



KDOT Scenario Planning Factbook

August 13, 2019



Table of Contents

About the Factbook	2-3
People	3-8
Freight	8-10
Resiliency	10-13
Technology	13-16
Economy	16-19
Electric Vehicles	19-22
Connected and Autonomous Vehicles	22-24
Mobility as a Service	24-26
Healthcare	26-27
Kansas Transportation Background	28-29

About the Factbook

- The following issues and trends were compiled from a **variety of sources**.
- Some information presented includes expert projections of what they believe will happen in the future based on current trends. However, **experts have been wrong before**.
- KDOT does not “endorse” any of these projections; rather this information was utilized to develop **plausible future scenarios**.
- And it may be helpful for you to review this information as you complete the scenario planning exercise.

A modern transportation system

Moves



People



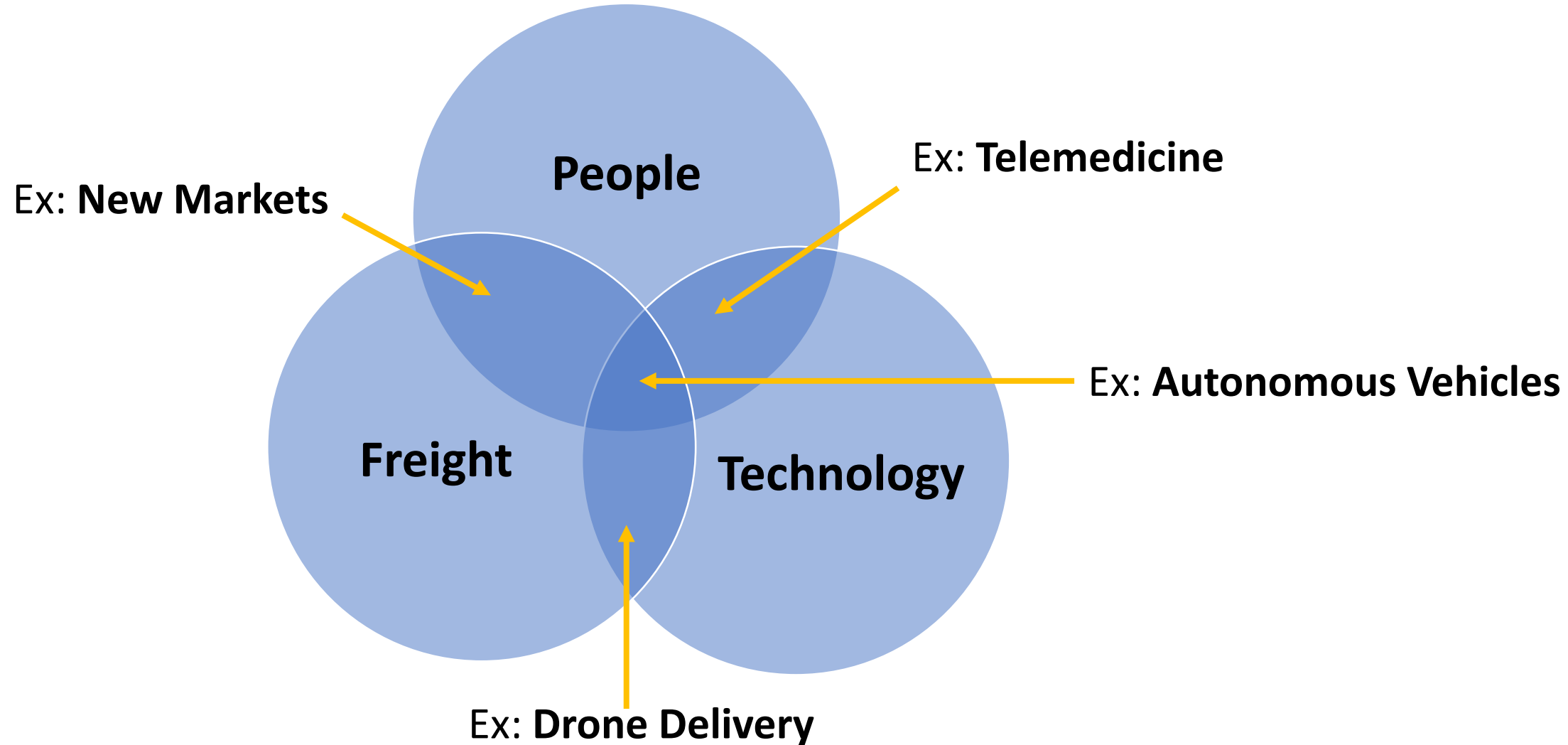
Freight



Technology

Issues overlap

Topics assigned to one section to avoid repetitiveness



People

A large, diverse crowd of people is shown at an outdoor festival or concert. Many individuals have their arms raised in the air, some holding up smartphones to take photos or videos. The crowd is dense and appears to be in a state of excitement. The background features lush green trees under a bright sky, suggesting a park or festival setting. The overall atmosphere is one of joy and community.

Our Plan Horizon is
2045

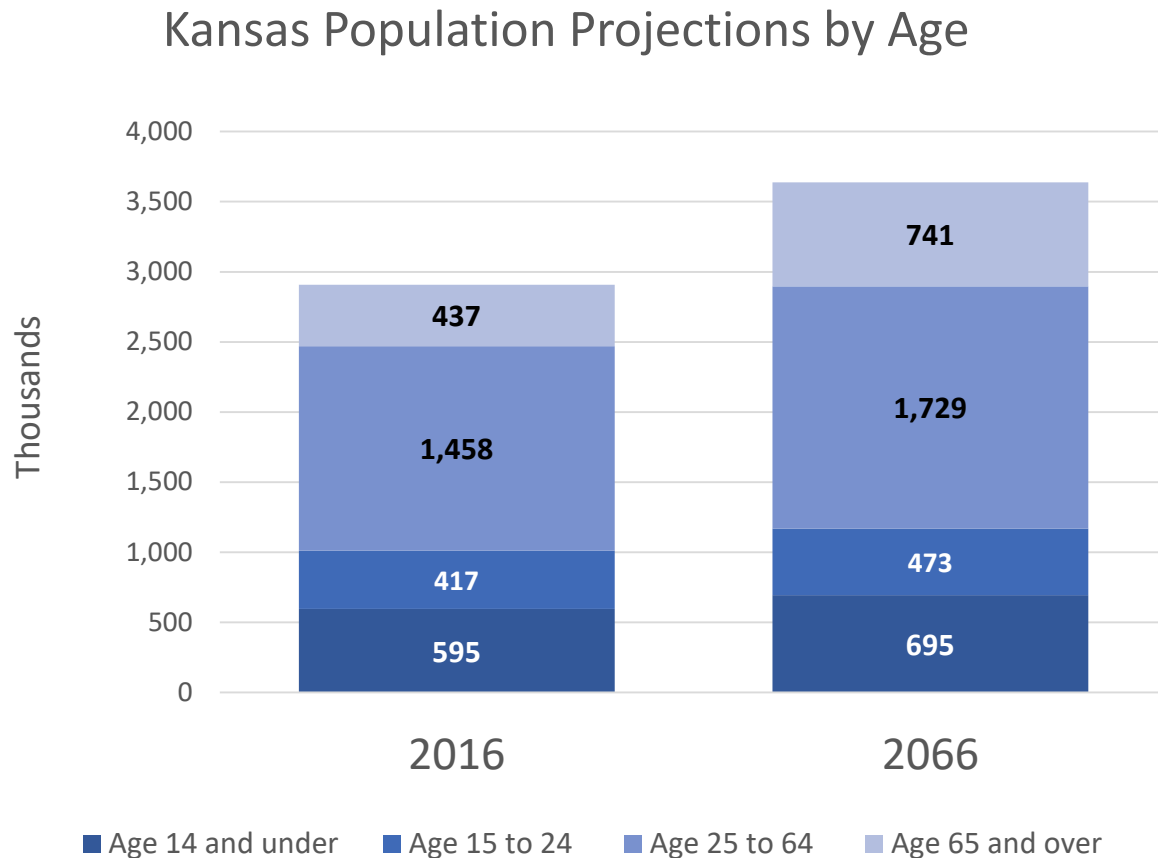
31%

of Kansans in 2045 have
not been born yet

Because transportation investments are designed to serve generations, the State's changing demographics raise the following kinds of questions:

- How will changes in population impact demands on infrastructure?
- How will changes in population impact revenues available to support & maintain infrastructure?
- How will mobility needs vary by age group?
 - E.g. What will an increasing elderly population mean for transit service?

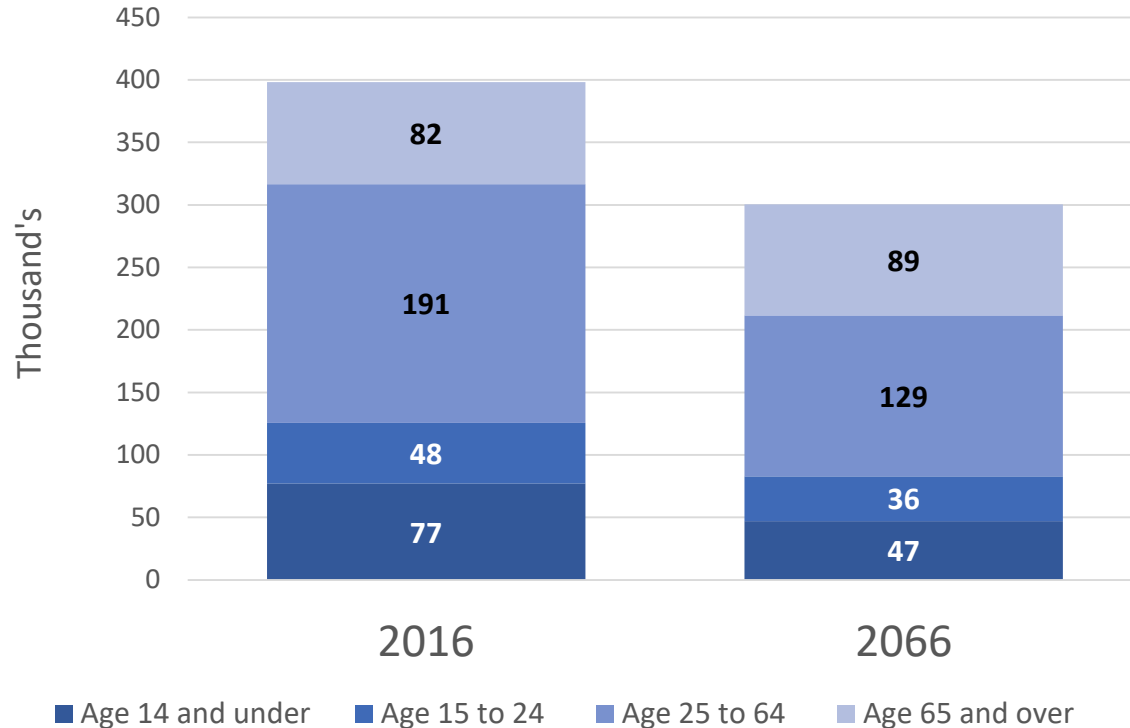
Seniors will be an increasingly significant fraction of total population



Kansas Population Percentage Change 2016-2066	
<i>Age 14 and under</i>	17%
<i>Age 15 to 24</i>	13%
<i>Age 25 to 64</i>	19%
<i>Age 65 and over</i>	70%

Particularly in rural areas

Kansas Population Projections by Age: Eastern & Western Rural Region



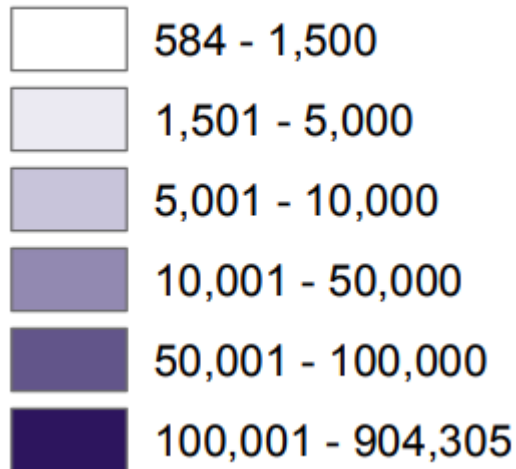
Eastern & Western Rural Region Population Percentage Change 2016-2066

<i>Age 14 and under</i>	-39%
<i>Age 15 to 24</i>	-26%
<i>Age 25 to 64</i>	-33%
<i>Age 65 and over</i>	9%

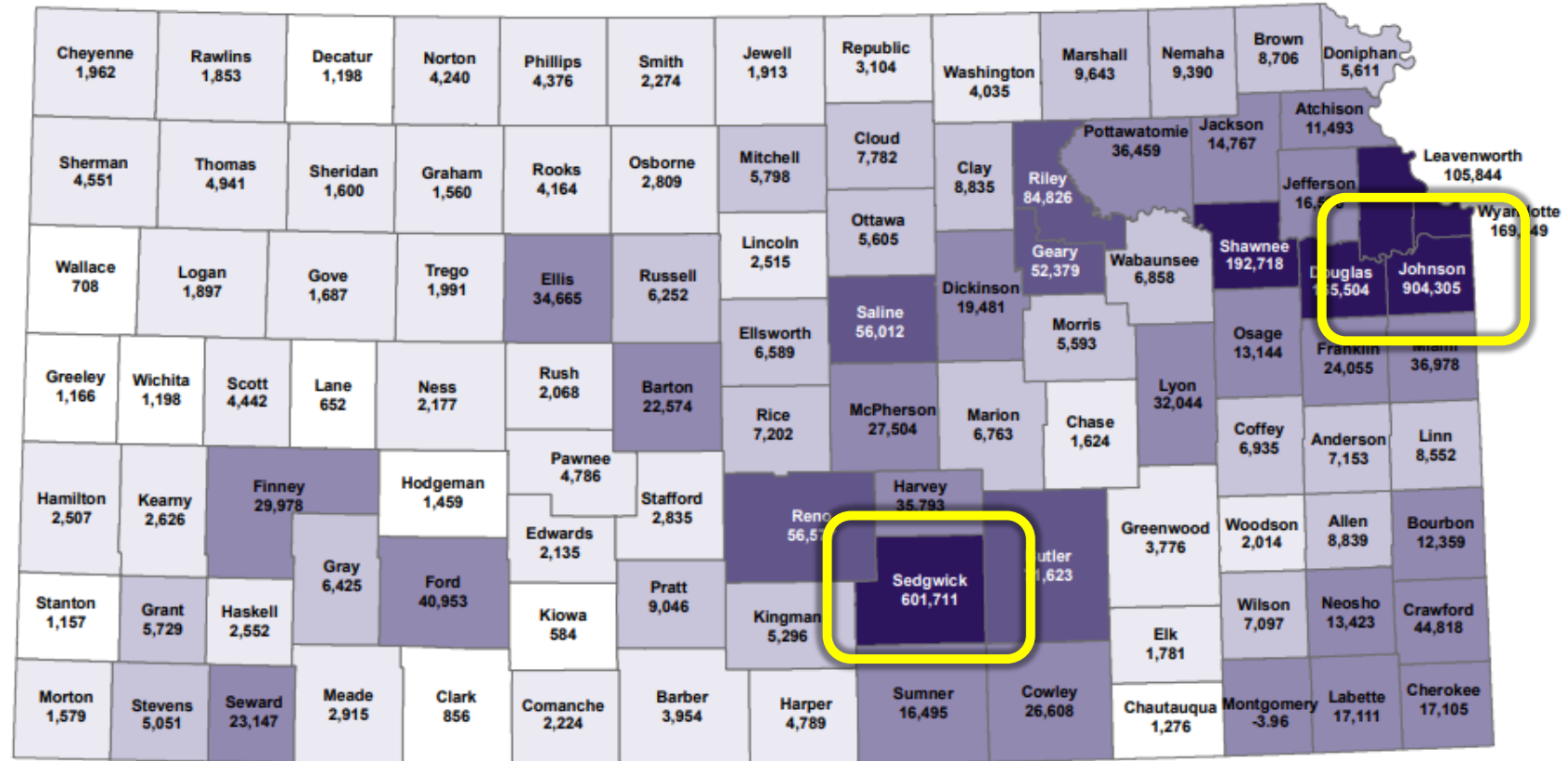
In 2044, almost half of Kansans are expected to live in Sedgwick or Johnson Counties

Projected Population in Kansas, by County, 2044

Projected Population



State: 3,240,702

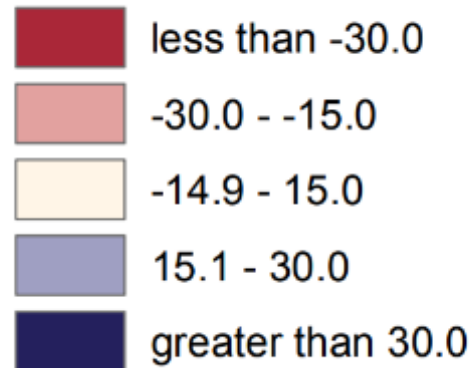


Source: Institute for Policy & Social Research, The University of Kansas

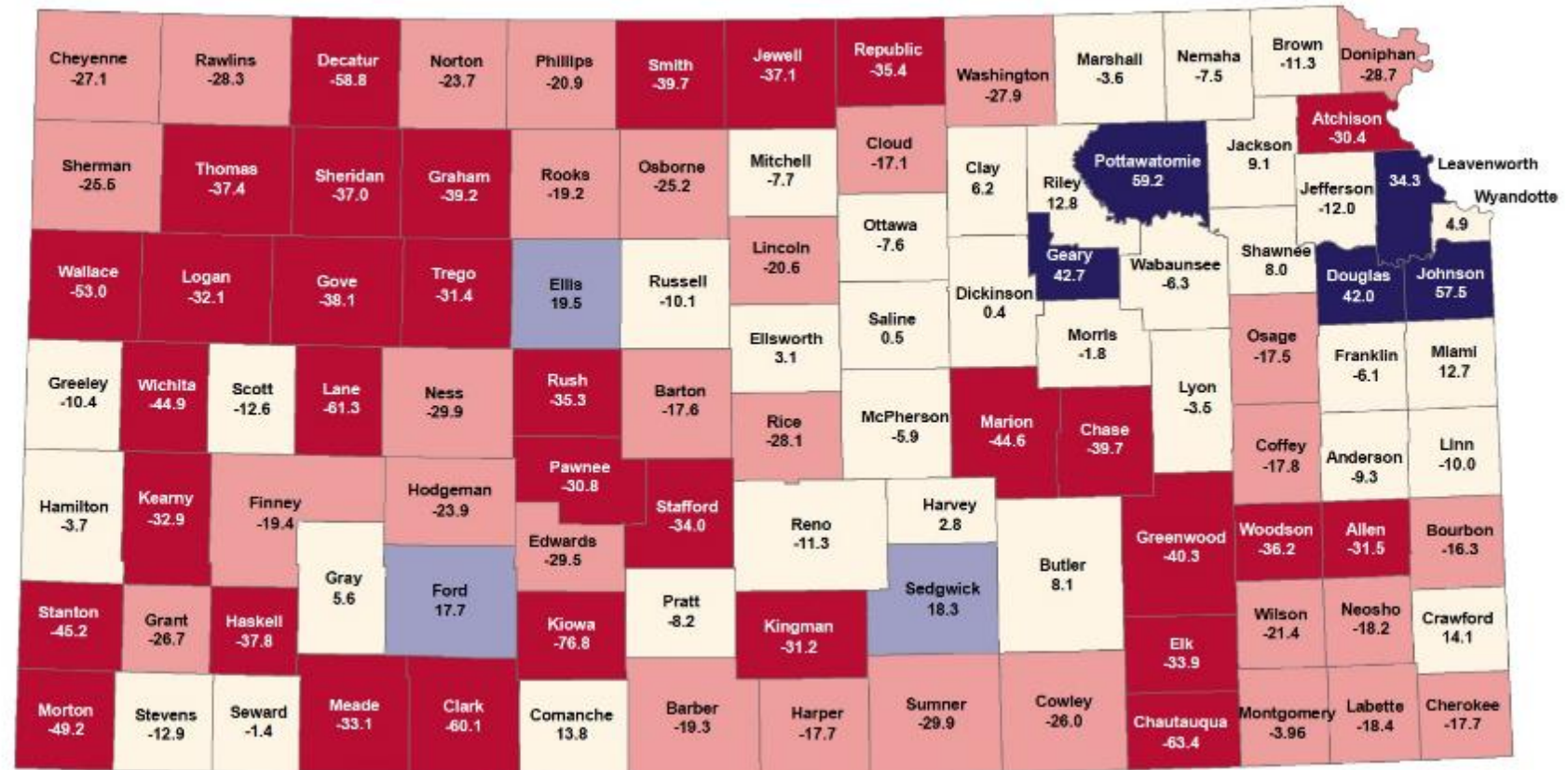
Projections show Kansas growing by 11.6% or about 329,000 people by 2044

Projected Percent Population Change in Kansas, by County
2014 - 2044

Percent Population Change



State: 11.6



Source: Institute for Policy & Social Research, The University of Kansas

Population projections can be wrong

From 2010 to 2017, the number of 20 to 39-year-olds grew by 4% in rural Kansas, defying previous projections.

Rural areas need housing that's affordable

Jobs Are Plentiful In Some Rural Areas. Housing Not So Much.

By GRANT GERLOCK - JAN 15, 2018

Rural Housing Crisis Looms For Low-Income Renters

The nation is not keeping pace with repairing and replacing more than 400,000 affordable rentals.

12/27/2018 11:06 am ET | Updated Dec 28, 2018

Housing Affordability Crisis Spreads to Rural America

By STATELINE | MARCH 25, 2019 AT 7:20 AM

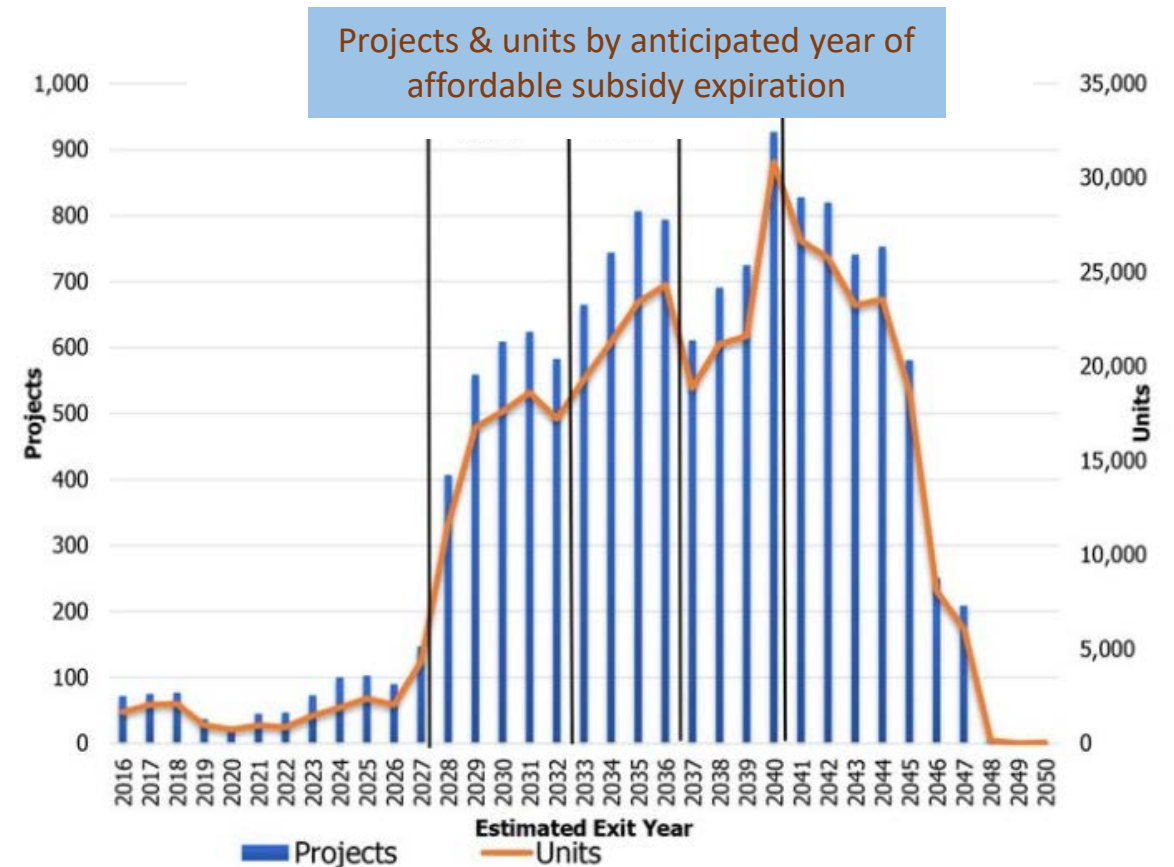
Housing's hidden crisis: Rural Americans struggle to pay rent

By AIMEE PICCHI
APRIL 10, 2019 / 5:00 AM / MONEYWATCH

Dodge City manager offers blueprint for dealing with rural Kansas housing shortage

By Tim Carpenter
Follow
Posted Feb 21, 2019 at 4:47 PM
Updated Feb 21, 2019 at 7:55 PM

Potential loss of affordable rental units and properties in rural America



Source: Housing Assistance Council

Freight



UPS could receive FAA approval to conduct drone delivery nationwide by end of year according to news reports



Medical delivery drones used in developing countries could soon help rural Americans



“*[This program] is an important first step towards bringing Zipline’s lifesaving drone delivery technology to the United States.*”

– Keller Rinaudo, CEO of Zipline

- California-based company specialized in **medical deliveries**
- Has made **over 17,000 deliveries** from operations in Africa
- Drones can carry up to 4 lbs. and travel at **68 miles per hour**
- Recently **secured FAA permission** to make deliveries in North Carolina

Technology is re-shaping engines of growth

Chart of the Week

THE LARGEST COMPANIES BY MARKET CAP

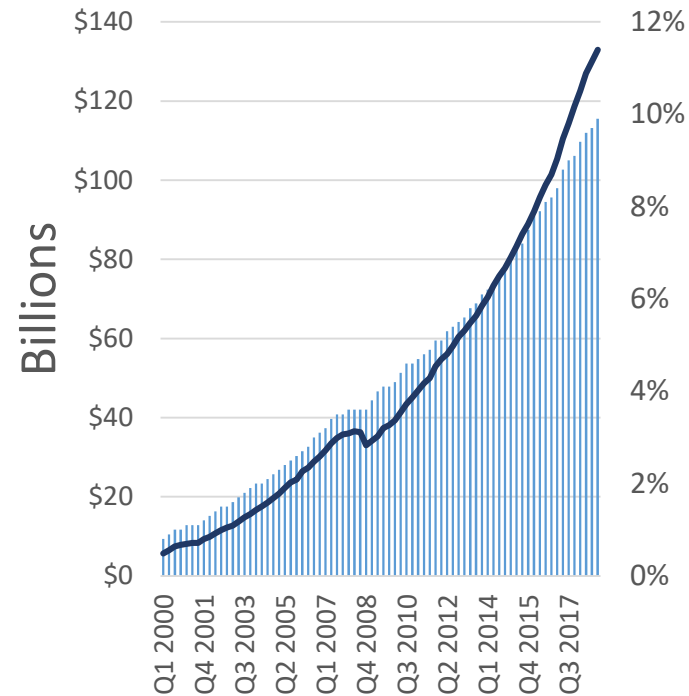
The oil barons have been replaced by the whiz kids of Silicon Valley



visualcapitalist.com

Image source: Visual Capitalist

Growth in E-Commerce

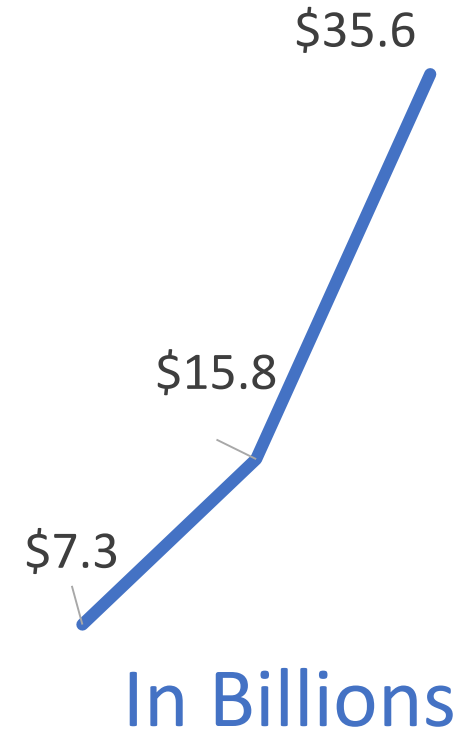


■ E-Commerce as Percent of Total Retail Sales

— E-Commerce Retail Sales

Source: US Census Bureau E-Commerce Report

3D Printing Growth Forecast



In Billions

2017 2020 2024

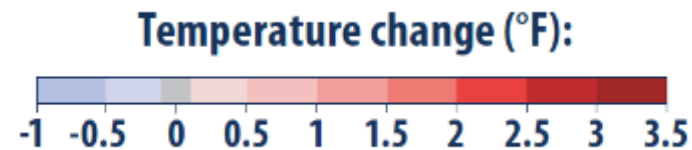
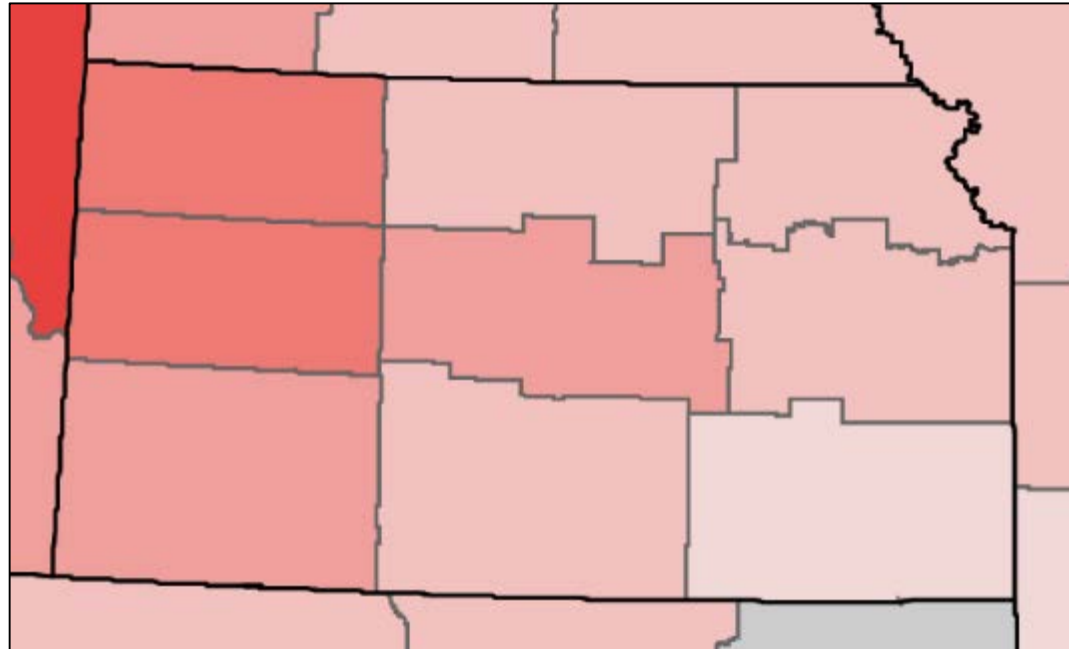
Source: Wohlers Report 2019

Because we are seeing more frequent extreme weather events, making our transportation system more resilient raises the following questions:

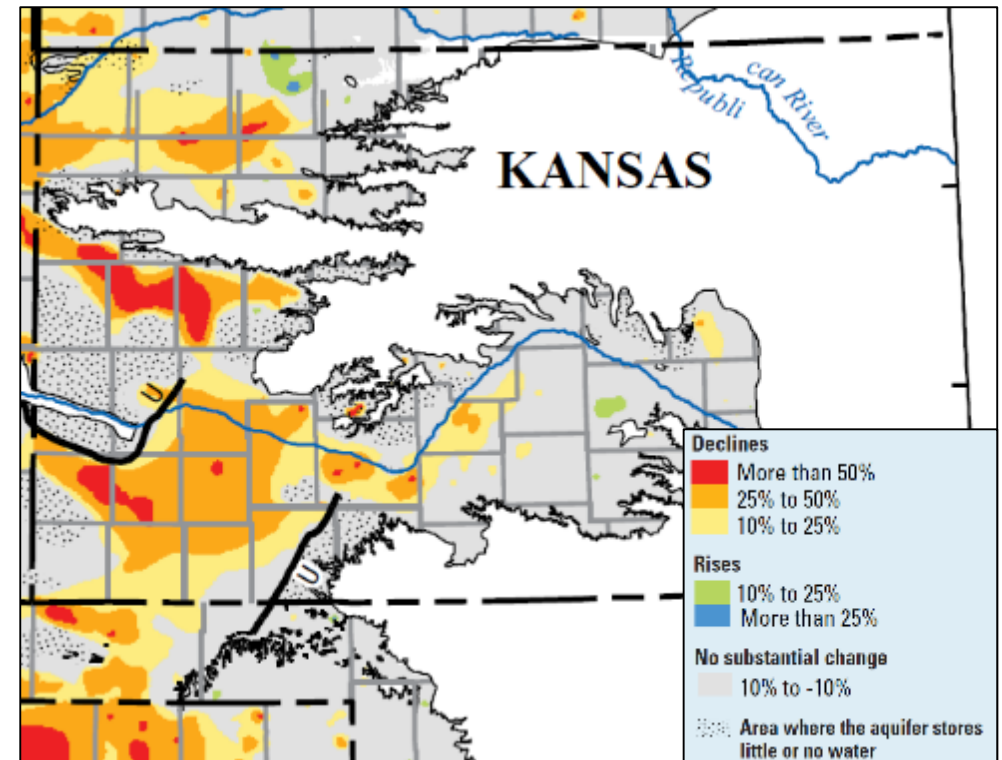
- How will changes in frequency of severe weather impact planning for development of infrastructure?
- How can we design and maintain infrastructure to handle extreme weather events, such as extreme heat and flooding?

Higher temperatures are leading to drier soils and a depletion of water sources

Rising temperatures in the last century

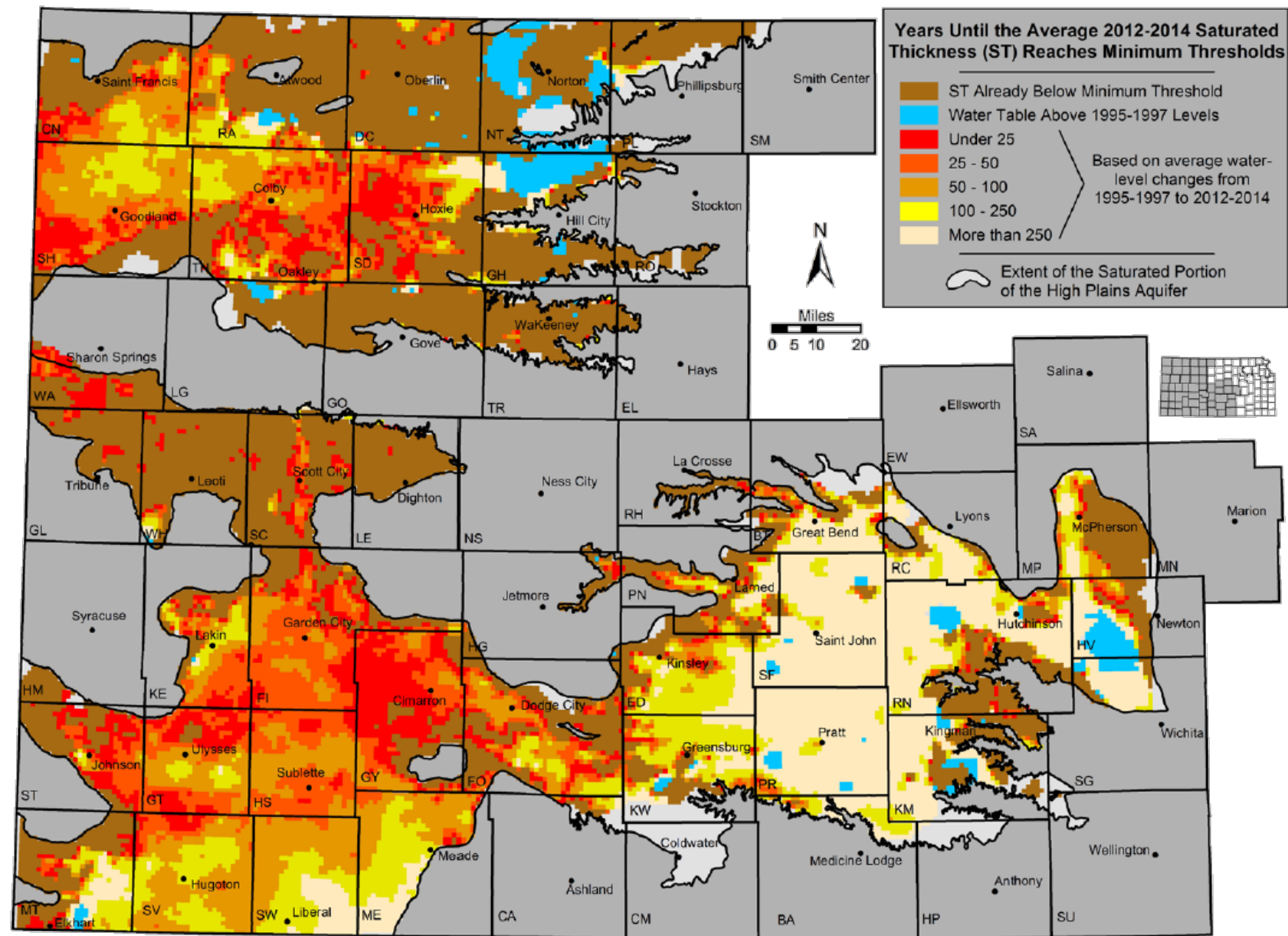


Percent depletion of ground water in the High Plains Aquifer, 1950-2013



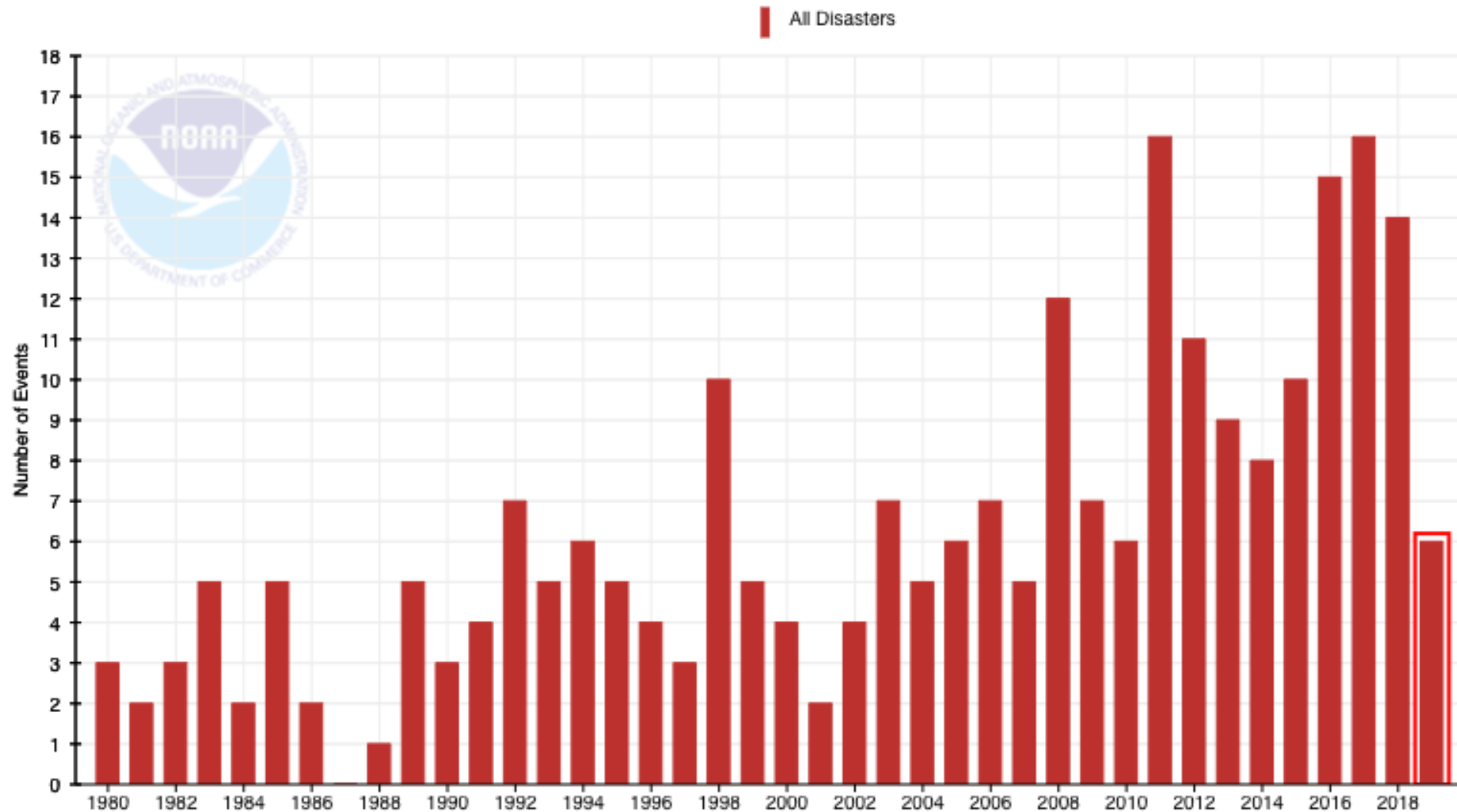
The High Plains/
Ogallala Aquifer
serves as a major
source of water for
Western Kansas.

Once considered a
limitless “underground
ocean”, there is
actually much
variability with some
areas showing less
than 25 years of
water availability.



Frequency of billion-dollar disasters in U.S. is growing

Billion-Dollar Disaster Event Types by Year (CPI-Adjusted)



Source: National Oceanic and Atmospheric Administration (NOAA)

Hays road buckles due to heat

“U.S. may face **\$19 billion** in extra paving costs by 2040 if engineering standards of practice for asphalt are not updated to reflect warmer average temperatures.”

Source: B. Shane Underwood, Zack Guido, Padmini Gudipudi, Yarden Feinberg
Increased costs to US pavement infrastructure from future temperature rise Nature Climate Change
2017 Vol: 7 (10):704-707.

<https://www.kwch.com/content/news/Hays-road-buckles-due-to-heat-512810541.html>



Flooding along KS Turnpike in Sumner County

Weeks of flooding in May/June 2019 left [over 100 miles of Kansas roads and highways under water](#) for days. Understanding the extent of the damage and subsequent costs can take years.

<http://www.kake.com/story/40622762/kake-news-investigates-the-cost-of-flooded-roads-and-bridges>

[Widespread heavy rainfall](#) caused Slate Creek to flood over onto Interstate 35 washing out concrete barriers and forcing a shut down in both directions.

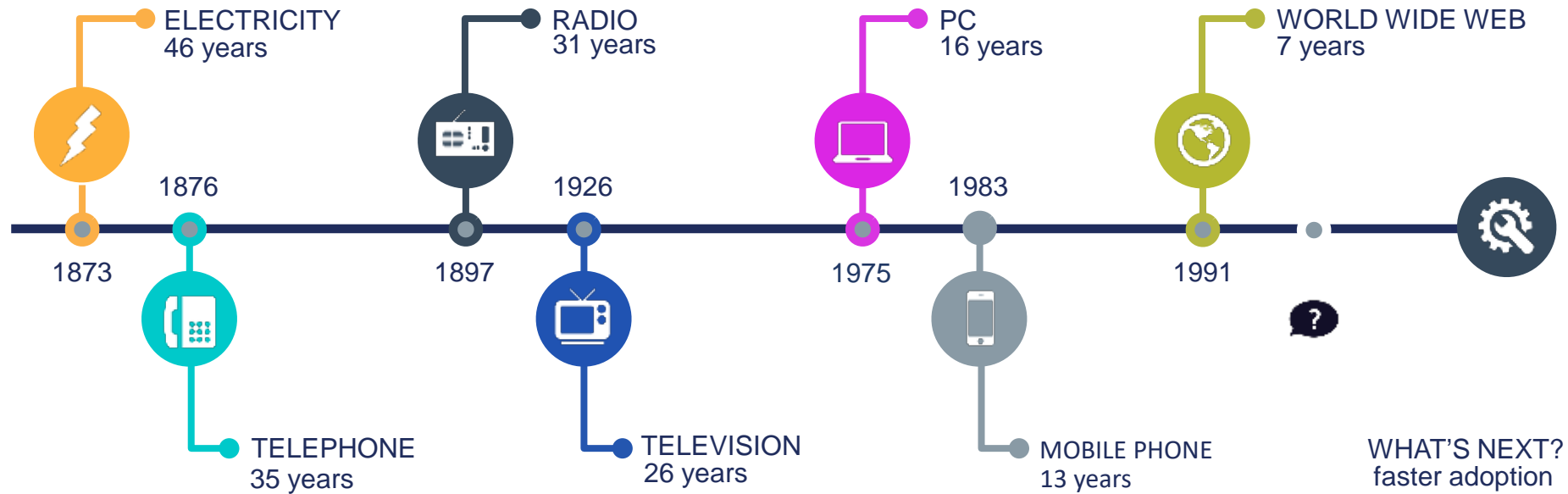
<https://www.kwch.com/content/news/Turnpike-closure-continues-with-water-covering-road-509662501.html>

Photo credit: <https://www.kansas.com/news/weather/article230187749.html>

Technology



PACE OF CHANGE IS ACCELERATING

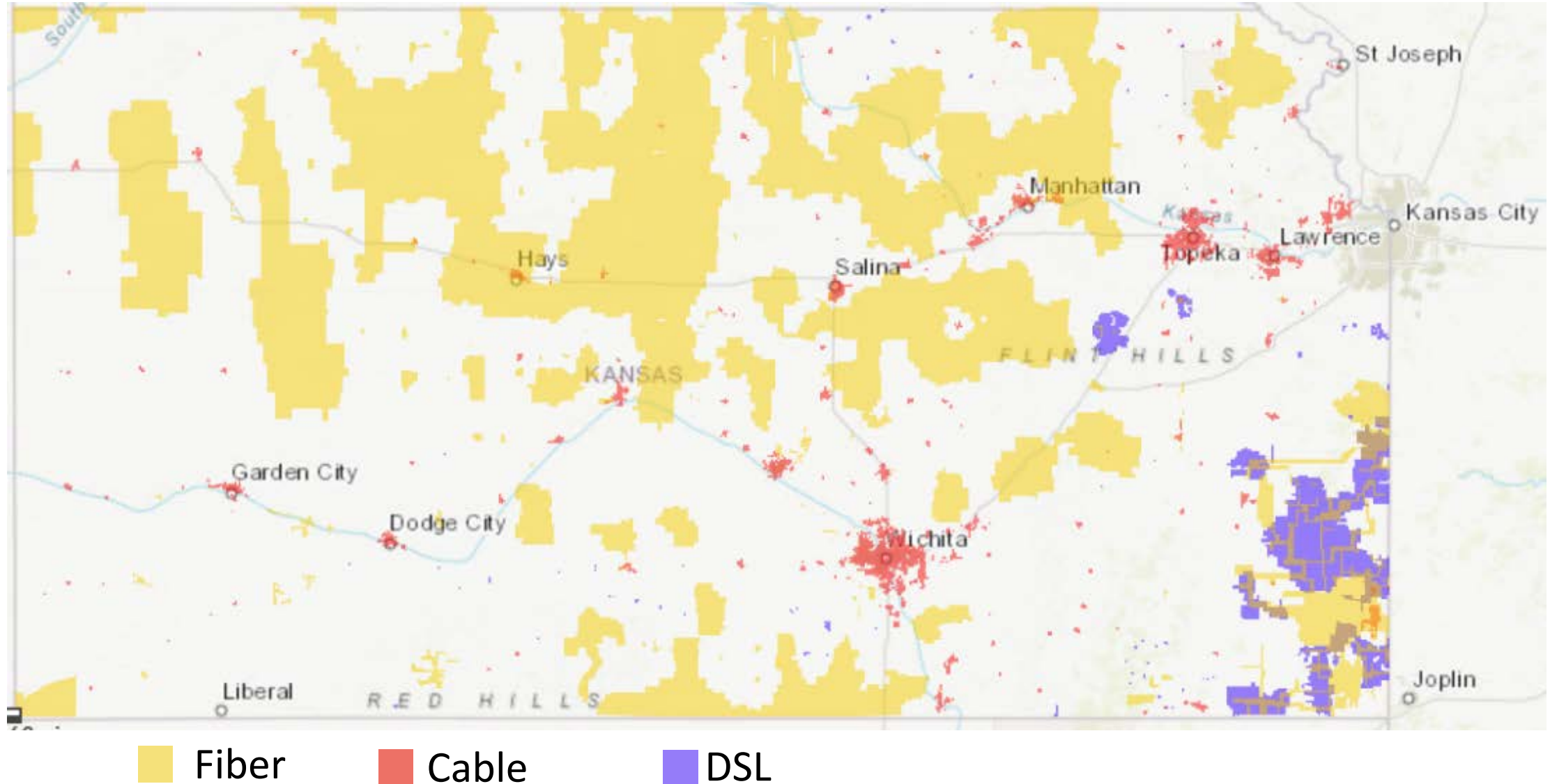


Years until technology was used by one-quarter of Americans

Broadband usage continues to increase which raises the following questions:

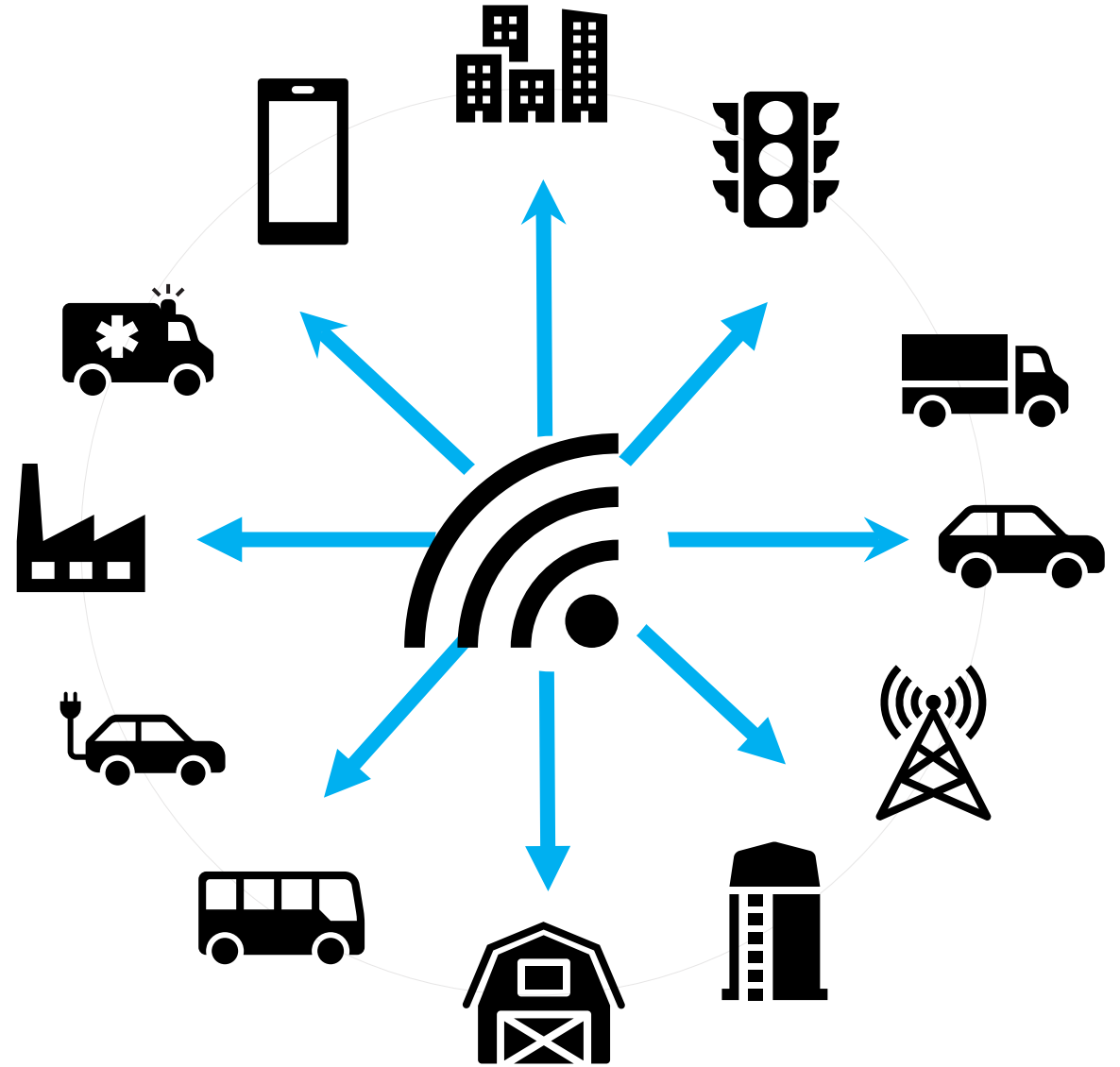
- How much additional broadband expansion needed to support transportation innovations?
- How will broadband influence the health of communities?
- Will community health affect the transportation needs of the region?

Current areas with broadband access



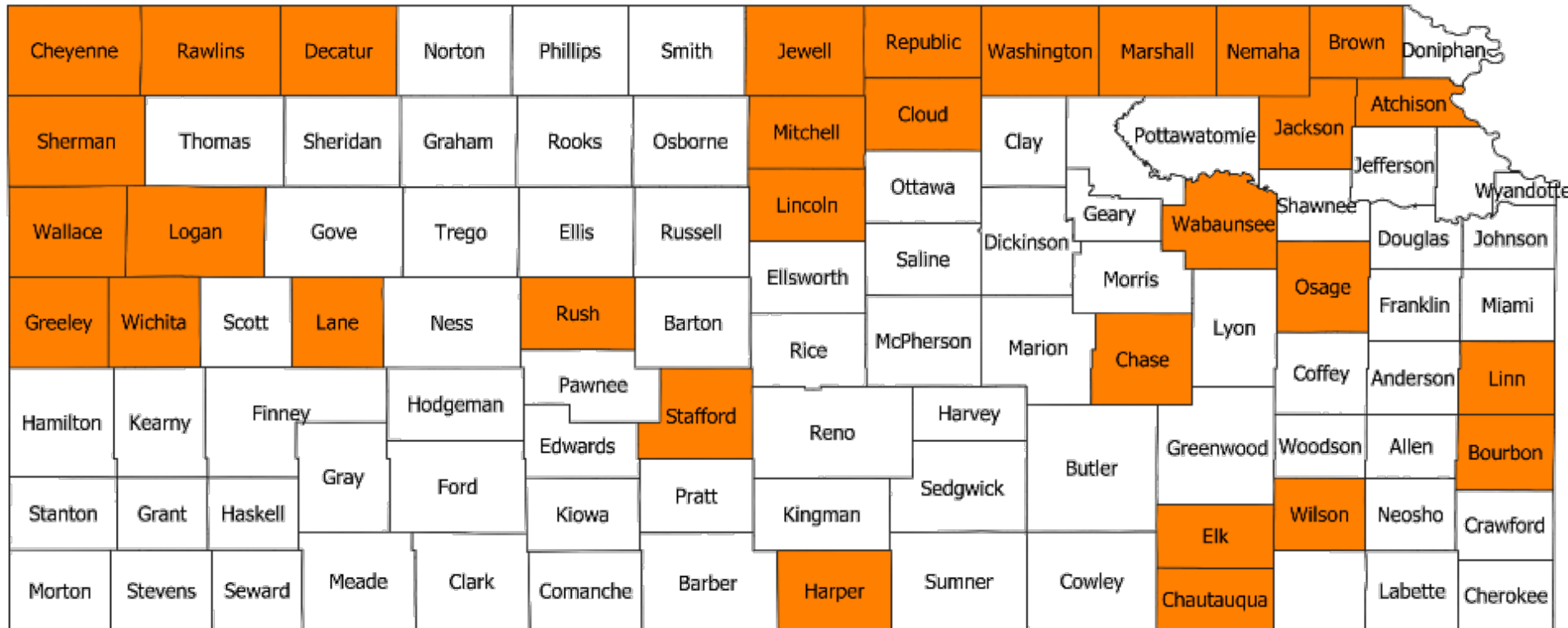
Source: Connected Nation, Kansas Broadband Map

Broadband is an enabling technology for fully connected transportation



Lack of Broadband access can create a “double burden” for counties in Kansas

Counties where less than 50% have broadband access & more than 10% of adults have diabetes.

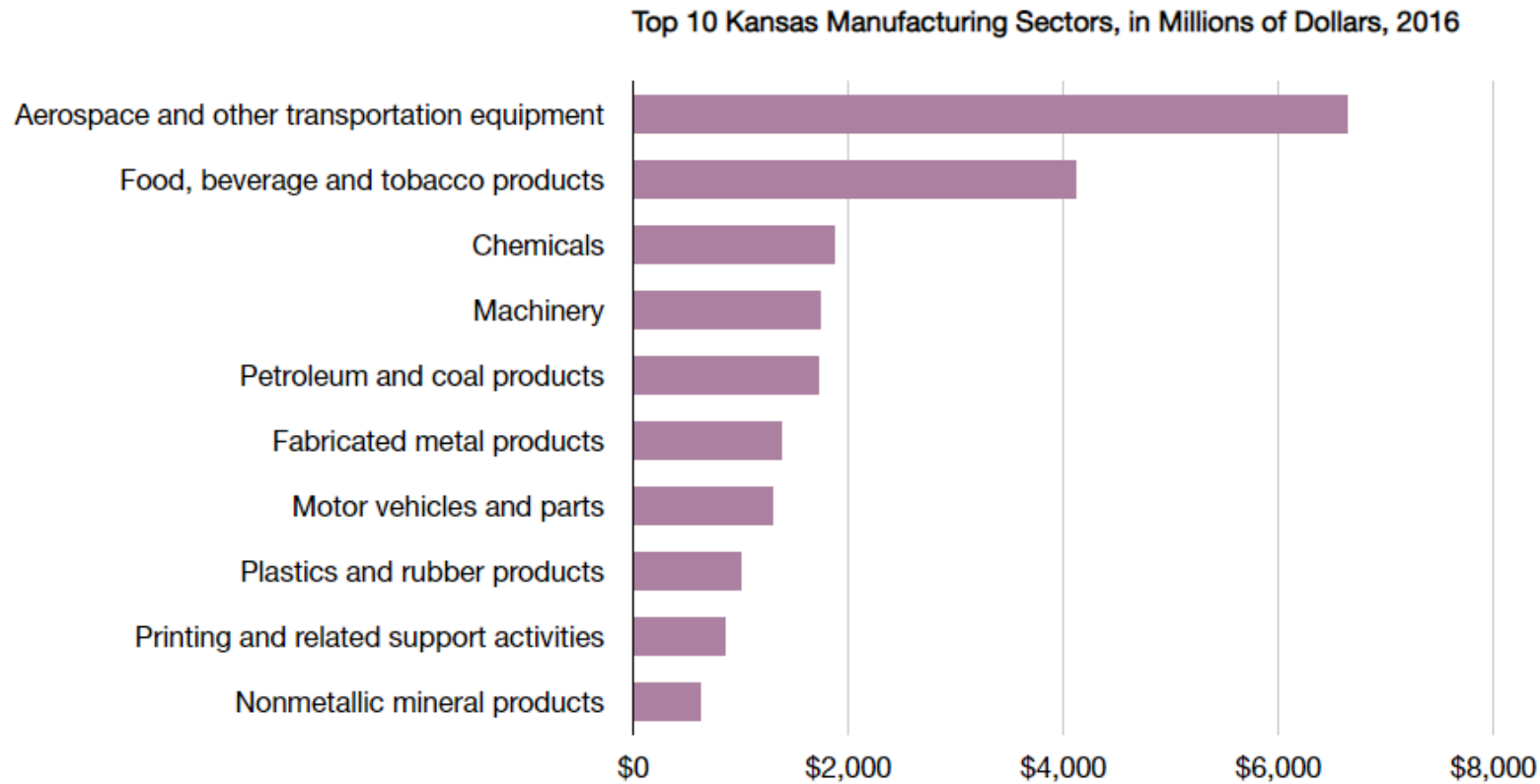


Double burden counties:
 Low broadband availability & high chronic disease rates.

Creating and sustaining a healthy economy in the future raises the following questions:

- What might be technology's impact on the economy?
- What might technology's impact be on where people choose to live and work?
- What is the future of Kansas' aviation sector, which has historically been a strong performer?
- How will technology impact the agriculture industry's transportation needs?

Aviation sector is a key contributor to Kansas' economy



Source: National Association of Manufacturers

Over 67% of the world's embedded aviation fleet was manufactured in Kansas

70% of FAA composites research is conducted in Kansas

Source: Kansas Dept. of Commerce

Kansas' aviation sector continues to advance... but it needs workers



Kansas is the first state to initiate an unmanned traffic management **(UTM) system**.¹



Spirit AeroSystems is planning an expansion that will **add 2,400 jobs**.²

Projected to be a **10% shortage** of aircraft mechanics by 2028.³

*Initiatives to address workforce shortage:*⁴



- WSU building an **innovation campus** that includes Airbus local HQ
- Wichita investing in **amenities** such as parks, bike-share program, and residential developments
- **Tuition incentives** to help train and supply workers

1: Kansas DOT press release. August 8, 2017

2: Spirit AeroSystems press release. December 19, 2018

3: Wichita Eagle. March 28, 2018. *If things don't change, there may not be enough of them to keep planes flying*

4: Wall Street Journal. August 2, 2017. *The 'Air Capital of the World' Has a Problem: Too Few Aviation Workers*

Agriculture's reliance on transportation systems remains critical, but new trends may impact how



Beef, the largest sector in Kansas agriculture, relies **solely on trucks** and highways.¹



Other products rely much on **network connectivity** including improved access to ports and new transload facilities.¹



Cotton is becoming a viable **alternative to wheat**, though there is **limited access** to cotton harvesters and gins.²



Drones will assist in implementing precision technologies into the management practices of farmers and ranchers.¹

1: Kansas Department of Agriculture. 2019

2: Reuters. May 29, 2018. Cotton makes a comeback in U.S. Plains as farmers sour on wheat

Agriculture sector could benefit much from broadband access



Broadband allows farmers and ranchers to better utilize **drone** technology.



Broadband allows producers to expand their business through the use of internet video auction services and other **online business services.**

Source: Kansas Department of Agriculture. 2019

Rural downtowns can be tomorrow's tech hubs

PROPERTY LINES

Reversing the rural brain drain with remote working

With a new network of rural tech hubs, the Rural Innovation Initiative wants to kickstart small downtowns

By [Patrick Slisson](#) | Feb 12, 2019, 1:00pm EST

“There are over 8.5 million rural Americans with access to gigabit internet, nearly equivalent to the workforce of New York City,” says Dunne.

Participants in the 2019 Rural Innovation Initiative are:

- [Codefi](#) and the Marquette Tech District Foundation, Cape Girardeau, Missouri
- [Emporia, Kansas](#)
- Grinnell, Iowa
- Independence, Oregon
- [Go Forward](#), Pine Bluff, Arkansas
- [Block22](#), Pittsburg, Kansas
- [Red Wing Ignite](#), Red Wing, Minnesota
- [20Fathoms](#), Traverse City, Michigan
- City of Wilson, North Carolina

The increase in electric vehicles (EVs) on our roadways raises the following questions:

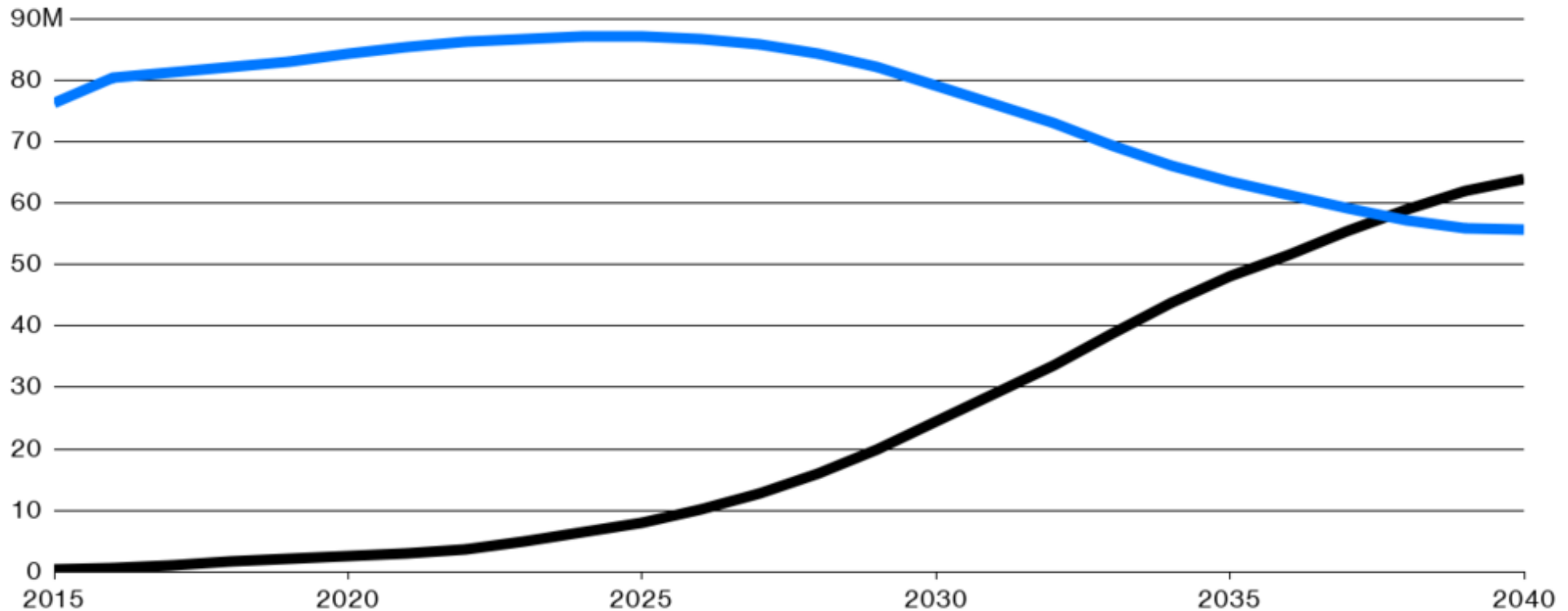
- Will EVs sales eventually outpace sales of gas/diesel vehicles?
- How will EVs impact motor fuel taxes, which currently provide a majority of transportation revenues?
- How will EV chargers, particularly fast chargers, impact the electric grid?

Global EV sales are expected to surpass traditional vehicle sales by 2038

Overtaking Lane

Electric vehicle sales will surpass internal combustion engine sales by 2038

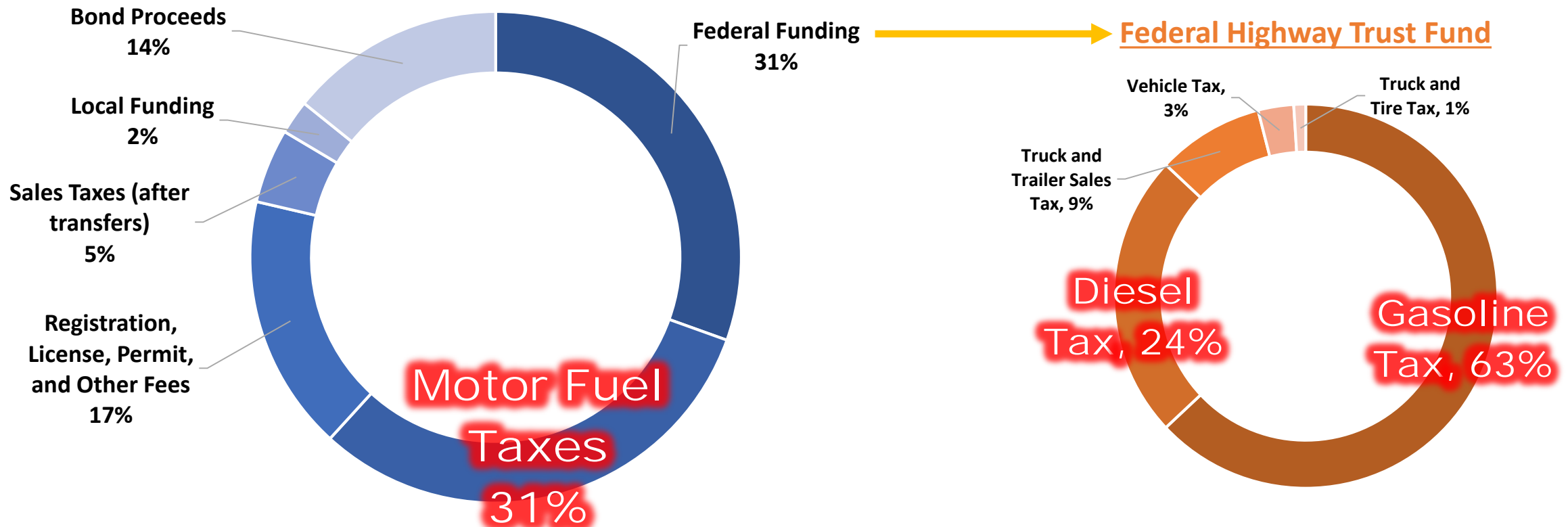
■ Electric vehicles ■ Internal combustion engine



Source: Bloomberg New Energy Finance

Motor fuel taxes are the primary funding sources for Kansas transportation costs

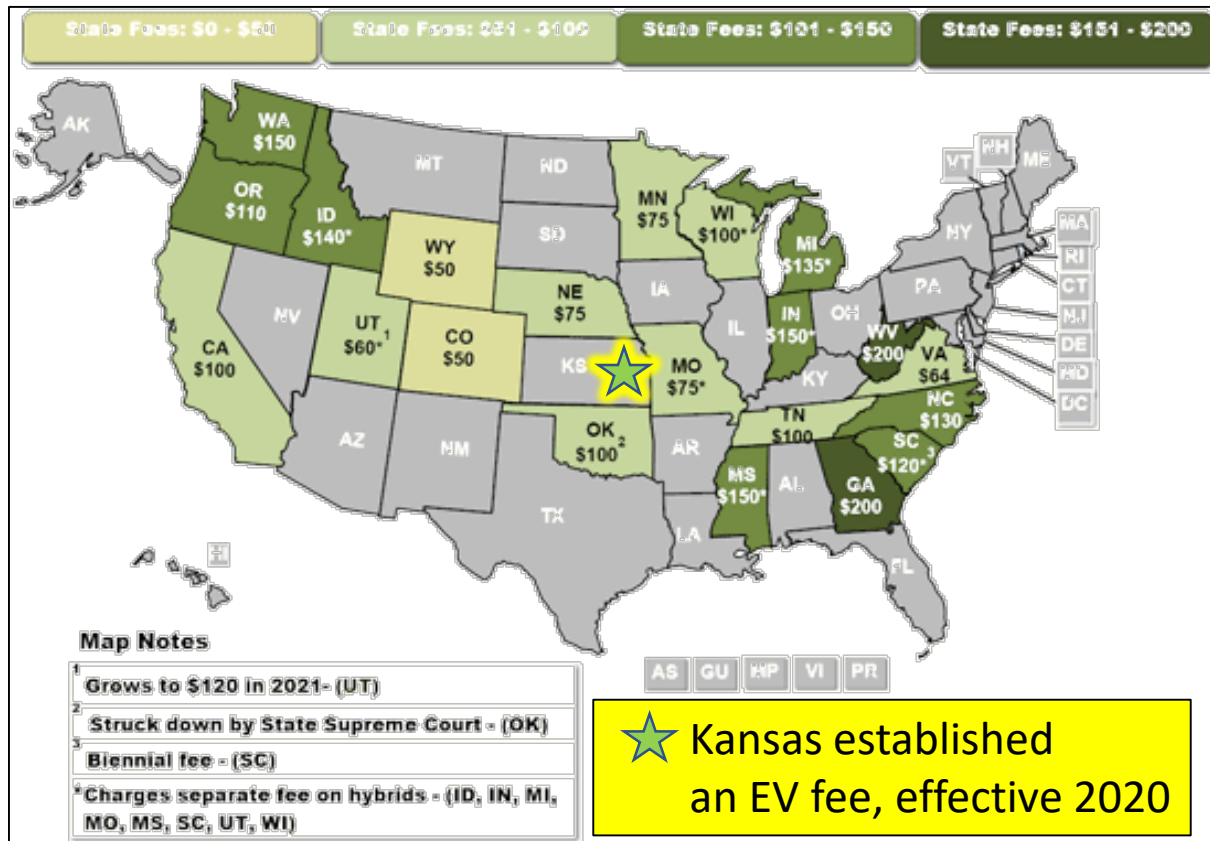
KDOT Revenue, FY 2011 - FY 2018



Source: KDOT and Congressional Budget Office

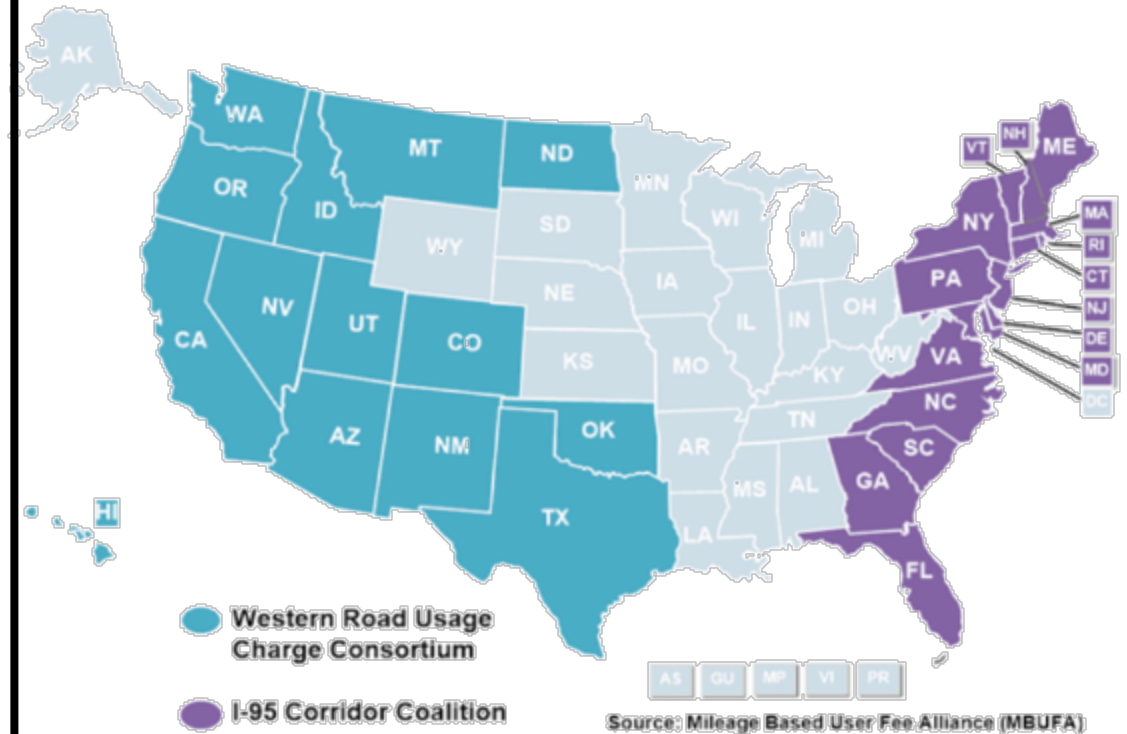
Some states are considering alternatives to motor fuel taxes

States are passing EV fees as a way to more equitably generate transportation funding



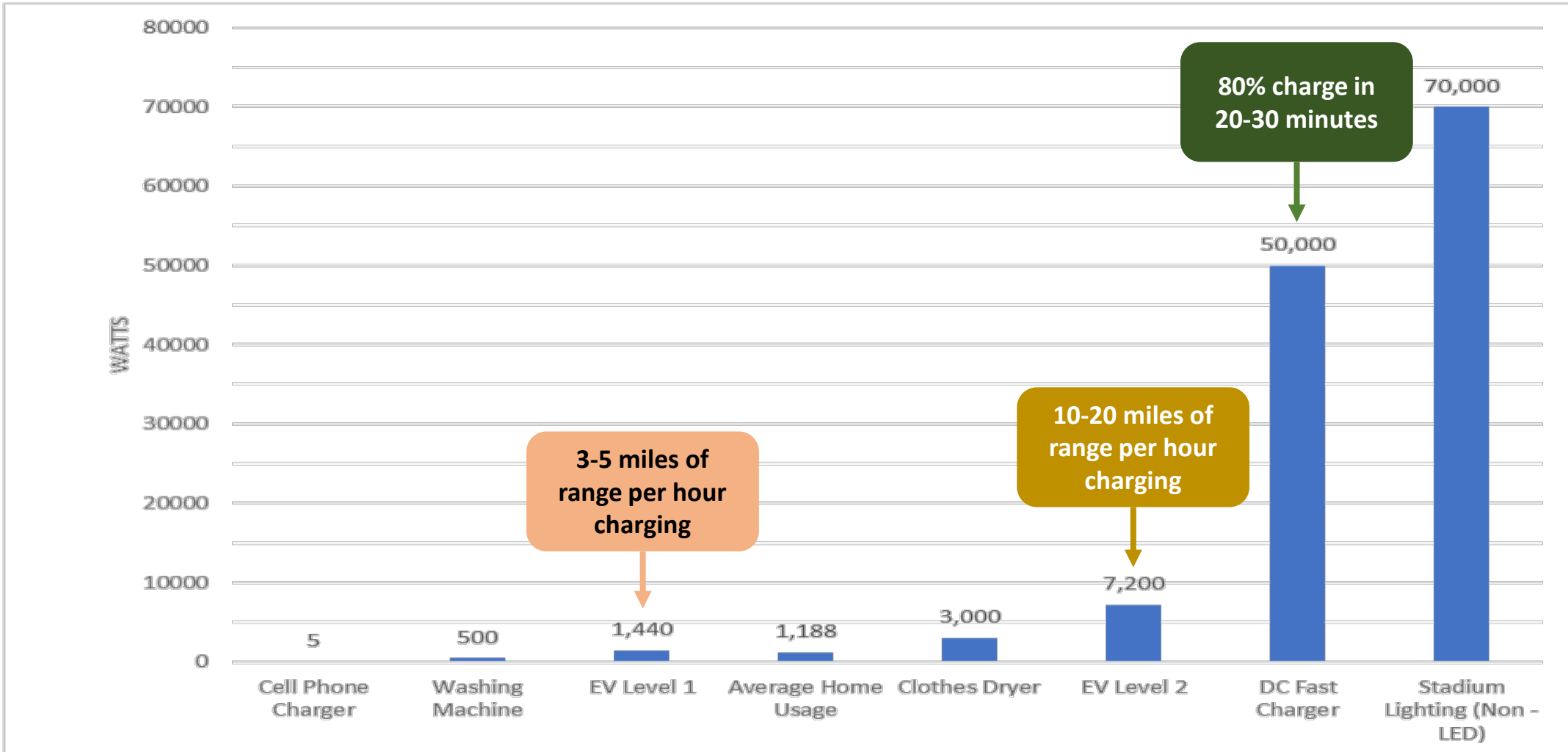
Source: National Conference of State Legislatures, March 2019

Plans are in place to explore Road Uses Charges which charge based on miles driven as opposed to gas consumed



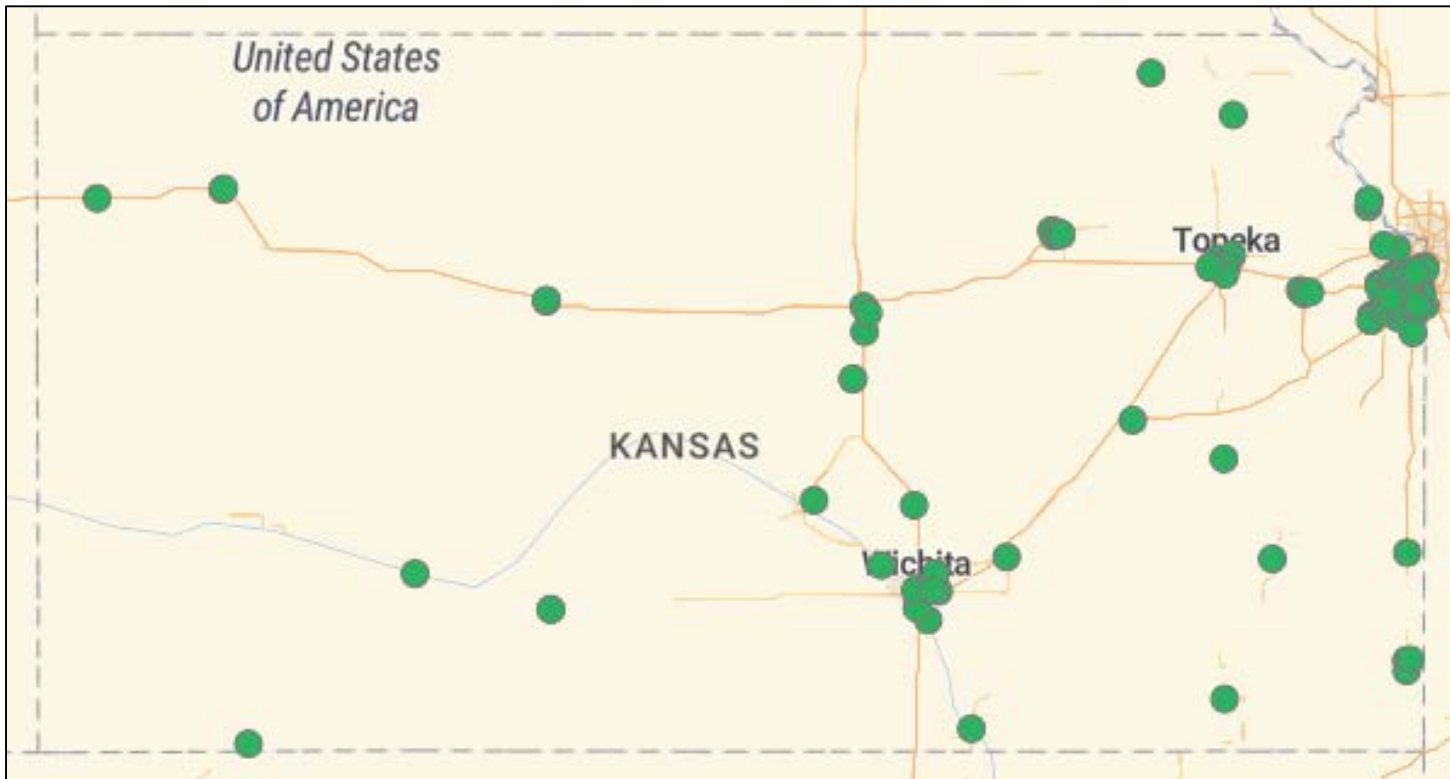
Source: Mileage Based User Fee Alliance

Fast EV chargers will put pressure on electric grid



Kansas has EV stations available and more on the way

186 charging stations with **797** charging outlets



Source: Alternative Fuels Data Center, 2019

Electric car charging stations introduced at turnpike service areas



▲ HIDE CAPTION

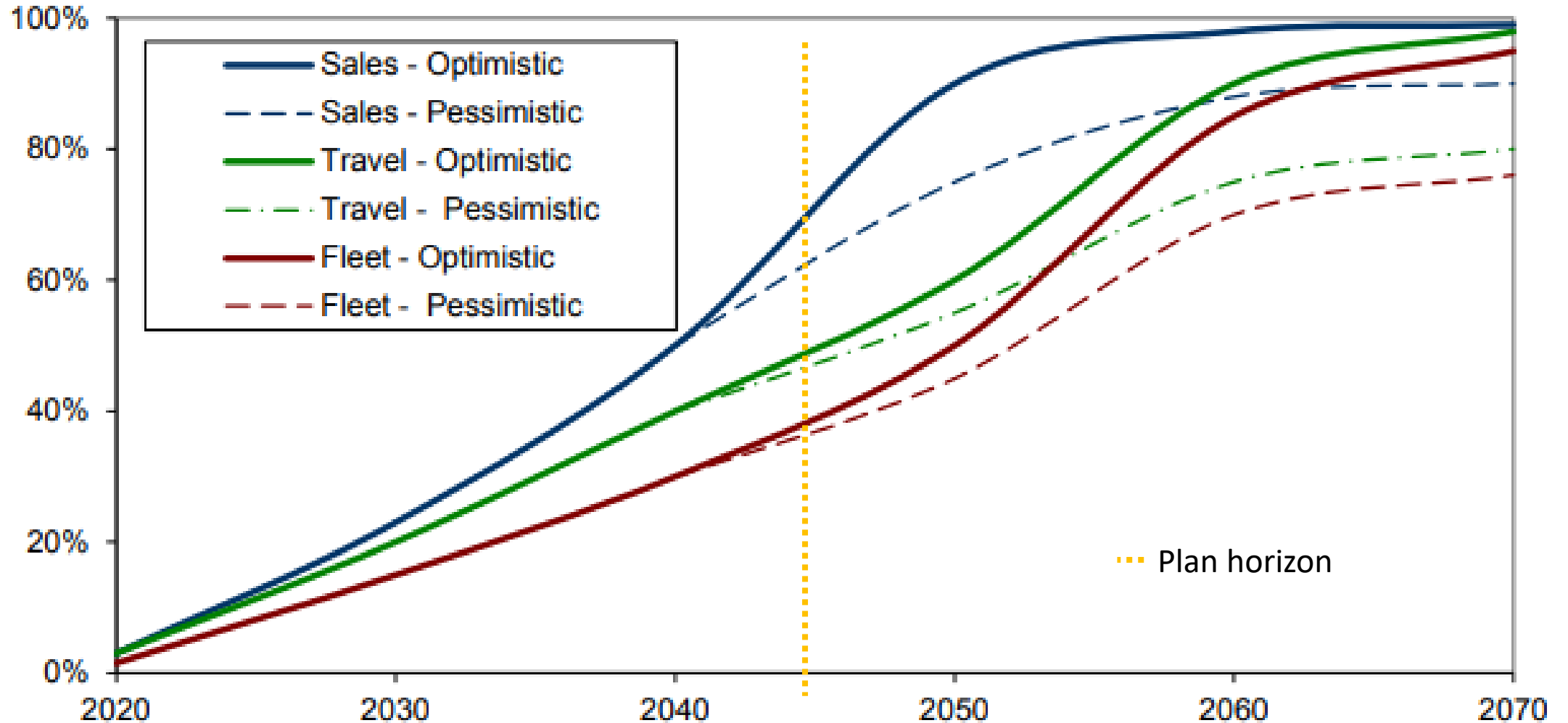
Gov. Laura Kelly speaks at Wednesday morning's news conference announcing the addition of electric car charging stations at the Topeka, Lawrence and Towanda service areas on the Kansas Turnpike. [Phil Anderson/The Capital-Journal]

Source: Hutchinson News

Because Connected & Autonomous Vehicles (CAVs) will revolutionize the way we travel, it raises the following questions:

- What types of new needs will CAVs create?
- How important is broadband access in supporting CAV safety features?
- What will be the safety implications of CAVs for pedestrians?

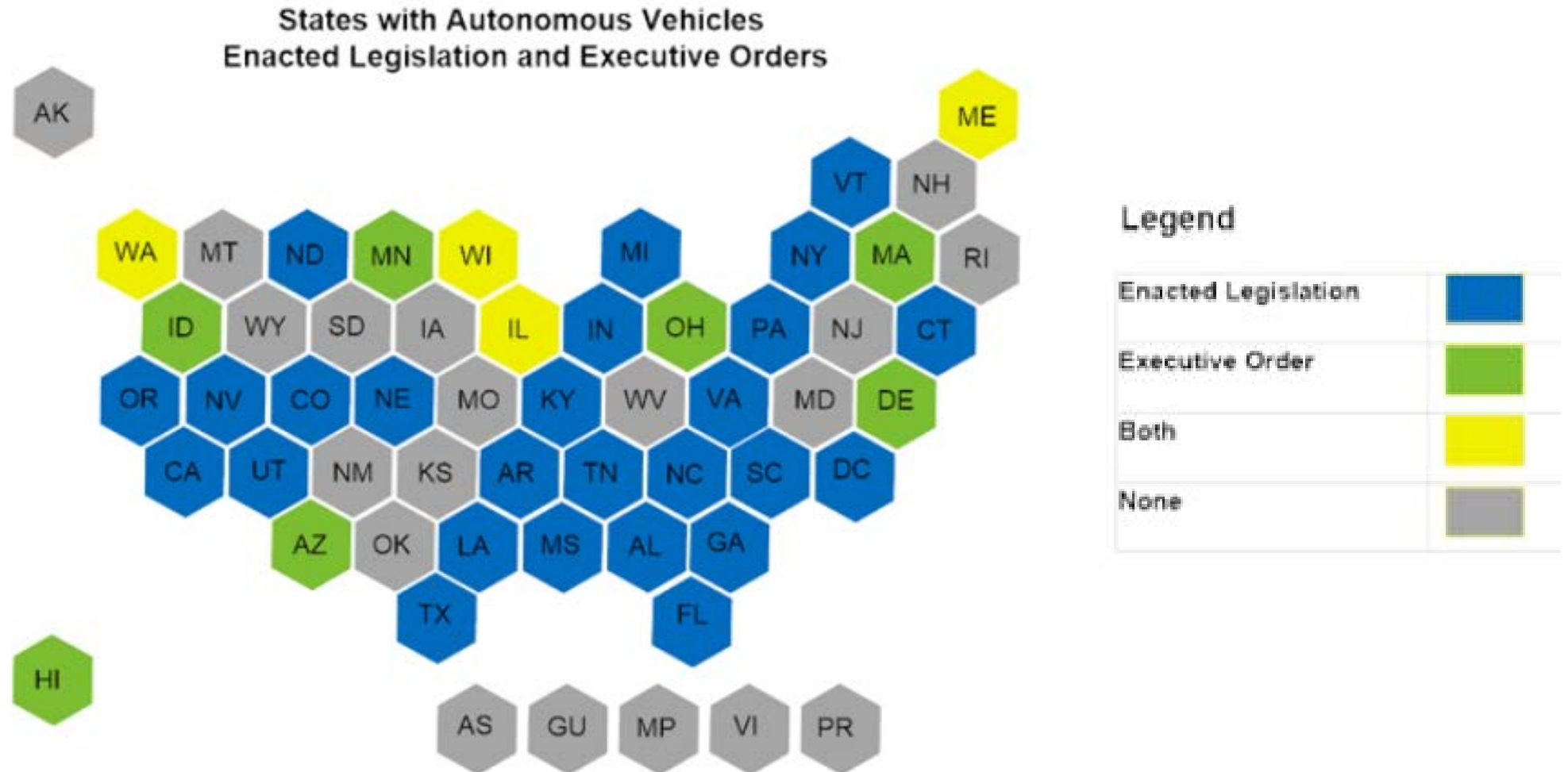
CAVs usage is expected to grow substantially in the next 25 years



CAVs could disrupt many aspects of our lives

- The number of vehicles on the road
- Vehicle distance traveled
- Average travel time
- Carbon Dioxide emissions
- Parking space needed

Some states are trying to get in front of CAV technology with legislation

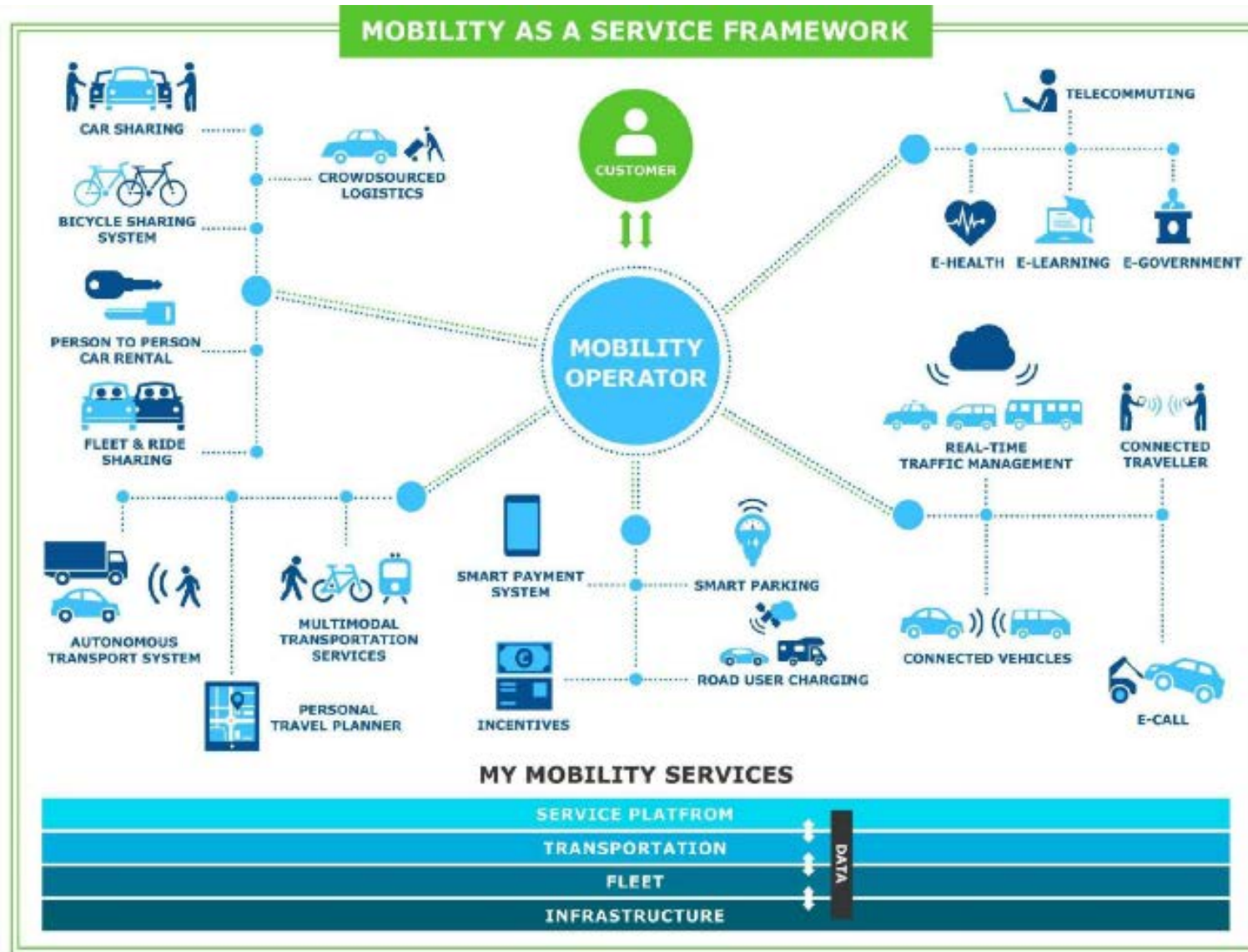


Source: National Conference of State Legislatures

Because Mobility
as a Service
(MaaS) changes
how people
travel, it raises
the following
questions:

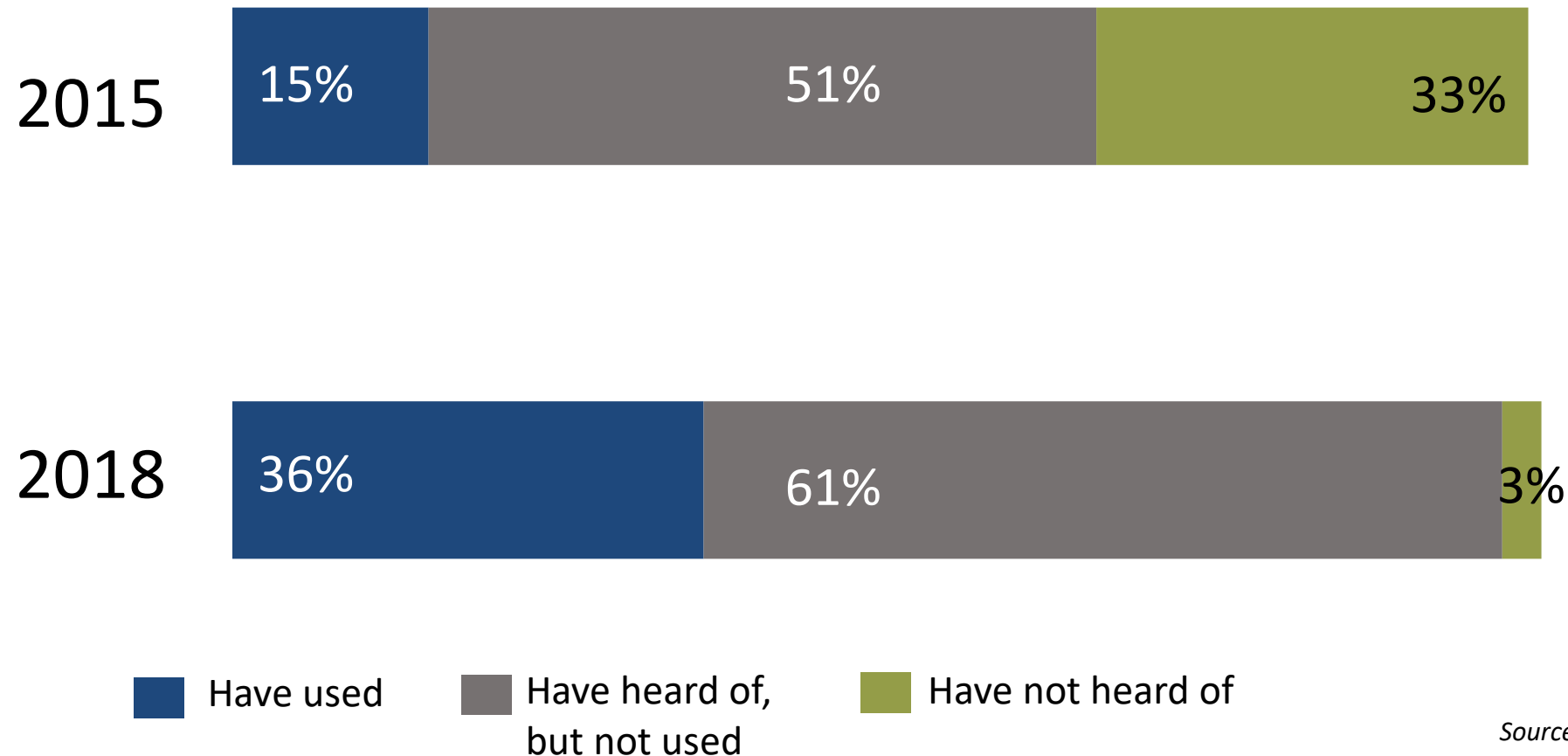
- How many people will own personal vehicles in the future?
- How will revenue models, including parking, change in the future?
- How can transit services be better targeted in the future?
- How can MaaS be best configured in rural areas?
- What other shifts will impact how we travel in the future?

MaaS changes how we plan, pay for, and take trips



MaaS has grown considerably in popularity:

Number of Americans using ride-hailing services like Uber or Lyft doubled since 2015

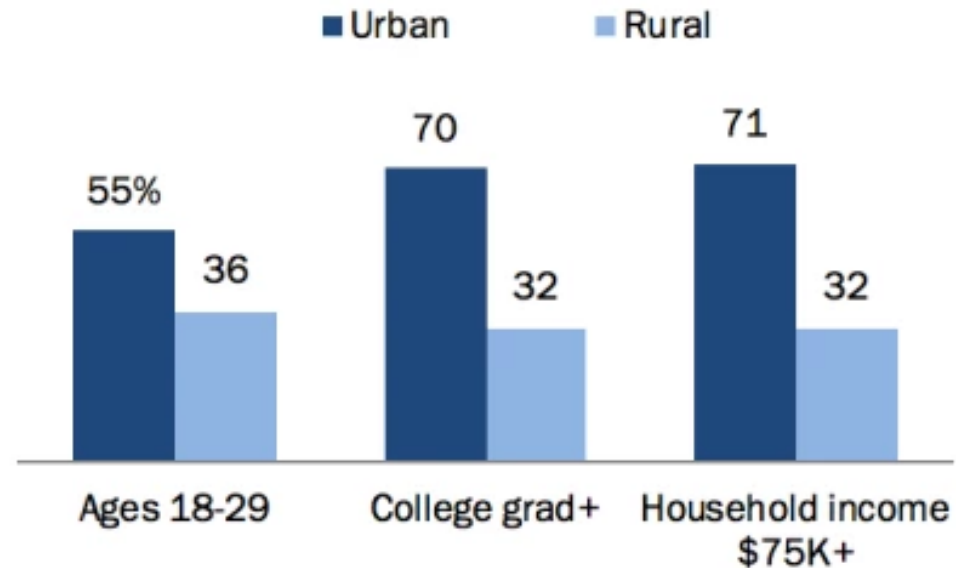


Source: Pew Research Center

MaaS is not yet widely used in rural areas

Wide urban-rural gaps in ride-hailing among younger, more affluent adults

% of U.S. adults in each category who say they have ever used ride-hailing services like Uber or Lyft



Note: Respondents who did not give an answer or gave other responses are not shown.

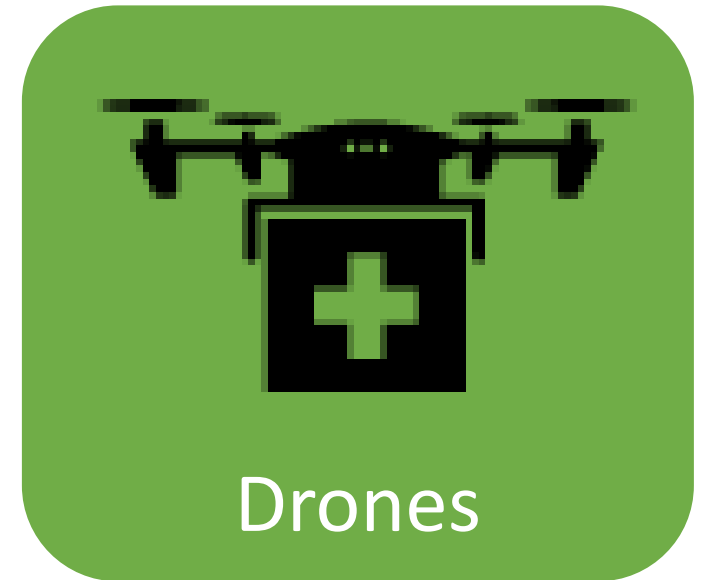
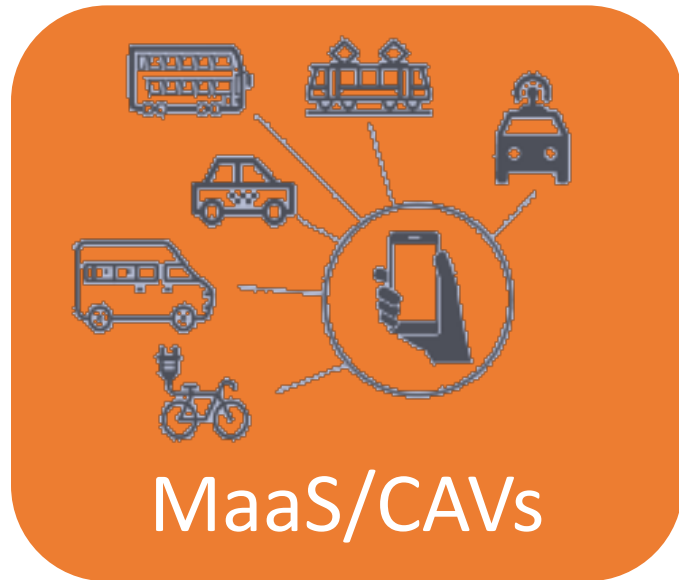
Source: Survey conducted Sept. 24-Oct. 7, 2018.

Source: Pew Research Center

Accessing
healthcare in the
future raises the
following
questions:

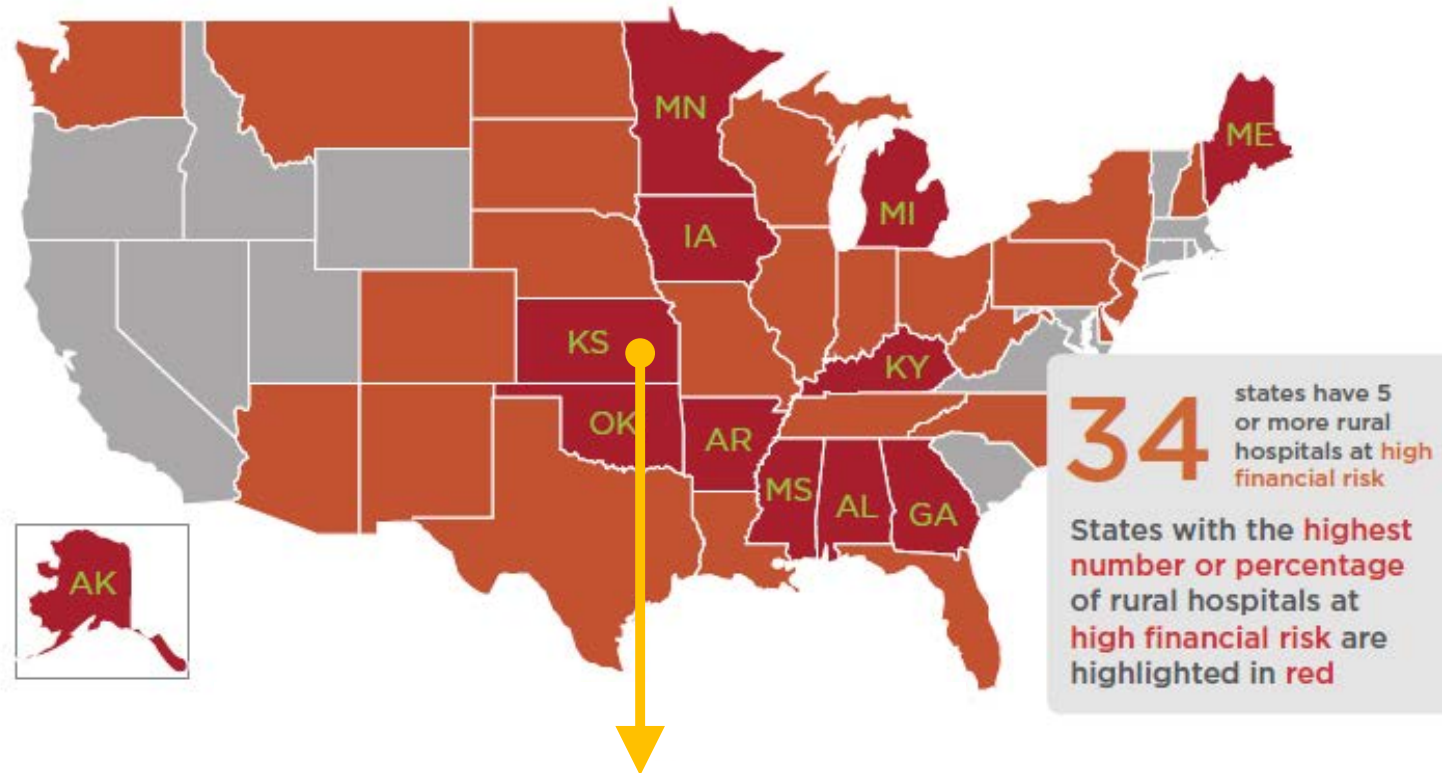
- What will technology's role be in healthcare access?
- What's transportation's role in providing better and more cost effective healthcare access?

Solutions to address access to health services will likely be driven by technology¹



1: Citris and the Banatao Institute

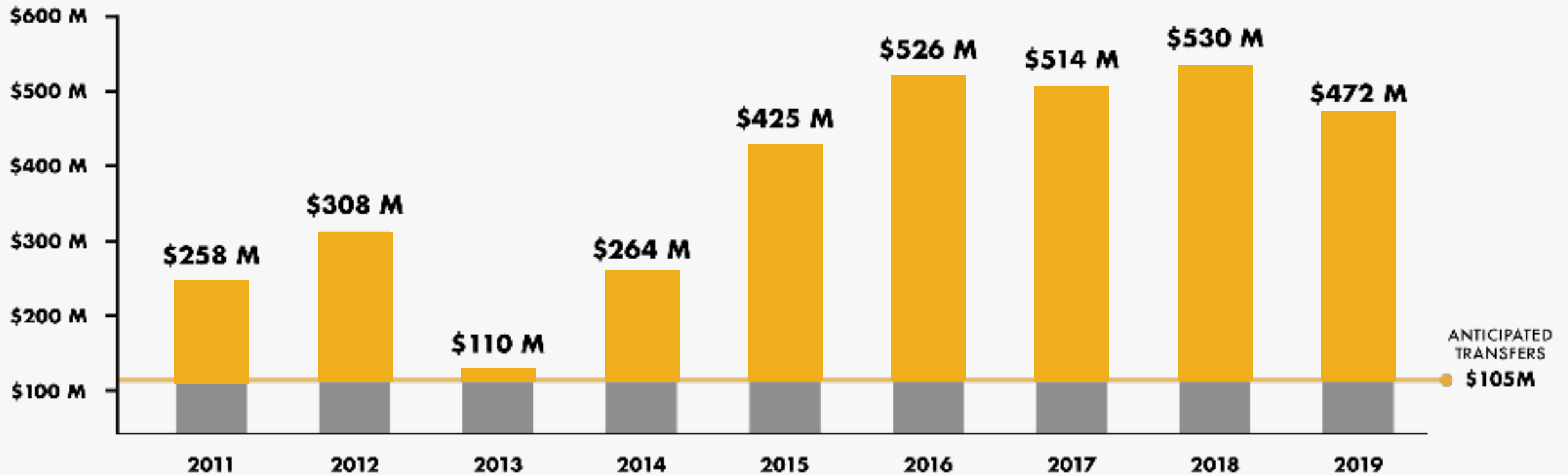
Moreover, many essential rural hospitals are at risk of closing



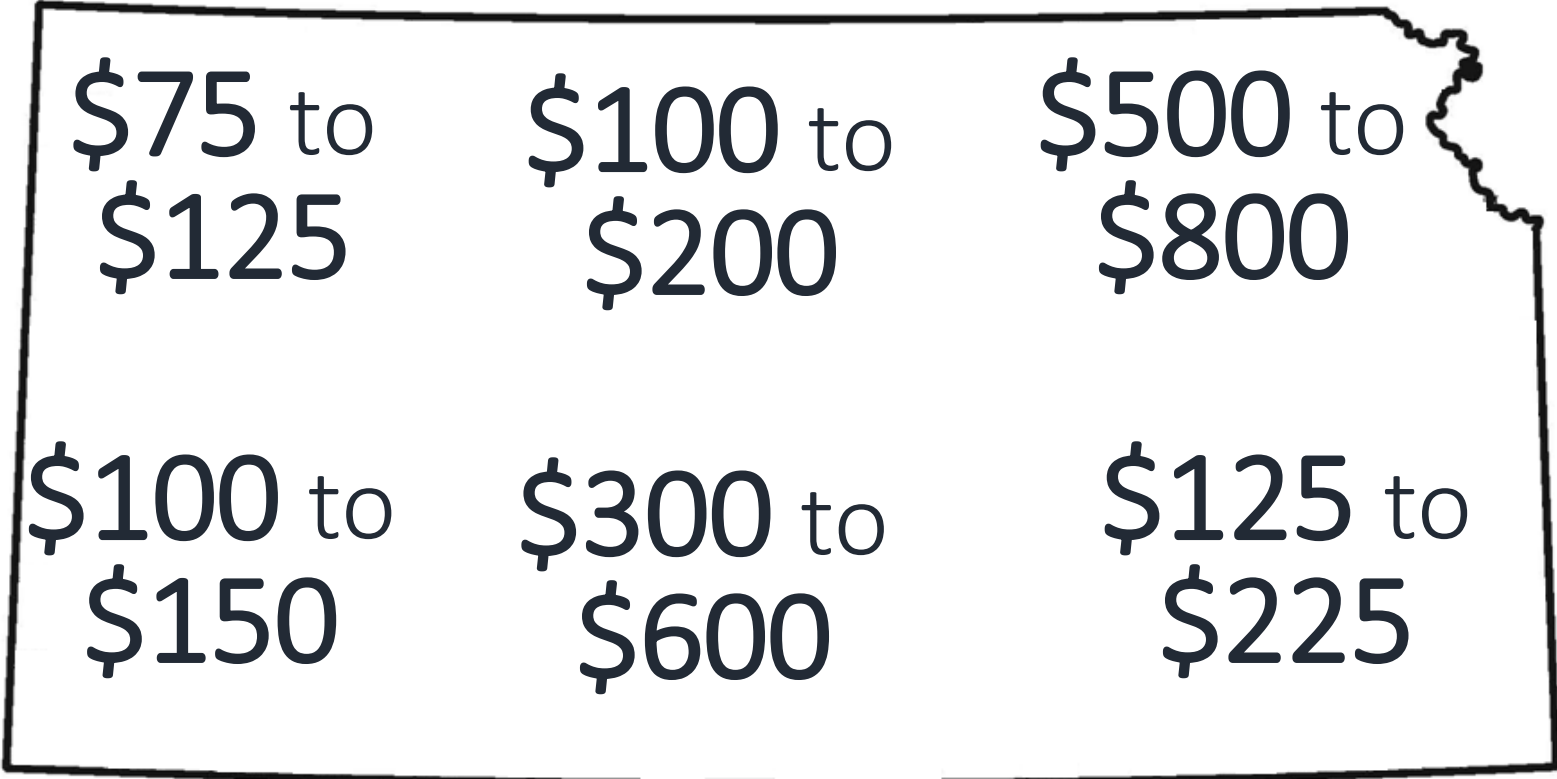
29 rural hospitals at risk of closing, of which **25** are considered essential

Kansas Transportation Background

Approximately \$2 Billion Transferred Out of State Highway Fund since 2011



T-WORKS Proposed spending ranges for expansion & modernization projects 2011-2020 (in millions)



Total Available Statewide: \$1,700

To develop ranges within each region, KDOT looked at a variety of factors in 2010

