

FAS Tool User Guide



WEST VIRGINIA STATE FREIGHT PLAN



June 2023

West Virginia State Freight Plan

FAS Tool User Guide

prepared by

Cambridge Systematics, Inc.

with

Mott MacDonald

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1.0 INTRODUCTION

The West Virginia Department of Transportation (WVDOT) commissioned a Freight Analysis System (FAS) tool to visualize commodity flow data analyzed for the West Virginia State Freight Plan. The FAS is a web-based, interactive framework that enables WVDOT and other users to:

- Interact with and share freight data at the County, Metropolitan Planning Organization (MPO), District, and State levels; and
- Understand freight movement trends and projections.

By providing easily accessible freight analysis and allowing for custom views at various levels of aggregation, the FAS makes the West Virginia State Freight Plan analysis easily accessible by planning partners and allows integration of freight planning into all stages of planning and project development. With the FAS, users can visualize commodity flow trends for a range of geographies and time periods.

1.1 Data

The primary data source deployed by the West Virginia FAS was Federal Highway Administration (FHWA) Freight Analysis Framework Version 5.4.1 (FAF5), which provides forecasts on tonnage and values by origins and destinations, commodity type, and mode. This analysis used 2019 as the base year and 2035 and 2050 as future years. The FAF5 data was processed in two steps before adding to the tool:

- 1) **Disaggregation:** Since the entire state of West Virginia is just one FAF region, the data was disaggregated to estimate commodity flows by county within the state.

The state-level domestic flow was disaggregated based on the ratio generated from the Bureau of Economic Analysis (BEA)'s Make and Use Tables (MUTs) and the County Business Patterns (CBP). The MUTs summarized the number of certain commodities produced or consumed by certain industries annually. The CBP data provided economic data on employment and establishments at the county level.

For international trade, the domestic zones are either Port of Entry or Exist. These regions are also regarded as Commodity Flow Survey (CFS) zones. If more than one entry/exist for the same type exists in the same FAF region, the disaggregation process used the Waterborne Commerce Statistic Center (WSCS) data from USACE to further break the commodity activity down to the individual port level for water mode and BTS Border Crossing data to disaggregate the truck and rail commodities to border crossing level. In international air mode, only international airports were considered as part of the system. In general, the disaggregation only requires relabeling the CFS region as the name of the associated international airport.

- 2) **Optimization:** The size of the disaggregated West Virginia FAF5 outputs were reduced to optimize the tool's performance. Commodities were also aggregated. FAF5 uses the two-digit Standard Classification of Transported Goods (SCTG) schema and the dataset contained 42 distinct SCTG codes that were re-grouped into 12 groups, as shown in Table 1.

Table 1 Commodity Code Groups

SCTG	Commodity Description	Aggregation Group
01	Live Animals and Fish	Agriculture and Fish
02	Cereal Grains (including seed)	Agriculture and Fish
03	Agricultural Products Except for Animal Feed, Cereal Grains, and Forage Products	Agriculture and Fish
04	Animal Feed, Eggs, Honey, and Other Products of Animal Origin	Agriculture and Fish
05	Meat, Poultry, Fish, Seafood, and Their Preparations	Agriculture and Fish
06	Milled Grain Products and Preparations, and Bakery Products	Food, Alcohol and Tobacco
07	Other Prepared Food Stuffs, and Fats and Oils	Food, Alcohol and Tobacco
08	Alcoholic Beverages and Denatured Alcohol	Food, Alcohol and Tobacco
09	Tobacco Products	Food, Alcohol and Tobacco
10	Monumental or Building Stone	Aggregates
11	Natural Sands	Aggregates
12	Gravel and crushed stone except dolomite and slate	Aggregates
13	Other Non-Metallic Minerals not elsewhere classified (n.e.c.)	Aggregates
14	Metallic Ores and Concentrates	Aggregates
15	Coal	Energy Products
16	Crude Petroleum	Energy Products
17	Gasoline, Aviation Turbine Fuel, and Ethanol, Including Kerosene, and Fuel Alcohols	Energy Products
18	Fuel Oils including diesel, Bunker C, and Biodiesel	Energy Products
19	Other Coal and Petroleum Products	Energy Products
20	Basic Chemicals	Chemicals, Pharmaceuticals, Plastics, and Rubber
21	Pharmaceutical Products	Chemicals, Pharmaceuticals, Plastics, and Rubber
22	Fertilizers	Chemicals, Pharmaceuticals, Plastics, and Rubber
23	Other Chemical Products and Preparations	Chemicals, Pharmaceuticals, Plastics, and Rubber
24	Plastics and Rubber	Chemicals, Pharmaceuticals, Plastics, and Rubber
25	Logs and Other Wood in the Rough	Raw and Finished Wood Products
26	Wood Products	Raw and Finished Wood Products
27	Pulp, Newsprint, Paper, and Paperboard	Raw and Finished Wood Products
28	Paper or Paperboard Articles	Raw and Finished Wood Products
29	Printed Products	Raw and Finished Wood Products
30	Textiles, Leather, and Articles of Textiles or Leather	Textiles and Leather
31	Non-Metallic Mineral Products	Nonmetallic Mineral and Base Metal Products

SCTG	Commodity Description	Aggregation Group
32	Base Metal in Primary or Semi-Finished Forms and in Finished Basic Shapes	Nonmetallic Mineral and Base Metal Products
33	Articles of Base Metal	Nonmetallic Mineral and Base Metal Products
34	Machinery	Machinery, Electric, and Precision Instruments
35	Electronic and Other Electrical Equipment and Components, and Office Equipment	Machinery, Electric, and Precision Instruments
36	Motorized and Other Vehicles (including parts)	Vehicles and Transportation Equipment
37	Transportation Equipment, n.e.c.	Vehicles and Transportation Equipment
38	Precision Instruments and Apparatus	Machinery, Electric, and Precision Instruments
39	Furniture, Mattresses and Mattress Supports, Lamps, Lighting Fittings, and Illuminated Signs	Mixed Freight
40	Miscellaneous Manufactured Products	Mixed Freight
41	Waste and Scrap	Waste and Scrap
43	Mixed Freight	Mixed Freight

2.0 USING THE TOOL

The WVDOT Freight Analysis System (FAS) tool demonstrates commodity movements throughout the state. This section guides the user through accessing the tool, making user selections, and viewing the commodity flow profile and trends.

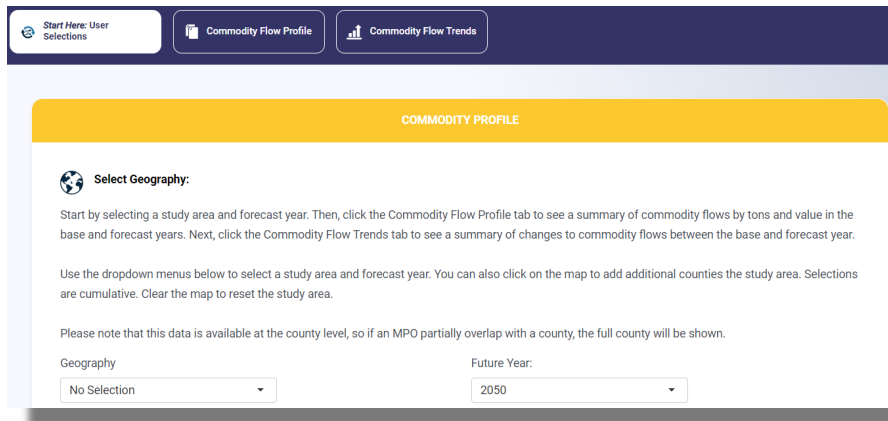
2.1 Gaining Access

The FAS is accessible through any browser with a stable internet connection. Users can access the FAS at https://camsys.shinyapps.io/WVDOT_FAS/. Depending on the user selection, loading, and processing information from the tool may take several minutes.

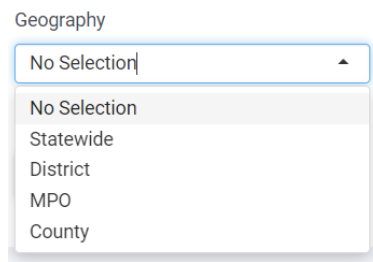
2.2 Start Here: User Selections

The WVDOT FAS begins on the Introduction/User Selections page. As previewed in Figure 1, the user is asked to select a study area and projection year from drop-down menus. These initial inputs are necessary to begin the commodity flow analysis and generate results.

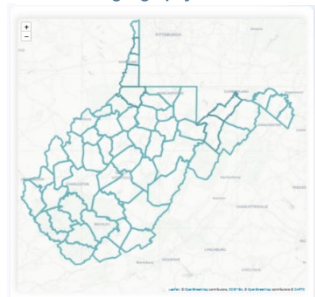
Figure 1 Introduction/User Selection Page



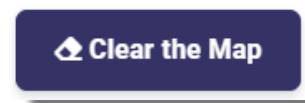
The “Geography” drop-down menu is on the left side of the page. Possible geographies for selection include Statewide, District, Metropolitan Planning Organization (MPO), and County. If District, MPO, or County is selected, another drop-down menu appears, allowing the user to select the specific geography for which they wish the tool to provide information. Once a geography is selected, the tool will highlight the selections in sea-green color on the county map shown below the inputs.



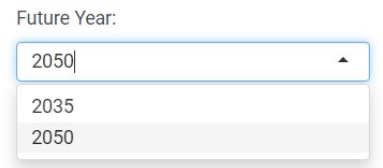
Preview of the selection map when “Statewide” geography is selected.



If the user wants to manually select counties or add to the selection made using the drop-down menu, the user can add to the selection by clicking on the county outlines shown in the map. The counties highlighted in sea-green color on the map define the study area used by the tool for the rest of the tool analyses and outputs. If a geography has been selected in error, ensure to click the “Clear the Map” button before making new selections.



On the right side of the page, there is a “Future Year” dropdown menu. The selected future year defines the forecast year used in the Commodity Flow Trends tab. Possible future years for this analysis include 2035 and 2050.



2.3 Output

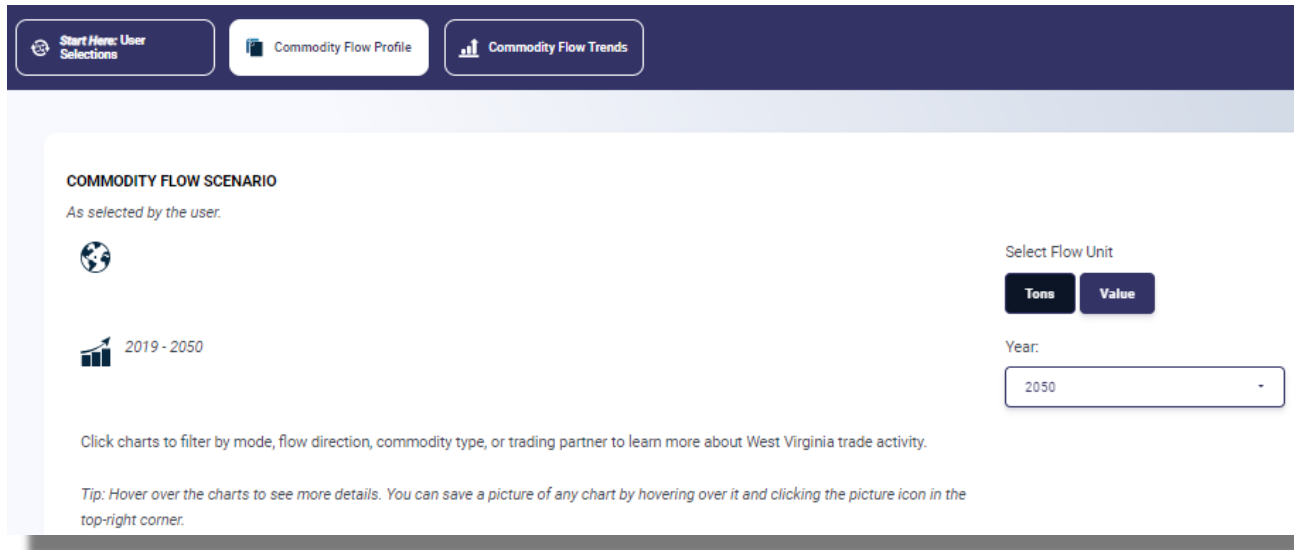
There are two interactive output tabs: Commodity Flow Profile tab and Commodity Flow Trends. The outputs visualize the commodity flow and trends using charts and maps based on geography, mode, and commodities. Hovering over the charts and maps provide additional details and can display the analysis outputs in many ways. The maps display the import and export values and weight for each of the trading partners. Zooming in and out and hovering the cursor over a particular state displays a popup with information on the import, export, and total trade values and weights of the trading partners. In addition to hovering for details, the user can select features on the graphs and map to filter results to whichever feature is selected. All charts and maps in the Commodity Flow Profile tab are interactive with filters, and only the charts in the Commodity Flow Trends tab have filtering capability.

2.3.1 Commodity Flow Profile

The Commodity Flow Profile tab shows the freight commodity flows for the geography and years as identified on the User Selections tab. At the top of the page (shown in Figure 2), the user can choose to output the results as Tons or Value and select the year of the output. The Commodity Flow Profile tab updates to reflect the user selections and presents the following figures and maps:

- Flow Direction: This chart demonstrates the tons or value of freight moving into, out of, or within West Virginia.
- Commodity Type: This chart demonstrates the tons or value of freight being shipped by commodity group for freight into, out of, or within West Virginia.
- Domestic Mode: This chart demonstrates the tons or value of freight being shipped by each mode for domestic freight into, out of, or within West Virginia.
- Foreign Mode for International Trade: This chart demonstrates the tons or value of freight being shipped by each mode for international freight into, out of, or within West Virginia.
- Top 10 Inbound Origins: This chart demonstrates the tons or value of the top 10 origins of freight moving into West Virginia.
- Top 10 Outbound Destinations: This chart demonstrates the tons or value of the top 10 destinations of freight moving out of West Virginia.
- Domestic Trading Partners Map: This map demonstrates the tons or value of freight movements between U.S. states and West Virginia.
- County Map: This map demonstrates the tons or value of freight movements for West Virginia counties.
- Foreign Trade Zones for International Trade Map (CFS Zones): This map demonstrates the tons or value of West Virginia's international freight by the U.S. port of entry or exit.
- International Trading Partners Map: This map demonstrates the tons or value of freight movements between other continents and West Virginia.

Figure 2 Commodity Flow Profile – Commodity Flow Scenario



Figures 3 through 5 show sample outputs of the profile. Users can save a picture of any chart by hovering over it and clicking the picture icon in the top-right corner to save the plot as a PNG.

The filter functionality allows the user to select the specific data subset the user interested in. For example, the user may be interested in the most valuable commodity type in US dollars for trade with Pennsylvania. To do this, select the flow unit “Value”, then click on the state of Pennsylvania on the map. A filter will be applied wherein all the other data presented on the page filters to Pennsylvania. The “Commodity Type” circle chart will display the total value of each commodity.

The user can apply multiple filters and can clear the filters by clicking the “Clear Filter” button located above the charts.

CLEAR FILTER

The order of applying the filters affects the outputs. The user should practice selecting and clearing filters and examine the outputs until confident with the functions.

Figure 3 Commodity Flow Profile – Sample Summary Chart Outputs

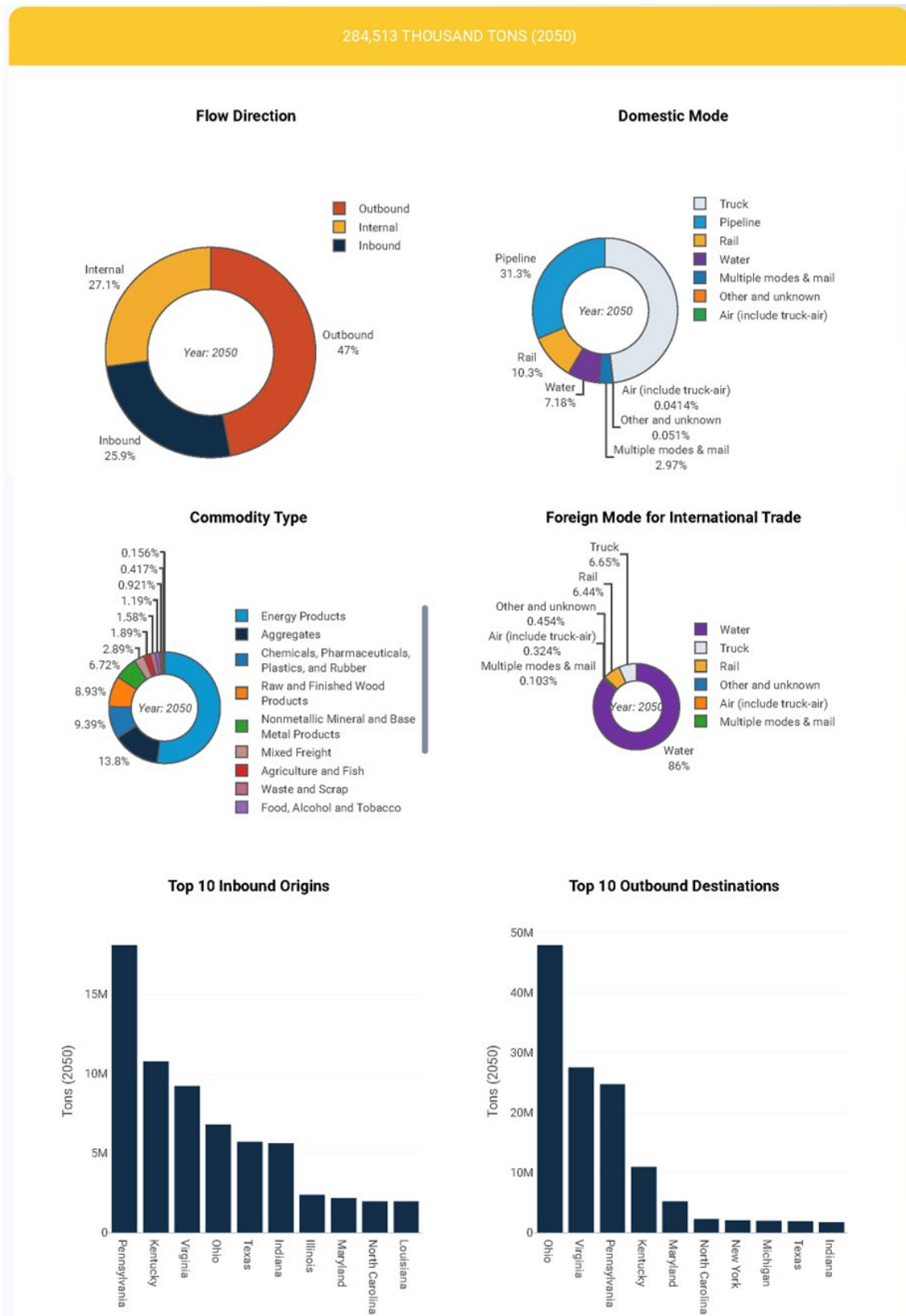


Figure 4 Commodity Flow Profile – Sample Domestic Trading Partners and County Outputs

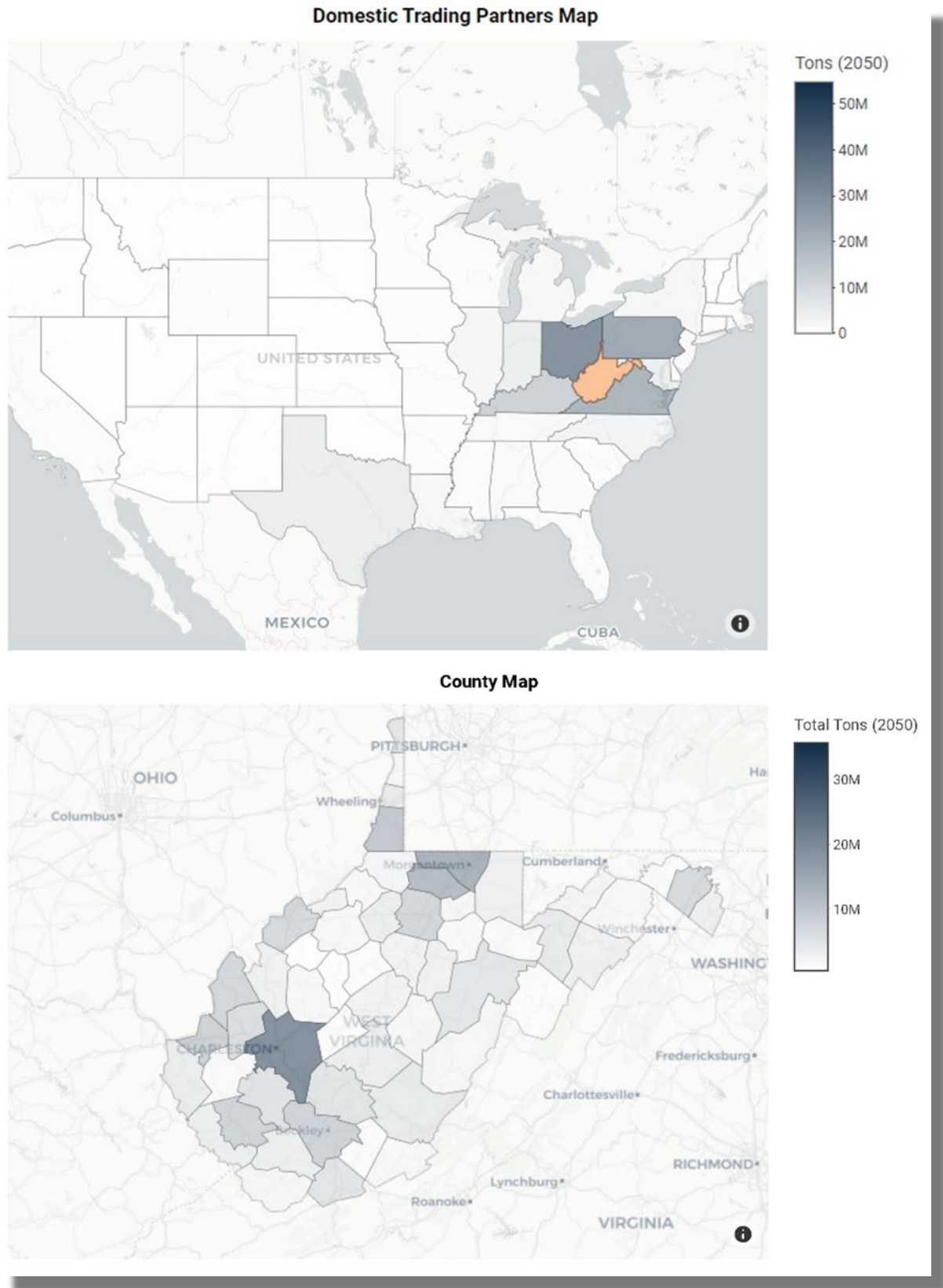
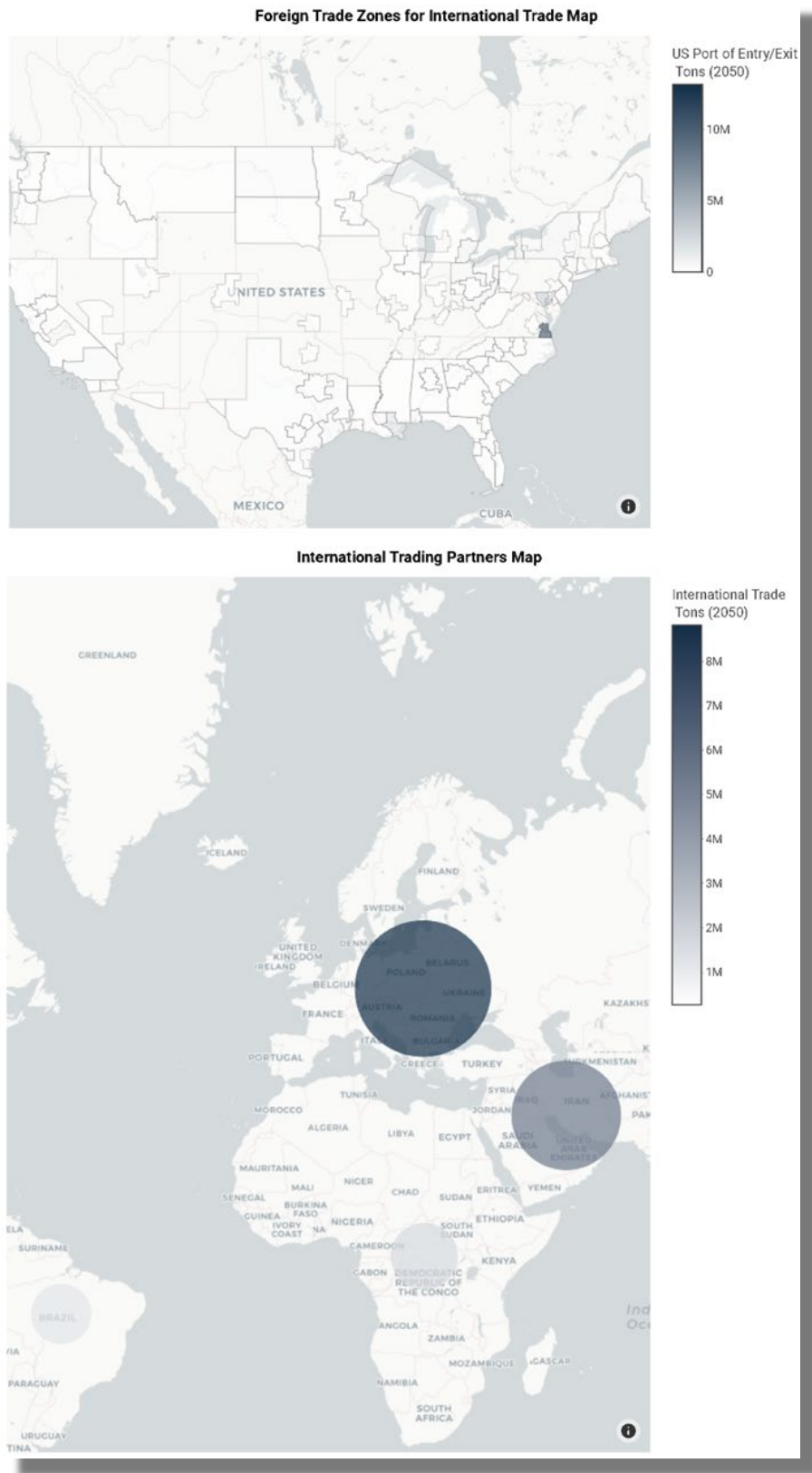


Figure 5 Commodity Flow Profile – Sample Foreign Trade Zones and Trading Partners Outputs



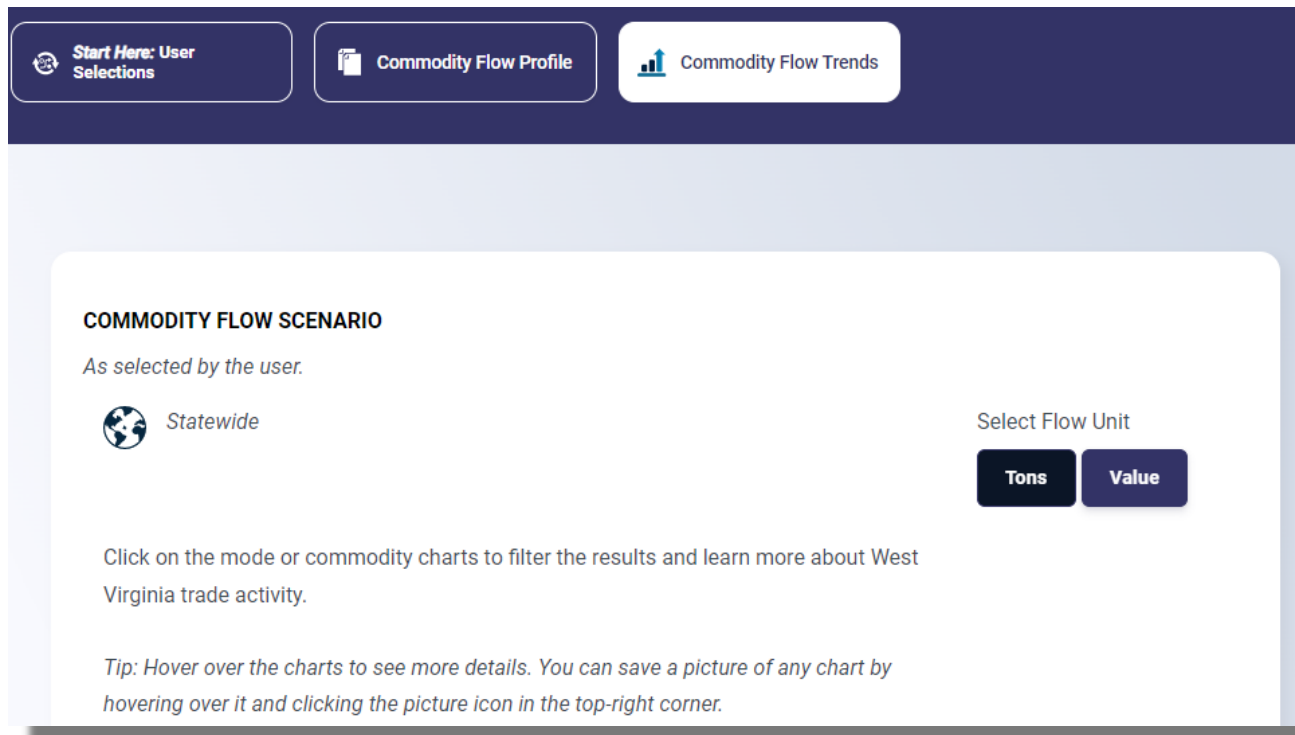
2.3.2 Commodity Flow Trends

The Commodity Flow Trends tab shows the changes in freight commodity flows for the geography and years as identified on the User Selections tab. Different than the Commodity Flow Profile tab, the results shown on the Commodity Flow Trends tab highlight the industries, modes, and geographies with the greatest changes in tonnage or value between the start and future years.

At the top of the page (shown in Figure 6), the user can choose to output the results as Tons or Value. Unlike the Commodity Flow Profile tab, the Commodity Flow Trends tab does not provide an option to select a year, as the outputs are the trends between the start and end years as selected on the User Selections tab. If users want to change the trend period, they must return to the User Selections tab to make the change. The Commodity Flow Trends tab presents the following figures and maps:

- **Change in Domestic Mode Share:** This chart demonstrates the percent value or weight change in mode for domestic flow (including domestic segment of international trade) from the base year to the user-selected future year.
- **Change in Foreign Mode Share:** This chart demonstrates the percent value or weight change in the mode for international flow only from the base year to the user-selected future year.
- **Trends by Commodities:** This chart demonstrates the percent value or weight change for each aggregated commodity from the base year to the user-selected future year.
- **Top 10 Growing Inbound Trading Partners:** This chart demonstrates the Top 10 import origins have the highest tons or value change from the base year to the user-selected future year.
- **Top 10 Growing Outbound Trading Partners:** This chart demonstrates the Top 10 export destinations have the highest tons or value change from the base year to the user-selected future year.
- **Change by Domestic Trading Partner Map:** This map demonstrates the tons or value change of freight movements between U.S. states and West Virginia in absolute value or in percentage from the base year to the user-selected future year.
- **County Map:** This map demonstrates the tons or value change of freight movements for West Virginia counties in absolute value or in percentage from the base year to the user-selected future year.
- **Change by Foreign Trade Zone for International Trade Map:** This map demonstrates the tons or value change of West Virginia's international freight by the U.S. port of entry or exit in absolute value or percentage from the base year to the user-selected future year.
- **Change by International Trading Partner Map:** This map demonstrates the tons or value change of freight movements between other continents and West Virginia in absolute value or percentage from the base year to the user-selected future year.

Figure 6 Commodity Flow Trends – Commodity Flow Scenario



Like the Commodity Flow Profile tab, the user can select features on the graphs to filter results. Filtering is only enabled for features in the charts. Clicking on the bar labeled “Truck” in the first chart, for example, filters the data presented on the page to freight shipments made by trucks. A second filter can be applied by clicking on a bar in the second chart. The order of applying the filters affects the outputs and the user can only filter the tab using the first three figures. Figures 7 through 9 show sample Commodity Flow Trend outputs.

To clear the filters, click on the “Clear Filter” button located above the charts. It is worth noting that some selections may lead to empty selections in certain figures. For instance, if users select Pipeline on the “Change in Domestic Mode Share” graph, no data will pass to the “Change in Foreign Mode Share” graph, a message “No foreign Mode involved” will show up in the graph area, the same message will show for the “Change by Foreign Trade Zones for International Trade Map” and “Change by International Trading Partners Map”. If this is undesired, the user can simply clear the filters and apply other filters.

For the trend maps, users can customize the Map Unit as either “Absolute Value” or “Percent”.

Users can save a picture of any chart by hovering over it and clicking the picture icon in the top-right corner to save the plot as a PNG.

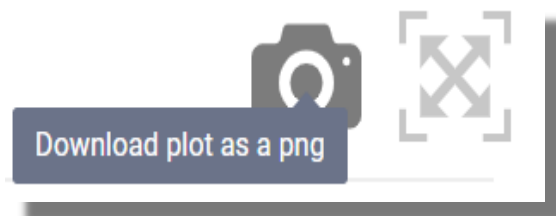
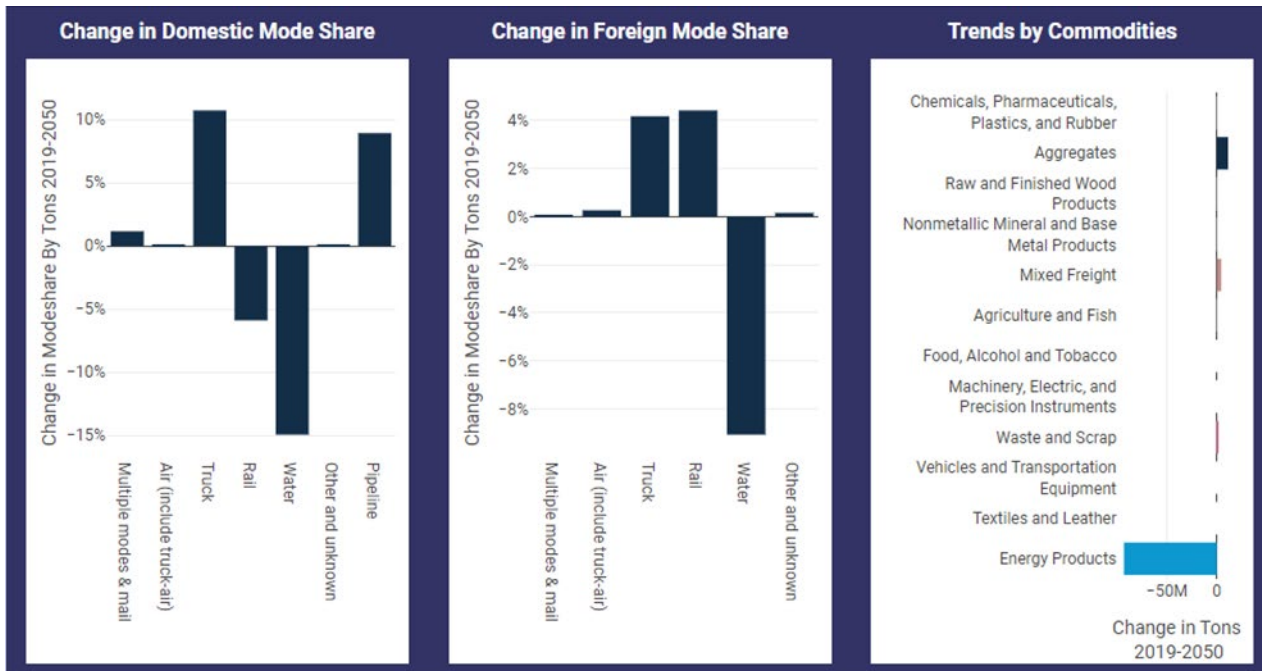
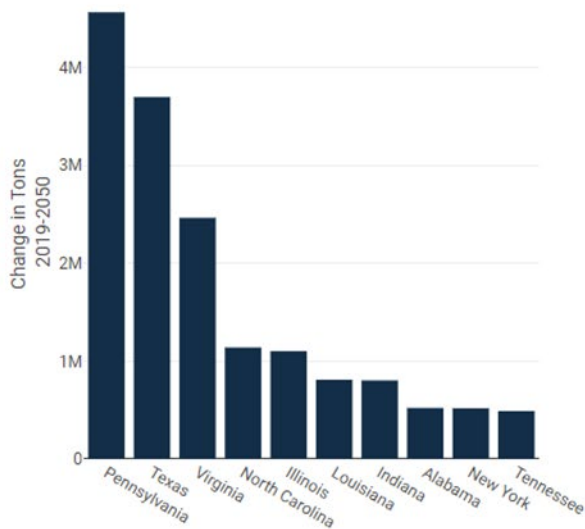


Figure 7 Commodity Flow Trends – Sample Summary Chart Outputs



Top 10 Growing Inbound Trading Partners



Top 10 Growing Outbound Trading Partners

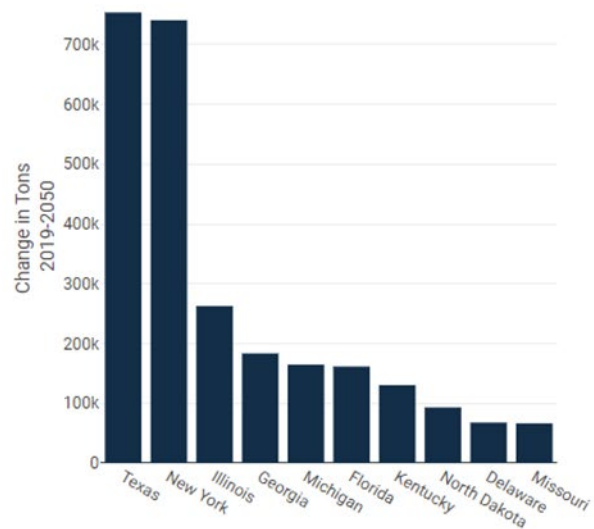


Figure 8 Commodity Flow Trends – Sample Domestic Trading Partners and County Outputs

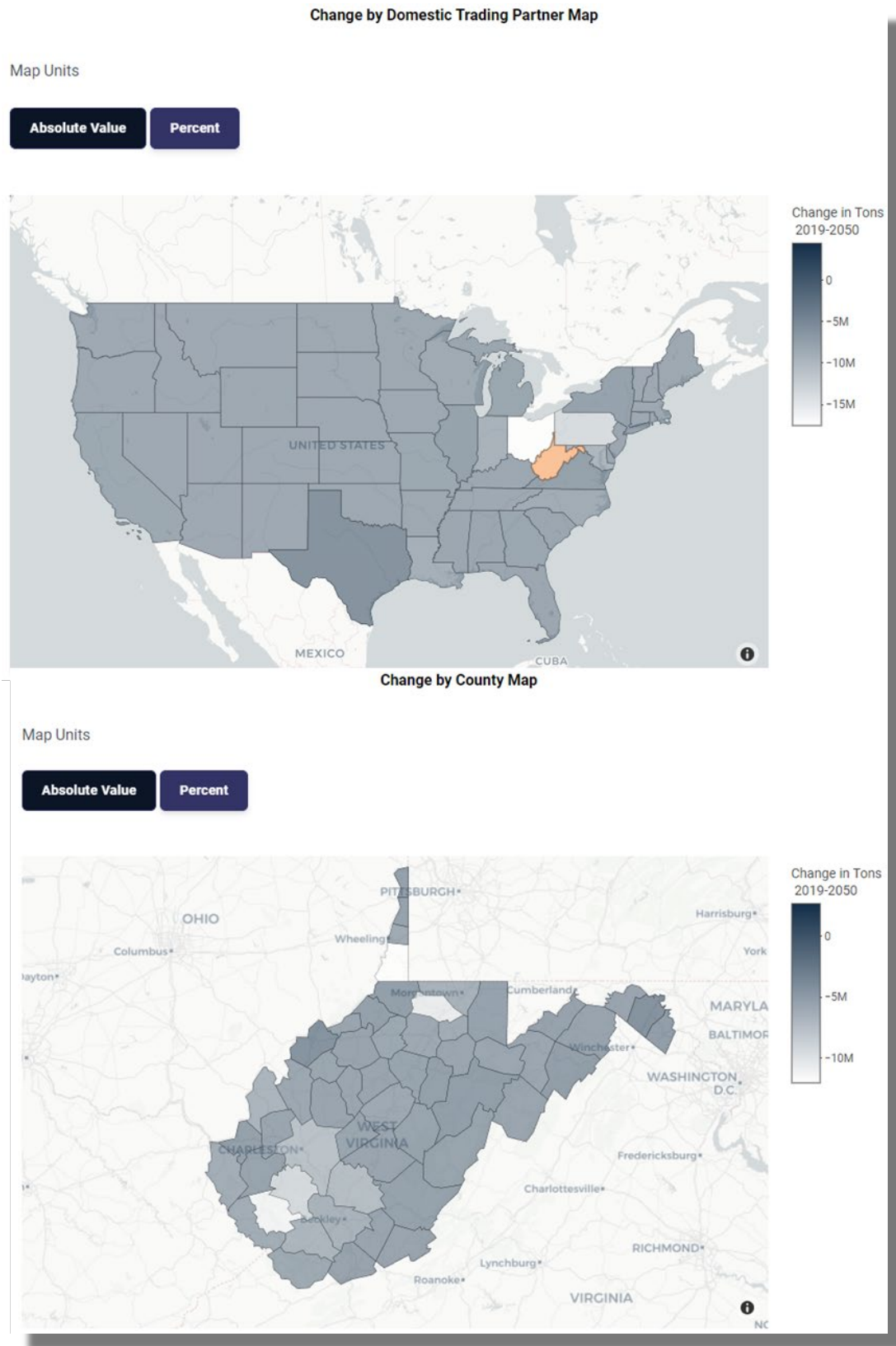


Figure 9 Commodity Flow Trends – Sample Foreign Trade Zones and Trading Partners Outputs

