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Melbourne
Energy
Institute

MEInetwork23 Seminar #1

Crude oil and product supply chains

Speaker: Mr Nicholas James,
Technical Manager, VIVA Energy

Moderator: Dr Adrian Panow
*Director of Major Projects,
Melbourne Energy Institute*

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MEInetwork23 Seminar Series

Seminar topic	Month
● <u>Crude oil and product supply chains - Nicholas James, VIVA Energy</u>	9 May
Uranium mining and refining	8 June
Energy commodity trading	6 July
New energy commodities and critical minerals	10 August
Fiscal policy to support future energy commodity exports	7 September

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Today's speakers



Mr Nicholas James
Technical Manager
VIVA Energy



Dr Adrian Panow
Director of Major Projects
Melbourne Energy Institute

Distribution and marketing of crude oil and its products

Nicholas James
Technical Manager

Agenda

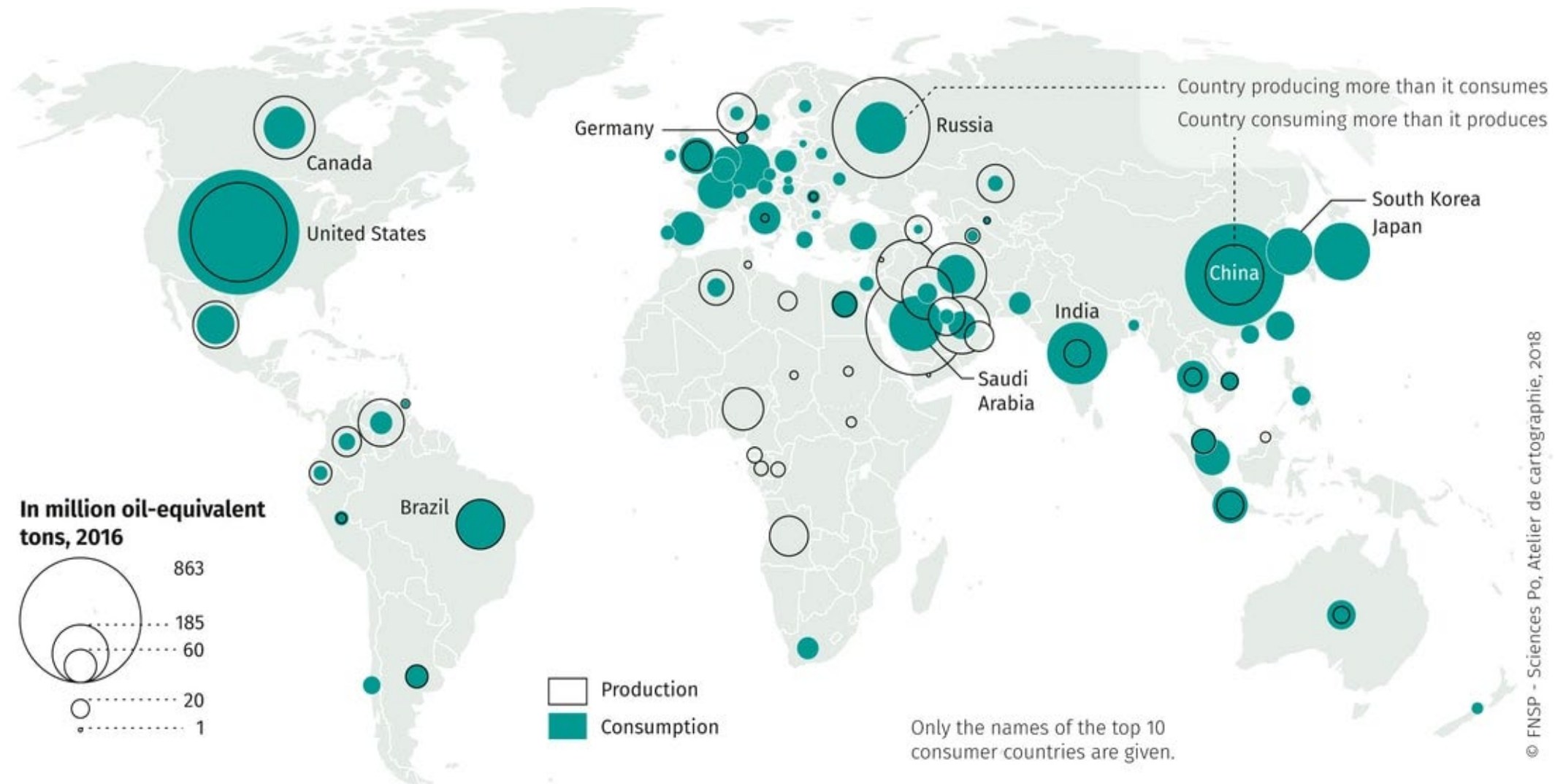
- **Global and local Crude markets**
- **Hydrocarbon trading and shipping**
- **Refined product market**
- **Australian distribution and supply chain**

Global Crude Oil Markets

Few major players driving macro economics of oil price

- OPEC
- USA
- Russia

Crude oil markets are complex! Just listen to the news.



OPEC's capacity

- 79% of world's crude reserves but....
- production is only around 30% of total, hence restrict supply to control prices.

Crude supplies different for each country.

- Nationalism (Venezuela)
- Capitalism (USA)
- Hybrid (Russia)

Global Crude Oil Markets

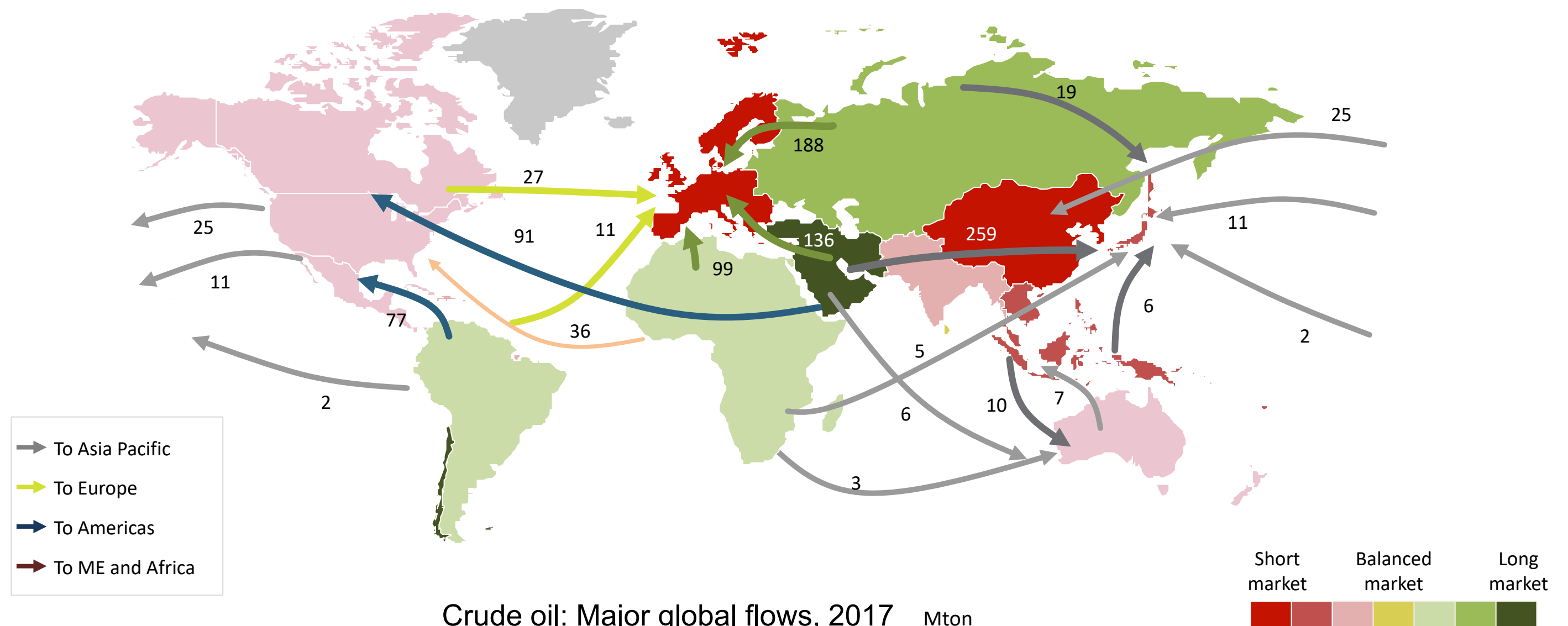
Remember how we said oil markets are complex

Need the **right** oil at the right place

- USA exports and imports oil?, Why?
- Australia exports and imports oil? , Why?

Crudes processed in Australian refineries

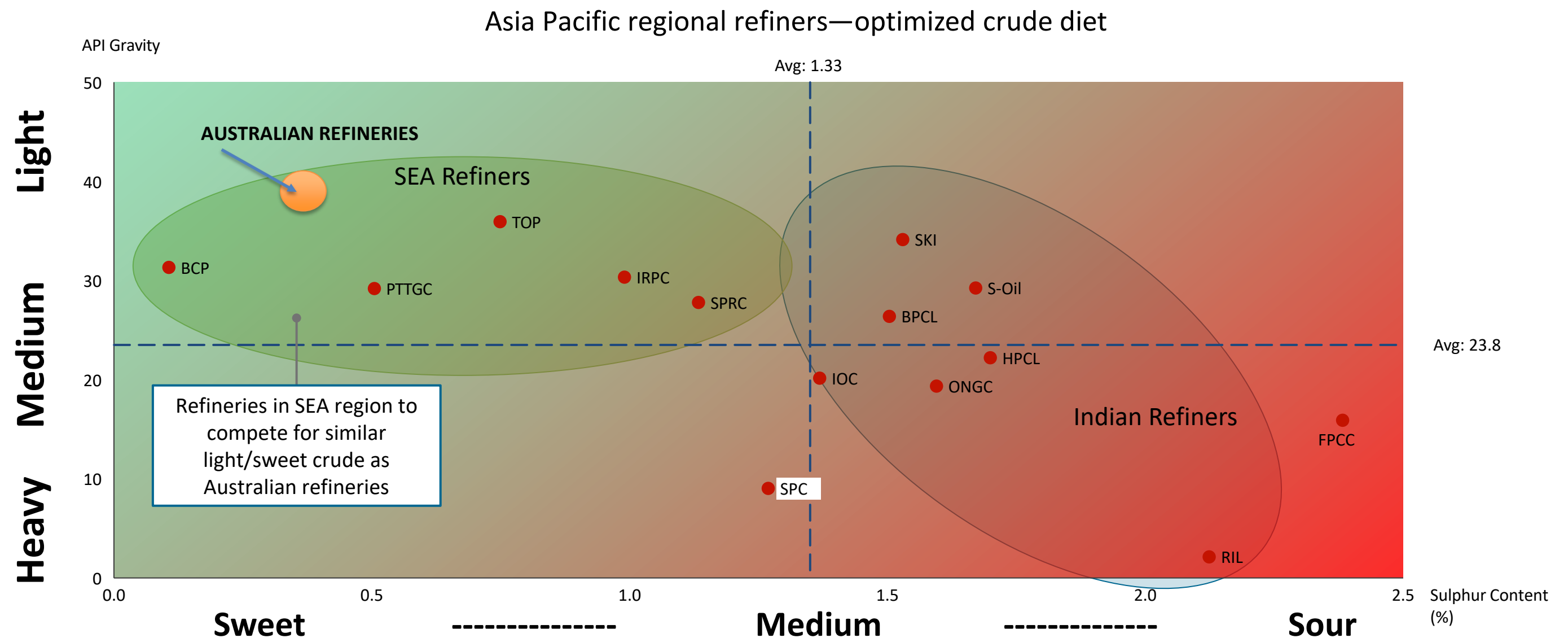
- ~60% Asian crudes
- ~15 % Middle east crudes
- ~20% African crudes



Note: Based on OECD flows; Based on OECD flows. Arrows are indicative and represent flows between regions, not exact trade lanes. if not specified, non-OECD flows are based on OECD export data
Source: International Energy Agency oil statistics database, BCG analysis

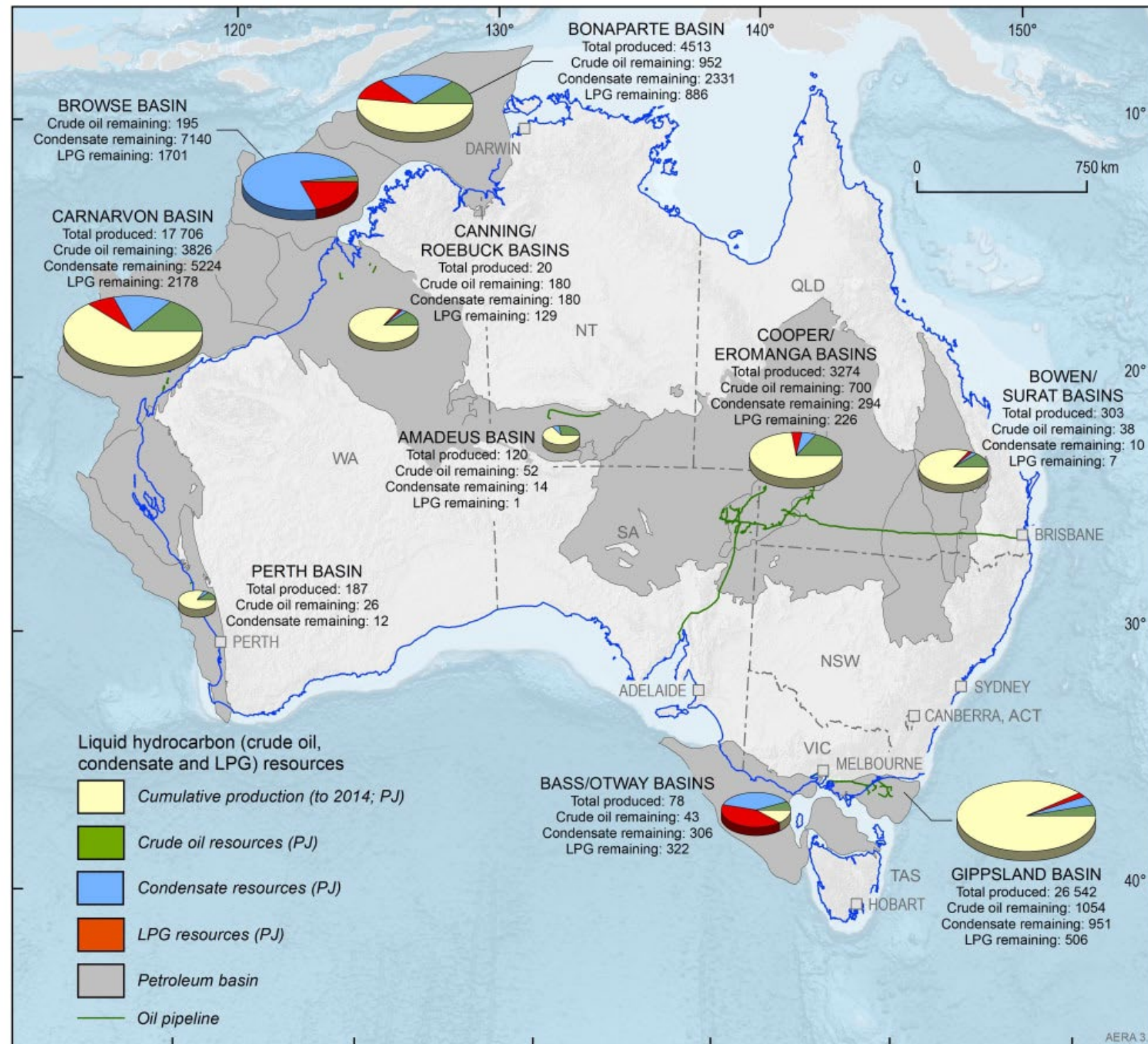
Crude Oil Qualities

- There can be a lot of contaminants within crude oil but density and Sulphur are key indicators
- Heavy and sour crudes are cheap, but hard to convert to finished products
- Refinery equipment makes all the difference



SPC: Sinopec Shanghai Petrochemical, ONGC: Oil and Natural Gas Corporation, IOC: Indian Oil Corporation, HPCL: Hindustan Petroleum, RIL: Reliance Industries, BPCL: Bharat Petroleum, SPRC: Star Petroleum Refining, BCP: Bangchak Petroleum, TOP: Thai Oil Pcl, FPCC: Formosa Petrochemical Corporation, SKI: SK Innovation
Source: HSBC; Viva Energy; BCG Analysis

Australian Crude Oil Market



Source: Geoscience Australia, Encom GPInfo, a Datamine Australia Pty Ltd.
Whilst all care is taken in the compilation of the petroleum pipelines by Datamine, no warranty is provided re the accuracy or completeness of the information, and it is the responsibility of the Customer to ensure, by independent means, that those parts of the information used by it are correct before any reliance is placed on them. Accurate at August 2017.

Traditional Australian oil fields are depleting

- Gippsland basin (Bass strait)
- Cooper basin (South Australia)

North west shelf discoveries have bolstered Australian crude reserves

Australia is net short crude but we export ~70% of our crude, why ?

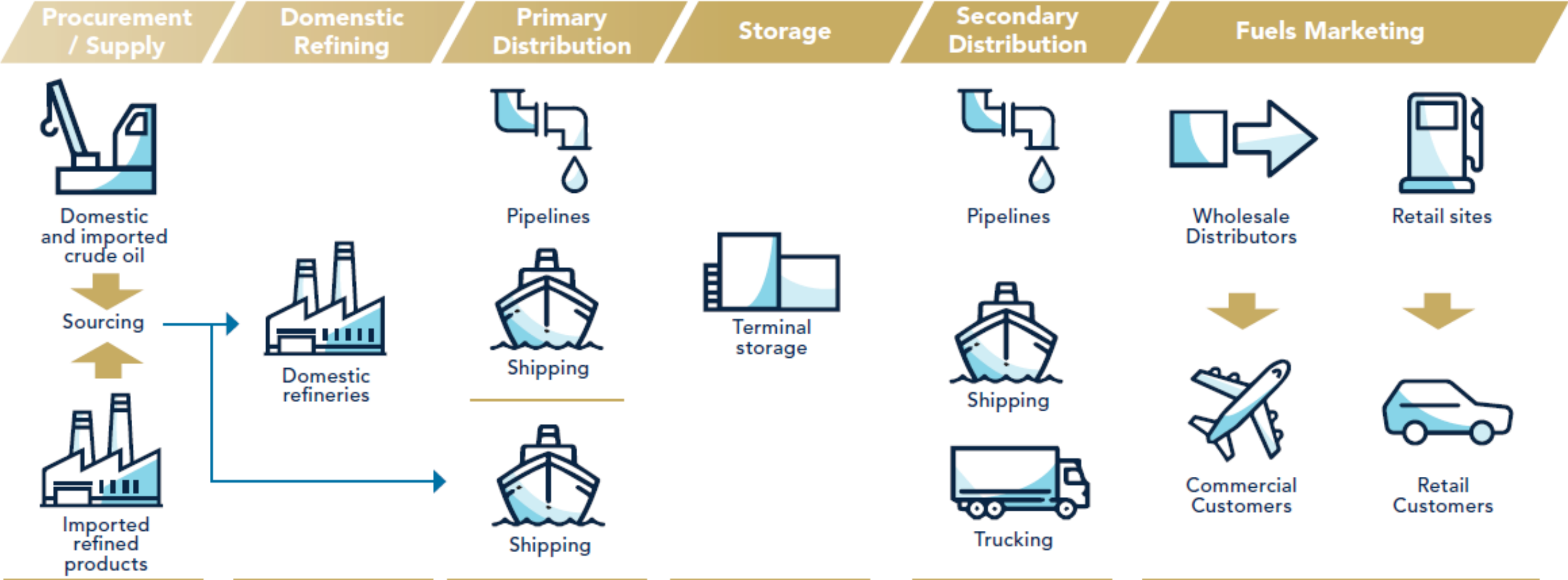
- Right oil at the right place
- North west shelf crude very light and preferred feed for complex chemical production refineries in Asia.

Future crude field discoveries expected to come from WA and Northern Territory

- Ichthys field recently online producing large amounts of gas and condensate

Oil supply chain

Now the basics of crude is understood, we will explore the supply chain



Trading crude oil

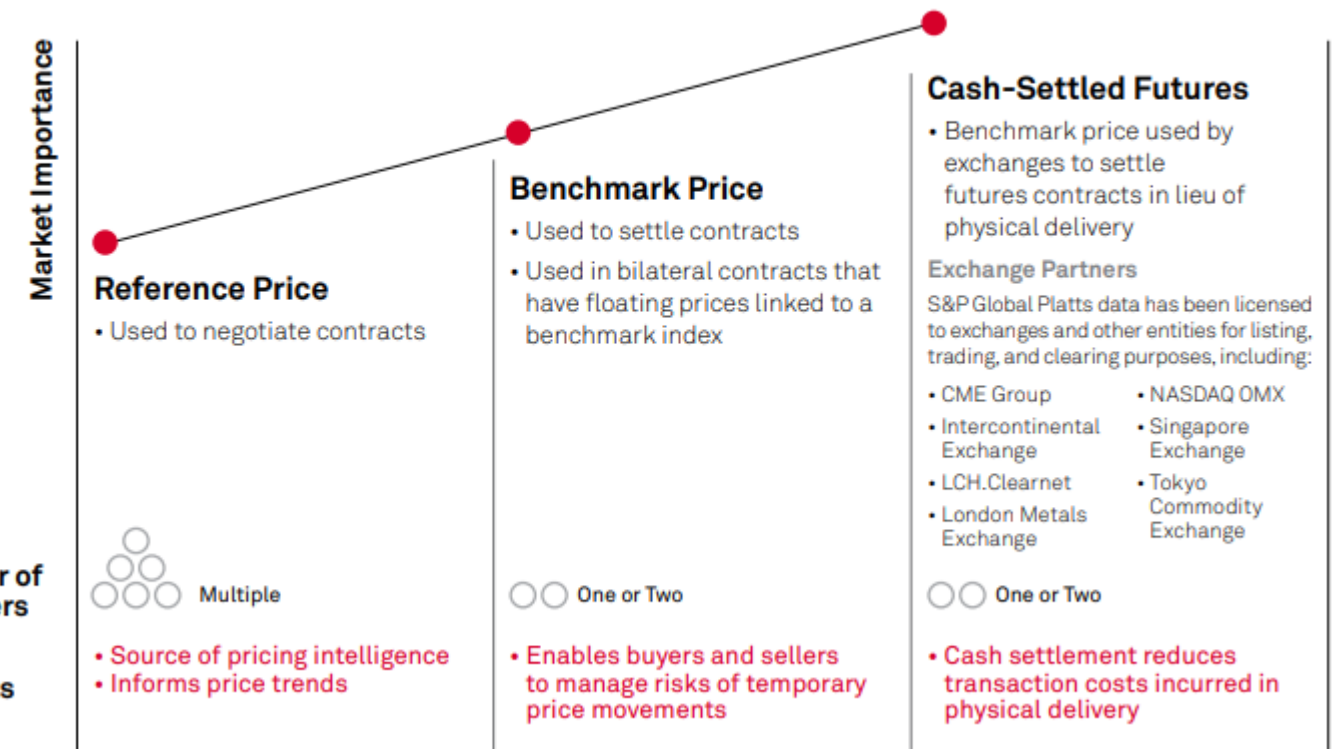
Market pricing benchmarks

- Crude -> Brent , West Texas Intermediate (WTI), Dubai
- Products -> Mean of Platts Singapore(MOPS), ARGUS
- Oil purchased for a price based on agreed marker price

For Australia,

- most crude traded off Brent
- most product traded off MOPS markers

How Market Participants Use Price Assessments



Import Parity Pricing basis for Australian fuels (ie diesel)



The price I pay for diesel in Singapore

- *MOPS Diesel+ Quality premia*

I hire a boat to get it from Singapore to Melbourne

- *Cost of freight*

The landed price in Melbourne
MOPS Diesel +premia+ freight

Shipping Crude Oil

Now you have purchased the right crude how do you get it to you ?

Shipping can be analogous to travelling by car

- Spot voyage: Hiring boat is similar to hiring a taxi. Pay a rate to get oil to you but ship owner covers the rest
- Time charter: Similar to a hire car
- Bareboat: Similar to a car lease

Windows for picking up the oil are to be negotiated with the seller and you need a boat that can meet that window

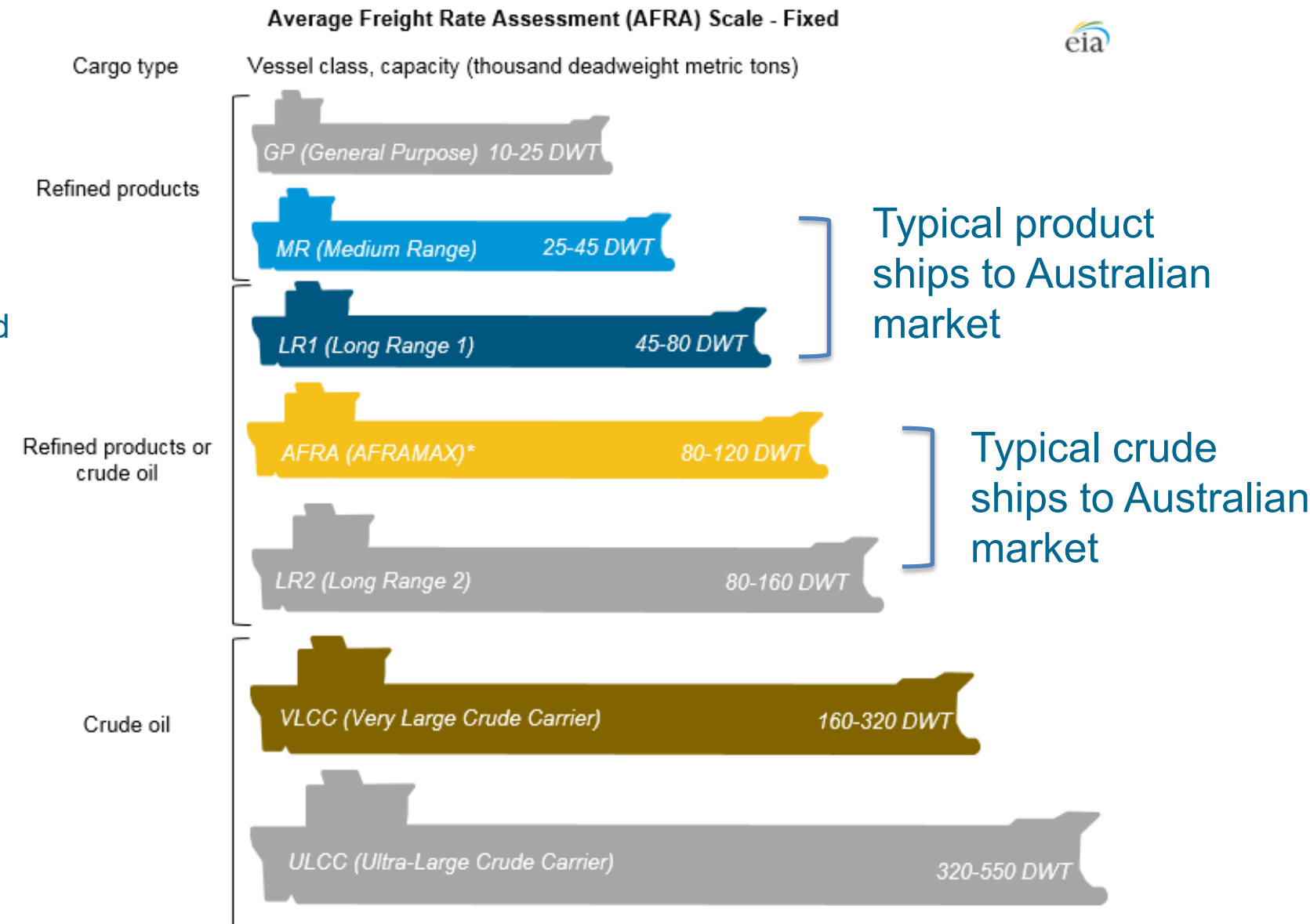
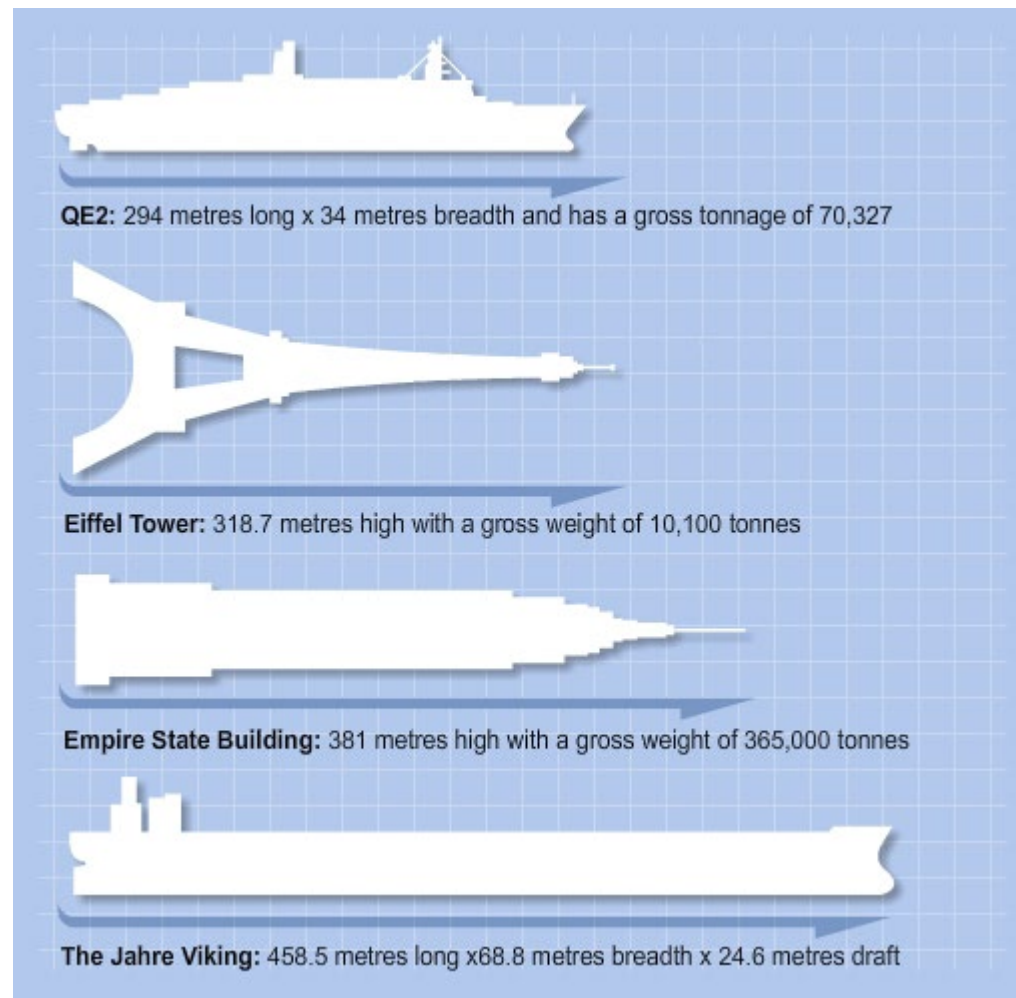
- Think of it as a queue to pick up your product.
- Brokers negotiate timing with supplier and ships to solve this logistics puzzle.



Shipping Oil products

Ship size and type is important.

- What can you fit on your berth/port?
- What can the load port take?
- What is economical?
 - Expensive to under fill a boat but
 - The bigger the boat the cheaper per ton of product shipped

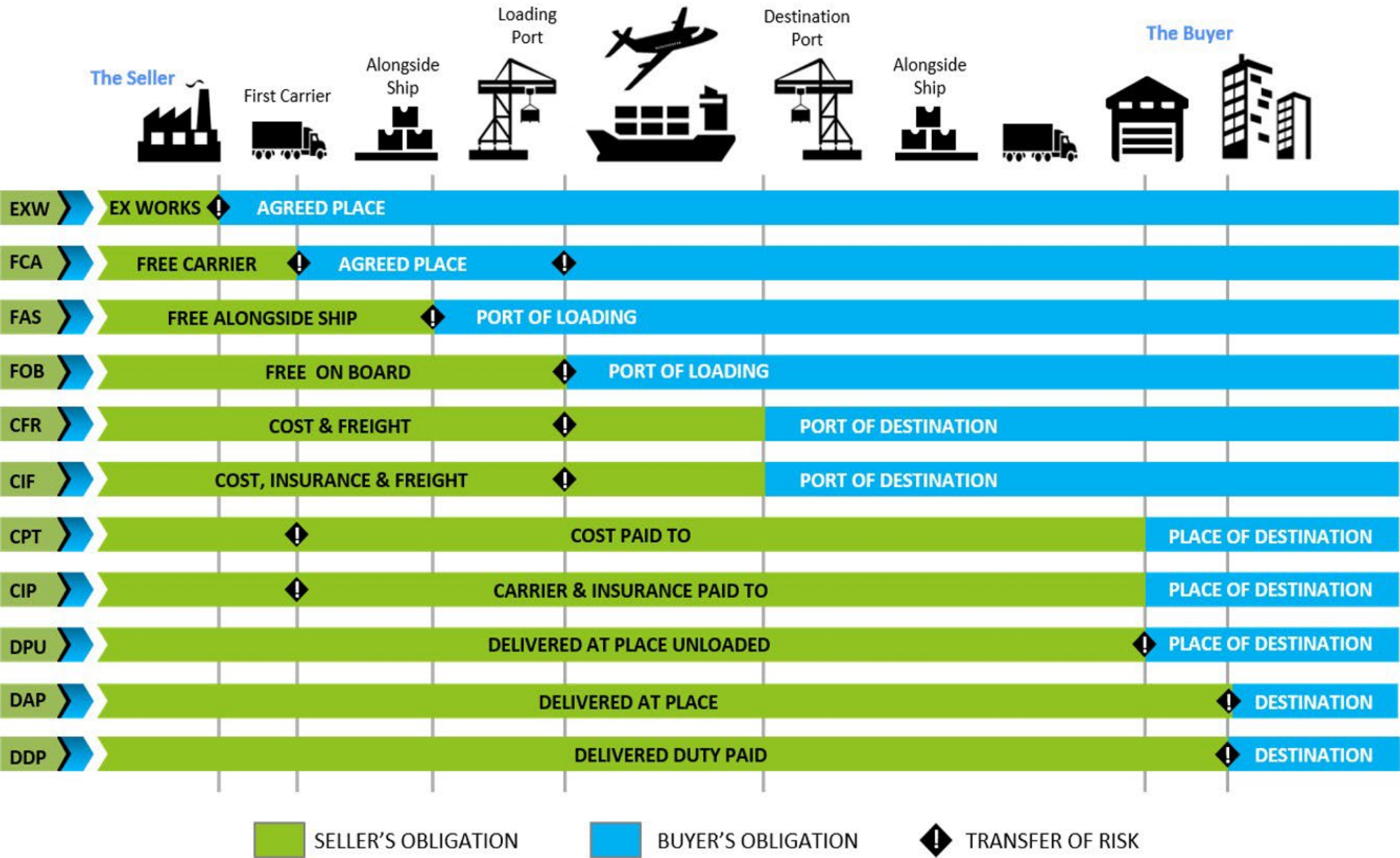


Shipping International Commercial (INCO)

INCOTERMS 2020

Point of Delivery and Transfer of Risk

Common to
oil shipments

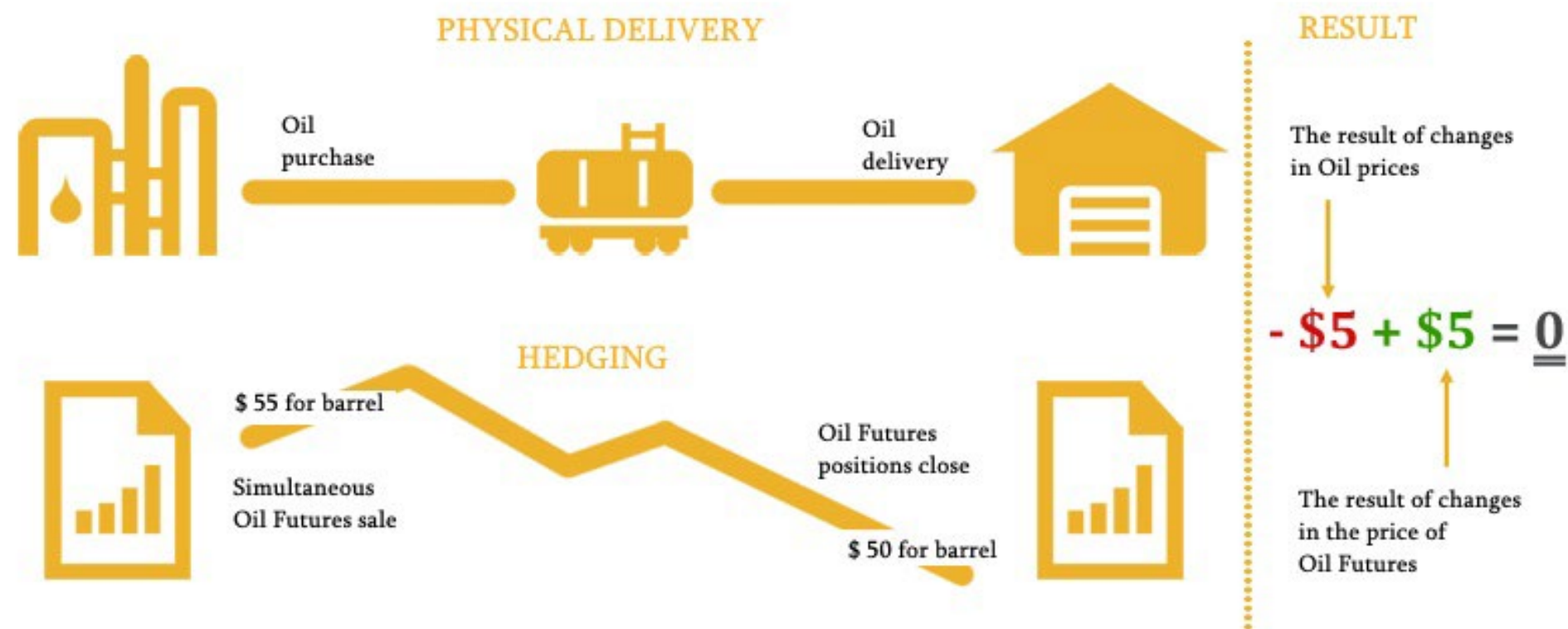


Hedging

Crude oil stocks held are partially or fully hedged to reduce the exposure to market prices during transport and production

Refining margins are more complex to hedge as over hedging will erode value when refining margins are strong

Australian oil industry has large FX exposure as oil purchased in US\$ but sold at the pump in \$AUD.



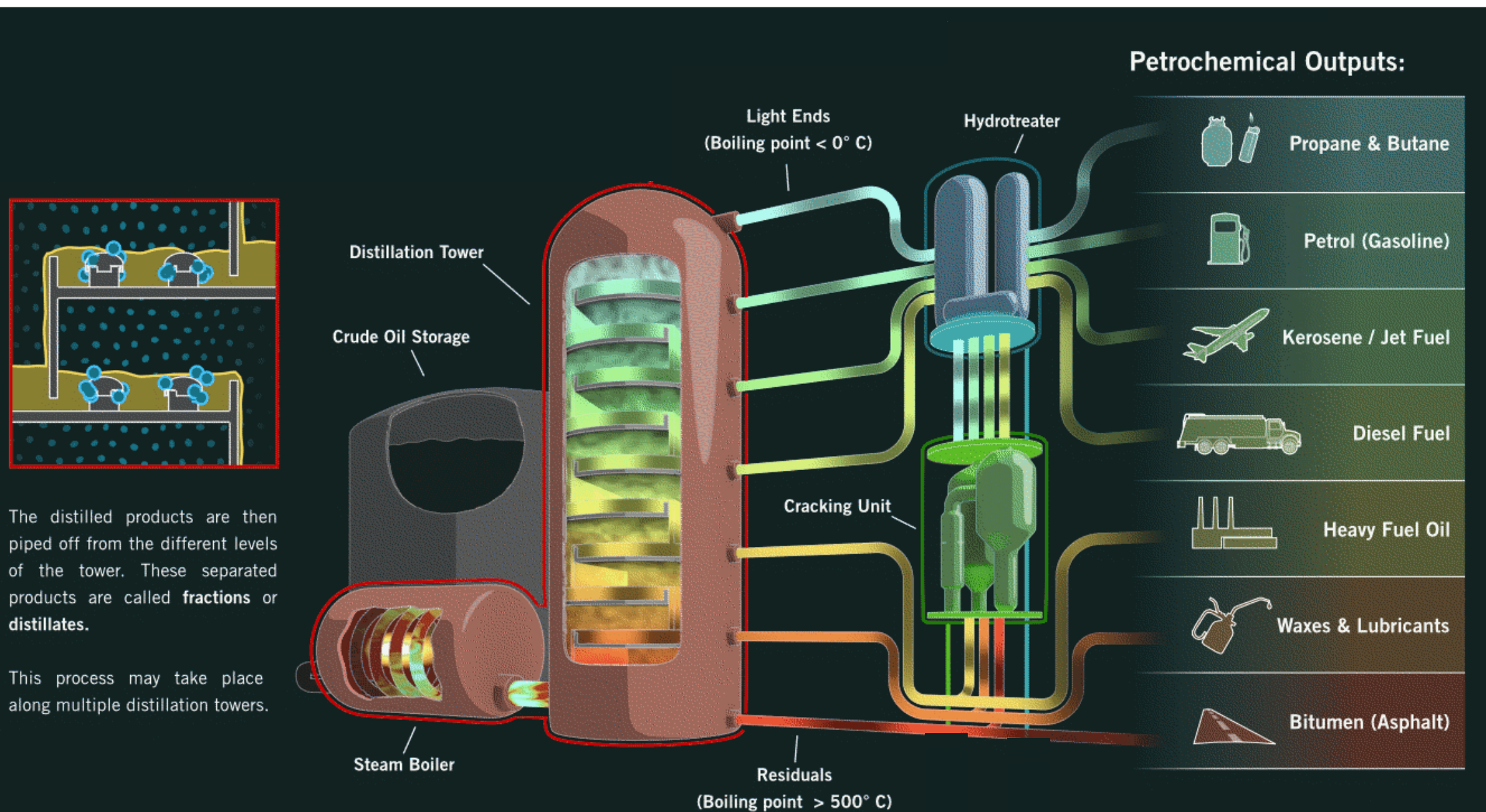
Refining Crude Oil

Often see images of refineries in the news but what is behind the scene?



Crude Refining Technology

- Distillation -> Boiling oil to separate heavy from light products
- Cracking -> Breaking heavy bitumen oil into gasoline, Diesel, LPG
- Reforming -> Production of high octane gasoline
- Treating -> Removal of impurities from crude, ie Sulphur removal



Other Oil Derived Products

PRODUCTS

In addition to fuels, lubricants, and bitumen, countless other products are made from chemicals derived from oil refining:

Cosmetics



Electronics



Detergents



House Paint



Plastic Bottles



Rain Boots



Nappies



Water & Sewage Pipes



Optical Media



Diving Suits



Hot Air Balloons



Tyres



Golf Balls



Plastic Bags



Australian Crude Refineries

These technologies and others applied multiple times and at scale.



There are four refineries in Australia:



PETROL
(38%)



DIESEL
(31%)



JET FUEL
(14%)



FUEL OIL
(3%)



LPG
(3%)

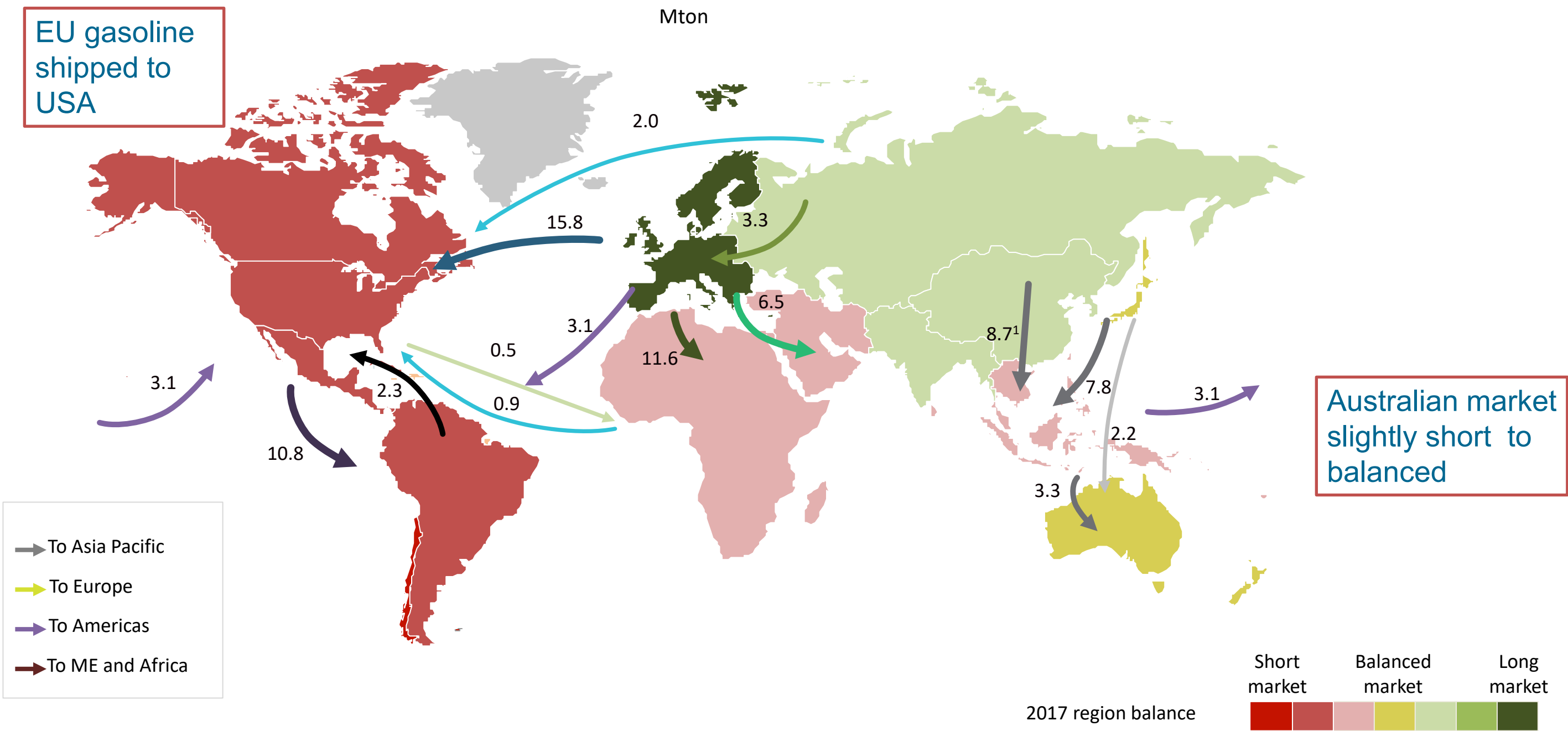


OTHER PRODUCTS
(11%)

These refineries combined produce around
50% of Australia's transport fuel needs
(and around **65%** for petrol).

Global Product Balances- Gasoline

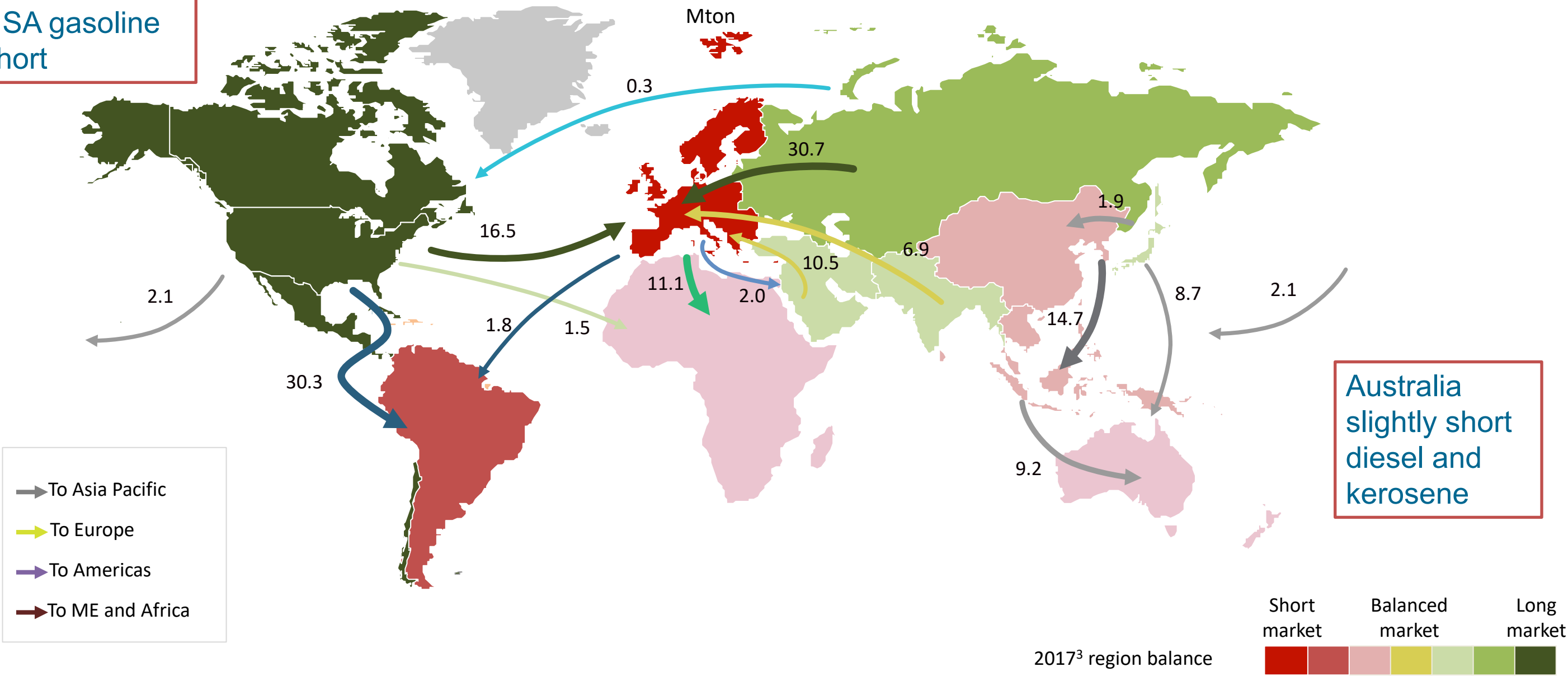
Gasoline: Major global flows, 2017



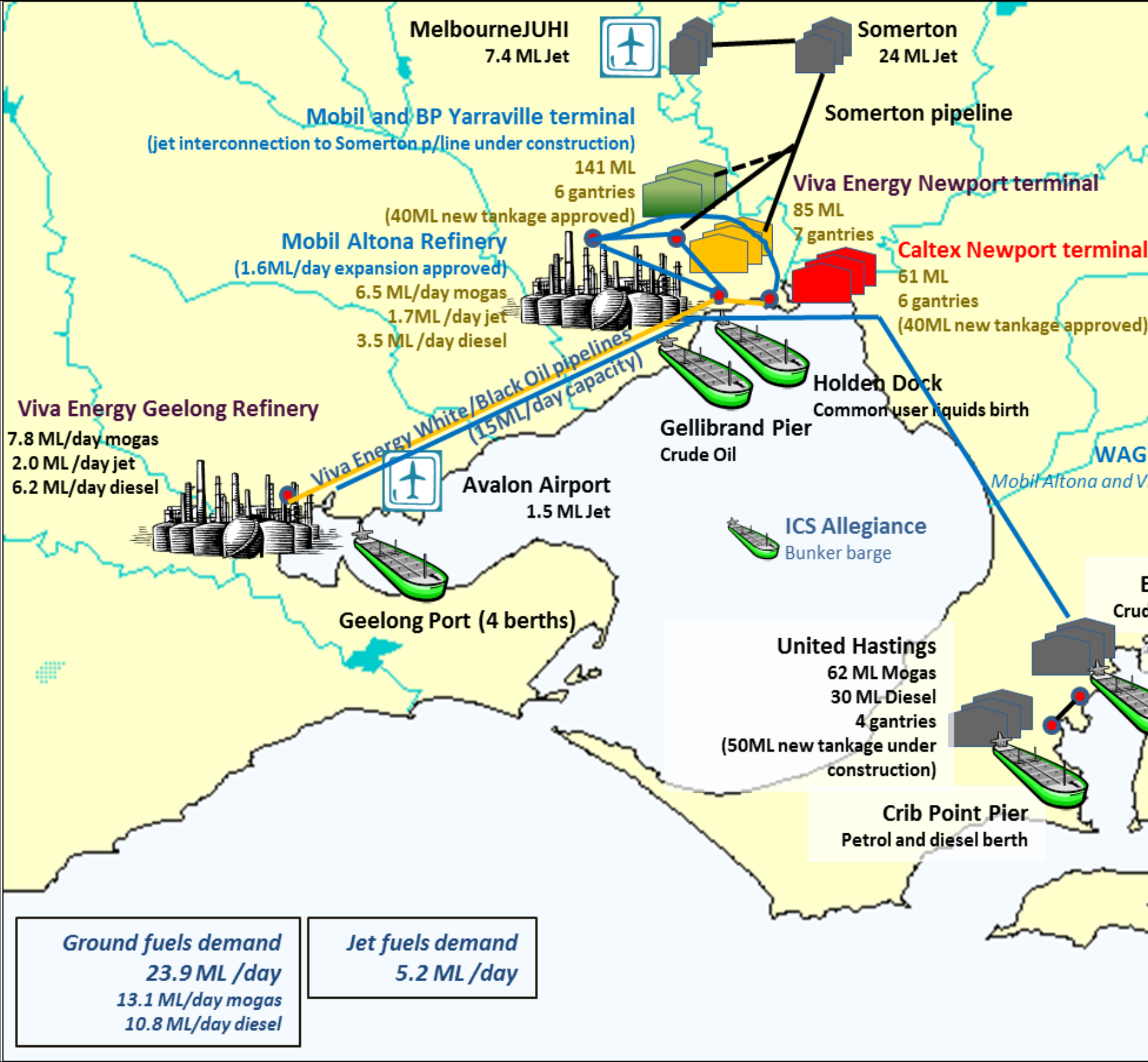
Global Product Balances- Diesel/Kerosene

EU short diesel
and matches
USA gasoline
short

Diesel/Gasoil: Major global flows, 2017

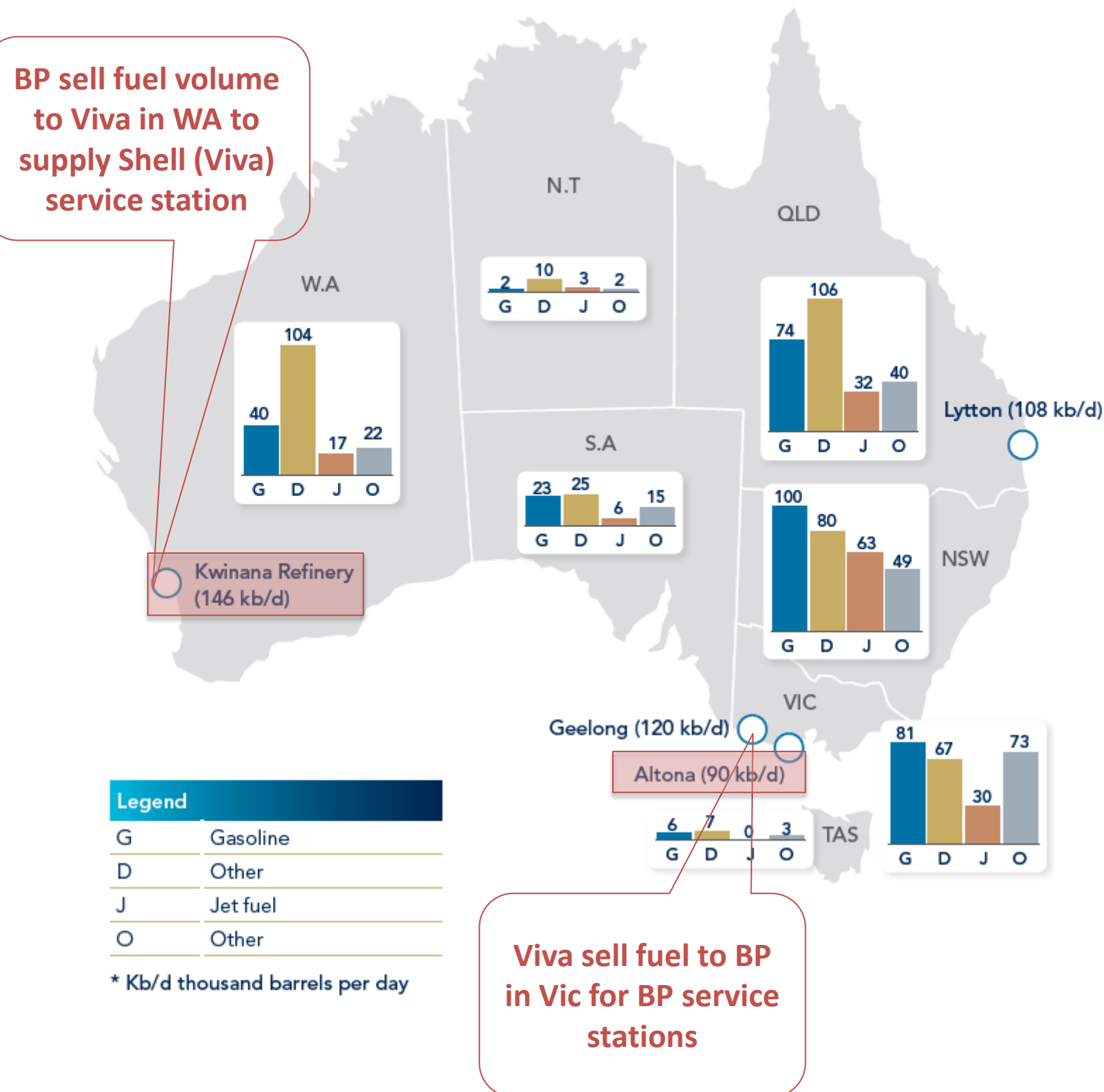


Victorian Infrastructure



Buy/ Sell

Figure 2.2: Refined product demand by state in 2017 (thousand barrels per day)



Balances product between locations around Australia with out need to ship product around the country.

- Reduce costs associated with shipping material
- 6-month term agreements between major competitors; BP, Ampol, Mobil and United with Trafigura and Glencore
- Volumes not balanced (ie not a swap), pricing is based on import parity

No buy/sell

- Viva refinery makes gasoline and exports gasoline to QLD to meet needs of Shell (Viva) service stations
- Ampol does the same, makes fuel in QLD and sends it to VIC
- Two full ships will pass each other at Sydney.....both companies paying for shipping. (\$3/bbl or ~\$2M per month)

Buy/Sell

- Viva agree to sell gasoline to Ampol service stations in Victoria and
- Ampol agrees to sell gasoline to Shell (Viva) service stations in QLD
- Each refinery can sell its gasoline without having to ship material around at increased cost to refinery and consumers

Consumer Networks

Product is trucked from fuel terminals to commercial customers and retail sites.
Secondary logistics system is very extensive to reach the end customer.

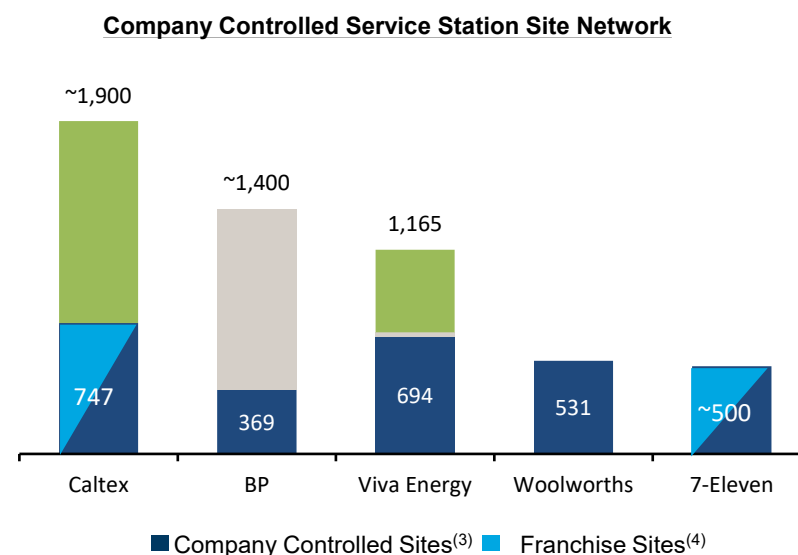
For Viva only there is a lot of trucking completed.

~45million Km per year (1,125 x around the earth)

~180,000 deliveries per year

~200 trucks (50% metro / 50% regional)

~20 Transport providers



Consumer Networks

The oil product market is very different for each product, as such there are a variety of companies that compete in each sector, some better than others.



RETAIL

Competitive market with major fuel companies and many independents competing



TRANSPORT

Limited to providers who can supply large volume contracts and supply chains



AVIATION

Airports limited to major oil players who own joint airport hydrant system. (JUHI)



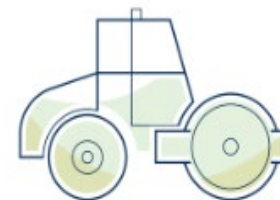
MARINE

Few competitors in fuel oil market due to complex nature of managing fuel barges. Only 2-3 companies in this market



MINING, OIL & GAS

Supply based on both pricing and whole solution packages. ie lubes and fuels



BITUMEN

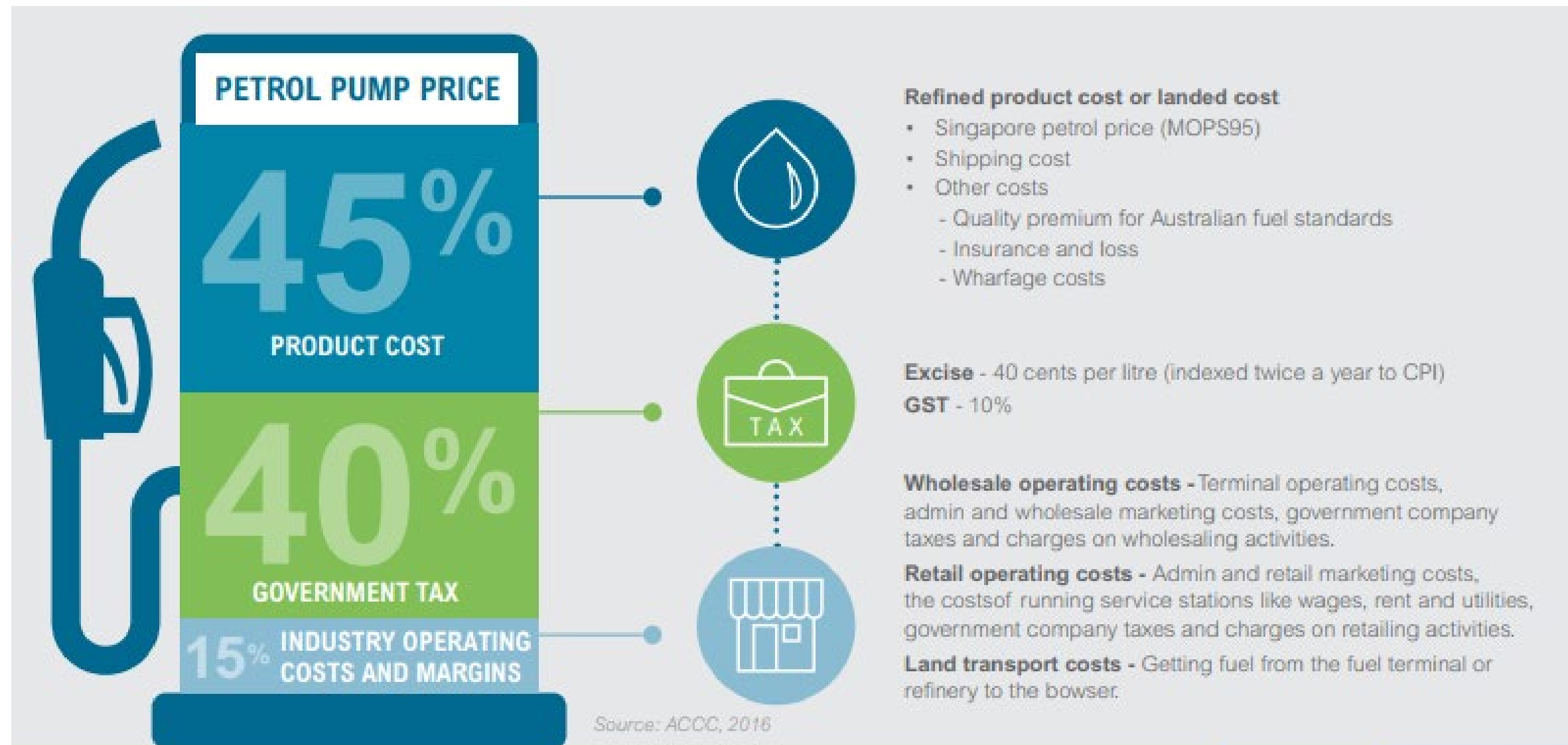
One refinery that can produce bitumen in Australia, remainder imported by two competitors.

Australian Fuel Taxes

Many people are not aware of the taxes imposed on fuel

- Fixed excise of 42.3 cents per liter
- 10% GST on sales , ie applied on top of the fuels excise

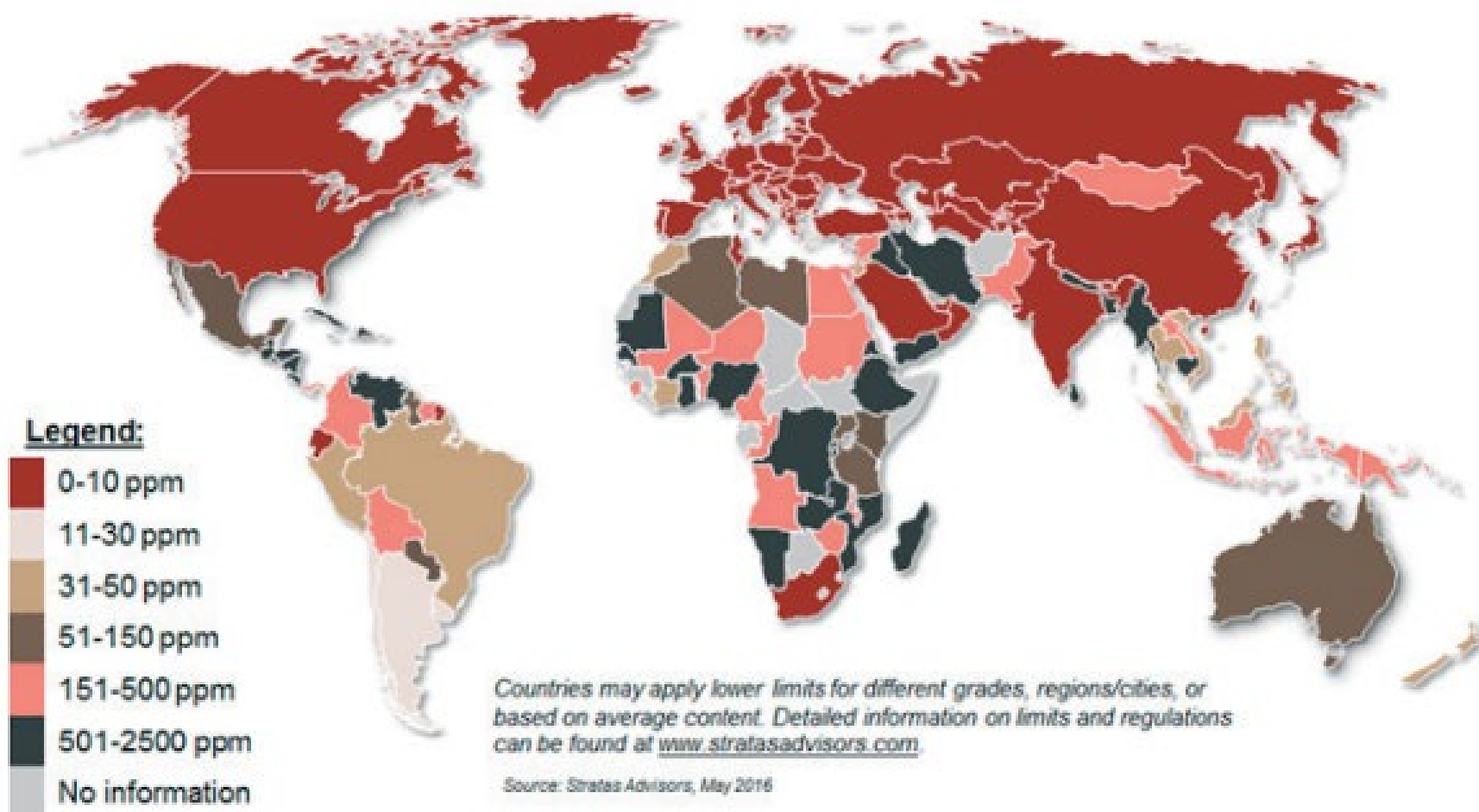
So as oil price halves , the pump price will not half due to affect of fixed excise system



Changes to Australian Fuel market

The world is moving towards low Sulphur gasoline

- Australia expected to move from 150ppm to 10ppm by 2027
- Cost to industry AU\$1bn to upgrade hydro treating capability, ~A\$250mIn per each refinery to install equipment
- Could present a significant challenge to Australian refineries.



Example of a hydro treater

Changes to Australian Fuel market

Increase in alternative fuel options coming to Australia

- Electric vehicles
 - Adoption dependent on several factors
 - EV cost decline as technology advances
 - More publicly available charging stations
 - Beat the range and charge rate hurdle
 - Currently expected to track on the lower adoption rate
- Hydrogen vehicles
 - Technical barriers to entry in logistics
 - Difficult to compete in personal car market but heavy industry would be an option

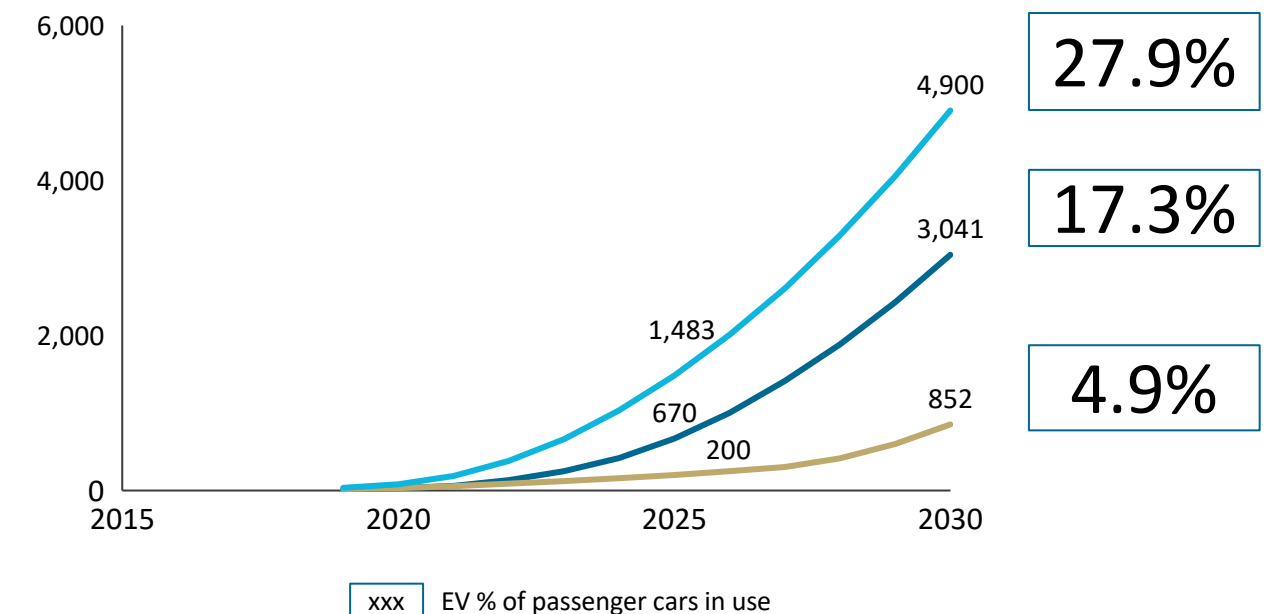
EV market expected to be beat hydrogen at this stage but who knows what the future will hold

If high EV take occurs

- expect it to hit the gasoline market due to family sedan being most likely substituted vehicle
- would place pressure on Australian refineries that are primarily set up for gasoline production
- would not impact on supply infrastructure

EV deployment uptake forecast

No. of EV on the road in ('000), ARENA 2018



Thank you

Questions?