Gas-Electric Modeling with GPCM® & GE MAPS®

Leah Kaffine
GE Power
Energy Consulting
December 5th, 2017

Gas-Electric Modeling with GPCM® & GE MAPS®

December 11, 2017

CAUTION CONCERNING FORWARD-LOOKING STATEMENTS:
This document contains "forward-looking statements" – that is, statements related to future events that by their nature address matters that are, to different degrees, uncertain. For details on the uncertainties that may cause our actual future results to be materially different than those expressed in our forward-looking statements, see http://www.ge.com/investor-relations/disclaimer-caution-concerning-forwardlooking-statements as well as our annual reports on Form 10-K and quarterly reports on Form 10-Q. We do not undertake to update our forward-looking statements. This document also includes certain forward-looking projected financial information that is based on current estimates and forecasts. Actual results could differ materially. to total risk-weighted assets.]

NON-GAAP FINANCIAL MEASURES:
In this document, we sometimes use information derived from consolidated financial data but not presented in our financial statements prepared in accordance with U.S. generally accepted accounting principles (GAAP). Certain of these data are considered "non-GAAP financial measures" under the U.S. Securities and Exchange Commission rules. These non-GAAP financial measures supplement our GAAP disclosures and should not be considered an alternative to the GAAP measure. The reasons we use these non-GAAP financial measures and the reconciliations to their most directly comparable GAAP financial measures are posted to the investor relations section of our website at www.ge.com. [We use non-GAAP financial measures including the following:

- Operating earnings and EPS, which is earnings from continuing operations excluding non-service-related pension costs of our principal pension plans.
- GE Industrial operating & Verticals earnings and EPS, which is operating earnings of our industrial businesses and the GE Capital businesses that we expect to retain.
- GE Industrial & Verticals revenues, which is revenue of our industrial businesses and the GE Capital businesses that we expect to retain.
- Industrial segment organic revenue, which is the sum of revenue from all of our industrial segments less the effects of acquisitions/dispositions and currency exchange.
- Industrial segment organic operating profit, which is the sum of segment profit from all of our industrial segments less the effects of acquisitions/dispositions and currency exchange.
- Industrial cash flows from operating activities (Industrial CFOA), which is GE's cash flow from operating activities excluding dividends received from GE Capital.
- Capital ending net investment (ENI), excluding liquidity, which is a measure we use to measure the size of our Capital segment.
- GE Capital Tier 1 Common ratio estimate is a ratio of equity

GE Fuels Team

Started in 2013 with the goal of contributing fuel market expertise to GE MAPS modeling and industry client studies including:

- North American (including Mexico) and international fuel markets
- Fuel market advantages to power generation
- Risk and reliability of fuel supply

DOUG WELSH
Technical Director
With GE from 2001-2007, 2013-present
Previously managed GE MAPS, MARS and PSLF
24 years in the electric power industry
Located in Chandler, AZ

(480) 280-7358

LEAH KAFFINE
Senior Engineer
Joined GE in 2014
Previously with SourceGas, NREL, Bentek
10 years in gas and power industries
Located in Golden, CO

(805) 708-1424

ANDY BACHERT
Senior Engineer
Joined GE in 2015
25 years in the gas and power industries
Led gas/power coordination for NYISO
Located in Schenectady, NY

(518) 385-6587

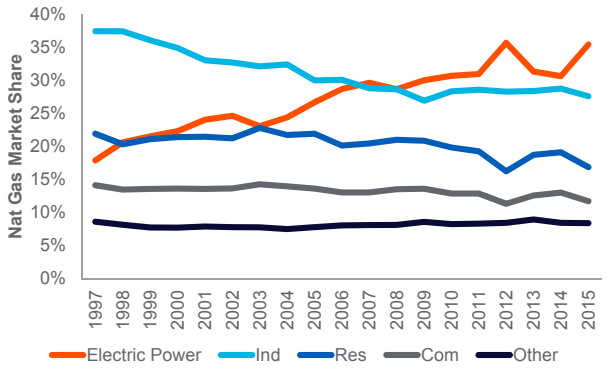
Overview

GE Energy Consulting model contributions

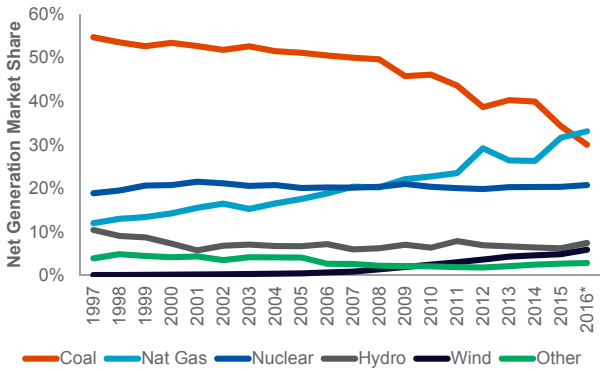
- Motivation
- Integrated Modeling: RBAC GPCM® & GE MAPS
- Burner Tip Price
- GPCM & GE MARS

Gas-Electric Modeling Motivation

Natural Gas Consumption



Electricity Generation



eia Source: U.S. Energy Information Administration

*2016 YTD Jul

Typically models will focus on a single market, however increasing codependent relationship is creating new modelling challenges.

GE integrated gas-power and coal modeling

*GPCM is a registered trademark of RBAC, Inc.

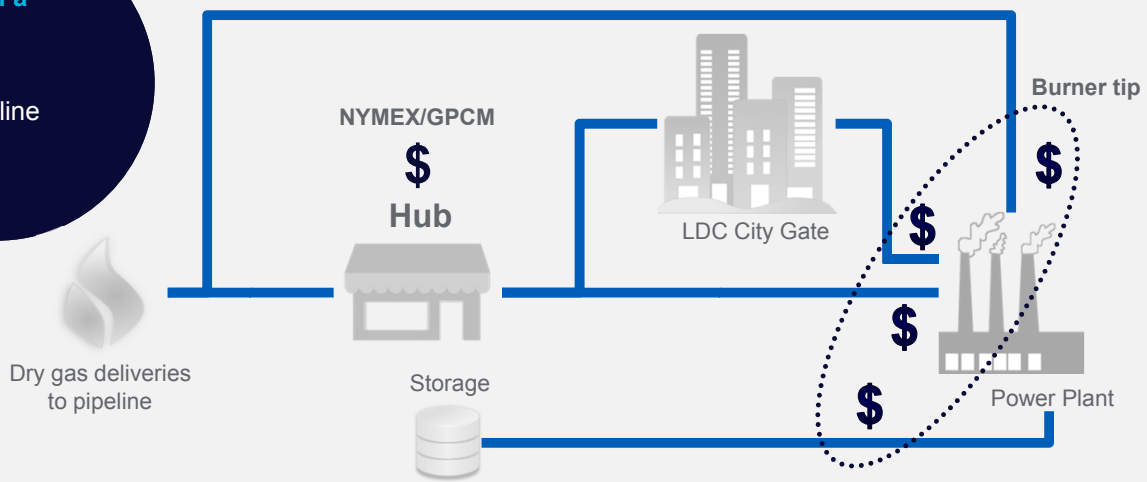
Differentiators

TOPIC	OTHERS	GE FUELS TEAM
Production simulation tool	Simplified transmission models, limited flexibility and all-around detail	Detailed transmission model, full flexibility on every parameter, extensive detail
Datasets	Generic assumptions regarding generation/transmission/pipeline expansion, etc.	Project-by-project status research
Regions modeled	Eastern interconnection, Western interconnection, ERCOT	Eastern interconnection, Western interconnection, ERCOT, and Mexico
Gas demand modeling	Generic, uniform elasticities define price/demand relationship	Custom elasticities from production simulation results
Burner tip prices	Burner tip price = Hub price	Burner tip = Hub price + Custom tip adders
Generation mapping	State or sub-state mapping of power demand	Generation mapped to pipeline/zone/state
Team and resources	Consultants with power and natural gas backgrounds	Consultants with power and natural gas backgrounds, technology experts, high performance computing

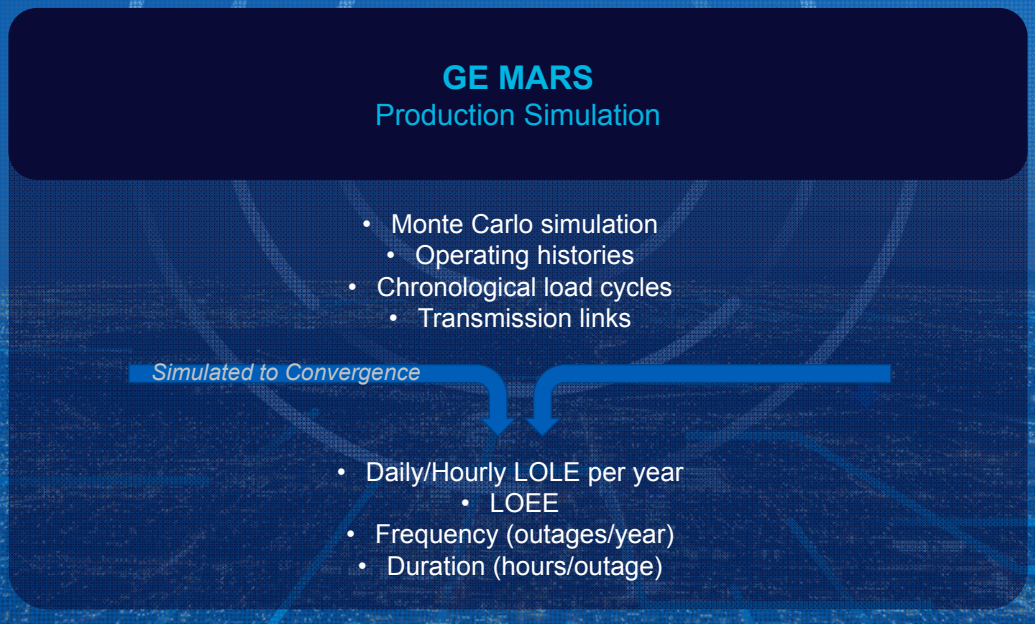
Tip Adders

Generator can have gas supply contract(s) from a variety of sources

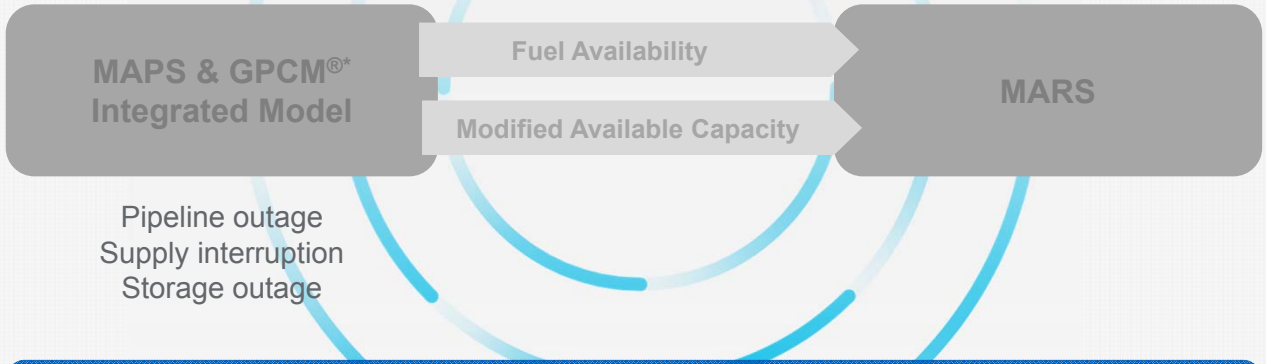
- LDC
- Inter or Intrastate pipeline (firm or interruptible)
- Storage Operator
- Supplier



GE's Multi Area Reliability Simulation



Assumptions



BENEFITS

Make a change in one system—understand the effects in both gas and power markets

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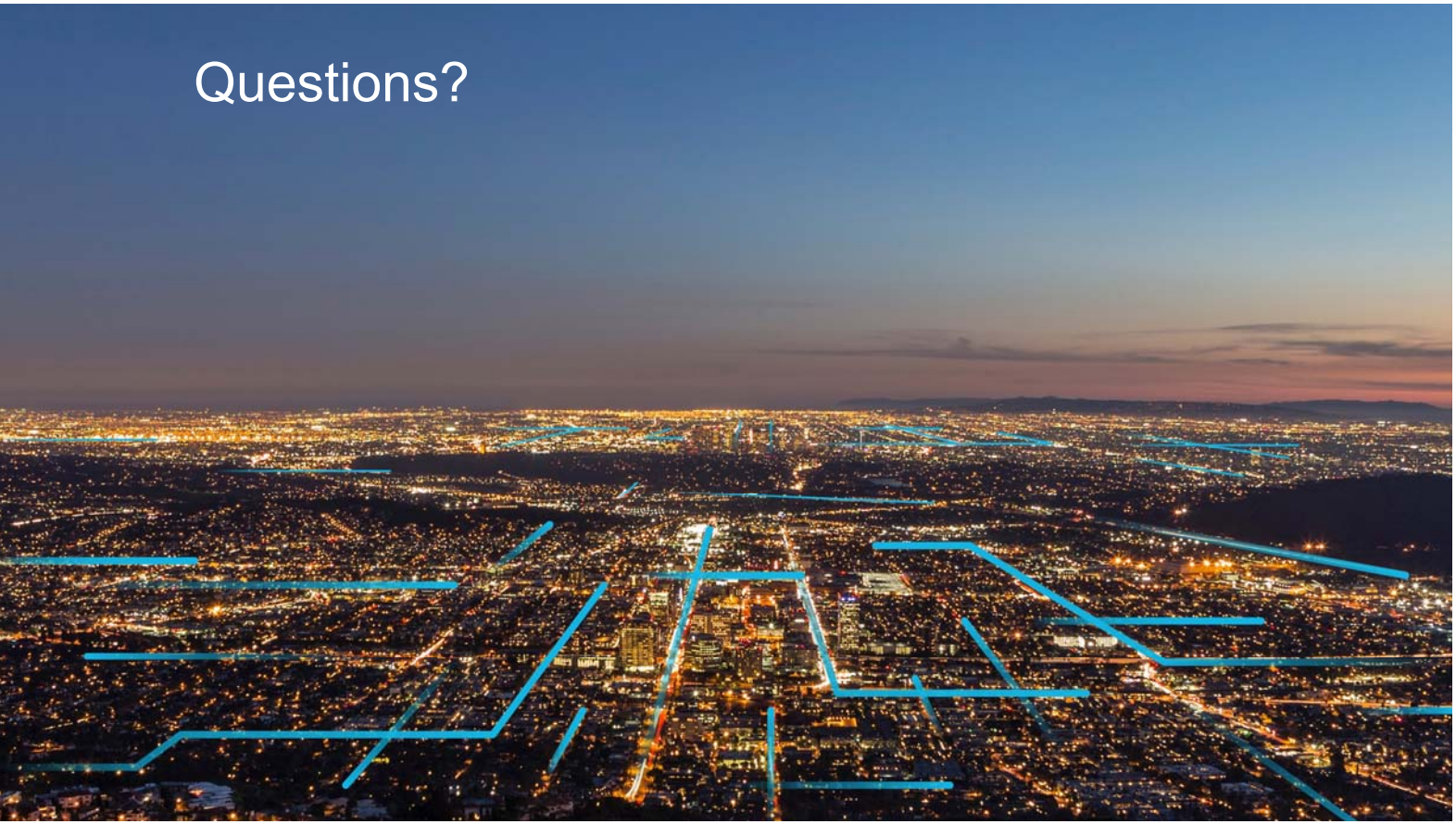

Questions?

Market Developments

Energy Consulting tracks market developments and it's impact on delivered gas

- Increased exports to Mexico
- LNG exports started February 2016. US entering global market as supplier.
- Pipeline reversals on REX & Transco
- TransCanada Pipeline lowers tariff to compete -$0.60
- PG&E rate adjustment for pipeline integrity +$1.10

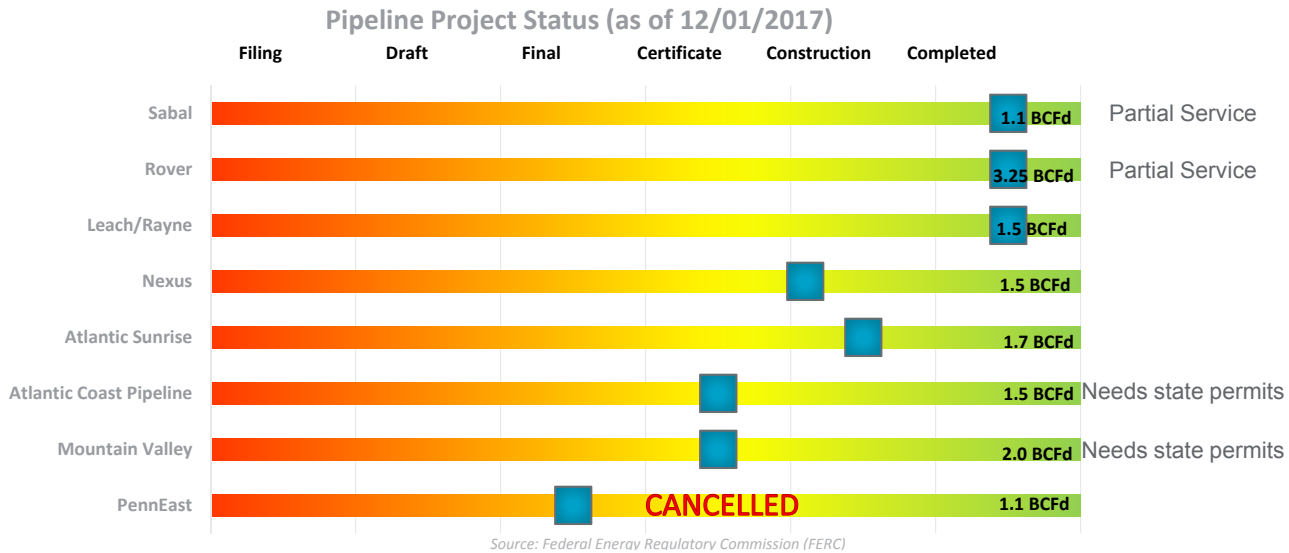
Natural Gas Market Uncertainty Increasing

Assumption on these key factors can greatly influence forecast of natural gas prices

- Future LNG Exports
- Mexico demand for natural gas
- Pipeline project completion
- FERC Quorum restored
- NY State blocking all pipeline construction
- Sierra Club v. FERC

Pipeline Construction Uncertainty

Lack of FERC quorum creates delays giving states opportunity to put projects at risk.



Source: Federal Energy Regulatory Commission (FERC)

Demand Curve Elasticities

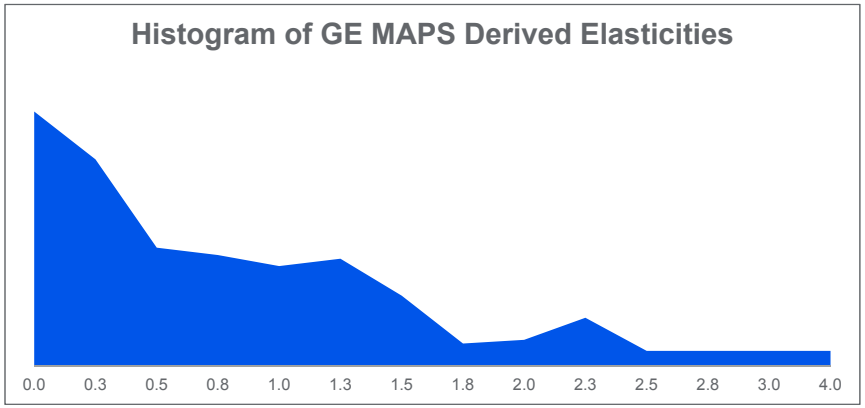
Elasticities Default GPCM

- Homogeneous elasticity assumed for all electric gas consumers

GE MAPS Derived Elasticities

- Derived from MAPS modeling
- Localized fuel substitution & generation competition

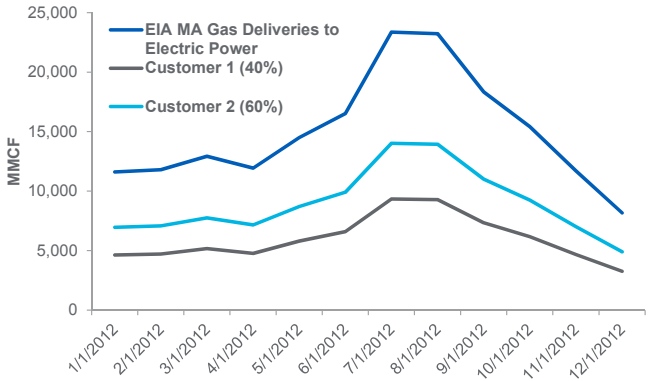
Elasticity
The response of gas fired generation to gas price changes. For example a -0.5 elasticity would mean for a 100% increase in price there is a 50% decrease in generation .



Demand Curve Quantity

Quantity Default GPCM

- State electric demand for gas broken down to customer by market share



GE MAPS Elasticities

- Quantity from MAPS modeling
- Localized generation profile