Energy+Environmental Economics

2017 Draft TDV Updates

CEC Staff Workshop
April 29, 2014

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2017 Updates

+ Updates

- Incorporate assumptions from the 2013 Integrated Energy Report (IEPR)
  - Natural gas cost to electric generators
  - Marginal energy costs under various demand and generation scenarios
  - GHG costs
  - Electric and natural gas rate forecasts
- Update hourly electric marginal cost of energy
- Incorporate Effective Load Carrying Capability (ELCC) method for electric generation capacity allocation factors
- Update electric T&D marginal costs

+ Considerations

- Evaluate scenarios for High Efficiency, 40% RPS, and High GHG cost
- Consider replacing T&D weather proxies with utility load data

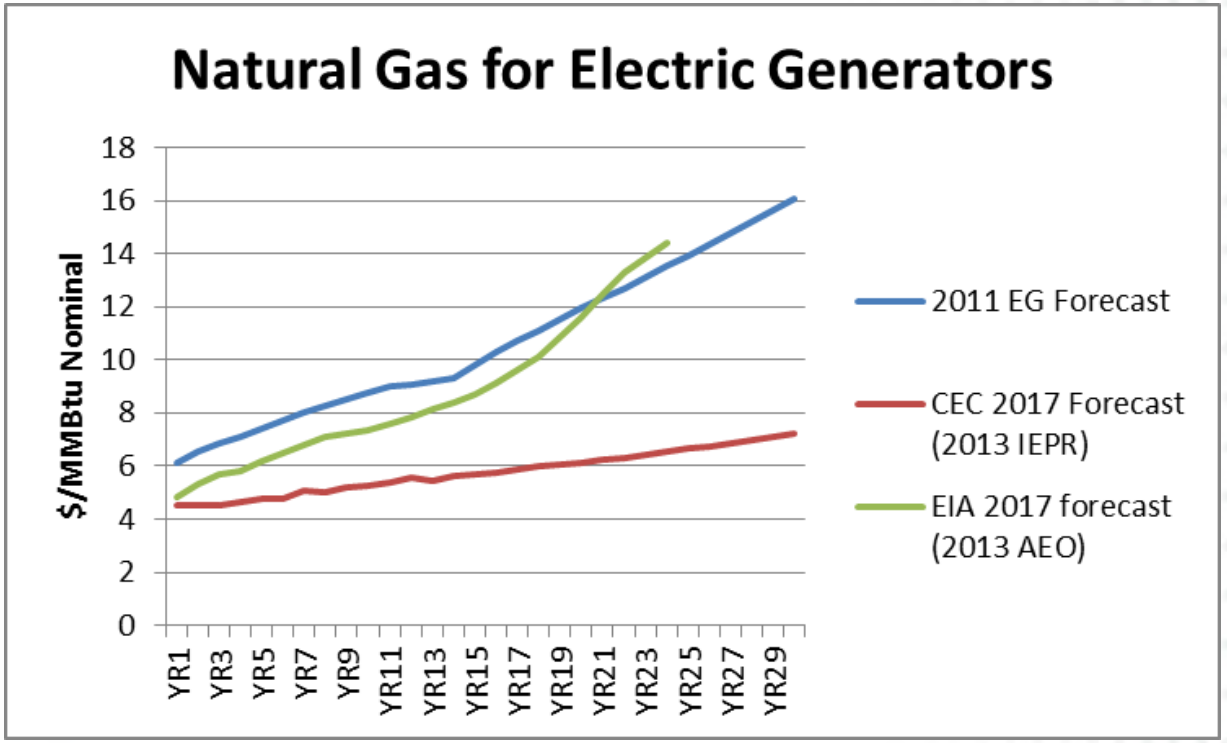
Avoided Cost Updates

- **For a complete list of updates to the avoided cost methodology see:**
  - California Net Energy Metering Ratepayer Impacts Evaluation Report, Appendix C. (October 28, 2013)
  - http://www.cpuc.ca.gov/PUC/energy/Solar/nem_cost_effectiveness_evaluation.htm

NATURAL GAS AND PROPANE UPDATES – MID CASE

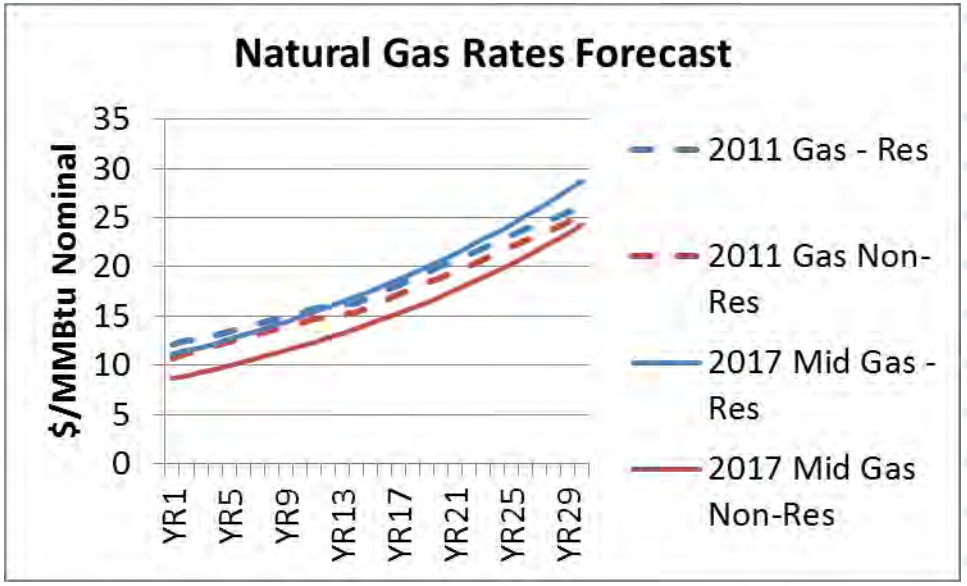
IEPR Update: Natural Gas Price Forecast for Electric Generators

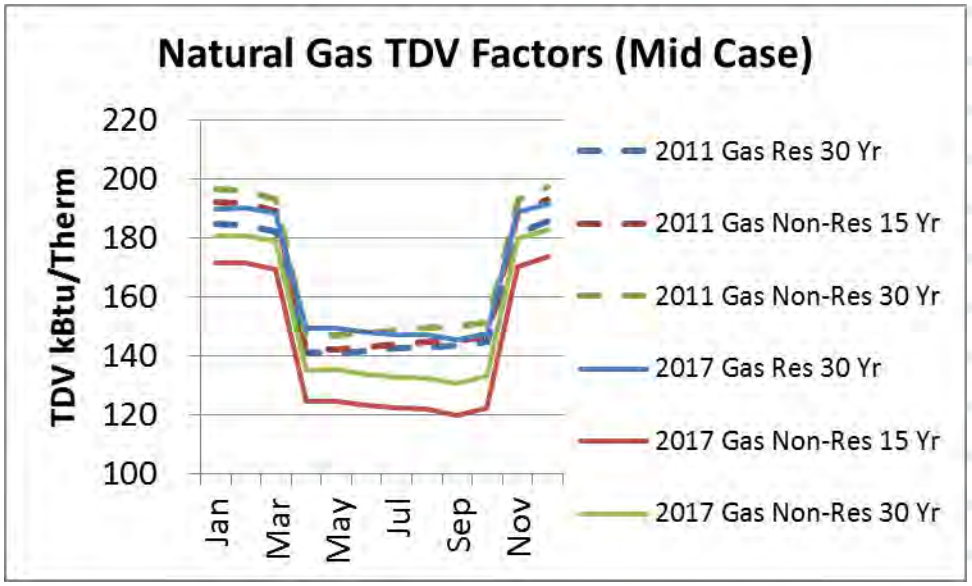
- **IEPR EG price forecast is a driver for the marginal cost of electricity. Mid Case (reference case) shown here.**
- **IEPR forecast is through 2035. Compound annual growth rate (CAGR) applied thereafter.**



Natural Gas Rates and TDV Factors (Mid Case)

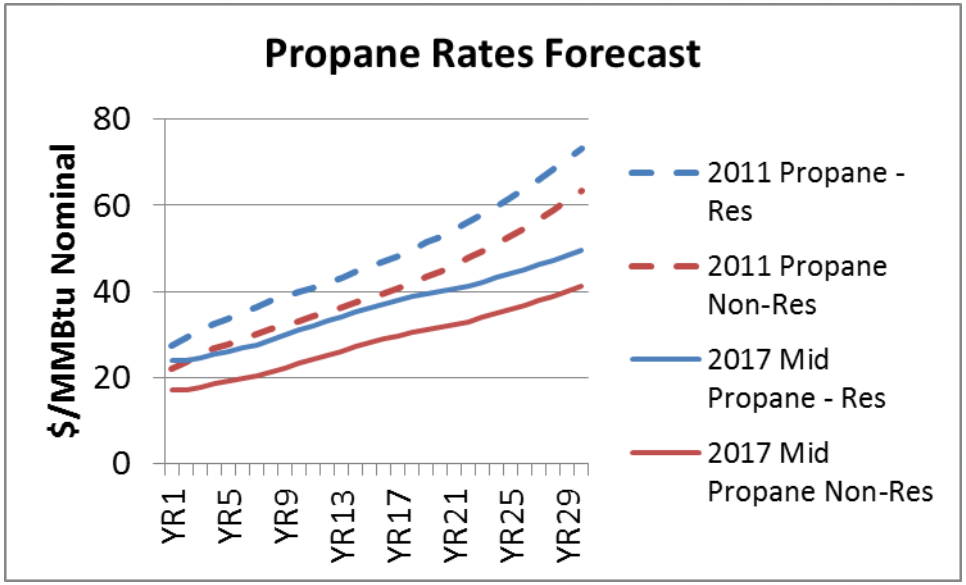
- **Forecast gas rates through 2025 from IEPR reference case. CAGR applied thereafter.**
- **Lower gas rates for Non-Res result in lower TDV factors.**

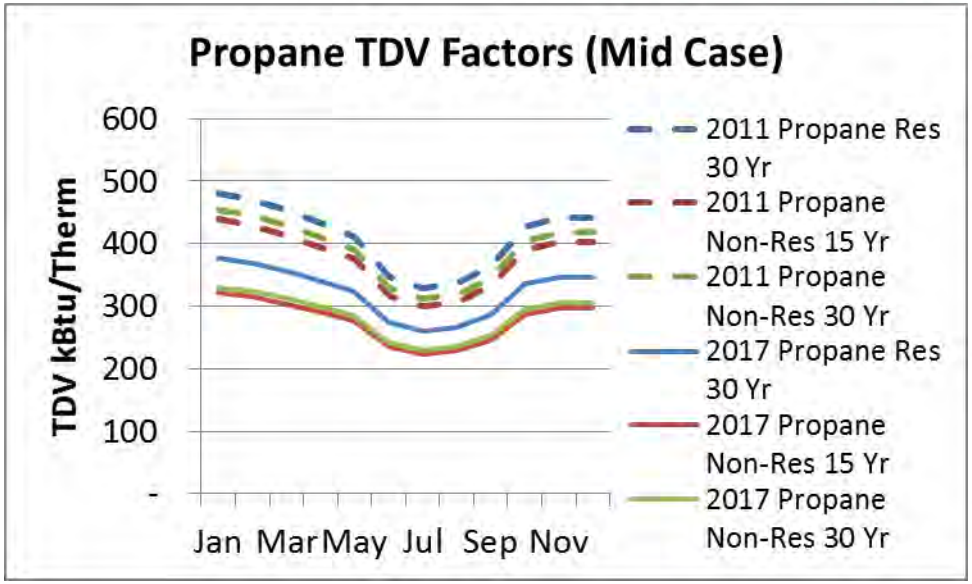


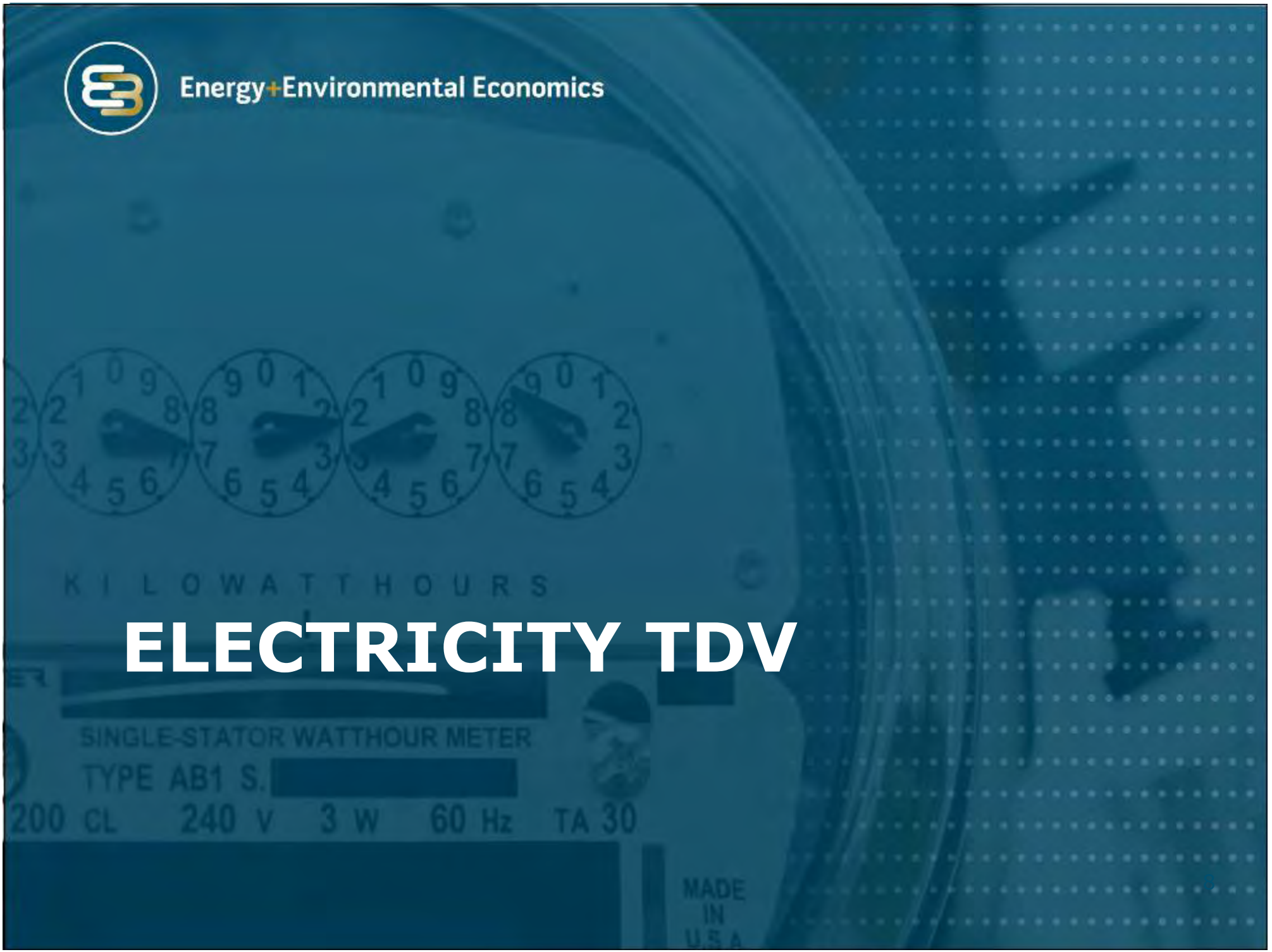


Propane Rates and TDV Factors (Mid Case)

- **Forecast prices updated from**
  - IEPR Gas Rate Forecast
  - EIA 2013 Annual Energy Outlook report for Pacific Region
  - Propane forecast = EIA Propane rate premium over natural gas added to IEPR gas rate forecast





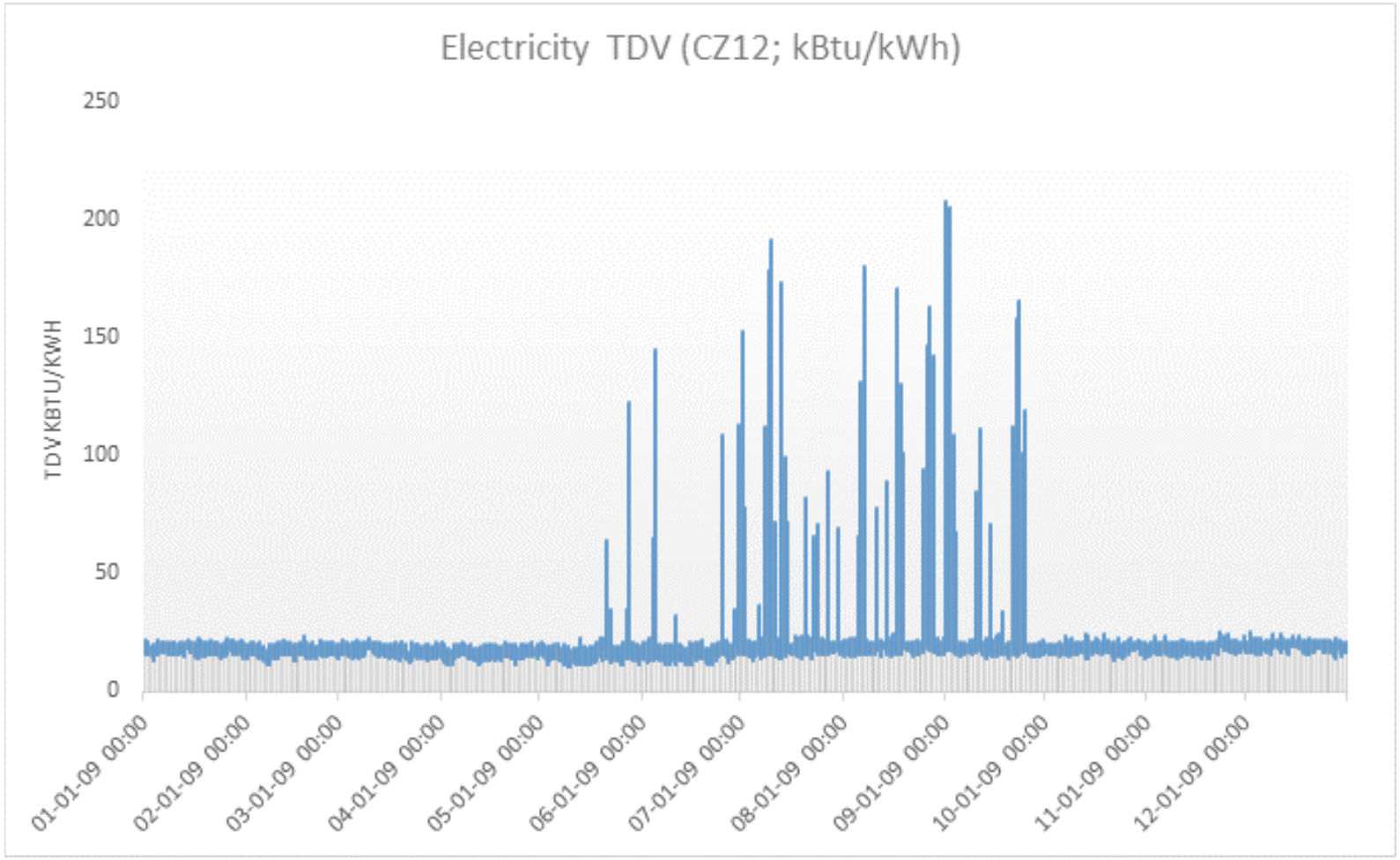


ELECTRICITY TDV

Electricity Draft Update

- Summary of the results
- Summary of the updates and major changes

Hourly TDV


Electricity TDV (CZ12; kBtu/kWh)
TDV KBTU/KWH
250
200
150
100
50
0
01-01-09 00:00
02-01-09 00:00
03-01-09 00:00
04-01-09 00:00
05-01-09 00:00
06-01-09 00:00
07-01-09 00:00
08-01-09 00:00
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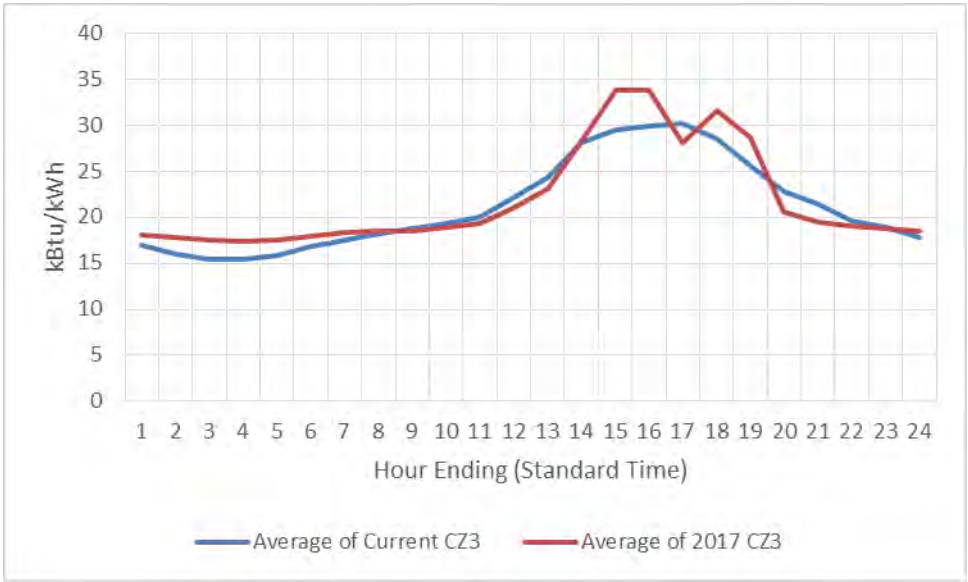
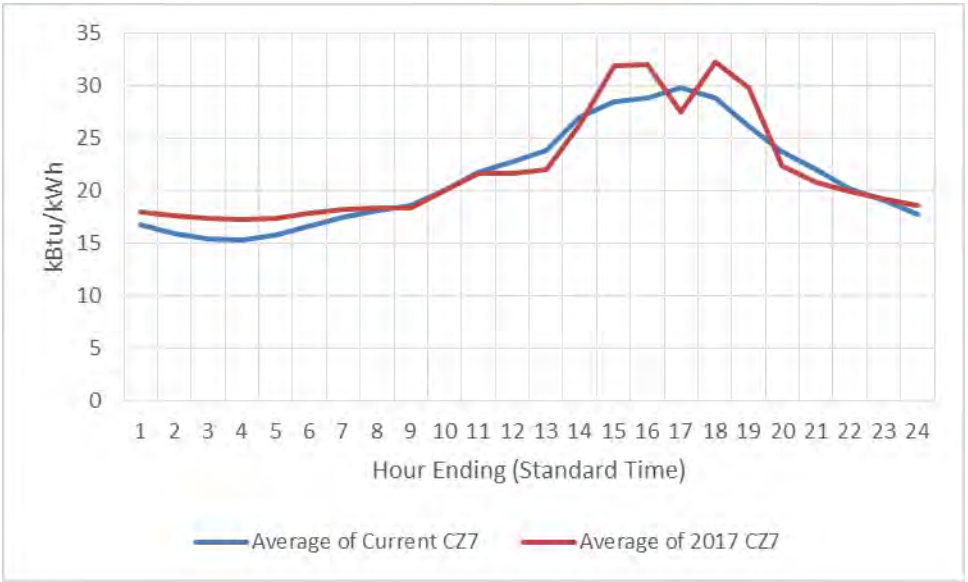
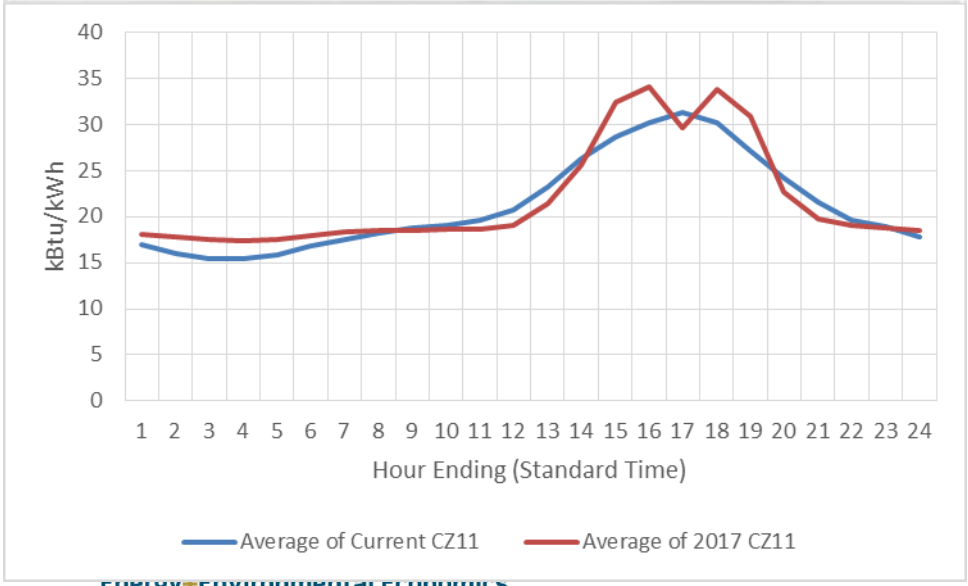
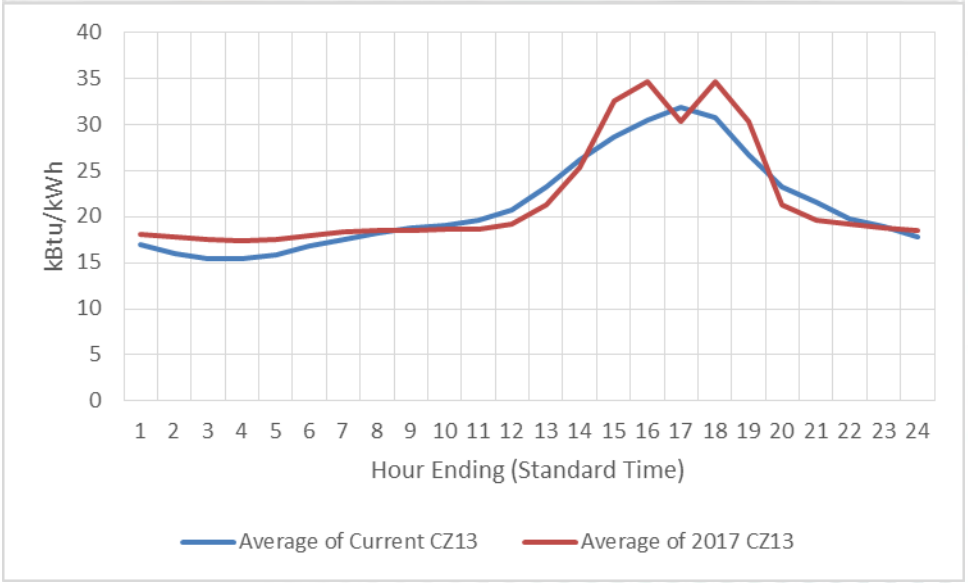
Average TDV: Elec-Res 30 Yr Mid Case

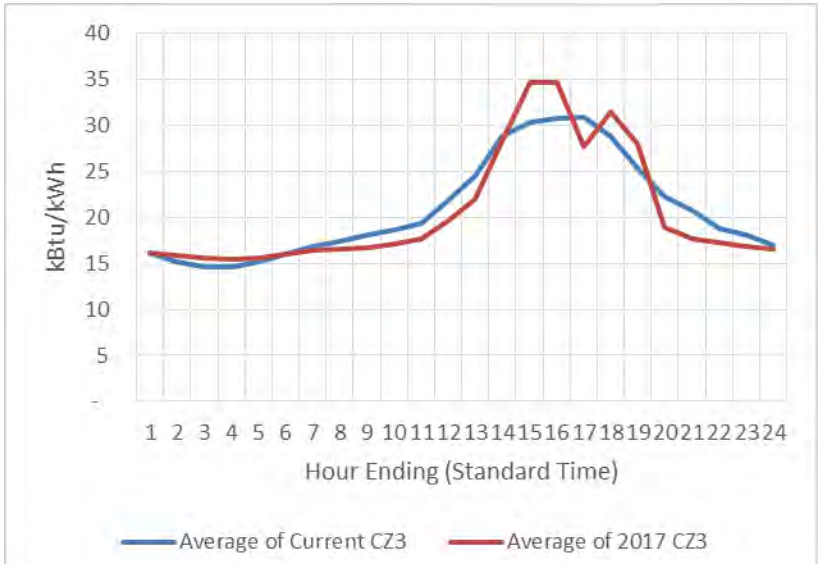


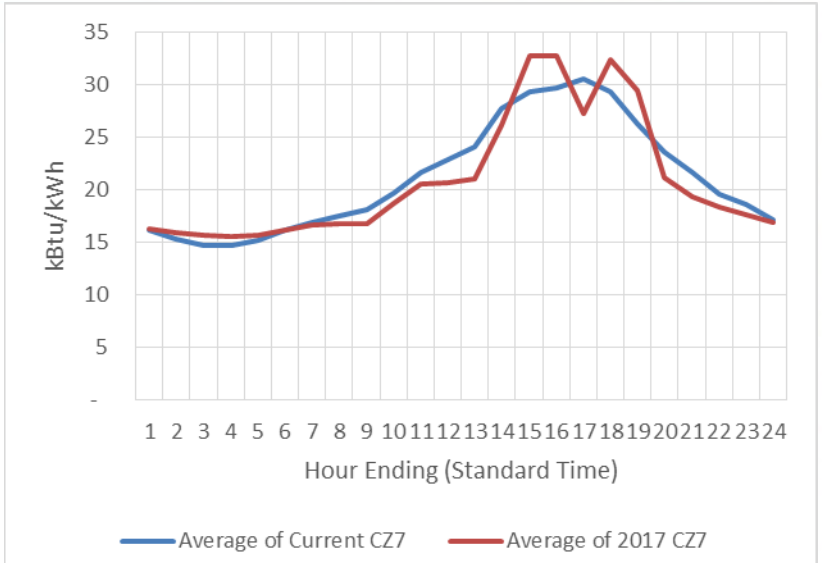


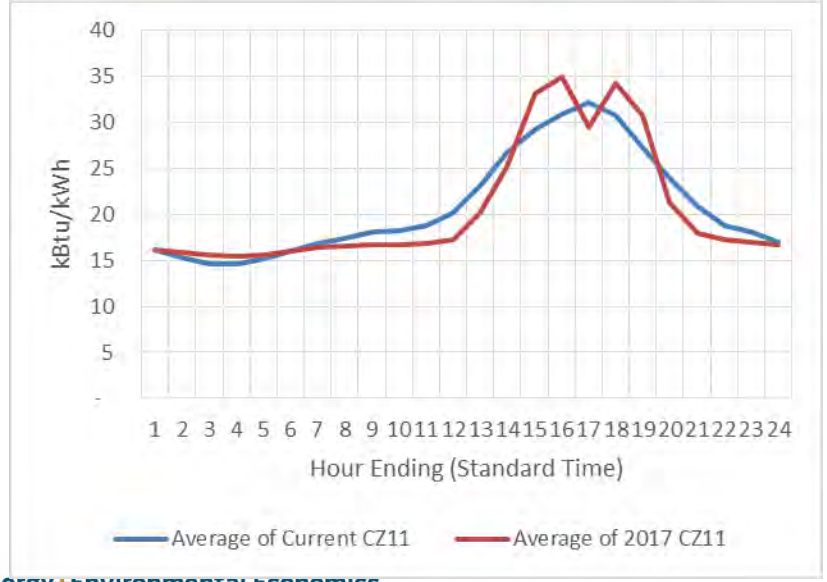


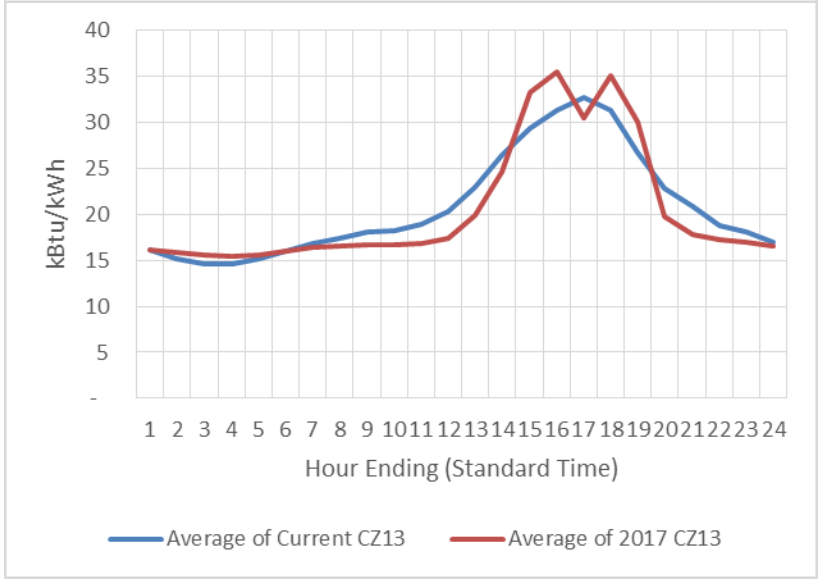


Average TDV: Elec Non-Res 15 Yr Mid Case



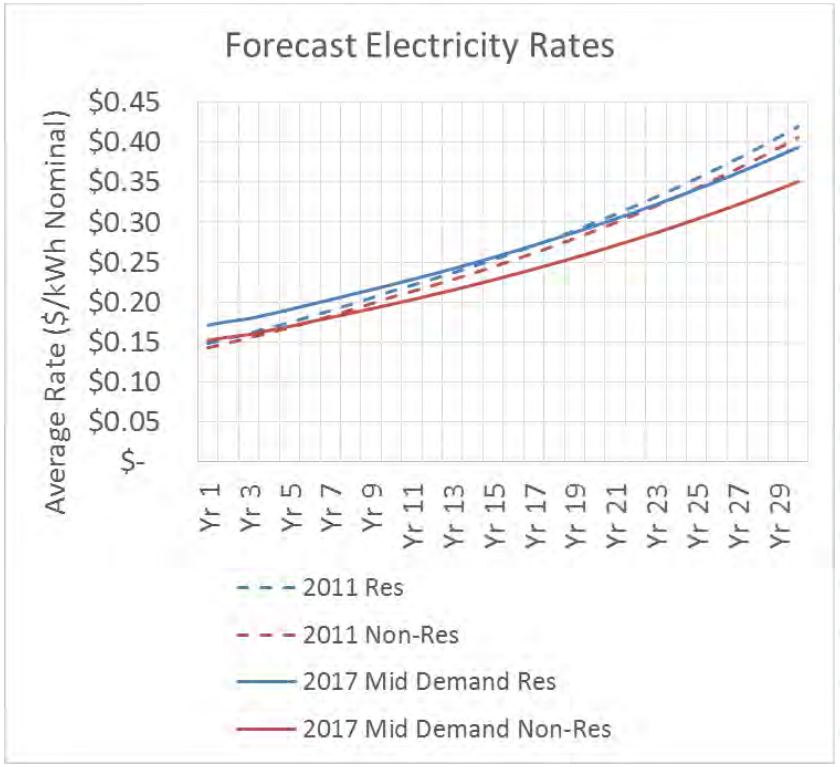






Major Updates

- **Rate Forecast from IEPR**
- **Energy price shape from Plexos**
- **ELCC for generation capacity**
- **T&D Capacity from PG&E 2014 GRC, SCE 2011 GRC, and SDG&E A11-10-002.**
  - $65.59/kW-yr in 2011 increased to $97.51/kW-yr in 2017

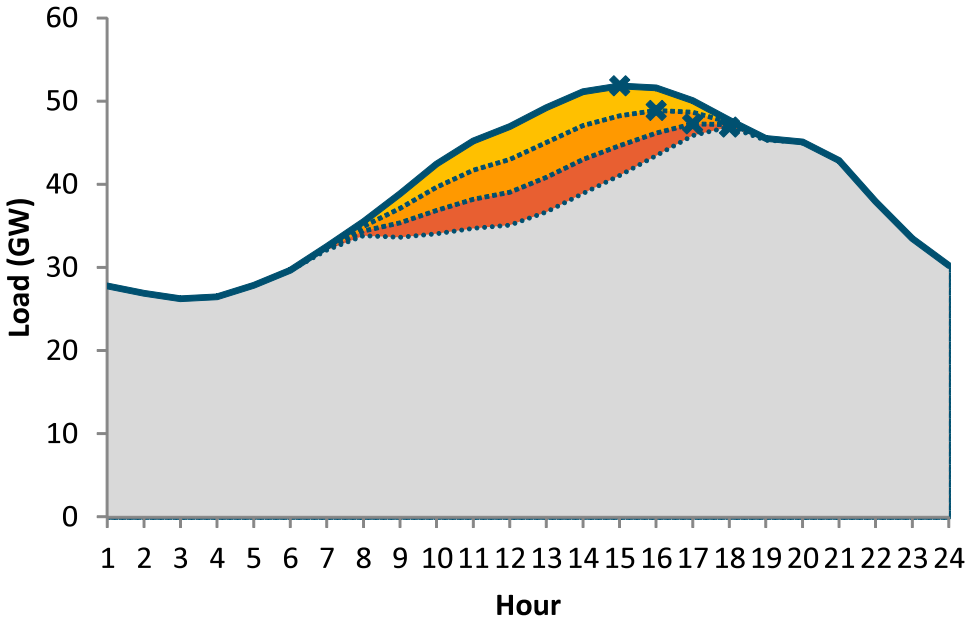


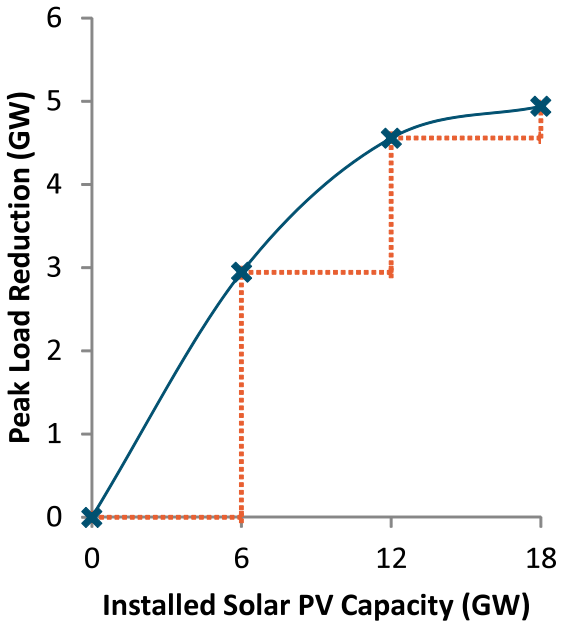
ELCC

- Effective Load Carrying Capability is a measure of a generators contribution to resource adequacy.
- Used to allocate the cost of generation capacity to hours of the year.
- Considers the distribution of likely load levels and the probability of generation availability, with a focus on renewable output variability.
- Replaces prior method that was based on system load levels
- ELCC values from CPUC Net Energy Metering Ratepayer Impacts Evaluation (2013).
  http://www.cpuc.ca.gov/PUC/energy/Solar/nem_cost_effectiveness_evaluation.htm

Capacity Planning with High Renewable Penetrations

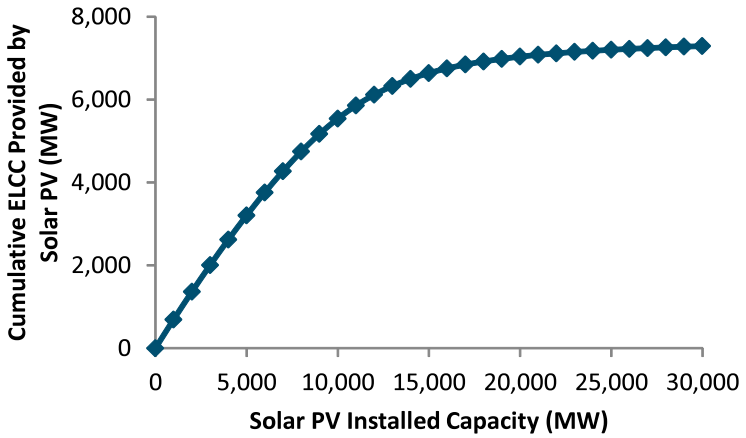
- **A resource's contribution towards reliability depends on the other resources on the system**
- **The diminishing marginal peak load impact of solar PV is illustrative of this concept**
  - While the first increment of solar PV has a relatively large impact on peak, it also shifts the "net peak" to a later hour in the in day
  - This shift reduces the coincidence of the solar profile and the net peak such that additional solar resources have a smaller impact on the net peak

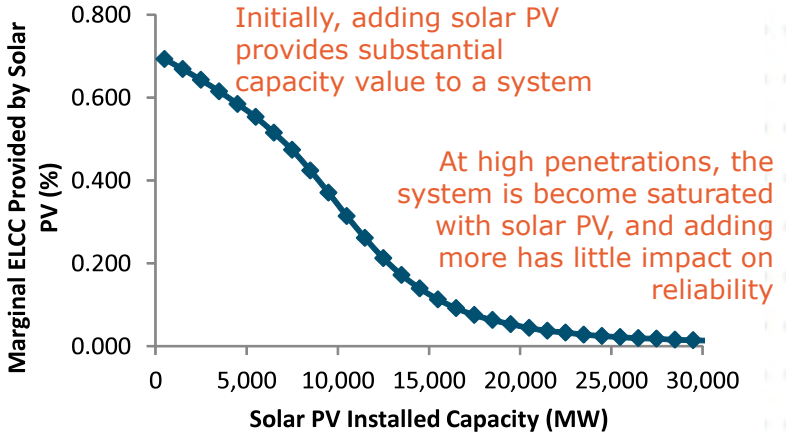




Declining Value of Capacity

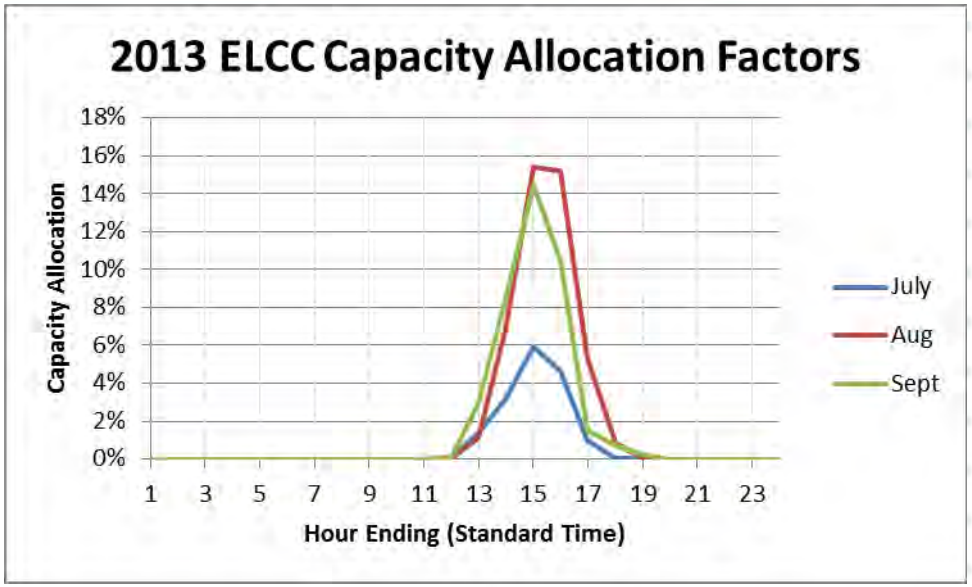
- **Stochastic modeling reveals that the effective load carrying capability (ELCC) of solar PV declines as penetration increases**
- **At high levels of RPS, the conventional paradigm that additional solar PV contributes value towards meeting peak loads no longer applies**
- **This decline in value signals the need to consider the value of resource diversity at high penetrations of renewables**

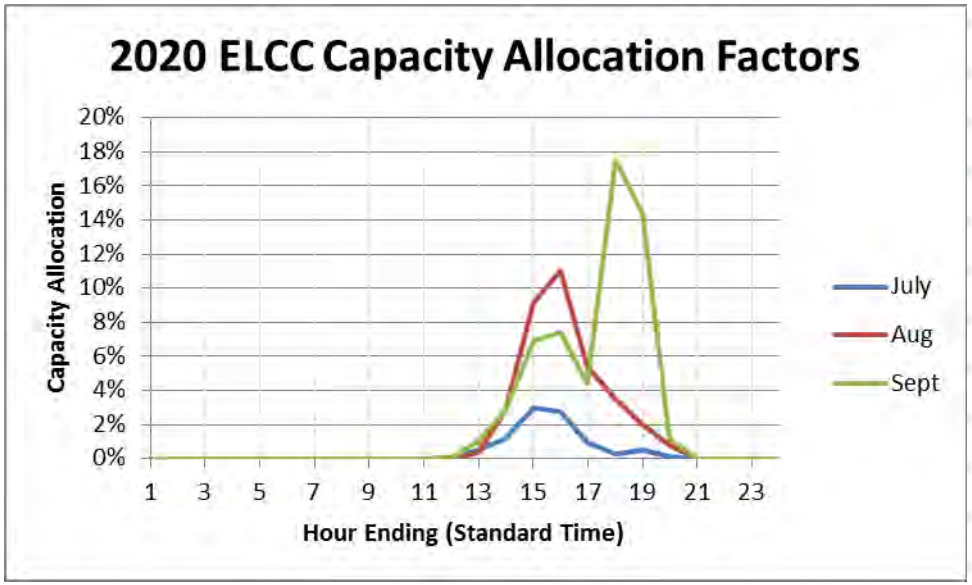




ELCC Allocation Factors

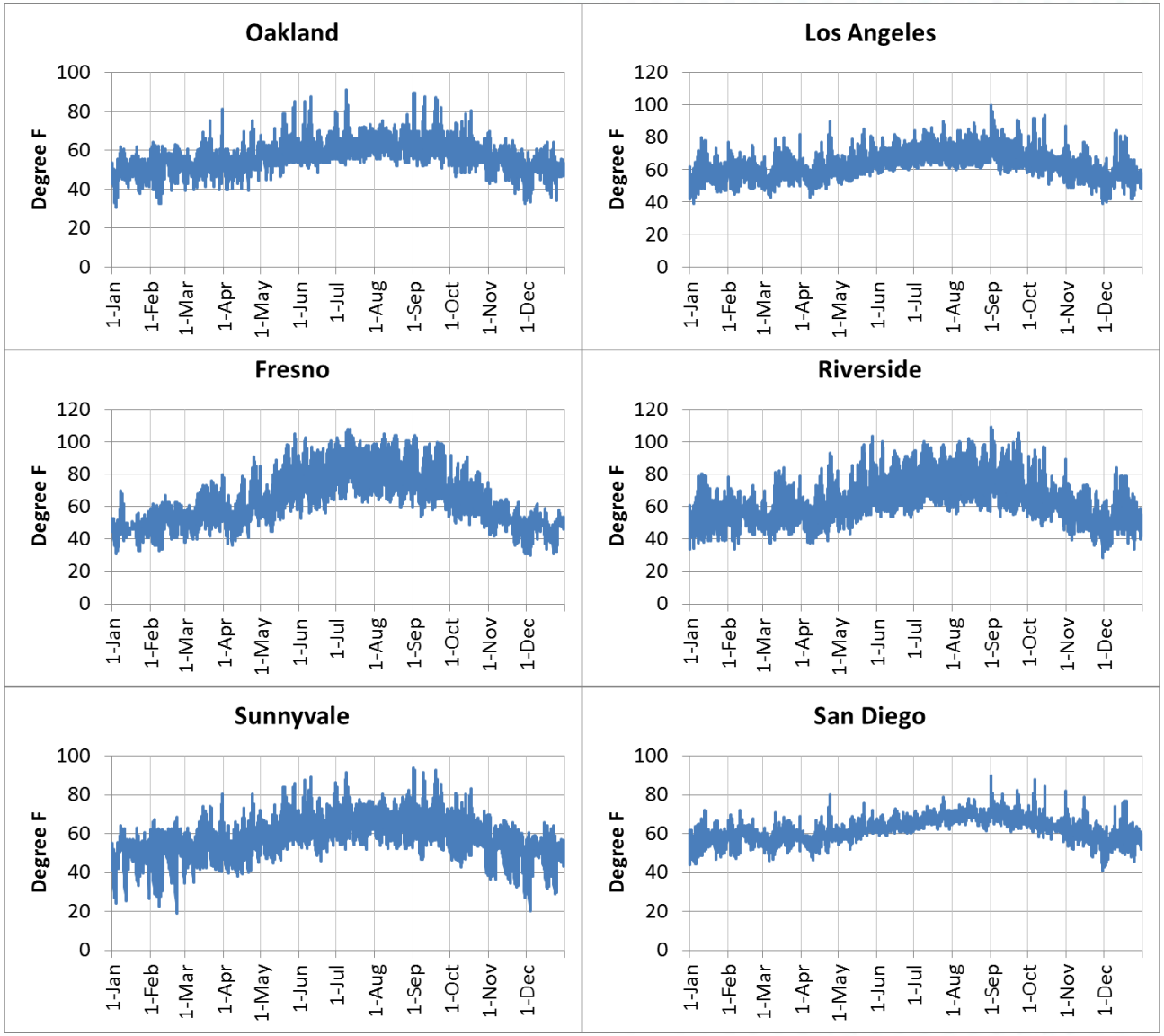
- ELCC values were developed for 2013 (current) and 2020 (33% RPS) conditions
- 2017 through 2019 are interpolated
- 2020 ELCC shows a shift of capacity need to September early evening





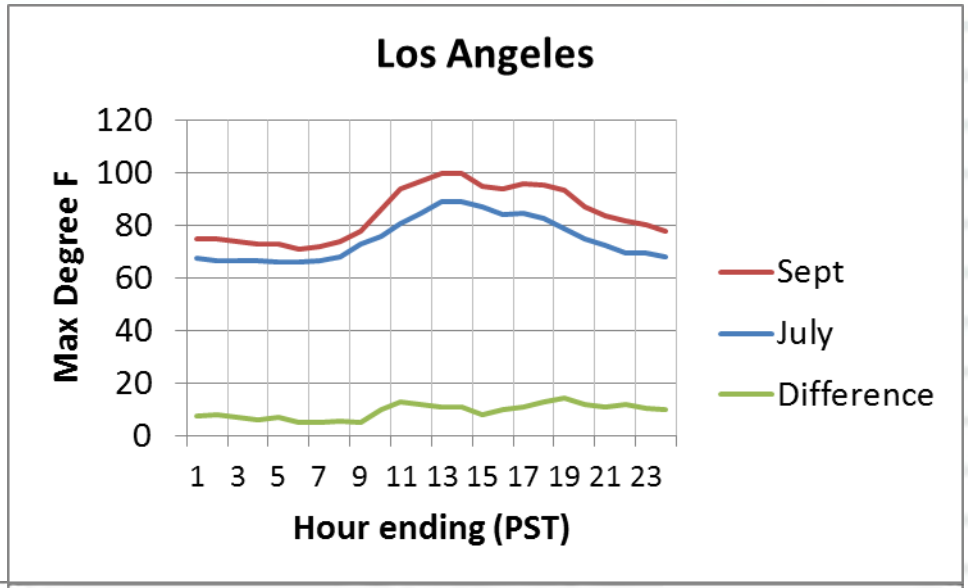
September Peak is due to new Weather Files

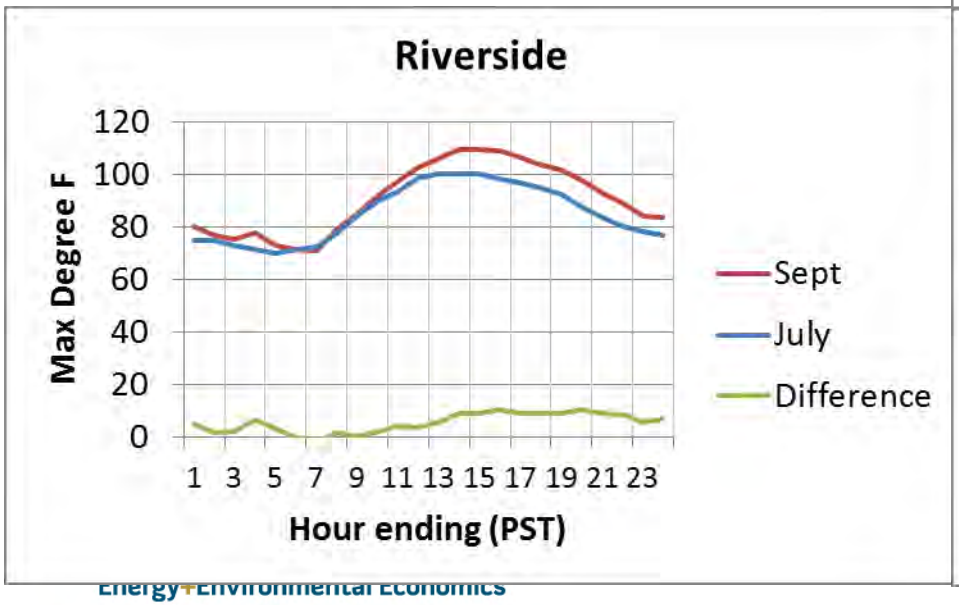
- **Overall statewide peak occurs in September**

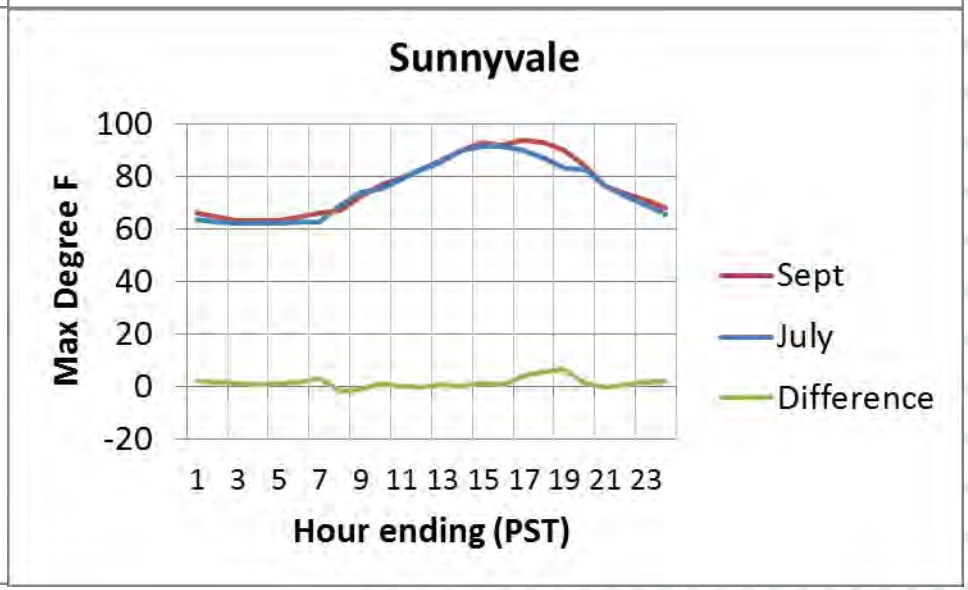


Temperature Profile

- **September high temperatures also persist later into the early evening**

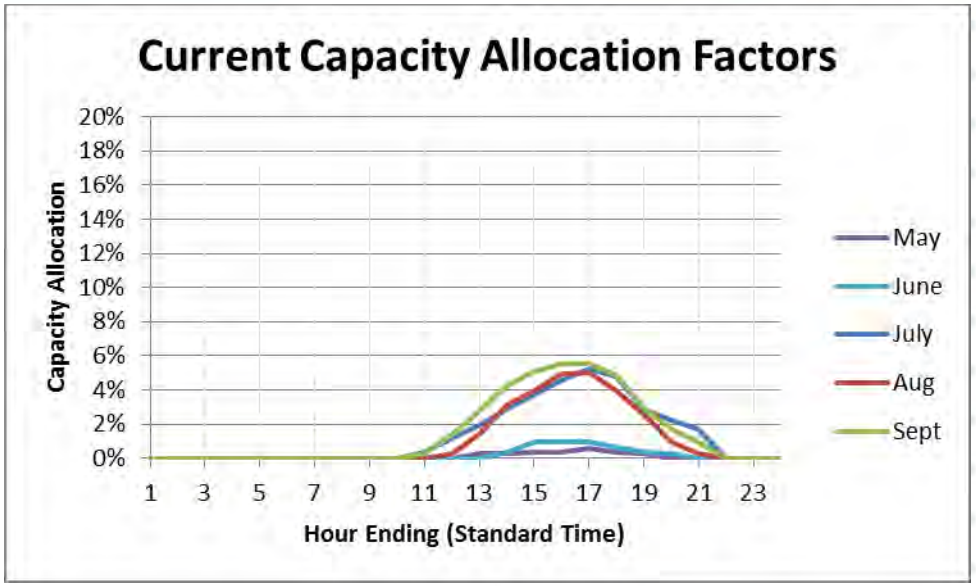


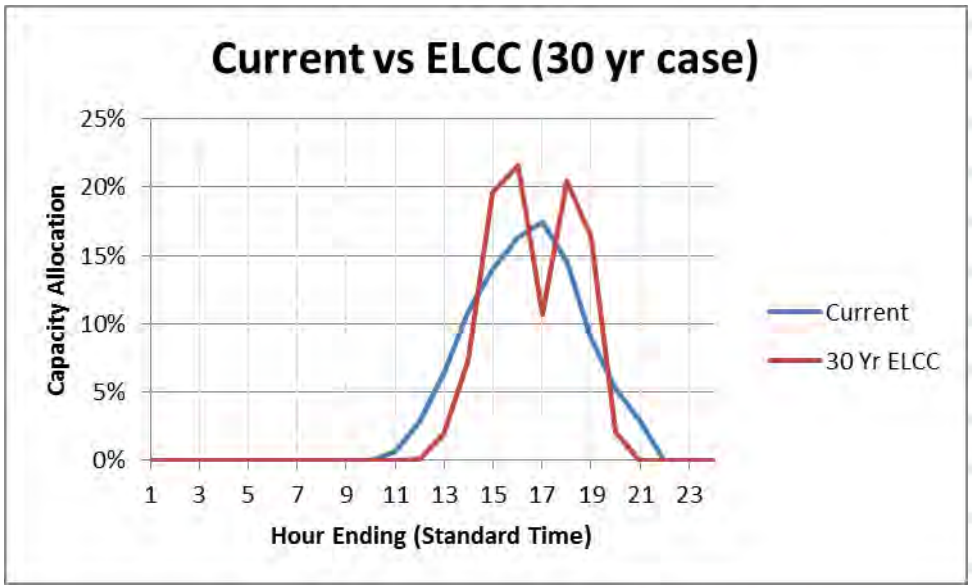




ELCC Compared to the Current Allocation

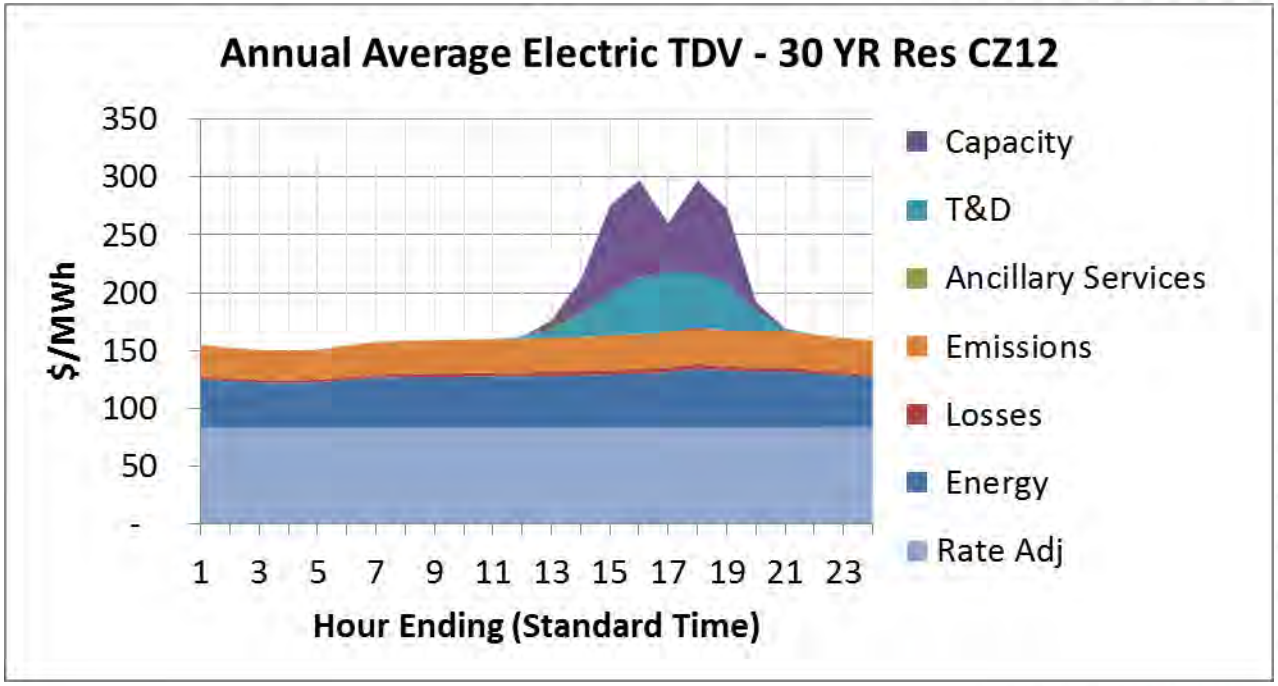
- Current method spreads value over more months and more hours
- Since ELCC facotrs vary by year, TDV will reflect a blend of 2013 and 2020 factors.
- ELCC method places more value on hours ending 3pm, 4pm, 6pm, and 7pm, PST.





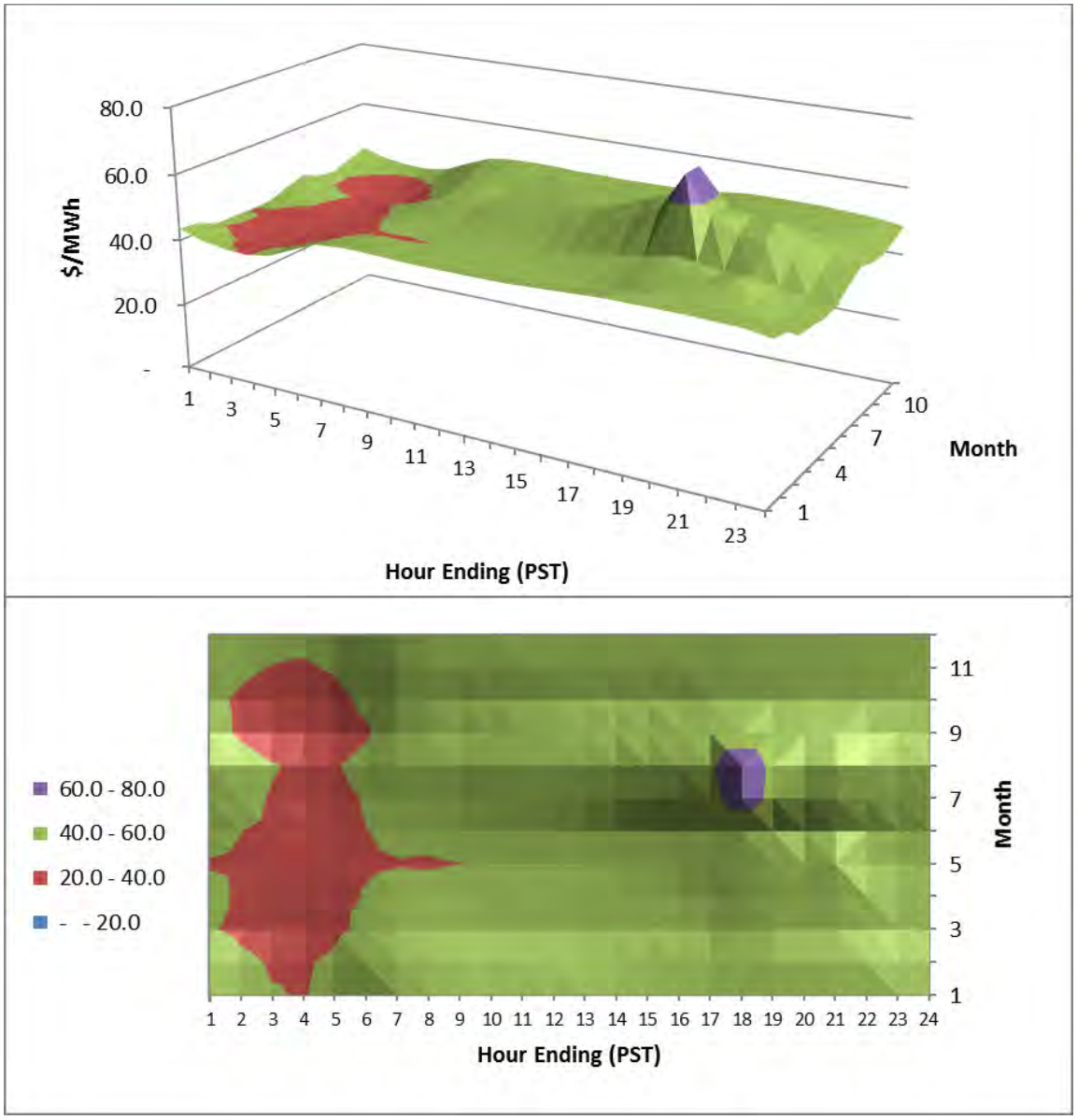
Example Decomposition for Electricity

- **Mid Case**
- **Note that annual average masks the hourly and monthly variations. Subsequent slides illustrate some of the variations in more detail.**



Average Energy Component

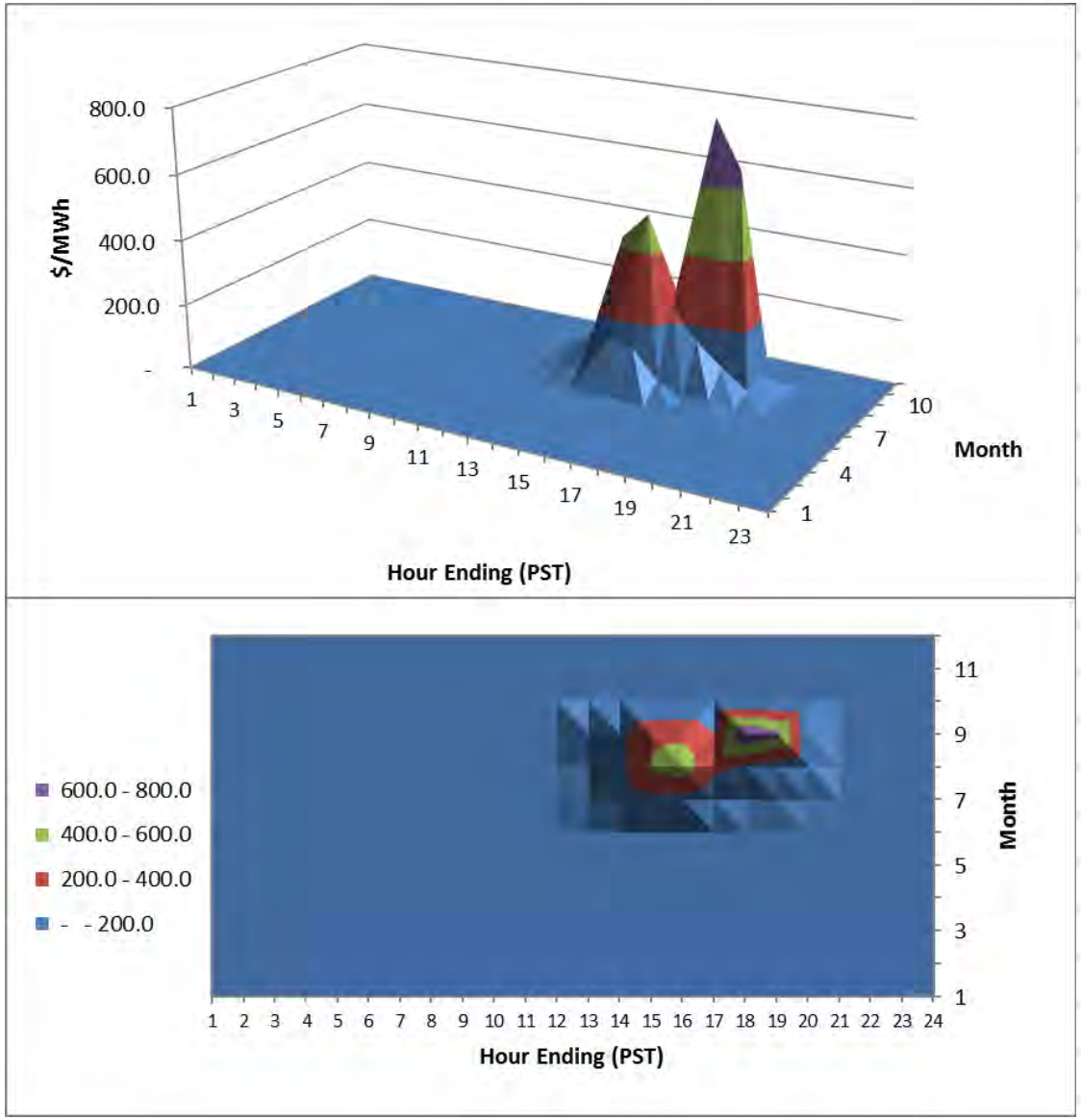
+ **Res 30 Yr CZ 12**



Energy+Environmental Economics

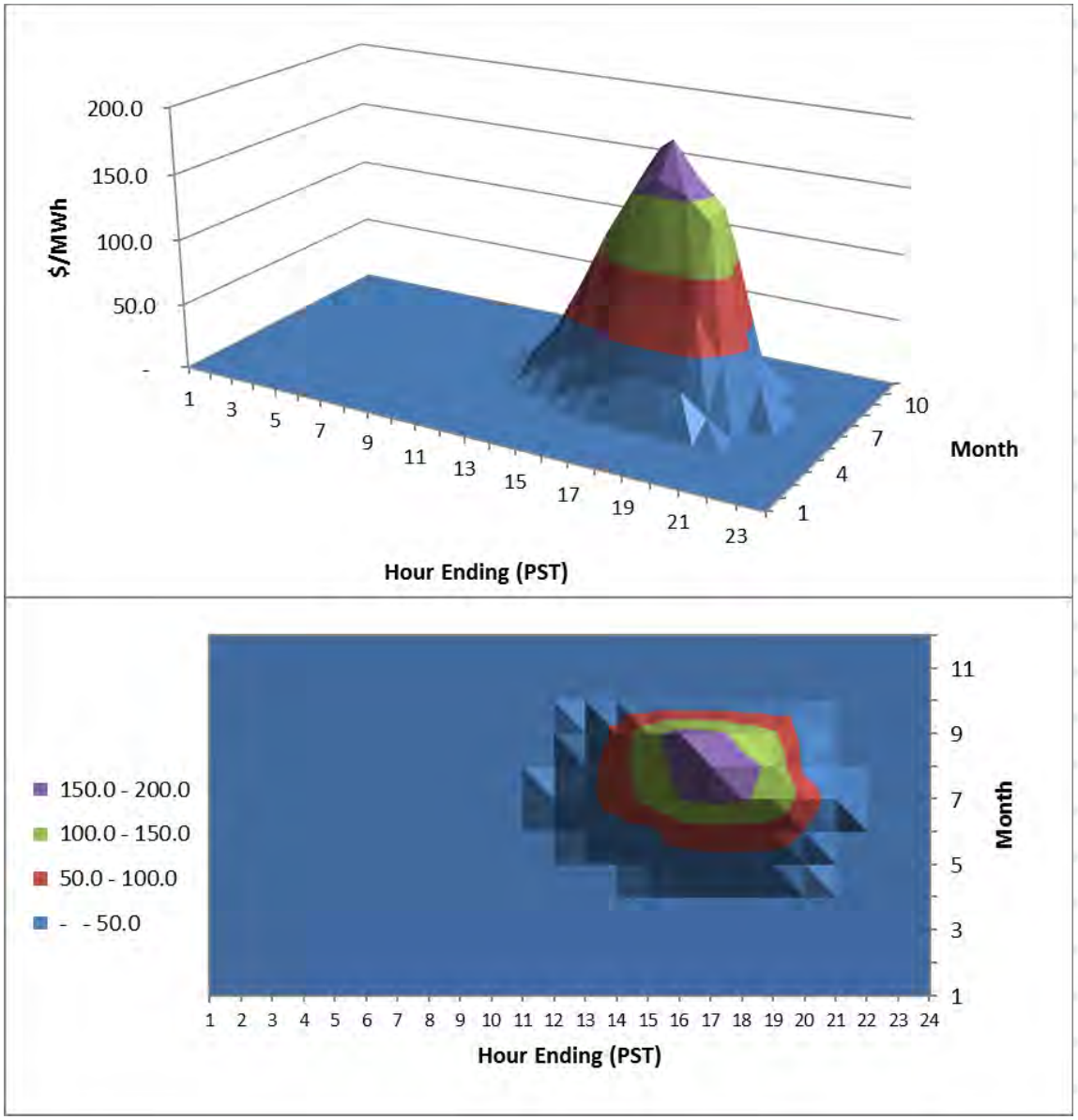
Average Generation Capacity Component

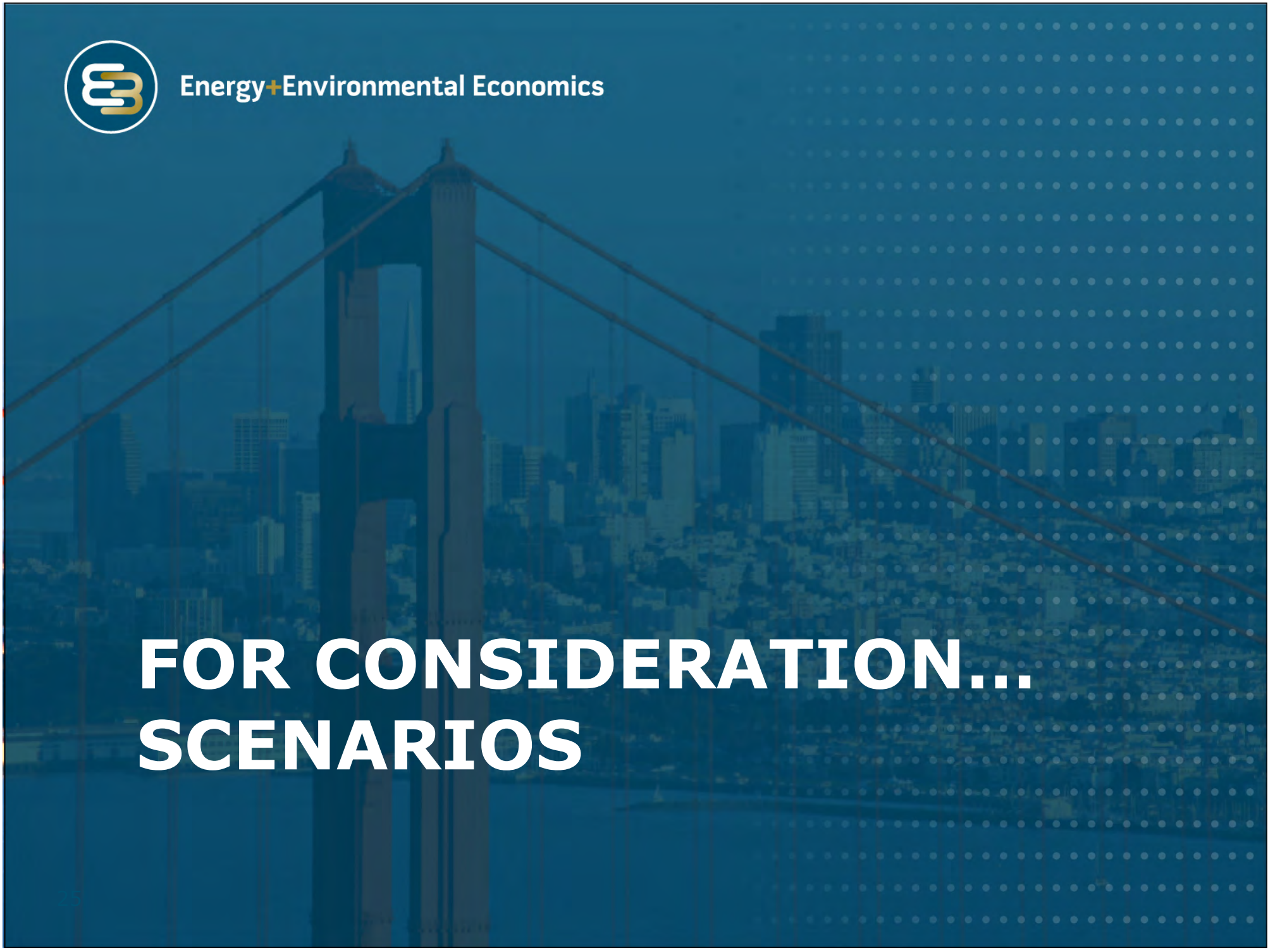
+ **Res 30 Yr CZ 12**



Average T&D Capacity Component

+ **Res 30 Yr CZ 12**



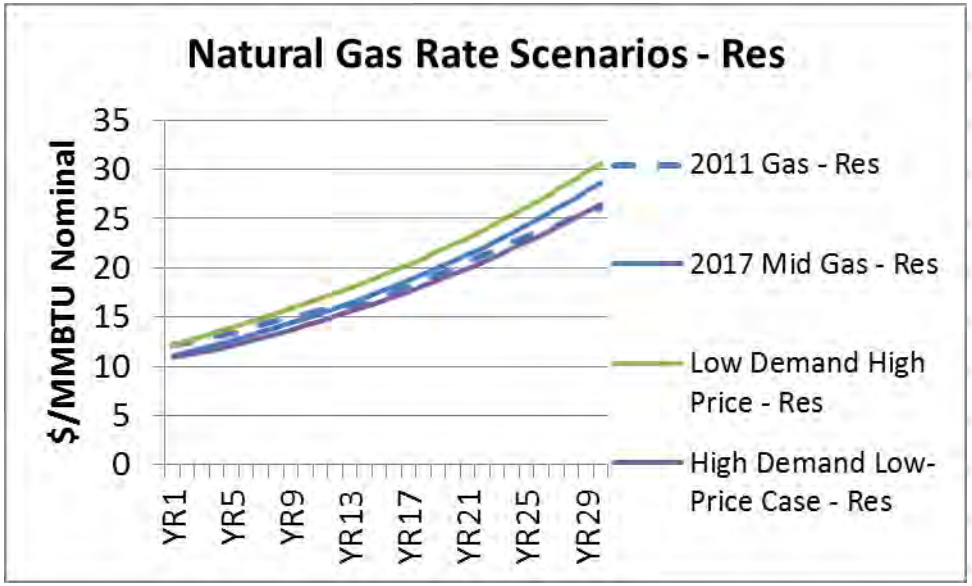

Energy+Environmental Economics
FOR CONSIDERATION…
SCENARIOS

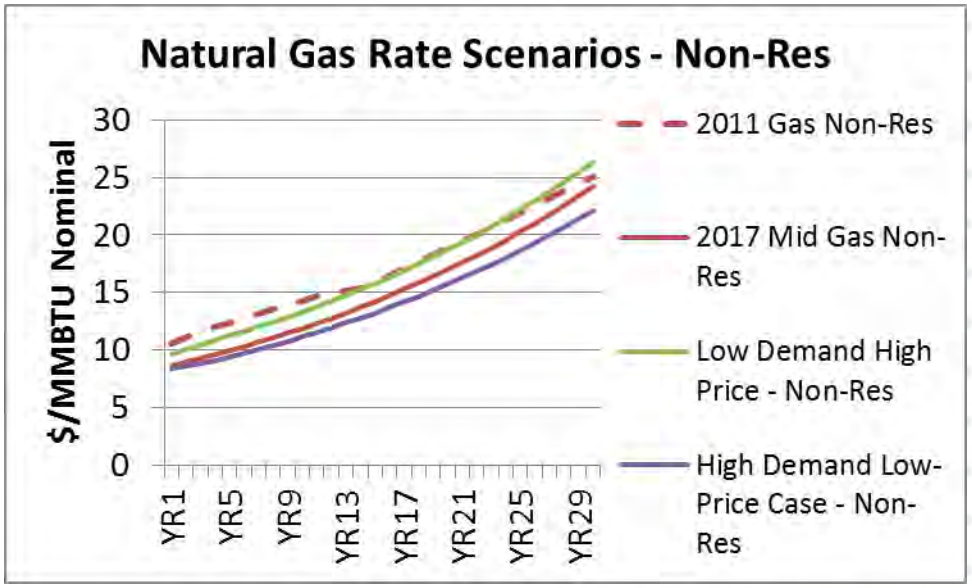
Scenarios

+ **Mid Case**
+ **Low Demand Case**
  - Higher achievable efficiency
  - Higher electric and gas rates
  - Higher natural gas EG cost
  - Separate Plexos run
+ **40% RPS Case**
  - Electric rates 3.2% higher than Mid Case after 2020
  - Slightly different natural gas EG cost
  - Separate Plexos run after 2020
+ **High GHG Case**
  - Higher GHG Cost forecast
  - Other inputs the same as the Mid Case
  - No separate Plexos run

Natural Gas Rate Scenarios

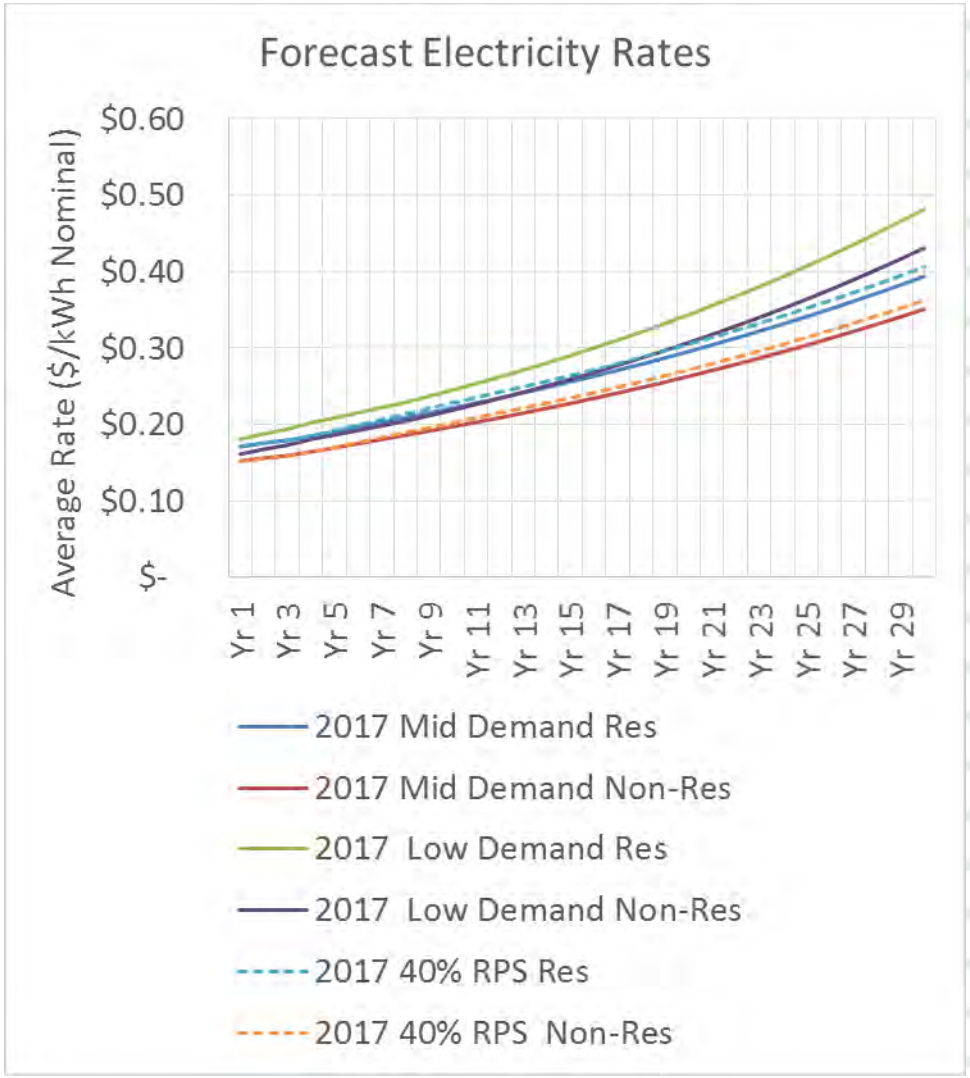
- **Three gas forecasts from IEPR**
  - Reference (mid)
  - Low Demand, High Rate
  - High Demand, Low Rate





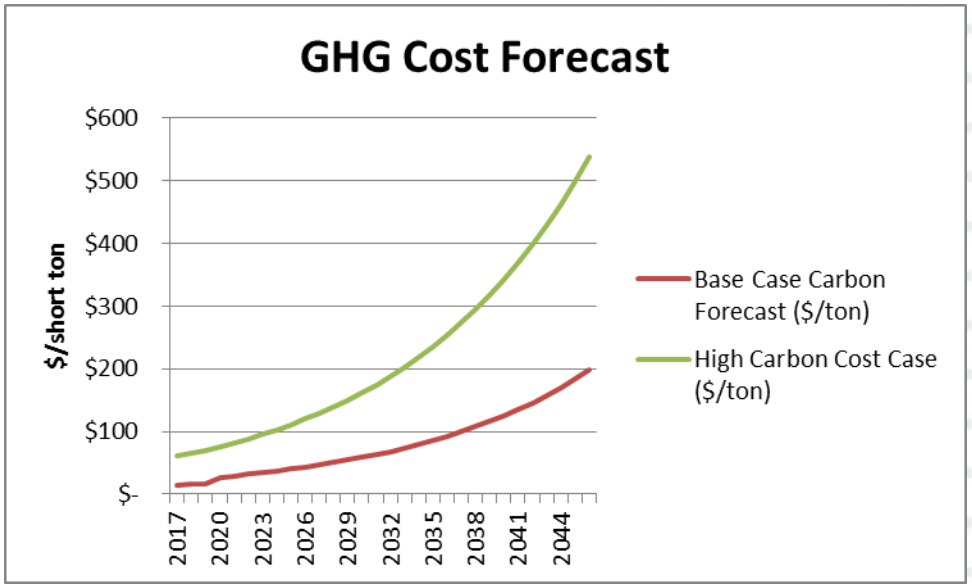
Electric Rate Forecasts

- **Mid case from IEPR, with escalation rate applied past 2024 based on compound annual growth rate from 2017 through 2024.**
- **Two additional rate forecasts, for low demand (high EE), and 40% RPS cases.**



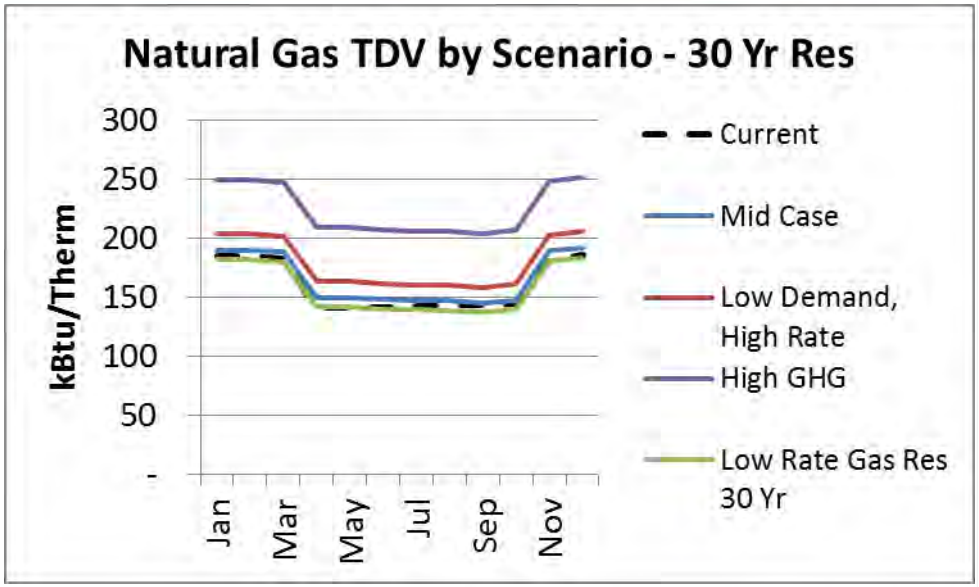
GHG Forecasts

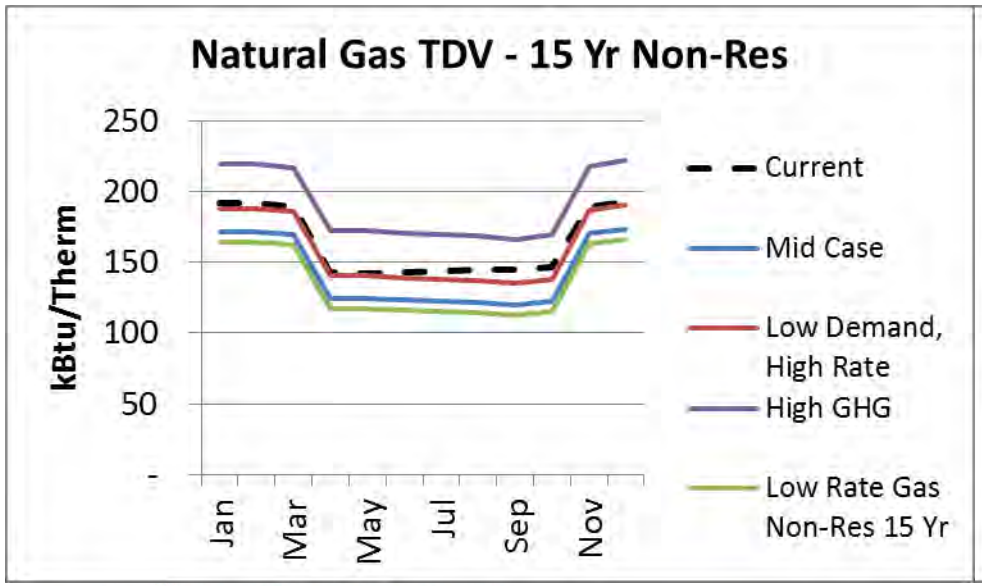
- GHG forecasts from IEPR.
- IEPR forecast through 2024, CAGR applied thereafter (just under 8% per year)
- High forecast is about 3x the base case forecast.

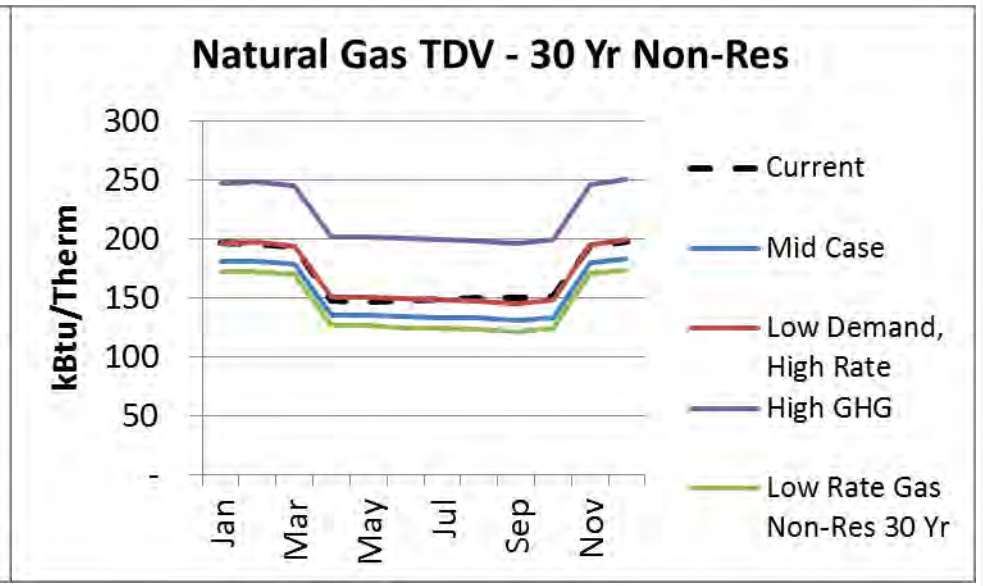


Natural Gas Scenario TDVs

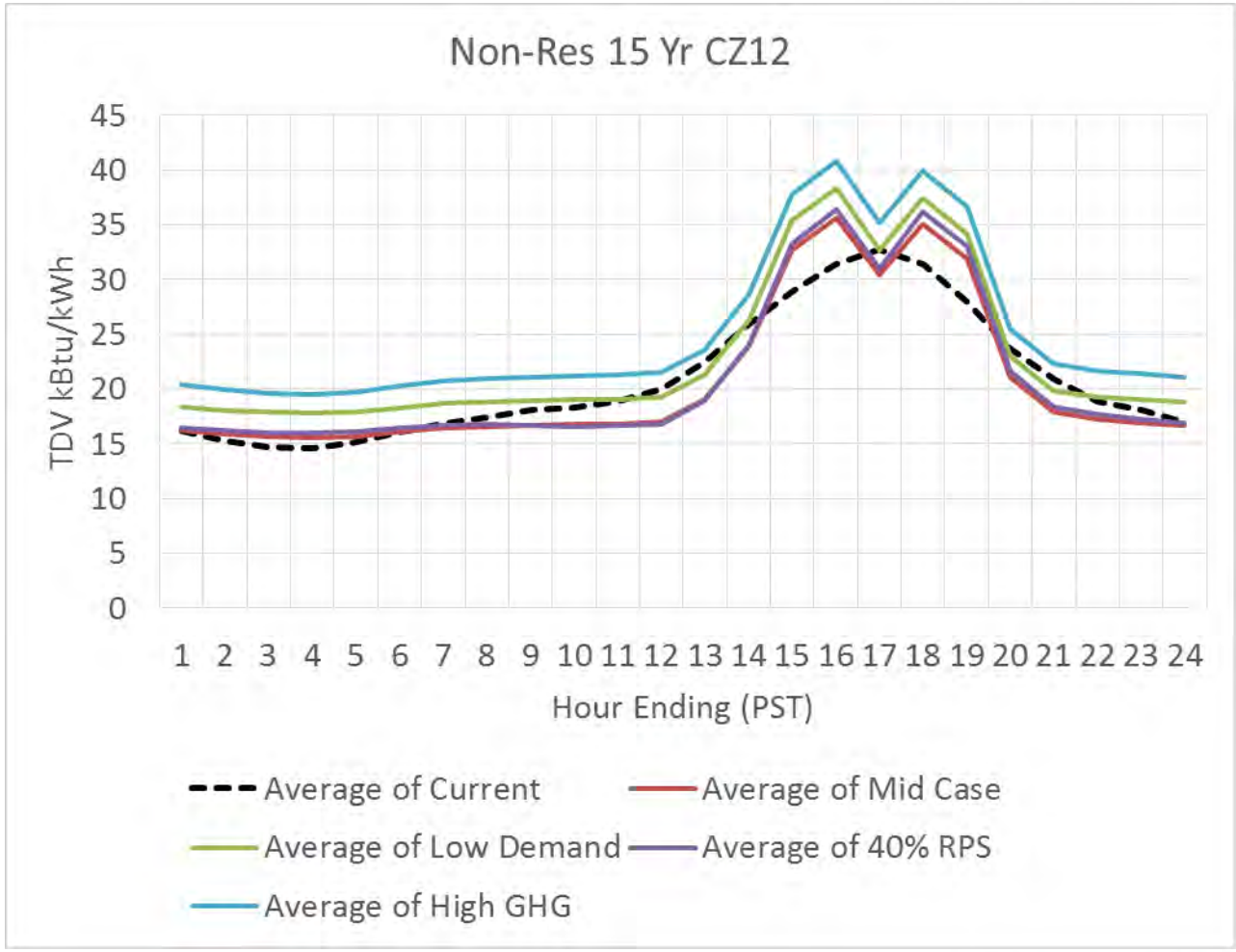
- **Dashed lines are the current TDV factors.**



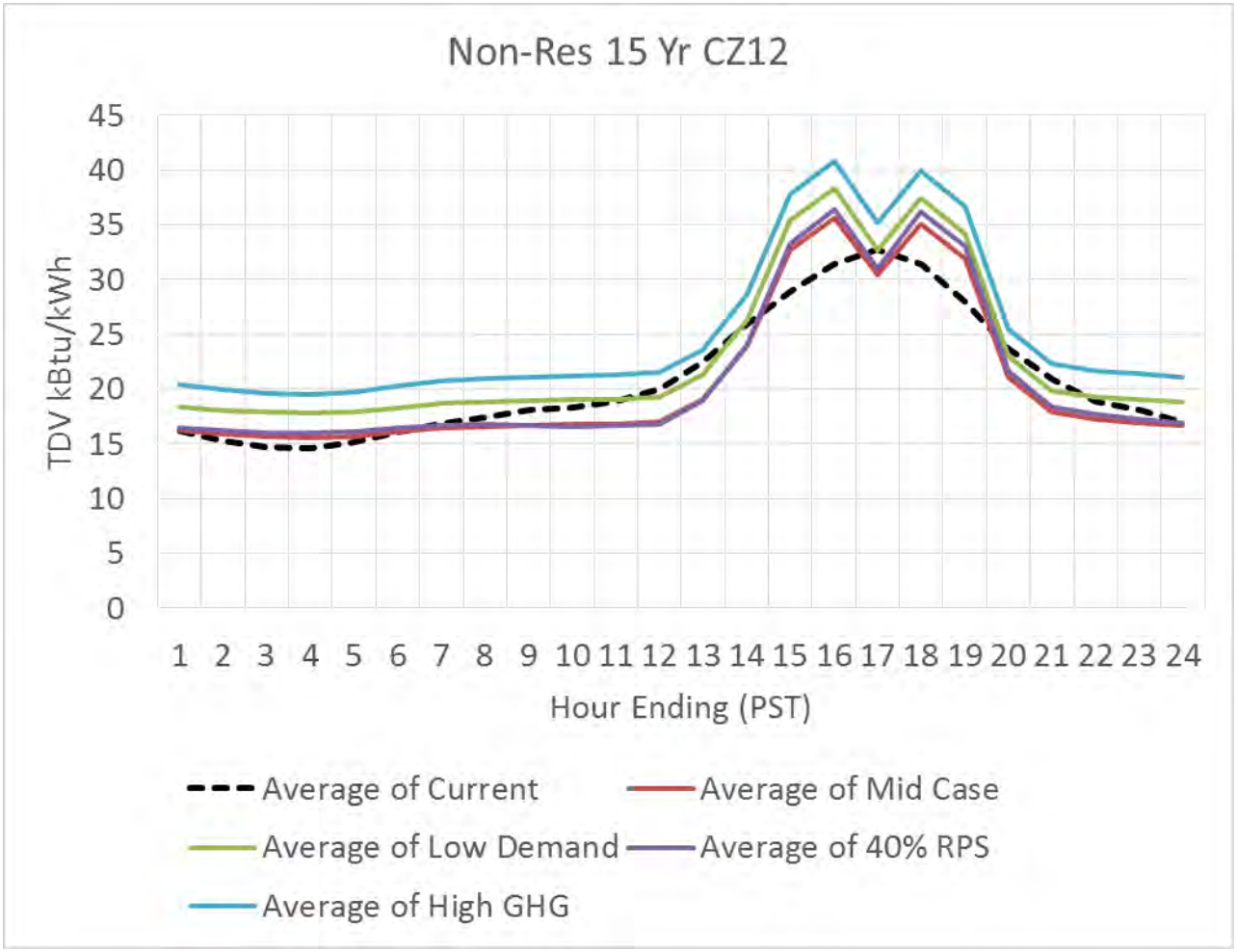




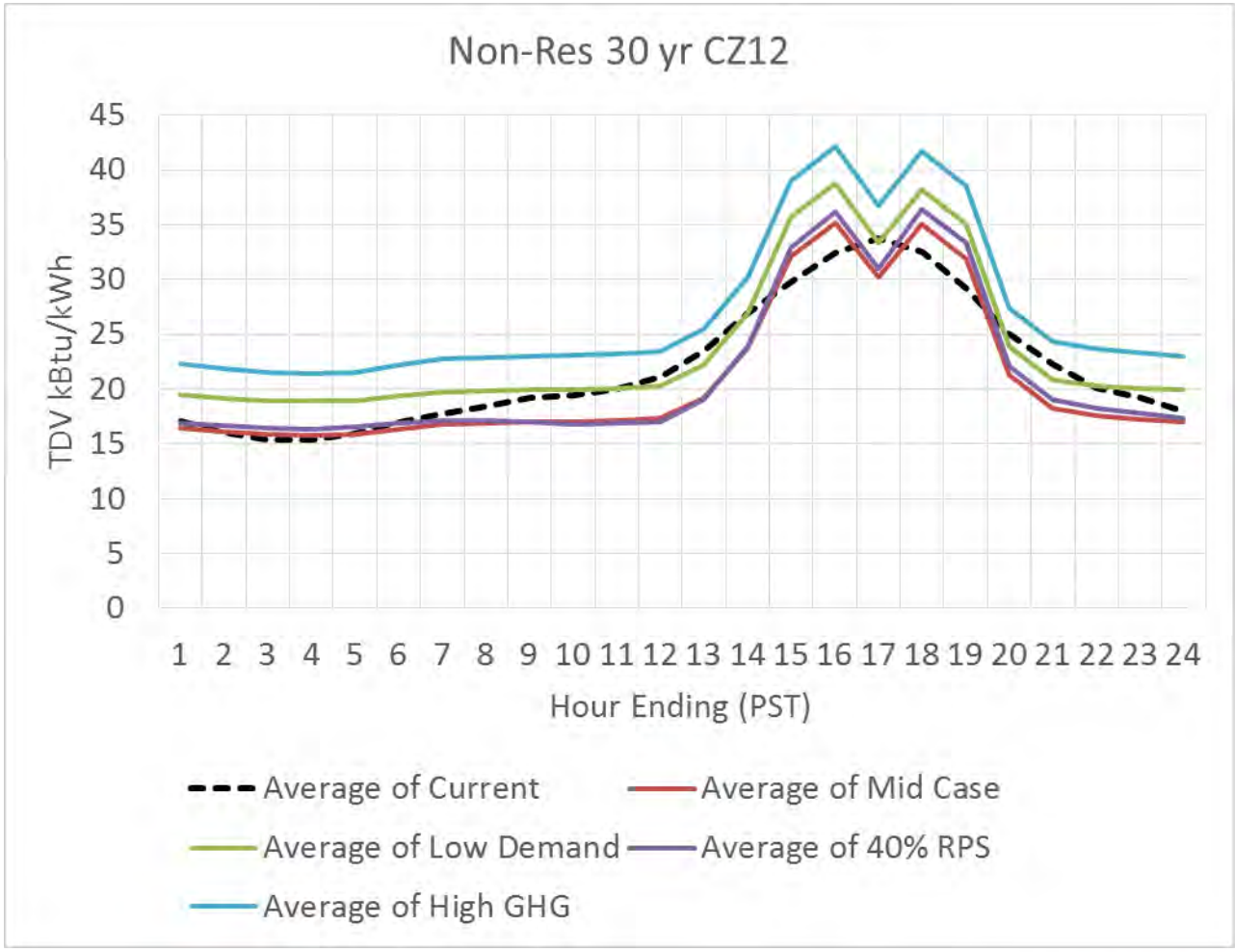
Scenarios – Elec Res 30 Yr



Scenarios – Elec Non-Res 15 Yr

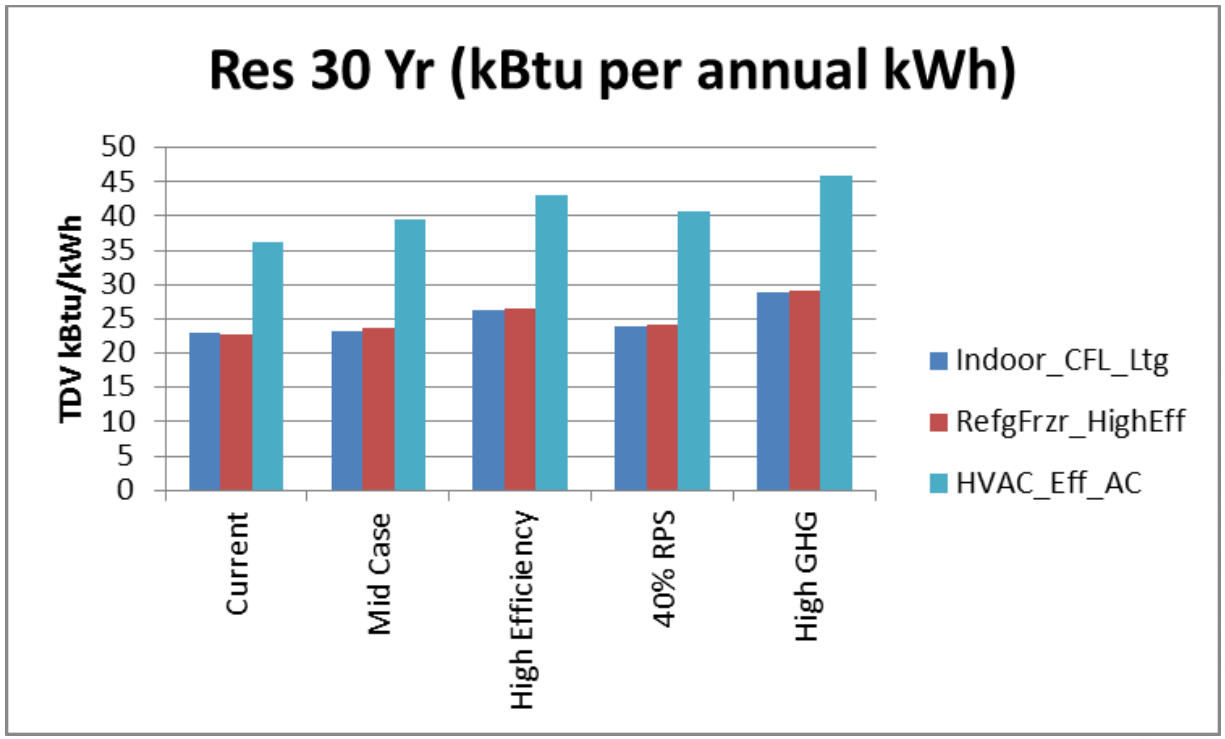


Scenarios – Elec Non-Res 30 Yr

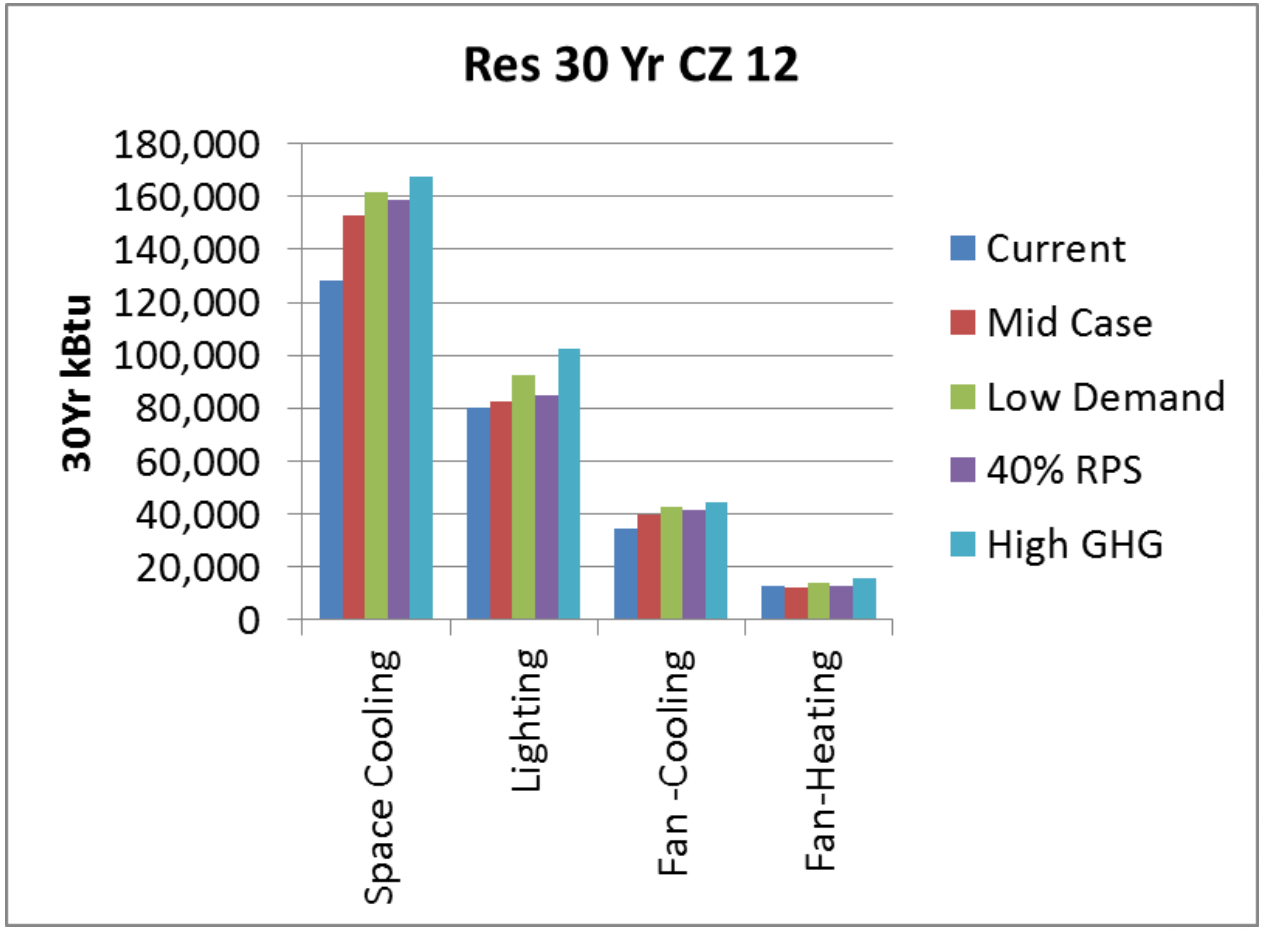


TDV Results for CZ 12: Res 30 Yr

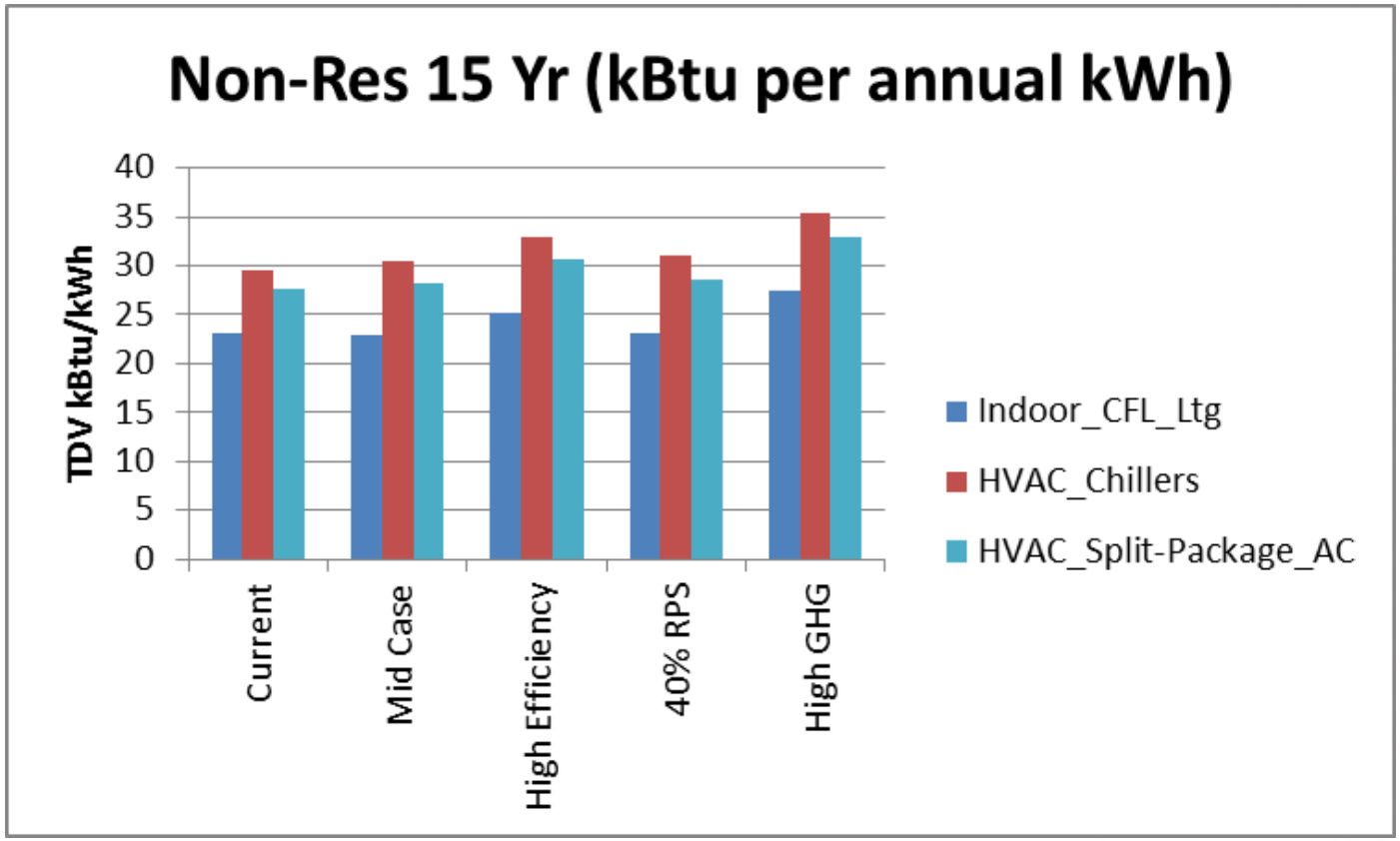
- Illustrative impact shapes from DEER
- Values are kBtu reductions per annual kWh of energy reduction



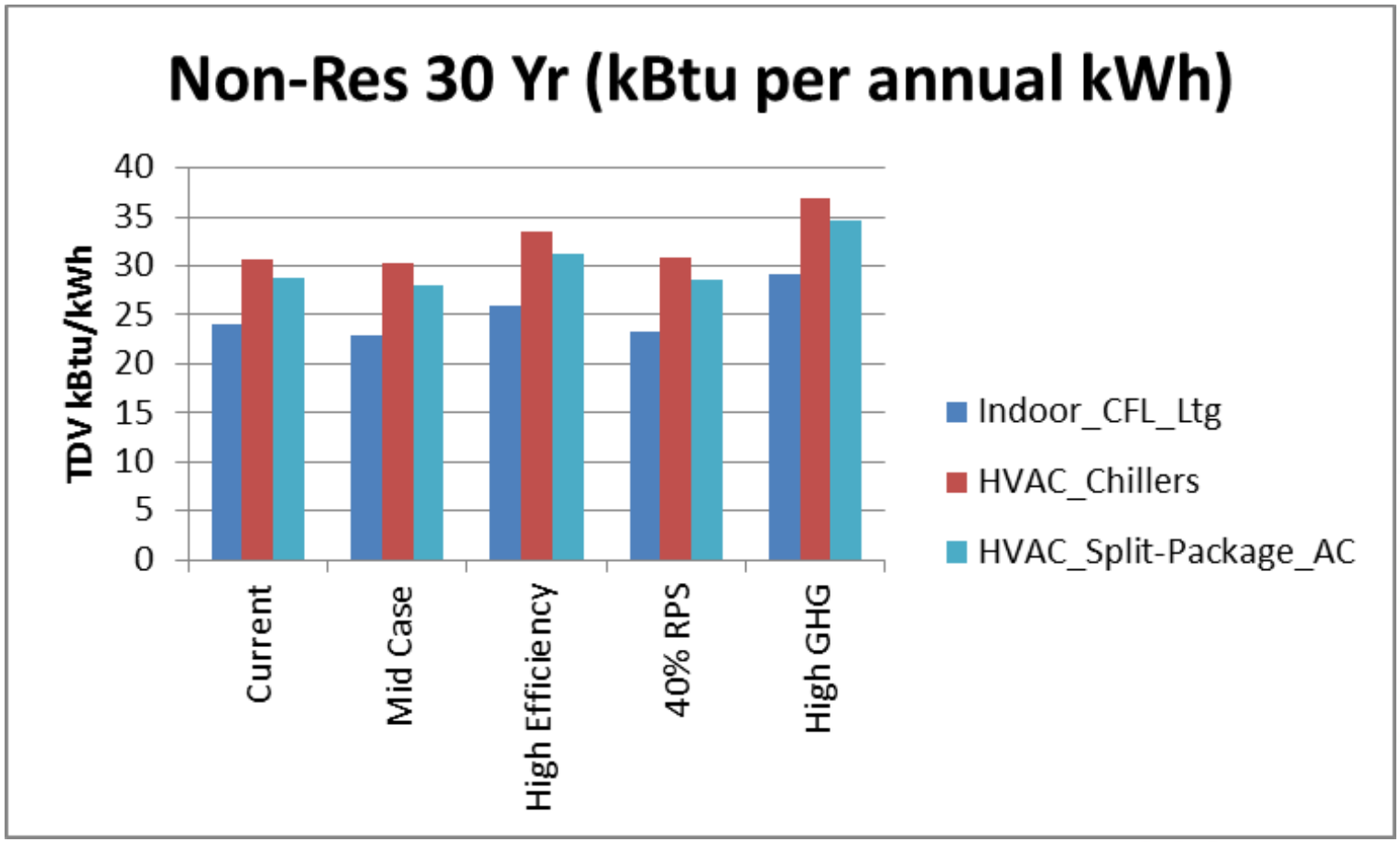
TDV Results for CZ 12: Res 30 Yr. CBECC-Res

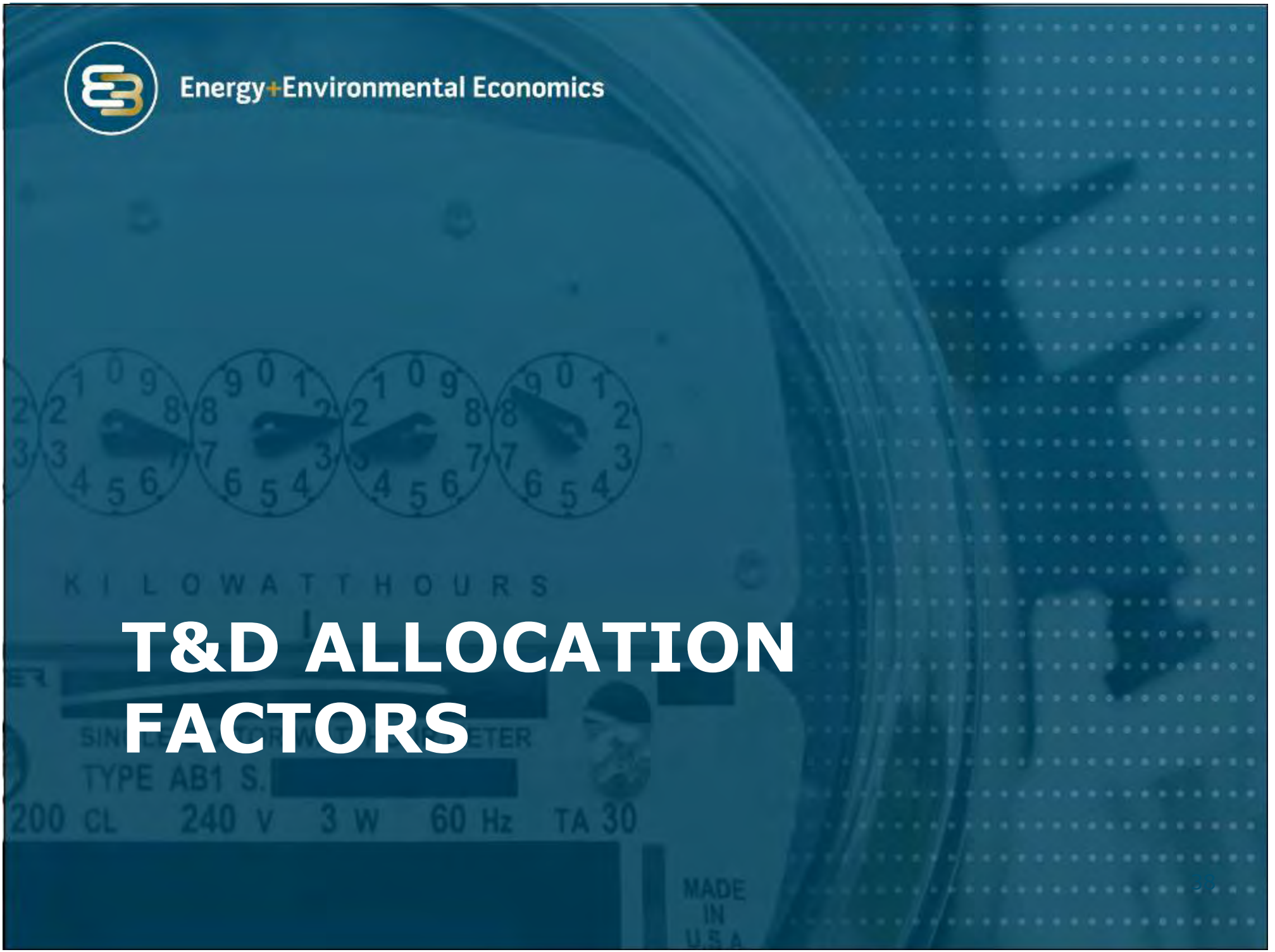


TDV Results for CZ 12: Non-Res 15 yr



TDV Results for CZ 12: Non-Res 30 yr





T&D ALLOCATION FACTORS

Allocation of T&D Costs to Hours

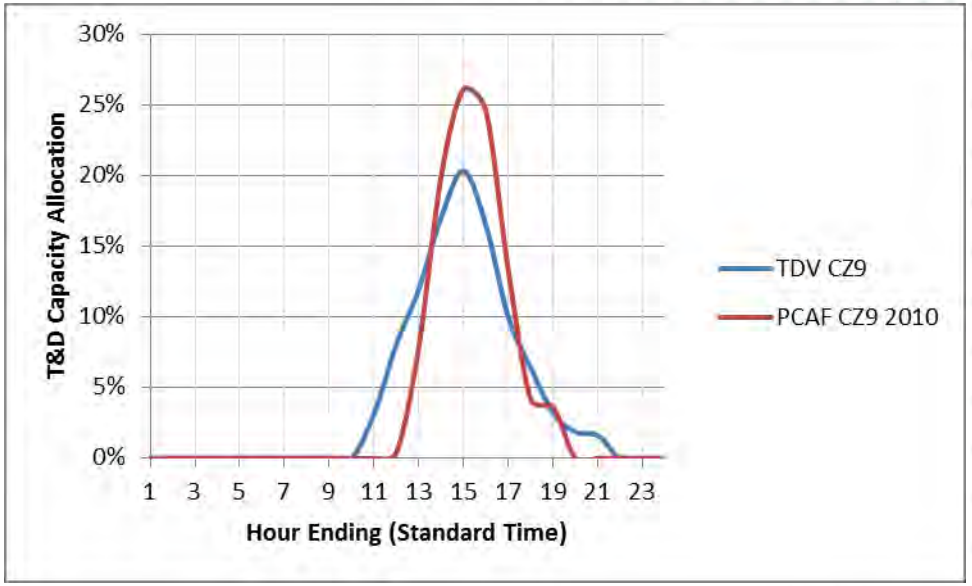
- **Current method uses temperature as a proxy for T&D loads**
- **Some parties have noted that temperature peaks (afternoon) may no longer match T&D peaks.**
- **Improved utility metering may allow the direct use of utility data, but there are issues.**
  - Actual load data would need to be adjusted to match the CZ2010 weather data.
  - Aggregation to 16 climate zones may negate the ability for TDV to match local peak conditions.
  - Use of separate loads for Residential and Non-Residential circuits might allow better reflection of the local peak conditions.

PCAF Method with Load Data

- The Peak Capacity Allocation Factor method is a load-based method
- Allocates capacity value to the hours with the highest load levels
- Includes all hours with load within one standard deviation of the annual peak

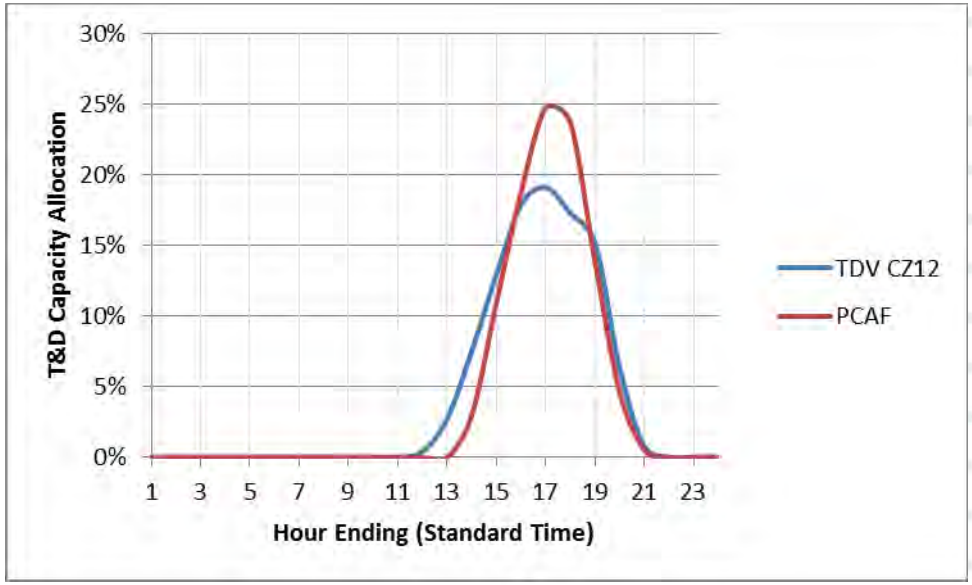
T&D Allocation Factors – CZ9

- Pasadena Weather Station
- TDV method and PCAF methods align
- PCAF method is more concentrated for hours ending 2pm through 5pm PST.



T&D Allocation Factors – CZ12

- Sacramento
- TDV method and PCAF methods align
- PCAF method is more concentrated for hours ending 5pm and 6pm PST.



T&D Allocation Factors – CZ6

- LAX
- PCAF method's peak occurs two hours after the TDV method (HE 3pm PST vs 1pm)