A glimpse into the “Electricity Initiative” at the U.S. Energy Information Administration

For
GASP 2019
September 23, 2019 | Washington, DC

By
Greg Lawson, Operations Research Analyst
April Lee, Industry Economist
Overview

I. EIA’s Electricity Initiative

II. Electricity market basics
   a) RTOs (Regional Transmission Organizations)
   b) ISOs (Independent System Operators)
   c) LMPs (Locational Marginal Prices)

III. Project progress and hurdles

IV. Example of future analysis possibilities
EIA

• Federal Statistical Agency within the Department of Energy, independent and policy-neutral by charter (only one political appointee)

• World-class energy statistics, primarily from surveys, as well as projections forward under assumed policy scenarios

• Weekly Natural Gas Storage Report is a “Principal Economic Indicator”

https://www.eia.gov/
Electricity Initiative

- EIA’s administrator, Linda Capuano, has announced an “Electricity Initiative” as one of her key priorities.

- Extant data offerings are strong, but EIA seeks to expand the offering by covering wholesale electricity markets, the engines by which supply and demand are ultimately met and by which local prices of electricity are set.
  - N.B., wholesale prices are different than retail prices, which residential consumers often pay to their utilities.

- About 2/3 of the U.S. have structured, coordinated wholesale electricity markets, referred to as either “ISOs” or “RTOs”.
  - Independent System Operators
  - Regional Transmission Organizations
RTOs & ISOs

- All of these RTOs & ISOs make troves of data public
- Instead of creating a new survey to collect this data, EIA proposes to begin its Electricity Initiative by first collecting the publicly available data

Value Proposition: Collocation & Demystification

- 7 different U.S. RTO/ISOs means 7 different data providers, each with its own formatting, conventions, definitions

Subtly, ISO/RTO data are not quite apples-to-apples

- Housing the most salient public information in one location at EIA will:
  - Increase ease of access and use for most EIA stakeholders
  - Provide a “curated” data offering for the non-expert
  - Allow for naturally interleaved educational material and explainers
  - House data alongside valuable, complementary datasets, like EIA’s 930 survey of hourly data from Balancing Authorities, including generation by fuel, demand, and interchange
Example: Locational Marginal Prices

Wholesale prices are cited as LMPs (“Locational Marginal Prices”)

- **Price** --- values are in US Dollars per MW of power purchased for delivery
- **Marginal** --- the intersection of supply and demand sets the price of power
  
  - **Supply offers**: generating units offer into the market how much power they would be willing to generate at what price
  
  - **Demand bids**: consumers bid into the market how much power they expect to need and at what price point(s) their demand might change
  
  - **Marginal unit**: if all supply offers are ranked by their offer price, then the generating unit that supplies the final demanded MW of power is the marginal unit, and its cost sets the cost that all generators will get paid for their power

- **Locational** --- prices vary geographically based on the network topology of suppliers and consumers and how congestion and losses will affect the ability to deliver power
Technical Approach

EIA DMZ Server

RTO/ISO Data Providers → Data Capture → Virus Scan

EIA Internal Servers

Validate & Process → Reject Bad

Project Internal Database → eia.gov Database

Data Capture → Publish → RTO Portal Customers

Validated & Processed Data → eia.gov Database

Rejected Data → RTO Portal Customers

RTO Portal Customers → EIA DMZ Server

EIA Internal Servers → eia.gov Database

RTO/ISO Data Providers → Data Capture

Data Capture → Virus Scan

Virus Scan → Validate & Process

Validate & Process → Reject Bad

Reject Bad → Project Internal Database

Project Internal Database → eia.gov Database

Publish → RTO Portal Customers

Publish → EIA DMZ Server

EIA DMZ Server → Data Capture

EIA DMZ Server → Virus Scan

EIA DMZ Server → Validate & Process

EIA DMZ Server → eia.gov Database

EIA DMZ Server → Publish

EIA DMZ Server → RTO Portal Customers

EIA DMZ Server → RTO/ISO Data Providers

EIA DMZ Server → EIA Internal Servers

EIA Internal Servers → Validate & Process

EIA Internal Servers → Reject Bad

EIA Internal Servers → Project Internal Database

EIA Internal Servers → eia.gov Database

EIA Internal Servers → Publish

EIA Internal Servers → RTO Portal Customers

EIA Internal Servers → EIA DMZ Server

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database

RTO Portal Customers → Project Internal Database

RTO Portal Customers → Validate & Process

RTO Portal Customers → Reject Bad

RTO Portal Customers → Virus Scan

RTO Portal Customers → Data Capture

RTO Portal Customers → Publish

RTO Portal Customers → eia.gov Database
Technical Approach

RTO/ISO Data Providers

Data Capture

EIA DMZ Server

Virus Scan

EIA Internal Servers

Validate & Process

Reject Bad

Project Internal Database

eia.gov Database

Data

Publish

Python used to poll data providers and access APIs or download raw files

RTO Portal Customers

Customers
Technical Approach

RTO/ISO Data Providers

EIA DMZ Server

Data Capture

Virus Scan

Validate & Process

Reject Bad

EIA Internal Servers

Project Internal Database

eia.gov Database

Python or SAS used to parse & validate data and wrangle into storage form

Publish

RTO Portal Customers

Customers

Data

Capture
Progress and Hurdles

• Progress has been forward, but we are trying to accelerate…

• Hurdles:
  – **Coding**: scraping public data is a different mode than what EIA typically does with its survey collections, so devising robust, operational code requires care
    • Operational mode to keep up-to-date
    • Historical mode to back-fill archives
  – **Republishing rights**: All RTOs/ISOs have warnings about trying to republish their data, so those rights need to be established, which takes time
  – **Front-end display**: EIA’s website has high standards for its display, dissemination, and interactivity, and these standards demand material development time to deliver a new product
Future Analysis…

• Once the data is housed at EIA and able to be disseminated, then further analysis will be possible into the following types of problems, without leaving the EIA website

• Other useful data and content to be added:
  
  • Weather
  • Fuel supply & prices
  • Demand response
  • Renewable penetration
  
  • Capacity markets
  • Ancillary services
  • Market rules
  • …
Texas Wind Power

- Wind power is plentiful in TX
- Generation is often far from load centers
- Transmission can get congested, leading to negative power prices near generating units
- Balance of supply and demand depends on accurate wind power expectations

https://www.eia.gov/state/?sid=TX
ERCOT: Wholesale Price Spike (6/7/2019)

ERCOT Hourly load & 15-minute Real-Time Market prices

ERCOT Hourly wind generation & 15-minute Real-Time Market prices
ERCOT: Wholesale Price Spike (6/7/2019)

Friday 6/7/19

Saturday 6/8/19

peak demand period

15-minute real-time wholesale electricity price

Hourly demand

Hourly wind generation

Actual minus projected wind generation

Greg Lawson, GASP 2019,
Washington, DC, September 23, 2019
Summary

• RTO/ISO data is a key piece of the Electric Industry

• The “RTO/Wholesale Power Portal” project will bring these data to EIA’s collection of world-class data and statistics

• Work is advancing…

• Analytical capabilities will be increased without needing to leave EIA’s site