CUSTOMER SPECIFIC REGRESSION OVERVIEW

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Energy solutions. Delivered.

INTRODUCTION TO REGRESSION

Regression analysis is about identifying and estimating statistical relationships between variables.

Regression analysis studies of the dependence of one variable, *the dependent variable*, on one or more other variables, *the explanatory variables*, with a goal of estimating and/or predicting the mean of the former in terms of the known values of the latter.[1]

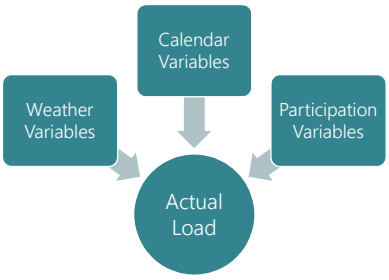
$$Y_{it} = \beta_0 + \beta_1 x_{it} + \ldots . \beta_n x_{it} + \varepsilon_I$$

- We use regression models to estimate the counter-factual – what would have happened in absence of an event
- The model uses information from non-event days to predict how much energy customers would have used in absence of an event

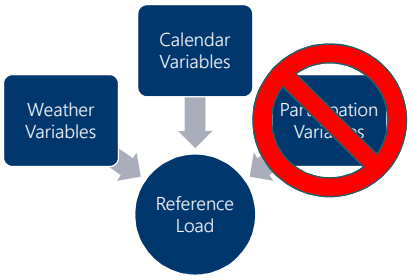
[1] Gujarati, D., Basic Econometrics, p.18, McGraw-Hill, 2003.

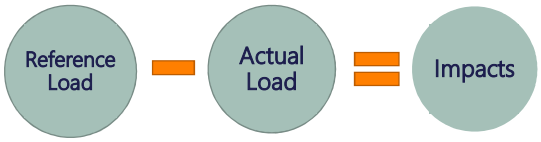
ESTIMATING IMPACTS

Actual consumption on an event day



Consumption on the same day but in absence of an event





WHY CUSTOMER-SPECIFIC MODELS?

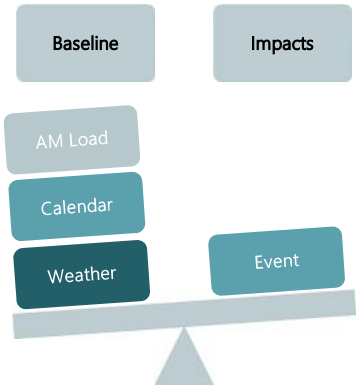
- Program participants are very large commercial and industrial customers and they consume energy very differently from each other
  - Solar Turbine
  - Wastewater treatment
  - Large Office Buildings
- Instead of pooling participants into a single group, we estimate individual models for each participant
  - A pooled model may be too "noisy" to isolate changes related to impacts
- This is a valid method for estimating the counter-factual without a matched control group, which is difficult to develop for these customers

CUSTOMER-SPECIFIC REGRESSION APPROACH

1

Develop a set of candidate models using building blocks set up in logical groups

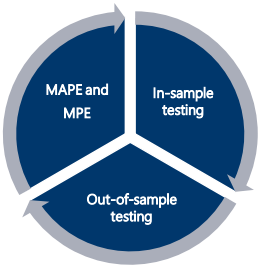
- ~35 Candidate Models



CUSTOMER-SPECIFIC REGRESSION APPROACH

2

Testing and optimization process that minimizes error and bias to select the best model for each participant

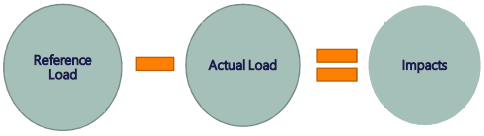


3

Model the actual load

Model the reference load

Calculate the impacts



EX POST AND EX ANTE RESULTS

- Estimate reference load and impact at customer level
- Estimate aggregate impacts by summing individual impacts to any subgroup level:
  - LCA, Industry Type, Size category, Aggregator, etc.
- Ex ante results leverage same models
  - But, use weather scenarios and enrollment forecasts as inputs