



Prevention First 2018

“The Impact of Digital Technology on Oil and Gas Operations and HSE Performance”

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Topics

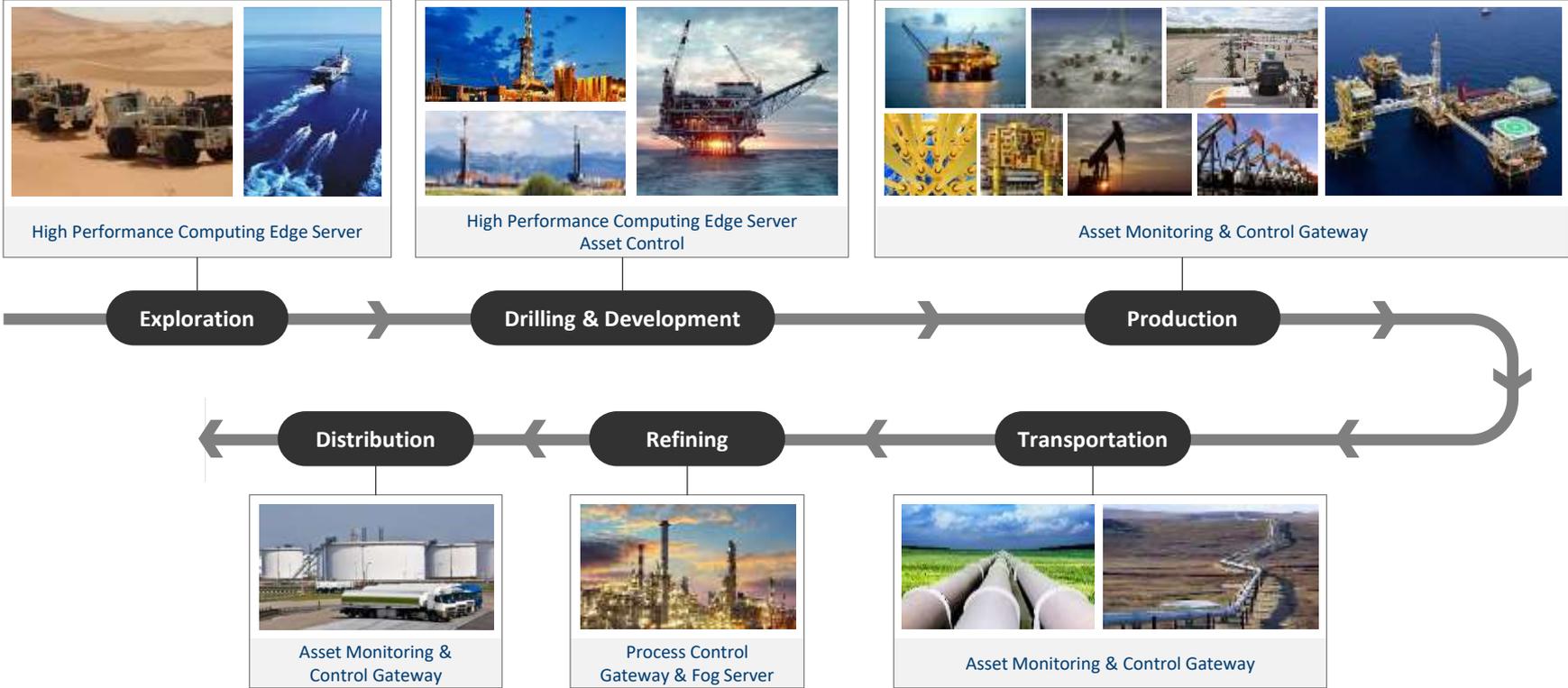
- “Digital Transformation”
- Drivers for the oil and gas industry
- Unique dimensions of the CA oil and gas system
- Opportunities and challenges
- Summary comments

“Digital Transformation” – what is it?

- Digitization – increasing digital intensity and connectivity
- Re-engineering work flows and work processes
- Transforming decision making



Digitizing the oil and gas industry



Digitization creates “Mirror Worlds”

Physical World



Digital World

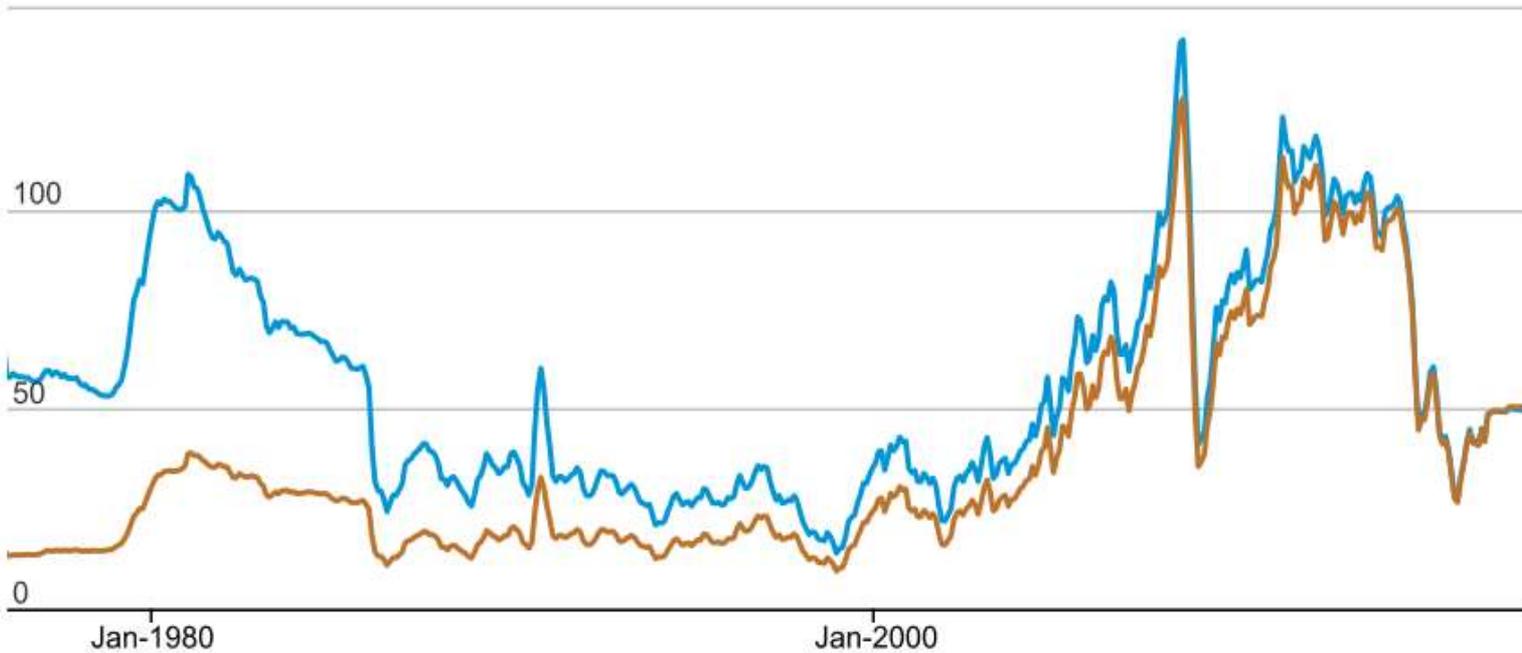


Digital Transformation is about the intersection, integrated operation, and co-evolution of these two mirror worlds

Oil prices from 1977 to 2017

Imported Crude Oil Prices

Dollars Per Barrel

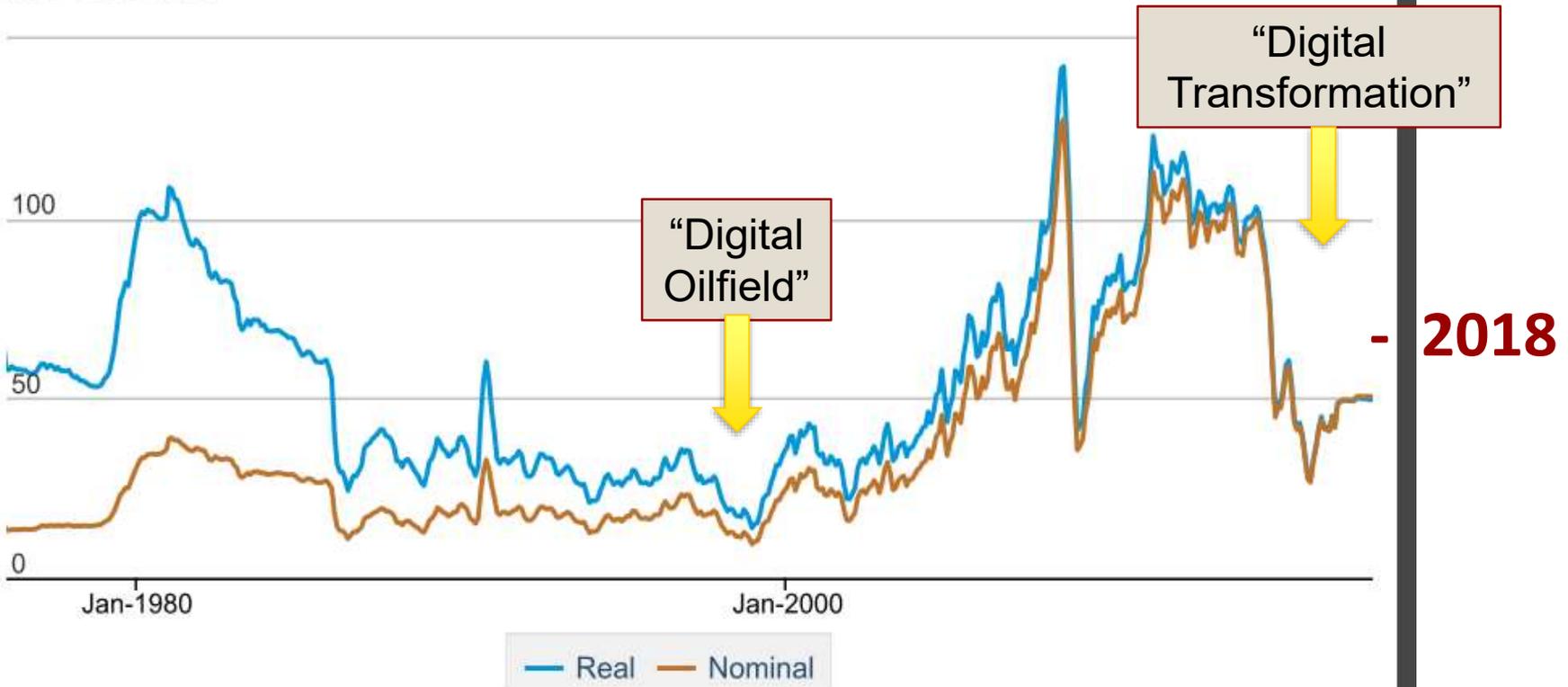


- 2018

Oil prices from 1977 to 2017

Imported Crude Oil Prices

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Industry framework

Business focus

- “Rediscovering” cost management
- Increasing asset and capital efficiency
- Implementing the “oilfield as a factory” paradigm
- Re-engineering the workforce
- Lowering environmental and social impacts

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Technology focus

- Big Data and analytics
- IIoT for oil and gas:
 - Vast expansion in sensing, digitization, and connectivity
 - Next-generation automation and control systems
 - Machine intelligence
 - Drones and robotics
- Cyber-physical security
- Human–machine relationships

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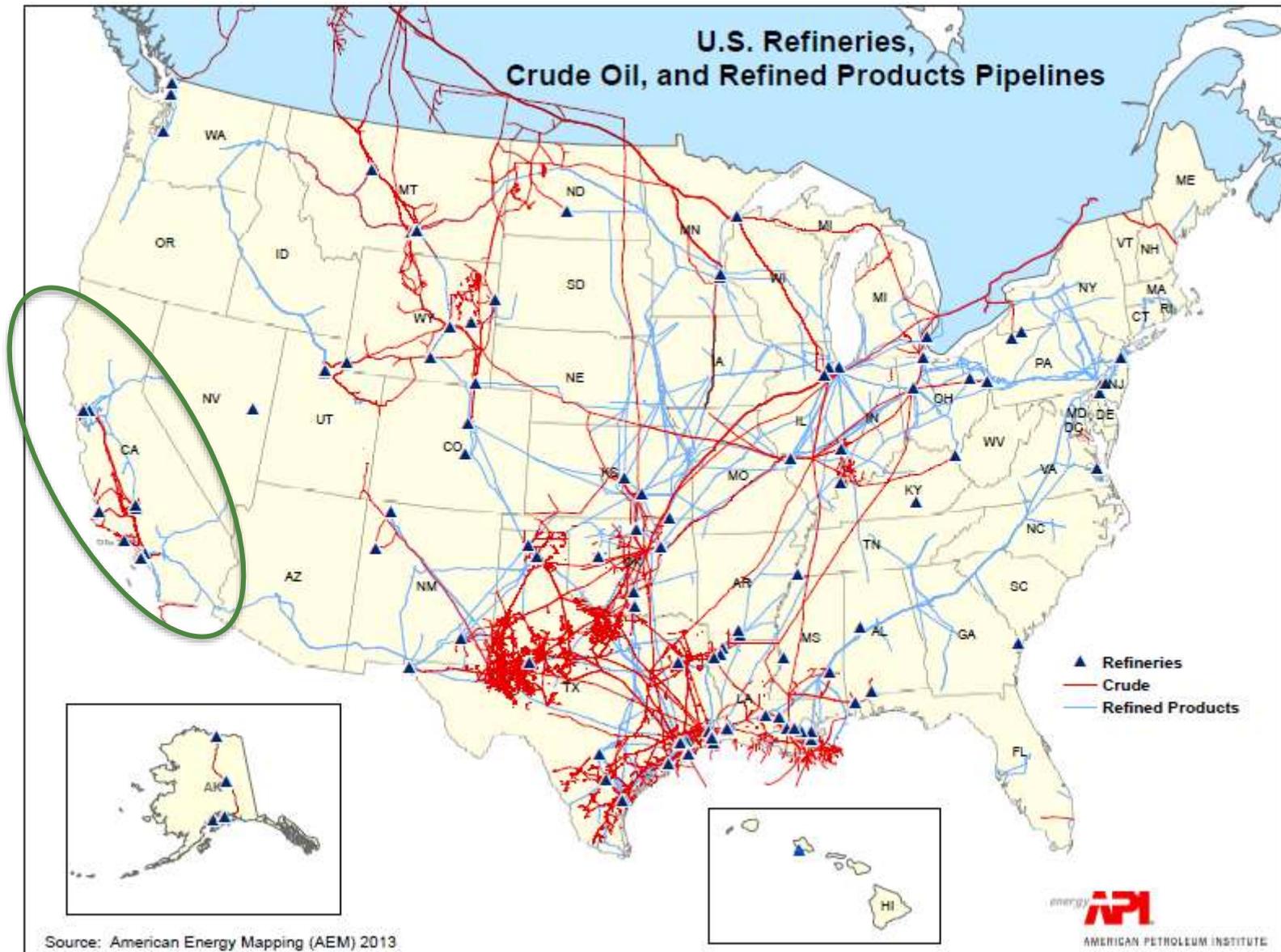
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**“Digital Transformation”
Is at the intersection**

Unique dimensions of the CA oil and gas system

- CA is an oil supply “island”
- CA is a major natural gas importer

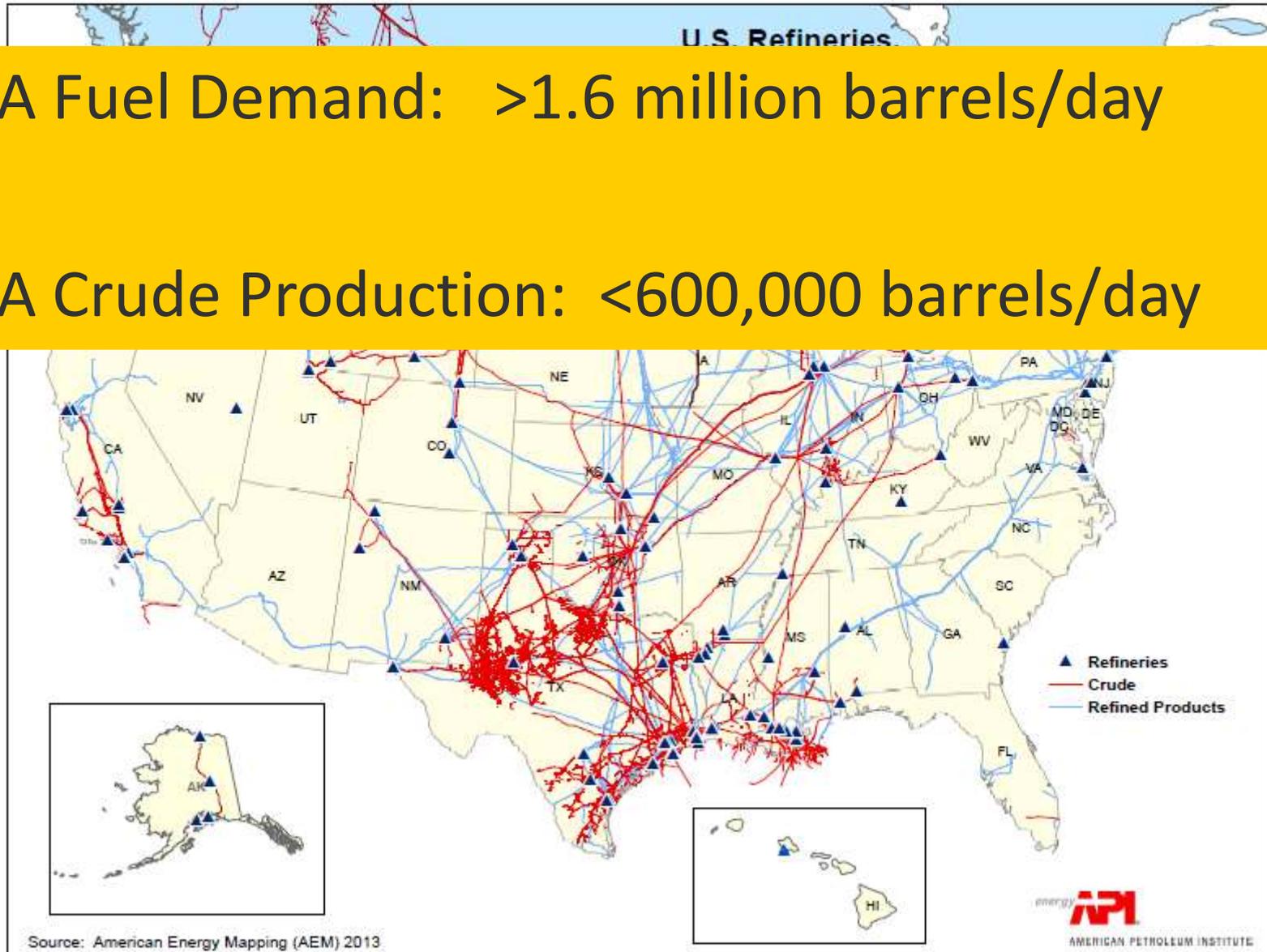
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CA Fuel Demand: >1.6 million barrels/day

CA Crude Production: <600,000 barrels/day

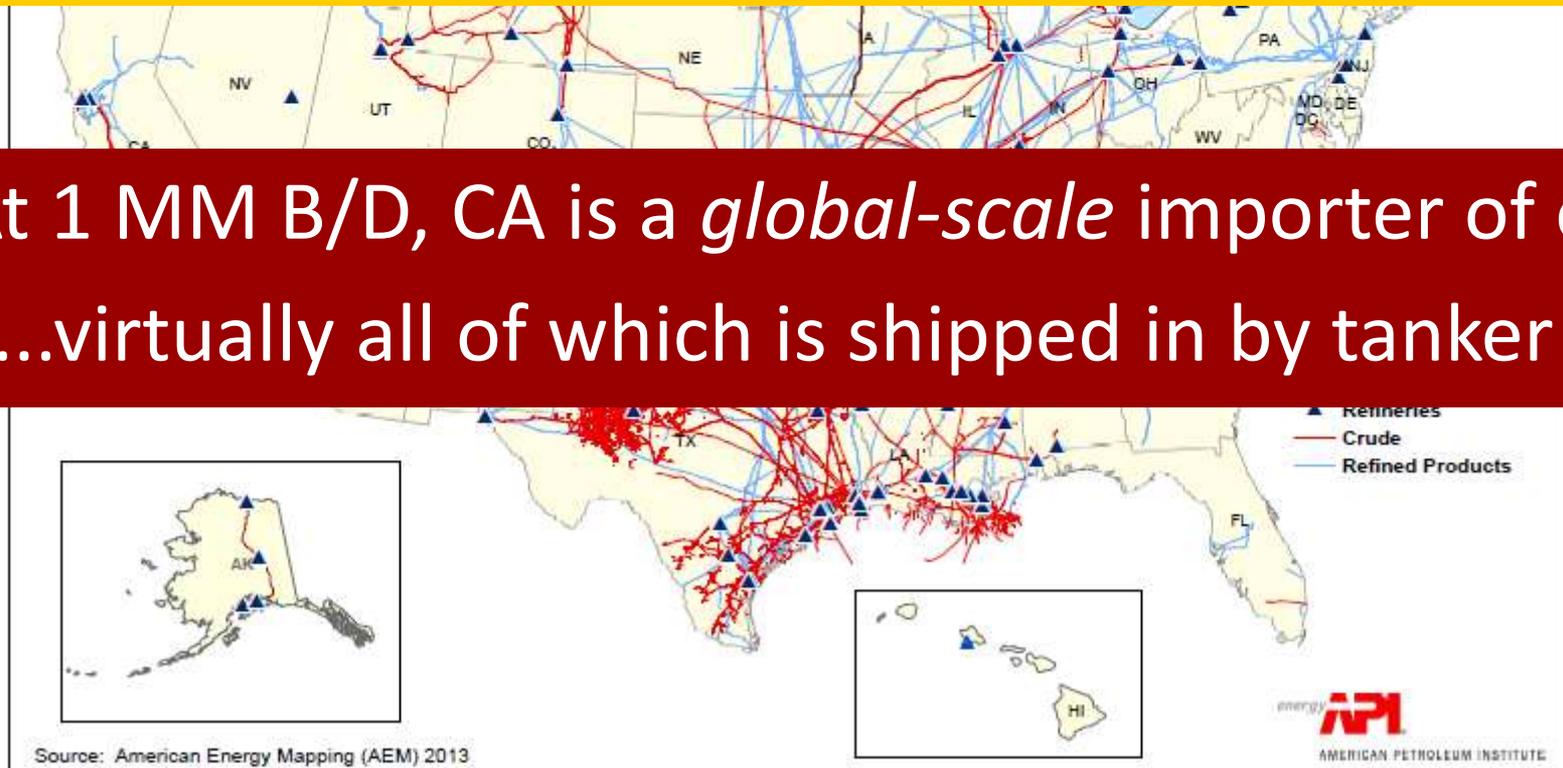


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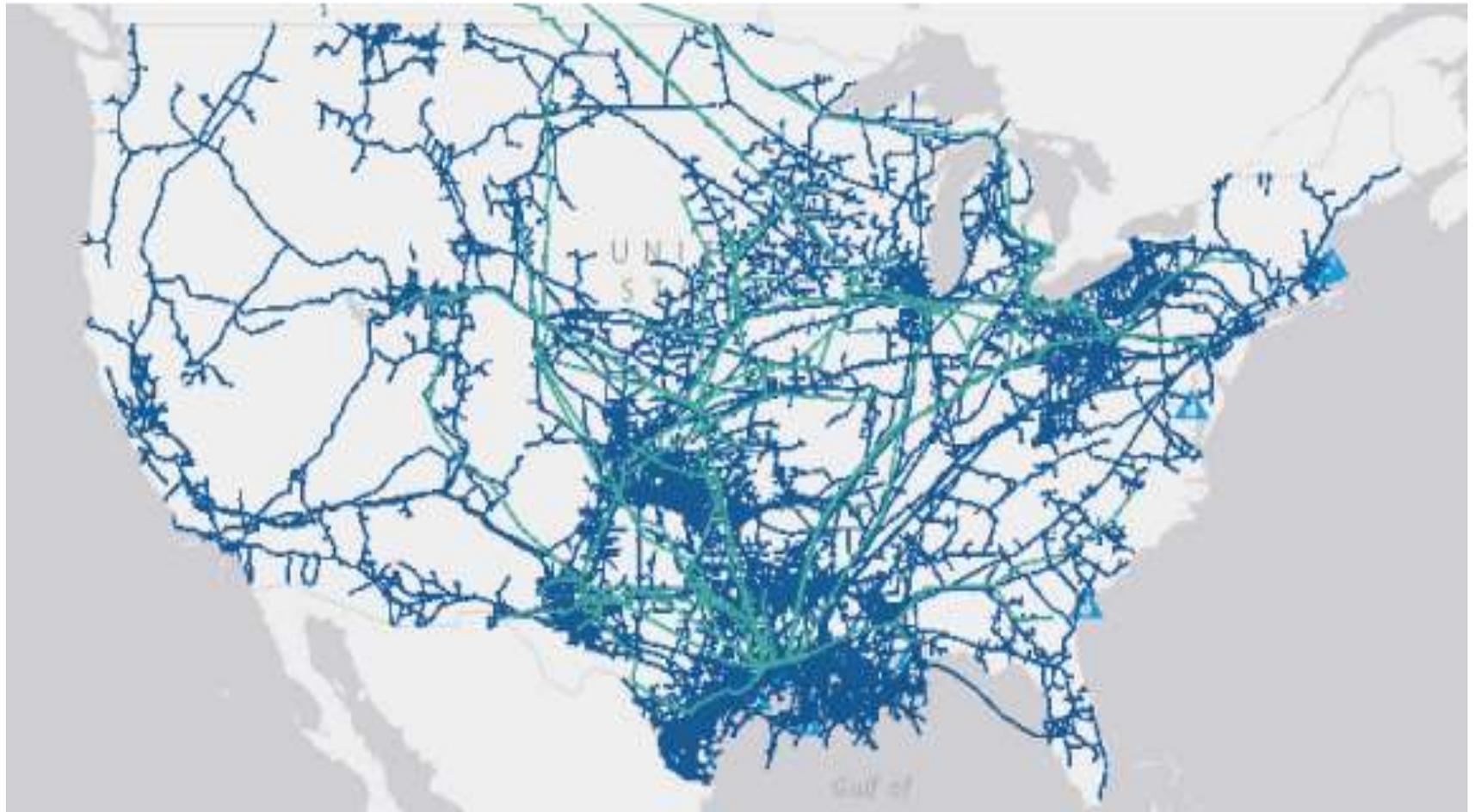
At 1 MM B/D, CA is a *global-scale* importer of oil
.....virtually all of which is shipped in by tanker



CA has good pipeline connectivity for natural gas supply

Natural gas

(pipelines for NG and HGL, LNG import/export terminals)



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Natural gas

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CA imports 90% of its natural gas supply; less than 50% is used for electric power generation



Unique dimensions of the CA oil and gas system

- CA is an oil supply “island”
- CA is a major natural gas importer
- High-density urban oil and gas operations
- Large and numerous legacy oil and gas infrastructures
- Extensive refining and distribution system built around oil import tanker facilities
- CA-specific environmental regulations and operating requirements
- CA societal expectations

Long Beach oil production islands



Ref. Dr. Donald Clarke / AAPG

Kern River oil field





Aliso Canyon - Porter Ranch

SPE 190134-MS **Securing California Gas Supplies** Ershaghi, Paul, Kaba

Digital transformation opportunities

- Optimizing recovery from our existing oil and gas assets
- Ensuring the integrity of the oil and fuel supply and distribution infrastructure
- Continuing to advance the performance of our refining system
- Managing the well and facilities abandonment process
- Increasing the efficiency and effectiveness of the regulatory information management process
- Leveraging CA's global digital technology position

Digital transformation challenges

- Transformation takes resources
- Transformed organizations will require workforce changes
- Transformation takes time to scale
- The dramatic increase in digital intensity, connectivity, and complexity will likely increase cyber-security risks

Thank you

