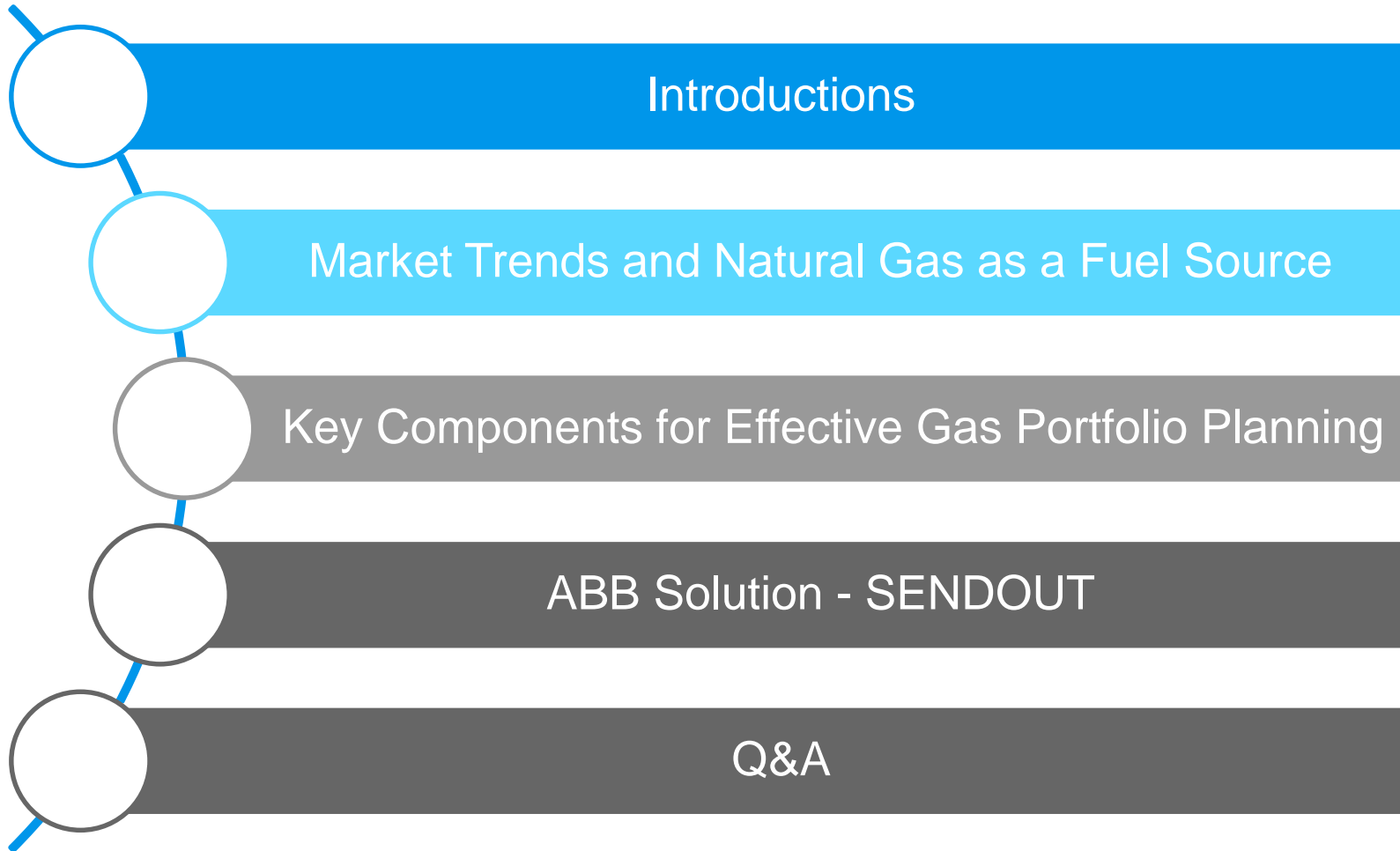


Rukiye Altun and Jeff Baker, June 15, 2016

# Gas Portfolio Planning: Anticipating market trends and realizing financial and operational benefits

## ABB Energy Portfolio Management

# Gas Portfolio Planning Agenda





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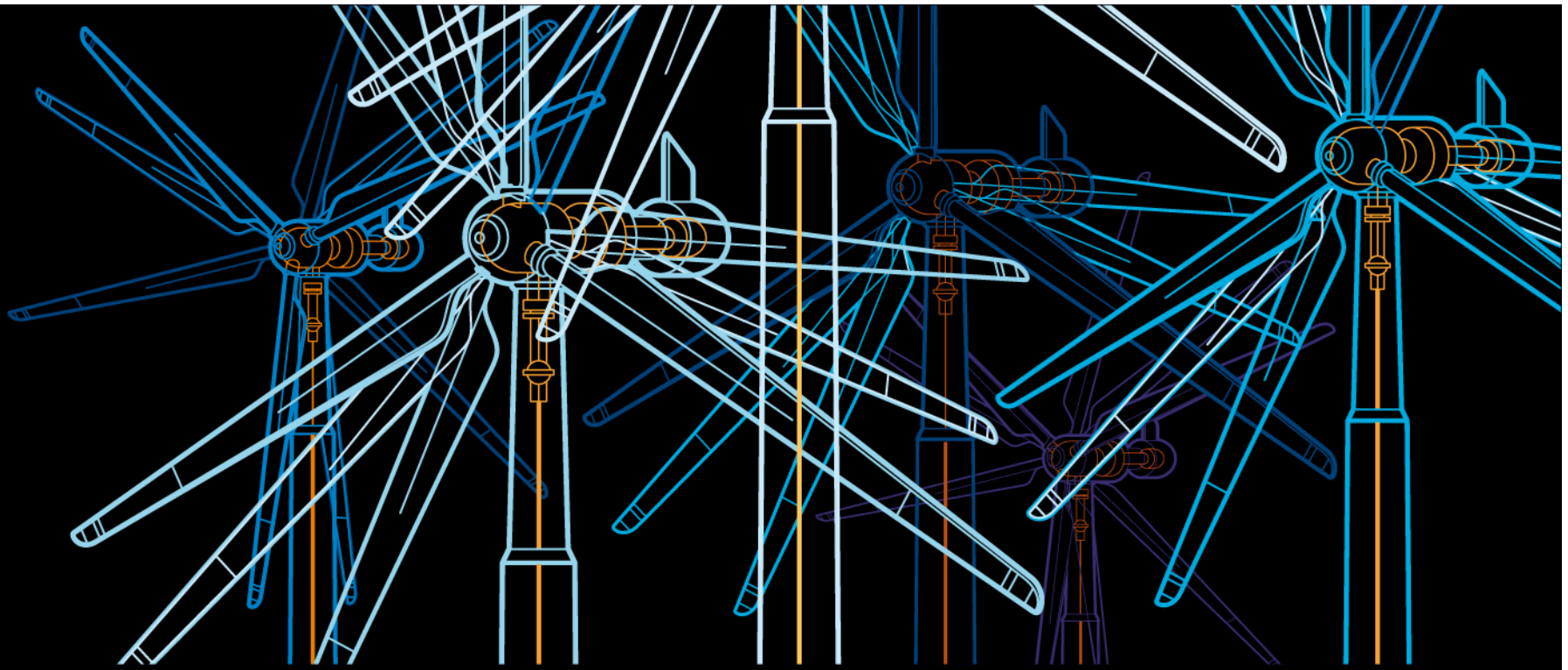
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Gas Portfolio Planning: Anticipating market trends and realizing financial and operational benefits

# Market Trends and Natural Gas as a Fuel Source



# THE DAILY NEWS

POLITICAL CAPITAL

As New York Gov. Cuomo's Energy Policy Went Greener, Natural Gas Industry Spent More On Lobbying

BY NED RESNAI

## Natural Gas to Overtake Coal in 2016

2016 | Energy | FOXBusiness

## FERC: Low gas prices continue to push down power prices

By Robert Walton | March 21, 2016



UPI TOP NEWS ENTERTAINMENT

HOME / BUSINESS NEWS / ENERGY INDUSTRY

## U.S. shale gas output increasing

Industry survey finds Utica shale a standout in the United States.

By Daniel J. Graeber | March 23, 2016 at 7:35 AM

Follow @crudeoilprices

## 3 Reasons Why the Natural Gas Industry Is Attractive

USNews MONEY

The decline in oil prices still dominates headlines, while natural gas continues to fly

## Southern Company to Acquire AGL Resources in \$12 Billion

08/24/2015

## Low gas prices continue to dent coal plant economics

By Robert Walton | April 14, 2016



BloombergBusiness

## TVA CEO: Gas to remain cheap through 2030

By Robert Walton | June 3, 2016



## U.S. Gas Extends Winning Streak on Power Plant Demand Forecast

by Christine Buurma

## Southern Kentucky Energy Completes Acquisition Of Natural Gas Operations

THE WALL STREET JOURNAL

April 25, 2016

Home World U.S. Politics Economy Business Tech Markets

## U.S. Coal Sector Faces Reckoning

BUSINESS



Global Shale Gas Market Poised to Surge from USD 63.0 Billion in 2014 to USD 105.0 Billion by 2020 – MarketResearchStore.Com

THE WALL STREET JOURNAL

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## New Market for U.S. Shale Gas Opens in Europe

Swiss company Ineos to accept the first American shipment of a type of shale gas to Europe

MARCH 16, 2016

## Natural gas expected to surpass coal in mix of fuel used for U.S. power generation in 2016

© ABB  
June 20, 2016

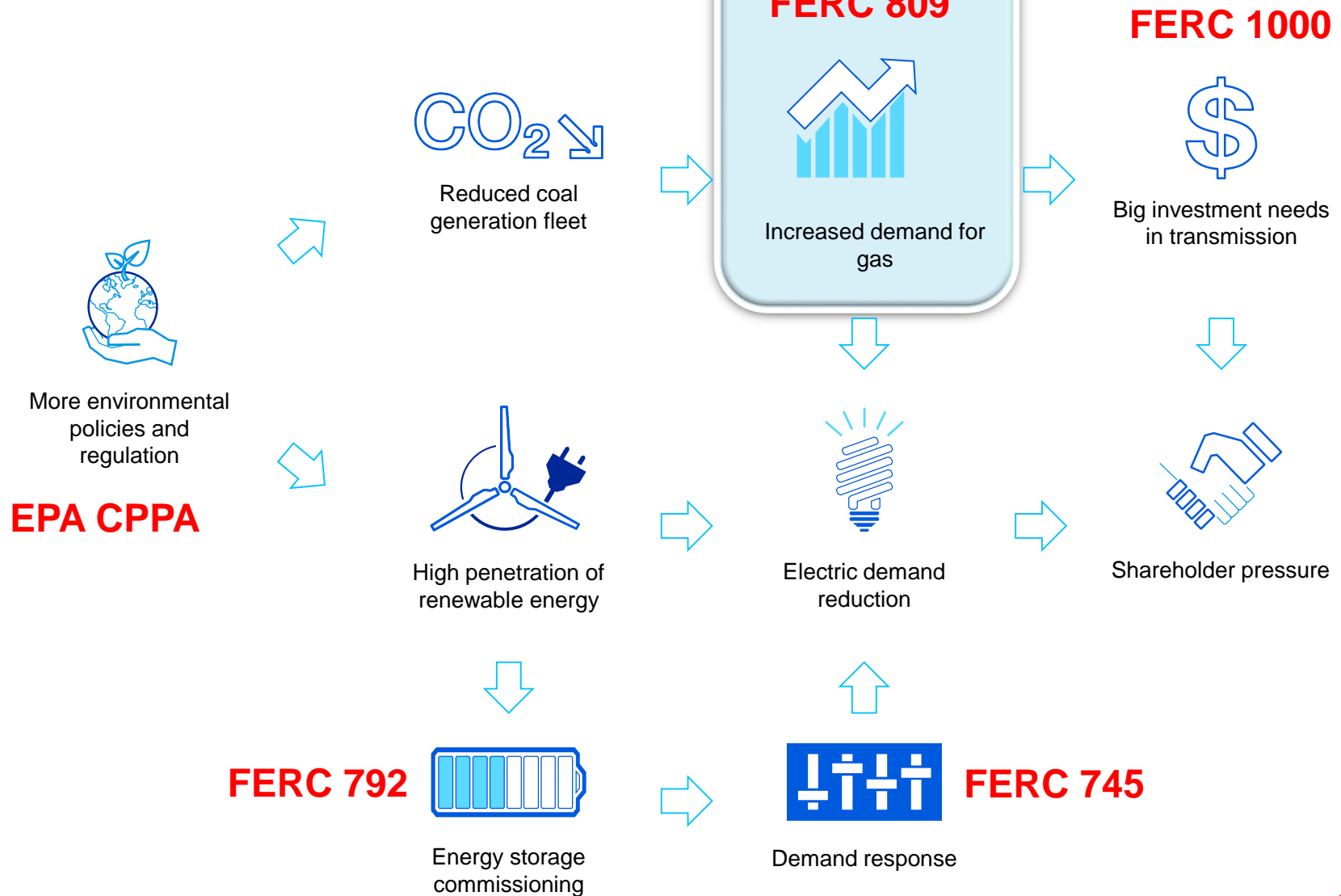
## Duke Energy to acquire Piedmont Natural Gas for \$4.9 billion in cash

Oct. 26, 2015



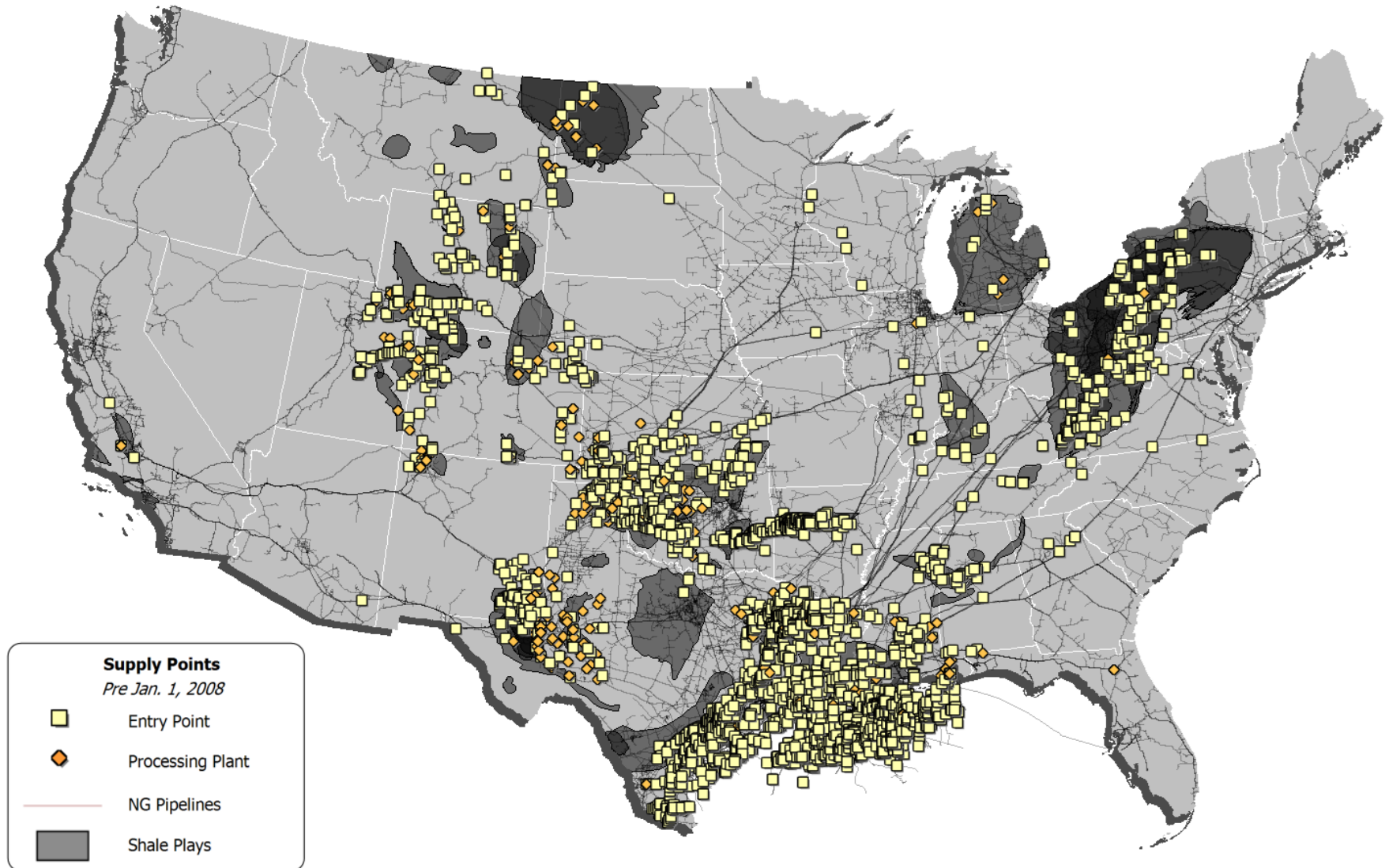
# Gas Portfolio Planning

## Key Market Drivers



# Gas Portfolio Planning

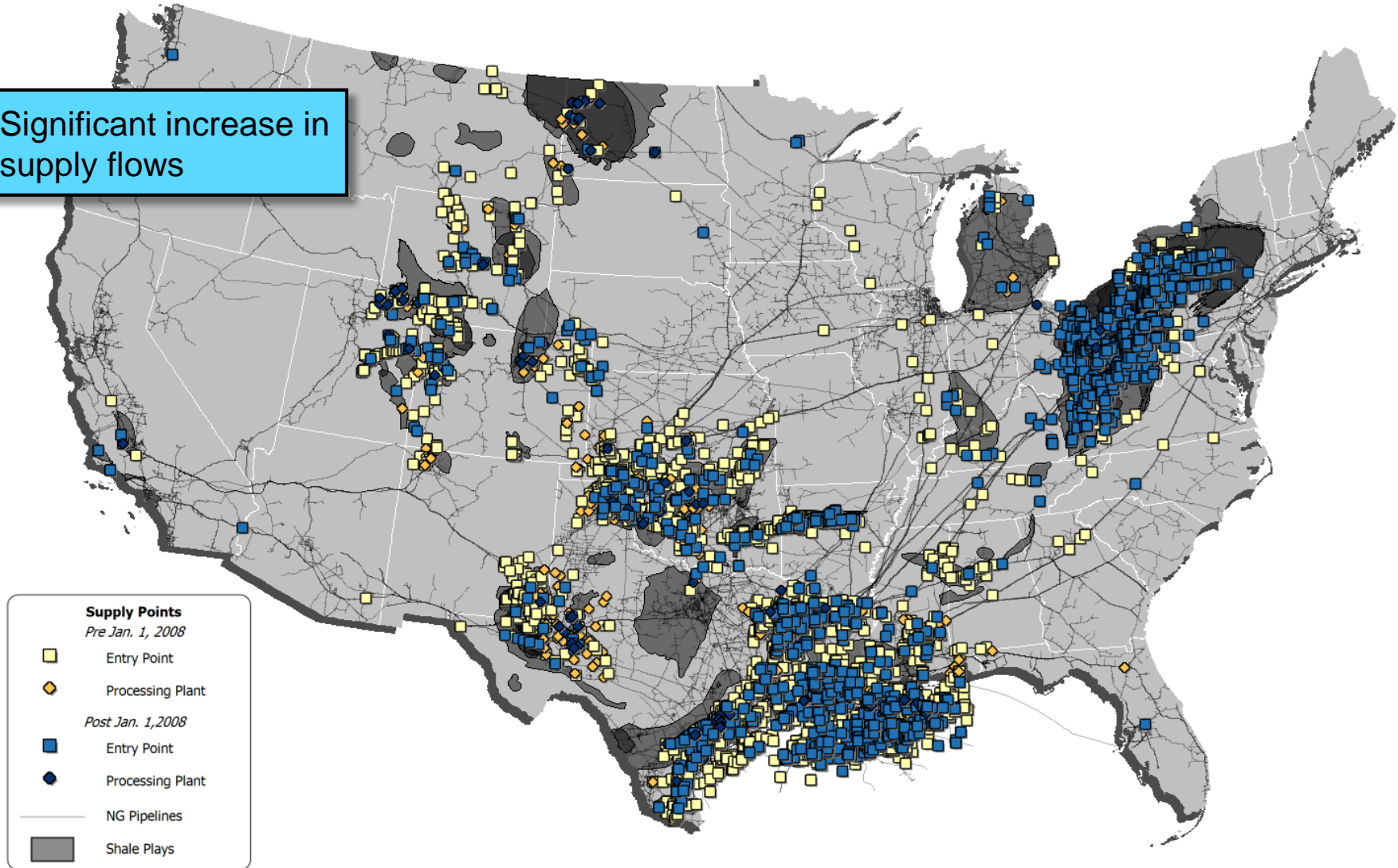
## NG Supply Points Pre-2008



# Gas Portfolio Planning

## NG Supply Points Post-2008

Significant increase in supply flows

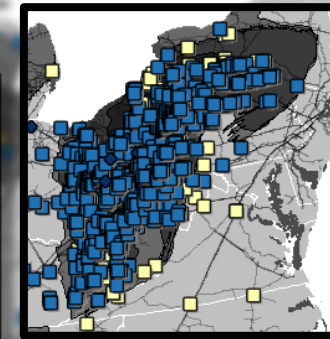
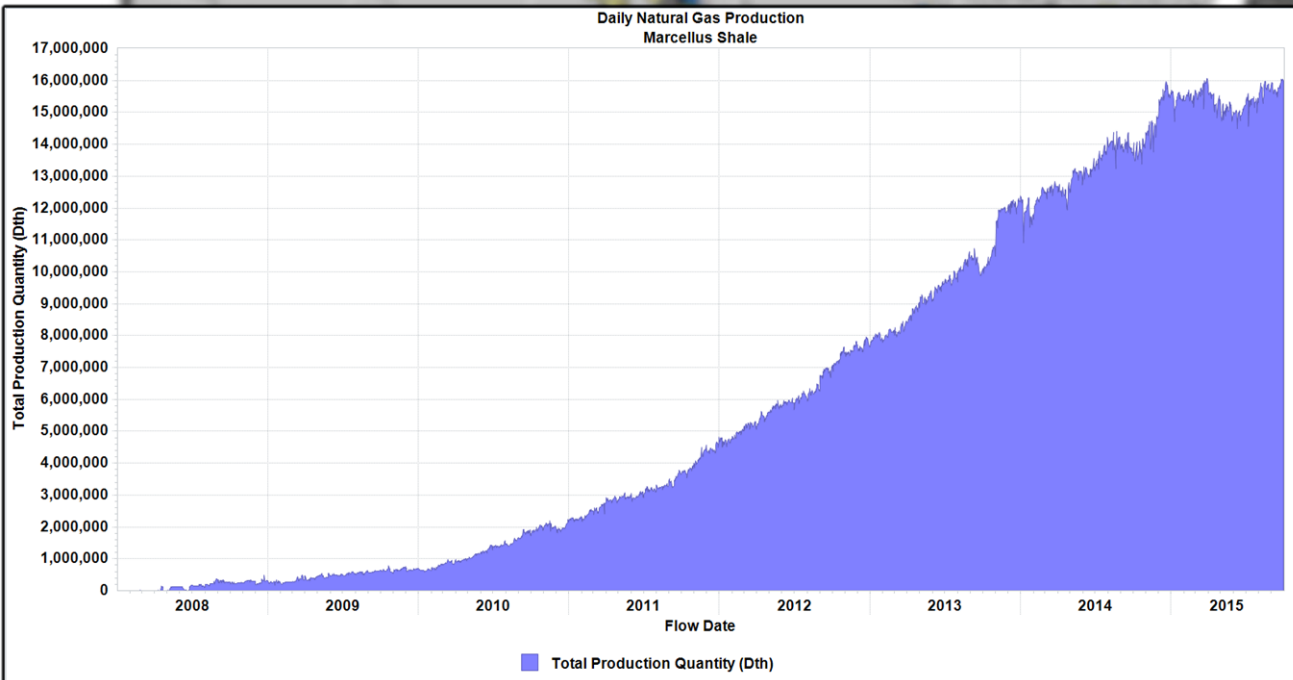




# Gas Portfolio Planning

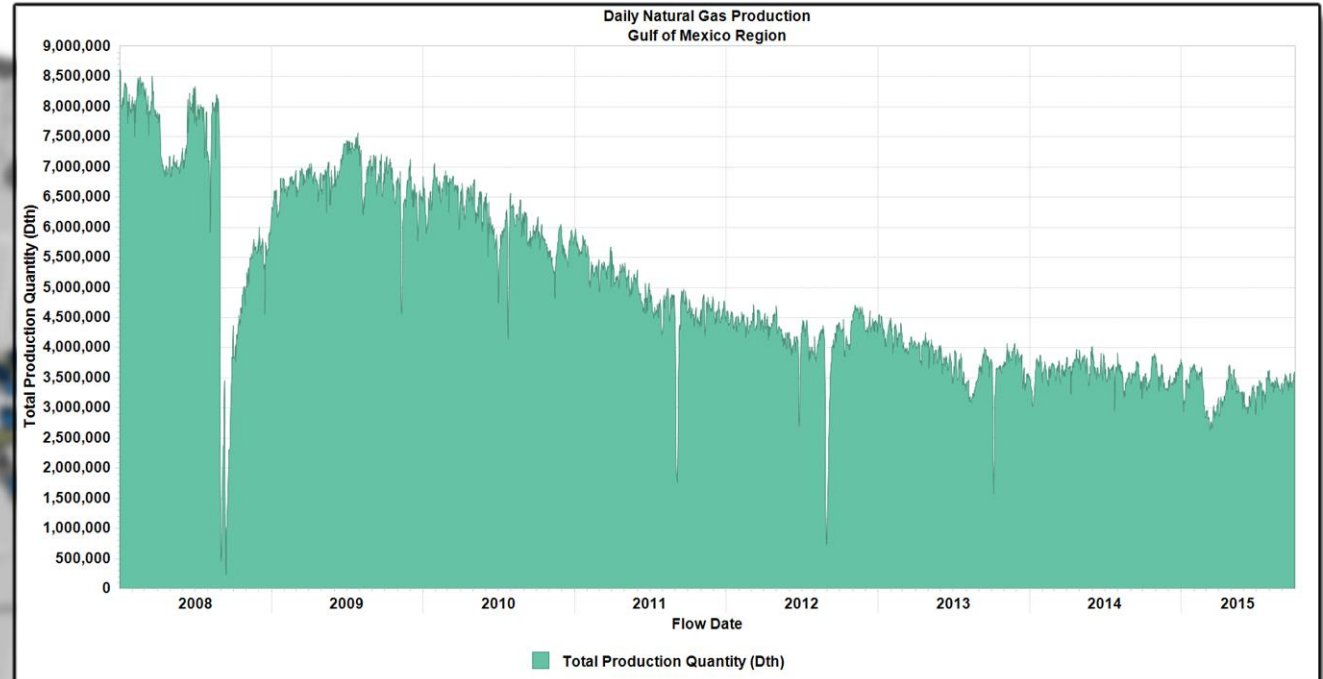
## NG Supply Points Post-2008

Booming Marcellus production

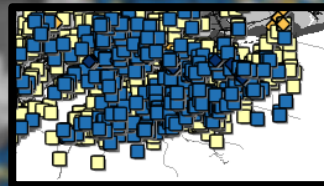


# Gas Portfolio Planning

## NG Supply Points Post-2008

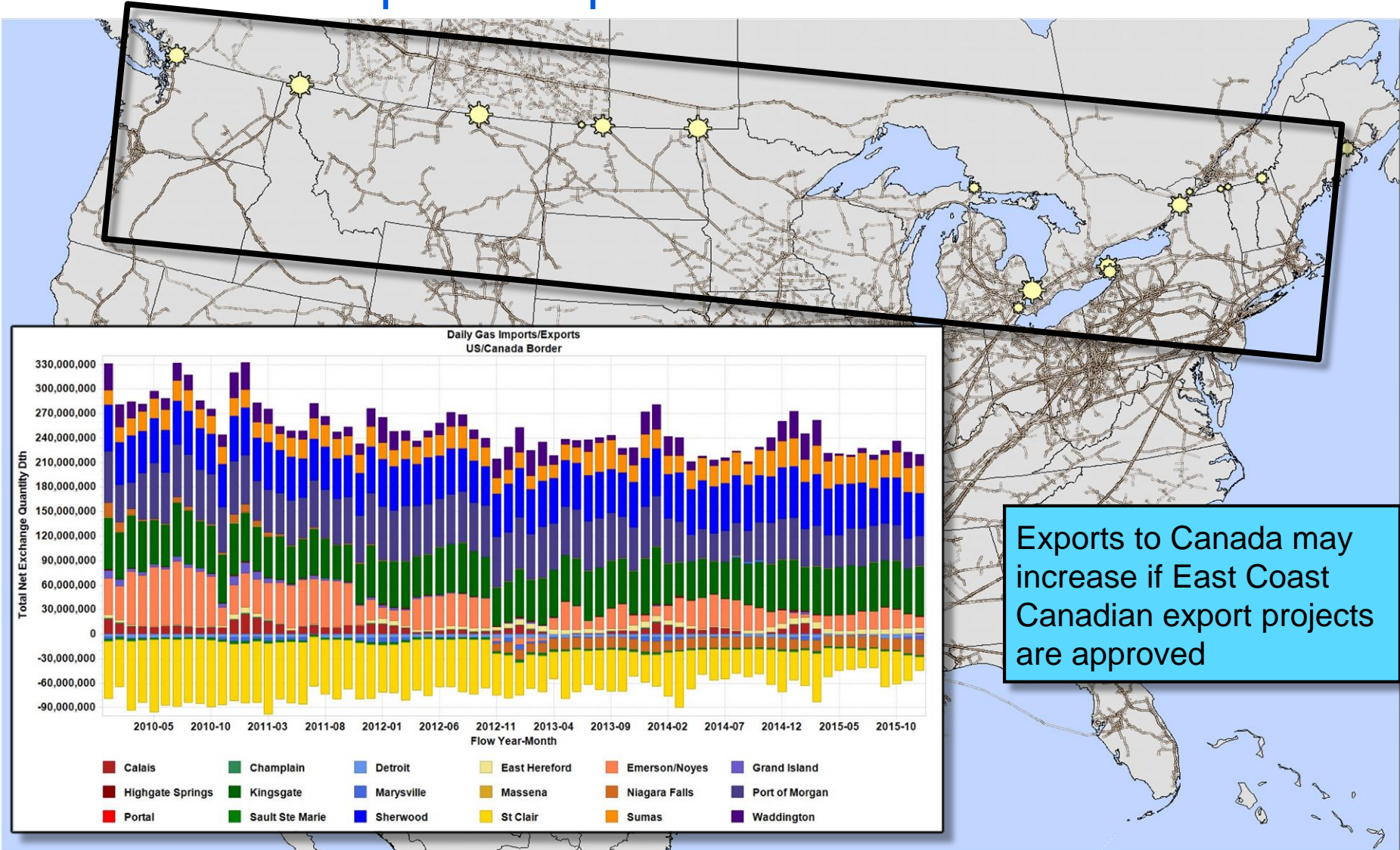


Declining gas production volumes off-shore



# Gas Portfolio Planning

## US/Canada Imports/Exports

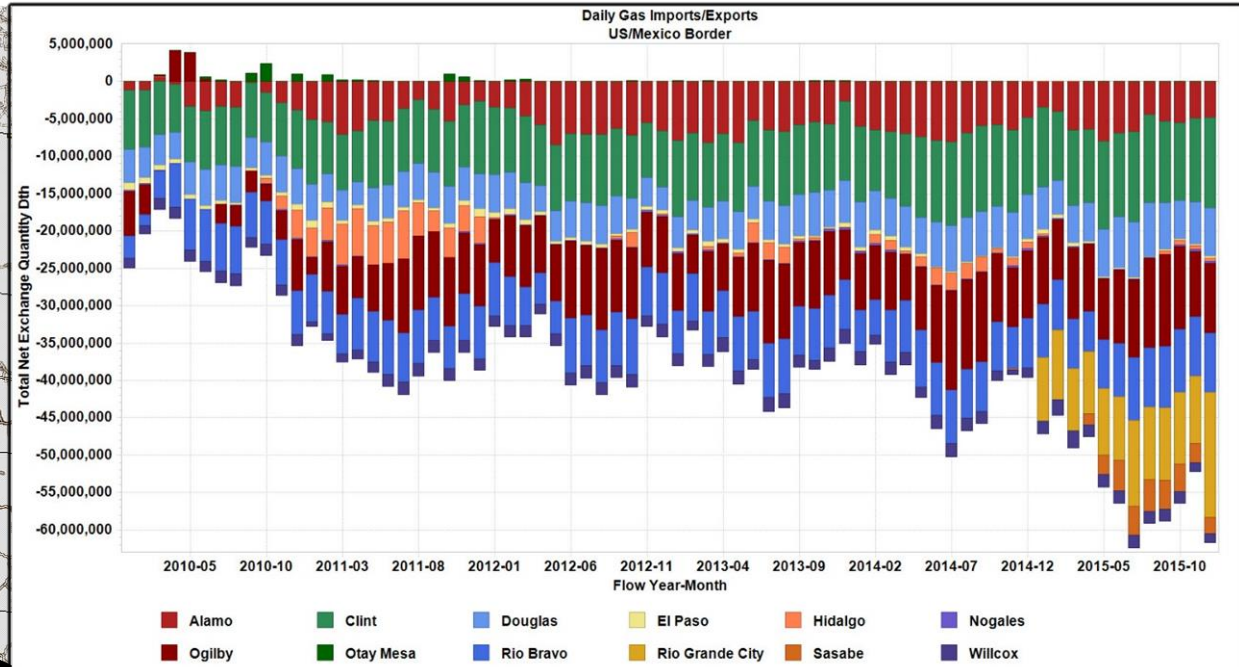




# Gas Portfolio Planning

## US/Mexico Exports

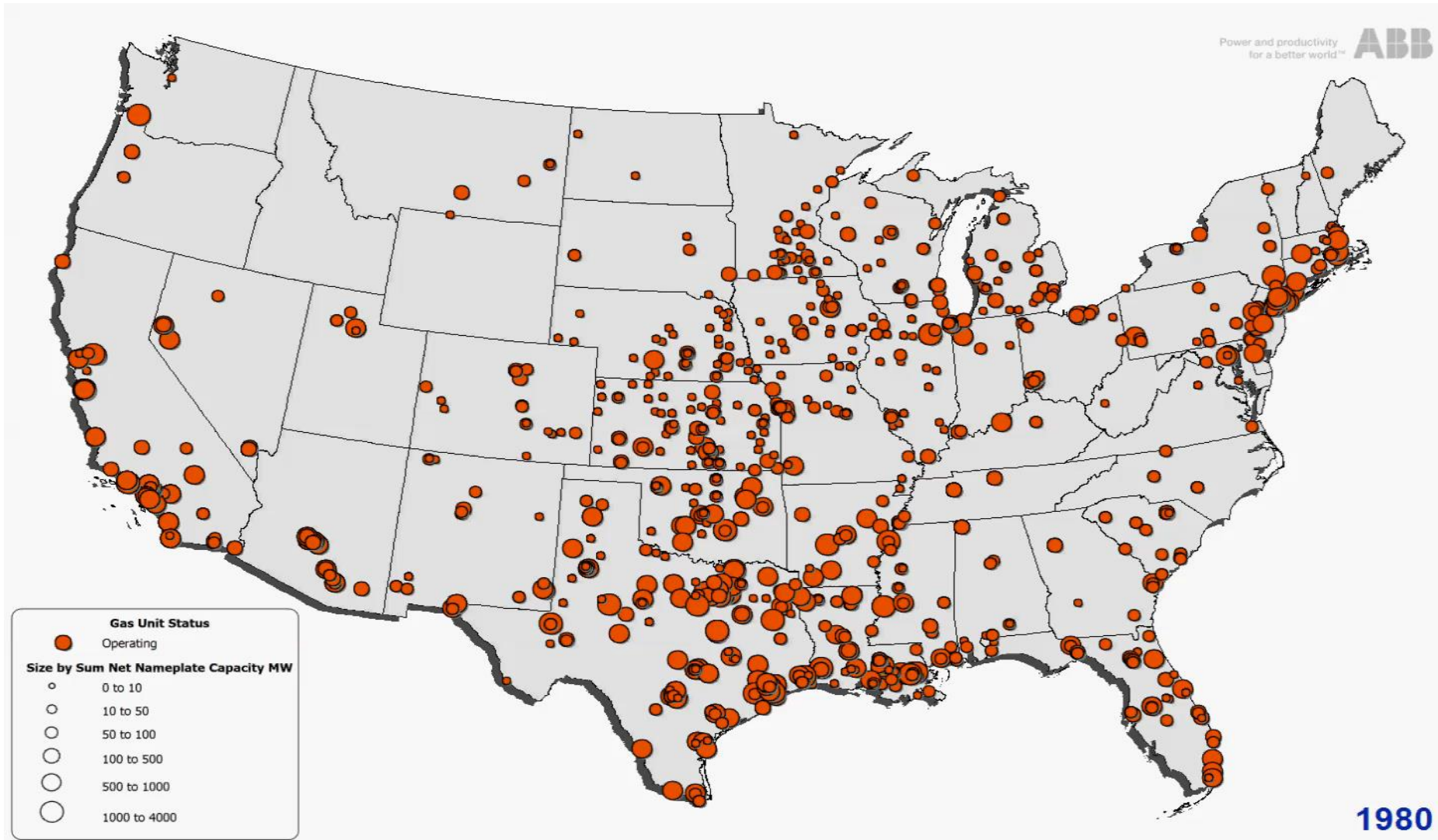
Large infrastructure projects proposed to carry gas into Mexico





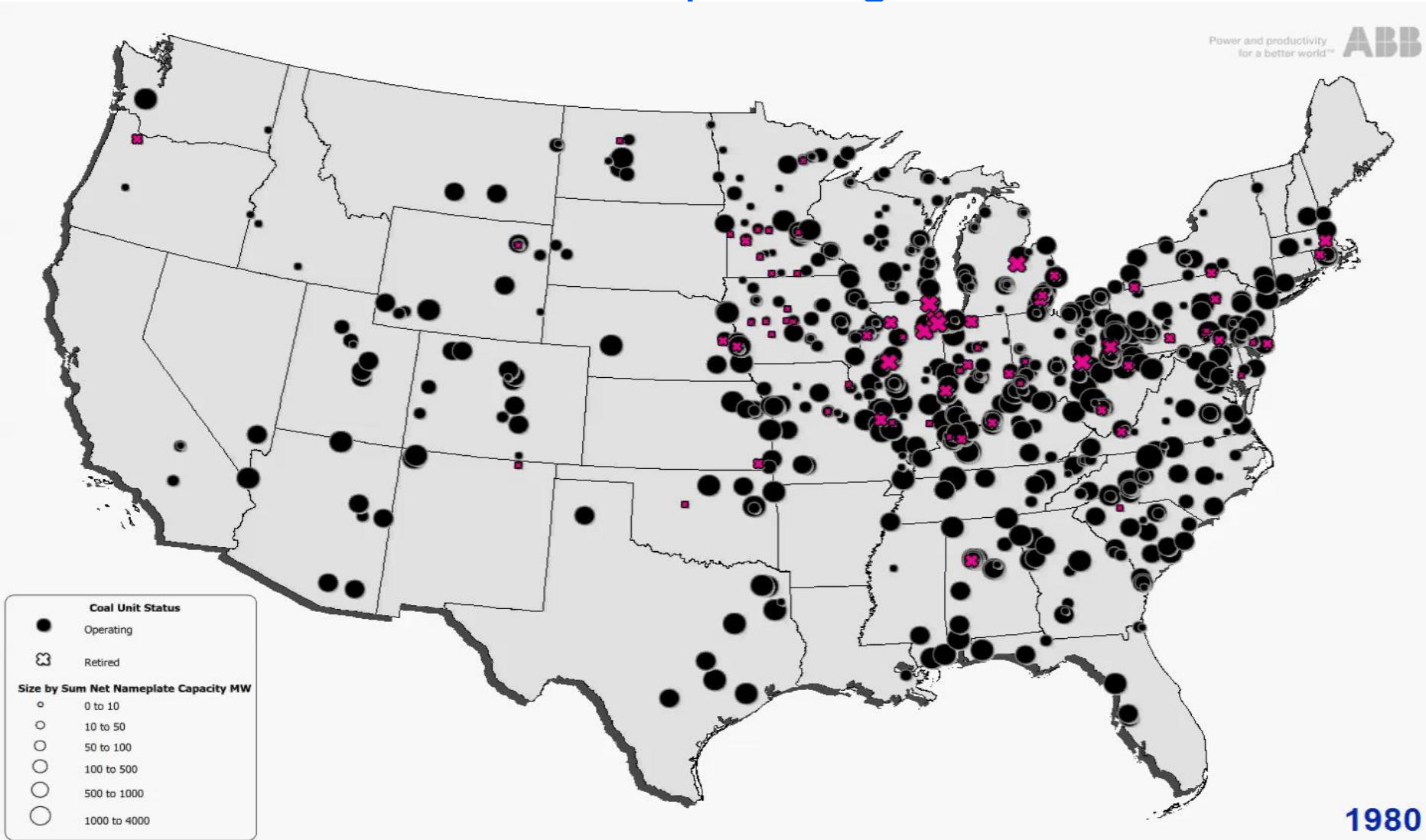
# Gas Portfolio Planning

## NG Units Since 1980 - Operating



# Gas Portfolio Planning

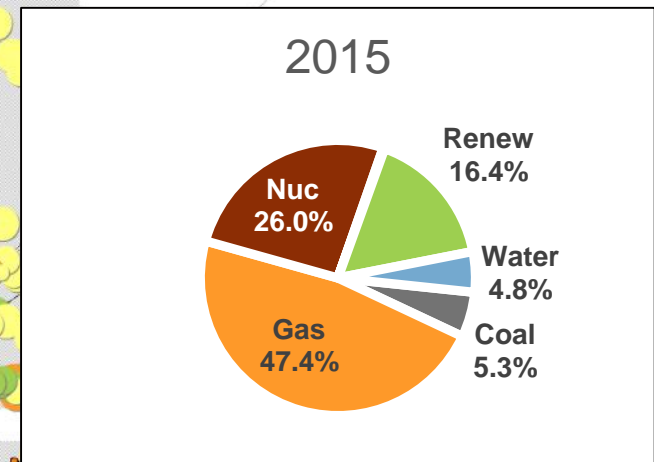
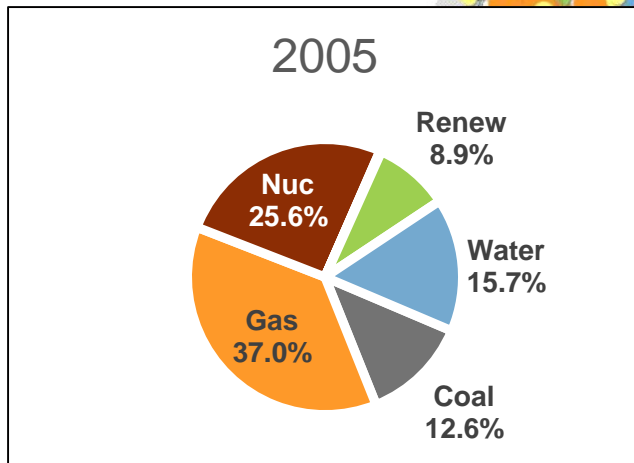
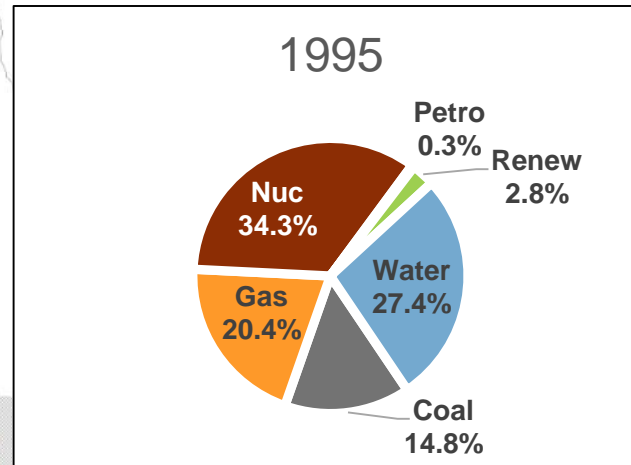
## Coal Units Since 1980 – Operating & Retired



# Gas Portfolio Planning

## CAISO Fuel Mix 1995-2015

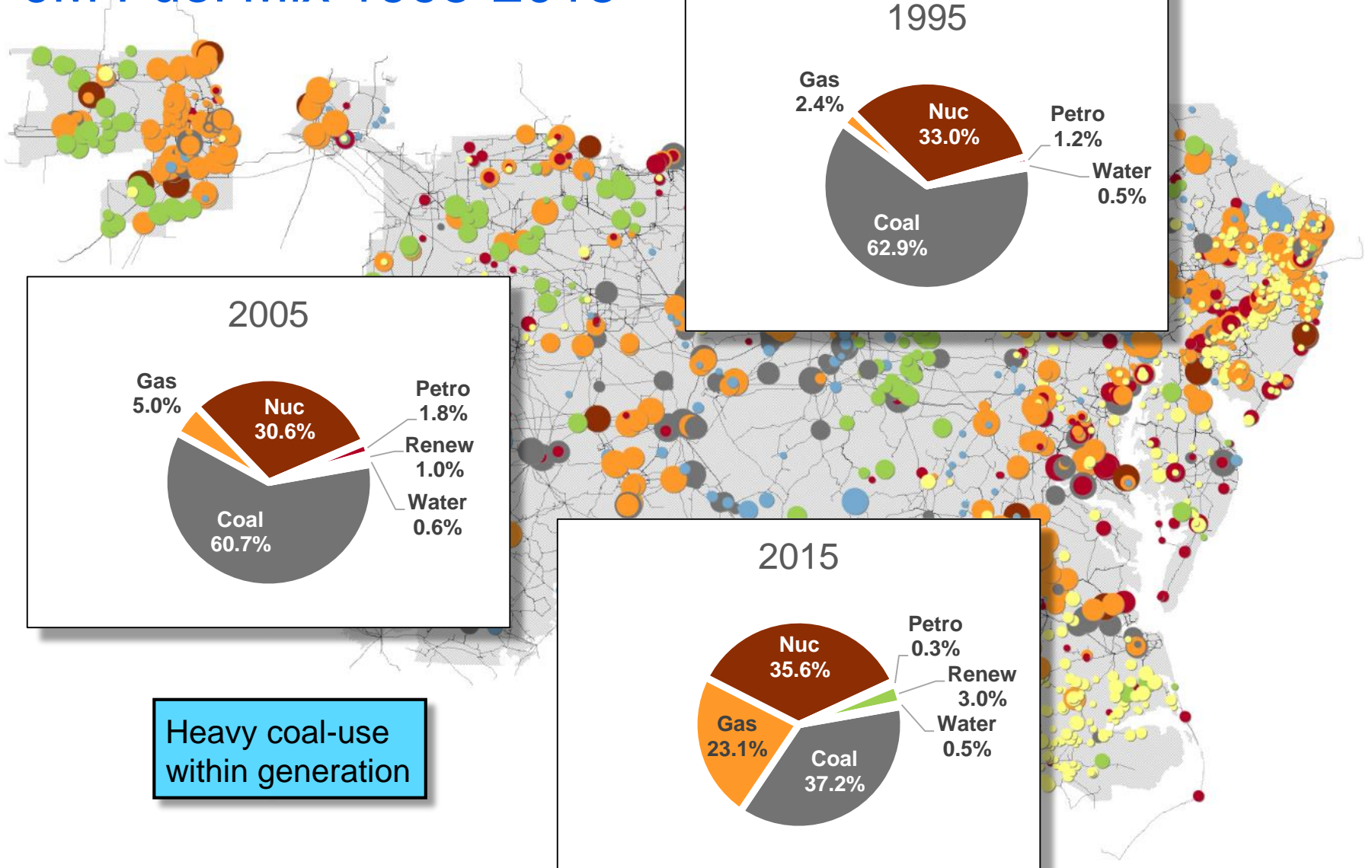
Less hydropower available but increased focus on renewable generation





# Gas Portfolio Planning

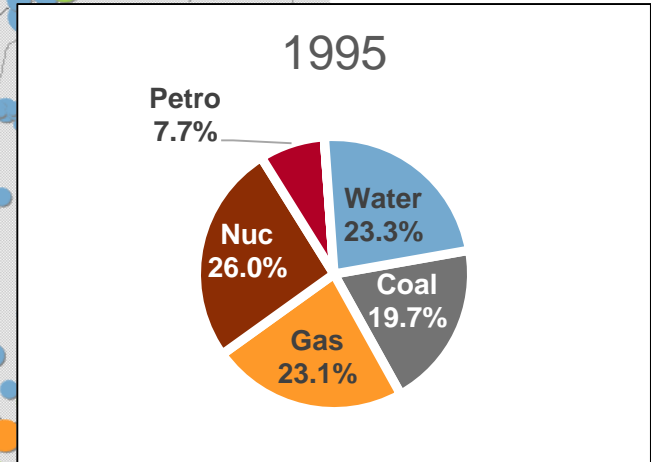
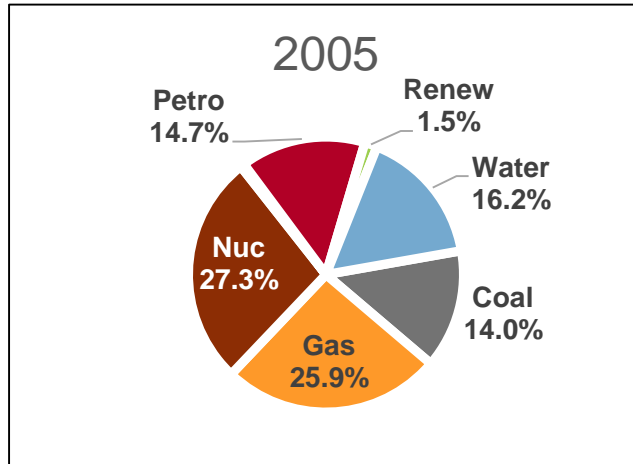
## PJM Fuel Mix 1995-2015



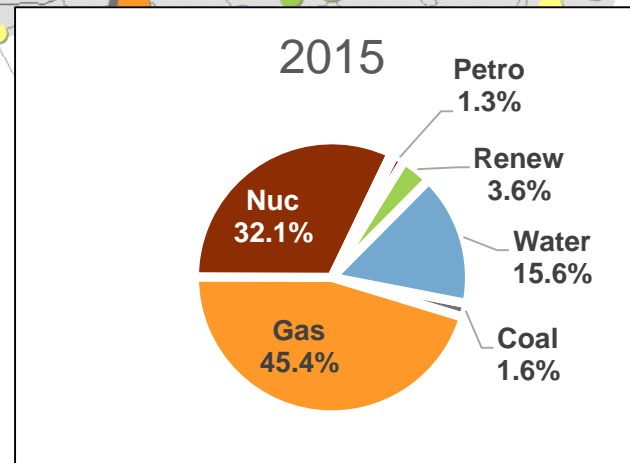


# Gas Portfolio Planning

## NYISO Fuel Mix 1995-2015



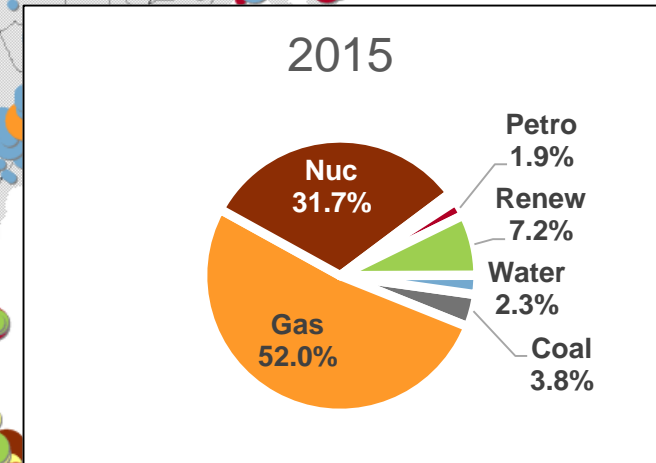
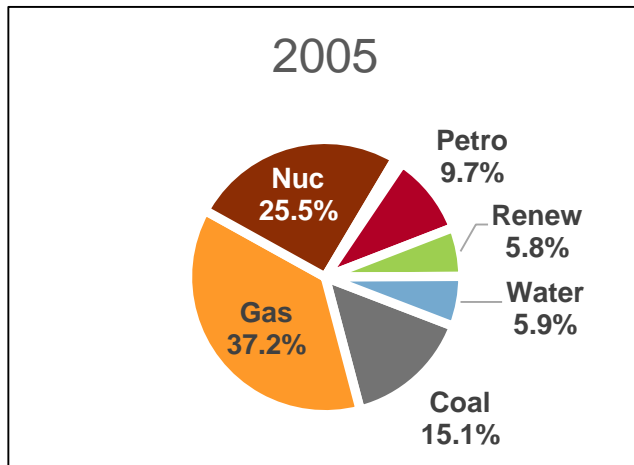
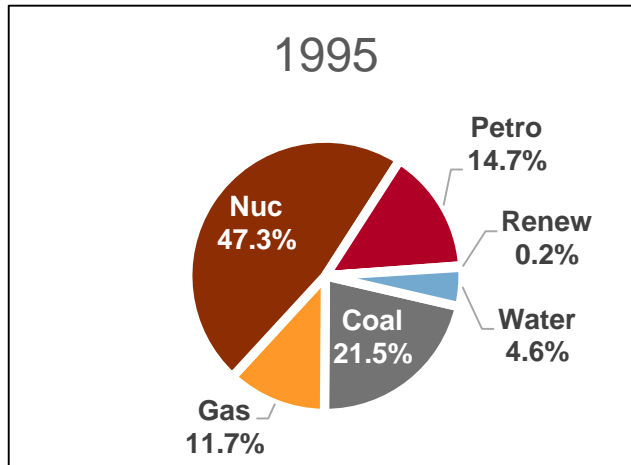
Oil and coal being superseded by NG

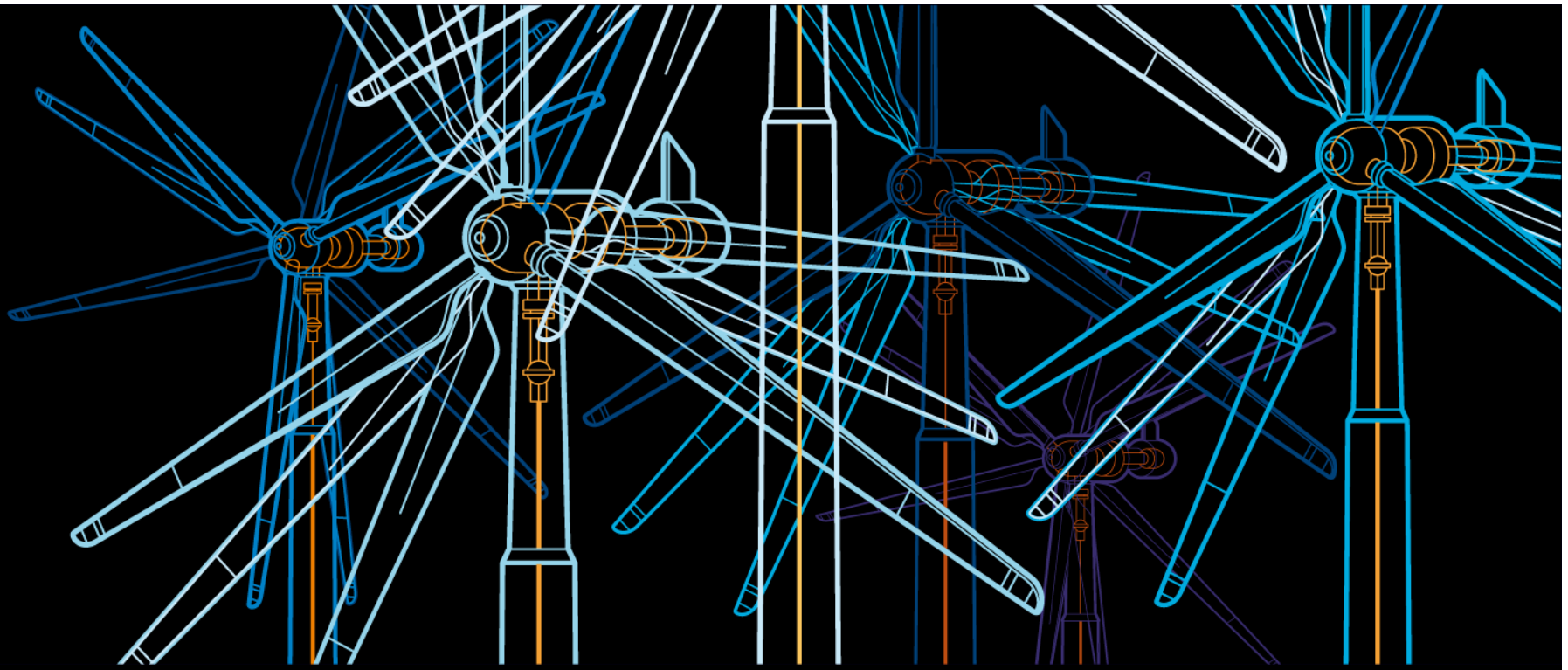


# Gas Portfolio Planning

## ISO-NE Fuel Mix 1995-2015

Less reliant on  
nuke and oil with  
more diversity in  
renewables





Gas Portfolio Planning: Anticipating market trends and realizing financial and operational benefits

# Key Components for Effective Gas Portfolio Planning

# Gas Portfolio Planning

## Key Components for Effective Gas Portfolio Planning

Integrated resource planning for gas and electric system coordination

Consistent data and modeling assumptions for planning and operational decisions

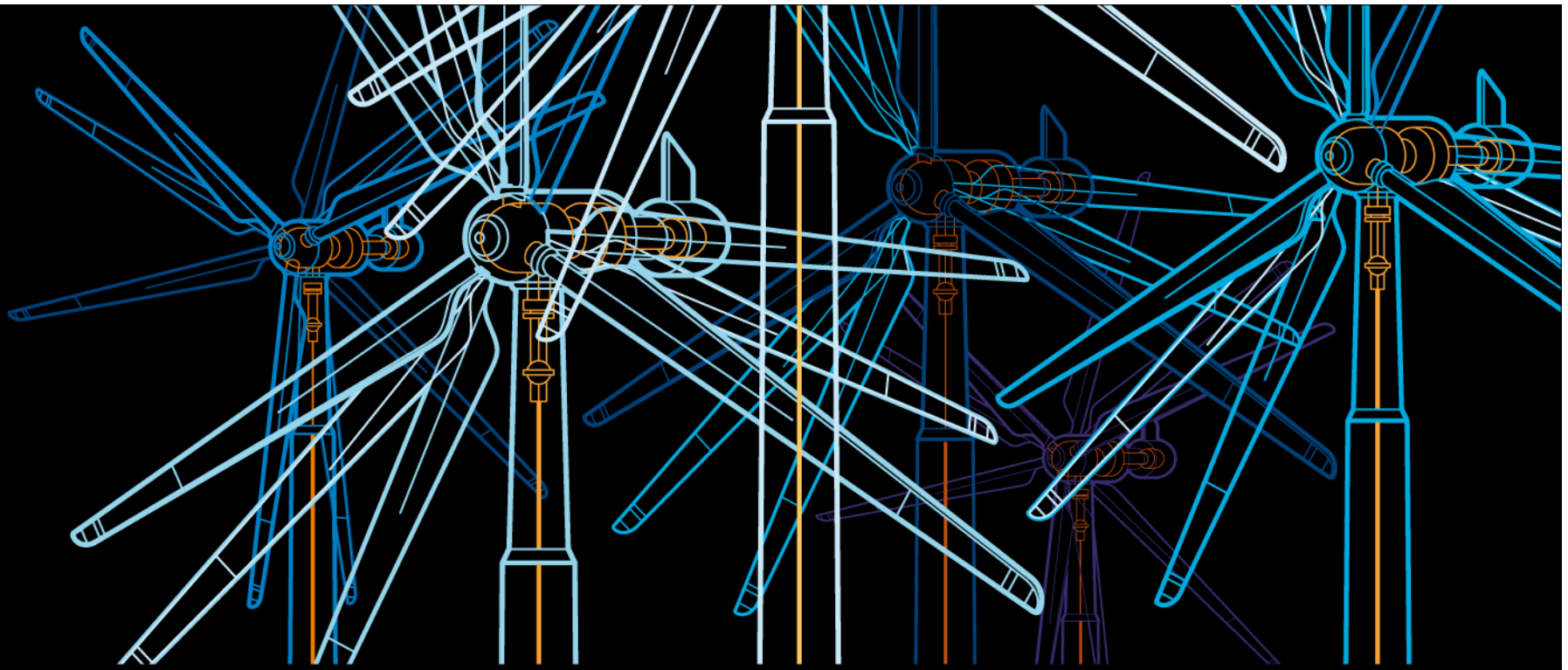
Comprehensive gas network modelling

What-if Scenario Analysis to handle different business cases

Deterministic/Stochastic Analysis for evaluation of volatility and risk mitigation

Flexible study horizons & Reporting





Gas Portfolio Planning: Anticipating market trends and realizing financial and operational benefits

# ABB Solution - SENDOUT

# Gas Portfolio Planning

## SENDOUT - High level description

*Industry standard natural gas portfolio planning software for 30 years*



# Gas Portfolio Planning SENDOUT Advantages

## Industry Standard Strategic Planning Software for Gas Portfolios

- Proven & established methodology – Linear Program & Mixed Integer Program
- Used on behalf of approx. 65 gas utilities/energy companies
- Widespread regulatory acceptance

## Fully Developed Software Solution

- Over 30 years of history
- Designed specifically for gas portfolio planning
- Low implementation cost & cost of ownership

## Intuitive Interface and Modeling Detail

- Hundreds of parameters
- Inputs & outputs may be easily integrated with Excel
- Easy to expand the model configuration

## Powerful / Flexible Reporting Tools

- 100+ system reports
- Custom report writer
- Output to Excel & Access

# Gas Portfolio Planning

## SENDOUT - Key features and differentiators

### Two modules/engines

- Physical Portfolio Dispatch / Cost Optimization
- Asset Valuation – PCA & Rolling Intrinsic Simulation

### Comprehensive portfolio modelling

- Advanced supply, storage, demand area & class, transportation segments
- Futures markets for asset evaluation

### Improved Trading decision

- Higher profitability, better managed trading risk/margin

### What-if scenario analysis

- Improved operational and planning decisions for unexpected events

### Advanced reporting/visualization

- Grid, graph and pivot displays



# Gas Portfolio Planning

## SENDOUT – Deterministic vs Stochastic

### Deterministic Analysis

#### Scenario Analysis

- Provides optimal solution for a specific (deterministic) set of assumptions in a scenario
- Scenario analysis - warm, cold, normal, high cost, low cost, etc.
- Detailed portfolio modeling - physical flow and economic parameters
- Maximizes margin

#### Standard Optimization

- Optimizes existing portfolio of resources - Fixed costs are considered sunk

#### Resource Mix Optimization

- Evaluates and sizes potential resources
- Optimally sizes supply, transport, & storage facilities to meet projected demand
- Considers both fixed and variable costs for incremental resources

#### Uncertainty/volatility analysis

- Can run thousands of draws
- Simulate Price, Weather or most other items
- Stress test your portfolio with weather analysis
- Run different price scenarios

#### Risk analysis

- Provides measures of portfolio risk and a distribution of results across a range of operating & economic conditions.
- Reveals areas of risk and opportunity and identifies system breaking points
- Weights results appropriately
- Probabilistic results provide more analytical information
- Mean, variance, probability of occurrence

#### Confidence

- Better information leads to better strategic planning decisions.

### Stochastic Analysis

# Gas Portfolio Planning

## SENDOUT - Value to Stakeholders

### Planning Staff/Internal

Balance system reliability & cost minimization

Improve analysis speed & quality

Justification for decisions

Consistent methodology over various planning needs

Maximize planning time / minimize model building

### Customers

Assure reliable gas supply

Reduce short term & long term gas costs

Minimize cost volatility

### Shareholders

Reduce gas costs, while assuring reliability

Maximize revenue opportunities

Understand impact of market volatility

Reduce portfolio risk

Optimize asset investment decisions

Reduce model maintenance and support costs

### Regulators

Improve communications with Regulators

Leverage analysis for improved negotiations

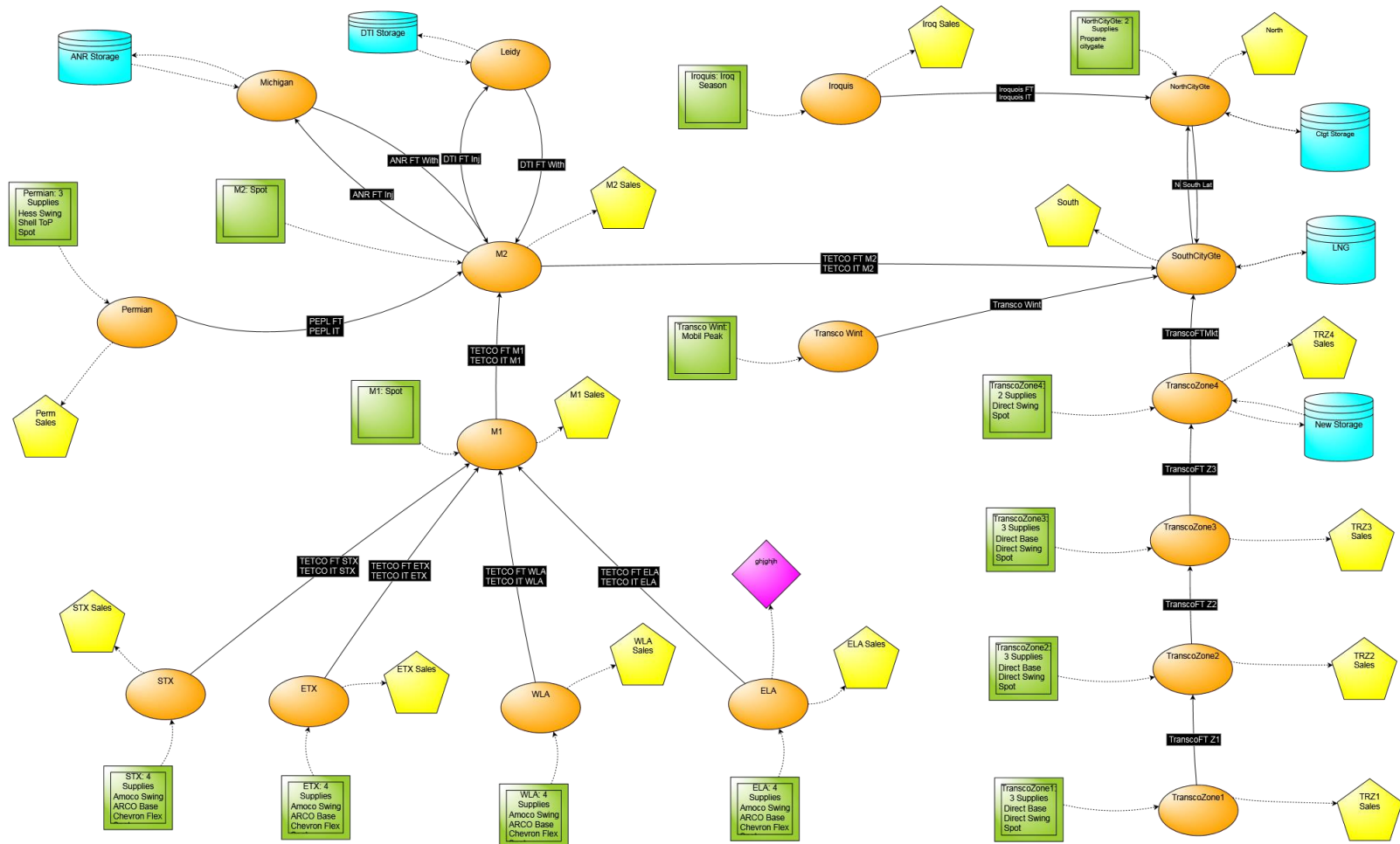
Support defensible / credible methodology

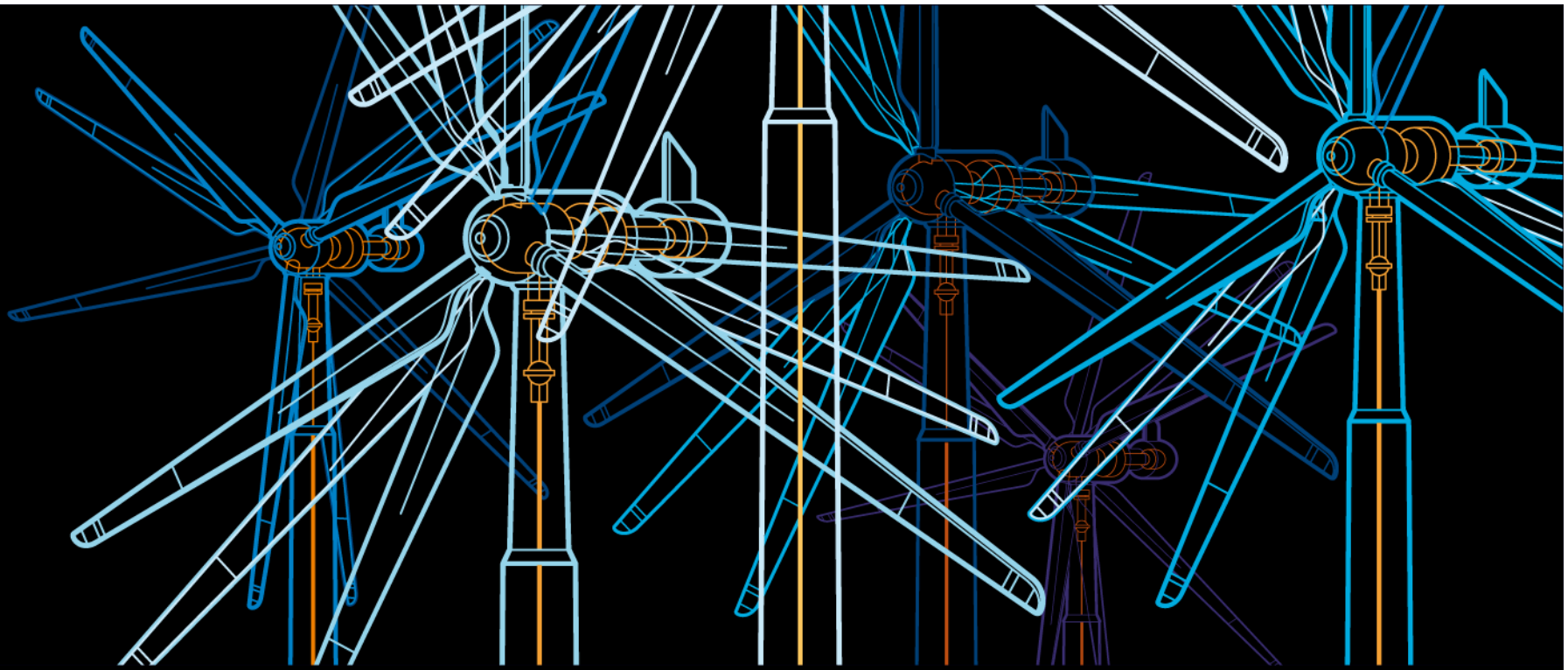
Justify resource decisions

Turn around data requests quickly

# SENDOUT

## Typical System Diagram





**Gas Portfolio Planning: Anticipating market trends and realizing financial and operational benefits**

**Q&A**



# Questions and Contact Information

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for a better world™

