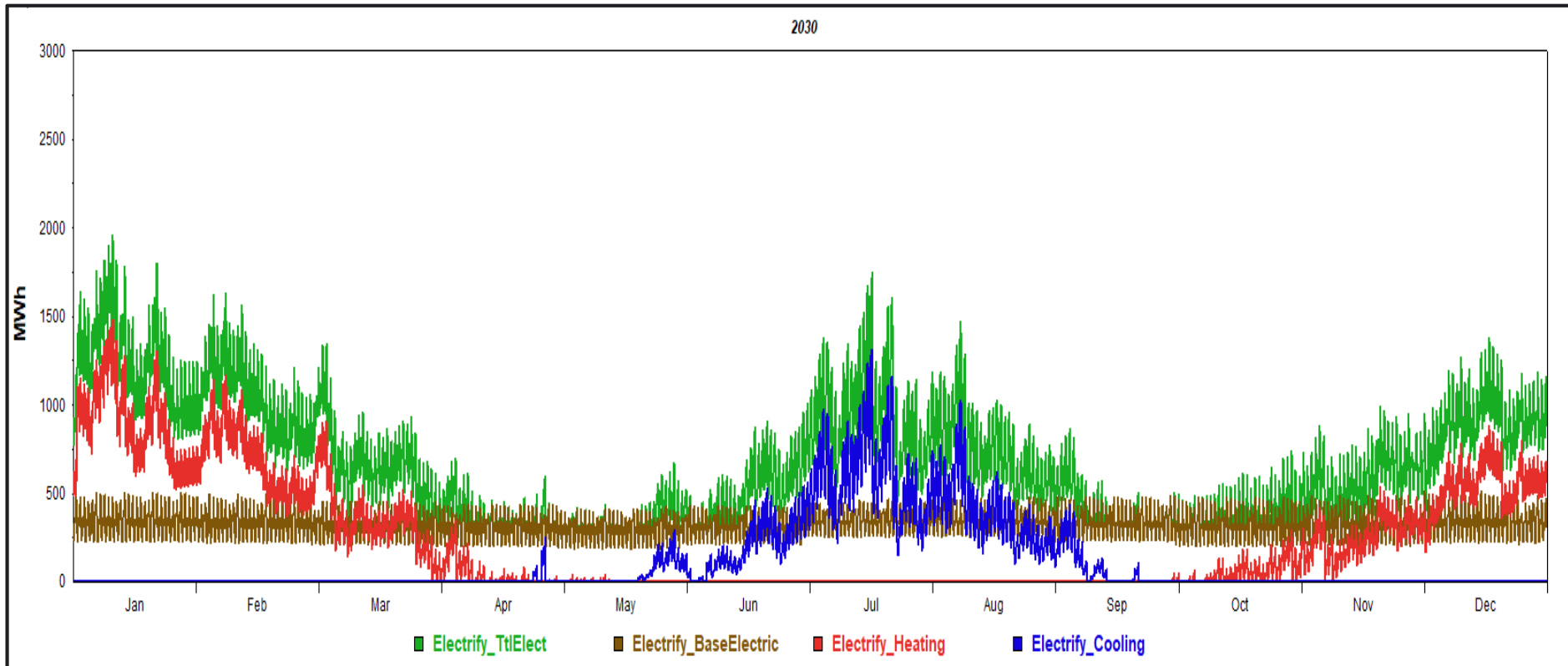


RESIDENTIAL HEAT PUMP PROJECTIONS

- » Baseline saturation in 2030 is 6.5%
- » A 15% saturation by 2030 reduces CO2 emissions from home heating by 3 million tons (40% of heating CO2 emissions)
- » Represents 75,000 new heat pump systems per year vs. baseline of 13,000 per year.
- » Associated higher load growth
 - Water Heating
 - Cooking
 - Dryers



ELECTRIFICATION LOADS

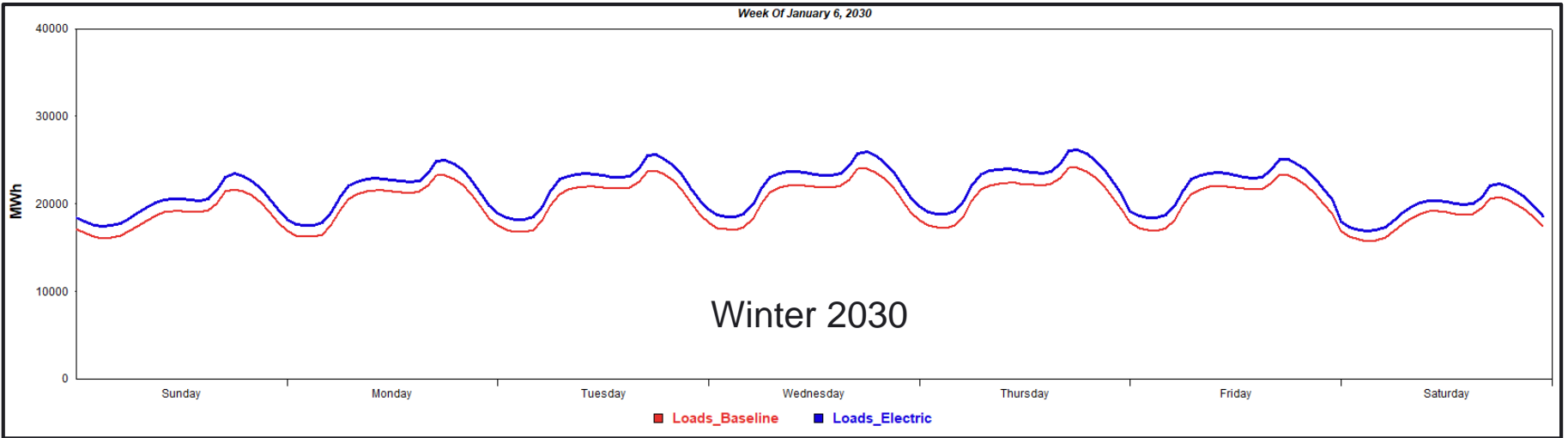


* Excluding electric vehicles

By 2030, adds 1,700 MW to summer peak and 2,000 MW to winter peak

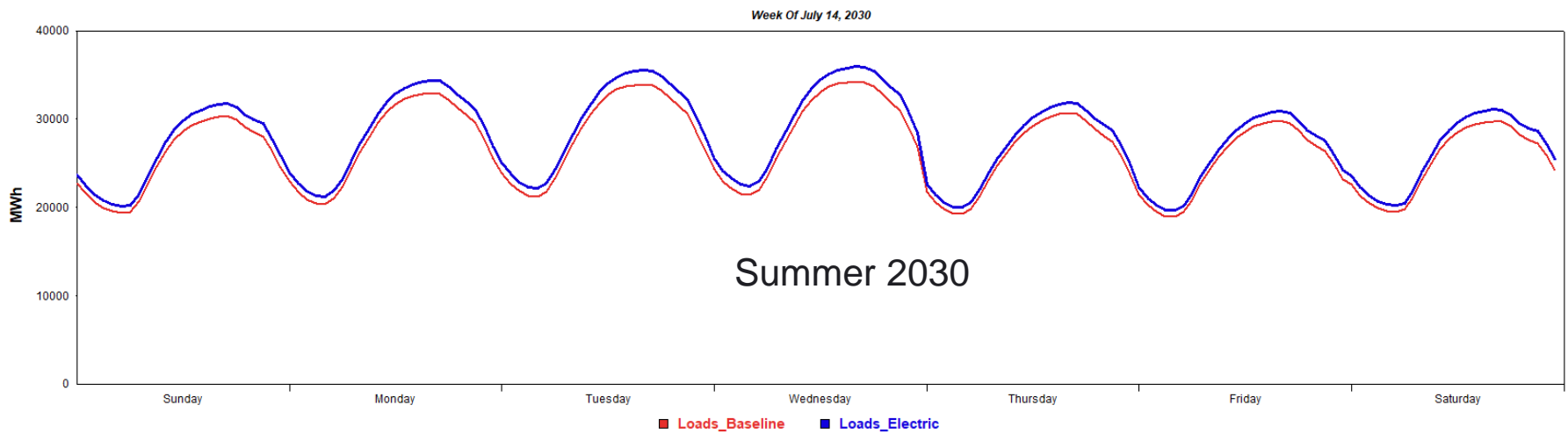
IMPACT ON LOAD

Week Of January 6, 2030



Winter 2030

Week Of July 14, 2030

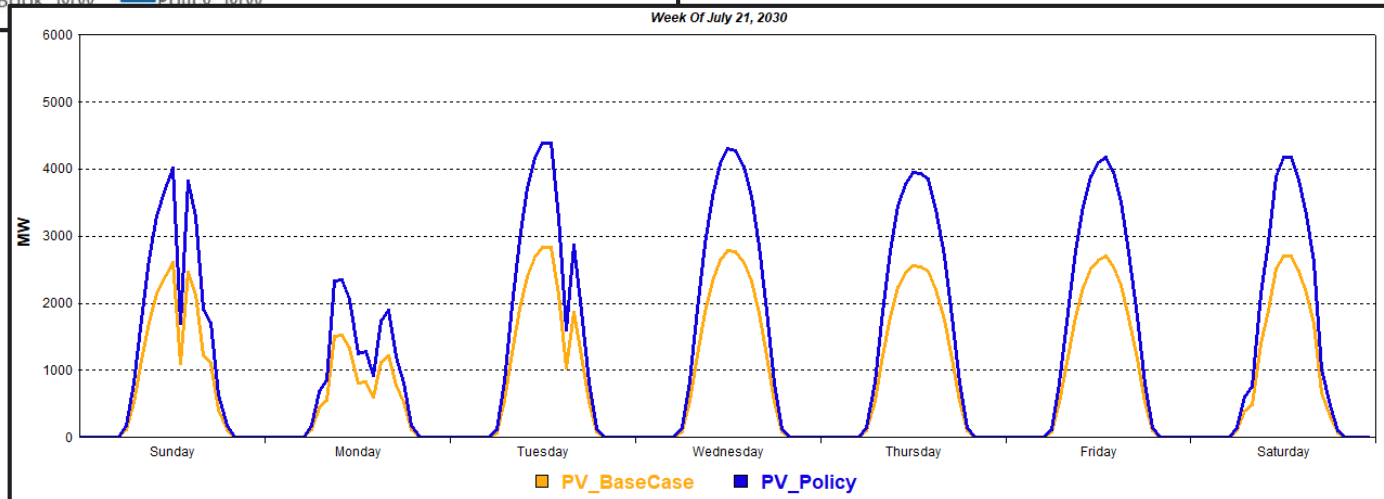
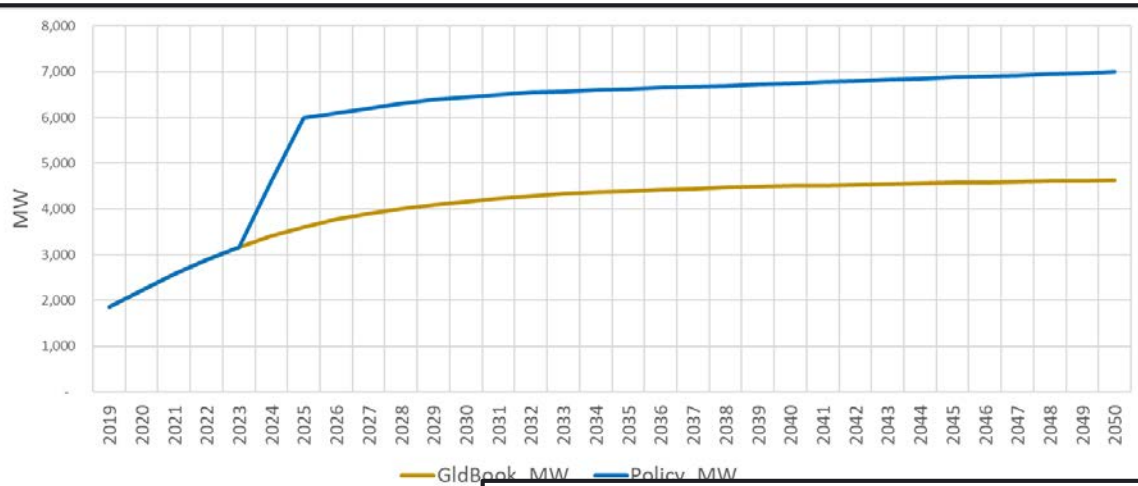


Summer 2030

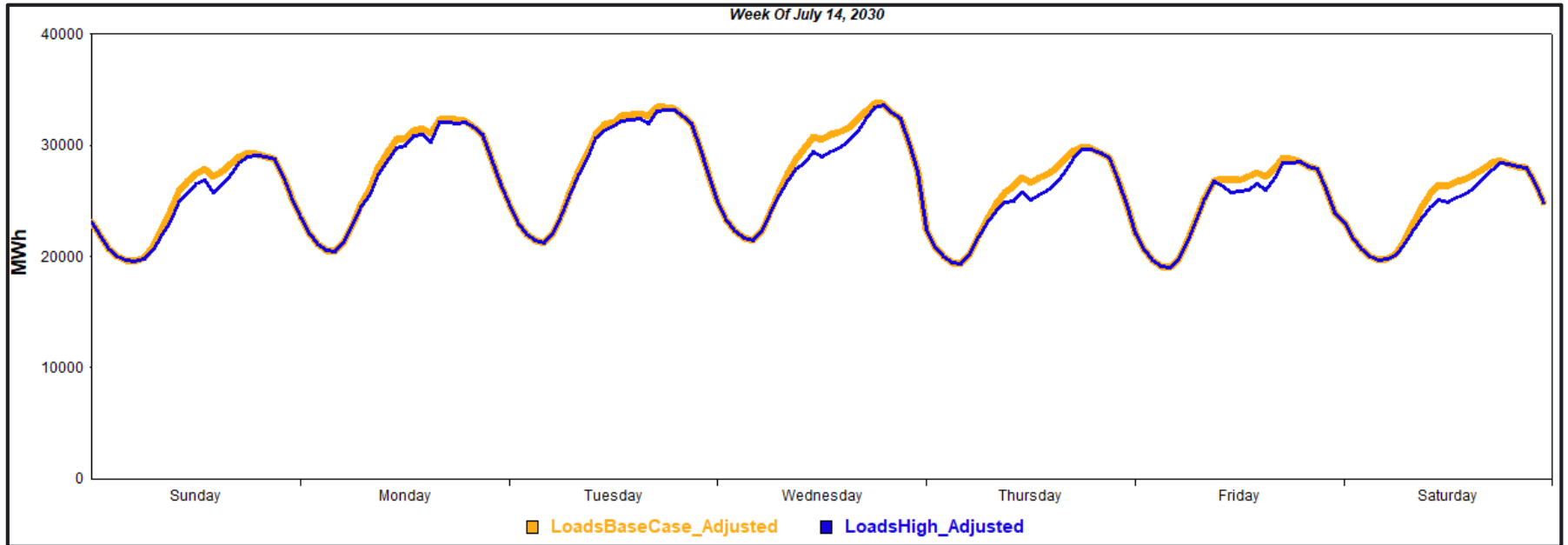
BEHIND THE METER SOLAR

SOLAR LOAD GROWTH IS ALSO STRONGER

- » Statewide Behind the Meter Solar Target of 6,000 MW by 2026
 - Baseline (Gold Book) forecast of 3,000 MW

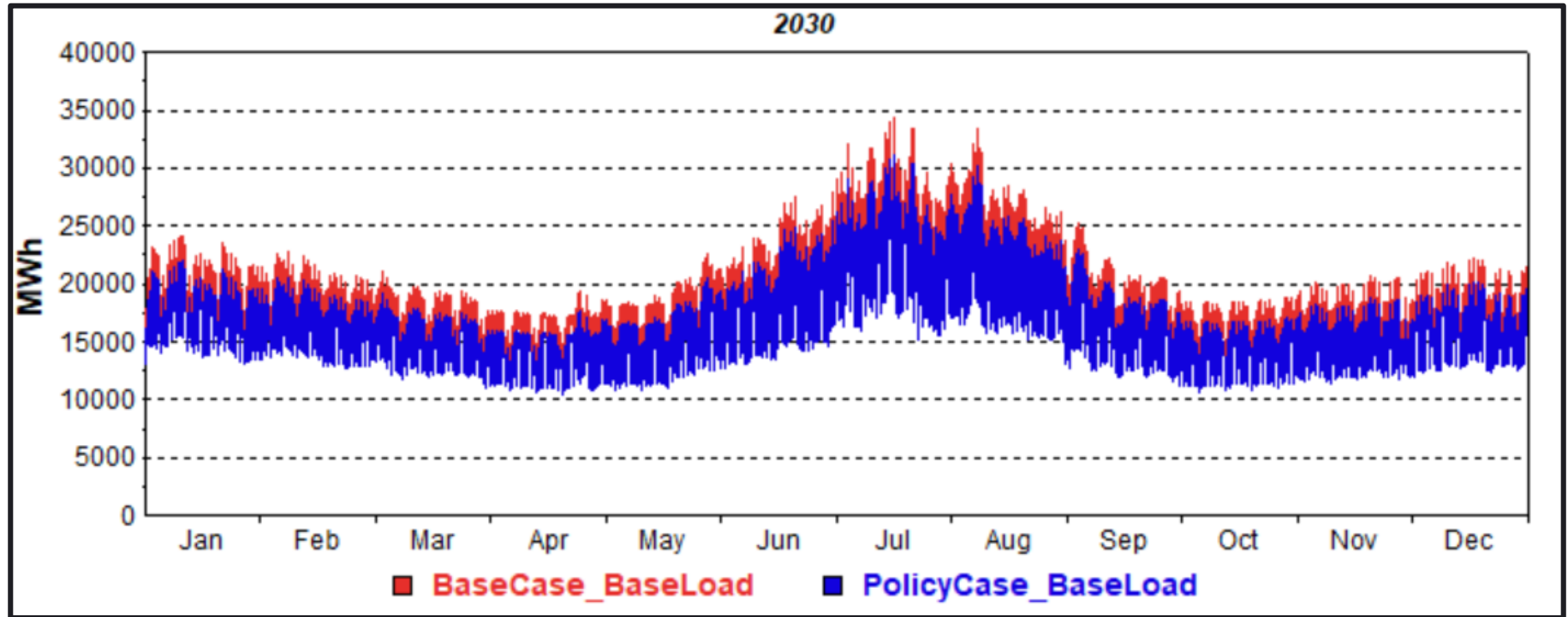


IMPACT ON LOAD



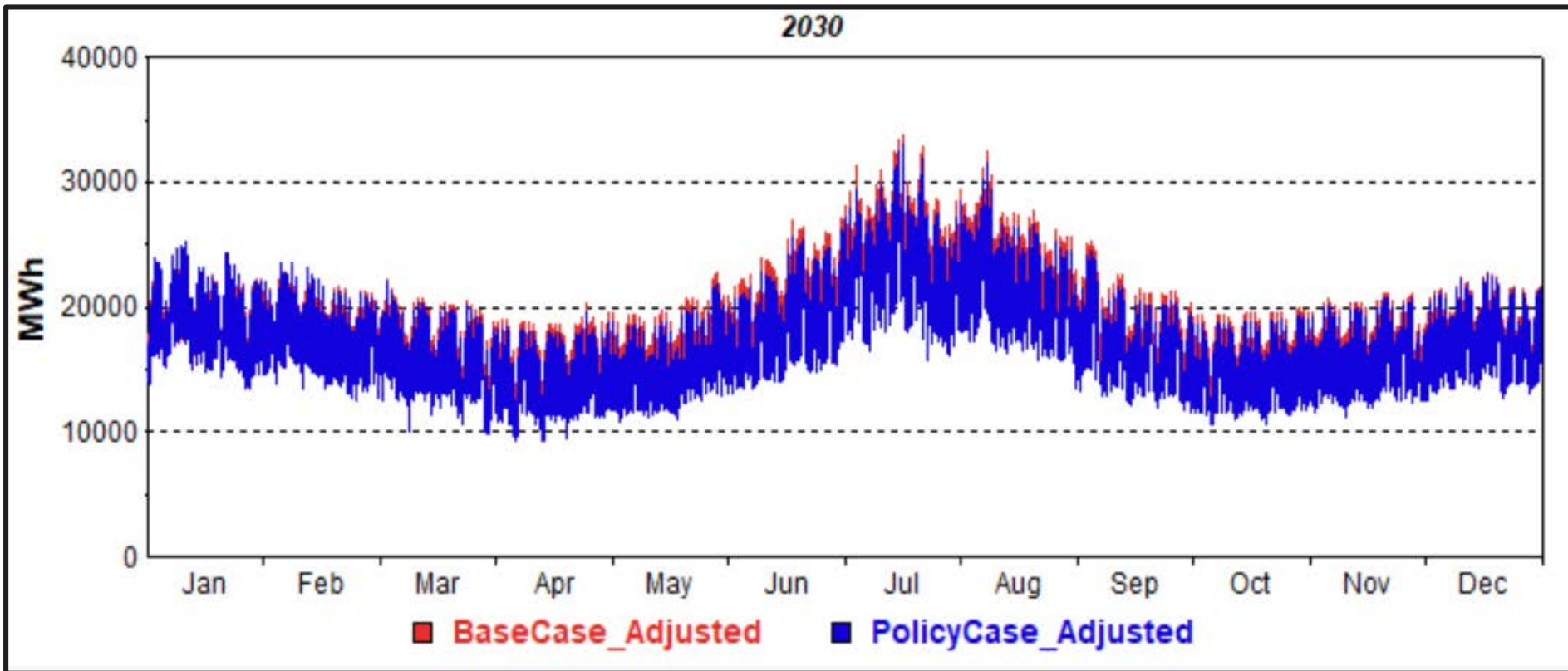
Doubling capacity has little impact on summer peak as by 2030 peak has shifted out to 7:00 PM

BASE CASE VS. POLICY FORECAST BASELOAD COMPARISON 2030



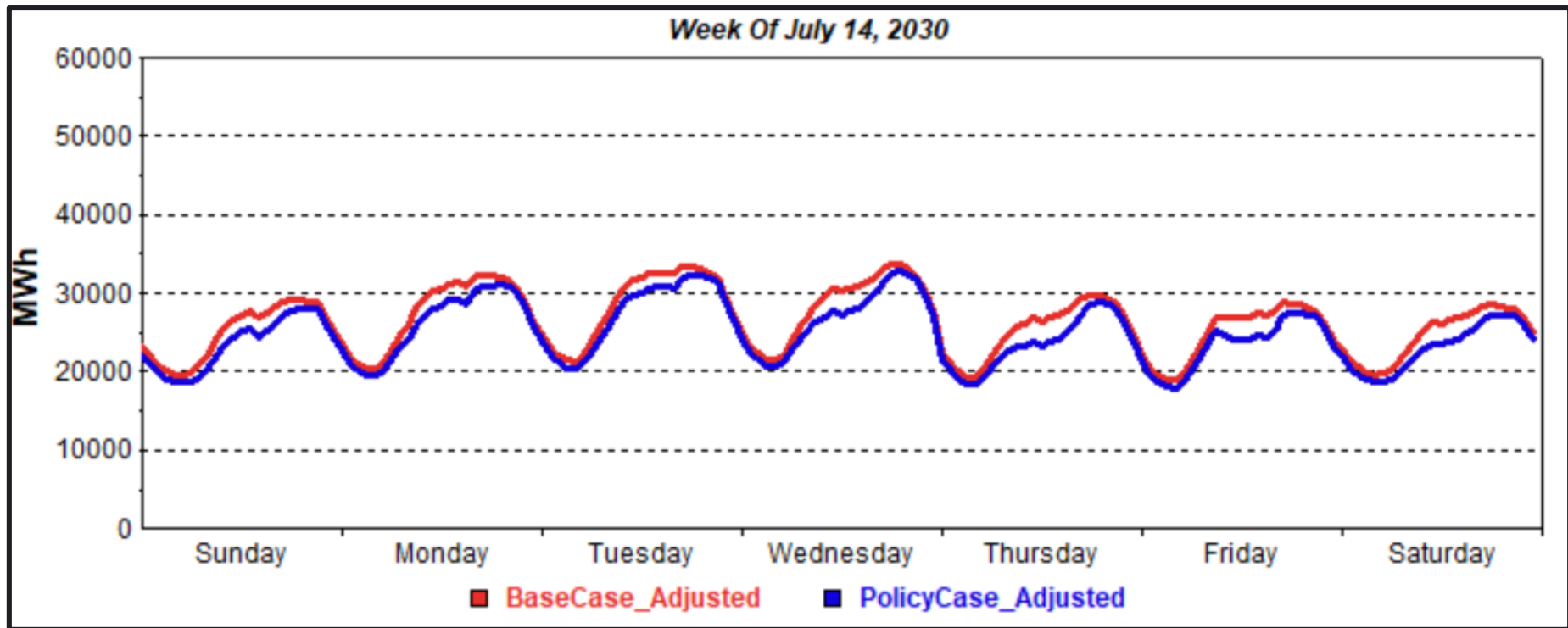
Lower Policy Scenario is a result of stronger EE savings

BASE CASE VS. POLICY FORECAST TOTAL LOAD COMPARISON 2030



Even with higher EV and electrification little difference in total load through 2030

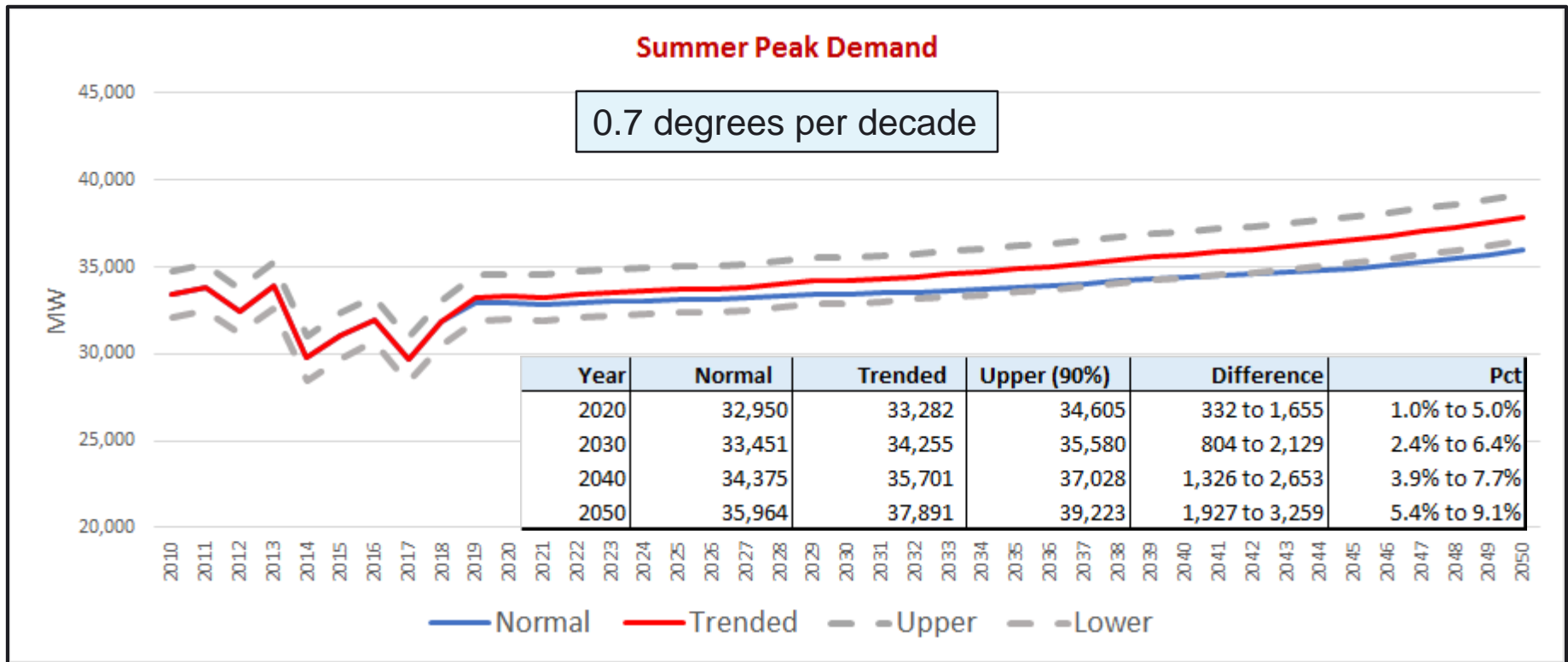
BASE CASE VS. POLICY FORECAST TOTAL LOAD COMPARISON



Policy Peak doesn't exceed the Base Case Peak until 2035

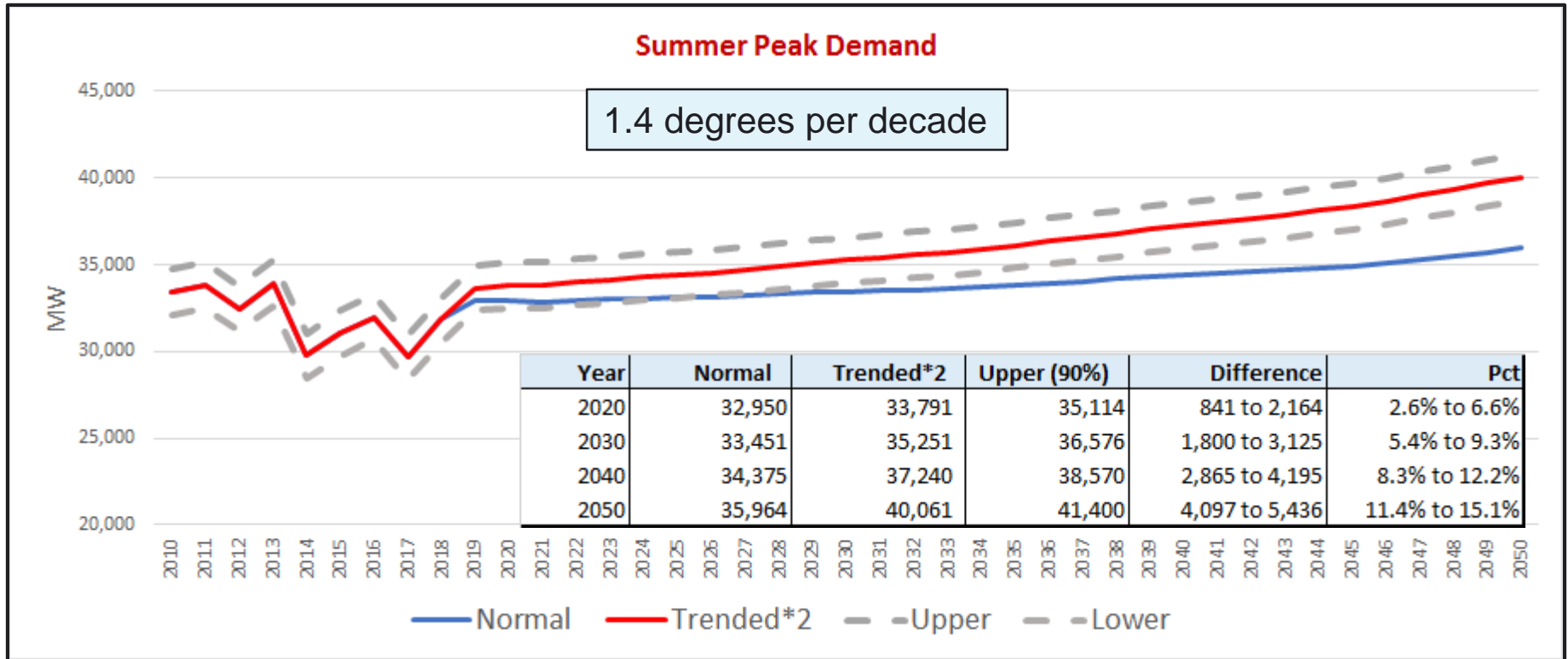
CLIMATE IMPACT

SYSTEM PEAK IMPACT COMPARISON WITH NORMAL PEAK WEATHER



1,326 to 2,653 MW higher by 2040

SYSTEM PEAK FORECAST WITH 1.4 DEGREE PER DECADE TREND



2,865 to 4,195 MW higher by 2040

CLIMATE IMPACT

- » State average temperature is trending at 0.7 degrees per year

- » New York City study shows 1.0 degrees per decade
 - In the scheme of things this is not a significant difference in terms of impact on electric loads
 - Could use 1.0-degree trend in the base case?

- » High uncertainty in long-term temperature projections as its largely dependent on green house emission paths
 - Stay with 1.4 degrees per decade for the high case
 - Bounds the most extreme possible temperatures

NEXT STEPS

- » Finalize policy scenario assumptions
 - Climate Trend
 - EE savings
 - Electrification – EVs, Cold Climate Heat Pump, other electric end-uses
 - Solar

- » Finalize forecasts
 - Baseline (Gold Book assumptions) and trended temperature impact
 - Baseline and faster climate change
 - Policy Scenario and trended temperatures

- » Present forecasts to LFTF
 - Finalize forecast
 - Delivery hourly zonal forecast to transmission planning for the second stage

- » Evaluate trends for other weather concepts
 - Humidity, rainfall, wind speed, cloud coverage

QUESTIONS ?