RESIDENTIAL SECTOR MODEL UPDATES

August 8th DAWG Meeting

Presented by: Greg Vitz @ Verdant Associates

VERDANT

OVERVIEW

- Model Background
- Modernizing the Old Model
- Model Updates
- Results from new model

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: FORTRAN MODEL

The Residential End-use model was originally written in Fortran maintained in a single file.

- Model documentation was from original coding, and did not cover all changes that occurred since it's origination
- Code updates and changes were tracked in code comments
- Model inputs were structured as plain text files
- Fortran code is compiled, so intermediary data files were hard to check

MODERNIZATION: UPDATE TO R

Staff chose to update the model to R. Some benefits result from the new language, but most benefits are from reevaluation of model structures and calculations

- 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.

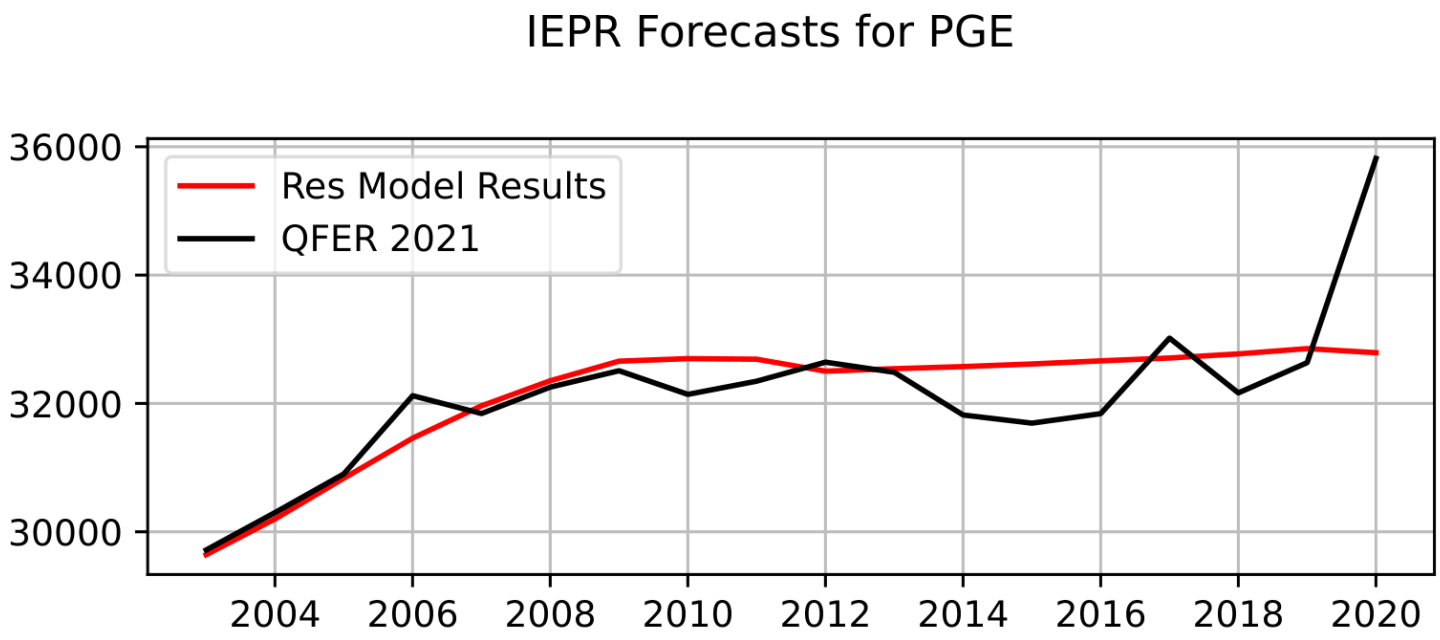
- Remapped forecast zones and the model is updated to “start” in 2002
  - County level forecasts (Housing and demographics) allocated to forecasting zones from American Community Survey Census data.
  - Census data provides a framework for properly aggregating demographic info for counties that fall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

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

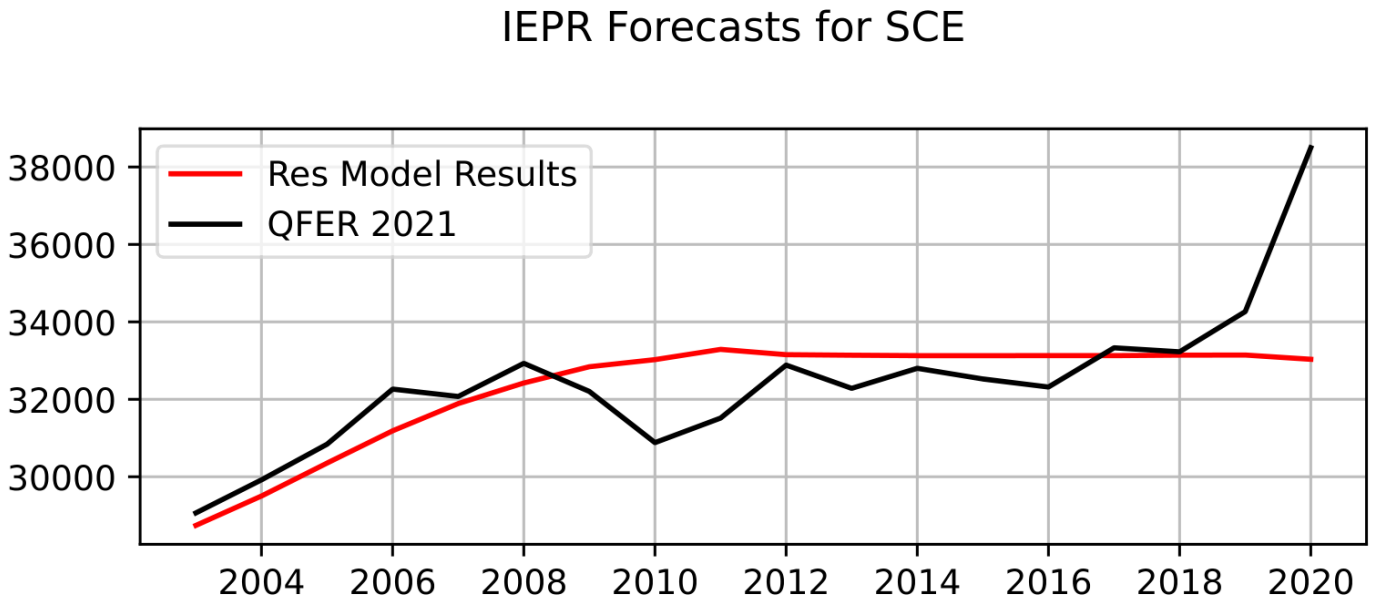
MODERNIZATION: UEC CALCULATION CHANGES

- 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

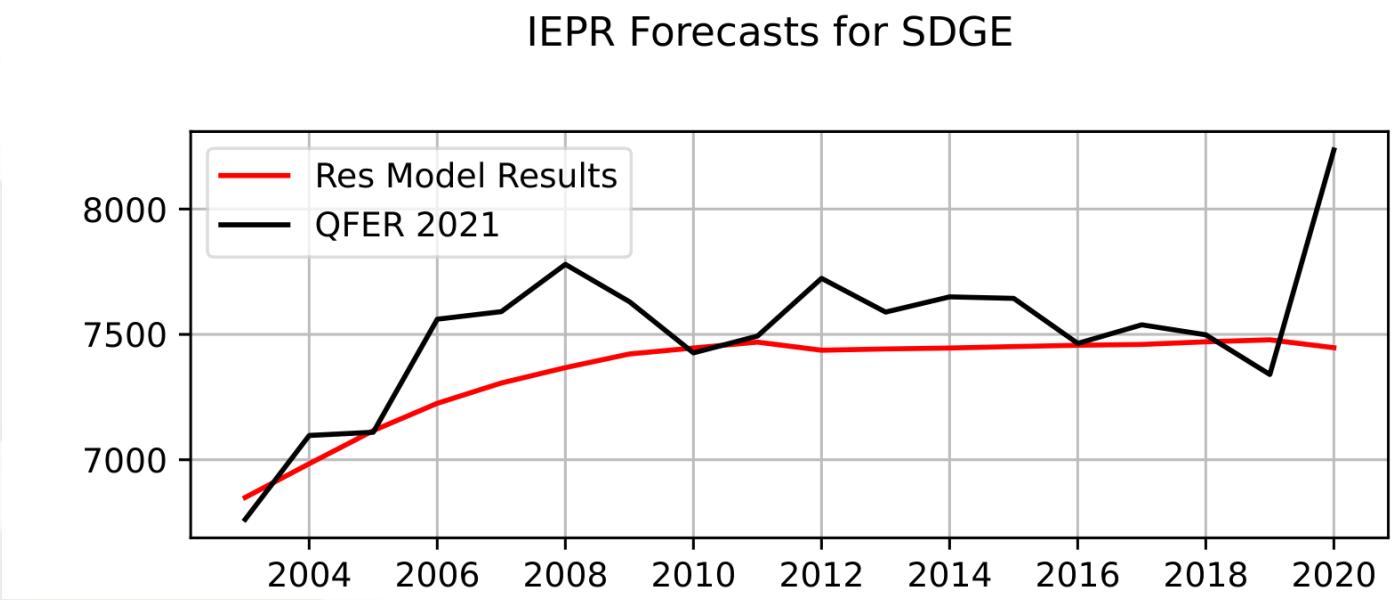
MODEL RESULTS: PG&E



MODEL RESULTS: SCE



MODEL RESULTS: SDGE



NEXT STEPS

- Modify inputs and assumptions as needed to model base case and scenarios
- Use the end-use model for the upcoming IEPR
- Update documentation to reflect new changes and changes made since original writing


THANK
YOU
VERDANT