6 Trends and Challenges

Economic changes can impact the freight system positively or negatively depending on the efficiency and adaptability of the transportation network. This chapter summarizes the internal and external economic trends and challenges related to the movement of goods on the Commonwealth's freight network.

6.1 Internal Trends and Challenges

Until the 20th century, agriculture was Kentucky's main economic activity. While farming remains important to the commonwealth's economy, as a result of abundant coal and hydroelectric power, manufacturing grew in importance after the 1930s. In 2015, Kentucky's leading economic activity was service industries, followed by manufacturing. The energy, automotive, and agriculture trends and challenges in Kentucky and how they affect freight transportation are discussed below.

6.1.1 Energy

According to the EIA, Kentucky is a leading coal-producing state, ranking third in 2013 with an output of 80 million short tons of coal, accounting for 8.2 percent of the total U.S. coal production. Approximately 60 percent of Kentucky's coal comes from underground mines in Kentucky's eastern Appalachian counties and in western Kentucky. The rest of the coal comes from surface mines. For electricity generation, coal-burning plants produce approximately 91 percent of Kentucky's electric power. However, many coal-fired generation plants on the Ohio River are anticipated to convert to natural gas over the next decade. Hydroelectric utilities, such as the Barkley and Kentucky dams, produce almost 4 percent of the electric power, followed by natural gas at 3 percent.

Significant coal production shifts, geographically or by volume, continue to have a dramatic impact on the Kentucky Freight Network. For example, roads that currently serve coal mining operations could continue to see heavy truck traffic, or if projections are correct, the same roads could see a dramatic decrease in heavy-haul traffic. Similarly, the inland waterway system carries a significant amount of Kentucky coal to customers throughout the Mississippi and Ohio River valleys. This excess capacity could provide opportunities to innovate and explore container-on-barge in the Midwest.

6.1.1.1 Coal Production Shifts

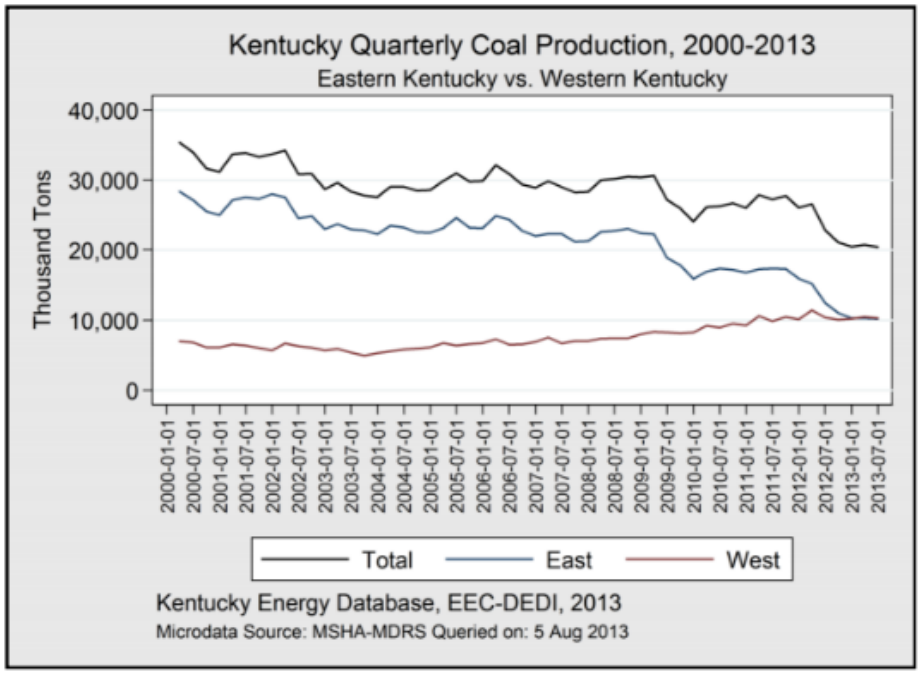
Historically, Kentucky is a net exporter of energy; however, with decreasing coal production and stagnant energy demand, Kentucky's position as an energy exporter has been declining since 1990.

Kentucky is the only coal exporting state with two distinct geologic basins: the Central Appalachian Basin of eastern Kentucky and the Illinois Basin of western Kentucky. Coal mining of some form has existed in these basins for at least 220 years. Historically, eastern Kentucky has been the primary coal producing region of the commonwealth, but in recent years the two regions have been trending in opposite directions. Eastern Kentucky coal has a higher heat content and lower sulfur content, so it burns hotter and cleaner than western Kentucky coal. However, western Kentucky coal is now

relatively less expensive by delivered price. The difference is a result of several factors, including transportation costs, ease of access, and mining techniques employed.[47]

Figure 6-1 illustrates the change in total statewide coal production alongside subtotals for eastern and western Kentucky from 2000 to 2013. In 2013, western Kentucky overtook eastern Kentucky in total coal production, generating 51 percent of Kentucky's 80.6 million tons of coal.

Figure 6-1: Kentucky Coal Production from 2000-2013

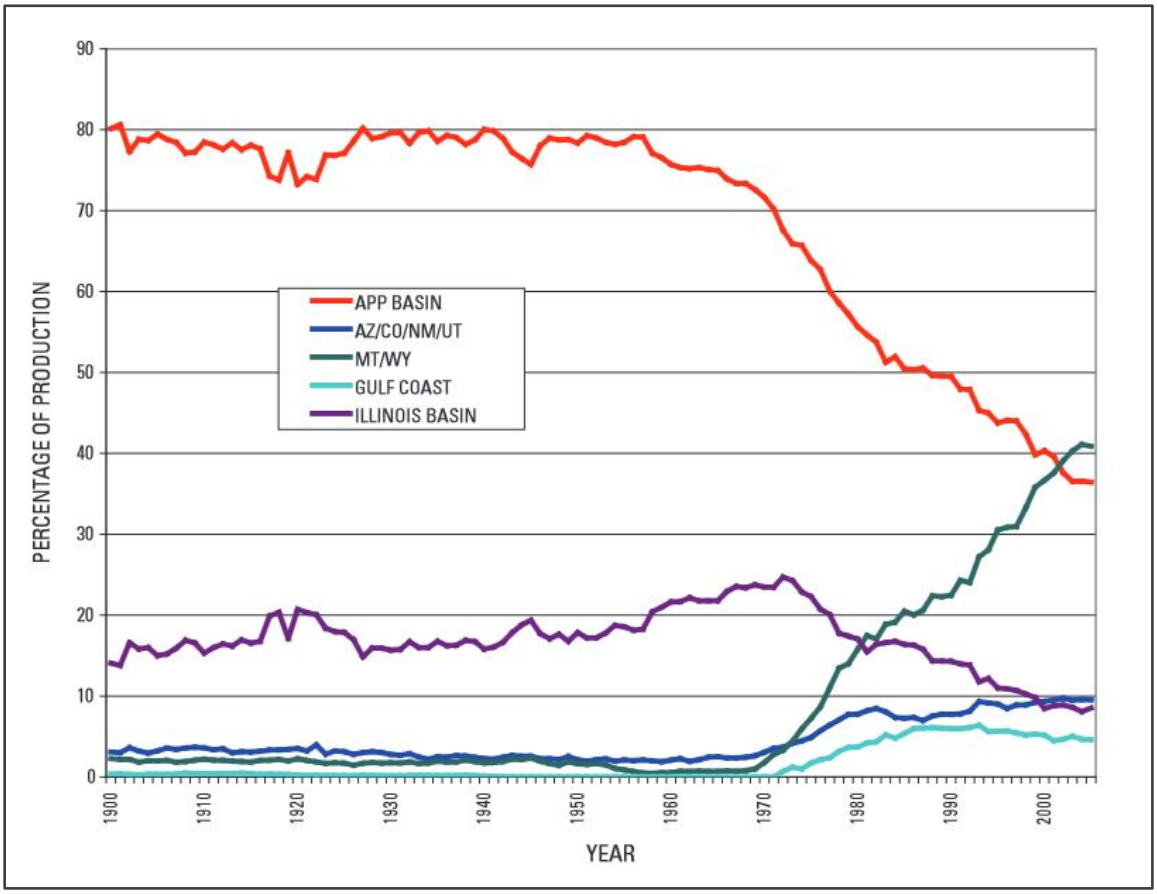


Source: Appalachian Voices, Appalachian Coal Losing Another Customer: Eastern Kentucky as a Case Study, October 24, 2013, http://appvoices.org/2013/10/24/eastern-kentucky-as-a-case-study/

The decline in eastern Kentucky coal production is representative of the larger decline in Appalachian Basin coal. **Figure 6-2** depicts this decline in comparison to competing coal reserves as a percentage of total U.S. coal production.

[47] *https://energy.ky.gov/Programs/Data%20Analysis%20%20Electricity%20Model/KEP_2014.pdf*

Figure 6-2: Historic Coal Production by Geologic Basin



Source: The National Coal Resource Assessment Overview, Chapter H Production and Depletion of Appalachian and Illinois Basin Coal Resources, 2009, http://pubs.usgs.gov/pp/1625f/downloads/ChapterH.pdf

As shown in **Figure 6-2**, eastern Kentucky is included in the Appalachian Basin line (red), while western Kentucky is included in the Illinois Basin line (purple). Kentucky's decline in coal production coincides with the rise of Powder River Basin coal from Montana and Wyoming (dark green line). The ongoing boom in shale gas also played a factor in hastening the decline of Appalachian Basin coal.

As the remaining coal in eastern Kentucky becomes more expensive to mine, coal companies are competing against cheaper fuels including western Kentucky coal, natural gas, energy efficiency, and some renewable sources.[48] The EIA's Annual Energy Outlook projects that Central Appalachian coal production will sharply drop from 2012 to 2020.[49] A recent United States Geological Survey (USGS) Coal Resource Assessment states that annual coal production from the Appalachian Basin will enter a period of irreversible decline over the next several decades.[50]

More than 91 percent of electricity produced in Kentucky is coal-generated. By comparison, coal generates only 39 percent of electricity in the U.S. Natural gas-generated electricity is growing but still

[48] *https://www.kftc.org/campaigns/appalachian-transition/coal-production-and-employment-trends*
[49] *http://www.eia.gov/forecasts/aeo/er/*
[50] *http://pubs.usgs.gov/pp/1625f/*

marginal in Kentucky. Coal has historically been the cheapest and most stable energy source, since it can easily be stockpiled and used when needed, unlike natural gas and renewables. The cost of natural gas has decreased significantly in recent years but is still more expensive than coal. Despite its precipitous decline, coal is expected to remain a major component of Kentucky's energy profile for the foreseeable future.[51]

6.1.1.2 Power Plant Conversions – Coal to Natural Gas

Across the U.S., 27 gigawatts of coal-fired power plant capacity has been retired or is set to be retired by 2017. In Kentucky, more than 40 power plants with 17 gigawatts of electric generating capacity are expected to remain online through 2020. Approximately 5.4 gigawatts of coal-fired generating capacity has recently been retired or will be retired by 2020. Of the approximate 16.8 gigawatts of total capacity expected to be online in 2020, approximately 65 percent are coal-fired, 30 percent are natural gas-fired, 4.8 percent are hydro power, and 0.4 percent are biomass units.[52]

Factors influencing this trend of retiring older, less efficient coal-fired power generators include slowing growth in electricity demand, shifts in relative fuel prices, increasing availability of high-efficiency natural gas combined-cycle power plants, and environmental compliance costs.[53] Most coal generators in Kentucky were constructed between the mid-1950s and 2010, and several have been retrofitted with environmental controls to meet air quality emissions standards. However, many others need further upgrades, as standards have become more stringent.

Since coal has encompassed a large percentage of commodities being moved across Kentucky, the trend of power plant conversions has significant implications on the way freight moves throughout Kentucky's freight system.

6.1.1.3 Kentucky Coal Movement Out of State

Foreign coal remains a small part of total U.S. coal consumption, but Central Appalachian coal is especially vulnerable to the competition as it loses market share to natural gas and coal from elsewhere in the U.S.[54]

In 2013, 39 percent of Kentucky coal stayed in state, while 60 percent was exported out of state. The remaining 1 percent was shipped overseas, representing a new high in Kentucky coal foreign exports. Eastern Kentucky coal was sold mostly to southeastern U.S. states (Georgia being the largest consumer), while western Kentucky coal (59 percent) was mostly used in state. Kentucky remains the single largest user of Kentucky coal, increasing its consumption as other states decreased consumption.

Table 6-1 provides 2012 freight transportation statistics for coal in Kentucky.

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[51] *http://energy.ky.gov/Pages/CoalFacts.aspx*

[52] *https://energy.ky.gov/Programs/Data%20Analysis%20%20Electricity%20Model/KEP_2014.pdf*

[53] *http://www.eia.gov/todayinenergy/detail.cfm?id=7290*

[54] *http://www.mcclatchydc.com/2014/09/22/240660/kentucky-is-hit-hard-as-its-coal.html*

Table 6-1: Freight Statistics – Coal

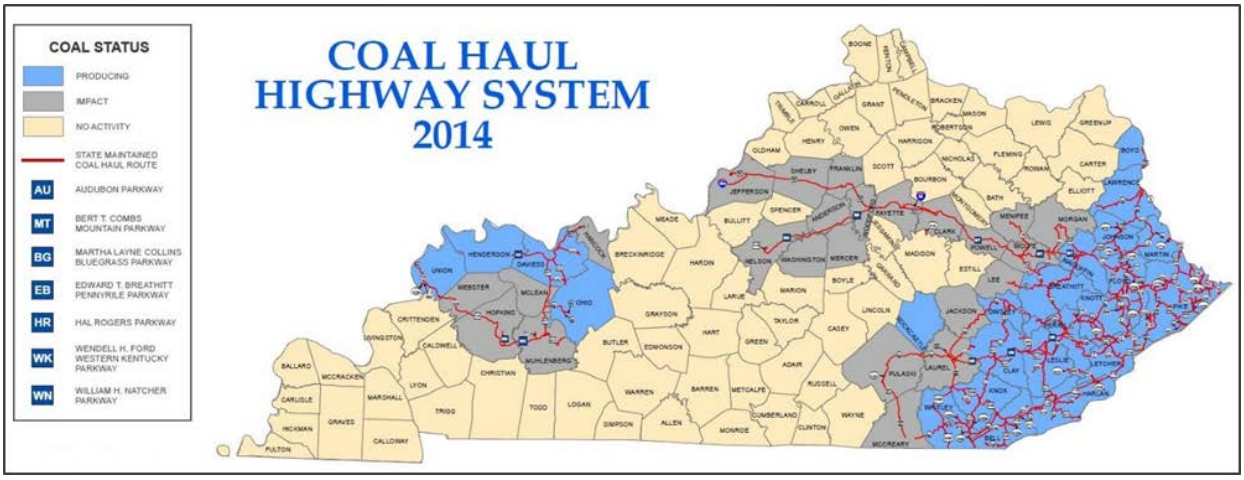
Freight Commodity: Coal	Ton-Miles (millions)			Commodity Ton-Miles Share		Commodity Value Share	
	2007	2012	Change	2007	2012	2007	2012
Within Kentucky	6,862	7,307	6%	31%	32%	1%	2%
From Kentucky	76,189	82,728	9%	59%	59%	4%	4%
To Kentucky	32,832	36,877	12%	36%	37%	0%	0%

Source: Freight Analysis Framework Summary Statistics, 2012

In 2012, coal was the top ranking commodity transported within, from, and to Kentucky by ton-miles. However, by commodity value, coal ranks 7th as an export from Kentucky, and it is ranked outside the top 10 commodities by value as a shipment within and to Kentucky.[55]

Due to the production of coal on the eastern and western portions of the state, significant volumes of coal are shipped on Kentucky's roadways. **Figure 6-3** illustrates the major coal producing counties in Kentucky, the highways on which coal is transported, and the counties included in the road transport of coal.

Figure 6-3: 2014 Kentucky Coal Haul Highway System



Source: http://transportation.ky.gov/Planning/Pages/Coal-Haul.aspx, 2014

In terms of tonnage, commodity transport consists largely of coal on the Ohio River (56 percent in 2010) and the Tennessee-Tombigbee Waterway (69 percent 2010).[56] Railroads are also integral for the delivery of coal from mines to power plants. The Paducah & Louisville Railway annually transports approximately 12 million tons of coal to river terminals located on the Tennessee River, where hopper cars of coal are delivered by rail to an intermodal facility for transloading to truck and delivery to final destinations.

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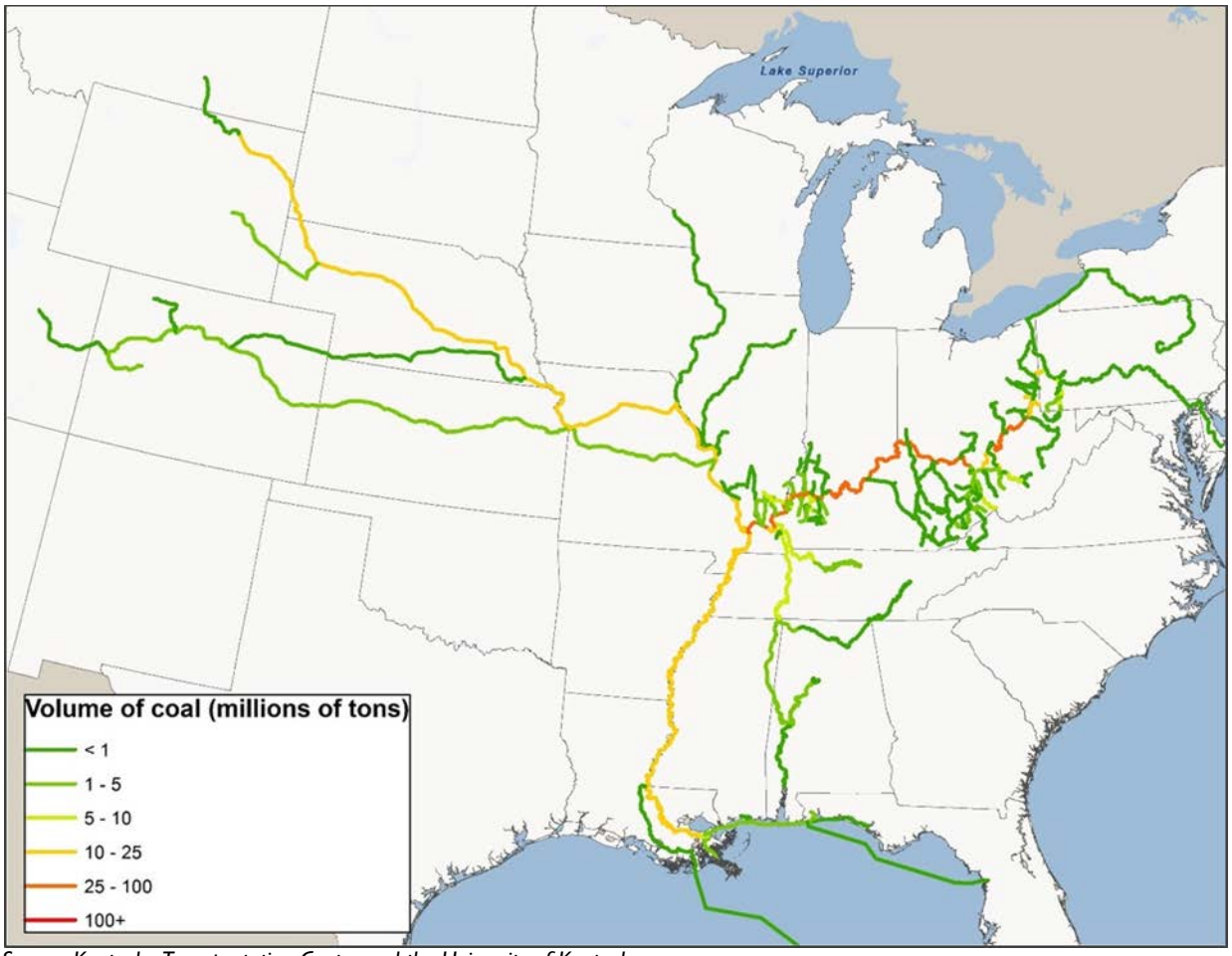
[55] http://faf.ornl.gov/fafweb/FUT.aspx

[56] http://www.lrd.usace.army.mil/Portals/73/docs/Navigation/PCXIN/Inland_Waterways_and_Export_Opportunities-FINAL_2013-01-03.pdf

Figure 6-4 illustrates the full intermodal routes of coal shipments on the Ohio River.

Figure 6-4: Full Intermodal Routes of Coal Shipped on the Ohio River



Source: Kentucky Transportation Center and the University of Kentucky

6.1.2 Automotive

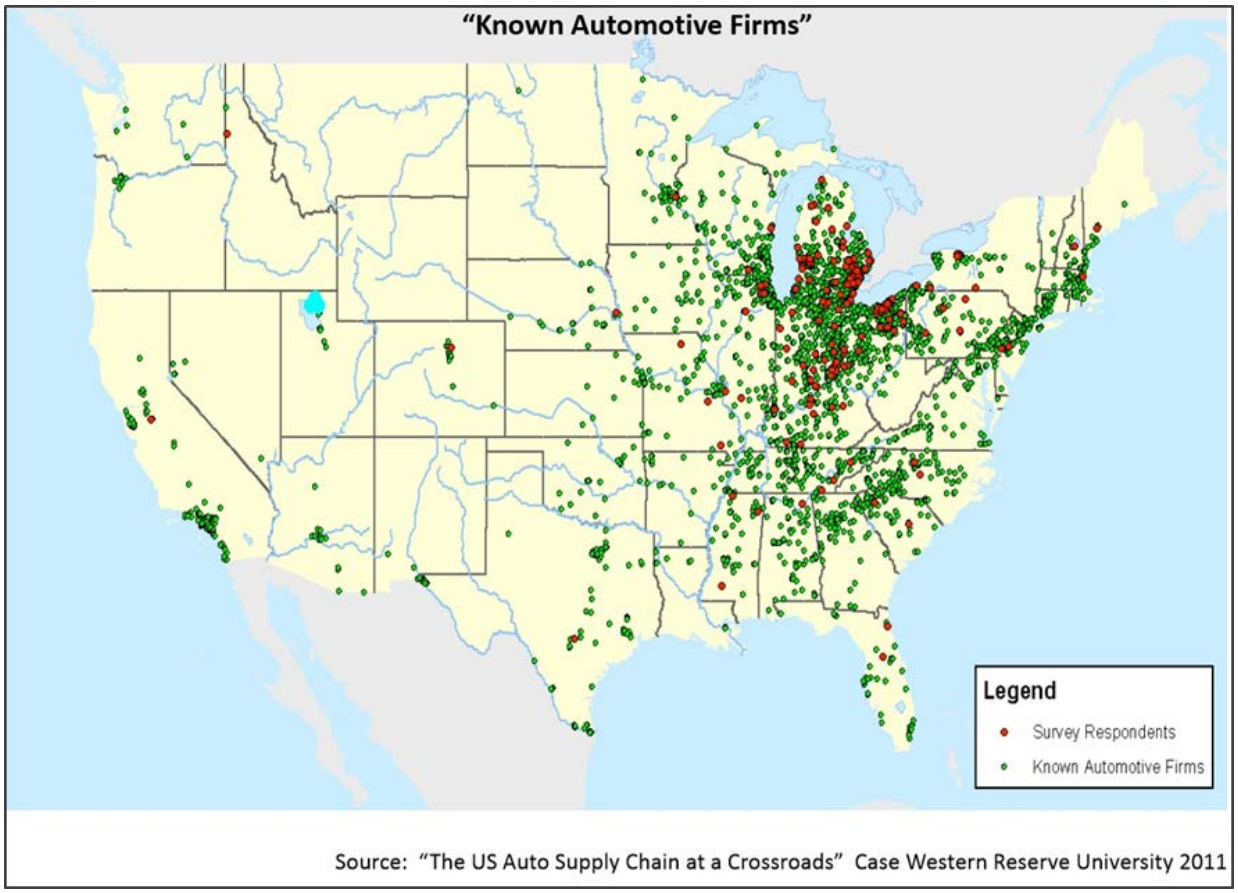
Kentucky is a major player in the auto industry, with four assembly plants and over 450 parts suppliers located in-state. In 2013, Kentucky manufactured over 1.2 million automobiles, which accounted for 11.2 percent of total U.S. auto production, ranking Kentucky third overall (behind Michigan and Ohio) in auto production by state. More specifically, Kentucky ranks third in car manufacturing and second for light trucks. Automotive-related industries represent 2.36 percent of total state GDP, or $908 motor vehicle GDP per capita. The success of Kentucky's automobile industry can be primarily attributed to its geographic location along the north-south rail and highway distribution corridors, which are tapped into North America Free Trade Agreement (NAFTA) flows.[57]

Nationally, a concentration of automotive manufacturing exists along a multistate north-south corridor, roughly following the paths of I-65 and I-75, both of which transect Kentucky and parallel NS and CSXT rail lines. The northern half of auto manufacturing largely consists of domestic manufacturers (Ford, GM,

[57] http://midamericafreight.org/wp-content/uploads/Lambert_AutoIndustryInTheSoutheast.pdf

and Chrysler), while the southern half consists of foreign manufacturers (Nissan, Toyota, BMW, Mercedes-Benz, and Volkswagen). Scattered throughout the U.S. are thousands of parts suppliers and manufacturers who are integrated into the automotive supply chain that extends from Canada to Mexico. **Figure 6-5** is a map of motor vehicle-related firms throughout the U.S.

Figure 6-5: Automotive Industry in the U.S.



Source: Case Western Reserve University, 2011

Louisville is home to two Ford assembly plants: the Kentucky Truck Plant (KTP) and the Louisville Assembly Plant (LAP). The KTP assembles Ford F-Series Super Duty trucks, the Ford Expedition, and the Lincoln Navigator. The Louisville Assembly Plant assembles the Ford Escape and Lincoln MKC, but also has the capability to simultaneously produce the company's Focus, Fiesta, and Fusion models to meet demand.[58]

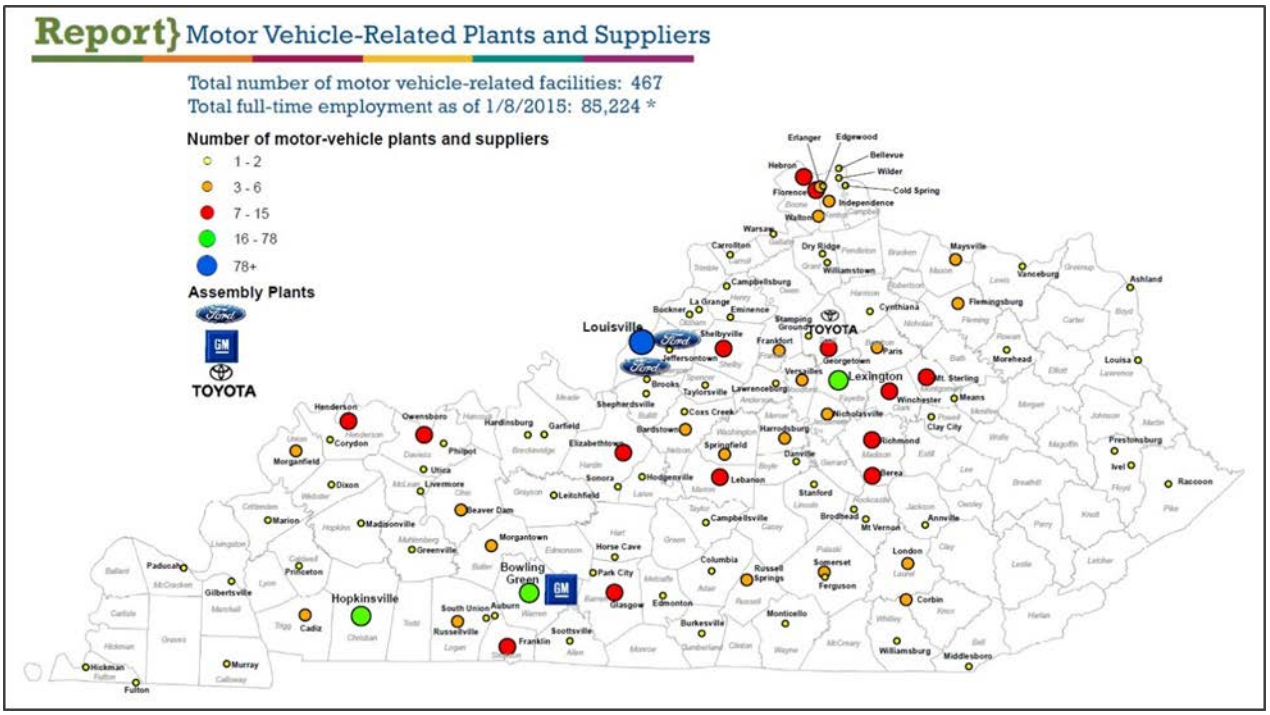
Toyota opened its first assembly plant outside of Japan in 1988 in Georgetown, and today Toyota Motor Manufacturing Kentucky (TMMK) is the company's largest production plant outside of Japan. TMMK has two vehicle production lines and a powertrain, engine, and axle facility. The plant currently assembles the Camry, Camry Hybrid, Avalon, Venza, and Lexus ES 350—becoming the first plant outside of Japan to assemble a Lexus model. TMMK is the only U.S. plant to export Camrys outside of North America. Starting in 2015, TMMK is producing 50,000 Lexus vehicles per year, bringing TMMK's total production

[58] *http://businessclimate.com/kentucky-economic-development/auto-companies-accelerate-investment-kentucky*

capacity to 550,000. TMMK utilizes more than 350 suppliers across the U.S., including approximately 100 in Kentucky.[59] [60]

Lastly, Bowling Green has been the exclusive production home of Chevrolet's high-performance Corvette since 1981.[61] **Figure 6-6** illustrates the automotive-related plants and suppliers in Kentucky.

Figure 6-6: Automotive Industry in Kentucky



Source: Kentucky Cabinet for Economic Development, 2015

Motor vehicles are transported by truck on car carrier trailers, by rail on 'autorack' rail cars, or by sea on car carrier ships. Autoracks have two or three decks and can carry up to 20 vehicles, but the average is around 12 vehicles. Domestically assembled vehicles are transported from assembly plant to dealership either by truck or a combination of truck and rail depending on distance to destination. Costs rise substantially for car carrier truck routes that are more than a few hundred miles. Generally, after vehicles are transported by rail, trucks carry the vehicles for the final leg from the railhead to the dealership, which is typically up to 75 miles. The average rail journey for a new car in the U.S. is approximately 1,300 miles. Automakers, which generate 8 to 9 percent of total rail freight, have little leverage with railroads, since there are no cost-effective alternatives to shipping vehicles via rail. Vehicles assembled overseas arrive into coastal ports and are accepted into the existing domestic transport system.[62] [63]

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[59] http://www.thinkkentucky.com/kyedc/pdfs/kyautoquickfacts.pdf

[60] http://businessclimate.com/kentucky-economic-development/toyota-selects-kentucky-lexus-es-350-production

[61] http://businessclimate.com/kentucky-economic-development/auto-companies-accelerate-investment-kentucky

[62] http://www.autonews.com/article/20120612/oem01/120619973/rail-car-shortage-hampers-auto-shipments

[63] https://www.aar.org/Pages/Freight-Rail-Traffic-Data.aspx#annualrailtraffic

From Kentucky, motor vehicle rail shipments are typically transported from the assembly plant to a regional rail yard, where the rail cars are organized and shipped out to a railhead near their destination market. Toyota in Georgetown and Ford's two Louisville plants are major drivers of rail freight in Kentucky.[64] **Table 6-2** provides freight transportation statistics for motorized vehicles in Kentucky in 2012.

Table 6-2: Freight Statistics – Motorized Vehicles

Freight Commodity: Motorized Vehicles	Ton-Miles (millions)			Commodity Ton-Miles Share		Commodity Value Share	
	2007	2012	Change	2007	2012	2007	2012
Within Kentucky	176	184	5%	1%	1%	21%	22%
From Kentucky	4,628	4,904	6%	4%	4%	26%	25%
To Kentucky	2,144	2,314	8%	2%	2%	12%	12%

Source: Freight Analysis Framework Summary Statistics, 2012

In 2012, motorized vehicles were the fourth ranked commodity transported from Kentucky and the eighth ranked commodity to Kentucky by ton-miles; however, vehicles do not rank inside the top 10 commodities shipped within Kentucky by ton-miles. By value, motor vehicles rank as the top commodity shipped within, from, and to Kentucky.

Continued growth of Kentucky's automotive industry, represented by the growth in commodity ton-miles and commodity value share, will put increased pressure on the freight transportation system in Kentucky, particularly on the rail and highway systems, which bear the brunt of movement of motor vehicles.

6.1.3 Agriculture

Agriculture is geographically dispersed due to its reliance on land. It cannot simply locate near its customers, especially since more and more of those customers are global. Agricultural production depends on a complete transportation system that includes all major modes of transportation (truck, rail, barge, aircraft, and ocean vessel), with their complementary and competitive roles in transporting farm goods. Due to its cyclical nature during annual periods of growth in volume, agriculture, in turn, puts pressure on the transportation system. Many agricultural commodities are perishable, seasonal, and of relatively low value, making efficient and appropriate transportation challenging but critical.

Kentucky remains one of the nation's major agricultural states. Kentucky ranks second among states, after North Carolina, in the production of tobacco. The Commonwealth's other major cash crops are corn, soybeans, and hay. Kentucky's farmers also raise livestock, mostly cattle and horses. The breeding and selling of thoroughbred horses is Kentucky's most valuable source of livestock income. Most of the thoroughbred horses come from the bluegrass pastures located near Lexington.

Agricultural trends in Kentucky are consistent with the trend of population migration out of rural areas and into more urban and suburban settings. Kentucky's rural population share decreased from 69 percent in 1930 to 41 percent in 2010. Increased agricultural efficiency and automation have resulted in

[64] *http://www.lanereport.com/32260/2014/06/freight-rail-still-on-a-roll/*

increased output that, when coupled with advancements in transportation technology, have enabled population growth to occur far from food production.

Between 1950 and 2010, the average farm size in the U.S. increased from 213 acres to 418 acres, while Kentucky's average farm size increased from 86 acres to 163 acres (or by 90 percent) over the same period. Kentucky has 63 percent fewer farms and 29 percent fewer total farm acres in 2010 versus 1950, but over the same period, production volume increased by 283 percent.[65]

The current composition of Kentucky crop production consists primarily of corn, soybeans, and wheat. In 2013, corn accounted for 13 percent of all Kentucky farm revenue ($6 billion), which was a decrease from 18 percent in 2012. Kentucky's production of grains and soybeans provided a net increase of 134 million bushels between 1950 and 2010.[66] In general, crop production in the eastern half of Kentucky has been decreasing while the remainder of the commonwealth has seen an increase in production.

Kentucky's agricultural producers rely heavily on rural infrastructure to transport farm products, as crops are moved from production regions by truck, rail, or barge to elevators and processing facilities. As with most commodities, trucks are often the first and last mode in the transport of agricultural products. Inland waterways are plentiful in Kentucky, with access to the Ohio, Tennessee, Green, and Cumberland rivers; however, inland waterway shipments of grain are much smaller than shipments of coal and aggregates.[67]

Table 6-3 provides freight transportation statistics for all agriculture-related commodities in Kentucky in 2012. The table combines data from the following commodities: live animals/fish, cereal grains, other farm goods, animal feed, meat/seafood, milled grain products, and tobacco products.

Table 6-3: Freight Statistics – Agriculture (All Farm Goods)

Freight Commodity: All Farm Goods	Ton-Miles (millions)			Commodity Ton-Miles Share		Commodity Value Share	
	2007	2012	Change	2007	2012	2007	2012
Within Kentucky	1,796	1,922	7%	8%	8%	6%	6%
From Kentucky	9,166	9,838	7%	7%	7%	5%	5%
To Kentucky	3,015	3,141	4%	3%	3%	4%	4%

Source: Freight Analysis Framework Summary Statistics, 2012

Of all agricultural freight in Kentucky, cereal grains comprise the vast majority of shipments. To provide additional perspective, **Table 6-4** outlines the freight transportation statistics for cereal grains in 2012.

[65] *Soy Transportation Coalition, http://www.soytransportation.org/RuralInfrastructure/KentuckyProfile.pdf*
[66] *http://www.soytransportation.org/RuralInfrastructure/KentuckyProfile.pdf*
[67] *http://www.kentucky.com/2013/12/05/2970927_kentucky-agriculture-forecast.html?rh=1*

Table 6-4: Freight Statistics – Agriculture (Cereal Grains)

Freight Commodity: Cereal Grains	Ton-Miles (millions)			Commodity Ton-Miles Share		Commodity Value Share	
	2007	2012	Change	2007	2012	2007	2012
Within Kentucky	1,228	1,301	6%	6%	6%	1%	1%
From Kentucky	5,941	6,357	7%	5%	5%	1%	1%
To Kentucky	594	628	6%	1%	1%	0%	0%

Source: Freight Analysis Framework Summary Statistics, 2012

6.2 External Trends and Challenges

6.2.1 Panama Canal

The Panama Canal, completed in 1914, created one of the most important trade routes in the world, linking the Atlantic and Pacific oceans. After nearly a century, the canal is undergoing a $5.25 billion expansion to increase capacity and accommodate larger ships. The expanded canal with new locks will allow for deeper, longer, and wider "New Panamax" vessels, doubling existing throughput capacity from 5,000 20-foot equivalent units (TEU) on current vessels to (potentially) 13,000 TEU. The expansion, scheduled to be completed in 2016, should reduce delays and shipper costs and will likely have some impact on future freight flows. The timing and scale of the impacts on Kentucky freight flows are unknown, but it is anticipated that there will be some change in the demands on transportation networks, service, and operations. These impacts may result in needed improvements to ports, railroads, and interstate highways in western Kentucky.

6.2.2 Near-shoring

Some of the world's largest companies have joined a steady stream of smaller companies in a concept known as near-shoring—returning operations to nearby countries. More U.S. businesses are opting to return manufacturing processes to North America from overseas in response to reduced cost advantages of manufacturing in low-cost countries as well as changes in supply chains. An expectation of faster and more direct delivery of goods by the consumer and supply chains becoming more complex—with too many individuals and components—are driving U.S. businesses to start strategizing for near-shoring. Near-shoring allows businesses to streamline their distribution processes so that they are leaner, more efficient, and more collaborative. However, increased investment in freight transportation infrastructure in the U.S., as well as Kentucky, will be needed to improve these supply chains.

6.2.3 Environmental Policy Changes

6.2.3.1 U.S. Clean Power Plan

In August 2015, the U.S. Environmental Protection Agency (EPA) announced the final Clean Power Plan to reduce carbon pollution from power plants, the nation's largest source of power, while maintaining energy reliability and affordability. The EPA also issued final Carbon Pollution Standards for new, modified, and reconstructed power plants and proposed a federal plan and model rule to assist states in

implementing the Clean Power Plan. If the Clean Power Plan is implemented, it could mean potentially less demand for Kentucky coal and thus less use of primary highway routes to ship coal.[68]

6.2.3.2 Alternative Energy Resources

According to the EIA, renewable energy sources and natural gas accounted for 8 percent of the transportation sector's total energy demand in 2015. Forecasts indicate that the consumption of petroleum and diesel fuel in the U.S. may level off over the next 20 to 25 years, as motor vehicles become more fuel-efficient and as renewable sources account for a larger share of the total energy supply for transportation.

In 2015, the EPA proposed rulemaking that would require manufacturers of heavy-duty trucks to increase fuel efficiency by 40 percent over 2010 standards. Current heavy-duty truck fleets average around 6 miles of travel per gallon of diesel fuel. As heavy-duty trucks become more fuel-efficient, Kentucky will likely generate less funding from the state fuel tax.

6.2.3.3 Air Quality and Regulation

The U.S. Clean Air Act regulates areas that do not meet standards for criteria pollutants under the National Ambient Air Quality Standards (NAAQS). In nonattainment areas, federal law requires state and local governments to develop and implement plans for bringing these areas back into compliance. These areas operate under 'maintenance' state implementation plans (SIPs), which often have provisions affecting the transportation network.

As they relate to freight, project delays only prolong bottlenecks for truckers (who carry goods to other parts of the system). Air quality regulation under the Clean Air Act is yet another factor driving environmental improvements in truck emissions and fuel use.

Additionally, the EPA is adopting more stringent exhaust emission standards for large marine diesel engines; the overall strategy includes adjusting Clean Air Act standards and implementing international standards. By 2030, the measures are expected to reduce annual nitrogen oxide (NOx) emissions in the U.S. by approximately 1.2 million tons and particulate matter emissions by 143,000 tons.[69] As trucking companies are required to retrofit exhaust systems or purchase new compliant trucks to meet more stringent requirements, the associated costs will mean higher operating expenses for shippers, which in turn will lead to higher costs to transport goods.

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[68] *U.S. EPA website, http://www.epa.gov/cleanpowerplan/fact-sheet-overview-clean-power-plan, Accessed December 30, 2015*

[69] *U.S. EPA Office of Transportation and Air Quality. "EPA Finalizes More Stringent Standards for Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder." Available at http://www.epa.gov/nonroad/marine/ci/420f09068.pdf*

6.2.4 New Technology

6.2.4.1 Dedicated Freight Infrastructure

As freight volumes have increased across the U.S. during the past several decades, concepts for dedicated freight infrastructure—like autonomous freight vehicles and dedicated truck lanes—increasingly have entered the transportation discussion.

Dedicated truck lanes physically separate commercial vehicles from passenger vehicles or mixed traffic flows. In recent years, states including California, Florida, Georgia, Indiana, Missouri, Ohio, and Texas have examined dedicated truck lane concepts. Separating vehicle streams introduces a new level of complexity in highway design (e.g., on-/off-ramps) and operations (dealing with incidents or breakdowns). To date, there are no dedicated truck lanes in Kentucky, and those that do exist elsewhere tend to be relatively short routes serving ports or key border crossings. Benefits associated with dedicated truck lanes include significant safety gains, the potential of adopting high productivity vehicle (HPV) configurations, and the possibility of advanced technologies such as Intelligent Vehicle Initiatives (IVI) and the autonomous truck or self-driving truck.

Division of Planning closely monitors KYTC's proposed changes in overweight / over dimension records. The new program will enable the freight staff to track routes approved by permit. This is no available with the current data system. KYTC will explore dedicated freight infrastructure when travel by heavy vehicles (including mining, agricultural, energy cargo or equipment, timber vehicles, and containerized freight) substantially deteriorates the condition of roadways significantly more than currently observed. KYTC plans to review and update the National Network in 2018 as needed to reflect movement of freight by overweight / over dimension vehicles. Routes with substantial deterioration as a result of freight movement will be identified at that time.

6.2.4.2 E-Commerce and Drone Delivery

Electronic commerce (e-commerce) is the use of electronic devices and technologies to conduct commerce, or trade, including buying products on the internet and electronic banking. E-commerce has increased from 0.6 percent of total retail activity in 1999 to 6.7 percent in the fourth quarter of 2014.[70] To compete, traditional retailers such as Wal-Mart, Target, Lowes, and Home Depot have implemented new strategies like 'buy on-line, pick up in store" and have established more local distribution centers to create expedited supply chains. E-retailers like Amazon and eBay have constructed a series of centralized distribution centers. This rapid e-commerce requires fast, on-time delivery, which is sensitive to distance and congestion, among other factors. A result of this trend is a higher number of delivery vehicles entering into residential neighborhoods. As residential deliveries increase, a potential concern is an increase in related congestion and wear and tear to the local road network.

One emerging potential alternative strategy for home delivery uses unmanned aircraft, also known as drones. A drone is defined as an unmanned aircraft or ship guided autonomously or by remote control. While drones help relieve congestion and traffic on the local road network caused by e-commerce delivery vehicles, they present their own set of challenges, particularly in how their use is governed and

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[70] *U.S. Census Bureau, Quarterly Retail E-Commerce Sales 4th Quarter 2014, http://www.census.gov/retail/mrts/www/data/pdf/ec_current.pdf*

in avoiding over-crowded air space. In February 2015, the FAA released proposed rules governing the use of drones for commercial purposes.

6.2.4.3 Automated and/or Connected Vehicles

KYTC plans to test Dedicated Short Range Communication (DSRC) technology enabling two-way communications between vehicles and infrastructure (V2I). This investment has enormous potential of returning safety and economic benefit to all users of Kentucky's transportation system. Below are potential DSRC Transportation Applications for Public Safety and Traffic Management that US DOT has identified.

- Traffic and travel condition data to improve traveler information and maintenance services
- Intersection collision avoidance and movement assistance
- Commercial vehicle clearance and safety inspections
- Transit or emergency vehicle signal priority
- Approaching emergency vehicle warning
- Electronic parking and toll payments
- Vehicle safety inspection
- In-vehicle signing
- Rollover warning

For automated vehicles, inventory of signage and pavement markings are loaded into the technology of the vehicles. KYTC is aware and planning accordingly.

KYTC is preparing for smart technology. US 31W (Dixie Highway) in the City of Louisville was an applicant for US DOT's Smart City Challenge. KYTC is also supporting ongoing research through the Kentucky Transportation Center at the University of Kentucky intended to review existing Statute, Regulation, and Policy for barriers to Automated and/or Connected Vehicles. A notable barrier to allowing truck platooning exists in KRS 189.340, as follows:

> KRS 189.340 (8)(b): The operator of any motor truck, semitrailer truck, bus, or heavy construction equipment unit, when traveling upon a highway outside of a business or residential district, shall not follow within two hundred fifty (250) feet of another such vehicle or equipment unit. This subsection shall not prevent overtaking and passing, nor shall it apply to any lane specially designated for use of motor trucks or semitrailer trucks, buses or heavy construction equipment units.

Another notable barrier to automated vehicles exists in many Kentucky statutes where passages reference a *person* operating a vehicle.

Another form of testing is through the National Connected Vehicle SPaT Deployment Challenge, newly initiated by AASHTO, in partnership with the Institute of Transportation Engineers (ITE) and Intelligent Transportation Society of America (ITS America). This program will support all states to install DSRC equipment on a 20-signal corridor by the year 2020. The potential of both fuel savings and safety improvements has the attention of much of the transportation community. Kentucky is planning to make this investment. More information about the AASHTO National Connected Vehicle SPaT Deployment Challenge can be viewed at http://www.transportation.org/spatchallenge. KYTC is also exploring how to develop a conduit/fiber program through partnership with communications companies.