

DOCKETED

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Gas Demand Forecasting Methodology

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Key Concepts

- factors affecting demand - space heating & cooling / electricity generation
 - multi seasonality / trend / calendar
- types of demand forecast - 1-in-2 peak-day gas demand
 - 1-in-10 and 1-in-35 peak-day gas demands
- historical weather & demand data - monthly & daily demand profiles
 - categorized by sectors & by core, noncore, & EG
- degree of uncertainty - data / factors / modeling / estimates
 - probabilistic inference - quantify uncertainties by Bayesian



Methodology and Data

Methodology

- probabilistic programming
Python
Facebook Prophet / PyMc
domain knowledge
- 631 weighted moving average
trend direction
generate forecast

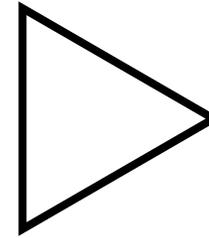
Data

- NOAA 30-year daily temperature
631 weighted average temp
sustain effects
- logarithm historic gas demand
631 weighted average temp
calendar dummies
- CEDF
CA Energy Demand Forecast
Quarterly Fuel Energy Report (QFER)
SoCalGas – Southern CA Edison

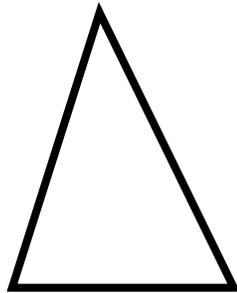


Deriving Monthly Demand Profiles

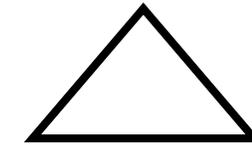
scaled to annual CEDF gas forecast of 2008-2025
to calibrate sectors' monthly demand



scaled to CEDF's sectors
monthly demands to create
the core, noncore, & EG
monthly demands



monthly profiles of QFER's sectors for 2008-2020
scaled to the monthly demand

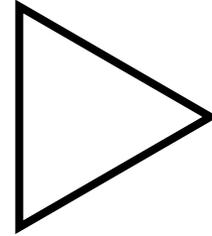


monthly profiles of QFER's core,
noncore, & EG for 2008-2020
scaled to the monthly demand

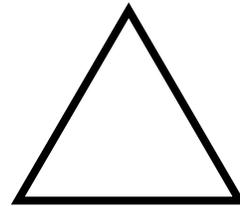
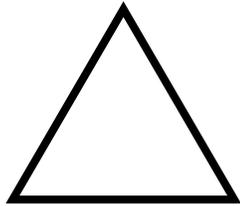


Calculating Demand for the Electricity Generation Sector

monthly gas demand forecasts from electricity generation



growth rate weighted moving average to obtain 2022-2023



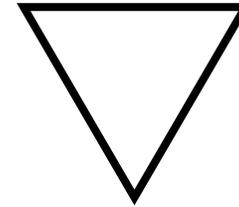
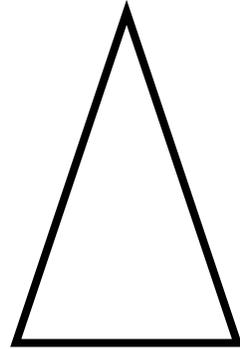
SoCalGas monthly EG gas demand for 2017-2021

QFER monthly electricity demand for 2008-2021, provided by SCE, as a proxy for SoCalGas



Deriving Daily Demand Profiles

historical daily gas demand profiles over time by core, noncore, and EG



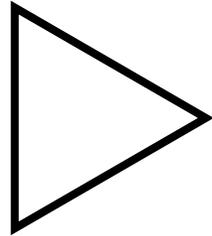
daily profiles scaled to the daily demand and to the daily core demand

SoCalGas daily gas demand categorized by core, noncore, and EG for 2017-2021

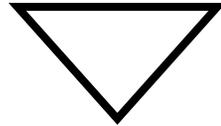


Steps for Estimating the 1-in-2 Peak-day Gas Demand

SoCalGas daily gas demand send-outs for 1999-2020



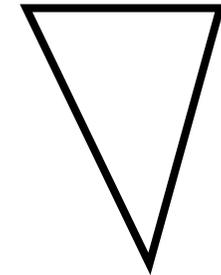
regressing actual past gas demand against explanatory factors



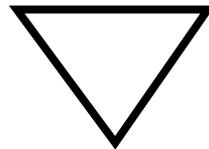
historical 30-year weather



simulating and normalizing demand for weather effects



coefficients used at the next step

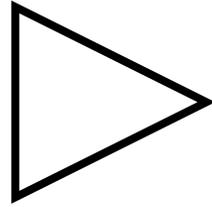


forecasted daily demand based on average weather conditions
1-in-2 daily probability of average weather conditions



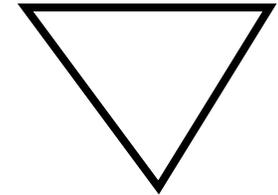
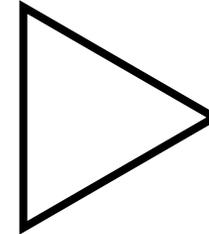
Steps for Estimating the 1-in-10 and 1-in-35 Peak-day Gas Demands

estimation of a 10-year and 35-year weather

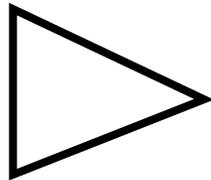


calibration to a 1-in-10 and 1-in-35 daily peaks

simulating and selecting daily peak demand by applying the coefficients calculated at the step before

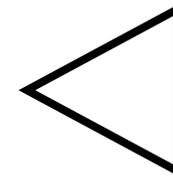


daily demand profiles



calculates abnormal peak-day demand for core, noncore, and EG

applying 1-in-10 temperature values to all categorized demands, but 1-in-35 values only to core





Contribution

- probabilistic programming
 - accounting for uncertainty
data, factors, modeling, & estimates
 - fine-tuning – cross-validation
- 631 average temperature - simplifies modeling & reduces volatility
- gas demand profiles - matching datasets
- accurate forecast gas demand for winter reliability under extreme weather