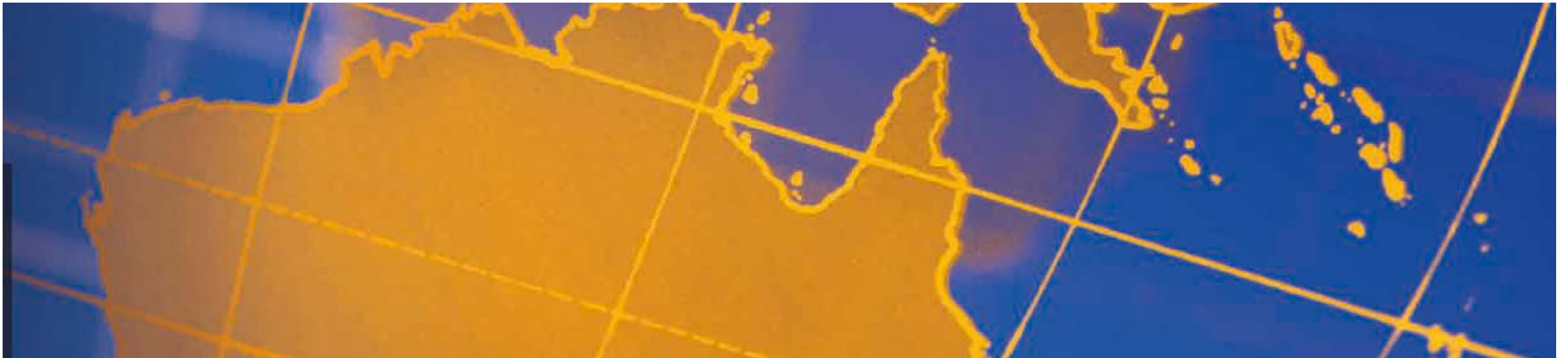


The Price of Oil: Why it Rose, Why it Fell, and What it Will Mean for Australian LNG

Roberto F. Aguilera

r.aguilera@curtin.edu.au



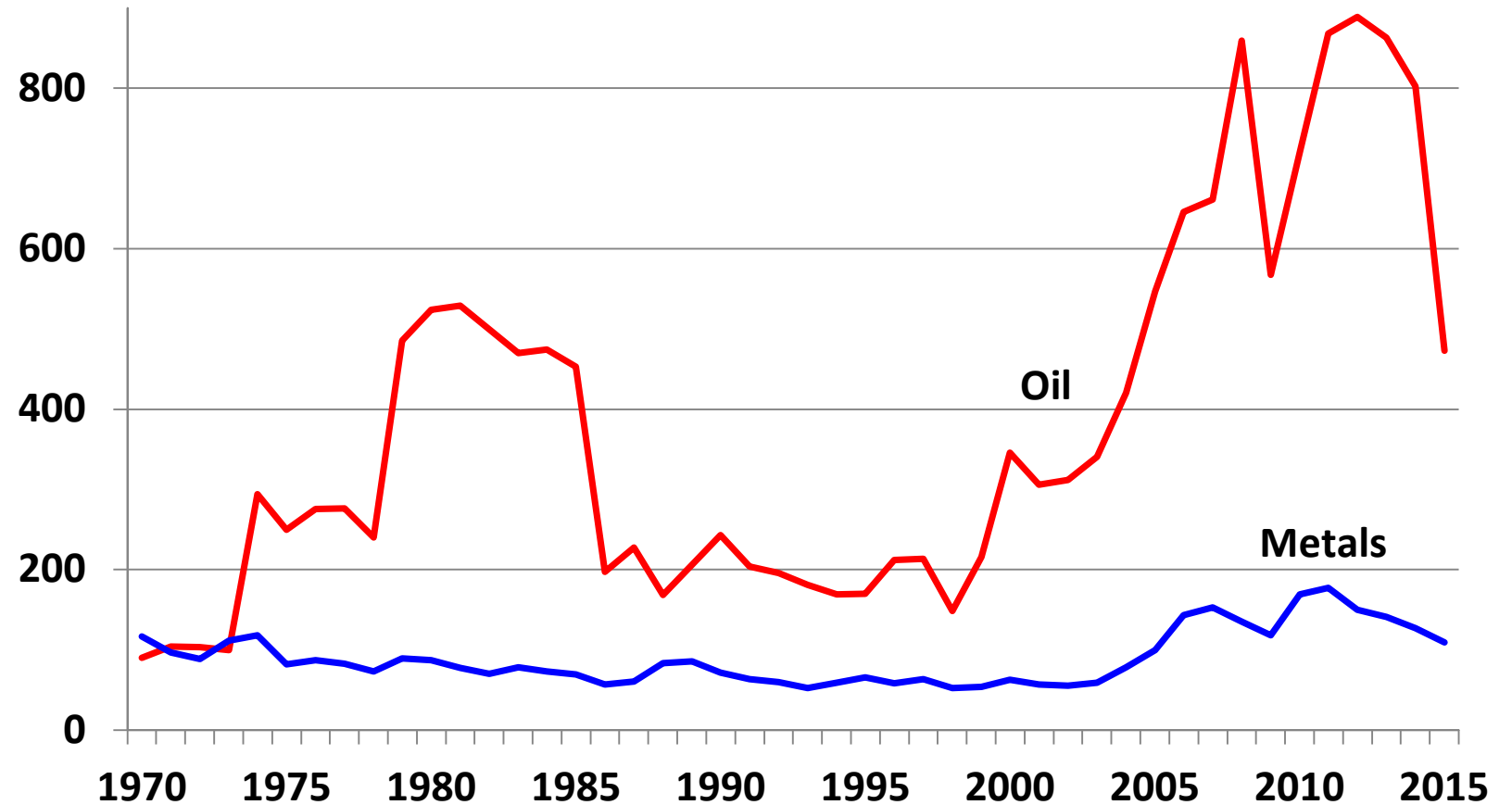
Background

- **Shale oil industry <10 years old, still in its infancy**
- **Boom has potential to spread globally**
 - Several countries well-positioned (e.g. Australia, Argentina, Canada, China, Mexico, Russia)
- ➔ **Increased production and downward pressure on oil prices over the long term**
- **Implications for Australian LNG?**

Price Indices in Constant Money, 1970-72=100

- What explains oil's extraordinary price history?

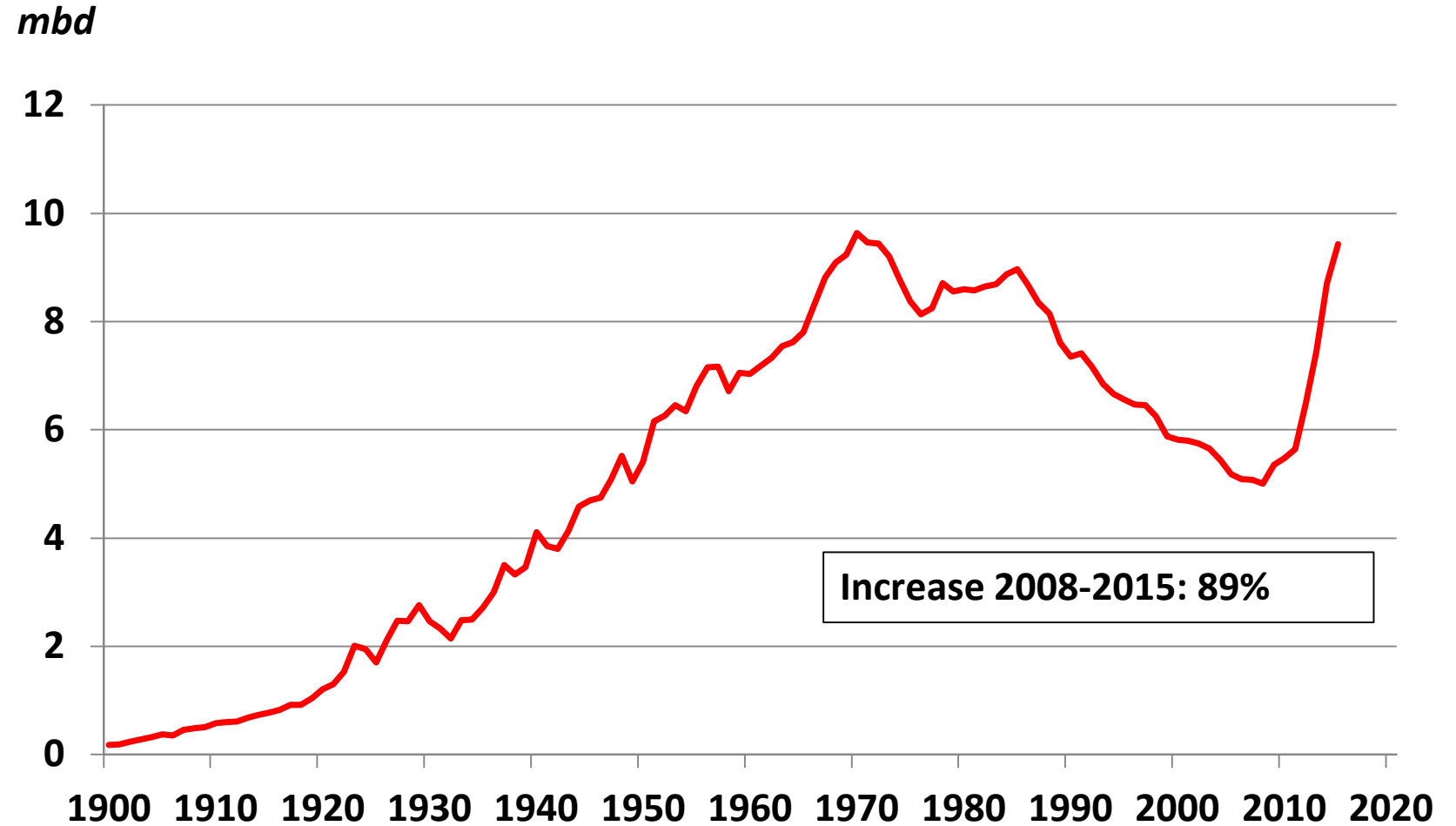
➔ Problems with state ownership and 'resource curse'



Sources: UNCTAD and UNSTAD.

US crude oil production, 1900-2015

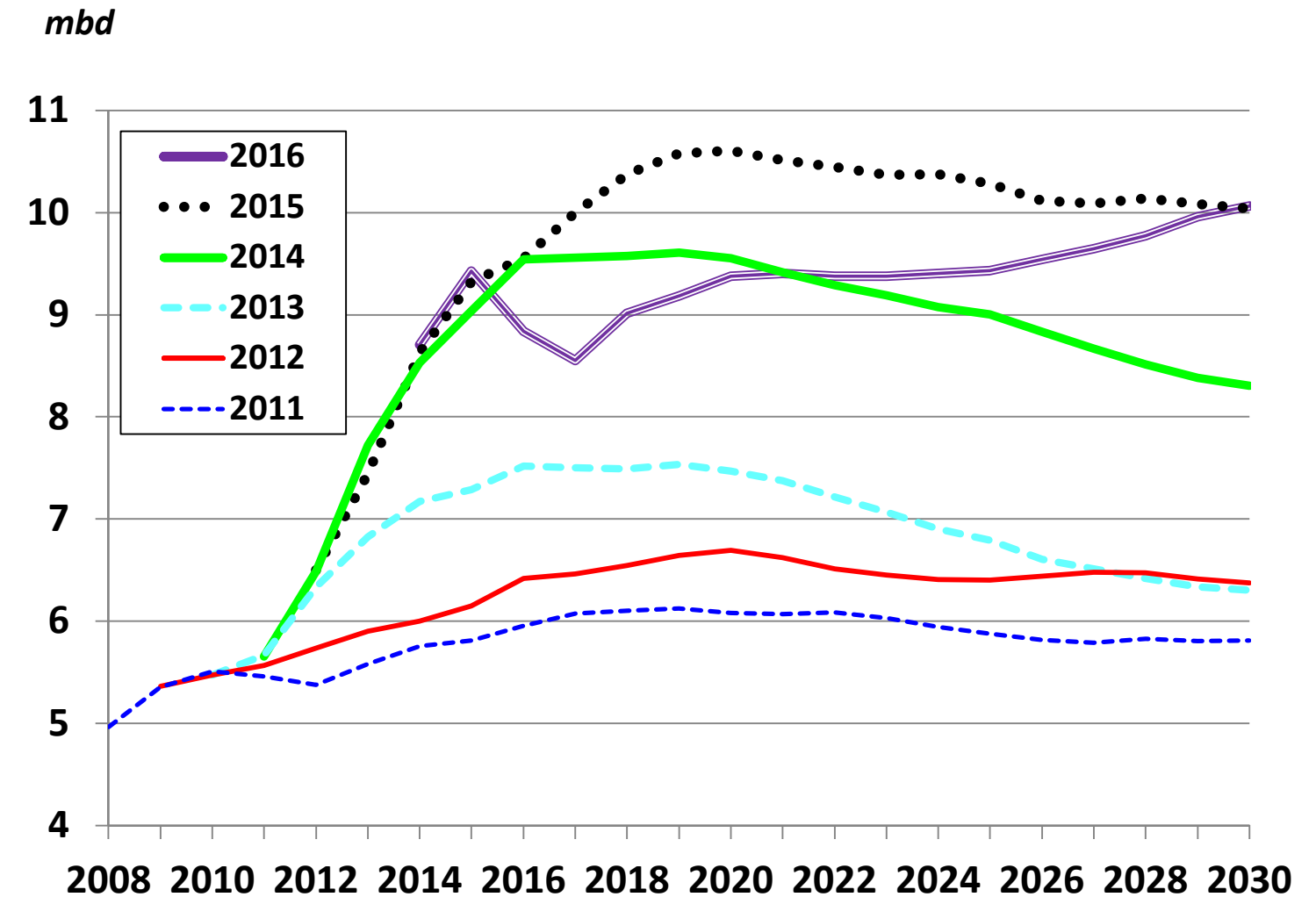
- What explains the price fall?
- ➔ The astonishing rise of shale oil (and disappointing economic growth)



Source: EIA (annual)

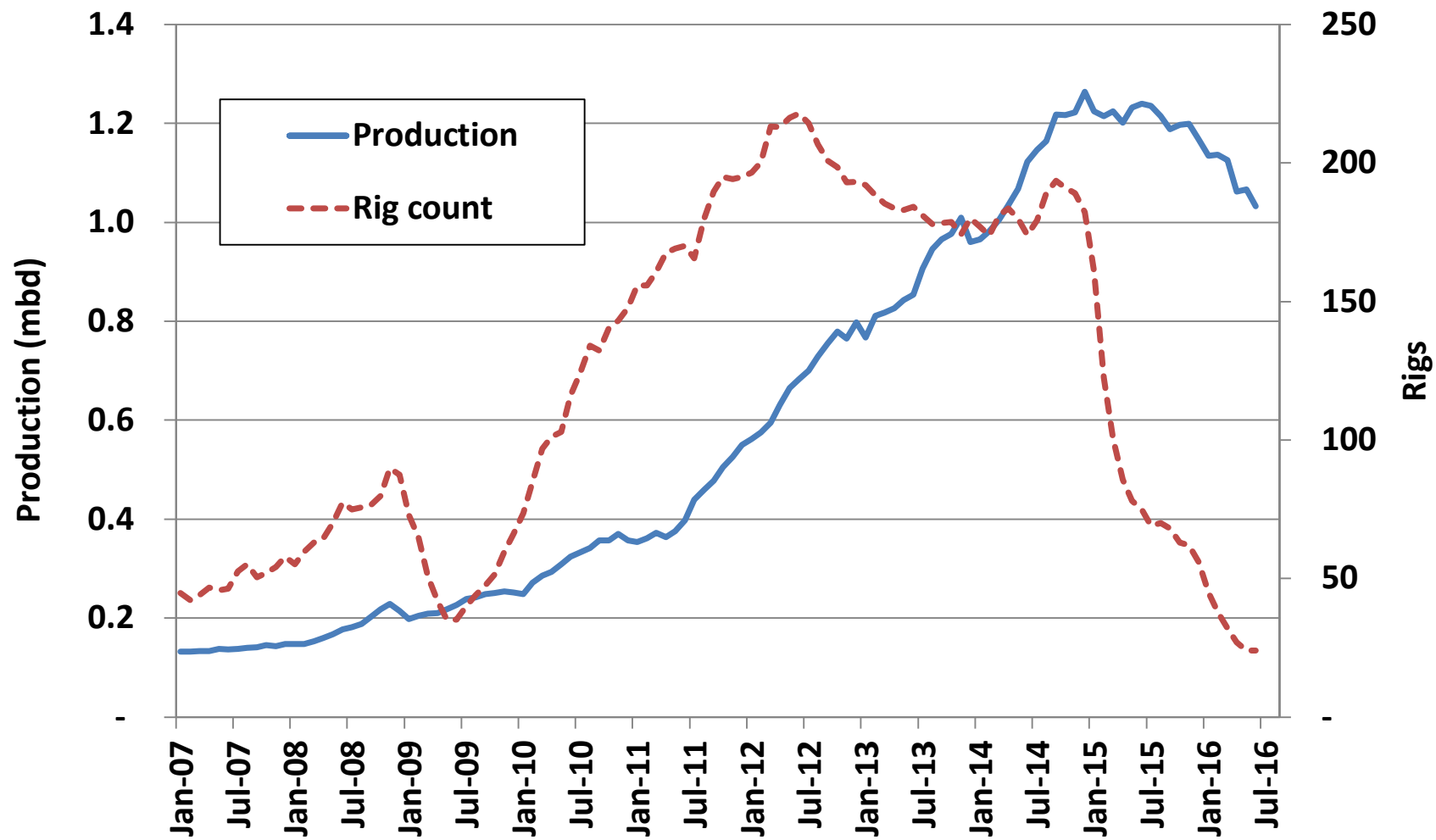
Have we only seen the beginning?

- Generally, shale has been seen as medium-term phenomenon
- US oil production forecasts repeatedly revised upwards by EIA



Source: EIA Annual Energy Outlook (annual).

Technological progress: Bakken oil production & rig count



Source: EIA (2016)

Has technology played out?

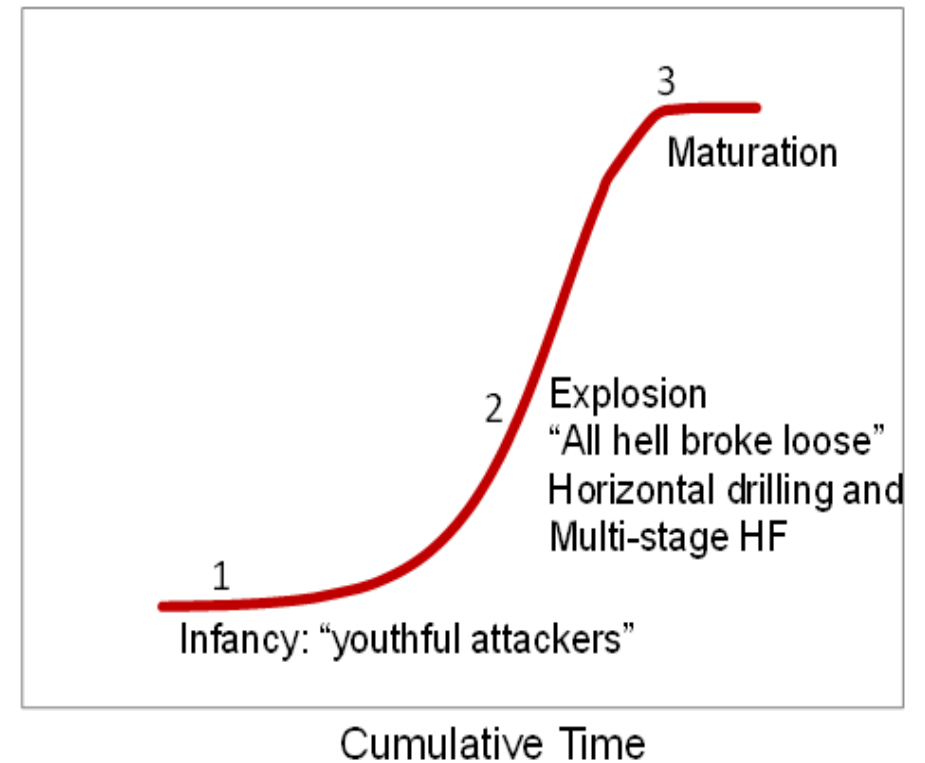
■ Drilling

- Operational efficiencies (e.g. # days to drill)
- Increased pad drilling, multi-lateral drilling
- Reduced well spacing
- Longer horizontal laterals

■ Fracking

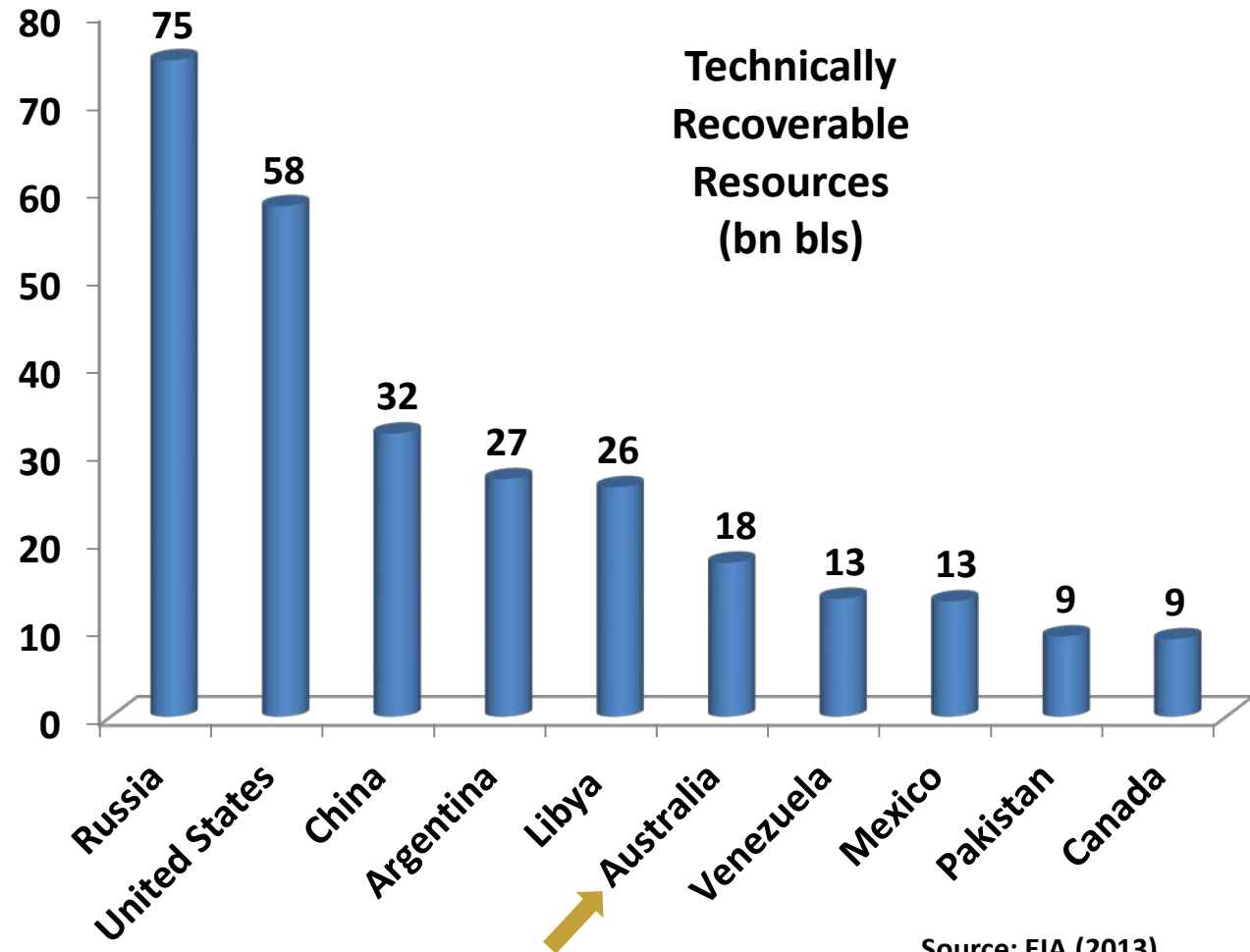
- Increased # of stages
- Optimal spacing of stages
- “Zipper” fracking
- Waterless fracking
- Re-fracking

Cumulative Technology Development



Global shale oil resources widely distributed

- Assessment by EIA (2013): global shale oil resource of **~345 billion barrels**
- Of the total:
 - Russia 22%
 - US 17%
 - China 9%
 - Argentina 8%
 - Libya 8%
 - **Australia 6%**

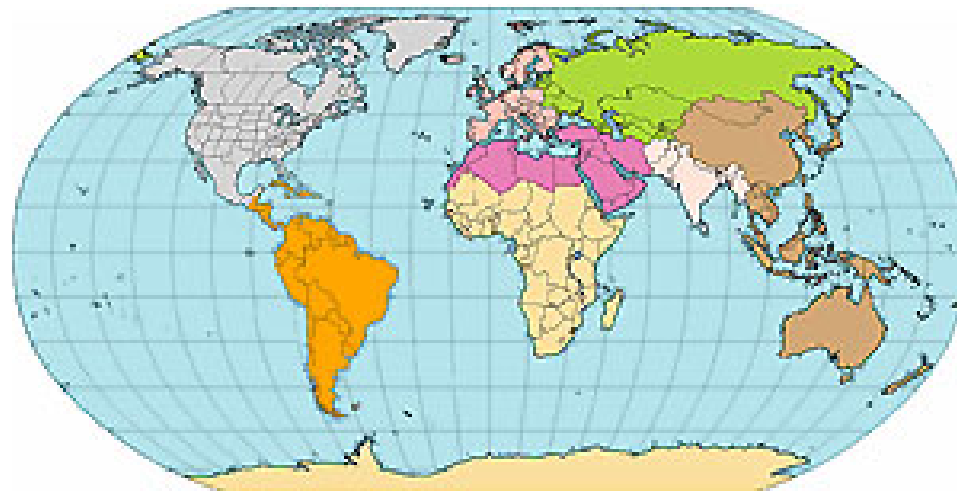


➤ Our estimate, calculated with a Variable Shape Distribution Model (VSD), is **~650 billion barrels**

Speculative rest of world shale oil impact 2035, mbd

Global 2014 oil output	Global rise, 20 years (1994-2014)	US share of shale oil resources, EIA (2013)	US shale production rise, 10 years (2004-2014)	ROW shale production rise, 20 years (2015-2035)
88.7	21.6	17%	3.9	19.5

Source: The Price of Oil (2015)



Key considerations for global shale development

1. Developed infrastructure
2. Ownership
3. Drillers
4. Risk capital
5. Supply chains
6. Regulation
7. Environmental impact
8. Public acceptance



Environmental constraints

- There are indeed environmental problems, though often exaggerated by media
- Most concerns relate to:
 - Intensive water use
 - Contamination drinking water
 - Methane leakage
 - Induced earthquakes
- Damage caused by “wild west” industry, but hazards will be overcome as industry matures and becomes more tightly regulated



Recommendations for unconventional gas/oil development

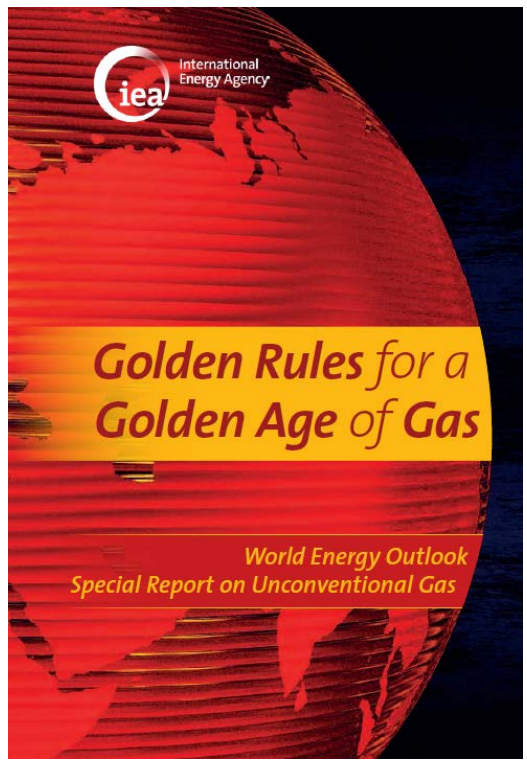
- Organizations identified measures to reduce environmental impacts
- Some regulation in place (including in WA)

**Secretary of Energy
Advisory Board**



**Shale Gas Production
Subcommittee
Second Ninety Day Report**

November 18, 2011



International Energy Agency
Golden Rules for a Golden Age of Gas
World Energy Outlook
Special Report on Unconventional Gas

REGULATION OF SHALE, COAL SEAM AND TIGHT GAS ACTIVITIES IN WESTERN AUSTRALIA FINAL

An analysis of the capacity of the Petroleum and Geothermal Energy Act 1967 (WA) to regulate onshore gas activities in Western Australia

Includes corrections to structure actioned by Dr Tina Hunter on 25th October 2011. Formerly HUNTER REPORT SHALE GAS REGULATION IN WA © docx

Dr Tina Hunter
Faculty of Law
Bond University

July 2011



Non-US shale oil production costs, 2014 and 2035, \$/bl

Country/Region	2014	2035
Russia	65	47
Argentina	50	36
China	75	55
North Africa	100	73
Mexico	60	44
Australia	85	62
Colombia	95	69
Brazil	90	66

Cost estimates for 2014 based on IHS (2014), they comprise a 10% rate of return on invested capital; Costs in 2035, estimated in The Price of Oil (2015), assume technological progress (i.e. cost reductions) of 1.5% per annum.

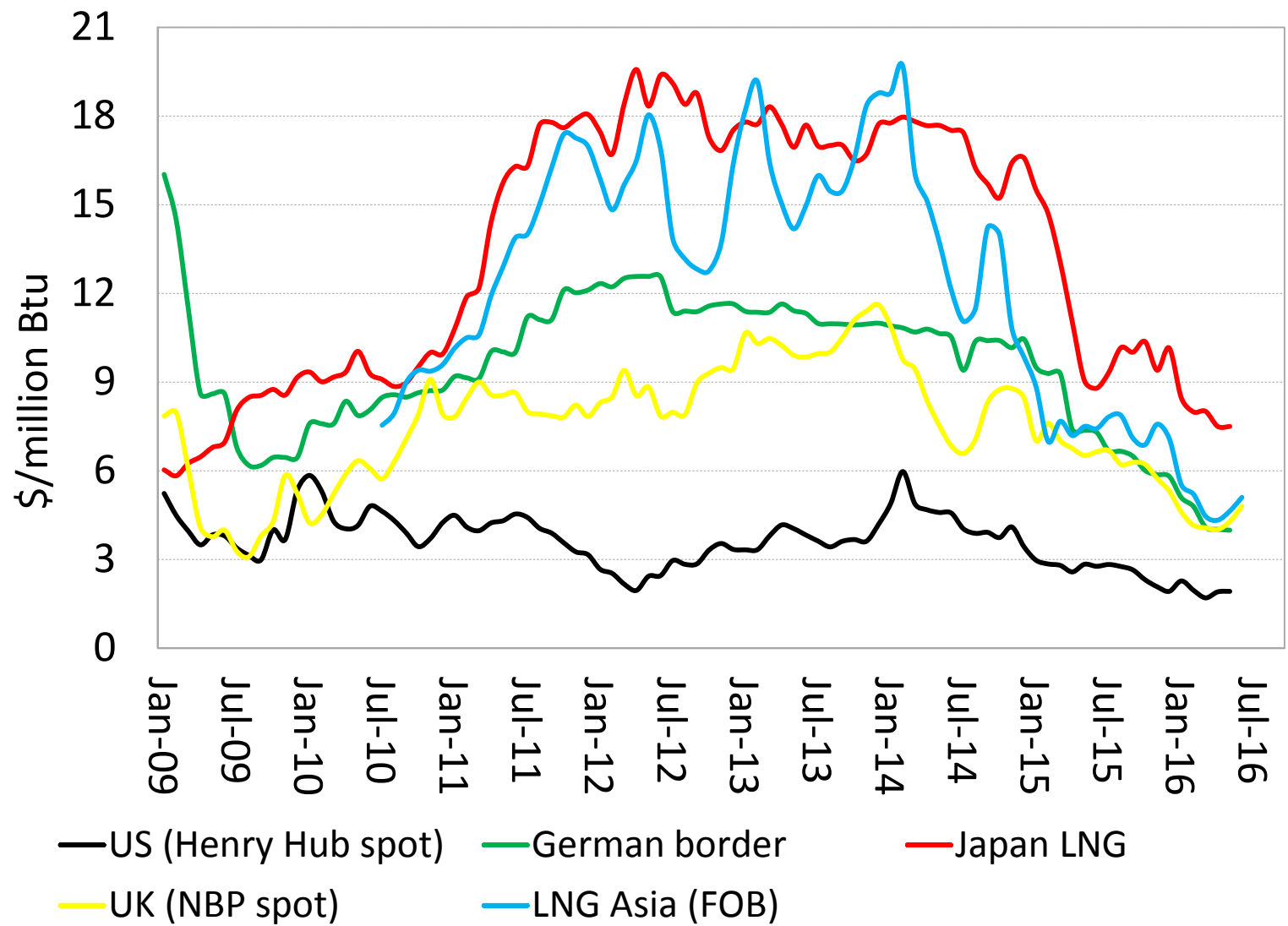
- Total costs around \$60/bl in 2035, so price cannot fall below that level for global revolutions to succeed

Price implications:

Successful global revolution will put significant downward pressure on global oil price

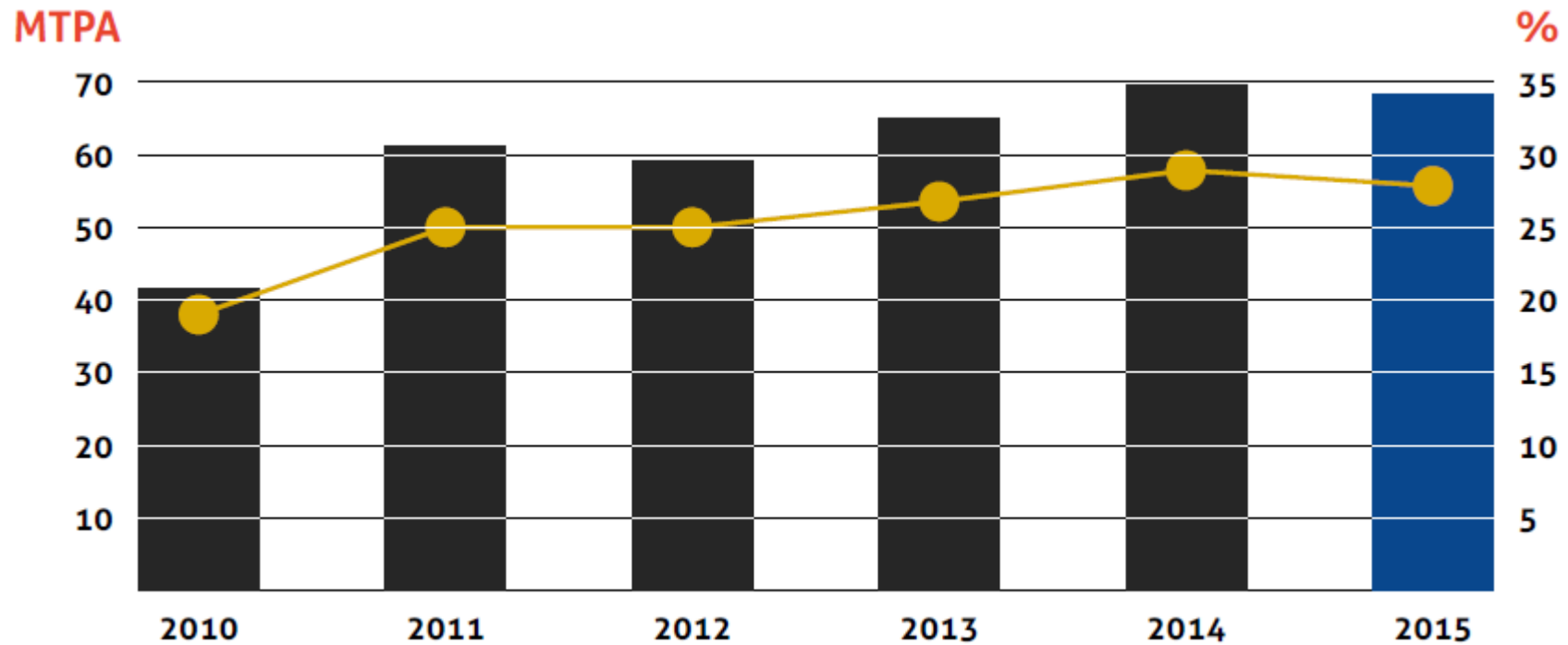
- Sufficient amounts of oil available in 2035 at total costs not exceeding \$40-60/bl
 - Thus, \$40-60 price adequate to support almost any conceivable level of demand
- Ample supply additions at this level assure that price settles at \$40-60 in the long term
 - ➔ Winners and losers, but on balance, a great advantage

Natural gas prices: divergence significantly narrowed



Source: IMF, Platts (2016)

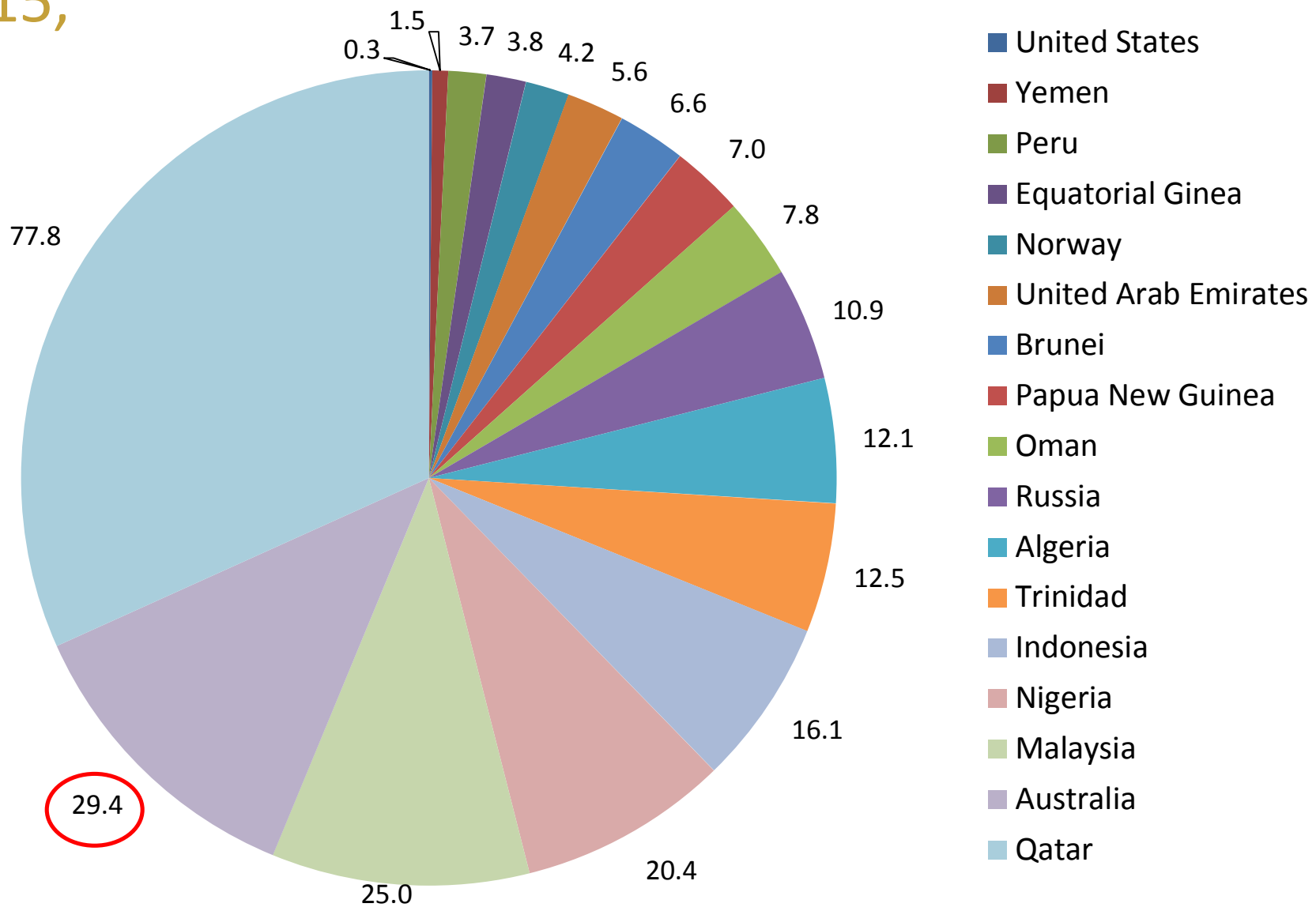
Spot and short-term trade vs. total LNG trade



Source: GIIGNL(2016)

- Low oil prices will keep oil-indexed LNG prices low
- Gas-on-gas pricing will rise with growing global LNG trade

LNG Exports in 2015, mtpa

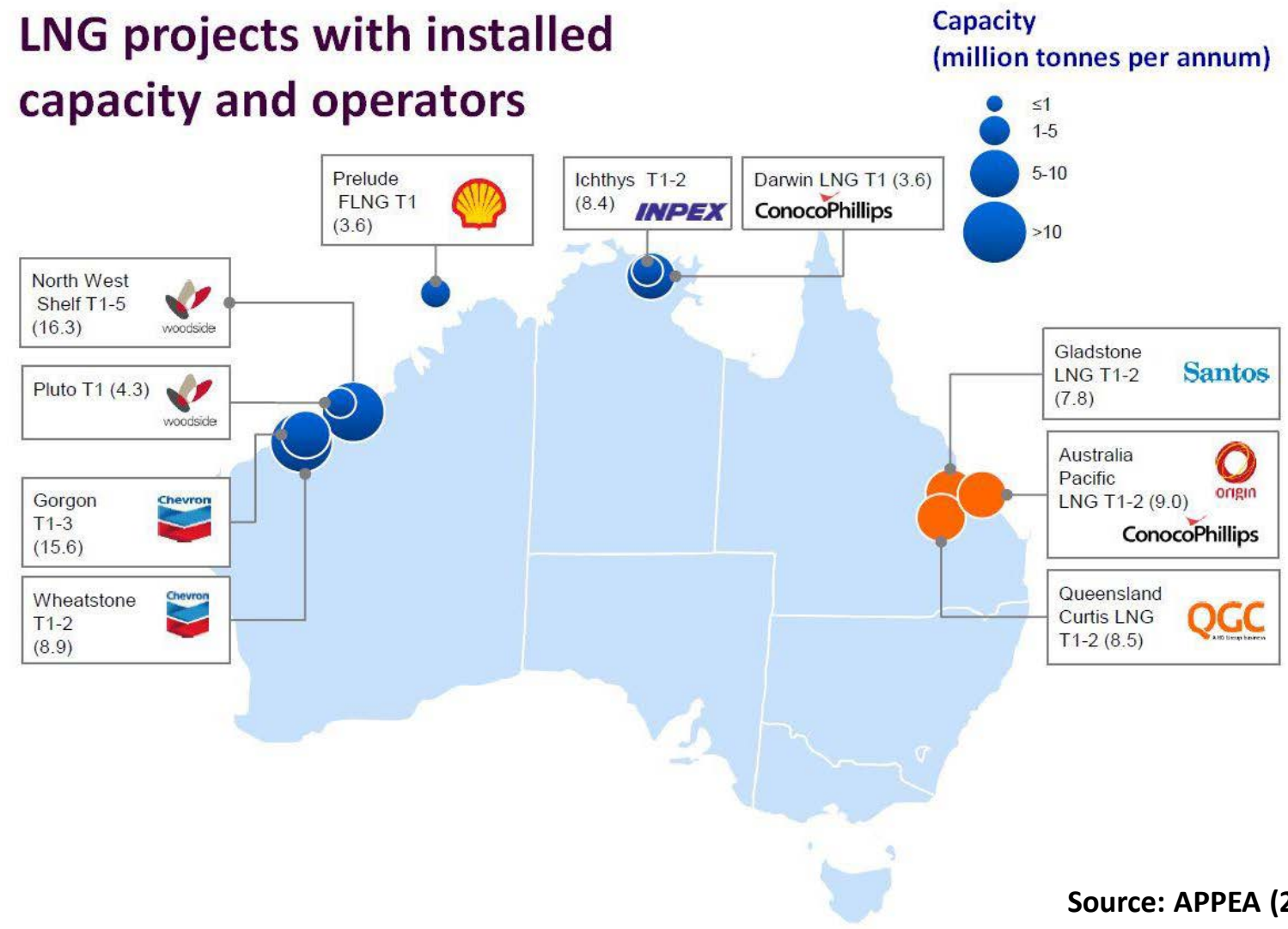


Source: International Gas Union (2016)

Australia: \$200 billion investment in LNG projects

- By end of decade, Australia will export 85 mtpa of LNG, making it world's largest exporter
- Contribute to already existing supply glut
- Proximity to Asia, resulting in lower shipping costs, makes region ideal destination for exports

LNG projects with installed capacity and operators



Source: APPEA (2016)

In low price environment, LNG sellers striving to bring project costs down

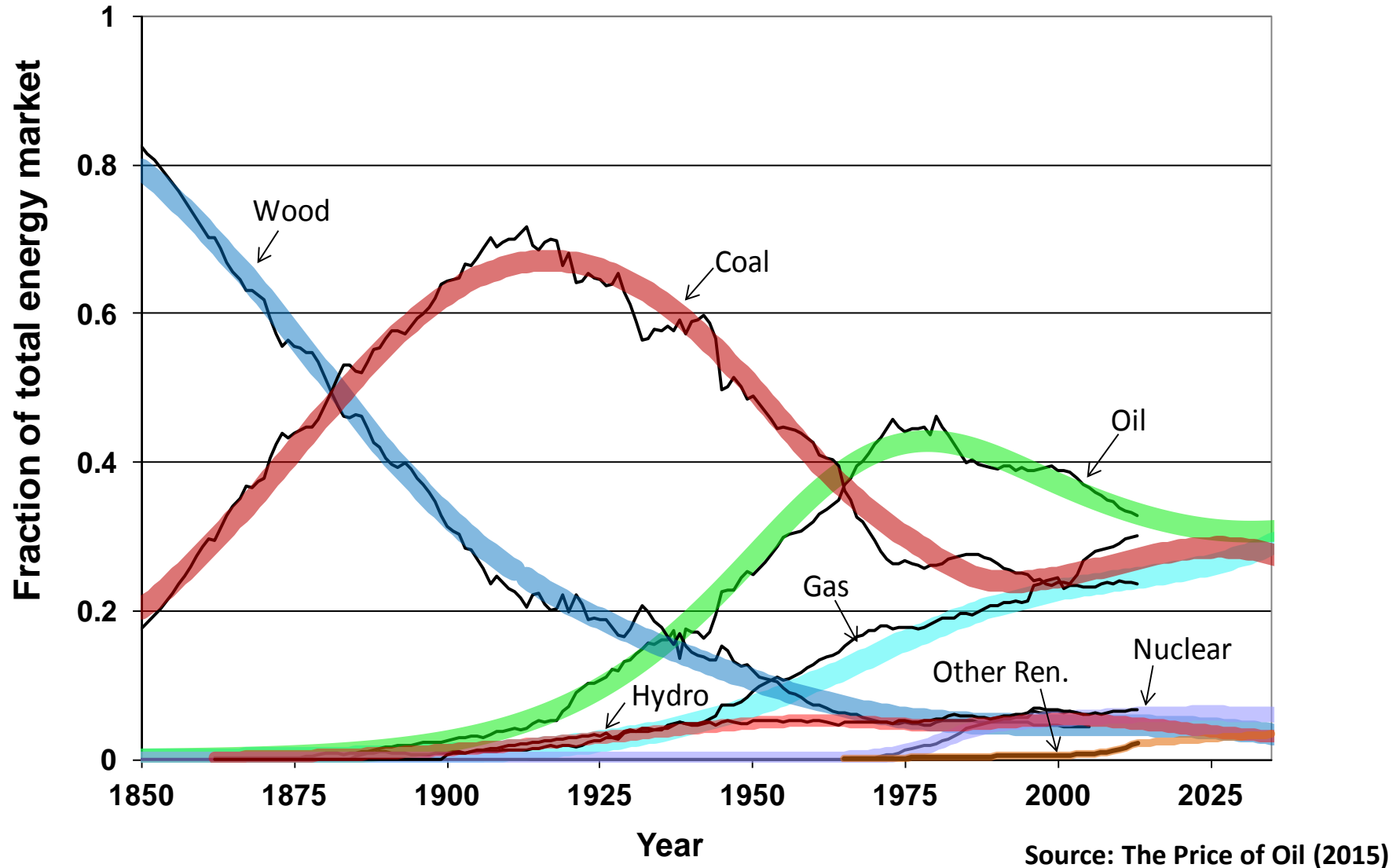
- Improved productivity and operational efficiencies are seen as vital
- Better early-stage planning, standardisation of equipment, simplifying construction, and flexible technologies like FLNG
- On the consumption side, floating import infrastructure enables poorer countries to increase their natural gas consumption



Concluding thoughts

- **Despite low prices and current oversupply, gas/LNG long-term fundamentals remain attractive, especially in Asia**

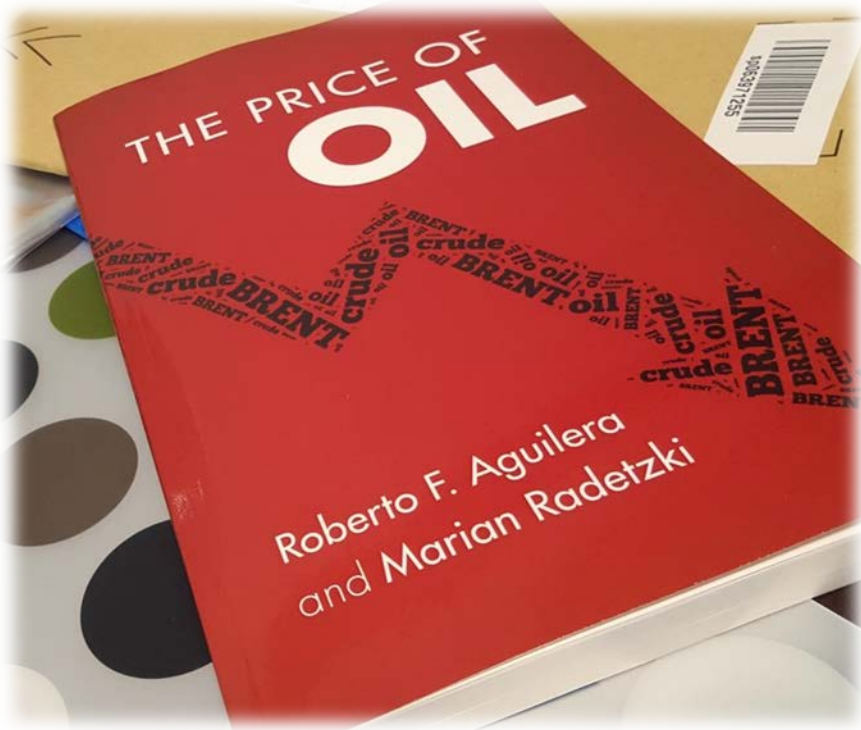
World primary energy mix (1850-2035)



Concluding thoughts

- **Despite low prices and current oversupply, gas/LNG long-term fundamentals remain attractive, especially in Asia**
- **Australia to remain competitive, but cost reduction important**
- **Low oil and gas prices ahead**

The Price of Oil



- Why it rose stupendously over the past 40 years
- Why it is likely to fall substantially in the coming decades
- What it will mean for the world economy, politics and the environment

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THANK YOU

r.aguilera@curtin.edu.au

