RESIDENTIAL SECTOR MODEL RESULTS

October 26th DAWG Meeting

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OVERVIEW

- Model Background
- Modernizing the Old Model
- Model Updates
- Results
- Adjustments and Further Considerations

MODEL BACKGROUND: INTRODUCTION

The Residential End-use Model forecasts energy usage by estimating the age, efficiency, and stock of installed appliances by forecasting zone.

This bottom up approach allows energy consumption to be attributed to specific end-uses, and therefore allows for end-use specific changes to be reflected in the overall forecast.

At its simplest, consumption calculations for an end-use are the result of…

$$Consumption_{enduse} = \sum UEC_{enduse,age} * Stock_{enduse,age}$$

MODEL BACKGROUND: INTRODUCTION CONT.

- 26 different end-uses that have individually estimated annual unit energy consumption (UEC) and saturation values.
  - Saturations represent the share installed in households
  - Saturation values are tracked by fuel/appliance types for each end-use
- End-uses can be individual appliances (dishwasher, water heater, etc.) or they can be an aggregate home value (household lighting)
- Saturation and UEC values are derived from the Residential Appliance Saturation Study (RASS) survey

MODERNIZATION: UPDATE TO R

Staff chose to update the model to R. Benefits result from the shift to R and overall model restructuring.

- Future updates will be easier, and modifications will be faster to run and diagnose
- R knowledge and ecosystem is active and growing
- Shift towards modularity allows intermediary steps to be evaluated more easily
- Rebuild from Fortran allows piece by piece evaluation of the Fortran calculations

MODERNIZATION: MODEL INPUTS

In addition to a shift from Fortran to R, many model processes and structures were evaluated and updated.

- Reevaluation of end-uses (18 → 26)
  - Both removal of non-relevant past enduses and addition of new enduses
- A shift from old 16 forecast zones to the new 20 forecast zones
- Updated UEC calculations

MODERNIZATION: MODEL INPUTS CONT.

- Remapped forecast zones and the model is updated to “start” in 2002
  - County level forecasts (Housing and demographics) allocated to forecasting zones from American Community Survey Census data.
  - Census data provides a framework for properly aggregating demographic info for counties that fall in multiple forecast zones

- Updating housing forecast methodology
  - Using census data to update county to forecast zone mapping

MODERNIZATION: UEC CALCULATION CHANGES

- Shift towards UEC values derived from RASS
  - Shift away from engineering calculations with assumptions about usage
  - UEC values are rooted in RASS and what consumers behavior is
- Climate considerations for climate sensitive end-uses
  - Utilize HDD/CDD forecasts
- New housing vintage splits justified by the RASS data
  - Decreasing vintages from 5 to 2 due

MODERNIZATION: UPDATING IN THE FUTURE

The model incorporates **committed** energy savings.

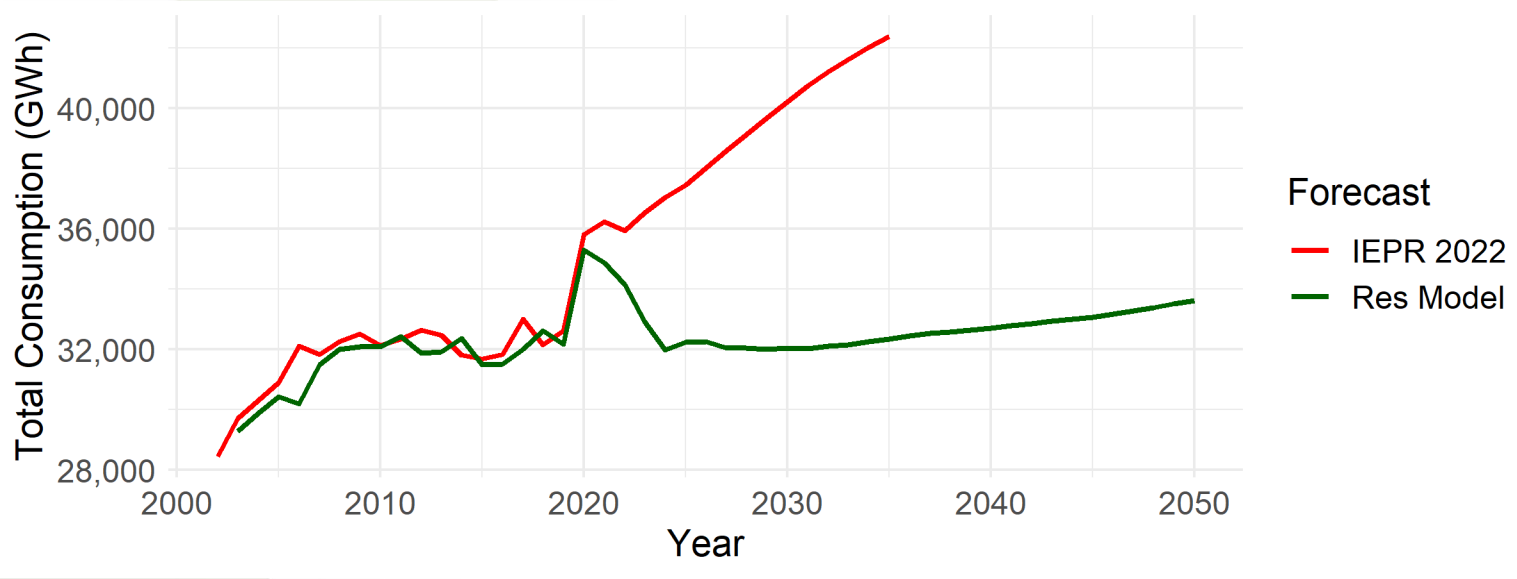
- Newly committed programs can be incorporated to adjust…
  - Installations in new homes
  - Installations for failed appliances

In this manner, the model can be adjusted as programs, codes and standards change.

MODEL RESULTS: CONSIDERATIONS

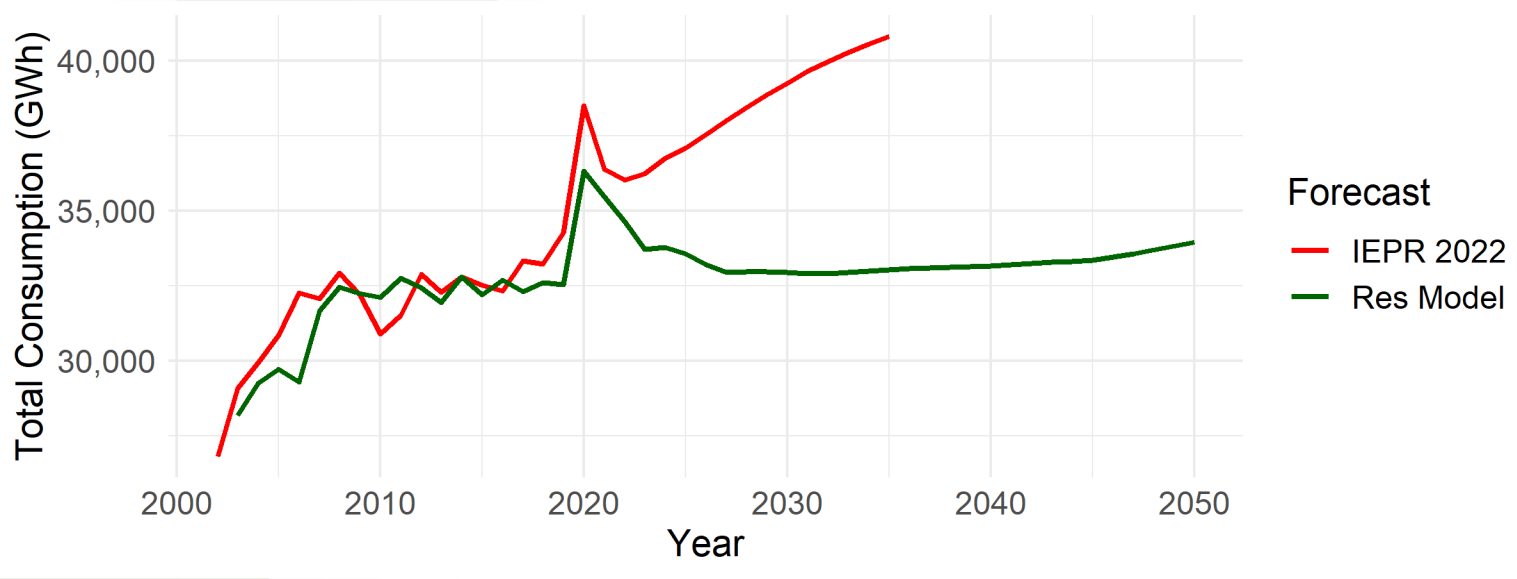
- A Covid-19 impact is applied directly to UEC estimates on a unit specific basis
  - The impact is applied as a percentage increase in UEC estimates for a given enduse and then tapers off in subsequent years
- Climate adjustment is not included in the following results
- Known efficiency gains with no fuel switching considered in current input parameters result in flat projections mid term

MODEL RESULTS: PG&E



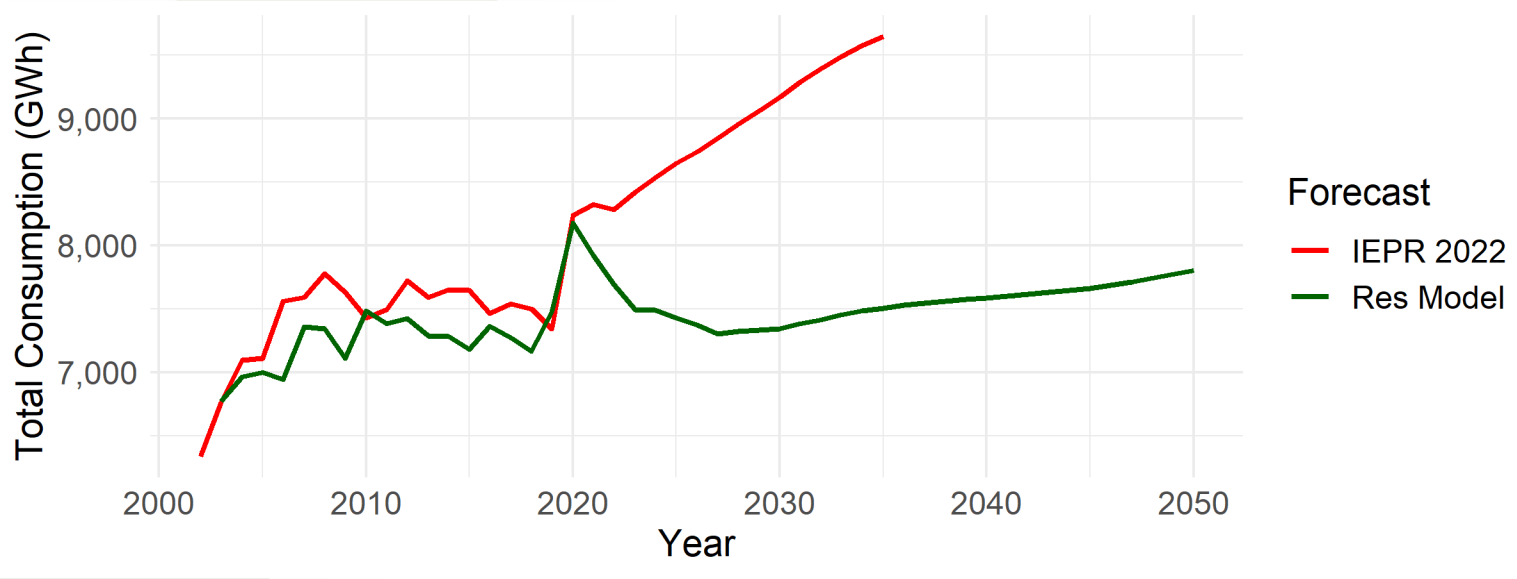
Source: CEC and Verdant

MODEL RESULTS: SCE



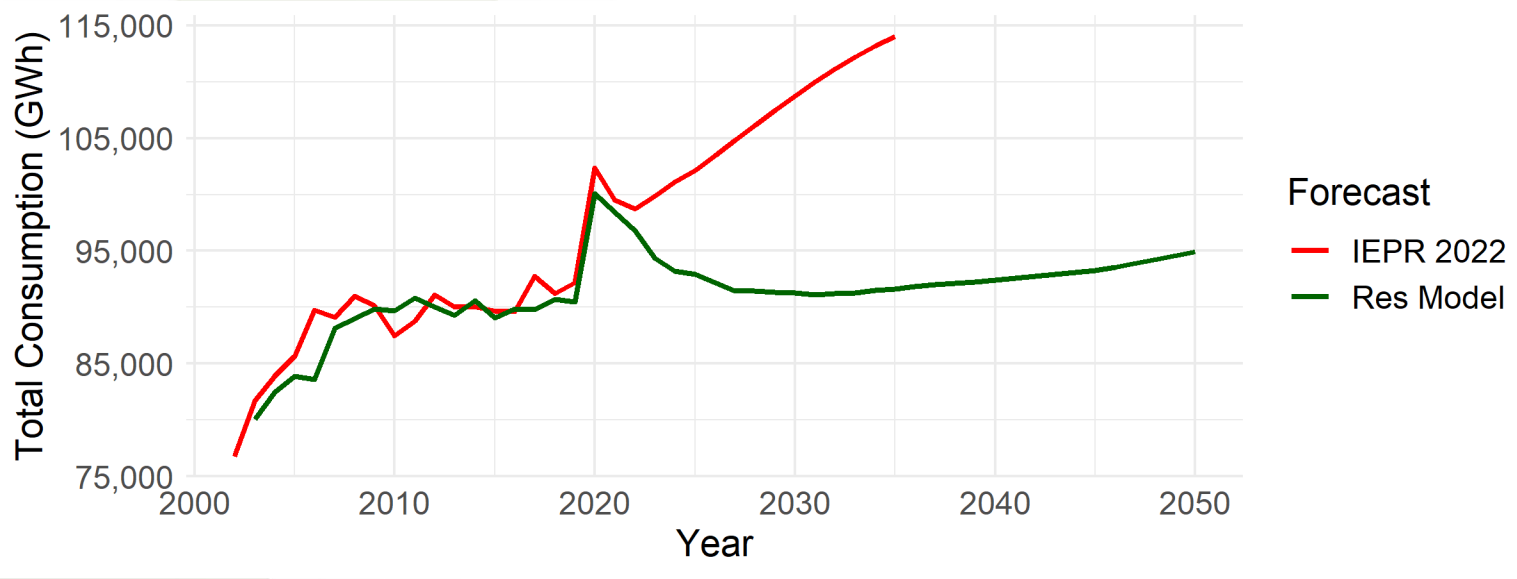
Source: CEC and Verdant

MODEL RESULTS: SDGE



Source: CEC and Verdant

MODEL RESULTS: CALIFORNIA



Source: CEC and Verdant

ADJUSTMENTS AND FURTHER CONSIDERATIONS

- Known efficiency gains with no fuel switching considered in current input parameters result in flat projections mid term
  - Lighting and HVAC enduses make up majority of committed efficiency
- Climate considerations are built into the model, but were not used for this run due to availability of input data
  - Additional climate impacts were applied through a separate process for this years run

THANK YOU

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