

Propane Supply Alternatives: Preliminary Results Discussion

Eric Pardini, Jill Steiner, and Maggie Pallone, Public Sector Consultants

Little Bear East Arena
North and South Conference Rooms
275 Marquette St. St. Ignace, Michigan 49781
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Michigan Propane Study Objectives

- Model current propane supplies system based upon existing research that assesses Michigan's existing propane supply and distribution system throughout the state and with respect to each peninsula.
- Identify alternative approaches to meeting the propane needs of Michigan's residents and businesses to optimize the propane distribution network for reliability, cost, and emergency preparedness

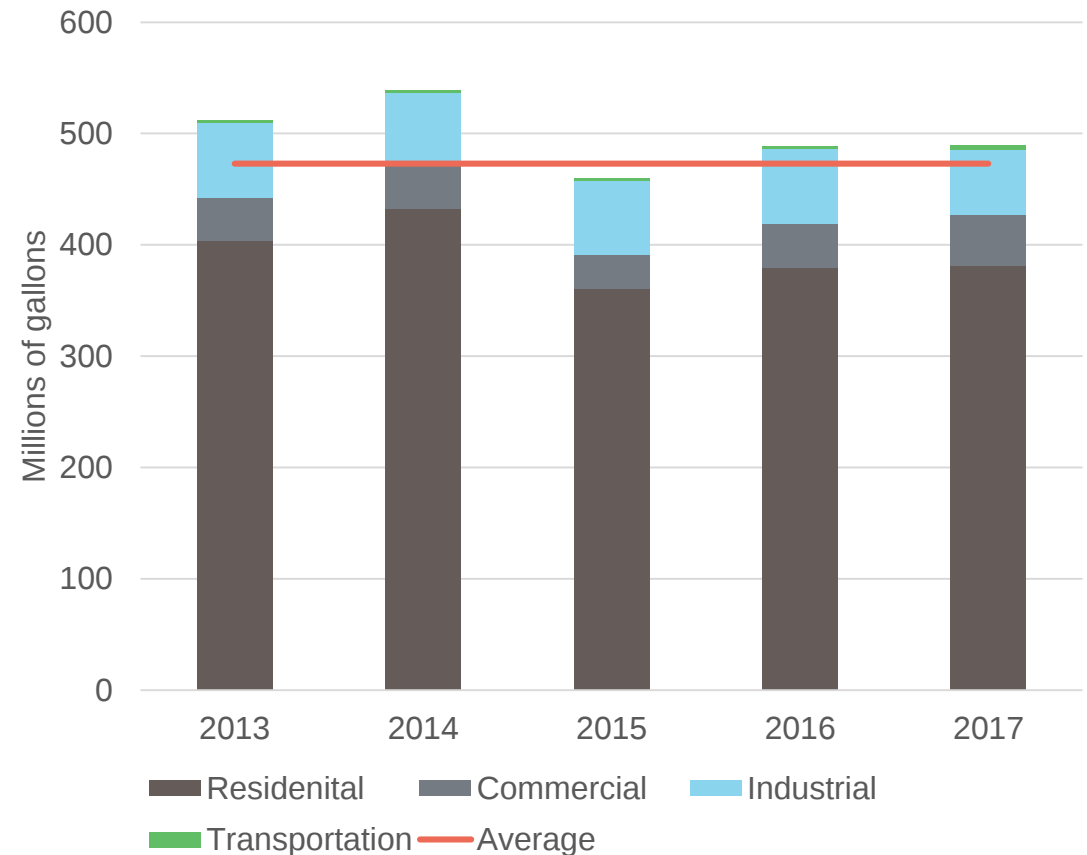
Study Approach

- Document underlying inputs, assumptions, and methodologies
 - Conduct comparative analysis of existing studies
 - Survey industry partners
 - Define inputs, assumptions, and sensitivities
 - Develop and program propane supply model
- Develop and assess alternative propane pathways to optimize the propane distribution network
 - Assess demand for propane in the state
 - Identify supply alternatives
 - Model supply alternatives

Propane Industry Characteristics

- Michigan is a top propane consuming state and has the highest residential propane consumption in the U.S.
- Average consumption over the past five years was 473 million gallons.

Statewide Annual Propane Consumption

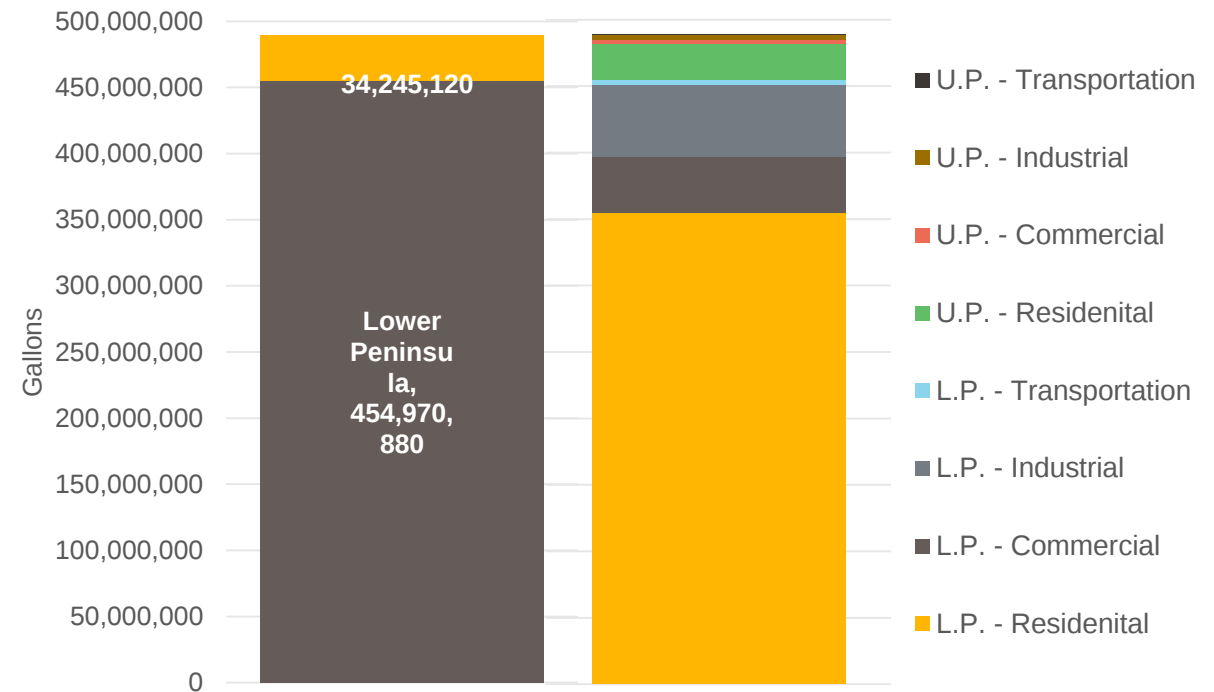


Source: Propane Education and Research Council

Propane Industry Characteristics

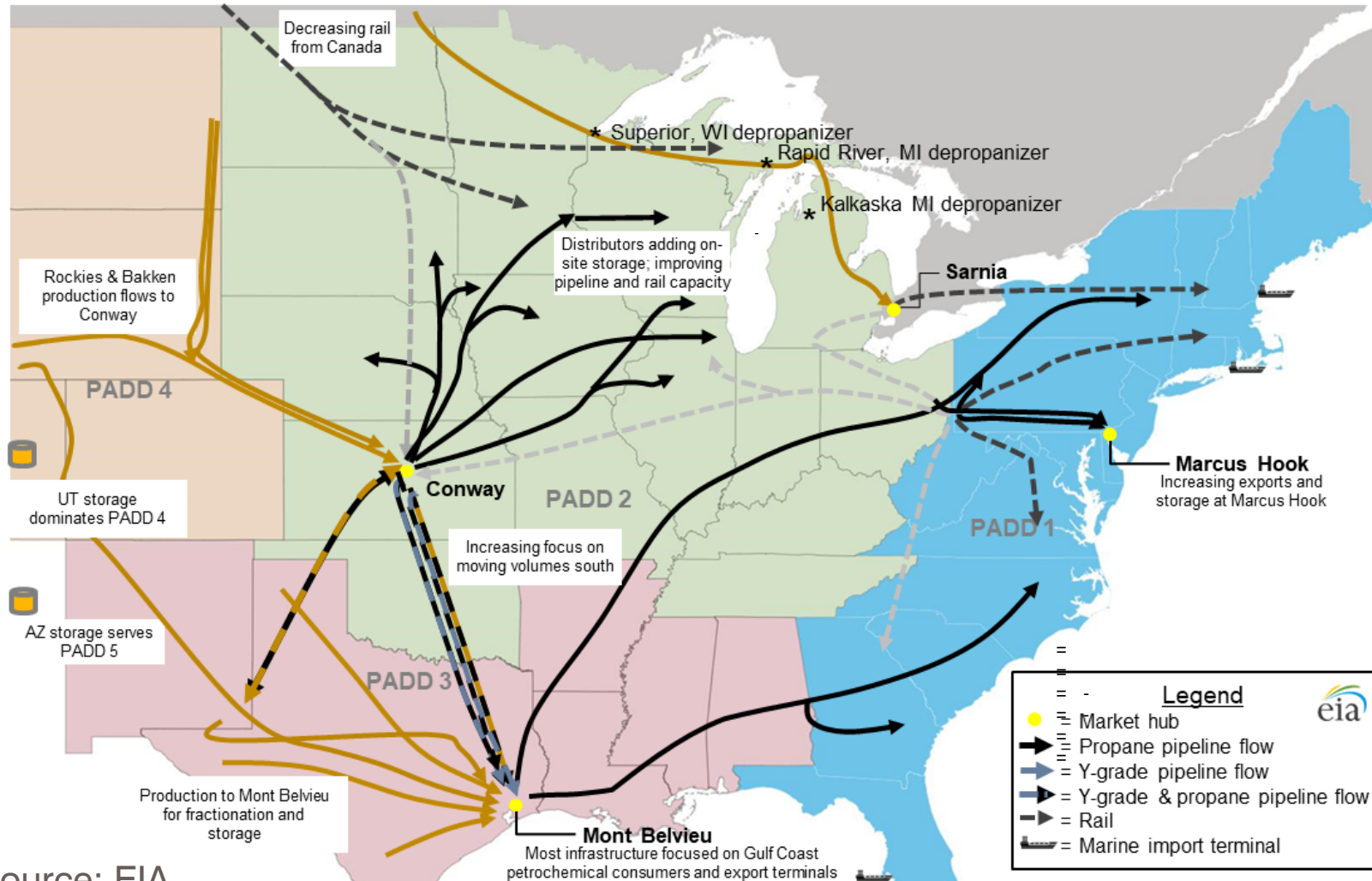
- The Lower Peninsula is responsible for 93 percent of statewide propane consumption.
- The remaining 7 percent of consumption occurs in the Upper Peninsula.
- Residential customers account for 78 percent of all propane consumption.

Annual Propane Consumption, 2017



Source: Propane Education and Research Council

Propane Supply



Source: EIA

Primary Sources of Propane Supply

Upper Peninsula

- **Production**
 - Rapid River, MI
 - Superior, WI
 - Direct rail supply from Western Canada
- **Storage**
 - Kincheloe, MI

Lower Peninsula

- **Production**
 - Sarnia, ON Production
 - Kalkaska, MI Production
 - Marathon Refinery Detroit, MI
- **Storage**
 - Marysville, MI
 - St. Clair, MI
 - Alto, MI
- **Neighboring States**
 - Refineries in IL, IN, OH
 - Other propane producers and terminals

Propane Storage

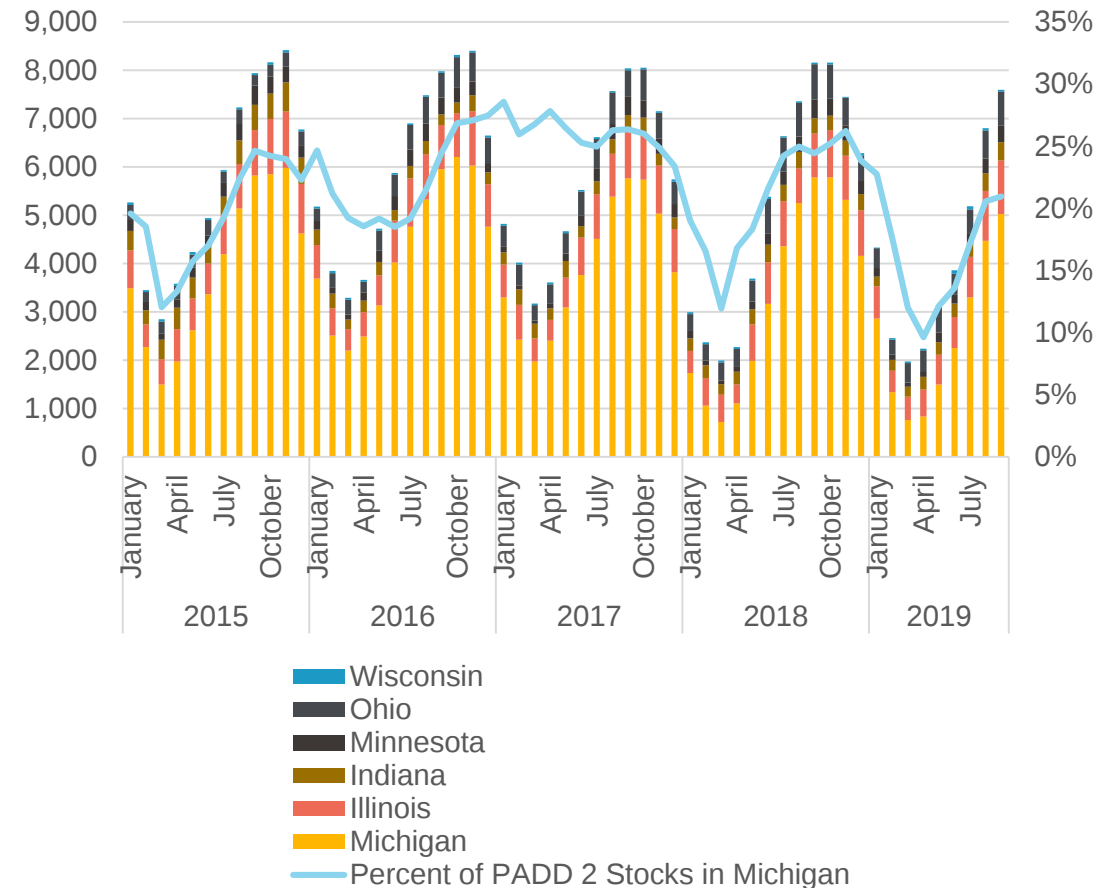
- Michigan has significant propane storage capacity.
- Provided 21 percent of PADD 2 stocks on average for the past 5 years.

Michigan Propane Storage Capacity (gallons)

Underground Storage	582,080,100
Aboveground Storage	3,252,144
Total	585,332,244

Source: MPSC

Propane Stocks

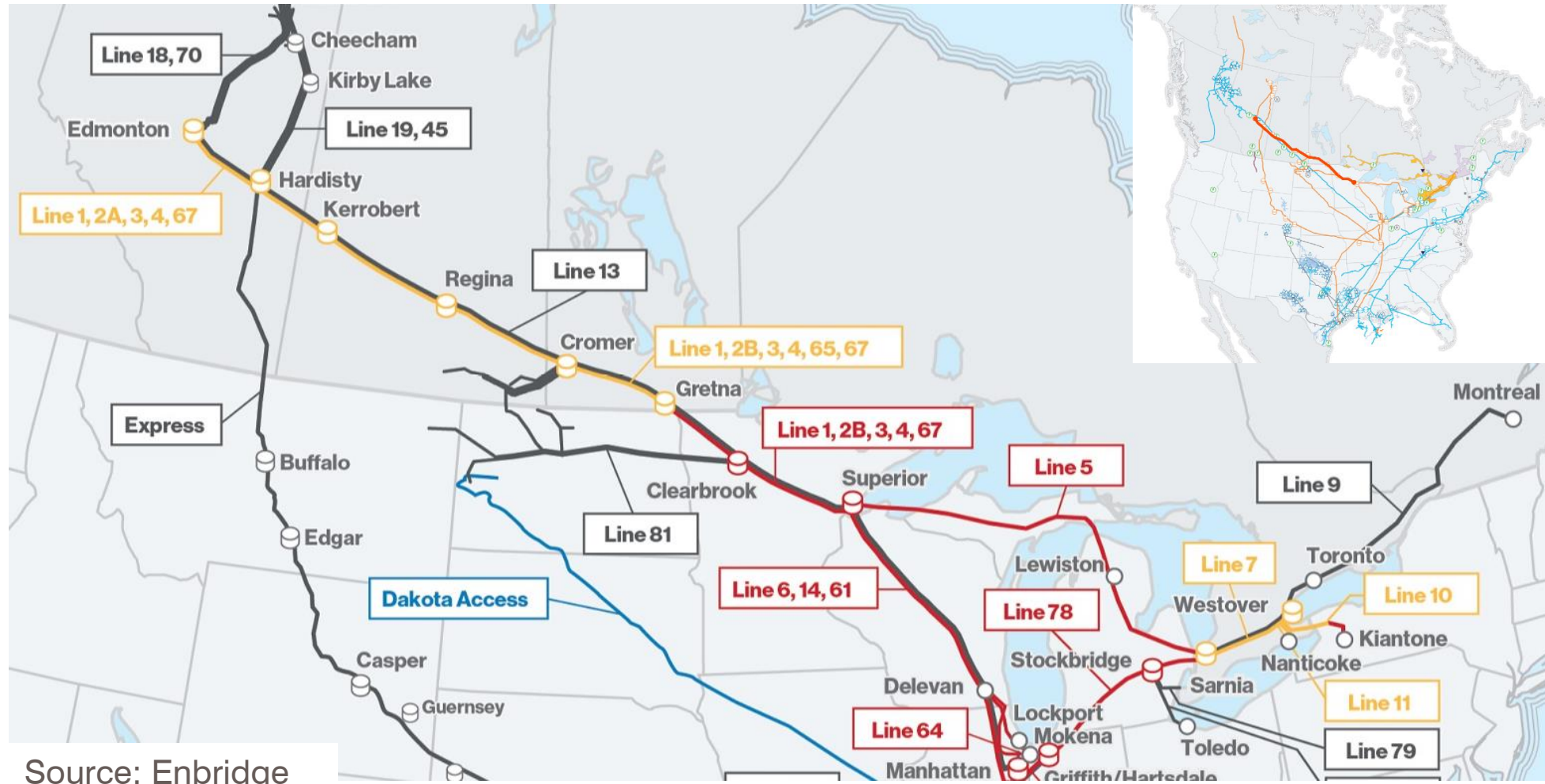


Source: EIA

Scenarios Evaluated

- **Scenario One:** Supply Disruption on Enbridge's Lakehead system between Edmonton, Alberta to Superior, Wisconsin
- **Scenario Two:** Supply Disruption on Enbridge's Line 5 from Superior, Wisconsin to Sarnia, Ontario
- **Scenario Three:** Weather related supply disruption (including polar vortex and/or wet/ late drying season)

Scenario One – Enbridge Line 1 Disruption

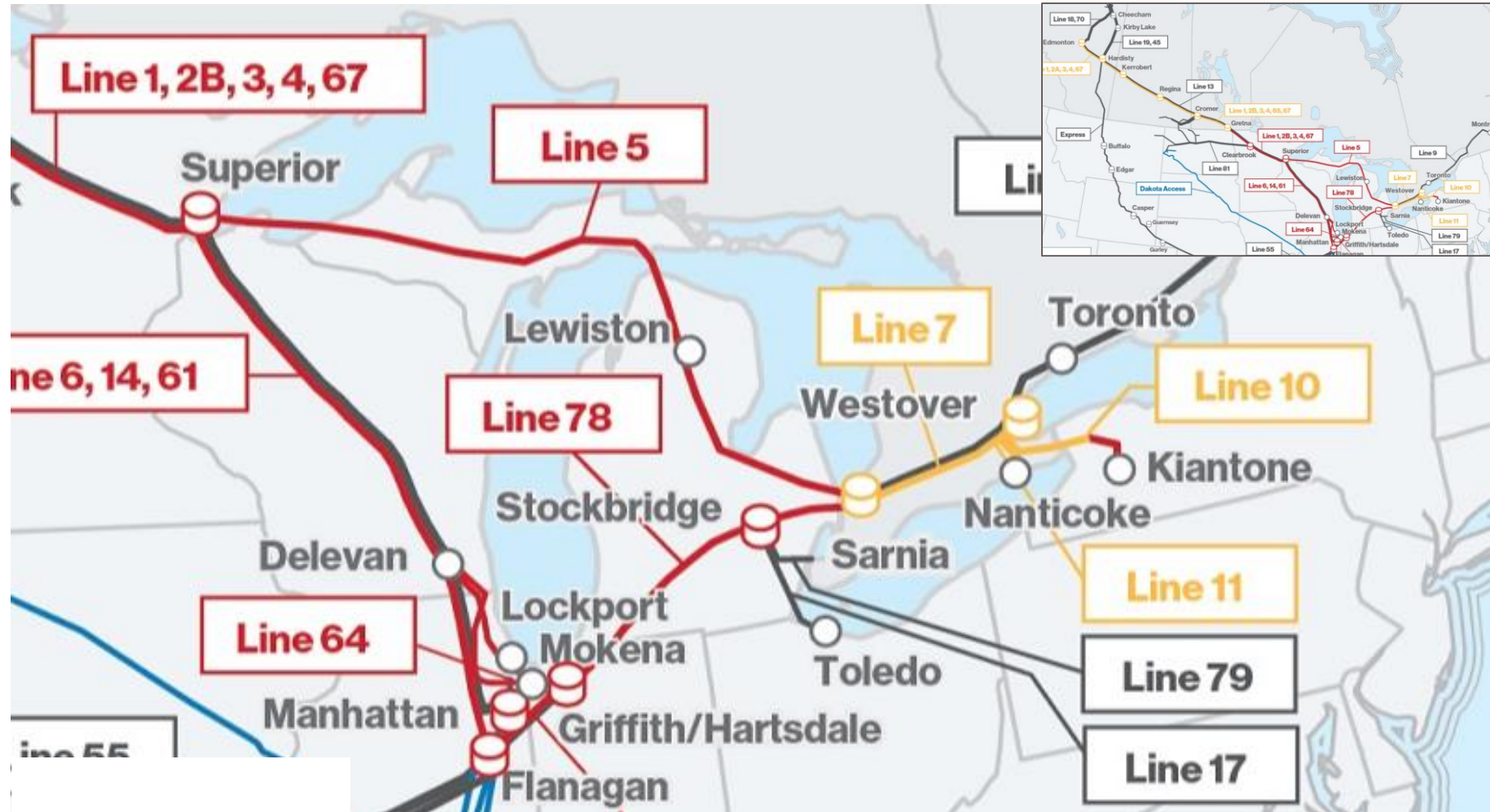


Scenario One – Enbridge Line 1 Disruption

- The loss of propane production at Superior, Rapid River, and Sarnia in the event of a Line 1 disruption would impact between 34-55 percent of Michigan's statewide propane supply.
- Rapid River and Superior are estimated to provide up to 90 percent of propane supply in the Upper Peninsula.
- The Lower Peninsula would see up to half of its propane supplies impacted.*

* There are competing estimates as to the amount of Michigan's propane supply that is sourced from Line 5. Estimates range from 34 percent up to 55 percent of Michigan's total propane needs are provided via Line 5. PSC continues work to refine this number.

Scenario Two – Enbridge Line 5 Disruption



Scenario Two – Enbridge Line 5 Disruption

- The loss of propane production at Rapid River and Sarnia in the event of a Line 5 disruption would have a significant impact on Michigan's propane supply.
- Rapid River is estimated to provide 65 percent of the propane supply in the Upper Peninsula.
- The Lower Peninsula would see up to half of its propane supplies impacted.*

* There are competing estimates as to the amount of Michigan's propane supply that is sourced from Line 5. Estimates range from 34 percent up to 55 percent of Michigan's total propane needs are provided via Line 5. PSC continues work to refine this number.

Scenario Three – Extreme Weather Events

- Propane consumption is driven, in large part by weather. PSC estimates between 60-65 percent of total propane consumption is weather dependent.
- PSC calculated Michigan's weather normalized propane consumption as a basis for this analysis, but also developed a propane demand profile for Michigan that illustrates the potential increased demand resulting from an extreme cold snap.

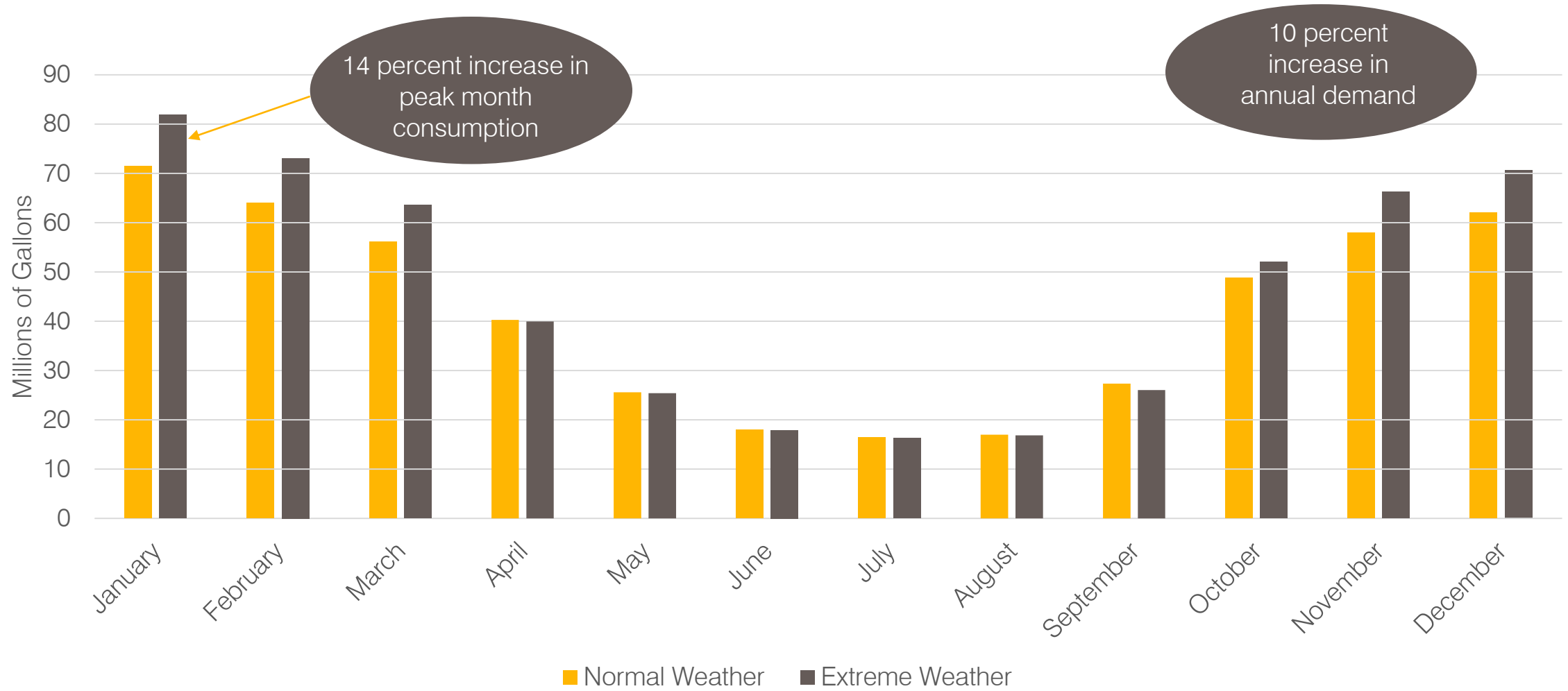
Scenario Three – Extreme Weather Events

- For Scenario Three, PSC assumed that monthly heating degree days would be 20 percent higher than the 10-year average from 2010-2019. For comparison, 2014 was the 7th coldest year recorded since 1919. Compared to the average from 2010-2019, 2014 witnessed 15.3 percent more heating degree days.

Heating Degree Days

Period	January	February	March	April	May	June	July	August	September	October	November	December	Total
1919-2019	1,336.6	1,158.5	991.6	591.3	289.2	63.7	14.5	34.9	138.6	464.1	818.7	1,176.6	7,078.1
2010-2019	1,305.6	1,130.4	943.8	570.9	225.4	47.5	9.4	23.0	101.9	418.6	798.2	1,084.1	6,658.8
2014	1,549.0	1,368.0	1,233.0	580.0	253.0	40.0	40.0	31.0	146.0	462.0	938.0	1,036.0	7,676.0
Scenario 3	1,566.7	1,356.5	1,132.6	685.1	270.5	57.0	11.3	27.6	122.3	502.3	957.8	1,300.9	7,990.6

Scenario Three – Extreme Weather Events



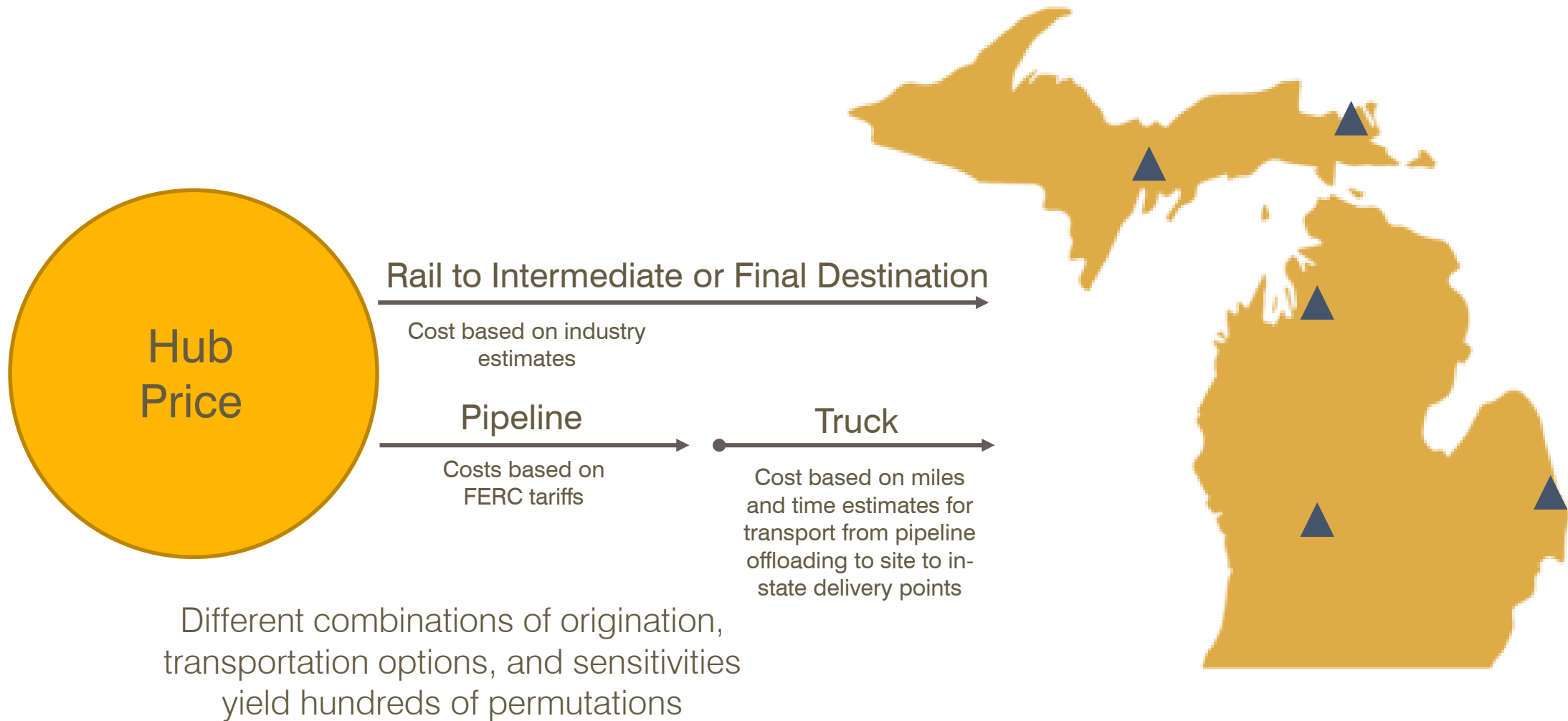
Sensitivities Analysis

- **Sensitivity One: Weather Variability Affecting Seasonal Heating Demand**
 - Results in increase or decrease in propane demand based on seasonal temperatures (Scenarios 1&2)
- **Sensitivity Two: Demand Reduction through Conservation**
 - Results in decreased propane demand over the long run, estimated at 1.5 percent per year (All Scenarios)
- **Sensitivity Three: Customer Storage Optimization**
 - Results in increased propane stocks within the state that can potentially mitigate seasonal pricing impacts (All Scenarios)

Propane Modeling Process

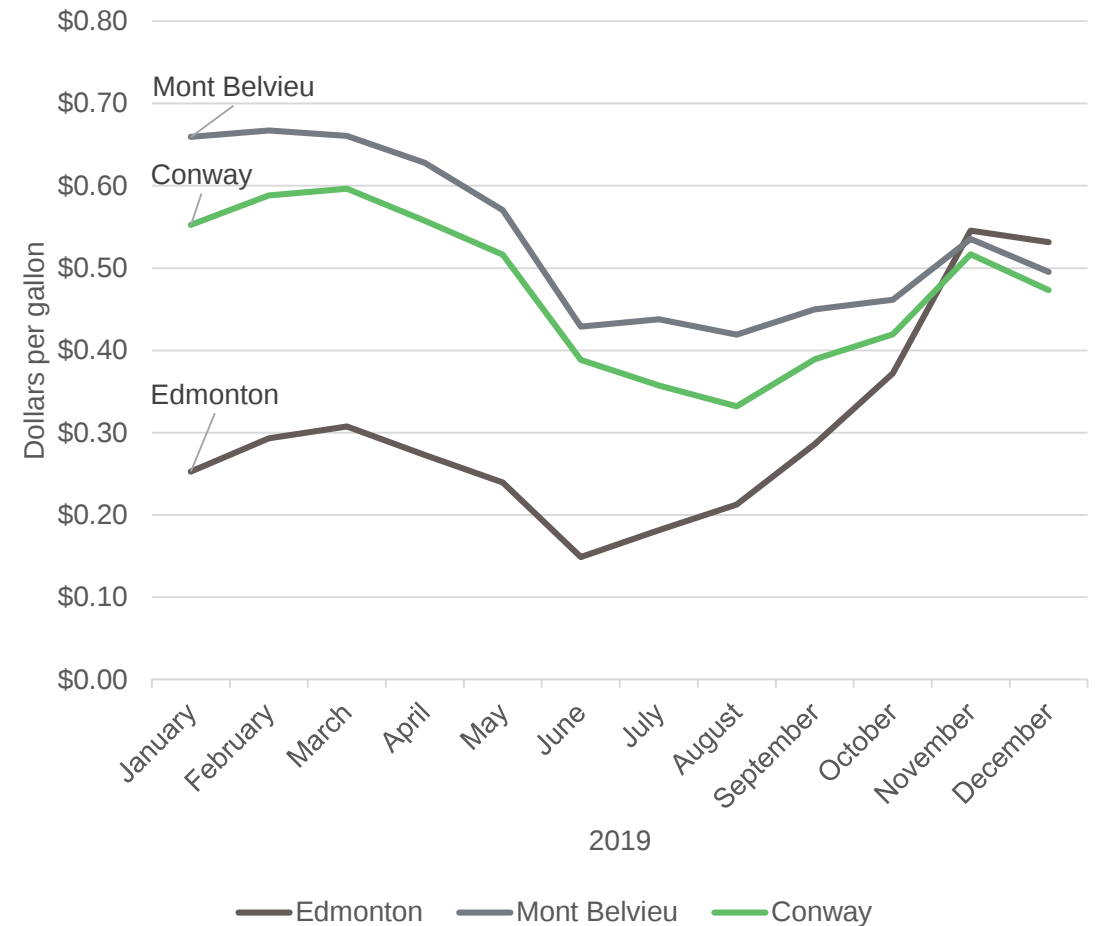
- Inventory and characterize supply options
 - Existing options
 - Quantity and cost
 - Alternate options
 - Fuel, transportation, and other costs
- Develop demand curves
 - Weather-normalized, Flat, Extreme weather,
 - Statewide, Lower Peninsula, Upper Peninsula
 - Residential, commercial, industrial, agricultural, and transportation
- Calculate cost of supply alternatives from point of origin to delivery at designated points Michigan
- Estimate impact of scenarios (line outages or weather) on demand and supply
- Balance supply and demand with alternate options

Modeling Supply Alternatives



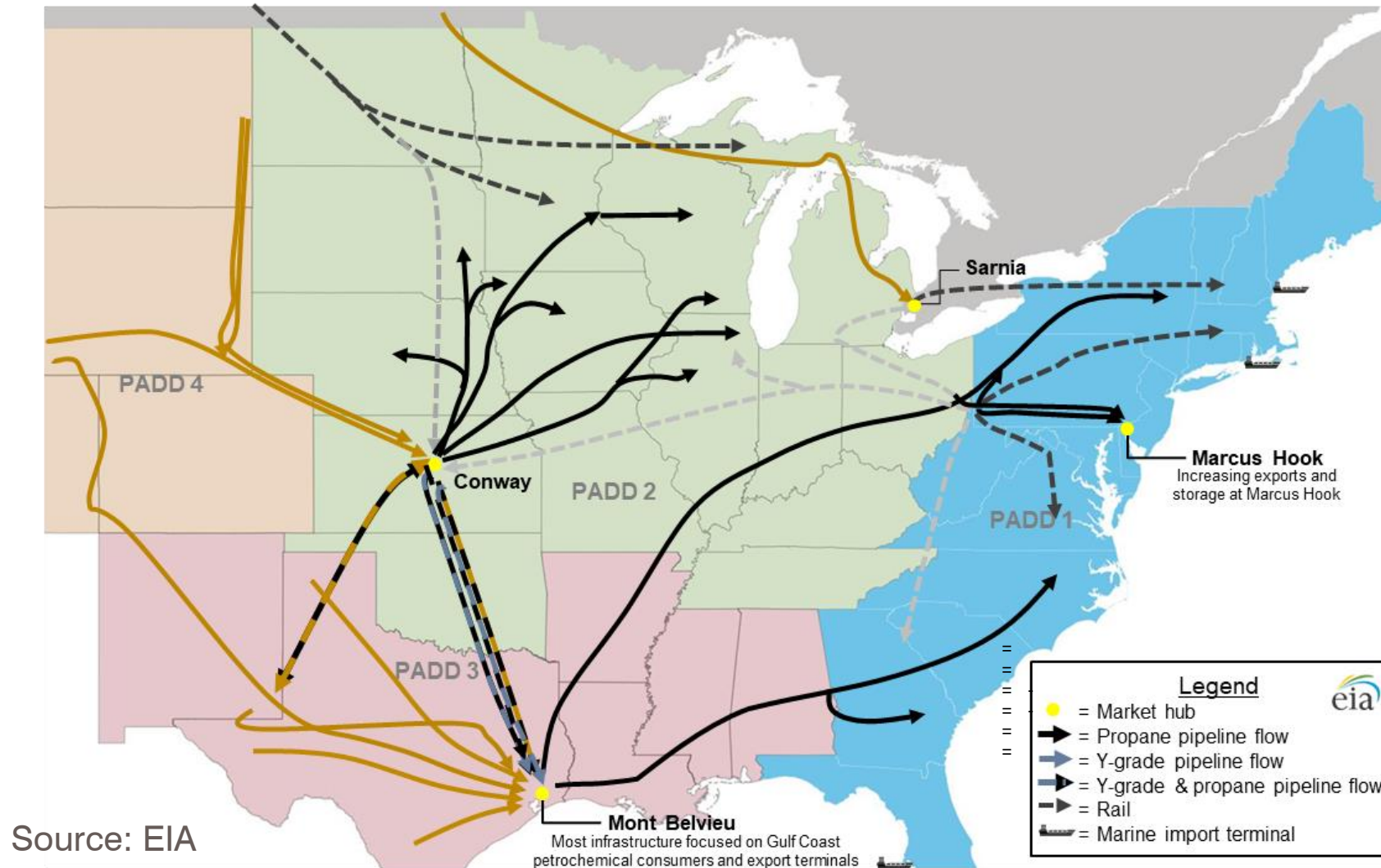
Supply Alternatives – Sources of Propane

- North America has an abundance of propane. The question is how to get it to end users.
- Three major North American supply hubs
 - Edmonton, Alberta
 - Mont Belvieu, Texas
 - Conway, Kansas

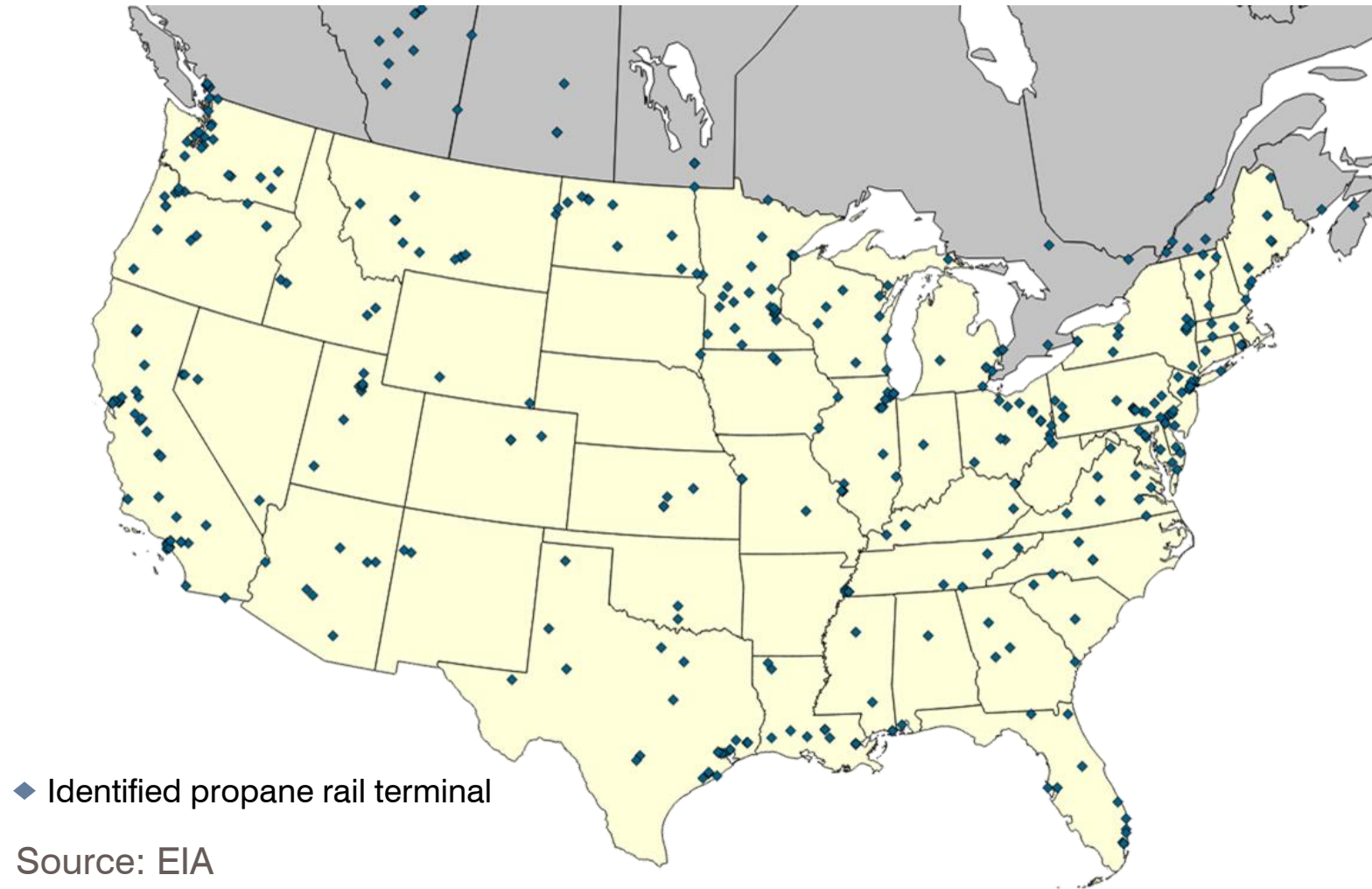


Source: EIA

Supply Alternatives – Transportation Options



Supply Alternatives – Transportation Options

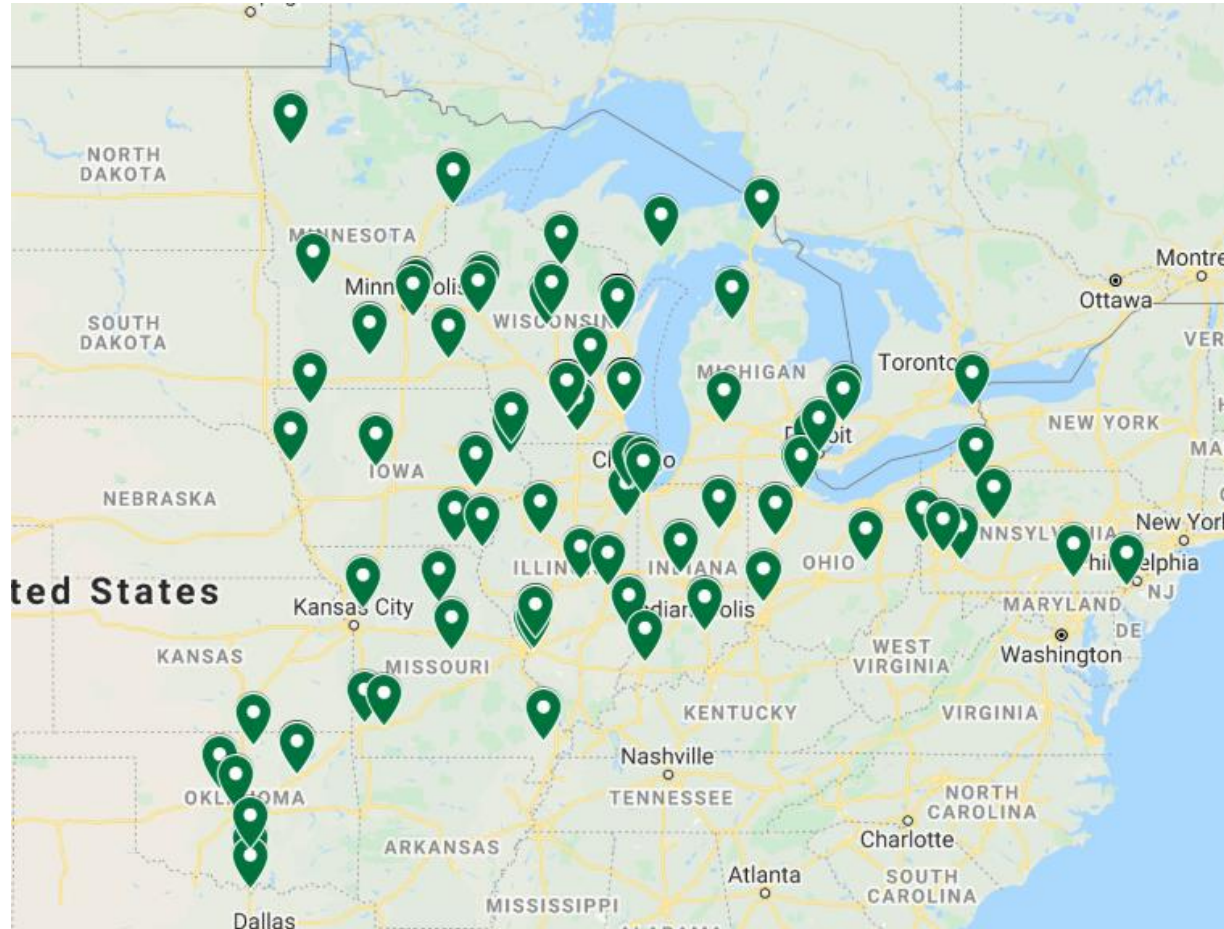


Supply Alternatives – Regional Terminals



Source: OPIS/STALSBY Petroleum Terminal Encyclopedia

NGL and Propane Terminals



Map includes Alto, Rapid River, Kincheloe, and Kalkaska Facilities

Source: OPIS/STALSBY Petroleum Terminal Encyclopedia

Delivery Points to Michigan

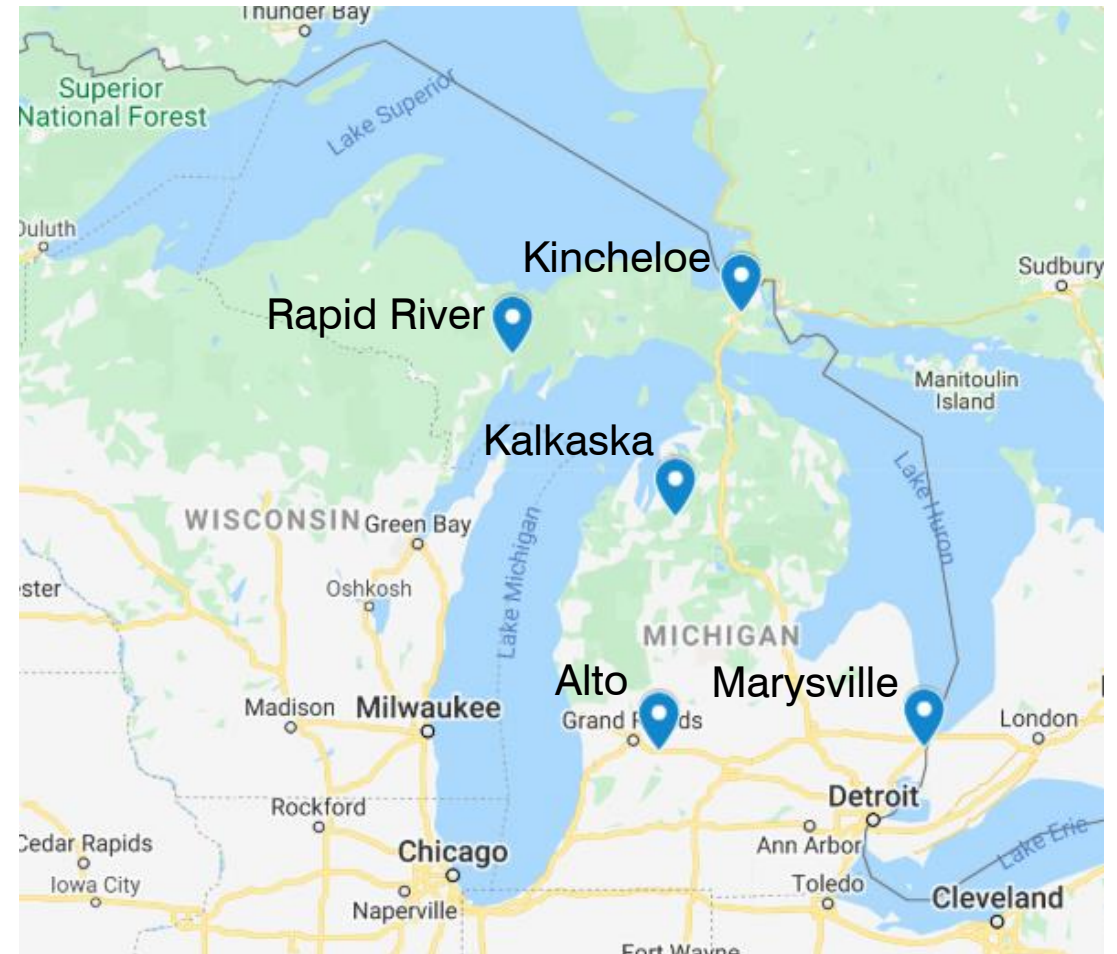
Western Upper Peninsula – Rapid River

Eastern Upper Peninsula – Kincheloe

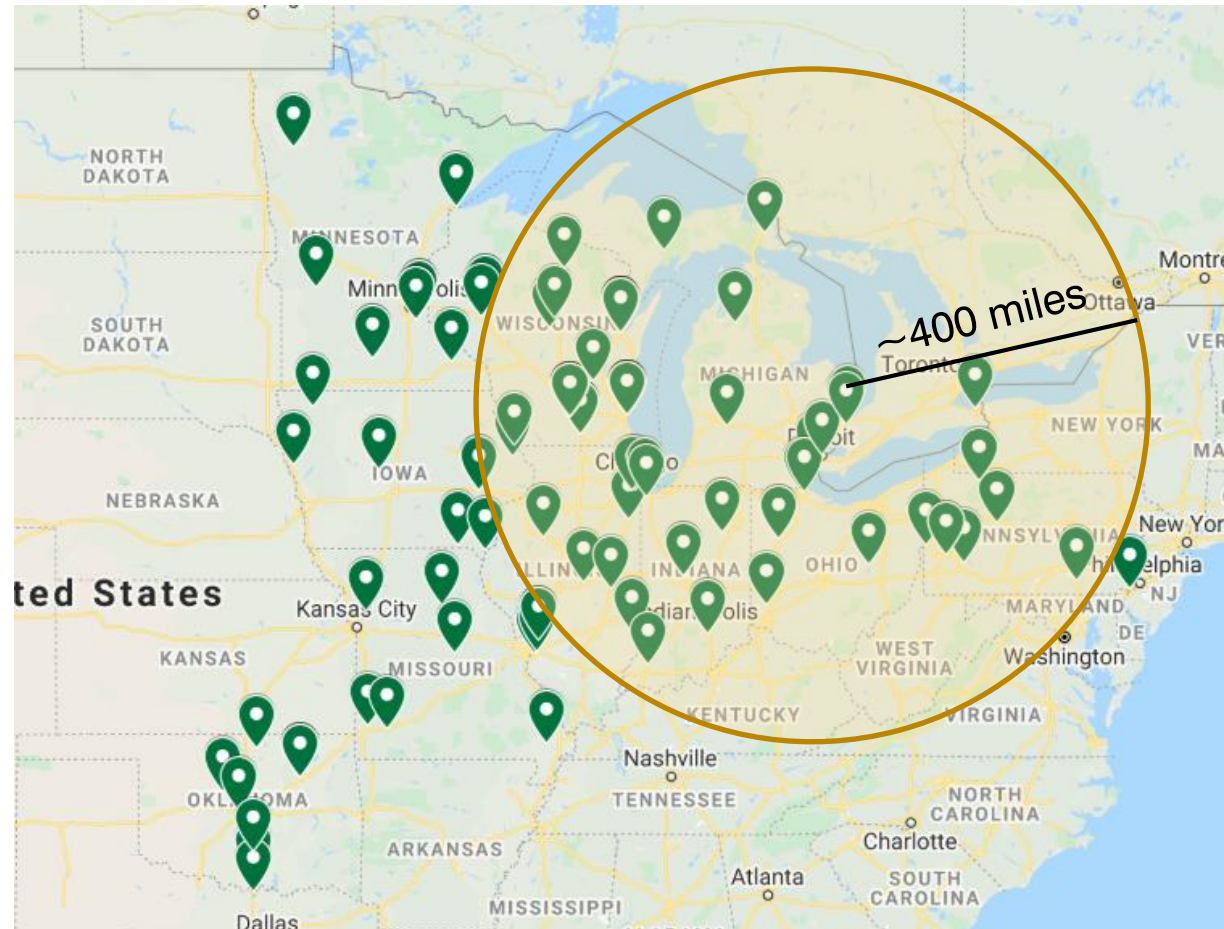
Northern Lower Peninsula – Kalkaska

Western Lower Peninsula – Alto

Eastern Lower Peninsula – Marysville



NGL and Propane Terminals – Marysville



Ranges are approximate

Source: OPIS/STALSBY Petroleum Terminal Encyclopedia

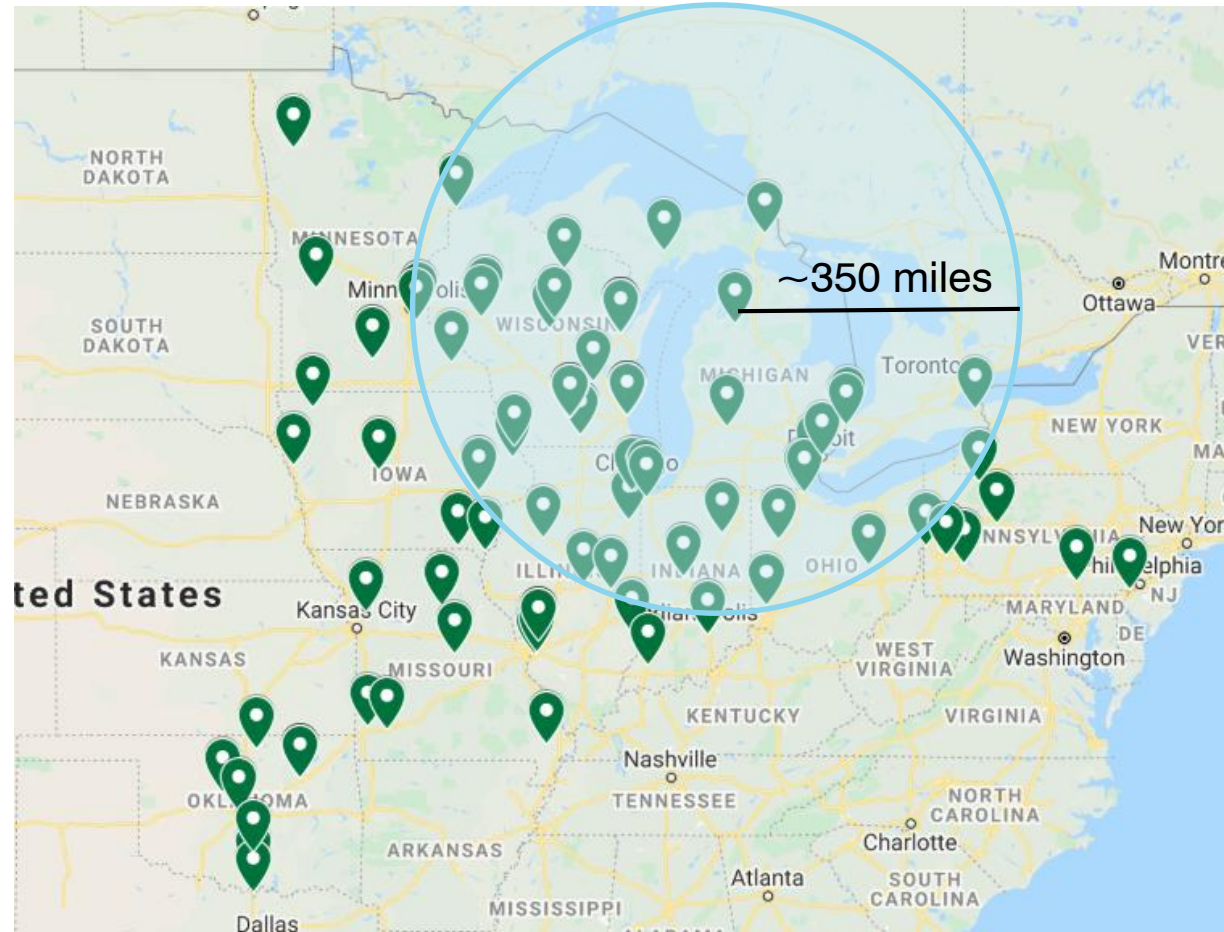
NGL and Propane Terminals – Alto



Ranges are approximate

Source: OPIS/STALSBY Petroleum Terminal Encyclopedia

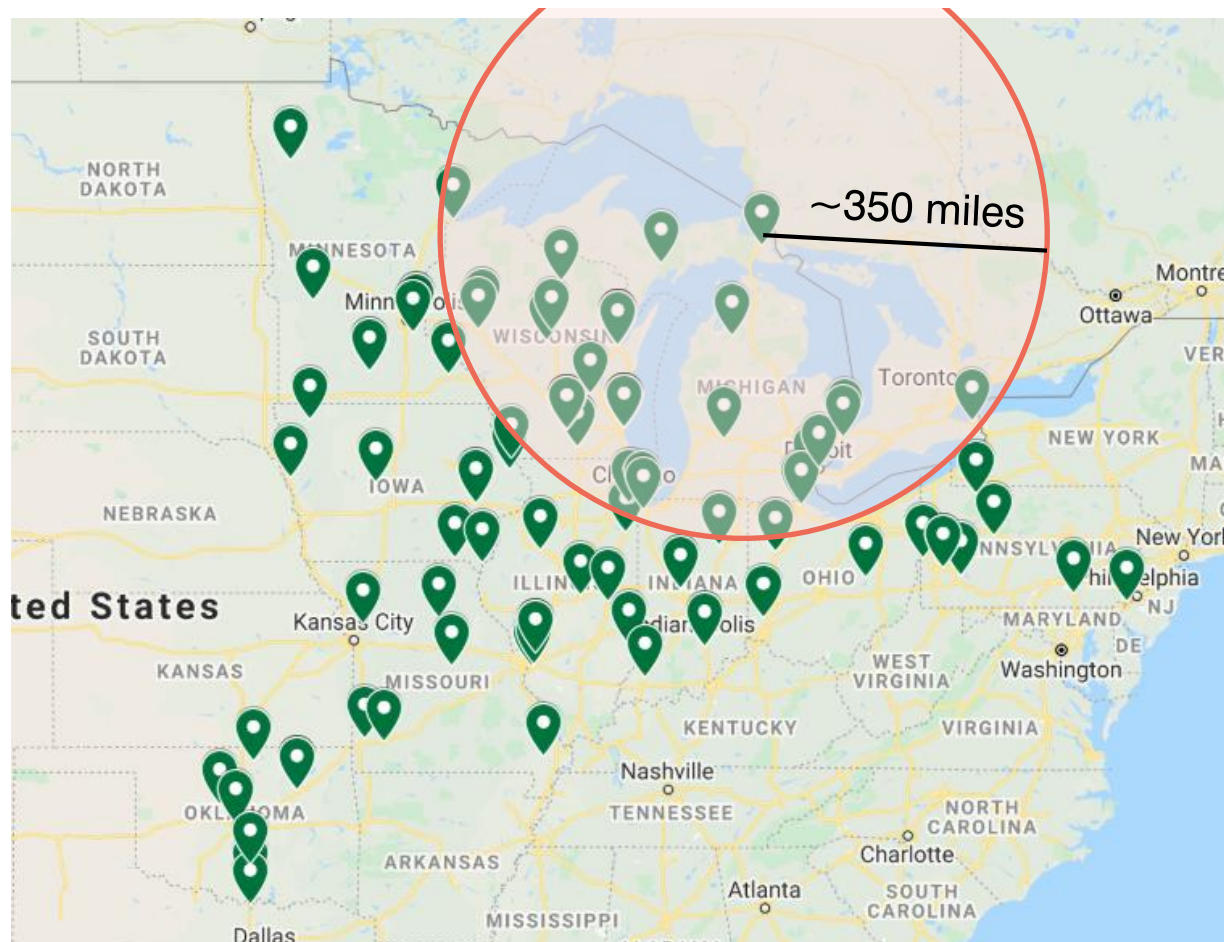
NGL and Propane Terminals – Kalkaska



Ranges are approximate

Source: OPIS/STALSBY Petroleum Terminal Encyclopedia

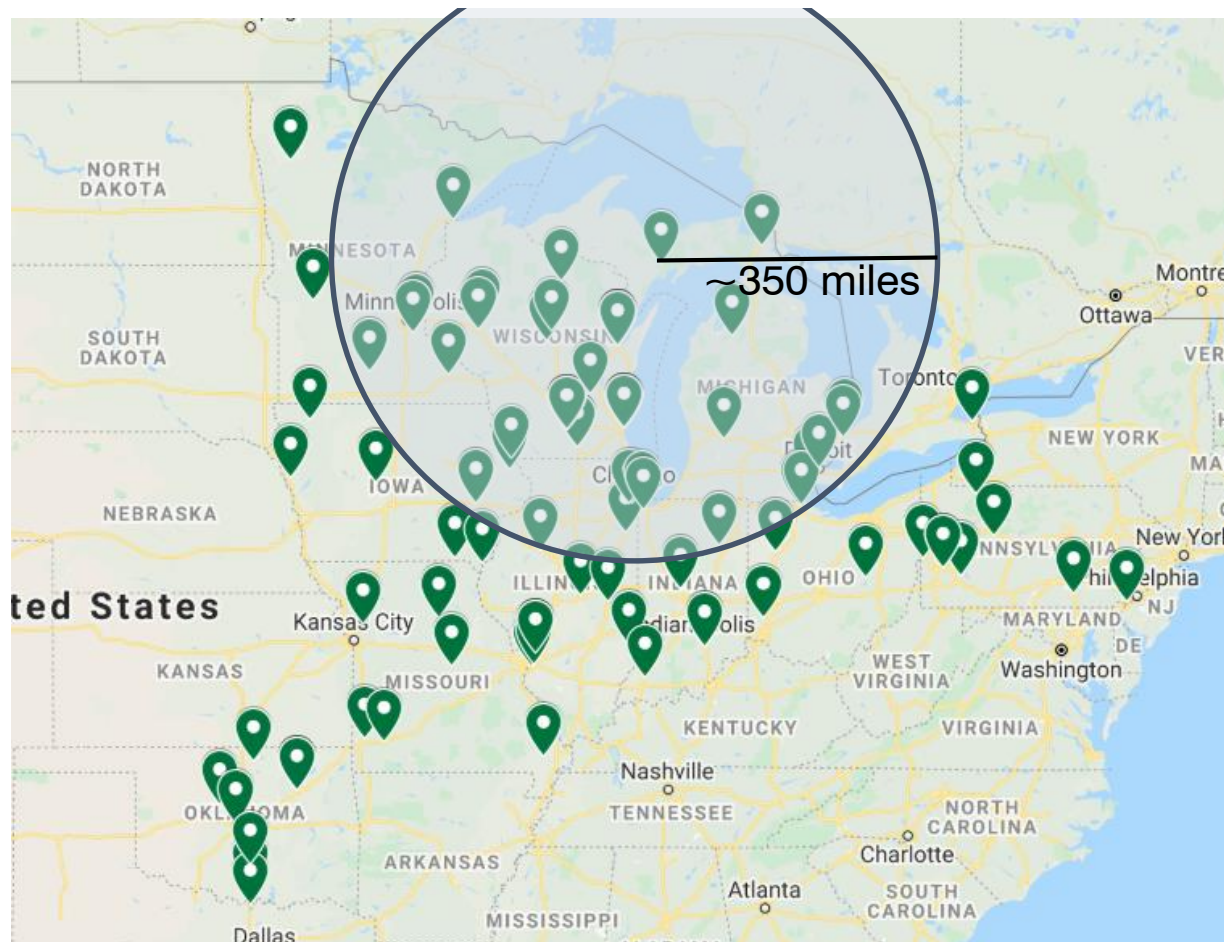
NGL and Propane Terminals – Kincheloe



Ranges are approximate

Source: OPIS/STALSBY Petroleum Terminal Encyclopedia

NGL and Propane Terminals – Rapid River



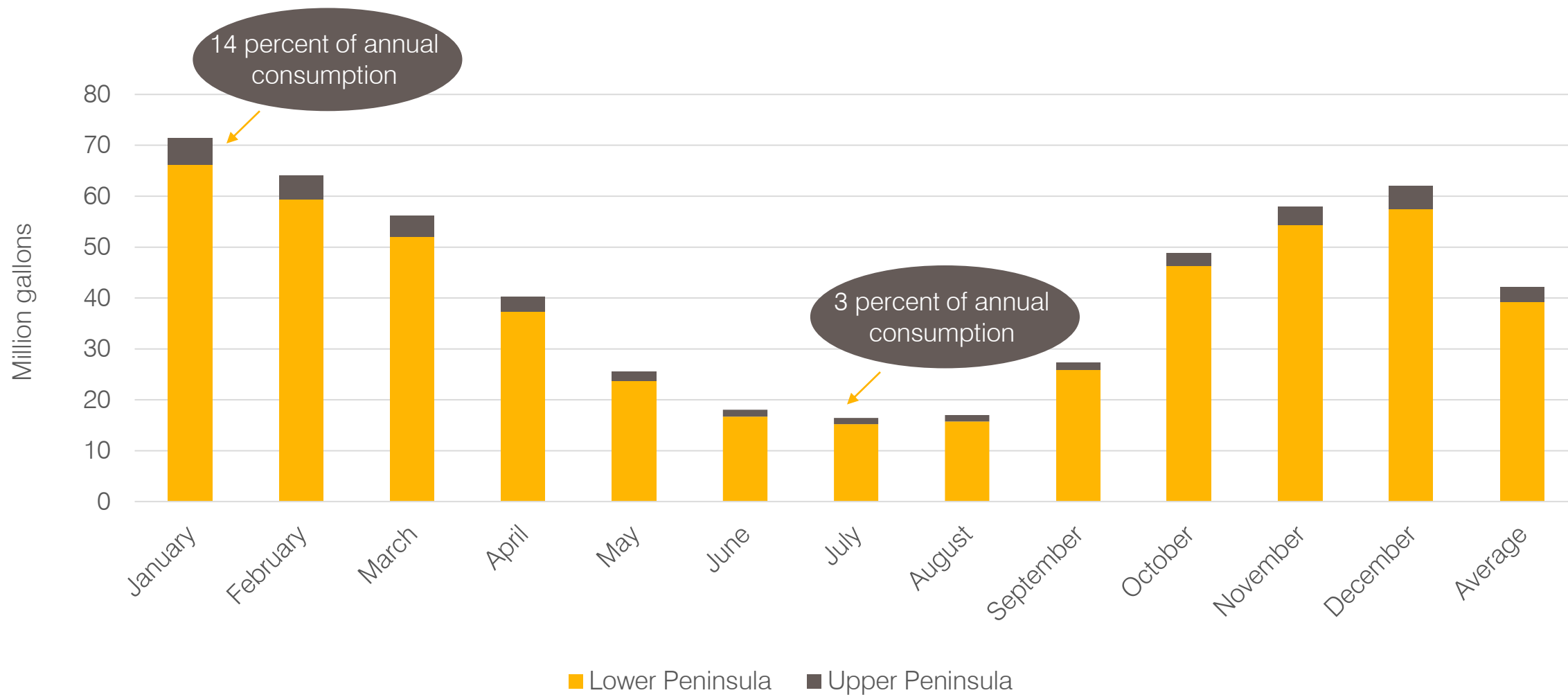
Ranges are approximate

Source: OPIS/STALSBY Petroleum Terminal Encyclopedia

Demand Curves

- Determine weather-sensitive and non-weather-sensitive propane usage
 - Bottom-up analysis by sector end-use
 - Regression analysis
- Calculate weather-sensitive demand using “normal weather”
- Calibrate using actual weather data
- Allocate consumption between Upper and Lower Peninsulas

Weather-Normalized Demand Curve



Anticipated Impact of Scenarios

Impact of Scenario One on Michigan's Propane Supplies

Statewide	170-275 million gallons	34-55 percent*
Upper Peninsula	30-35 million gallons	85-99 percent
Lower Peninsula	140-240 million gallons	30-52 percent

Impact of Scenario Two on Michigan's Propane Supplies

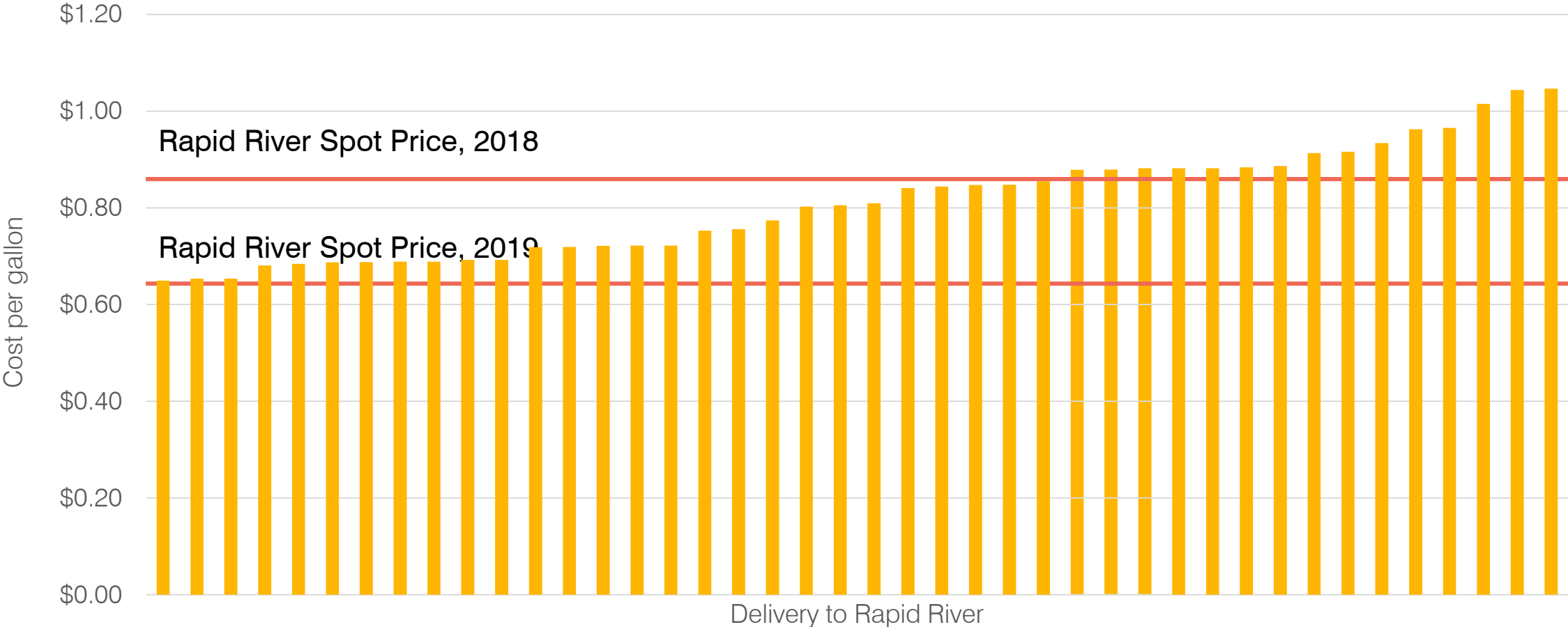
Statewide	160-275 million gallons	30-55 percent*
Upper Peninsula	20-30 million gallons	65-90 percent
Lower Peninsula	140-240 million gallons	30-52 percent

Impact of Scenario Three on Michigan's Propane Supplies

Statewide	45-55 million gallons	9-11 percent
Upper Peninsula	6-8 million gallons	15-20 percent
Lower Peninsula	39-47 million gallons	8-10 percent

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Preliminary Results



Preliminary Results

- Rapid River—\$0.65 to \$1.05 per gallon
- Alto—\$0.67 to \$1.05 per gallon
- Kalkaska—\$0.68 to \$1.04 per gallon
- Kincheloe—\$0.70 to \$1.05 per gallon
- Marysville—\$0.69 to \$0.99 per gallon

Next Steps

- Refine assumptions related to Michigan propane supply sources and disposition
- Refine transportation cost calculations
- Match supply alternatives to scenarios
- Assess risks for priority supply alternatives
- Calculate all-in costs for three scenarios
- Estimate impact of changes in supply cost on retail price and demand



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