INTERNATIONAL MARKETS FOR US CRUDE EXPORTS

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U.S. Refining and Crude Exports: An Update
Center for Strategic & International Studies, April 2, 2015
Washington, DC

EnSys Energy

Specialists in:

- Oil sector national and international developments
- Strategic issues in U.S. and global refining, markets & logistics
- Analysis of North America crude logistics developments

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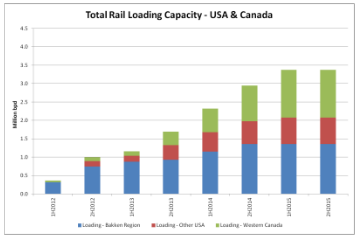
Recent US oriented projects:

- 2010 DOE, 2011 DOS, 2013 New DOS Keystone XL Assessments:
  - Evaluated alternative logistics for Canadian and US crude oils to market
  - Confirmed commercial need for KXL, but industry flexibility if not approved
  - Highlighted demand for WCSB crudes to Asia
  - Projected increasing industry options – pipeline revamps & rail

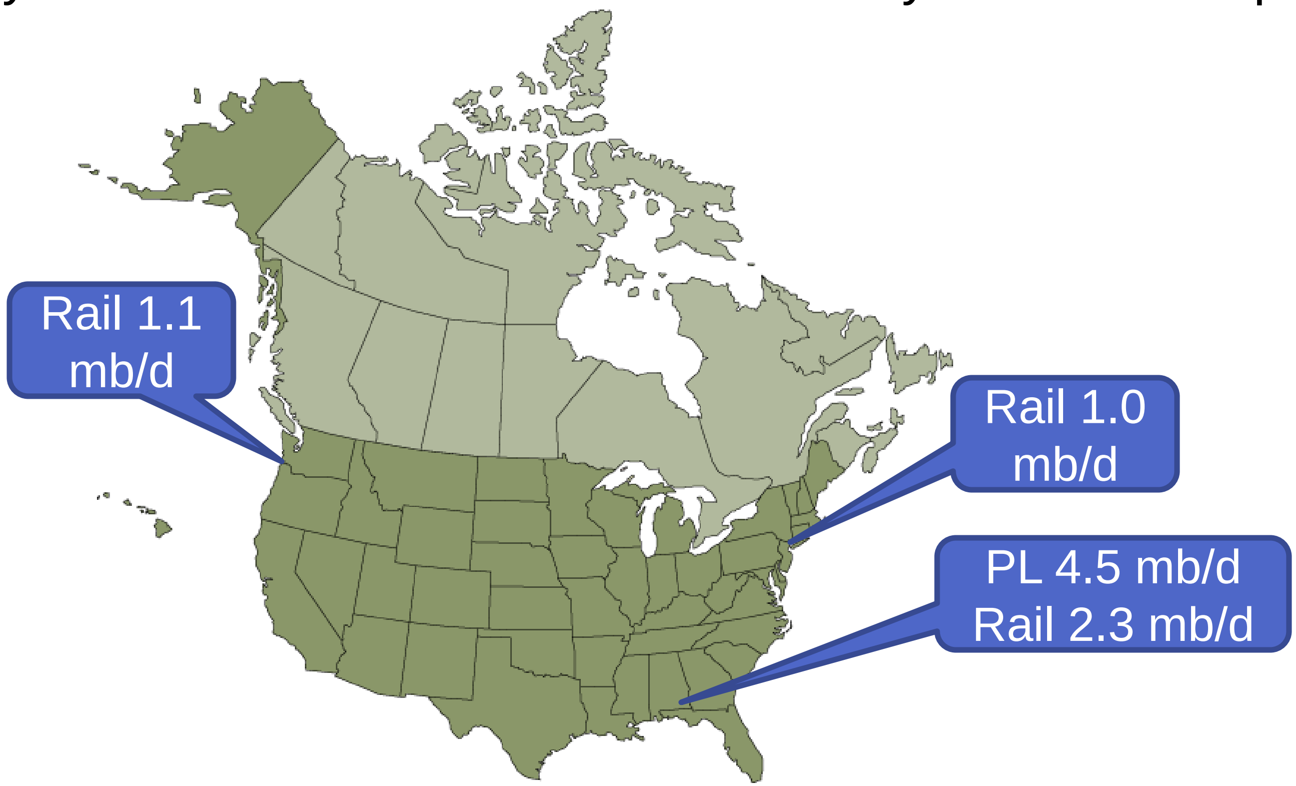
- EnSys North America Infrastructure Review (monthly)
  - Highlights and database on pipeline, rail and marine developments in Canada and USA – crude, NGL/condensate/diluent, products
  - Logistics balances: Cushing, Western Canada, Rail, Bakken



- 2014 API US Crude Oil Exports analysis
  - Impacts of allowing exports on oil trade, refining, pricing, US economy

US Crude Infrastructure

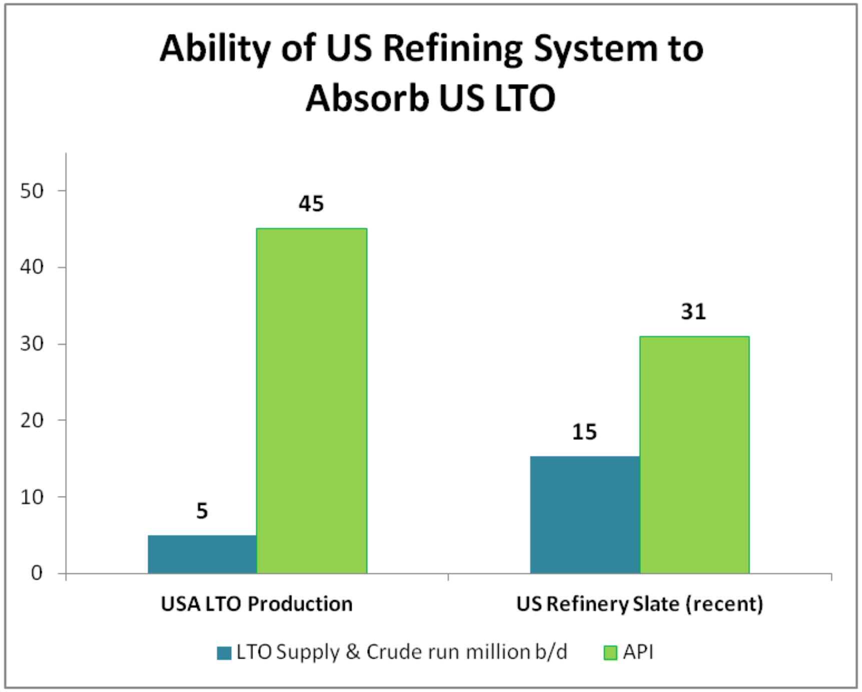
- **Can now enable high volume crude exports**:
  - West and East coasts as well as Gulf Coast
  - *Also potential via eastern Canada – Rail, Line 9, Energy East*
  - Capacity to deliver to coasts end 2015 – nearly 9 mb/d nameplate



Source: EnSys North America Logistics Review for February 2015

Ability to Absorb US LTO

- US non-optimal once light sweets backed out
- Incentivizes
  - maximizing exports where allowed – to Canada, also ANS
  - “get-arounds” – light processing then export



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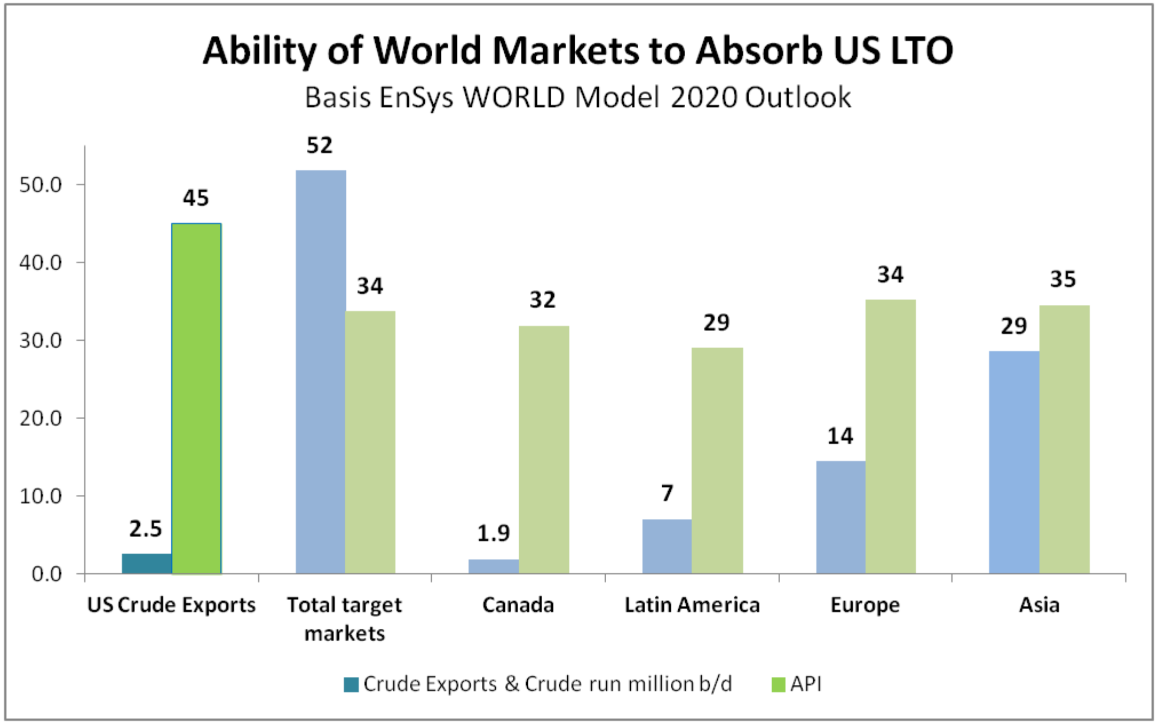
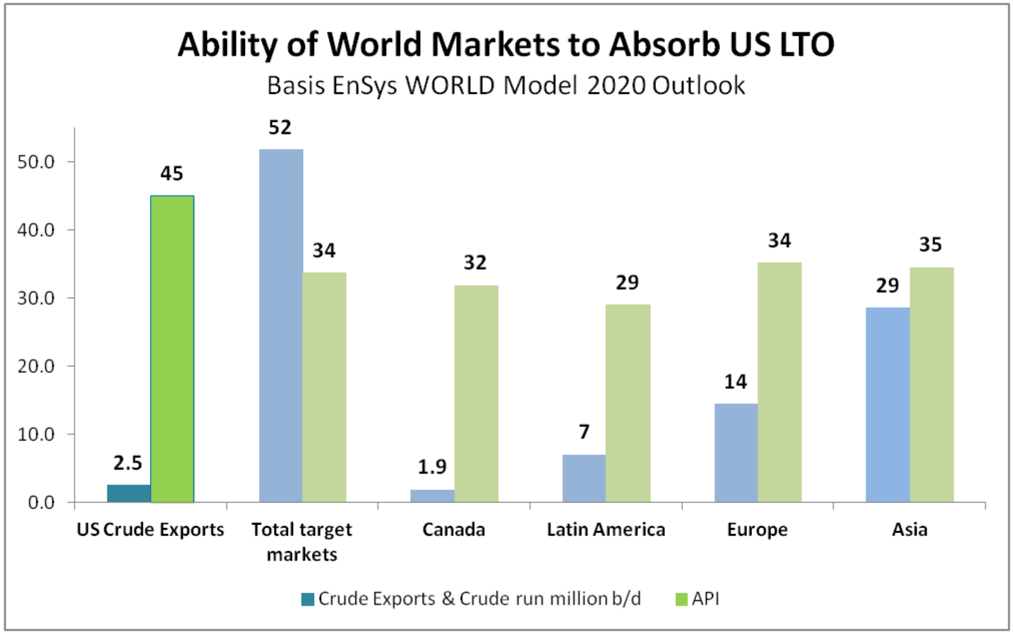
Ability to Absorb US LTO

- Exports to other regions – potentially 2-2.5 mb/d
  - Canada taking 0.5 mb/d today – drops if US exports open
  - Latin America – LTO complements heavy crudes, reduces investment needed – n.b. Mexico swap & potential



Ability to Absorb US LTO

- Exports to other regions – potentially 2-2.5 mb/d
  - Europe declining production & heavier, LTO enables more traditional North Sea look alike blends
    - Potential competition with Canada (Line 9, Energy East)
  - Asia massive and growing refining system
    - Potential access from US West & Gulf Coasts (Panama expansion)



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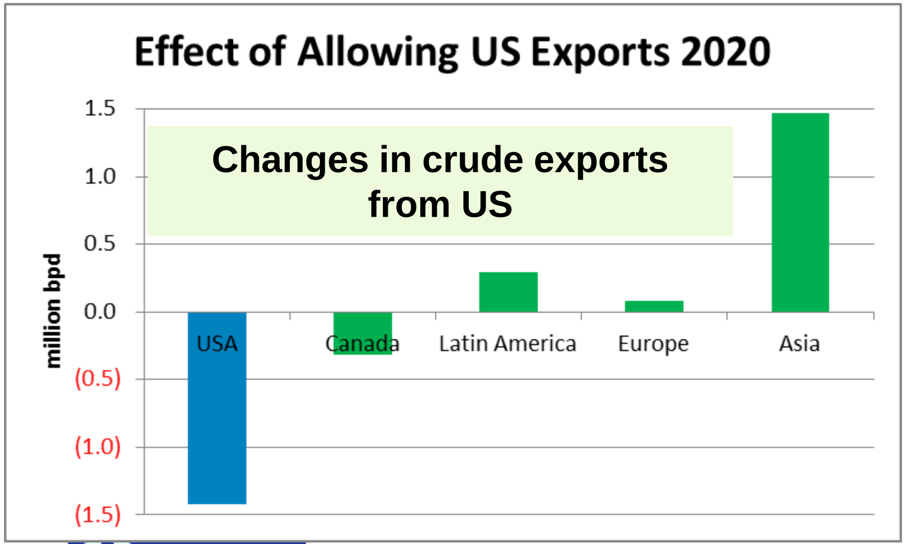
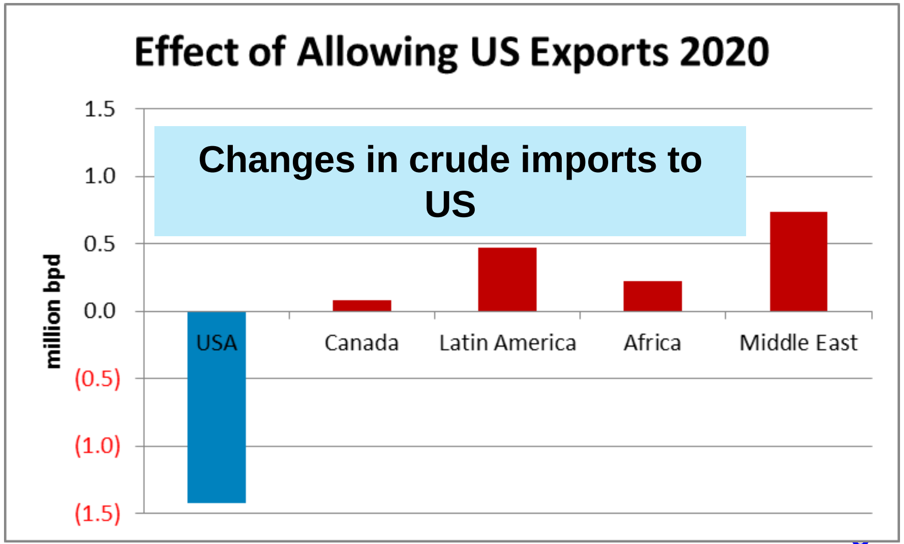
Trade Implications from ICF/EnSys Study

US Crude Exports

- Allowing exports would result in a “swap” trade
  - US exports light/very light crudes condensates
  - US imports medium / heavy grades at similar volume
  - Potential splitter type investments reduced
  - n.b. basis tanker freight low, Panama Canal expansion 2016





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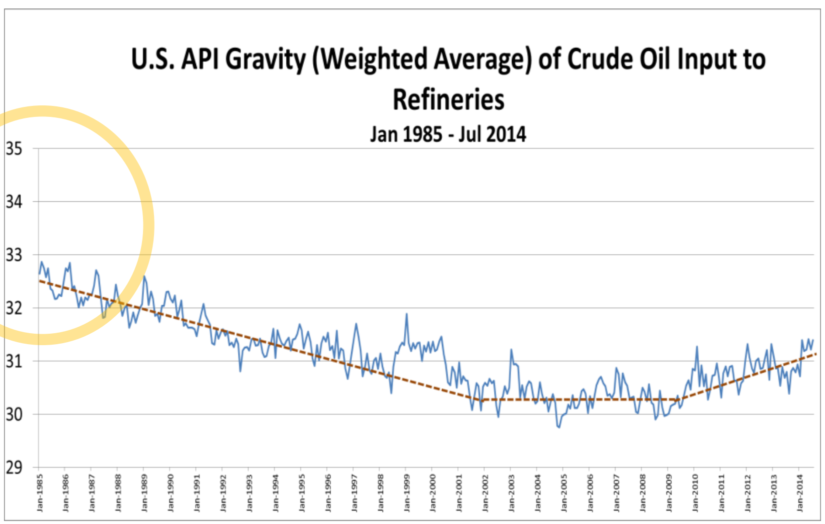
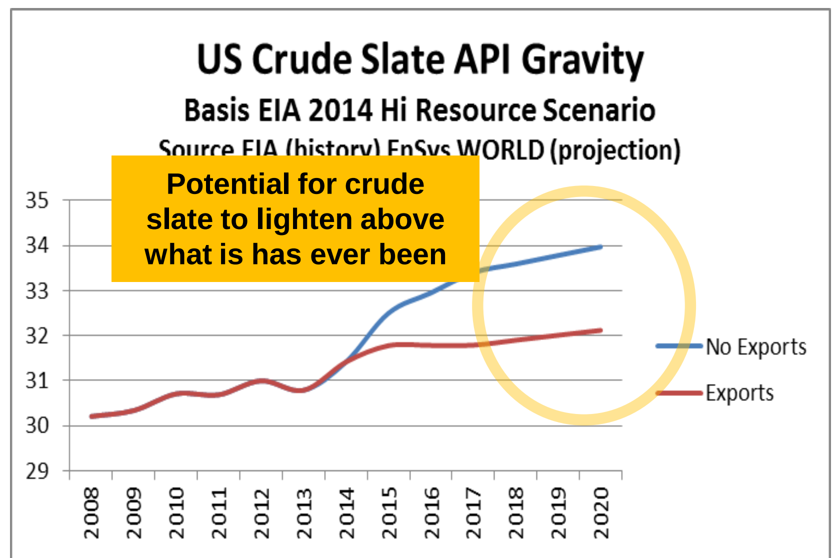
Refining Implications from ICF/EnSys Analysis basis EIA 2014 High Resource Outlook

- No exports and high production put major strain on US refineries to process sharply lighter crude slate
  - Especially PADD3
- With exports, still lighter crude slate but less severe trend





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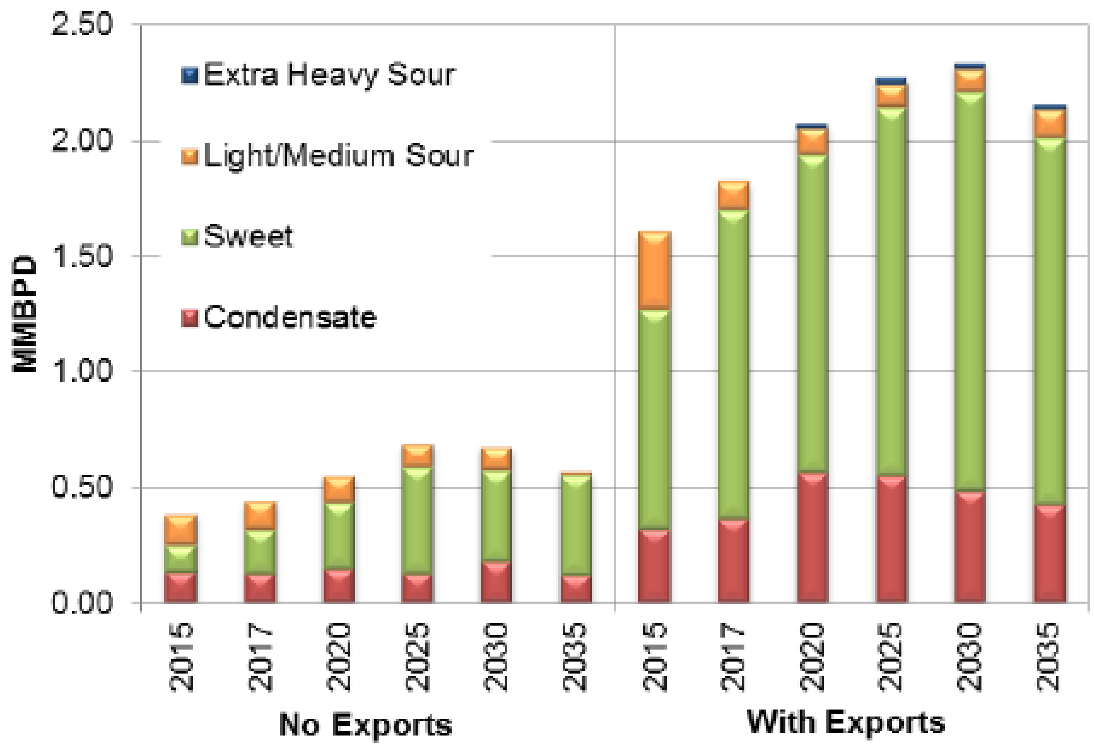
Trade Implications from ICF/EnSys Study

US Crude Exports

Types of Exported Crudes

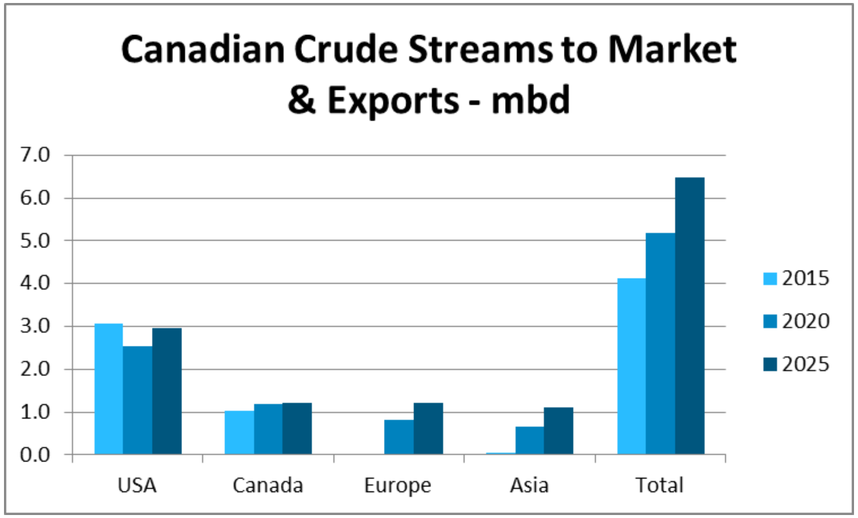


Source: The Impacts of U.S. Crude Oil Exports on Domestic Crude Production, GDP, Employment, Trade, and Consumer Cost Study – EnSys Energy Data

Trade Implications from ICF/EnSys Study

Canadian Crude Exports

- Export volumes / directions depend on which / whether major pipelines are built
  - Potential for > 1 mbd to Asia
    - basis Trans Mountain expansion & Northern Gateway go ahead – also western Asia via Energy East & Suez
  - Potential for > 1 mbd to Europe (long term)
    - basis Energy East, Line 9/PMPL, potential rail – especially if PL's west are stalled
  - Exports to US more of a balancing role
  - GC as a fallback route for WCSB exports – recent Enbridge applications



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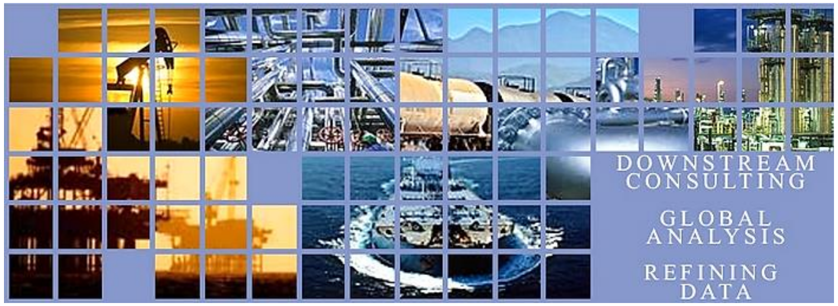
In Summary

- US has the infrastructure to export large volumes of crude
- Allowing US crude exports enables US and global refining system to operate optimally
  - Quality is the big driver
  - Cuts manufacturing costs / prices for clean products
- Non-US refining system can readily absorb US crude exports – even if light
- US and Canadian logistics & exports interact

THANK YOU !



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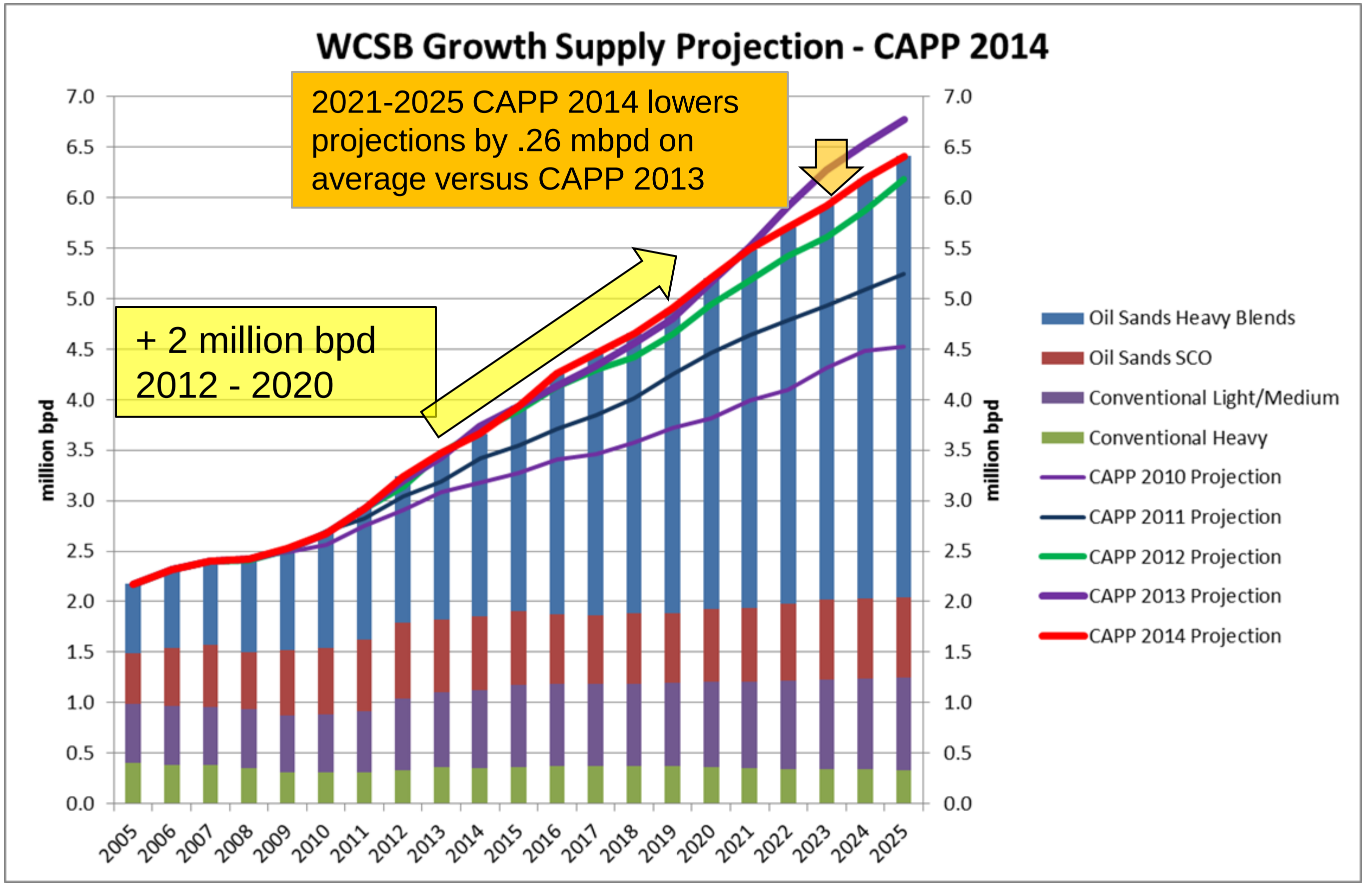
Extras

USA & Canada
Supply Growth, Logistics Adaptation

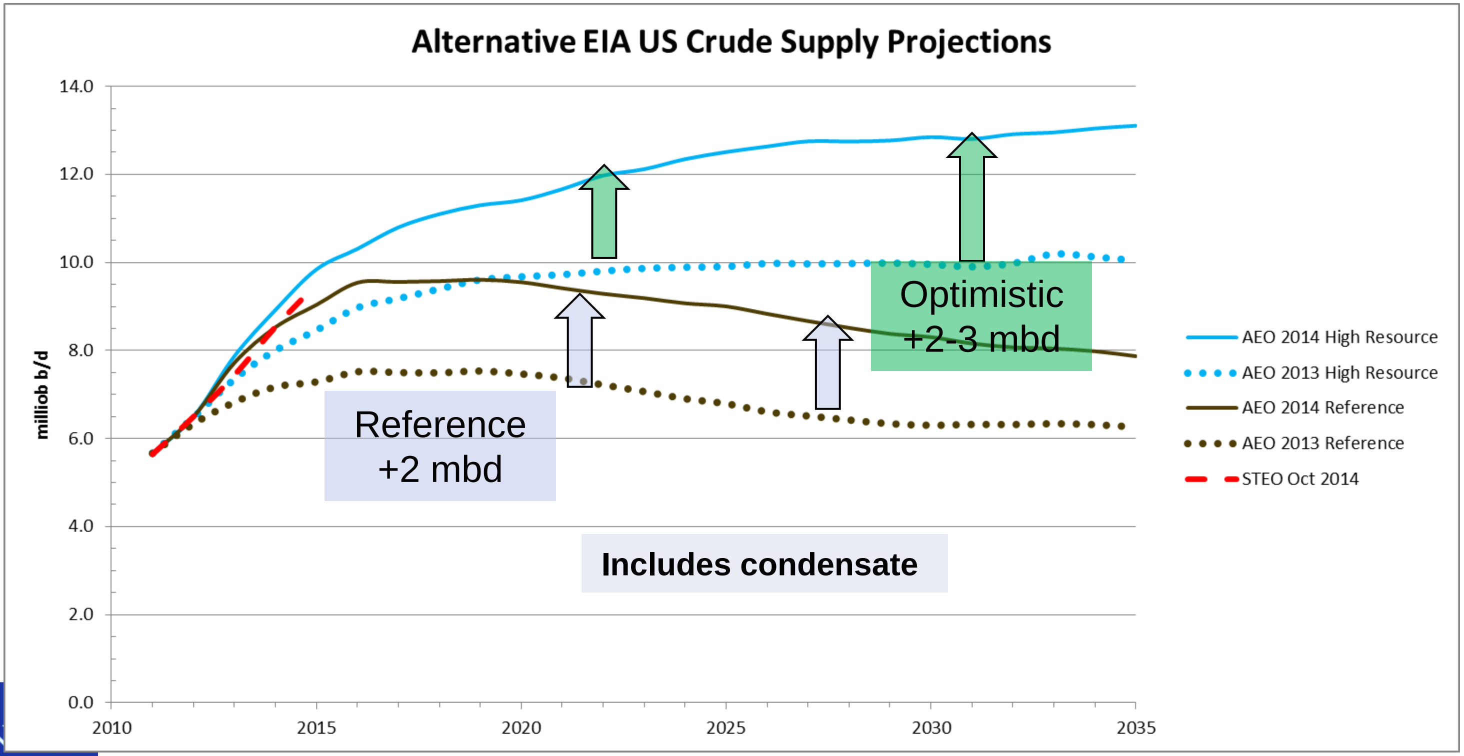
Crude Supply - Canada

- Trend has been up – but CAPP June 2014 adjusted outlook downward confirming concerns over logistics
- Bulk of growth is bitumen / DilBit



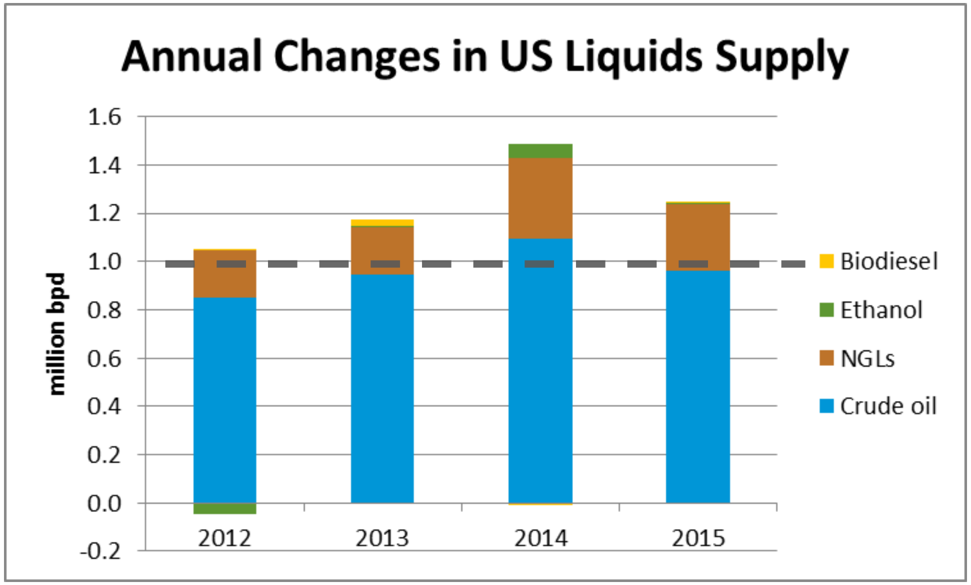
Crude Supply - USA

- 2014 perspective – major upward revisions AGAIN
  - “reference” peak before 2020 at around 9.5 mbd
  - “optimistic” (High Resource) over 11 mbd 2020 rising to 13 mbd
  - Other analysts projecting as high as 14 mbd
  - Crude price reduction curbs outlook

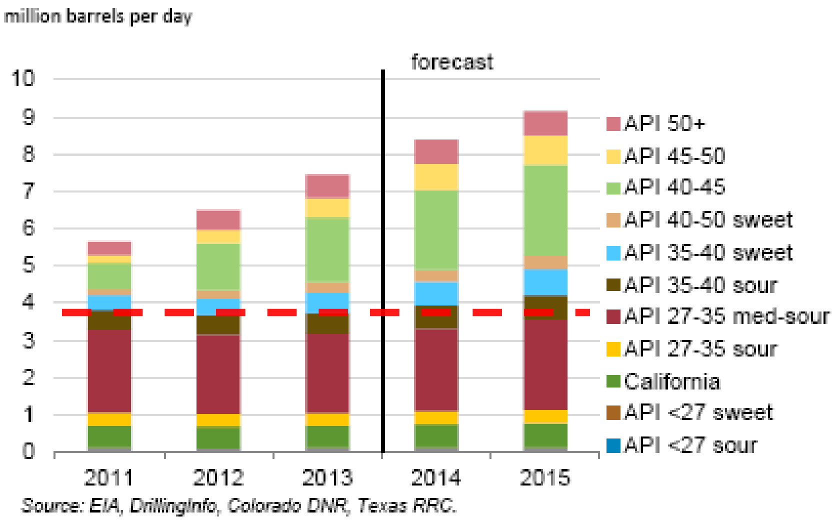


Total Liquids Supply - USA

- Annual change in liquids supply is averaging ~ 1 mbd
  - Biofuels flat
  - Crude, condensate NGLs dominate
  - Essentially all light to very light crude & condensate



Source: EIA Short Term Energy Outlook Oct 2014



Compare U.S. refinery crude slate at 30.5-31 API

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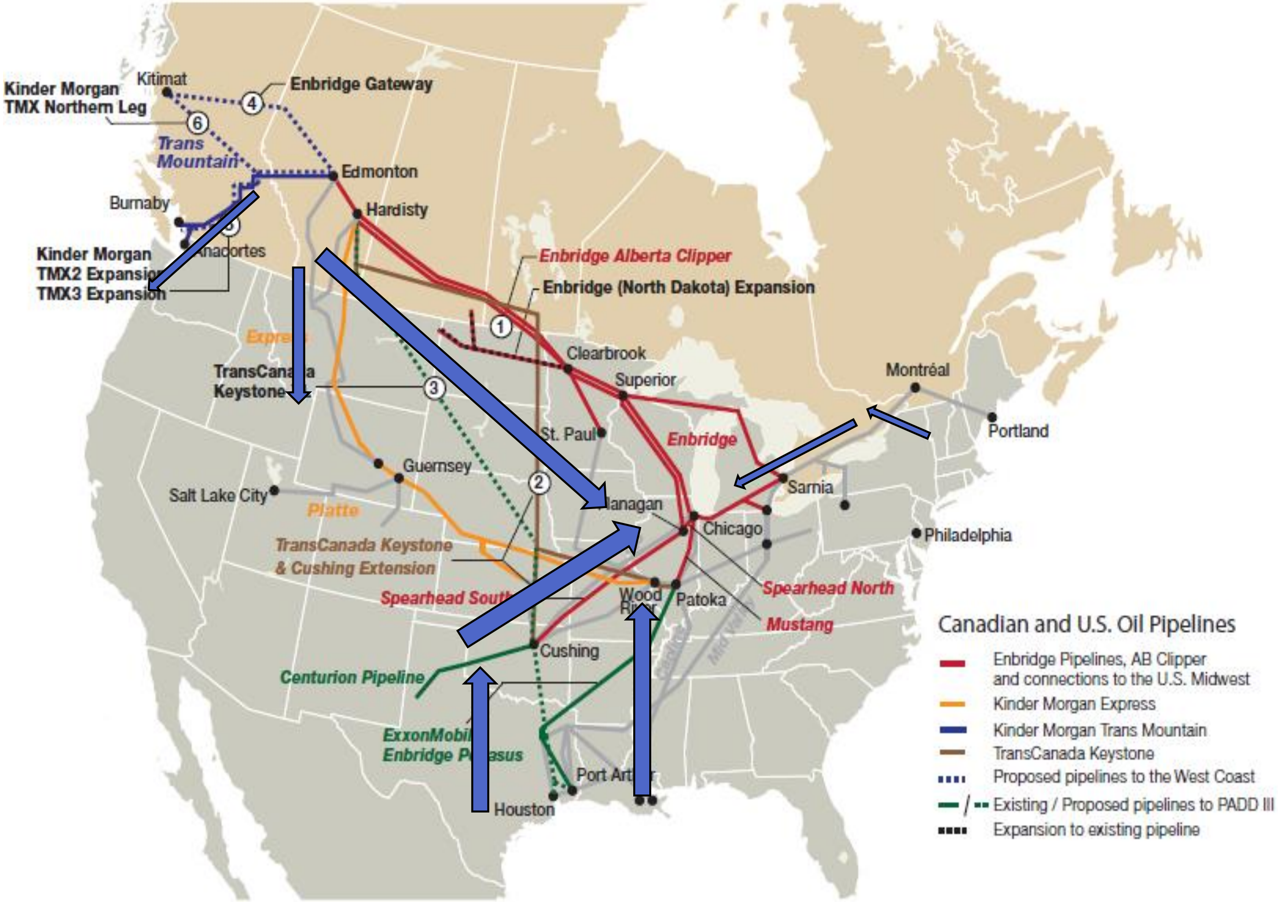
US/Canadian Crude Infrastructure

Caught off guard by production surge

- Rapid US/Canadian production increases led to congestion
- Issue is system was designed to take crudes IN to US and Canadian interiors not OUT to coasts

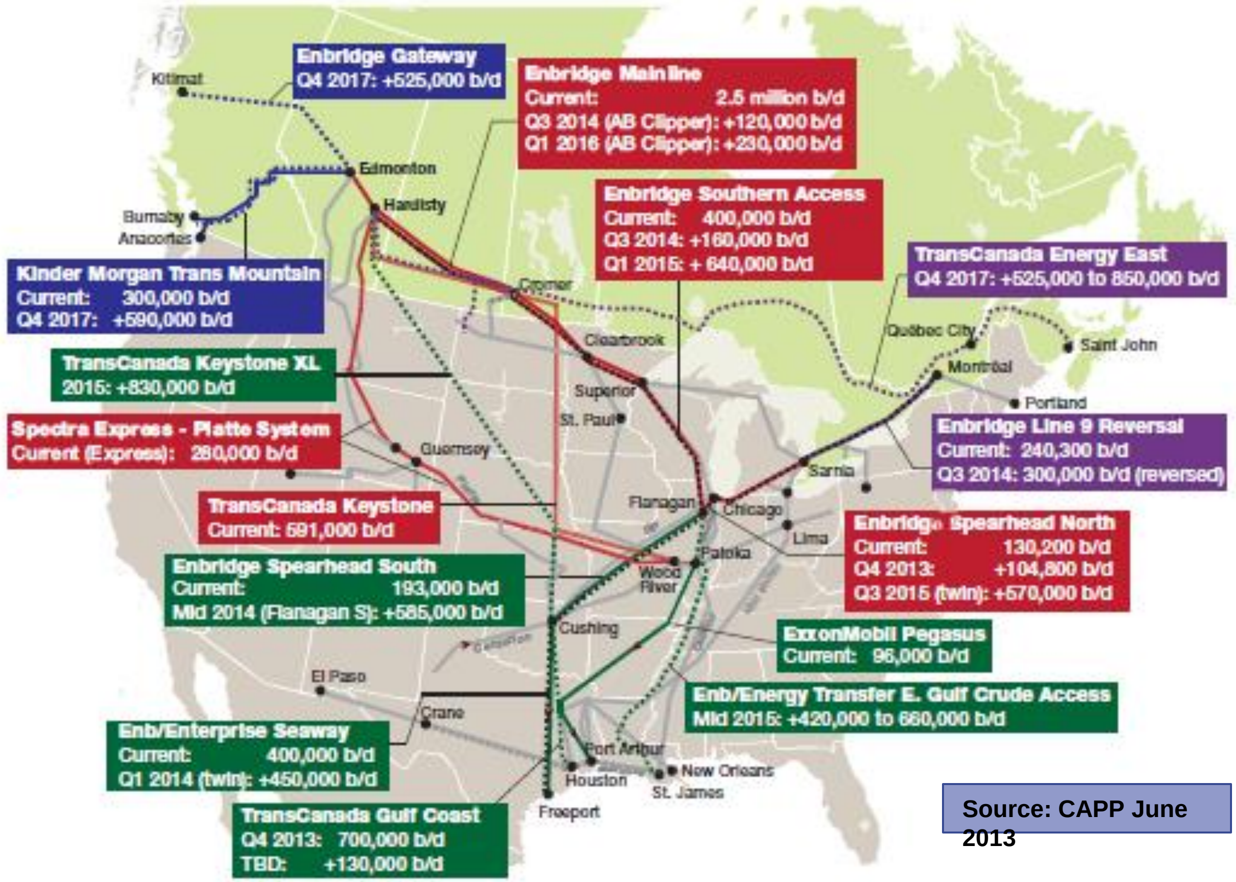


US/Canadian Crude Infrastructure

Multiple pipeline and rail projects now forging ahead

- but still a race against supply

Canadian & U.S. Crude Oil Pipelines and Proposals



Source: CAPP June 2013

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US/Canadian Crude Infrastructure

- **By region – West Coasts**:
  - Substantial US rail offloading capacity, some to refinery some to marine, potential delays
  - Trans Mountain expansion, Northern Gateway but resistance / delays
    - Strong incentive to take WCSB (and US) crudes West to Asia
    - Also California if AB32 allows
  - Possible new coastal refineries
    - e.g. Kitimat Clean – 550,000 bpd + DilBit PL from Edmonton, $31bn, low CO_2, $150mm feasibility study

West Coast Capacity mbd *end of year*	**2015**	**2018**	**2020**	**2025**
West Coast Rail	1.1	1.5	>1.5?	>1.5?
East Coast Rail	1.0	1.1	>1.1?	>1.1?
Total	**1.4**	**>1.8**	**1.8 – 2.9?**	**1.8 – 3.2?**

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Source: EnSys North America Logistics Review for February 2015

US/Canadian Crude Infrastructure

- **By region – East Coasts**:
  - Substantial rail offloading capacity
  - Enbridge Line 9 Reversal moving ahead (NEB delay)
  - TransCanada Energy East extensive commercial support
  - Possibility for Montreal to evolve as a trans-shipment hub
  - Potential to fully back out current E Can USEC imports
  - USEC pricing competition point on light sweet crudes?

East Coast Capacity mbd *end of year*	**2015**	**2018**	**2020**	**2025**
US EC Rail	1.0	1.1	>1.1?	>1.1?
E Canada Rail	.10	.15	>.15?	>.15?
E Canada Line 9 reversal	.30	.30	.30	.30
E Canada Energy East		1.1?	1.1?	1.1?
Total	**1.4**	**2.65?**	**>2.65?**	**>2.65?**

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Source: EnSys North America Logistics Review for February 2015

US/Canadian Crude Infrastructure

- **By region – Gulf Coast**:
  - Massive build out in crude PL capacity to and rail offloading at GC
  - Supported by multiple regional PL, terminal projects
  - Also NGL's, fractionation, refrigeration, export
  - C5+/ condensates export to WCSB via Explorer, Capline
  - Condensate export rulings: Enterprise/Pioneer others following

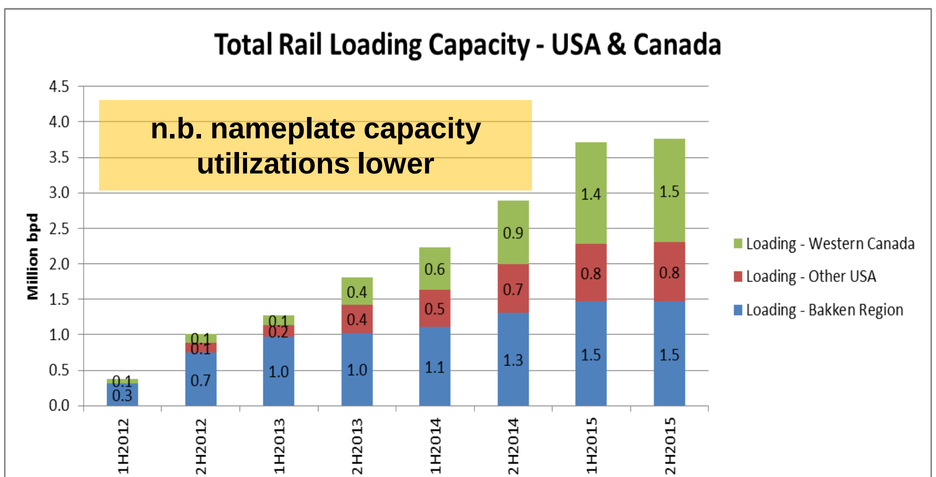
Gulf Coast Capacity mbd *end year*	2015	2018	2020	2025
PL's from Eagle Ford	1.9	>1.9?	>1.9?	>1.9?
PL's from West/East Texas	.9	>1.25?	>1.25?	>1.25?
PL's from Cushing	1.7	>1.7?	>1.7?	>1.7?
PL's from WRiver/Patoka / other PADD2		>0.42?	>0.42?	>0.42?
Rail offloading Bakken/US/WCan	2.3	>2.5?	>2.5?	>2.5?
Total	**6.8**	**>7.7?**	**>7.7?**	**>7.7?**

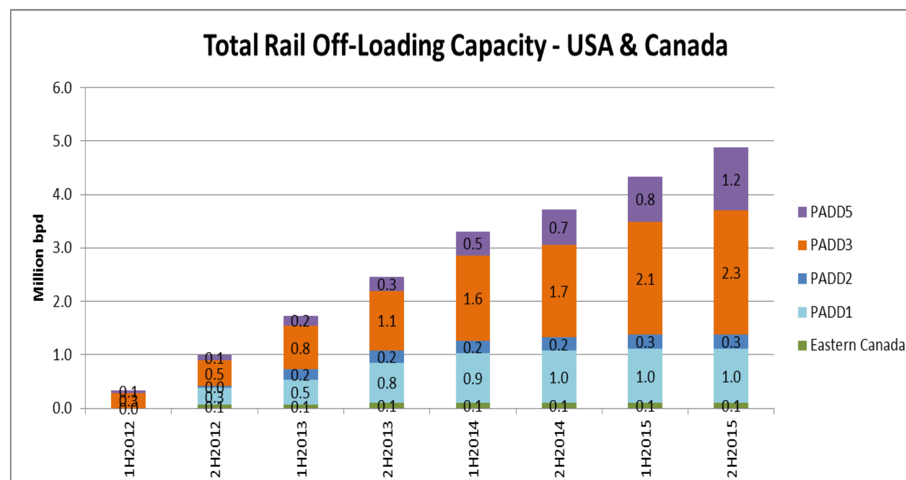
- Barring some PL reversals essentially none of this infrastructure was in place only 4 years ago!

Source: EnSys North America Logistics Review for February 2015

US/Canadian Crude Infrastructure

- **Rail – a key "relief valve" (but with issues)**
  - Rapid increases in terminal loading and offloading capacity
  - Enabling movements to East Coast, West Coast as well as Gulf Coast
  - Canadian rail loading capacity now building up – big announcements
  - New safety regulations will add costs, curb capacity





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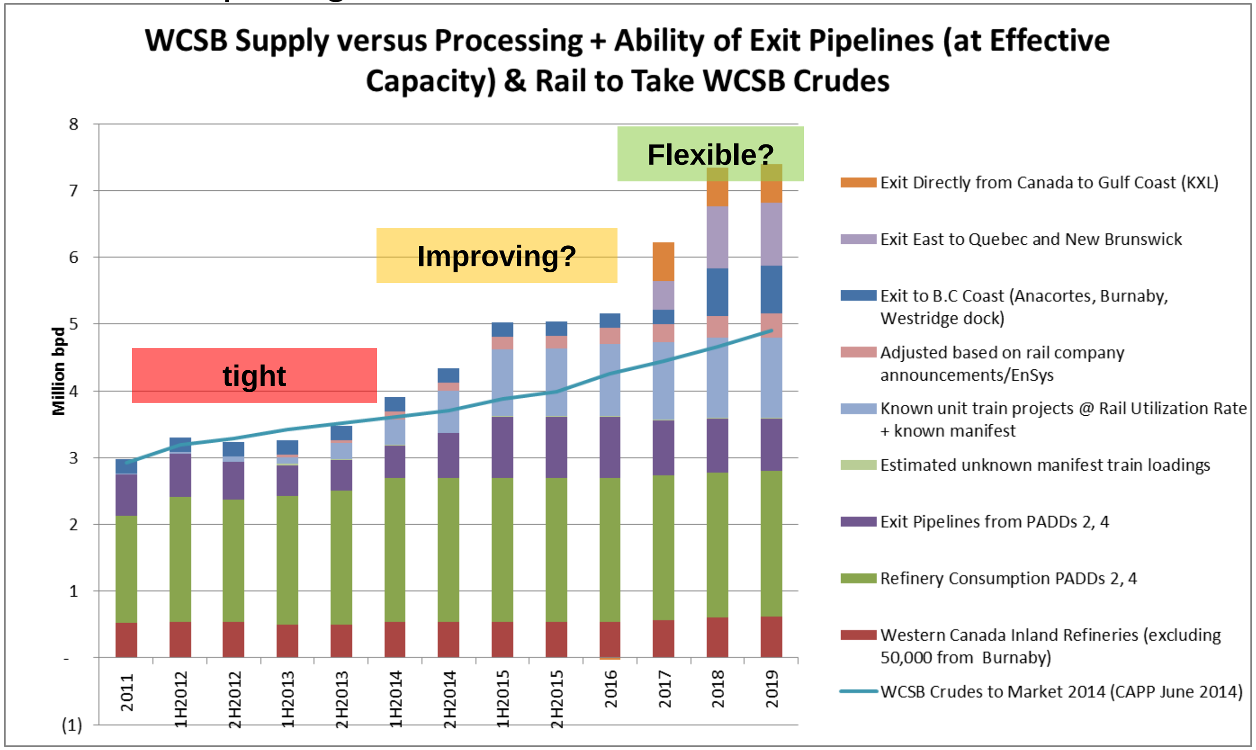
Source: EnSys North America Logistics Review – February 2015

Infrastructure Now Getting Crude to Coasts

- **For WCSB, 2014 could be a turning point**
  - More exit capacity led initially by rail mainly into US
  - Then major pipeline projects would bring potential West/South/East flexibility, open water markets and pricing
    - If pipelines built, pricing could detach from WTI



Source: EnSys North America Logistics Review for February 2015

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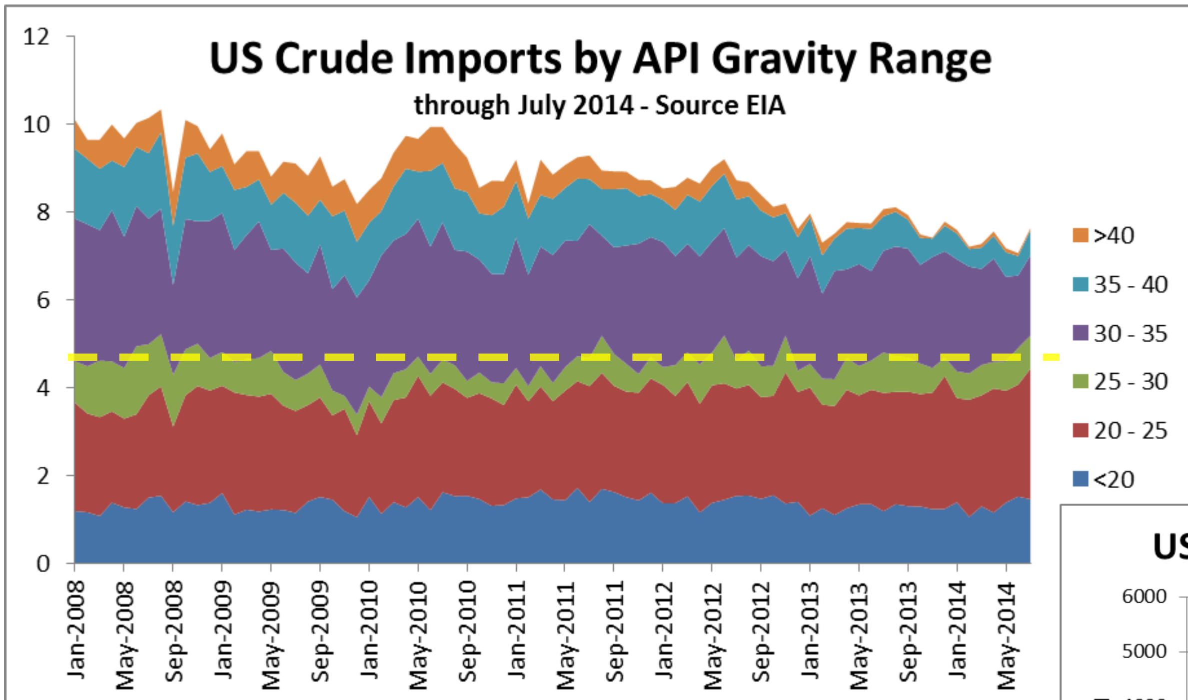
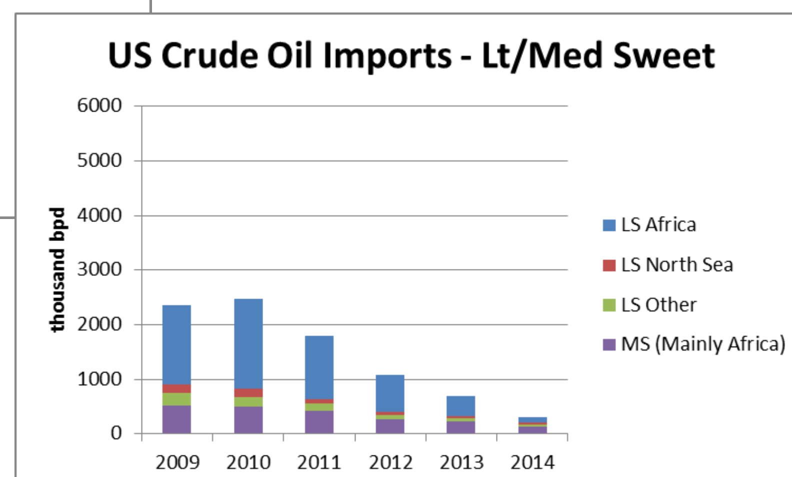
Infrastructure Now Getting Crude to Coasts

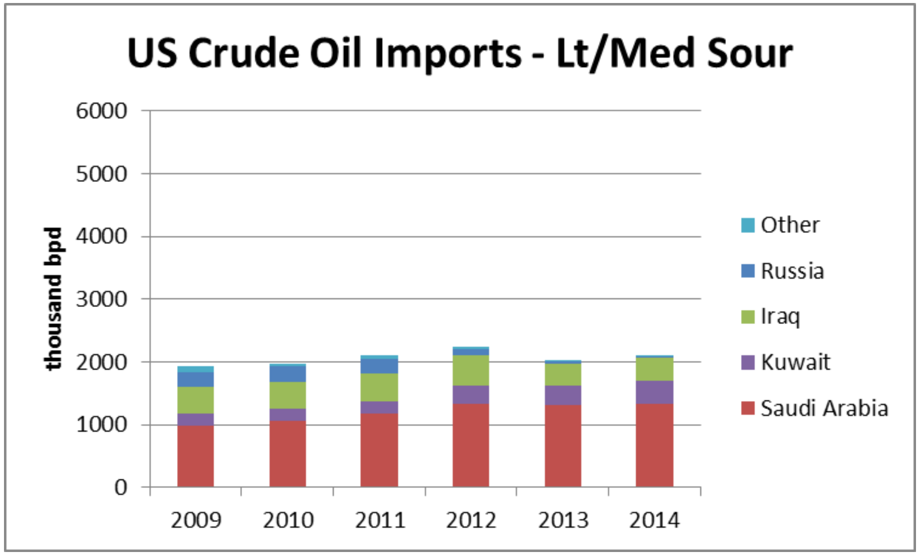
- **Light sweet crude imports largely backed out**
- “Buffer” almost gone

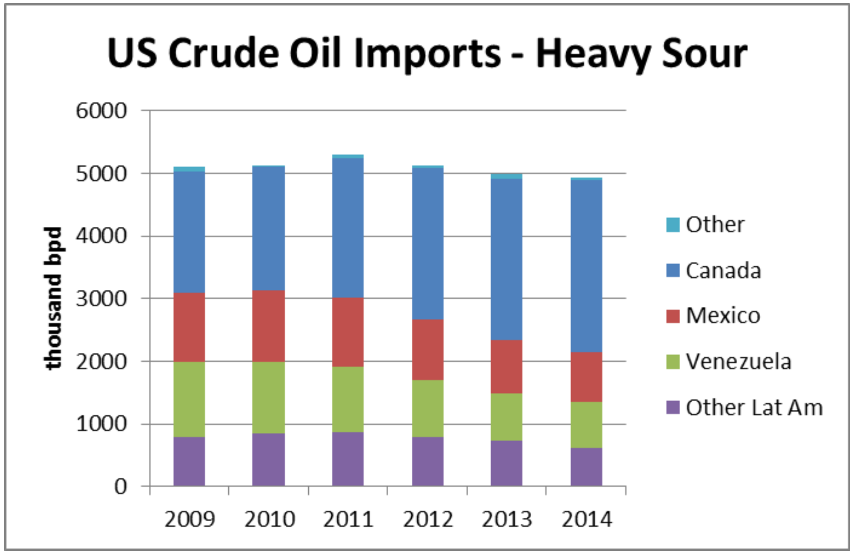




Infrastructure Now Getting Crude to Coasts

- **Medium and heavy crude imports stable until now**
- But medium sour next tranche to go
  - About 1 mbd medium sweet & non-Saudi sour remaining
  - Equals around 1 year at current US production growth
  - Question of how much inertia





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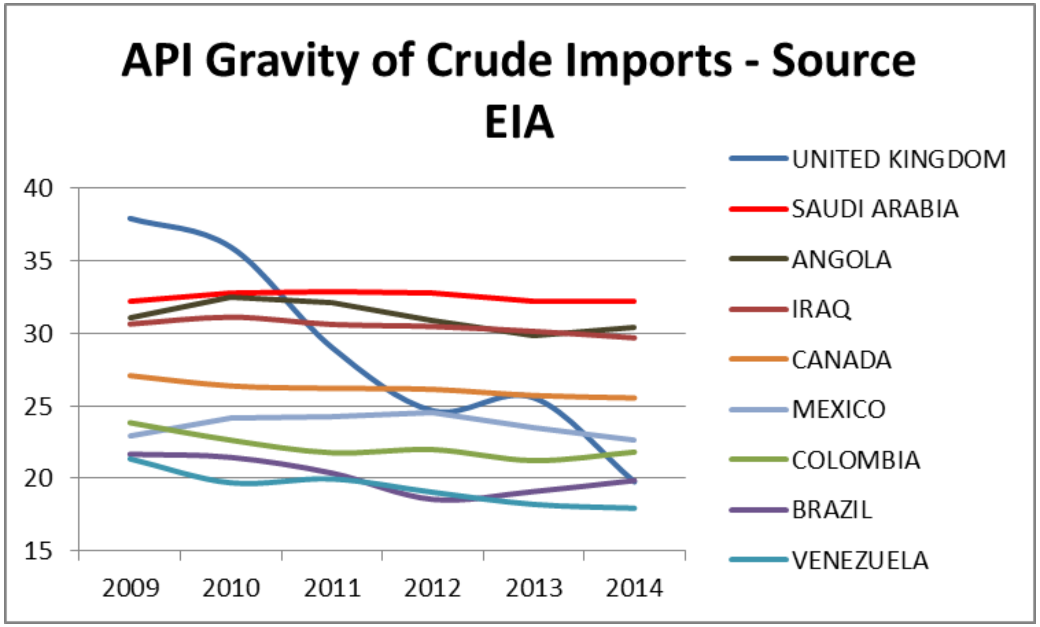
Infrastructure Now Getting Crude to Coasts

- **Crude imports from most countries trending heavier**
- Saudi Arabia, Kuwait exceptions
- Overall “loss of the middle”
- Growing potential for (dumbbell) blends
  - Incompatibility issues / costs / remedies, variable crude quality



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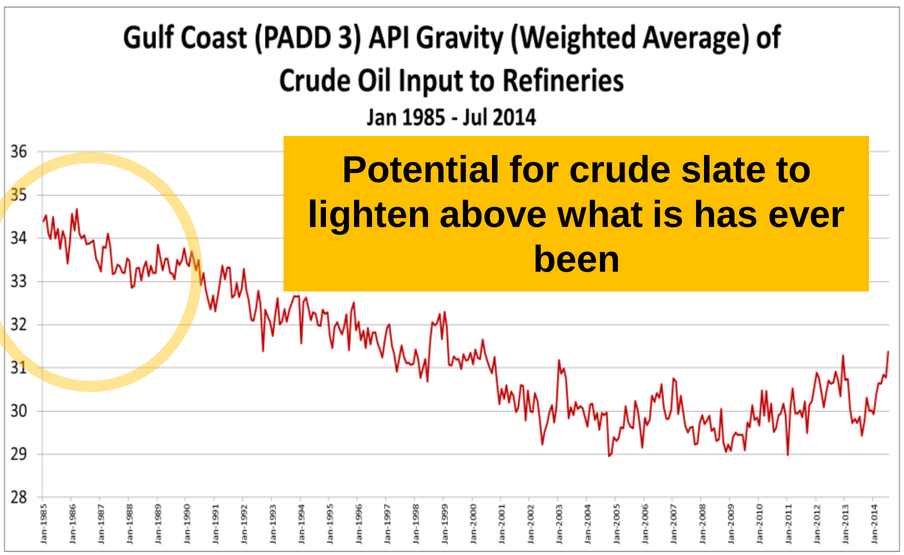
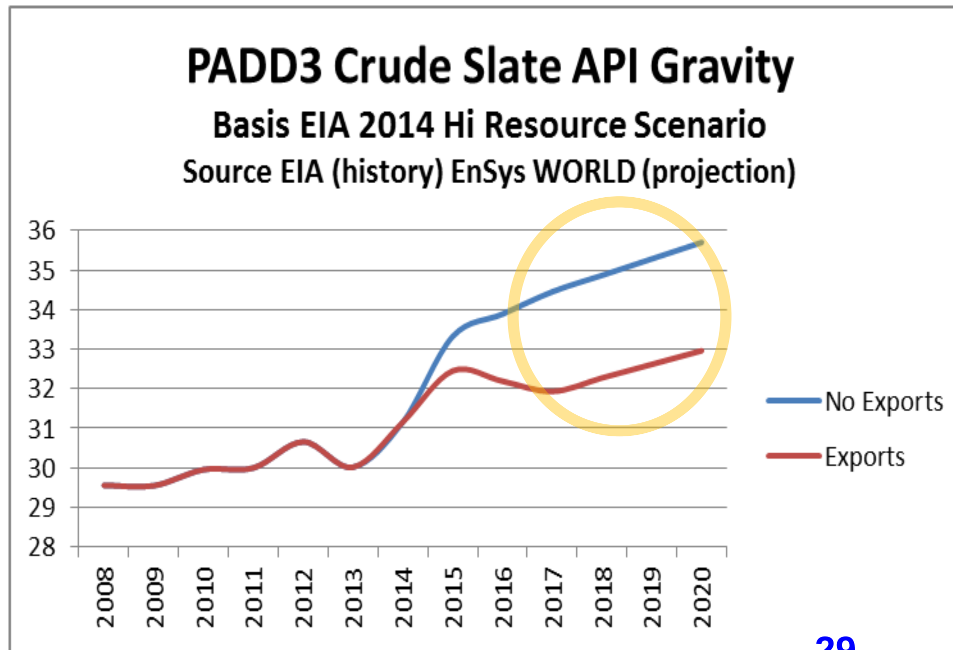
Refining Implications from EnSys WORLD Analysis basis EIA 2014 High Resource Outlook

- All PADDs affected but impact especially severe in PADD3
- Refineries unable to absorb? Throughput reductions?
- Need for splitters (but risk of stranding) & action on exports





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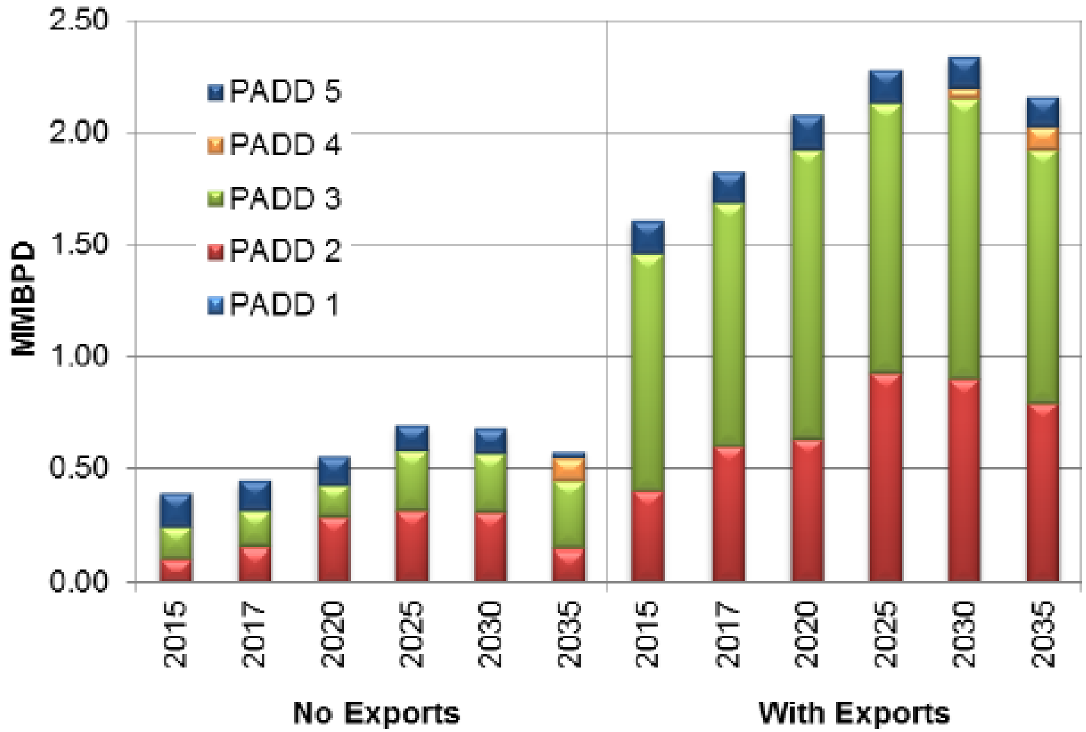
Trade Implications from ICF/EnSys Study

US Crude Exports

PADDs of Origin of Exported Crude

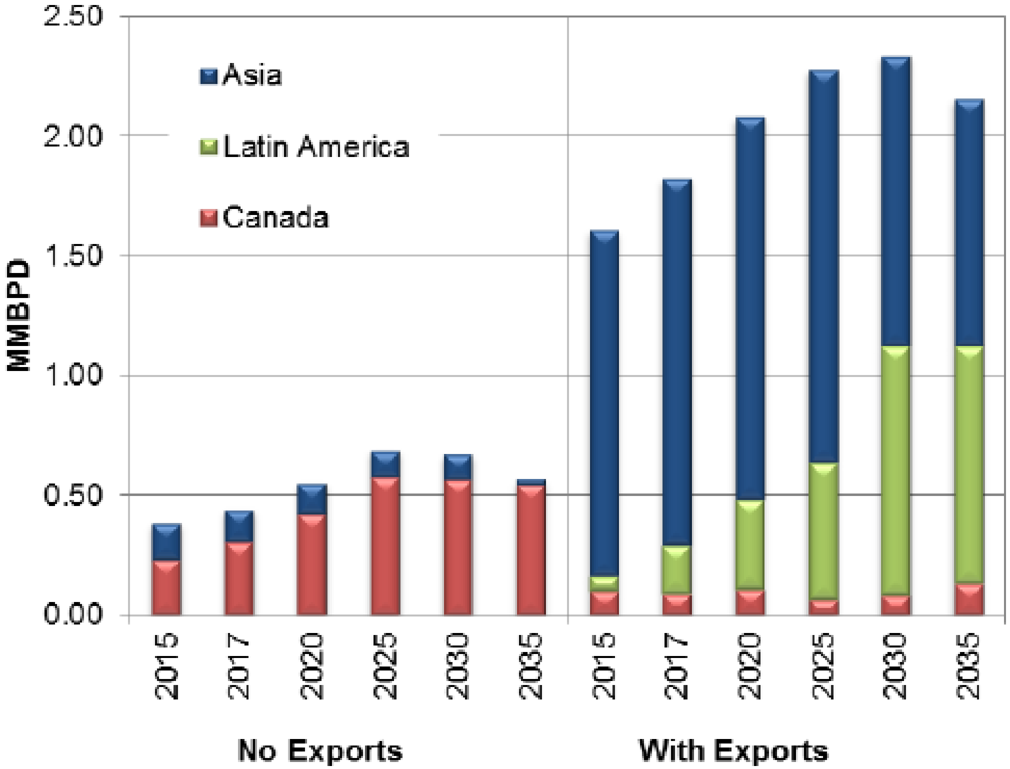


Source: The Impacts of U.S. Crude Oil Exports on Domestic Crude Production, GDP, Employment, Trade, and Consumer Cost Study– EnSys Energy Data

Trade Implications from ICF/EnSys Study

US Crude Exports

U.S. Crude Exports by Destination Market



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