

# PGE FORECAST REVIEW SUMMARY

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#### **Purpose of Load Forecast Model Review**

- PGE's load forecast model and approach has been used for many years.
- While the load forecast model has an established history and performed well, relationships between deliveries and drivers have changed.
- PGE recognized the potential for refinement and further examination of approach, particularly with respect to:
  - Modeling weather in short-term energy models
  - Long-term energy approach
  - Peak demand approach
  - Complexity of models and process
- In Q3 2014 PGE issued a Request for Quote (RFQ) seeking consulting services to evaluate the existing load forecast model and make recommendations based on industry practices to improve models, relationships in models and forecast process.



# FORECAST REVIEW SUMMARY

- » 4<sup>th</sup> Quarter 2014 Model Review
- » Energy Forecast
  - Residential Models
    - Customer Models (2 Connects, 2 Building Permits)
    - Energy Models (7 UPC Models)
  - Commercial Models
    - Customer Model (1 Connects Model)
    - Energy Models (11 Sector Models)
  - Industrial Models
    - Manufacturing Energy Models (7 Sector Models)
  - Post-Model Adjustments
    - Price
    - DSM
    - Long-Term Energy Growth
- » Peak Forecast



# ENERGY FORECAST: RESIDENTIAL MODELS



## **PGE RESIDENTIAL FORECAST**

PGE Residential Forecast	Annual Growth Rates
2015-2019 Average	0.52%
2015-2025 Average	0.73%
2012 National Survey*	0.95%
2013 National Survey*	0.78%
2014 National Survey*	0.65%

\* Itron 2012, 2013, and 2014 survey of utility 10 year forecast annual growth rate



\* Itron 2014 survey of utility 2014 forecast growth rate. 64 utility respondents

PGE residential energy growth rate projections are within common oneyear ahead and 10-year projections of industry



#### **COMMON RESIDENTIAL DRIVERS**



#### **Itron 2012 Benchmark Survey**

- □ 77 Utility Responses (PGE not included)
- D Population/Households is most common driver (21%)
- **D** PGE uses Unemployment (5%) and Housing Information (11%)



# **RESIDENTIAL FINDINGS**

<u>Customer Method</u> Survival Equation - Minority

<u>Energy Method</u> Econometric - Normal Weather Variables – Minority Economic Variables – Minority Growth Rates - Normal

#### Commercial

<u>Customer Method</u> Survival Equation - Minority

Energy Method Econometric – Normal Weather Variables – Normal Rohme Economic Variables – Normal Rohme Growth Rates - Normal

#### Industrial <u>Energy Method</u> Econometric - Normal Economic Variables – Normal Growth Rates – High

#### Key Residential Findings

- Overall forecast aligns with industry standards
- Explore more common drivers such as population and households
- □ Simplify model structure
- □ Improve weather response clarity with spline variables
  - Shorten estimation period to capture technology changes

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Subtract Incremental - Normal
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Load Factors – Minority
Use Load Research - Normal
Growth Rates - High
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Key: Standard Practice Minority Practice Consider Refinements



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#### **IMPROVE WEATHER RESPONSE MODELING**



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# ENERGY FORECAST: COMMERCIAL MODELS



#### **PGE COMMERCIAL FORECAST**

PGE Commercial Forecast	Annual Growth Rates
2015-2019 Average	0.39%
2015-2025 Average	1.03%
2012 National Survey*	1.20%
2013 National Survey*	0.93%
2014 National Survey*	0.71%

\* Itron 2012, 2013, and 2014 survey of utility 10 year forecast annual growth rate



- \* Itron 2014 survey of utility 2014 forecast growth rate. 64 utility respondents
- PGE commercial sector growth rate projections within common one-year ahead and 10-year projections based on industry benchmark

#### **COMMON COMMERCIAL DRIVERS**



#### **Itron 2012 Benchmark Survey**

- **77** Utility Responses (PGE not included)
- □ 37% use residential and/or employment information (similar to PGE)



# **COMMERCIAL FINDINGS**

Residential	Commercial	Industrial
Customer Method Survival Equation - Minority	<u>Customer Method</u> Survival Equation - Minority	<u>Energy Method</u> Econometric - Normal Economic Variables - Normal Belline
Energy Method Econometric - Normal Weather Variables – Minority Economic Variables – Minority Growth Rates - Normal	<u>Energy Method</u> Econometric – Normal Weather Variables – Normal/Refine Economic Variables – Normal/Refine Growth Rates - Normal	Growth Rates – High
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- Overall forecast, drivers, and models are aligned with industry standards Dev Ela
  - □ Simplify model structure
  - Improve weather response clarity with spline variables
  - Explore alternative employment drivers for better relationships
  - Consider top-down method due to class stability



**Standard Practice Minority Practice Consider Refinements** 



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## **TOP LEVEL STABILITY**



#### Key Variables

- Seasonal Binaries
- Non-Manufacturing Employment
- ➢ HDD Spline
- > CDD spline

- □ Simplicity in model structure
- □ Identify strong economic variables
- Sectors may be shared out using a top-down method



# ENERGY FORECAST: INDUSTRIAL ENERGY MODELS



## **PGE INDUSTRIAL FORECAST**

PGE Industrial Forecast	Annual Growth Rates
2015-2019 Average	2.49%
2015-2025 Average	2.26%
2012 National Survey*	0.84%
2013 National Survey*	0.91%
2014 National Survey*	0.61%

\* Itron 2012, 2013, and 2014 survey of utility 10 year forecast annual growth rate



\* Itron 2014 survey of utility 2014 forecast growth rate. 62 utility respondents

- PGE growth rate projections are higher than the 10-year average projections in the benchmark survey
- PGE one year growth rates are high relative to most 2014 forecasts



### **COMMON INDUSTRIAL DRIVERS**



#### **Itron 2012 Benchmark Survey**

- □ 77 Utility Responses (PGE not included)
- □ 25% use employment information (similar to PGE)

# **INDUSTRIAL FINDINGS**

Residential	Commercial	Industrial
<u>Customer Method</u> Survival Equation - Minority	<u>Customer Method</u> Survival Equation - Minority	<u>Energy Method</u> Econometric - Normal
Energy Method Econometric - Normal	Energy Method Econometric Normal	Economic Variables – Normal/Refine Growth Rates – High
Weather Variables – Minority Economic Variables – Minority	Weather Variables – Normal/Refine	
Growth Rates - Normal	Growth Rates - Normal	
Price A divertment	1 mm Promite Addimiteron	

#### Key Industrial Findings

- Overall forecast and models are aligned with industry standards
- □ Simplify model structure
- □ Explore alternative employment drivers for better relationships
- □ Consider shorter estimation periods
- □ Consider top-down forecast technique
- □ Consider flat forecasts for non-growing sectors

Growth Rates - Hugh

**Consider Refinements** 



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#### **CHANGING RELATIONSHIPS**





ENERGY FORECAST: FORECAST ADJUSTMENTS

### **PRICE ELASTICITY BENCHMARKS**

#### **PGE Elasticity Range**

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Class	Low	Average <sup>1</sup>	High	Benchmark Average <sup>2</sup>
Residential	0.000	0.101	0.163	0.150
Commercial	0.000	0.037	0.339	0.188
Industrial	0.000	0.016	0.117	0.193

(1) Sales weighted average. (2) Based on 91 electric company responses



#### **ACCOUNTING FOR DSM**



Itron, 2013 Forecasting Benchmark Survey



## SYSTEM ENERGY FORECAST





<u> 2015 – 2025 Forecast*</u>	
Energy	1.12%
Customers	1.07%
Res/Com/Ind Total*	
1992-2013 Energy Growth	0.97%
2000-2013 Energy Growth	0.21%
2013 Regional Comparison	1 3%-2 0%
EIA - US	0.8%
Global Insights – US	1.5%
*Forecast from September 2013	

- Overall forecast consistent with regional and national forecasts.
- □ Adjust growth rates based on economic drivers



## **ADJUSTMENT FINDINGS**

Residential	Commercial	Industrial
Cut Sur       Key Industrial Findings         Sur       No changes. Price elasticities are within industry range         Ent       DSM account method is commonly applied in industry         Ect       Forecast growth within industry bounds         We       Adjust growth rates with economic drivers		
Growth Kates - Normal	Growth Rates - Normal	
Price Adjustment	Long-Term Growth Adjustment	
<u>Method</u> Develop with Model –Normal Elasticity - Normal	<u>Energy Method</u> Average Growth - Minority Growth Rates - High	
DSM Adjustment	Peak Forecast	
<u>Method</u> Subtract Incremental - Normal	<u>Peak Method</u> Load Factors – Minority Use Load Research - Normal Growth Rates - Lligh	Key: Standard Practice Minority Practice Consider Refinements



# **PEAK FORECAST**

## **PEAK FORECAST**

Year	Peak Forecast Growth
2016	0.54%
2017	0.68%
2018	0.86%
2019	0.90%
2020	1.26%
2021	1.18%
2022	1.18%
2023	1.19%
2024	1.20%
2025	1.20%
2012 National Survey*	0.99%
2013 National Survey*	0.77%
2014 National Survey*	0.68%

- □ 2016-2025 Annual Average = 1.02%
- PGE growth rate projections above 10year average projections
- PGE forecast accelerates through the short-term forecast and flattens with the long-term forecast

\* Itron 2012, 2013, and 2014 survey of utility 10 year forecast annual growth rate



#### **PEAK FORECASTING METHODS**



Itron, Review of PJM Models, Phase 1 Load Forecast Model Evaluation, 2010

- 59% of companies use econometric models to forecast monthly peaks
- 8% of companies apply a load factor method to develop monthly peaks (PGE approach)
- 26% of companies use load shapes



## **PEAK FINDINGS**

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Residential	Commercial	Industrial	
<u>Customer Method</u> Survival Equation - Minority	<u>Customer Method</u> Survival Equation - Minority	<u>Energy Method</u> Econometric - Normal Economic Variables – Normal/Refine	
Energy Method       I Growth Rates – High         Ecc       Key Peak Findings         Ecc       Annual peak forecast is within the bounds of a reasonable projection			
<ul> <li>Explore econometric models to forecast monthly peaks to improve</li> <li>explanatory power and flexibility in peak forecast</li> </ul>			
<u>Method</u> Develop with Model –Normal Elasticity - Normal	Energy Method Average Growth - Minority Growth Rates - Figh		
DSM Adjustment	Peak Forecast		
Method Subtract Incremental - Normal	<u>Peak Method</u> Load Factors – Minority Use Load Research - Normal Growth Rates - High	Key: Standard Practice Minority Practice Consider Refinements	

#### **ECONOMETRIC PEAK MODEL STRUCTURES**

#### **Common Forecasting Structures**

Peak = f(HDD, CDD, Economic Driver)

Peak = f(HDD, CDD, System Energy)

Peak = f(HDD, CDD, Summer Energy, Winter Energy)

Peak = f(HDD, CDD, End-Use Trends)

Advantages of an econometric model

- HDD and CDD allow for weather scenarios
- Energy drivers tie energy forecast to peaks
- Seasonal energy allow for changing load factors
- End-use trends allow for detailed changes to monthly peaks
- Weather normalize peaks to identify underlying trends



# SUMMARY



## **OVERALL FINDINGS**

Residential	Commercial	Industrial
Customer Method	Customer Method	Energy Method
Survival Equation - Minority	Survival Equation - Minority	Econometric - Normal Economic Variables – Normal/Refine
Energy Method	Energy Method	Growth Rates – High
Econometric - Normal	Econometric – Normal	
Weather Variables – Minority	Weather Variables – Normal/Refine	
Economic Variables – Minority	Economic Variables – Normal/Refine	
Growth Rates - Normal	Growth Rates - Normal	
Price Adjustment	Long-Term Growth Adjustment	
Method	Energy Method	
Develop with Model –Normal	Average Growth - Minority	
Elasticity - Normal	Growth Rates - High	Key:
		Standard Practice
DSM Adjustment	Peak Forecast	Consider Refinements
Method	Peak Method	
Subtract Incremental - Normal	Load Factors – Minority	
	Use Load Research - Normal	
	Growth Rates - High	



#### **PGE Next Steps**



Electric