Moving Through Logistics

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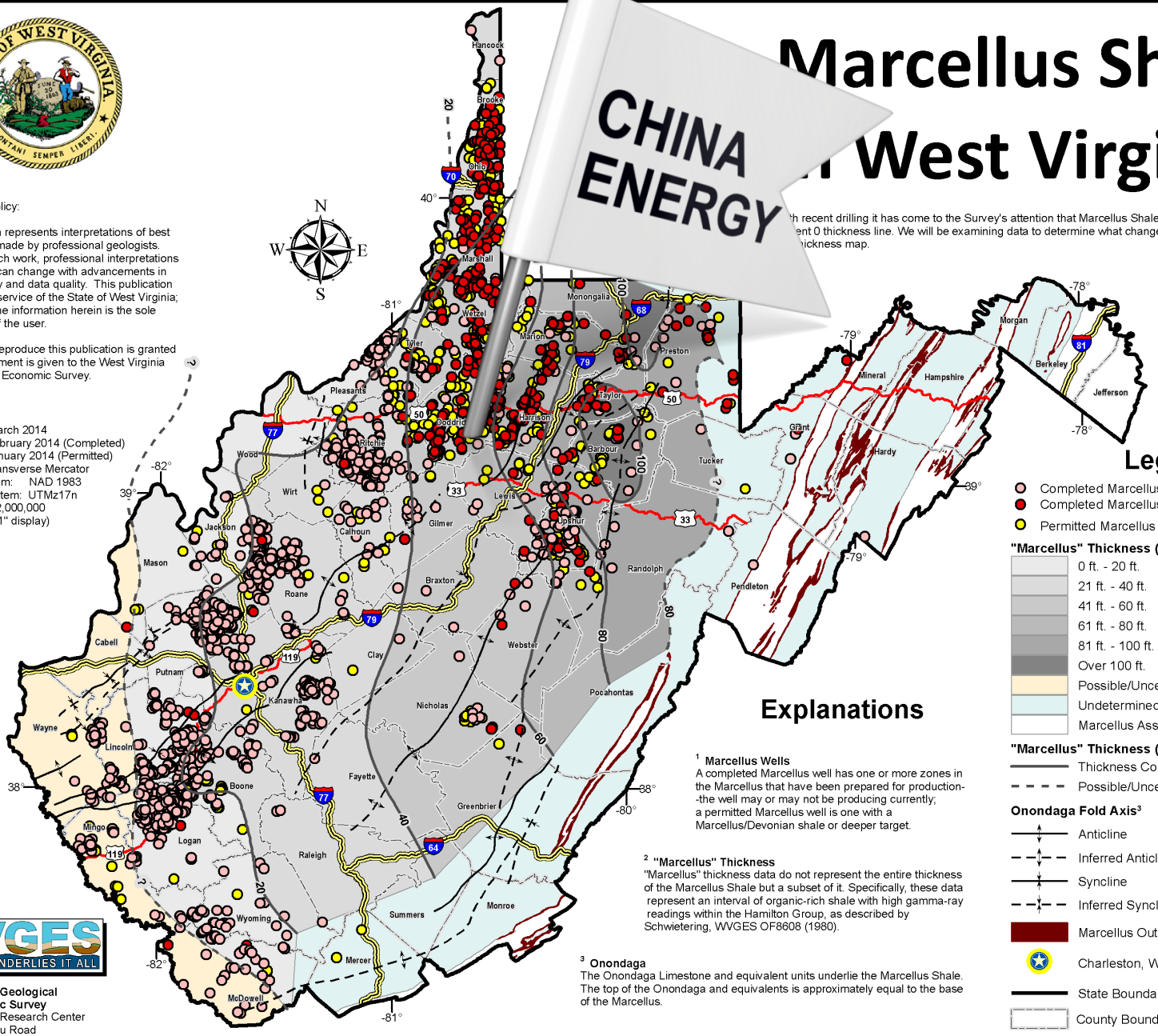
Marcellus Shale
West Virginia

CHINA ENERGY

h recent drilling it has come to the Survey's attention that Marcellus Shale may exist west of the
ent 0 thickness line. We will be examining data to determine what changes may be needed to
ickness map.



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Map Date: March 2014
Data Date: February 2014 (Completed)
January 2014 (Permitted)
Projection: Transverse Mercator
Horizontal Datum: NAD 1983
Coordinate System: UTMz17n
Map Scale: 1:2,000,000
(for full 8.5" x 11" display)

Explanations

[1] **Marcellus Wells**
A completed Marcellus well has one or more zones in the Marcellus that have been prepared for production--the well may or may not be producing currently; a permitted Marcellus well is one with a Marcellus/Devonian shale or deeper target.

[2] **"Marcellus" Thickness**
"Marcellus" thickness data do not represent the entire thickness of the Marcellus Shale but a subset of it. Specifically, these data represent an interval of organic-rich shale with high gamma-ray readings within the Hamilton Group, as described by Schwietering, WVGES OF8608 (1980).

[3] **Onondaga**
The Onondaga Limestone and equivalent units underlie the Marcellus Shale. The top of the Onondaga and equivalents is approximately equal to the base of the Marcellus.

Legend

- Completed Marcellus Vertical Wells[1]
- Completed Marcellus Deviated Wells[1]
- Permitted Marcellus Wells[1]

"Marcellus" Thickness (Isopach)[2]

- 0 ft. - 20 ft.
- 21 ft. - 40 ft.
- 41 ft. - 60 ft.
- 61 ft. - 80 ft.
- 81 ft. - 100 ft.
- Over 100 ft.
- Possible/Uncertain Marcellus
- Undetermined Thickness
- Marcellus Assumed to be Absent

"Marcellus" Thickness (Isopach) Contours[2]

- Thickness Contour (20 ft.)
- Possible/Uncertain Marcellus Shale Present

Onondaga Fold Axis[3]

- Anticline
- Inferred Anticline
- Syncline
- Inferred Syncline
- Marcellus Outcrop
- Charleston, WV
- State Boundary
- County Boundaries
- Interstate Highways
- U.S. Highways

0 10 20 30 40 50 Miles

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UNITED STATES

American Chemistry Council

NEW MANUFACTURING PROJECTS ARE **GROWING OUR ECONOMY & CREATING JOBS**

317 new chemical industry projects due to shale gas*

$185 billion
in new capital investment

464 thousand
direct & indirect jobs by 2025
359K add'l jobs generated by household spending

$310 billion
in new economic output

$26 billion
in new tax revenue by 2025

WestVirginiaUniversity.

americanchemistry.com/Policy/Energy/Shale-G

THE AVERAGE ANNUAL PAY IN THE BUSINESS OF CHEMISTRY IS NEARLY

$94,000

THAT'S 44% HIGHER THAN THE AVERAGE MANUFACTURING PAY

FOR EVERY JOB CREATED BY THE BUSINESS OF CHEMISTRY, 6.8 ARE GENERATED ELSEWHERE IN THE ECONOMY, TOTALING OVER

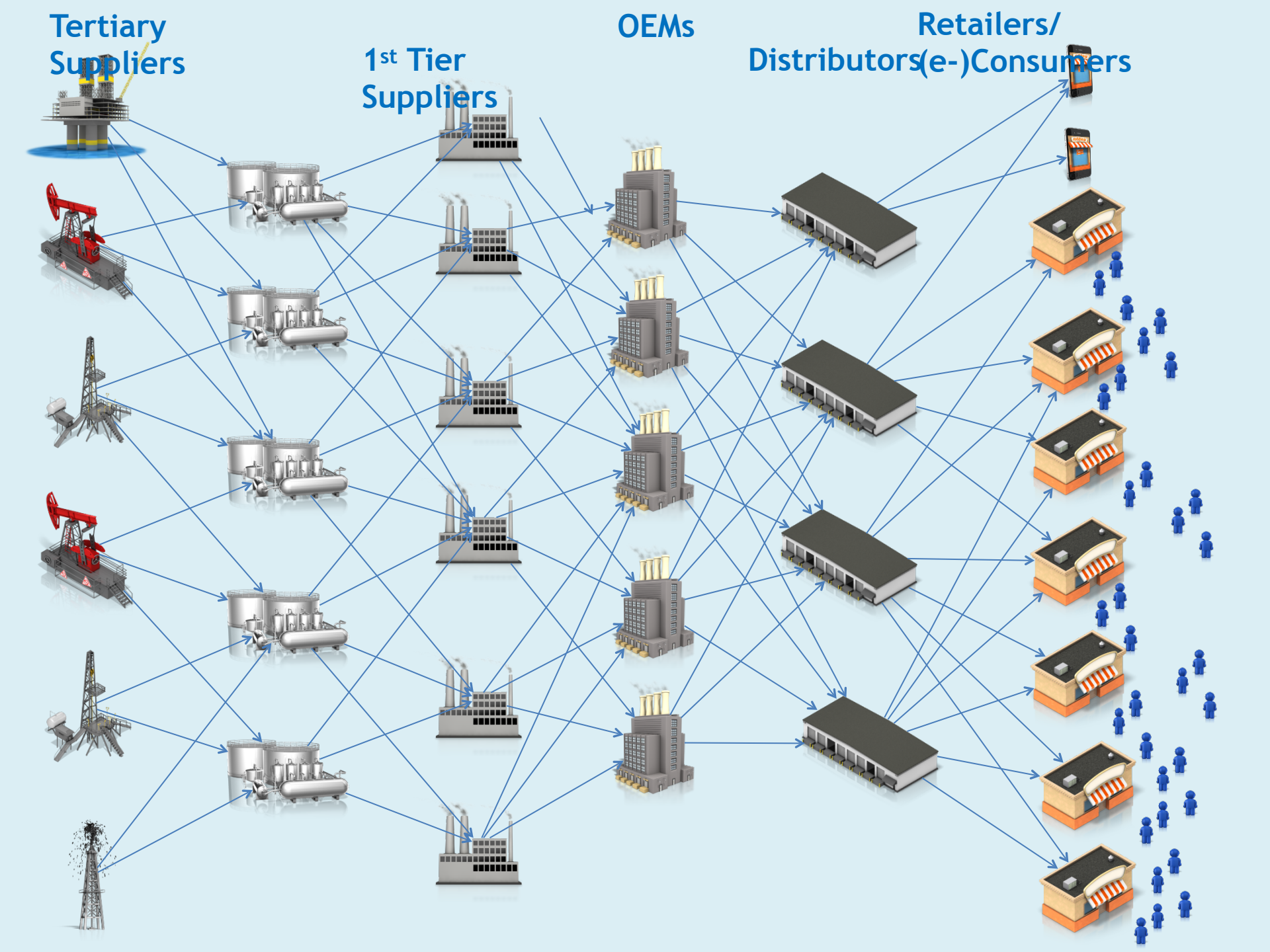
6 MILLION JOBS

American Chemistry Council

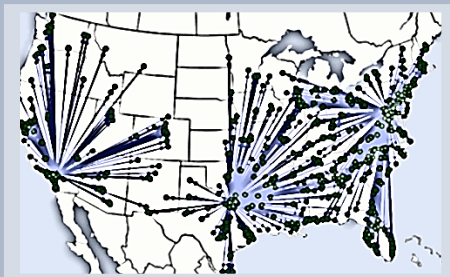
MORE THAN

96%

OF ALL MANUFACTURED GOODS ARE DIRECTLY TOUCHED BY THE BUSINESS OF CHEMISTRY


Tertiary Suppliers
1st Tier Suppliers
OEMs
Retailers/ Distributors
(e-)Consumers

SUPPLY CHAIN 101



80% OF COSTS ARE FIXED INTO THE SUPPLY CHAIN NETWORK DESIGN

LOCATE FACILITIES CLOSE TO TRANSPORTATION ACCESS POINTS

SPEED + GUARANTEED DELIVERY
= ↑ CUSTOMER SERVICE
= ↑ REVENUE

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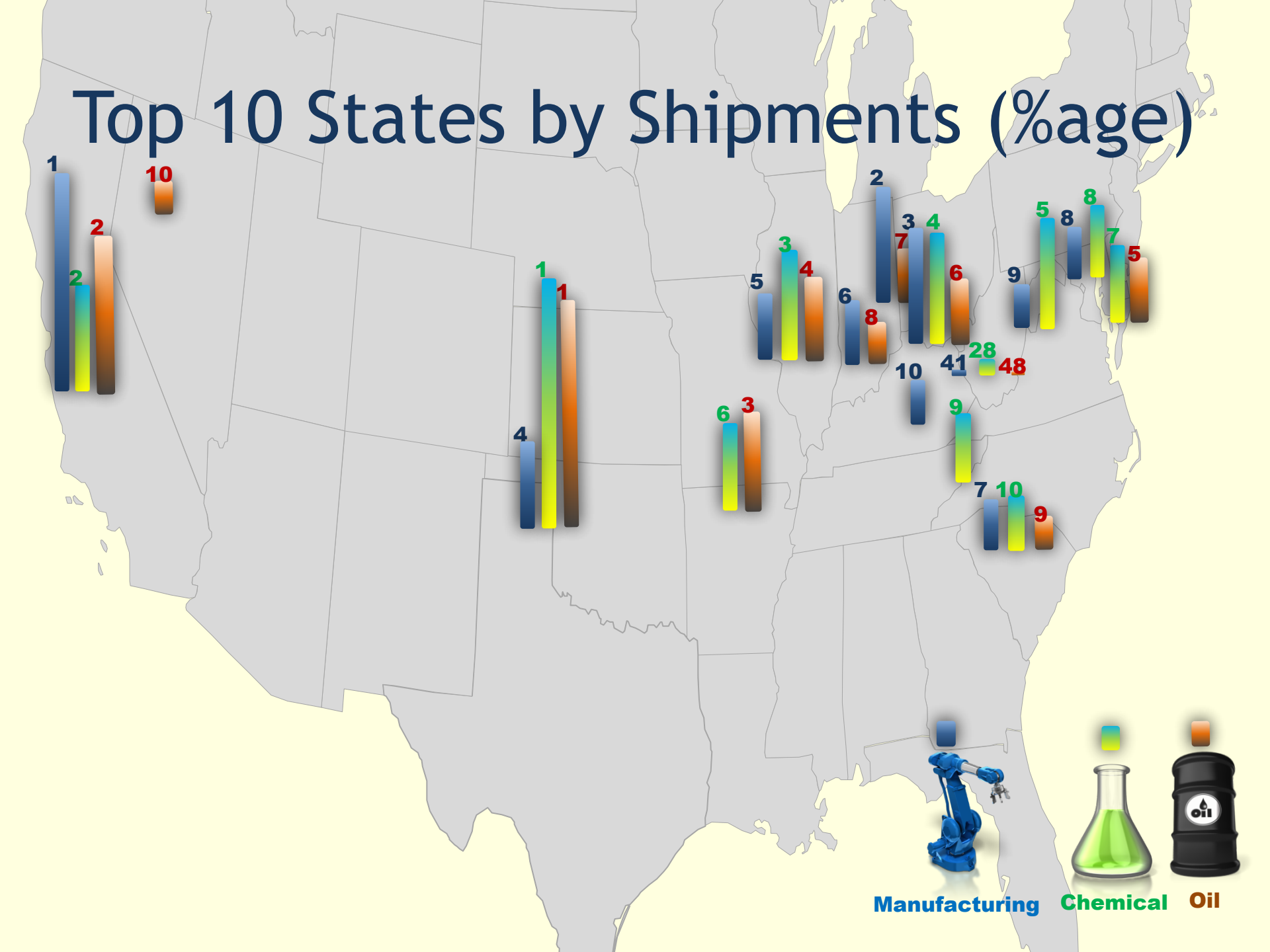
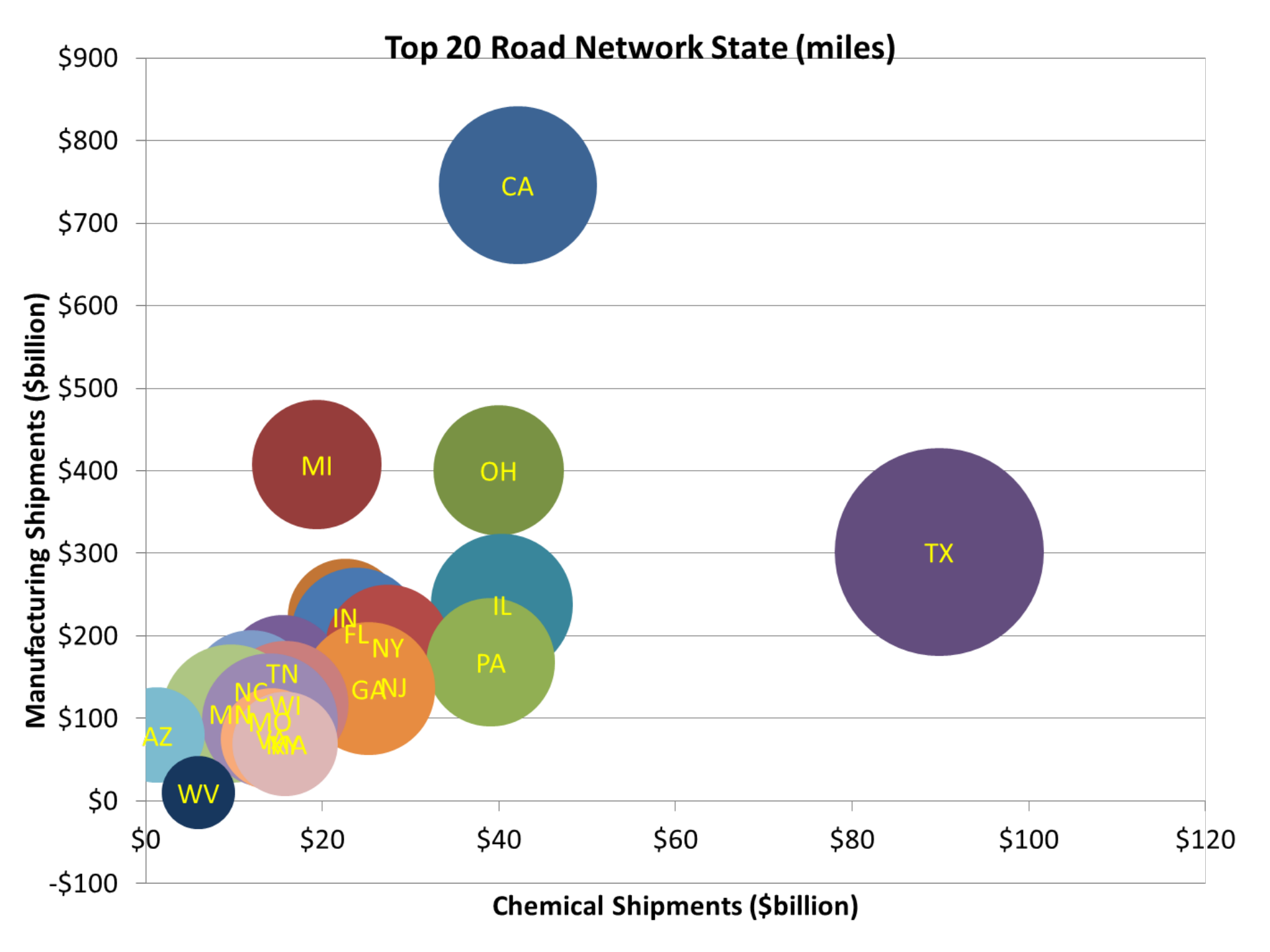
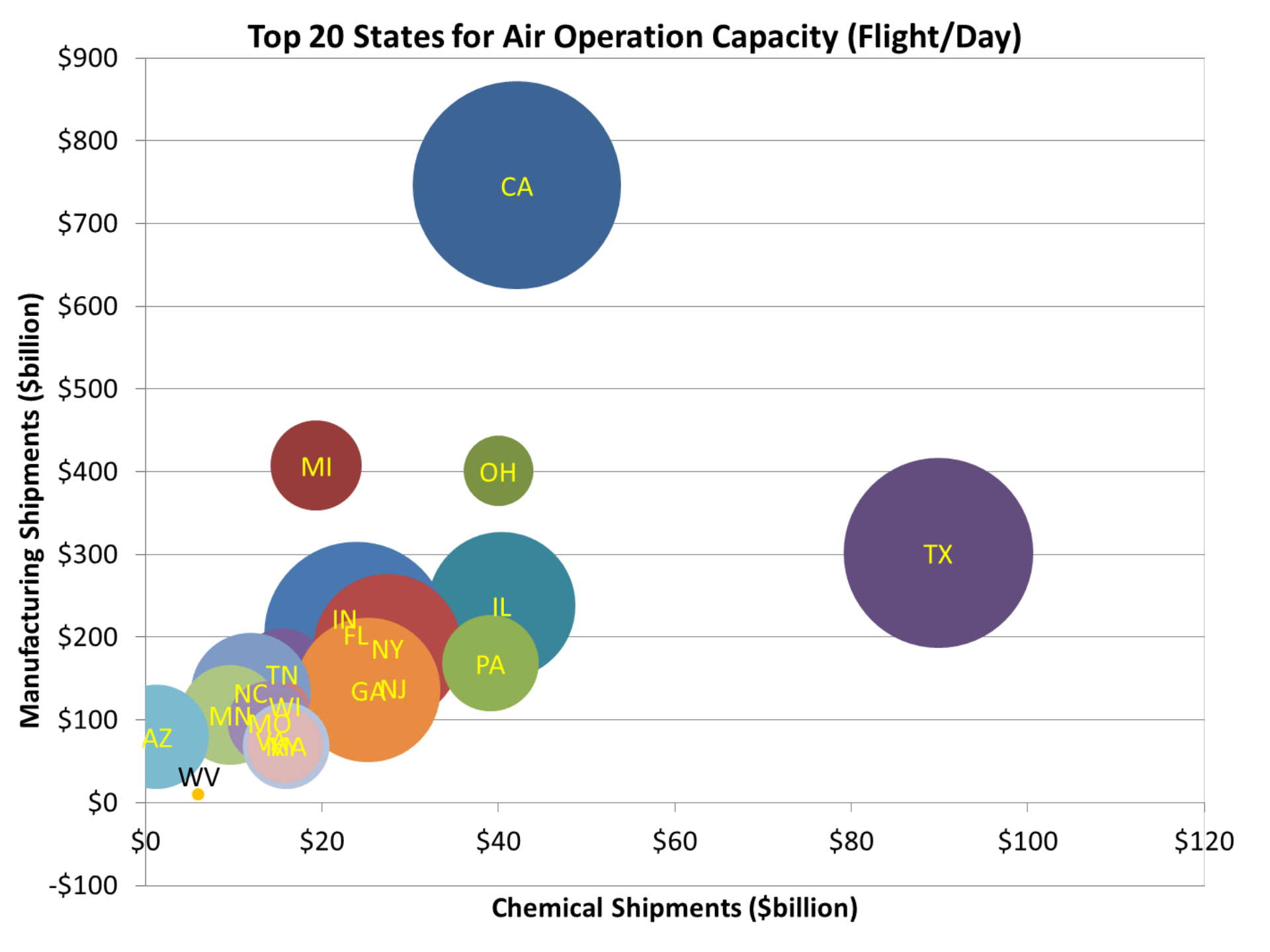
Top 10 States by Shipments (%age)



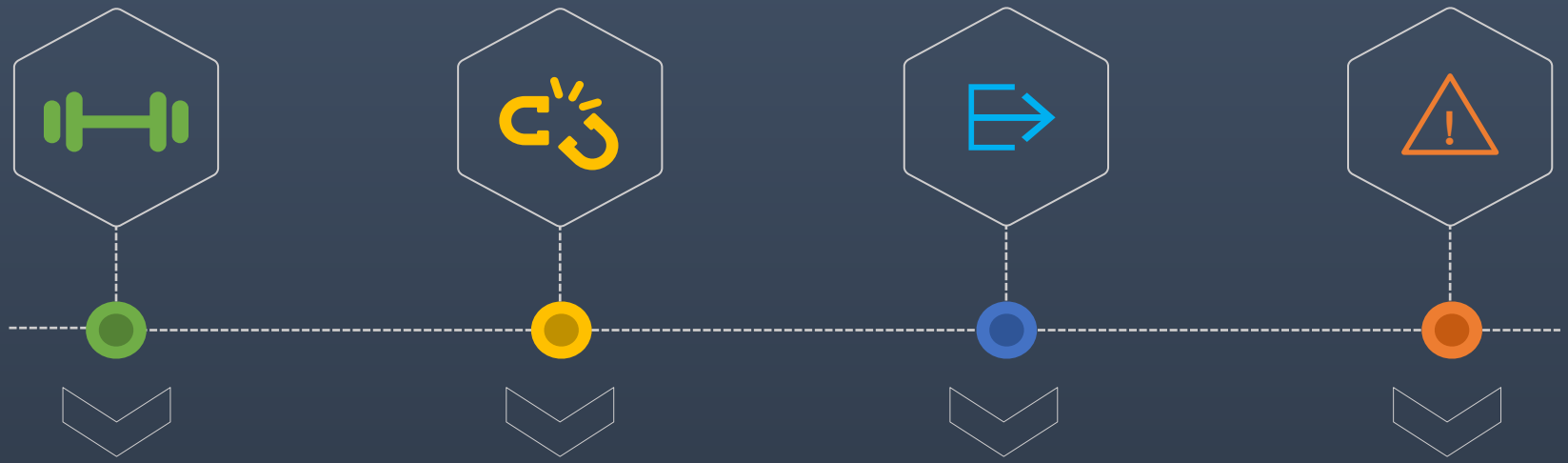

Top 20 Road Network State (miles)
Manufacturing Shipments ($billion)
Chemical Shipments ($billion)
$900
$800
$700
$600
$500
$400
$300
$200
$100
$0
-$100
$0
$20
$40
$60
$80
$100
$120
CA
MI
OH
TX
IL
IN
FL
NY
PA
TN
NC
GA
NJ
MN
WI
AZ
WV


Top 20 States for Air Operation Capacity (Flight/Day)
Manufacturing Shipments ($billion)
Chemical Shipments ($billion)
$900
$800
$700
$600
$500
$400
$300
$200
$100
$0
-$100
$0
$20
$40
$60
$80
$100
$120
CA
MI
OH
TX
IL
IN
FL
NY
PA
TN
NC
GA
NJ
MN
WI
AZ
WV

Forces Affecting Chemical Supply Chains

- Demands for greater customer service requiring greater differentiation in service performance
  - Greater digitization and transparency in customer orders
- Transportations costs between 2.2–3.6% of revenues
  - 0.5% savings increases profit margins by 5%
- Significant growth in chemical industry containerized Intermodal transportation
- Industry consolidation driving reductions in working capital and greater asset productivity
  - Challenging as inventory turns 6-14 times a year in the chemical industry

West Virginia Chemical Supply Chain SWOT Analysis



STRENGTHS

- Shale Gas
- Roads to Prosperity Amendment
- Proximity to major US population
- Proximity to U.S. manufacturing

WEAKNESSES

- Under developed transport infrastructure
- No Inland port

OPPORTUNITIES

- China Energy MOU
- Attracting downstream investments
- Grow inland port especially with Air operations, Prichard-HTS?

THREATS

- Neighboring states with better transport infrastructure attracts downstream investments

THANK YOU FOR YOUR TIME