CESER Guidance on Developing a State Energy Profile

May 2024

This document contains the outline for the state energy profile section of a State Energy Security Plan. The energy profile is part of the pre-event baselining activities performed during "blue sky" days, which can be used for comparison purposes while assessing consequences during event response. The profiles map and catalog key energy infrastructure and graph energy supply and demand and may be used to inform state policy and/or investment decisions.

The outline contains key pieces for a comprehensive energy profile. States do not have to follow the order but are encouraged to include all relevant items.

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DETAILED STATE ENERGY PROFILE OUTLINE

1. **Electricity**
   1.1. Electricity Consumption

   > Key aspects: Line chart with monthly data. Show seasonality of electric consumption.
   >
   > How to: Graph the latest year's data by month EIA Electricity Data Browser "Retail sales of electricity" data set filtered for the state.

       1.1.1.   – 1-year Pie Chart and 10-year Stacked Bar Chart

   > Key aspects: Break down into residential, commercial, industrial, and "other" categories into a 1-year pie chart graph and a 10-year stacked bar chart to understand the primary end uses make-up of electricity and how they may have changed over time.
   >
   > How to: Pull last 10 years of sector-level data from Electricity Data Browser, dataset "Retail sales of electricity" and filter to the state of interest. Graph data into pie chart and historical stacked bar chart. Note in the text any changes in end use across these sectors.

       1.1.2.   Map of Major Utilities

   > Key aspects: Different colors for each top utility, labeling of major utilities. The cutoff for major utilities may differ for each state but is likely between 10,000 – 50,000 customers for visibility.
   >
   > How to: Your state's public service commission may have pre-made maps showing the territories of the in-state electric utilities. If not, an option is to create a custom GIS map, pulling in DHS's Homeland Infrastructure Foundation- Level Data's (HIFLD) public electric retail service territories layer, based on key aspects. EIA's Energy Atlas has the electric retail service territory layer, but the boundaries can overlap, and they are all the same color so you can't visually tell boundaries or where they are. EIA's Energy Atlas has the electric retail service territory layer, but the boundaries can overlap, and they are all the same color so you can't visually tell boundaries or where they are.

       1.1.3.   Table of Major Utilities, listing number of customers, retail sales

   > Key aspects: Columns are Utility Name, Ownership Type, Total Customer Count, % of State's Customers, Total Sales (MWh). Shows location and size of major utilities in the state
   >
   > How to: Pull data from EIA-861 Annual Electric Power Industry Report

Utility Name	Ownership Type	Total Customer Count	% of State's Customers	Total Sales (MWh)

   1.2. Electricity Supply

       1.2.1.   Map of Electric Generating Units in the State

   > Key aspects: Map different fuel sourced generators, with the relative size of icons representing generator capacity and label largest generators on map and create legend. Consider if a capacity threshold needs to be set to prevent overcrowding (such as greater than 250-MW).

How to: Ideal option is to create a custom GIS map, pulling in EIA's public generator layer, based on key aspects. An alternative option could be to label generators on top of the map in the CESER Risk Profile. A third option is to create a graphic, using EIA's Energy Atlas, by using the screengrab function in the bottom left corner of the screen.

1.2.2.   Table of Top Generators by Capacity, listing generation and % of consumption in the state

Key aspects: Columns with generator name, owner, county, summer net capacity, annual generation in MWh, type, % of consumption in the state. This will show which generators are most important to the state.

How to: Identify top generators using the latest monthly file EIA-860M, filtering for your state on the operating generators tab and aggregating summer net capacity to the plant level (list the top 10-20). Ownership, county, and type are found on this form as well (type can be found in the "Technology" field). Find the annual generation of those top generators on the EIA-923 data for the latest year of finalized data ("EIA923_Schedules_2_3_4_5…Final" file, "Page 1 Generation and Fuel Data" tab, "Net Generation (Megawatthours)" column). Then calculate a % of consumption by placing generation over the state Total retail sales (MWh) from the EIA State Electricity Profiles. Comment on supply security aspects of critical generators, i.e., where coal is sourced and by what mode.

Generator Name	Owner	County	Summer Net Capacity (MW)	Type	2021 Annual Generation (GWh)	% of State Consumption

1.2.3.   Assessment of Net Importer or Exporter of Electricity

Key aspects: Assess if your state makes more electricity than customers need or if you are dependent on generation outside of the state.

How to: Compare retail sales to generation for the latest year (data from EIA State Electricity Profiles). If retail sales are higher, then the state is a net importer; but if they are lower, then the state is a net exporter.

1.2.4.   Generation Mix – 1-Year Pie Chart and 10-Year Stacked Bar Chart by Fuel Type

Key aspects: Understand which fuel/generation types are most critical in your state and how generation mix may have changed over time.

How to: Create a pie chart from the latest year's data and a stacked bar chart from the last ten years of data using the EIA Electricity Data Browser "Net Generation" data set filtered for the state. Note in the text any shifts in generation sources and the associated changes to energy security planning, including risk assessment and/or mitigation planning.

1.2.5.   Key Balancing Authorities

1.2.5.1.   Description and Map of Balancing authority boundaries

Key aspects: Describe and show the boundaries of their territory.
How to: Find stock map from their website or other online source.

1.2.5.2. Balancing authority Electricity Overview (demand, generation, and total interchange) Graph

Key aspects: Graph the balancing authorities' electricity demand, net generation, and total interchange. Analyze seasonality and amount of positive or negative interchange.

How to: Use the EIA Hourly Electric Grid Monitor to select the relevant balancing authority and use chart options on the electricity overview to select daily data for the latest year. Download the data from past 3 years to create a robust chart. Alternatively, you can clip the latest year of data from the dashboard.

1.2.5.3. Electricity Generation within Balancing Authority by energy source Graph

Key aspects: Graph the balancing authorities' electricity generation by energy source

How to: Use the EIA Hourly Electric Grid Monitor to select the relevant balancing authority and use chart options on the electricity generation by energy source graph to select daily data for the latest year. Download the data from past 3 years to create a robust chart. Alternatively, you can clip the latest year of data from the dashboard.

1.3 Electricity Trends

1.3.1 Description of State Long-term Electrification/Net-Zero Goals and Policies and Long-Term Impact Assessment of Policies on Electricity Sector

Key aspects: Qualitative assessment of how electrification/net-zero goals/policies by the state and/or by utilities will impact key components of the state's electricity sector, such as future generation mix, transmission infrastructure, total consumption, permitting for new generation, etc.

1.3.2 Planned Utility-Scale Generation Installment for Next Five Years

Key aspects: Understand current plans in your state for new utility-scale generation infrastructure projects in the next five years and assess any impacts these plans may have on energy security/reliability.

How to: Use latest Form EIA-860M file ("Planned" tab) to see the planned generation installments in your state for the next five years. Write text including the amount of generation capacity being installed for each generation source. If helpful, create a stacked bar chart by fuel type for planned utility-scale generation installation in the next five years. Use the same source to create a pie chart illustrating the generation mix of projects planned to be online in the next five years.

1.3.3 Planned Utility-Scale Generation Retirement for Next Five Years

Key aspects: Understand current plans in your state for utility-scale generation infrastructure retirement in the next five years and assess any impacts these plans may have on energy security/reliability.

How to: Use latest Form EIA-860M ("Operating" tab, look for "Planned Retirement Year" column) to see the planned generation retirements in your state for the next five years. Write text including the amount of generation capacity being retired for each generation source. If helpful, create a stacked bar chart by fuel type for future retirements of utility-scale generation in the next five years. Use the same source to create a pie chart illustrating the generation mix of retirements for the next five years.

2 Liquid Fuels

2.1 Petroleum Products Demand (consumption graphs and stocks with seasonality; usage by sector pie charts and stacked bar charts)

Key aspects: Best practice to layer 5-year average, 5-year range, plus the most recent year's data. Assess product consumption and stock withdrawal or build seasonality. Assess the primary end use sectors consuming liquid fuels.

How to: For consumption, consider using a combination of EIA Prime Supplier Sales volumes and EIA SEDS consumption volumes. Note: In May of 2023, the EIA announced that it was suspending the EIA-728C, *Monthly Report of Prime Supplier Sales of Petroleum Products Sold for Local Consumption.* The last month of data collected for this report was for March 2022. This survey was used as a primary source for understanding state-level demand for petroleum products. A similar, alternative data source is EIA's State Energy Data System (SEDS). However, a limitation of SEDS is that it provides annual data rather than monthly data. This method does not allow for the examination of seasonal changes in the consumption of petroleum products throughout the year, so a more out of date analysis of EIA Primer Supplier Sales volumes may still be helpful to understand the historical seasonal trend of consumption.

For stocks, pull data from EIA Refinery Bulk Terminal, and Natural Gas Plant Stocks by State and create 5-year graphic.

For usage by sector, pie charts and stacked bar charts can be made with EIA SEDS consumption by sector estimates in trillion BTU (residential, commercial, industrial, transportation, electric). Note in the text any changes that are salient for your state.

- 2.1.1   Gasoline
- 2.1.2   Distillate
- 2.1.3   Jet Fuel/Kerosene
- 2.1.4   Residual Fuel Oil
- 2.1.5   Propane
- 2.1.6   State Fuel specifications

Resources: EPA Reformulated Gasoline and RVP list, Insert any state-specific fuel specifications that are more stringent than the EPA required specifications.

2.2 Petroleum Products Supply

- 2.2.1   EIA PADD Transportation Fuels Study Regional Infrastructure Map

How to: Pull map for correct region from EIA Transportation Fuels Markets Reports (PADD 1 and 3, PADD 2 and 4, PADD 5) Maps are from 2017, so some updates may be worth flagging. Refinery capacities have changed in many cases.

- 2.2.2   Table of Refineries serving the state

Key aspects: Owner, Location, Crude Oil Capacity. This table gives readers a sense of how much production at each refinery and how that production links to pipelines (and in turn dependent markets). *Optional: Pipelines feeding, Takeaway Pipelines.*

How to: Pull all refineries in your state from EIA Refinery Capacity Report Table 3, Atmospheric Crude Oil Distillation Capacity, Operating, Barrels per Calendar Day. Group by regions in state if necessary. *Optional: Research critical connectivity (crude and product pipelines, waterways, etc.) through refinery websites and PHMSA's*

Owner	Location	Crude Oil Capacity (b/cd)	Crude Pipelines Feeding	Product Takeaway Pipelines

2.2.3   Map of Transportation Fuel Infrastructure in the state

<u>Key aspects:</u> Labeling of refineries and key pipelines, different color pipelines, legend

<u>How to:</u> Ideal option is to make a custom GIS map, pulling in EIA Petroleum Refineries, EIA Petroleum Product Pipelines, and EIA Petroleum Product Terminals layers, based on key aspects. Alternative option could be use EIA Energy Atlas to create the map.

2.2.4   Table of Key Refined Product Pipelines serving the state

<u>Key aspects:</u> Owner, Products, Origins, Destinations

<u>How to:</u> Pull from EIA Energy Atlas and then review the relevant EIA Transportation Fuels Markets Reports (PADD 1 and 3, PADD 2 and 4, PADD 5) for additional information about pipeline products, origin, and destination.

Owner	Line Name	Products	Origin	Destination

2.2.5   Table of Relevant Ports

<u>Key aspects:</u> Understand relative importance of ports to petroleum product supply.

<u>How to:</u> Use EIA's layer for petroleum ports from EIA Energy Atlas to produce a list of ports for your state. Then utilize USACE Waterborne Commerce Statistics Center to identify major petroleum ports and approximate volumes in your state. Select the most recent year and your region and search for your relevant port. Then select the "5-Year Cargo Report" and gather the relevant inbound receipts and outbound shipments. Petroleum products are typically the summation of gasoline, kerosene, distillate fuel oil, and residual fuel oil. The source reports these commodities in short tons per year, so use EIA's conversion factor to convert short tons to metric tons and these conversion factors to convert metric tons to barrels.

Port	Crude Petroleum Inbound Receipts (b/d)	Crude Petroleum Outbound Shipments (b/d)	Petroleum Products Inbound Receipts (b/d)	Petroleum Products Outbound Shipments (b/d)

2.2.6 Table of Key Terminals

Key aspects: Owner, City. *For states that want to include more detailed terminal information, optional additional categories of use are Fuel Types Stored, Storage Capacity, and Truck Rack Capacity.*

How to: Pull list of petroleum product terminals from EIA Energy Atlas in table. *Optional: Utilize Title V air permits within the state, if possible, to find terminal storage and truck rack capacities. Survey industry partners if needed.*

Owner	City	Fuel Types Stored	Storage Capacity (barrels)	Truck Rack Capacity (b/d)

2.2.7 Map of Natural Gas Liquids Infrastructure in the state

Key aspects: Labeling of refineries and key pipelines, different color pipelines, legend

How to: Ideal option is to make a custom GIS map, pulling in EIA Petroleum Refineries and EIA Hydrocarbon Gas Liquids Pipelines layers, based on key aspects. An alternative option could be using EIA Energy Atlas with the same layers and take a screengrab in the bottom left corner of the screen.

2.2.8 Table of Key Natural Gas Liquids Pipelines serving the state

Key aspects: Owner, Products, Origins, Destinations

How to: Pull list of Hydrocarbon Gas Liquids (HGL) pipelines from EIA Energy Atlas, checking which lines cross your state and then pull company-specific pipeline tariffs for products, origins, and destinations. Pipeline tariffs can either be found at FERC's Tariff List or on the company's website. Pipeline operators may have multiple tariffs for different pipeline segments, so be sure to find the right system with the state relevant origin and/or destination and choose the "effective" tariff. The tariff will indicate which product or products are able to be shipped on the system and then you should find the rate table. The rate table typically reflects the possible origin points across the top row and the various destination locations down the first column.

Owner	Line Name	Products	Origin	Destination

2.3 Crude Oil

2.3.1 Crude Oil Production Graph

Key aspects: Show 5-years of data on a line chart to analyze how much crude oil the state produces, in comparison with refinery consumption of crude oil and to understand how much crude oil is being transported within the state.

How to: Pull data from EIA Crude Oil Production and plot. Note in the text any changes in production for your state.

2.3.2 Crude Oil Map (pipelines, wells, refineries)

Key aspects: Labeling of refineries and key pipelines, different color pipelines, legend

How to: Ideal option is to make a custom GIS map, pulling in [EIA Petroleum Refineries](#), [EIA Crude Oil Pipelines](#), and [HIFLD Oil and Gas Wells](#) layers, based on key aspects. An alternative option could be using [EIA Energy Atlas](#) with the same layers and take a screengrab in the bottom left corner of the screen.

2.4 Biofuels

    2.4.1   Biofuel Map

Key aspects: Show locations of ethanol and biodiesel production facilities with different icons, legend

How to: Use [EIA Energy Atlas](#) and lay on biofuel production facilities.

    2.4.2   Ethanol and Biodiesel Production Plants Table

Key aspects: Owner, Site, Type, Capacity

How to: Use [EIA Ethanol Plant Production](#) and [EIA U.S. Biodiesel Plant Production](#) to create table.

Company Name	Site	Capacity (million gallons/year)	Capacity (thousand b/d)

2.5 Liquid Fuels Trends

    2.5.1   Description of State Long-Term EV/Electrification and Biofuels Goals and Policies and Long-Term Impact Assessment on Liquid Fuels Sector

Key aspects: Qualitative assessment of how the state's consumption and supply of traditional liquid petroleum fuels will change due to state EV/electrification/biofuels goals and policies.

    2.5.2   Energy Security Efforts to Adapt to Liquid Fuels Trends

Key aspects: Qualitative assessment of necessary adaptations to maintain energy security and reliability in the state's changing liquid fuels sector, such as how biofuels demand will be met with the future increase in consumption.

3   Natural Gas

3.1 Natural Gas Consumption

    3.1.1   Graph of State Natural Gas Consumption

Key aspects: Best practice to layer 5-year average, 5-year range, plus the most recent year's data.

How to: Pull [EIA Natural Gas Consumption by End Use](#) total consumption and plot. Note in the text any changes in consumption.

    3.1.2   Natural Gas Consumption by Sector – 1-year Pie Chart and 10-year Stacked Bar Chart

Key Aspects: Understand natural gas consumption of each sector as a percentage of total natural gas consumption, as well as Bcf/d consumption of each sector and how these percentages may have changed over time.

How to: Pull EIA Natural Gas Consumption by End Use total consumption volumes for residential, commercial, industrial, and electric power sectors. Note in the text any changes in end use across these sectors.

3.1.3 Map of Natural Gas Distribution Companies Territories

Key aspects: Different colors for each major natural gas distribution company, labeling of major utilities. The cutoff for major distribution companies may differ for each state but is likely based on 1-10 MMcf/d of distributions for visibility.

How to: Your state's public service commission may have pre-made maps showing the territories of the in-state natural gas distribution companies. If not, an option is to create a custom GIS map, pulling in HIFLD's natural gas service territories layer based on key aspects.

3.1.4 Table of Natural Gas Distribution Companies, sales

Key aspects: Columns for company and delivery volume

How to: Pull EIA Natural Gas Annual Respondent Query System (EIA-176 Natural Gas Deliveries) to generate table. Cross check with the list of Natural Gas Service Territories from HIFLD's natural gas service territories layer.

Gas Distribution Company	Delivery Volume (MMcf/d)

3.2 Natural Gas Supply

3.2.1 Natural Gas Production Graph

Key aspects: Show 5 years of data on a line chart. This can be used to understand how much natural gas is being produced vs. consumed in the state and if/how much gas needs to be brought in from other states or via imports.

How to: Use EIA Natural Gas Gross Withdrawals and Production to pull data and plot. Note in the text any changes in production for your state.

3.2.2 Natural Gas Map (pipelines, gas-fired power plants, storage, LNG facilities, processing plants)

Key aspects: Label critical pipelines and storage locations.

How to: Use EIA Energy Atlas and layer on natural gas pipelines, gas-fired power plants, natural gas processing plants, natural gas underground storage, and LNG import and export terminals.

3.2.3 List of Key Natural Gas Pipelines

Key aspects: Pipeline, Owner, State to state Capacity, Descriptions

How to: Pull list from EIA Energy Atlas Natural Gas Interstate and Intrastate Pipelines by zooming in on your state and toggling on the feature "Filter as map moves" to narrow in the table listing on pipelines in your state. There are many duplicative entries for many operators as they represent different segments of the same line. Use state-relevant capacities from EIA U.S. State-to-State Capacity.

Pipeline	Owner	Capacity (MMcf/d)	Description

3.2.4 Table of Storage Facilities

Key aspects: Columns should include Company name, Reservoir name, County, Working Gas Capacity, Maximum Daily Delivery. This can be used to assess how much underground storage is located in the state and where it is located.

How to: Use EIA Natural Gas Respondent Query System (EIA-191 Field Level Storage Data) to generate table for your state.

Company Name	Reservoir Name	County	Working Gas Capacity (MMcf)	Maximum Daily Delivery (MMcf/d)

3.2.5 Table of Processing Plants

Key aspects: Columns should include Plant Name, Owner, County, Plant Capacity, Storage Capacity. This table shows the relative importance of various processing plants in the state and the overall capacity can be compared to production within the state to assess excess capacity.

How to: Use EIA Natural Gas Respondent Query System (EIA-757 Processing Capacity) to generate table.

Plant Name	Owner	County	Plant Capacity (MMcf/d)	Storage Capacity (MMcf)

3.3 Natural Gas Trends

3.3.1 Description of State's Long-Term Electrification and Net-Zero Goals and Policies and Long-Term Impact Assessment on Natural Gas Sector

Key aspects: Qualitative assessment of how the state's consumption and supply of natural gas will change due to state electrification/net-zero goals and policies. Consider the rise of other forms of energy that may impact the natural gas sector, such as renewable natural gas and hydrogen.

3.3.2 Energy Security Efforts to Adapt to Natural Gas Trends

Key aspects: Qualitative assessment of what adaptations are necessary to maintain energy security and reliability in the state's changing natural gas sector.