

The Next 100 Years of Global Energy: Part VI

The Grand Energy Challenge: Energy Diversity and Economic Realities*

Kenneth B. Medlock III¹

Search and Discovery Article #70273 (2017)**

Posted June 28, 2017

*Adapted from oral presentation given at Forum, “The Next 100 Years of Global Energy Use: Resources, Impacts and Economics,” at AAPG Annual Convention and Exhibition, Houston, Texas, April 4, 2017

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Summary

- Energy markets are always in transition; the challenges evolve.
- Every country is different; one size does not fit all.
- -Legacy assets and infrastructure matter.
- We must be cognizant of scale.
- Most proposed climate mitigation strategies require enormous investments in non-dispatchable resources outside the OECD.
- Non-OECD nations comprise 6.1 billion people compared to 1.3 billion in the OECD. Non-OECD developments will dictate the future of energy.
- Energy poverty is an issue that must be addressed.
- We should expand focus to consider non-CO2 GHGs.
- -i.e.-N₂O is almost 300X more potent than CO₂.
- It is important not to be myopic.
- -We are currently in a market rebalancing. Inventories, the role of OPEC, the emergence of new supplies and supply disruptions dictate the theme.
- Price depends on many factors, but even with constraints, fundamentals win.
- -Cost environment, demand (economic growth, environmental policy, efficiency, etc.), technology, new production frontiers, and geopolitics.
- There are many “frontier” resources, which will have significant bearing on the global market for next 20+ years.
- Renewables will capture market share, but they face challenges.
- Energy efficiency is a virtual source of supply.
- Technology will play a critical role in balancing markets. This is where energy leadership will emerge.

Selected References

Energy Information Administration (USA) (EIA), 2016, International Energy Outlook. Website accessed June 5, 2017, <https://www.eia.gov/outlooks/ieo/>.

International Energy Agency (IEA), 2016, World energy outlook 2016. Website accessed June 5, 2017, <http://www.iea.org/newsroom/news/2016/november/world-energy-outlook-2016.html>.

Macrotrends, 2017, Crude Oil Prices - 70 Year Historical Chart. Website accessed June 5, 2017, <http://www.macrotrends.net/1369/crude-oil-price-history-chart>

The Grand Energy Challenge: Energy Diversity and Economic Realities



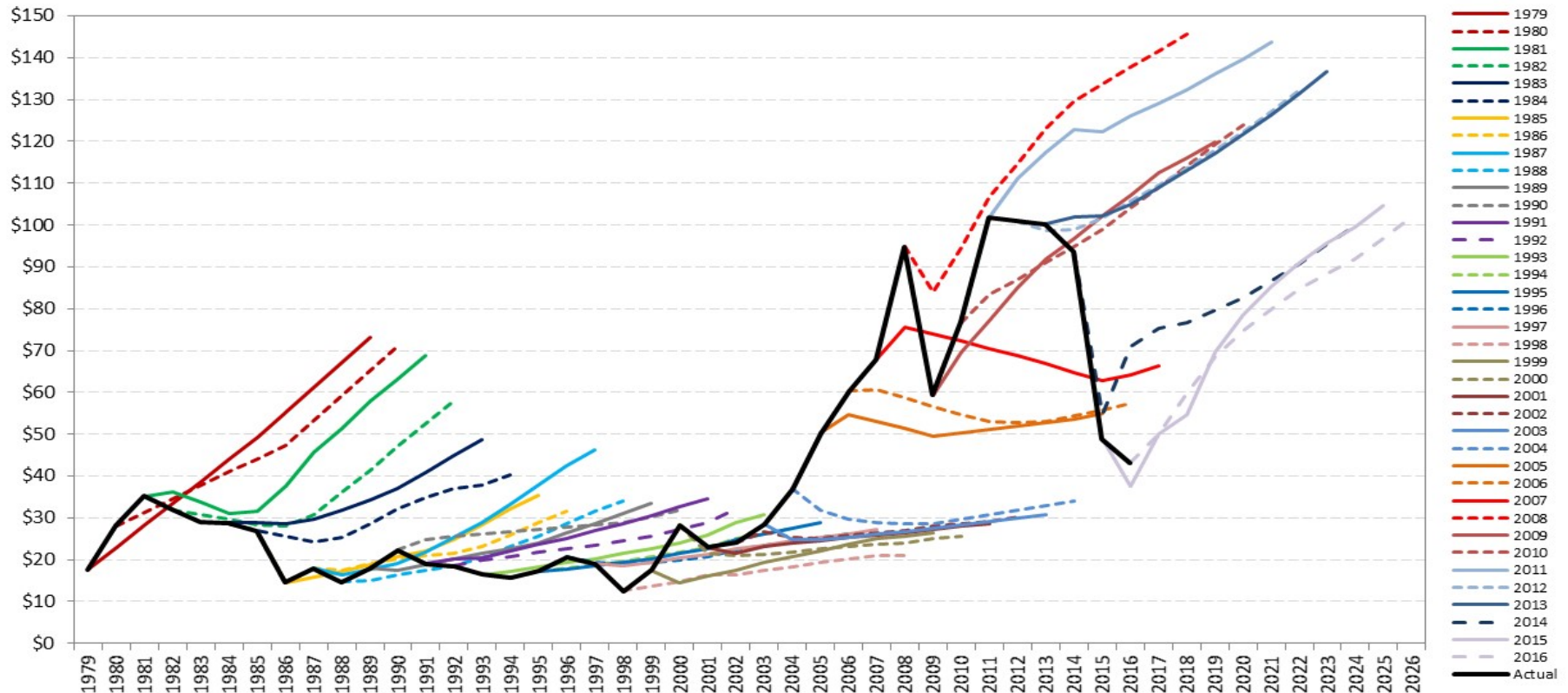
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April 4, 2017

Disclaimer: Forecasting 101 – Precision is Folly!

- Long-term price projections are rarely accurate, and appear adaptive.
- Myopia is a problem: it ignores long run fundamentals.
- “The best cure for high (low) prices is high (low) prices”



What does the future hold?

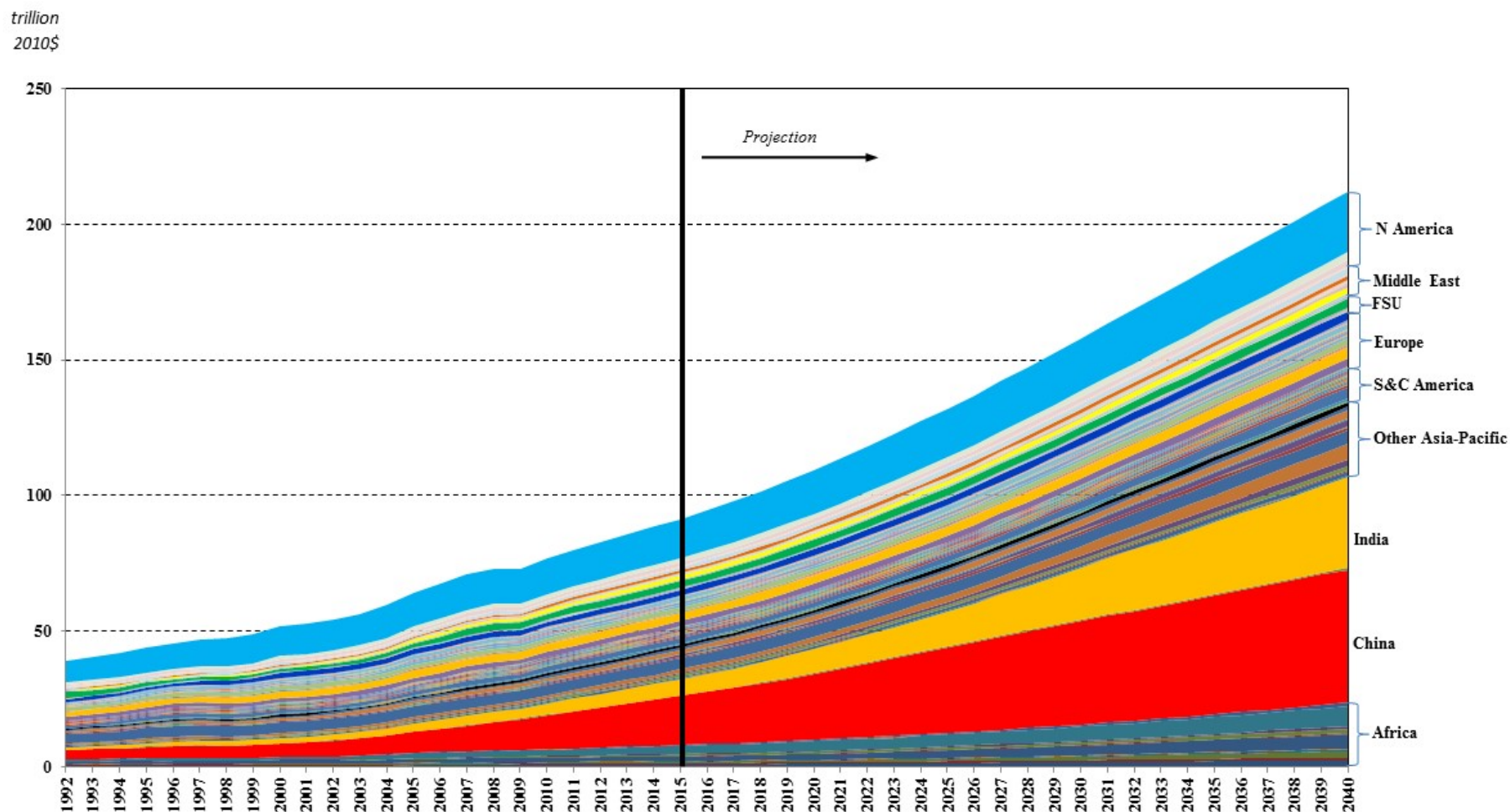
The story is in the picture, but the devil is in the details...



Old Lessons Oft Need Repeating:

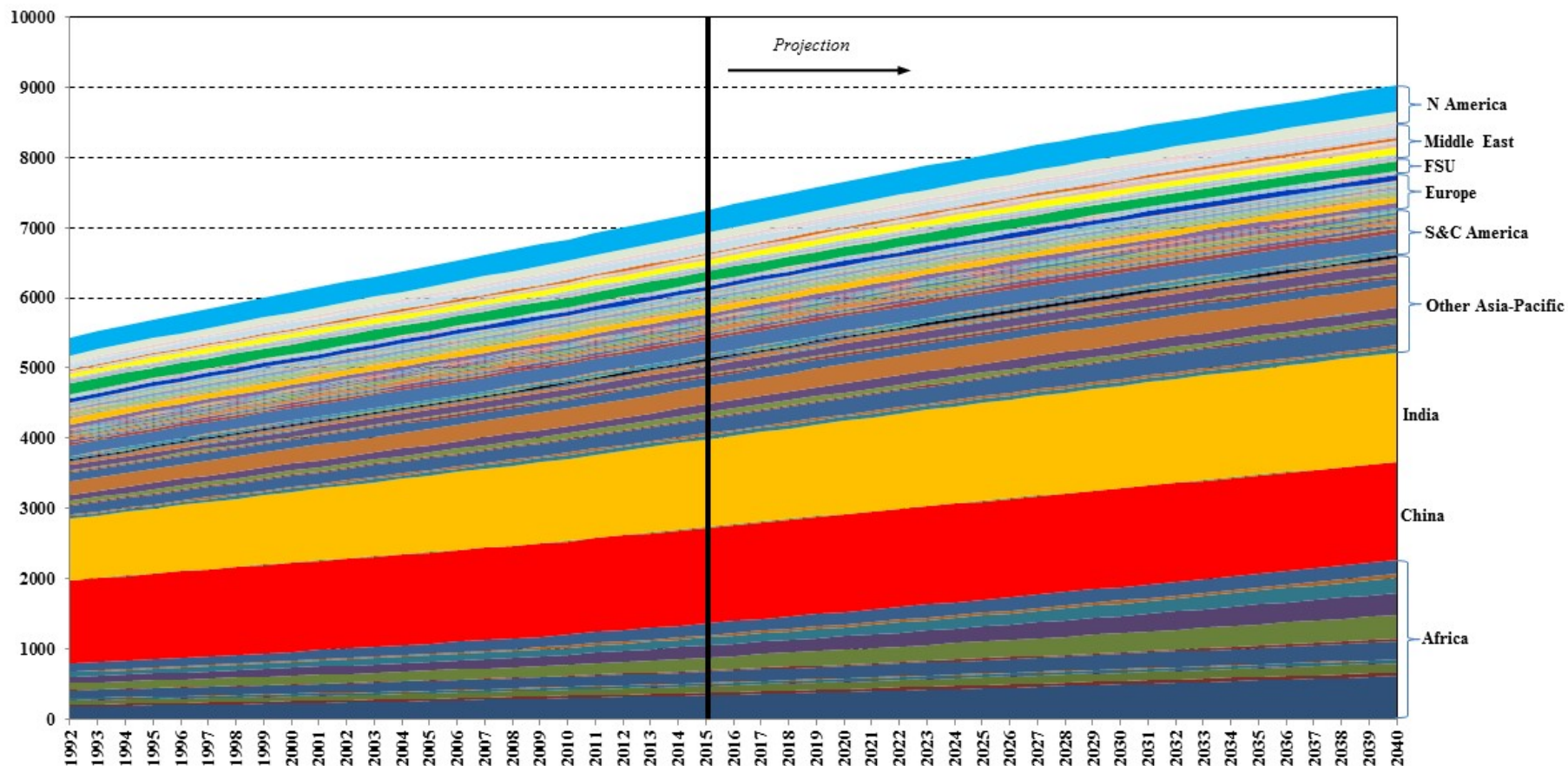
**Economic Growth Drives Energy Demand, but
not all Economic Growth is the Same**

Global GDP by Country



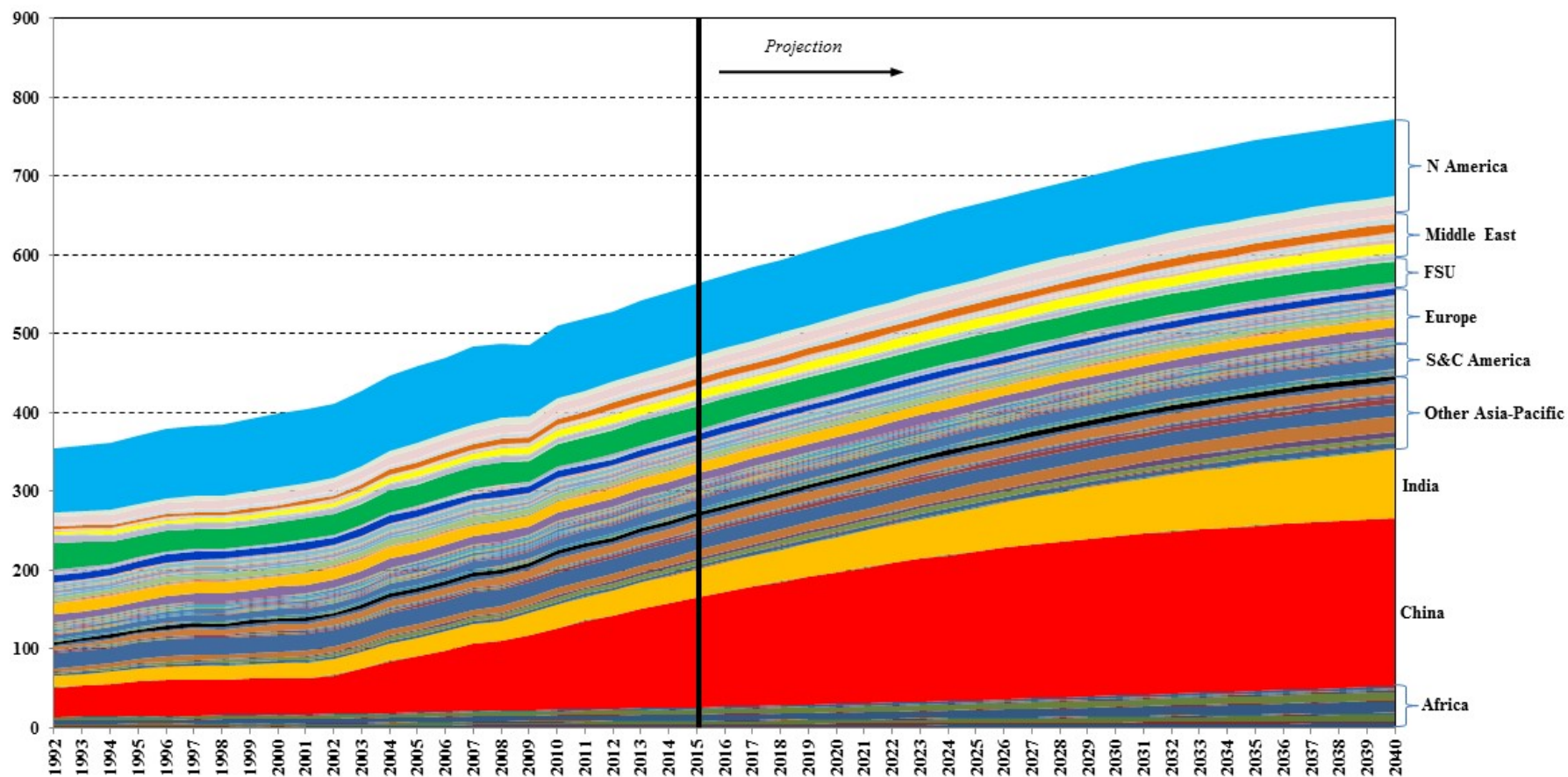
Global Population by Country

millions



Total Primary Energy Requirement by Country

quads

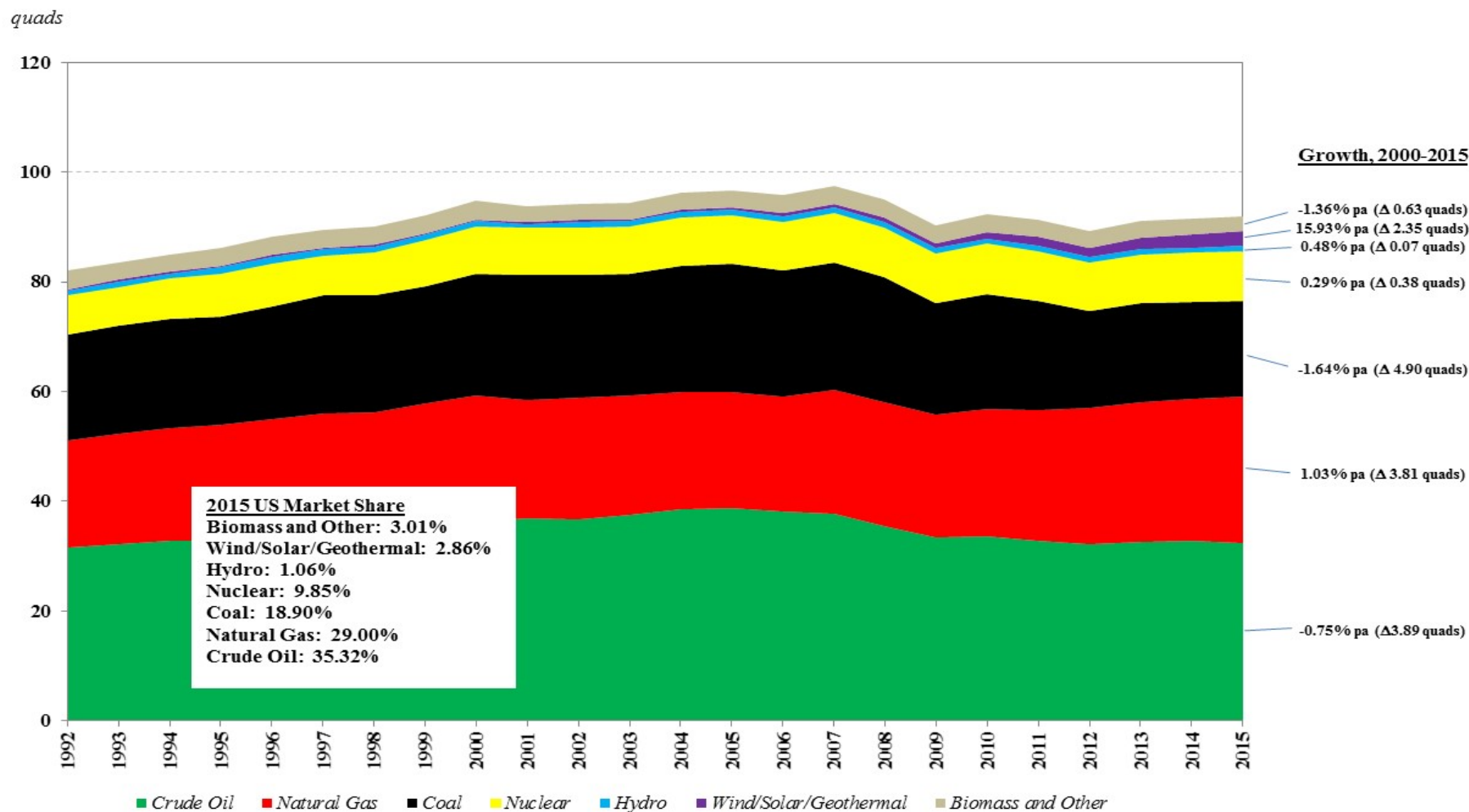


The dichotomy of the developed and developing worlds:

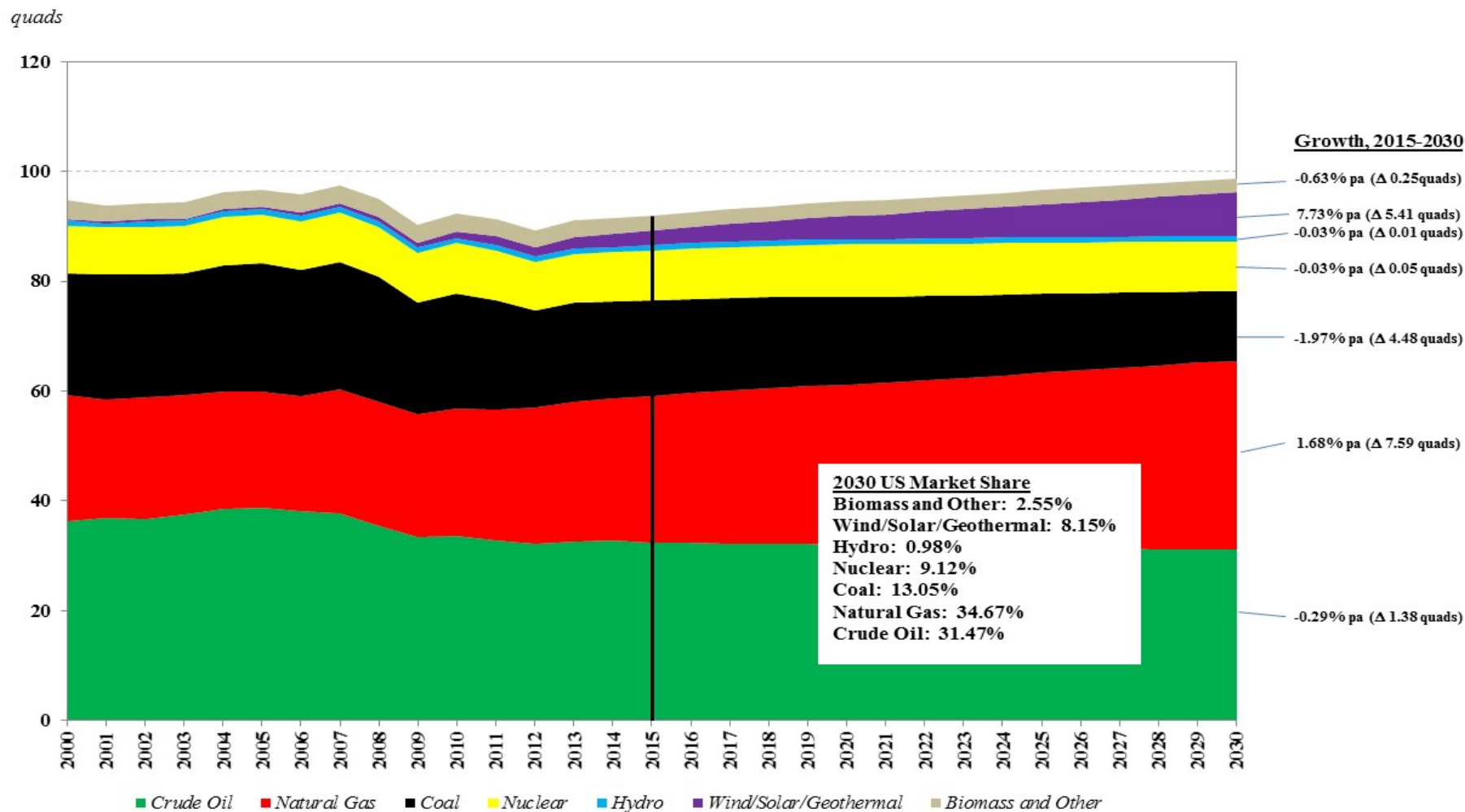
The US energy mix

Perspectives on energy transitions are shaped by regional experience. And, while the US will be an important part of the global energy platform, it will not drive global demands.

US TPER by Source



US “Business as Usual” to 2030

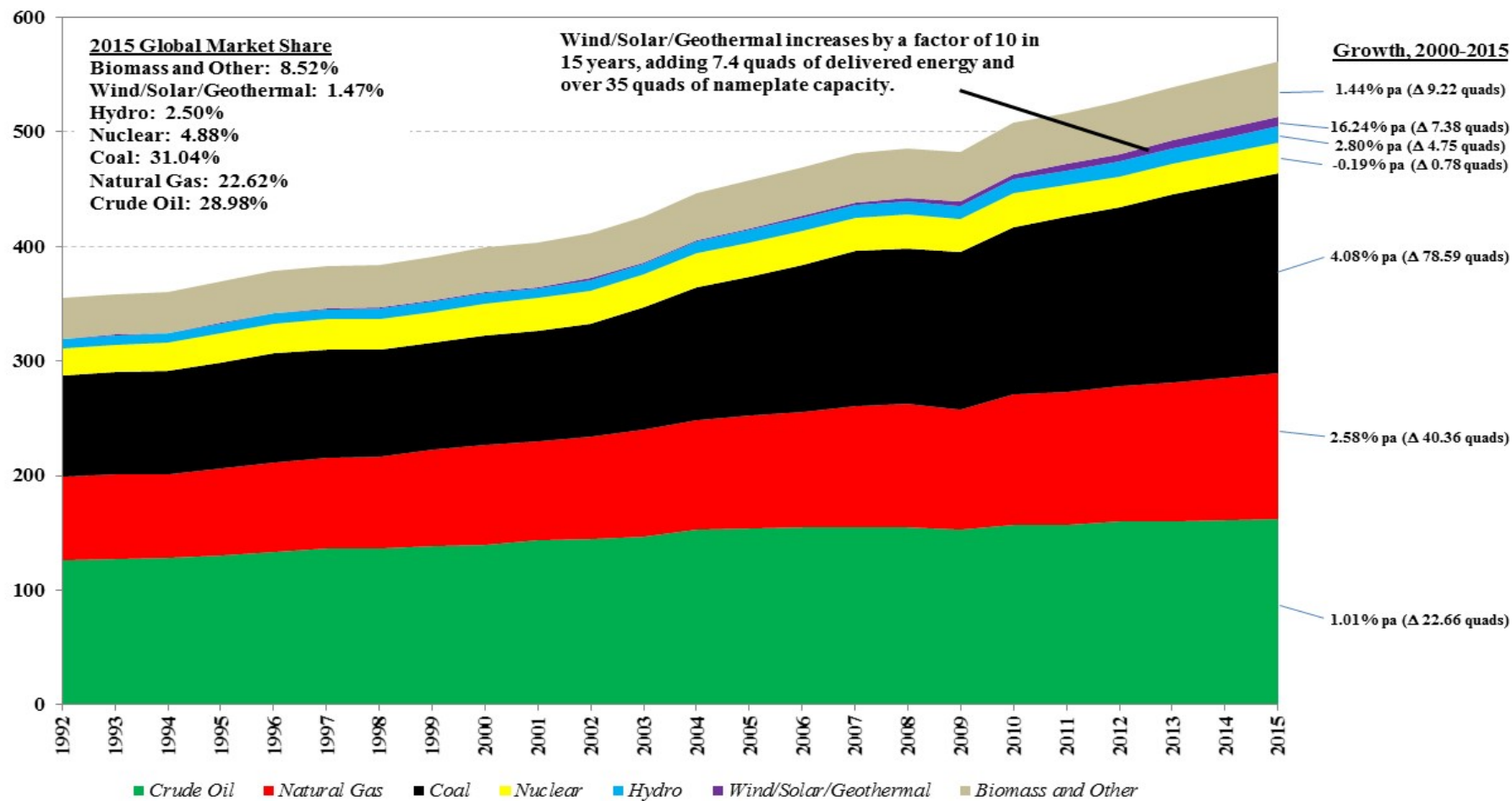


The Global Energy Mix

Charting a new energy future will require unprecedented levels of investment, and it is a global challenge. Countries must figure out the most impactful measure of capital investment given desired goals, and “scale” is paramount. Moreover, global goals will require significant capital investment in the developing world.

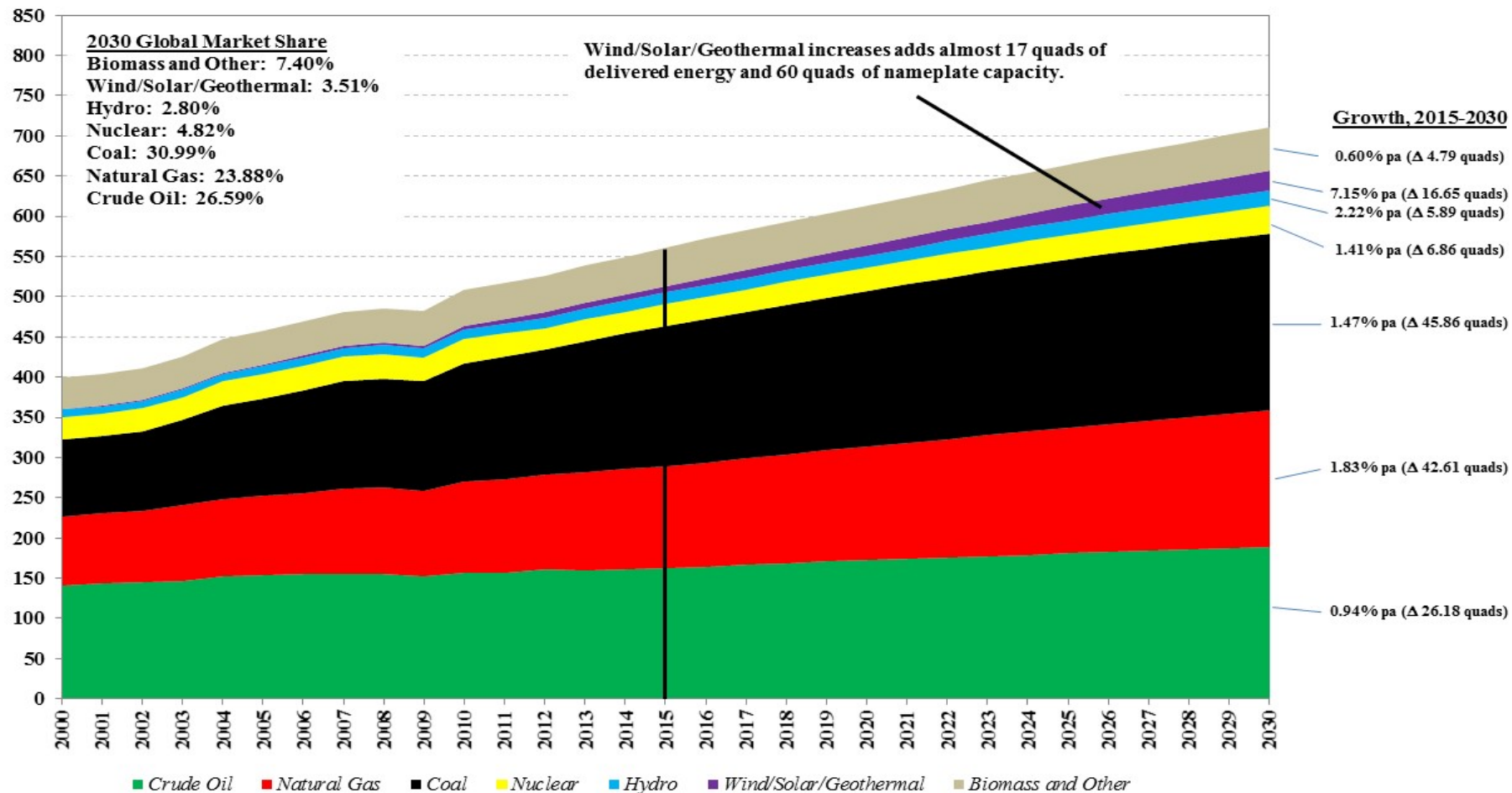
Global TPER by Source

quads



Global “Business as Usual” to 2030

quads



Closing Remarks

- Energy markets are always in transition; the challenges evolve.
- Every country is different; one size does not fit all.
 - Legacy assets and infrastructure matter.
- We must be cognizant of scale.
- Most proposed climate mitigation strategies require enormous investments in non-dispatchable resources outside the OECD.
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Closing Remarks (cont.)

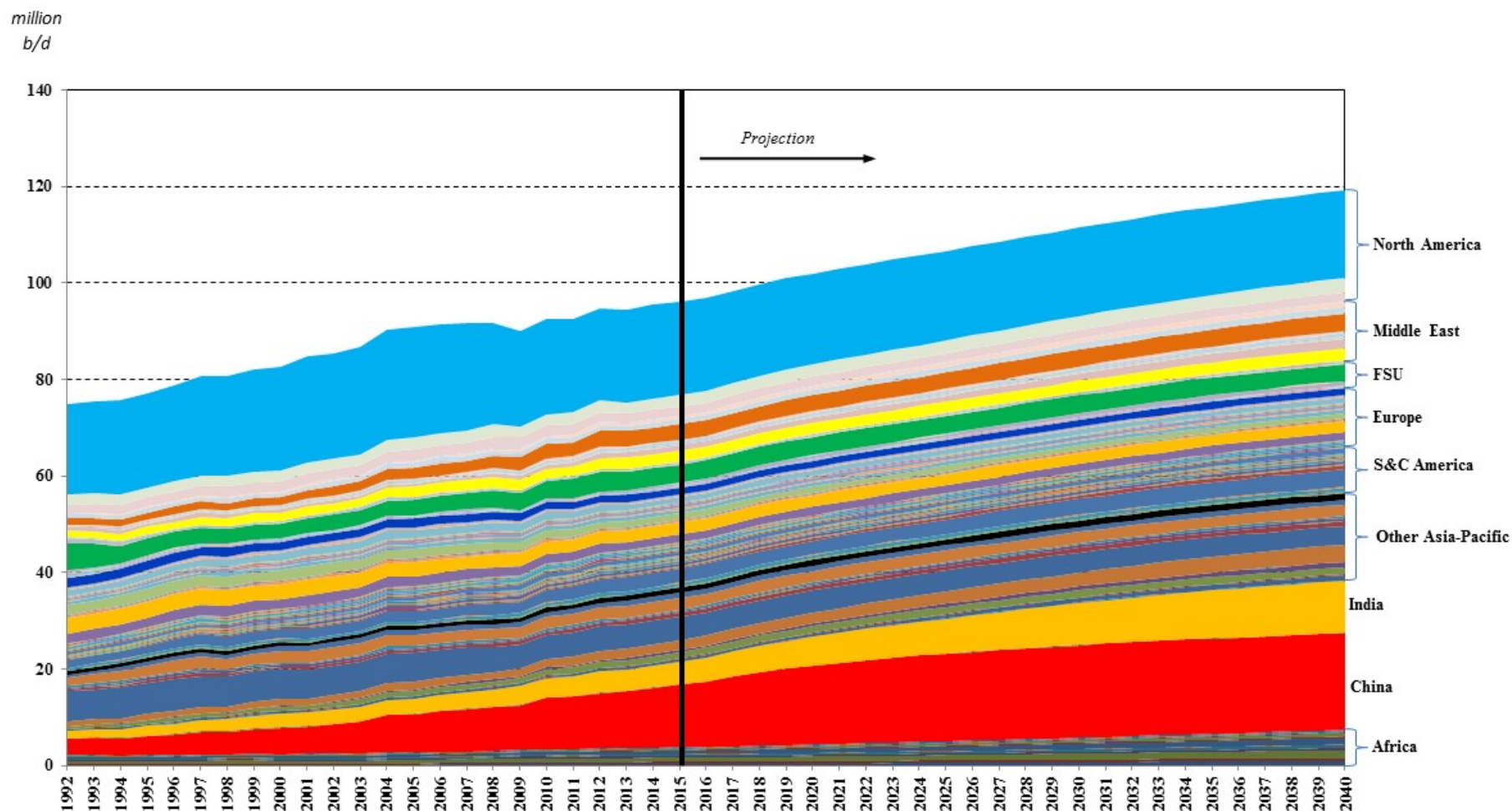
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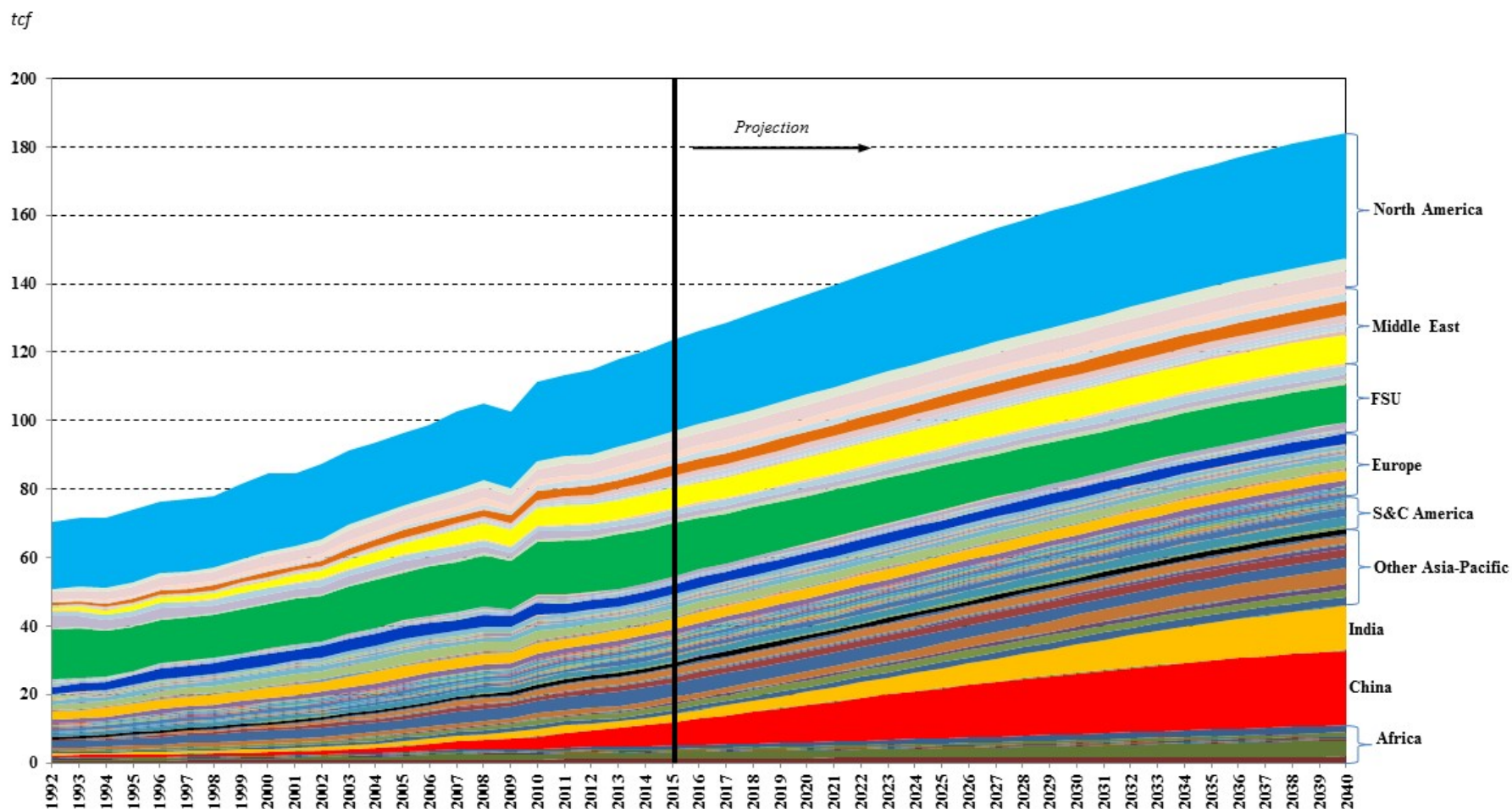
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Additional Material

Oil Demand by Country

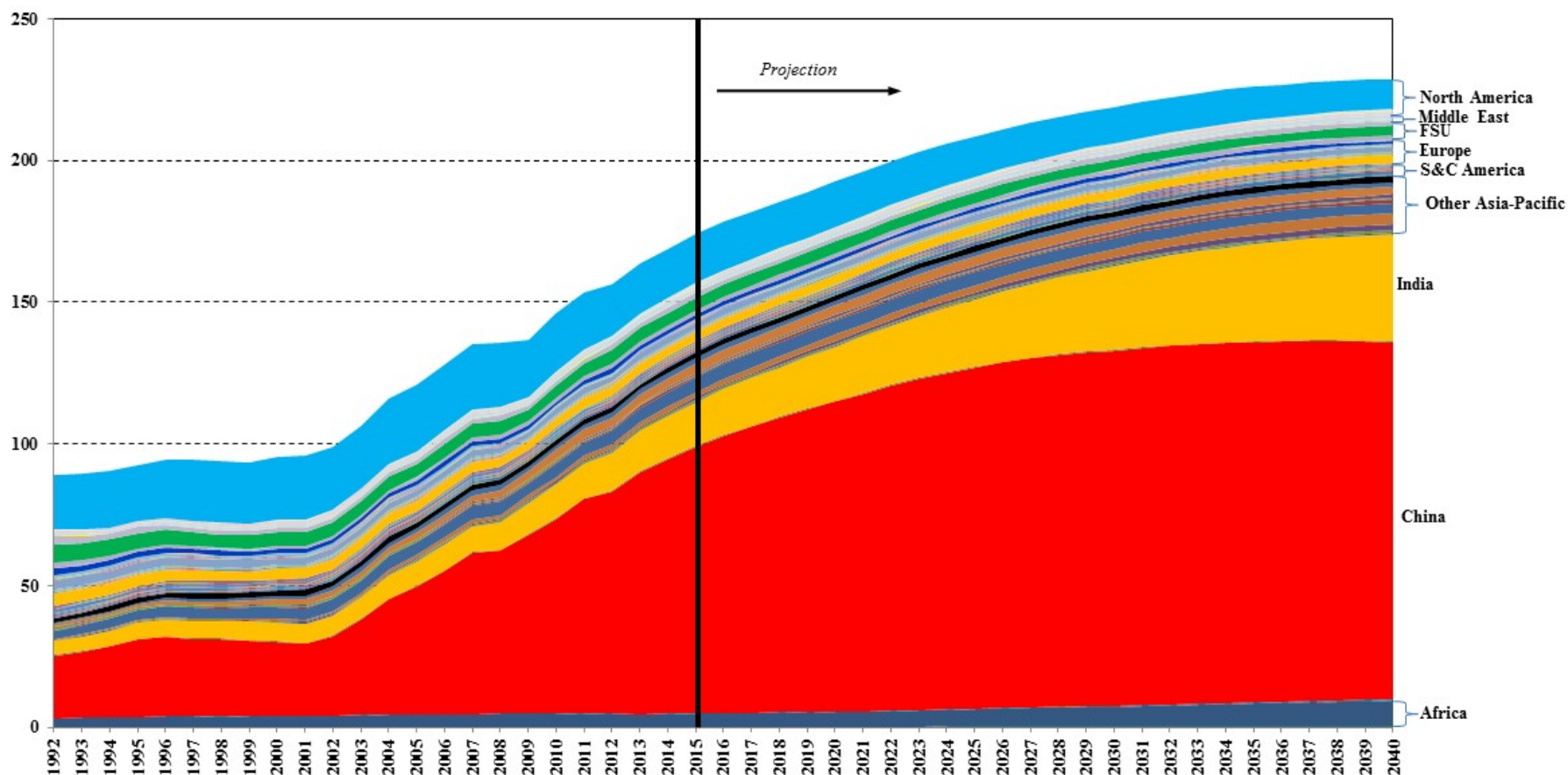


Natural Gas Demand by Country



Coal Demand by Country

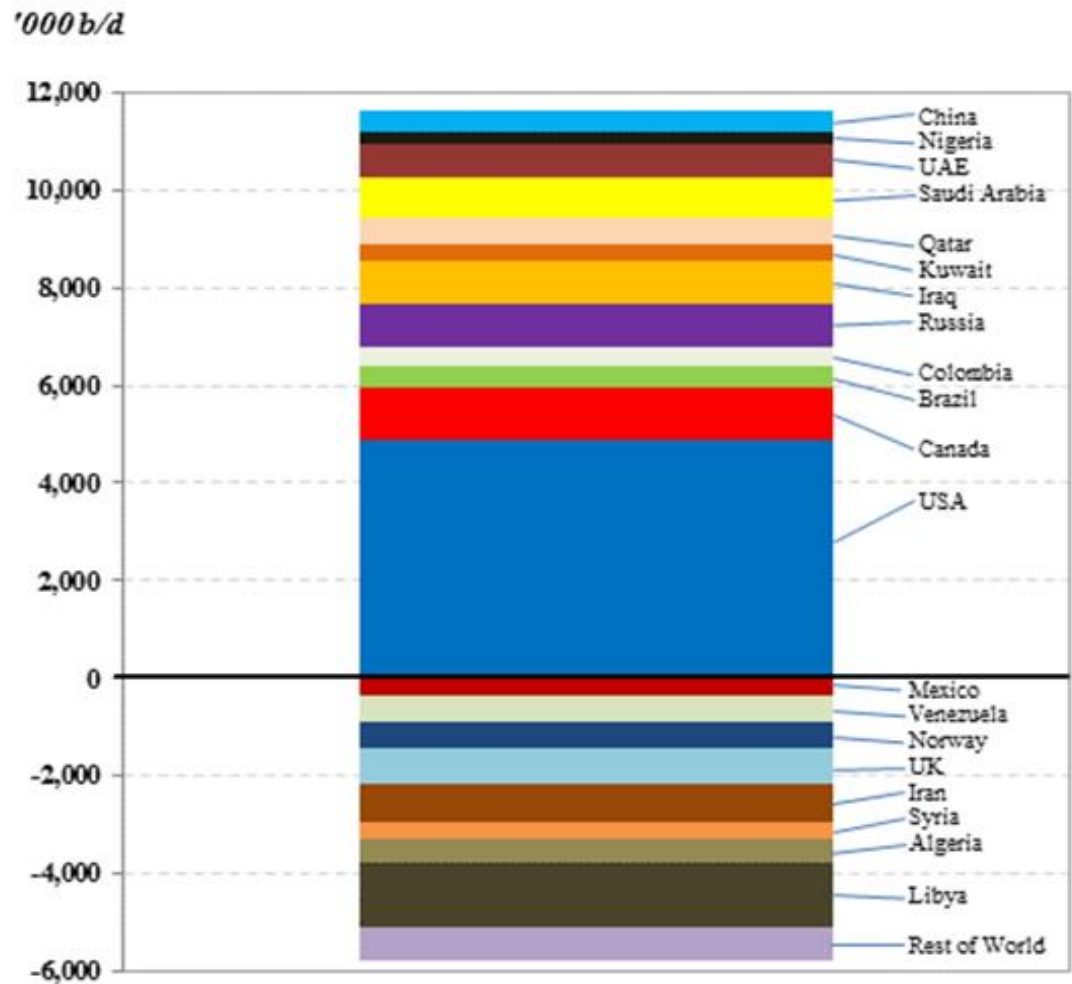
quads



2008-2015:
The Crude Oil Market as a Microcosm
Long-Term or Short-Term Developments?

Changes in Global Oil Supply, 2008-2015

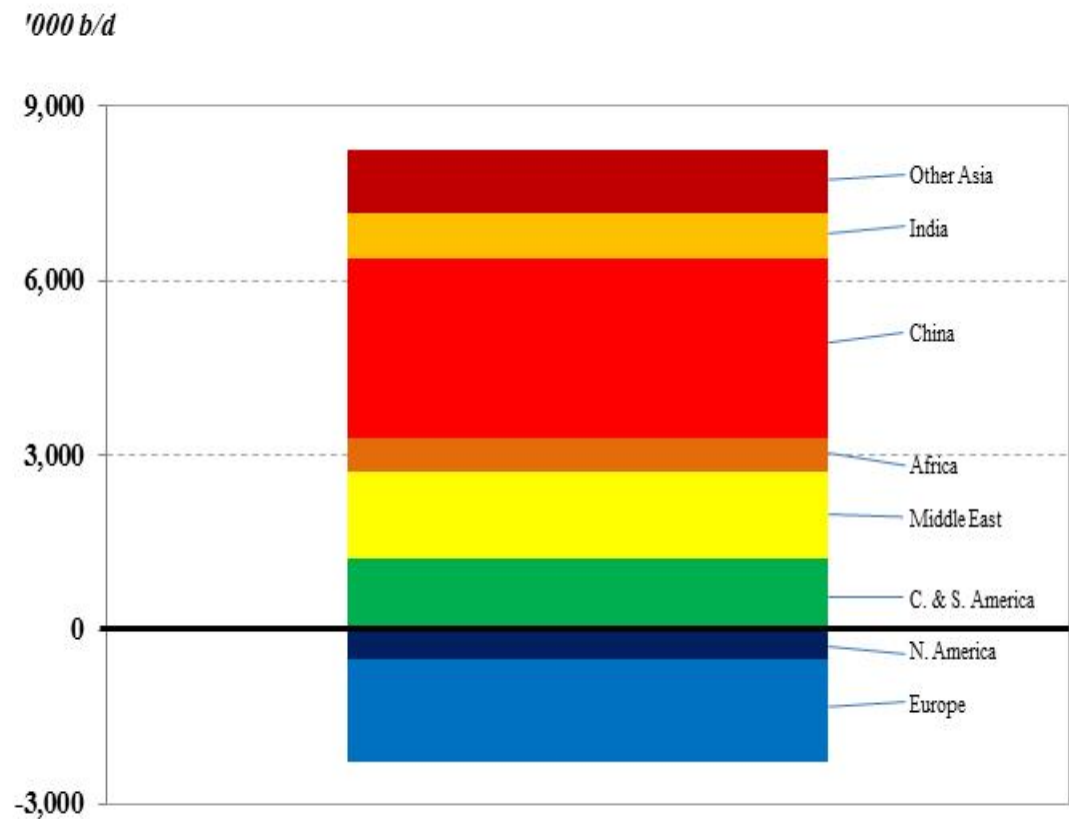
- Production declines have been largely in regions with civil strife, sanctions, or sector mismanagement. Less than a third of decline is due to geologic factors.
- Growth in the US offset the declines due to above-ground factors, and high prices encouraged a positive supply response from other regions.
- Production remained robust into 2015, exacerbated by efforts for market share by OPEC. Near-term market balance hinges largely on global demand.



Source: BP

Changes in Global Oil Demand, 2008-2015

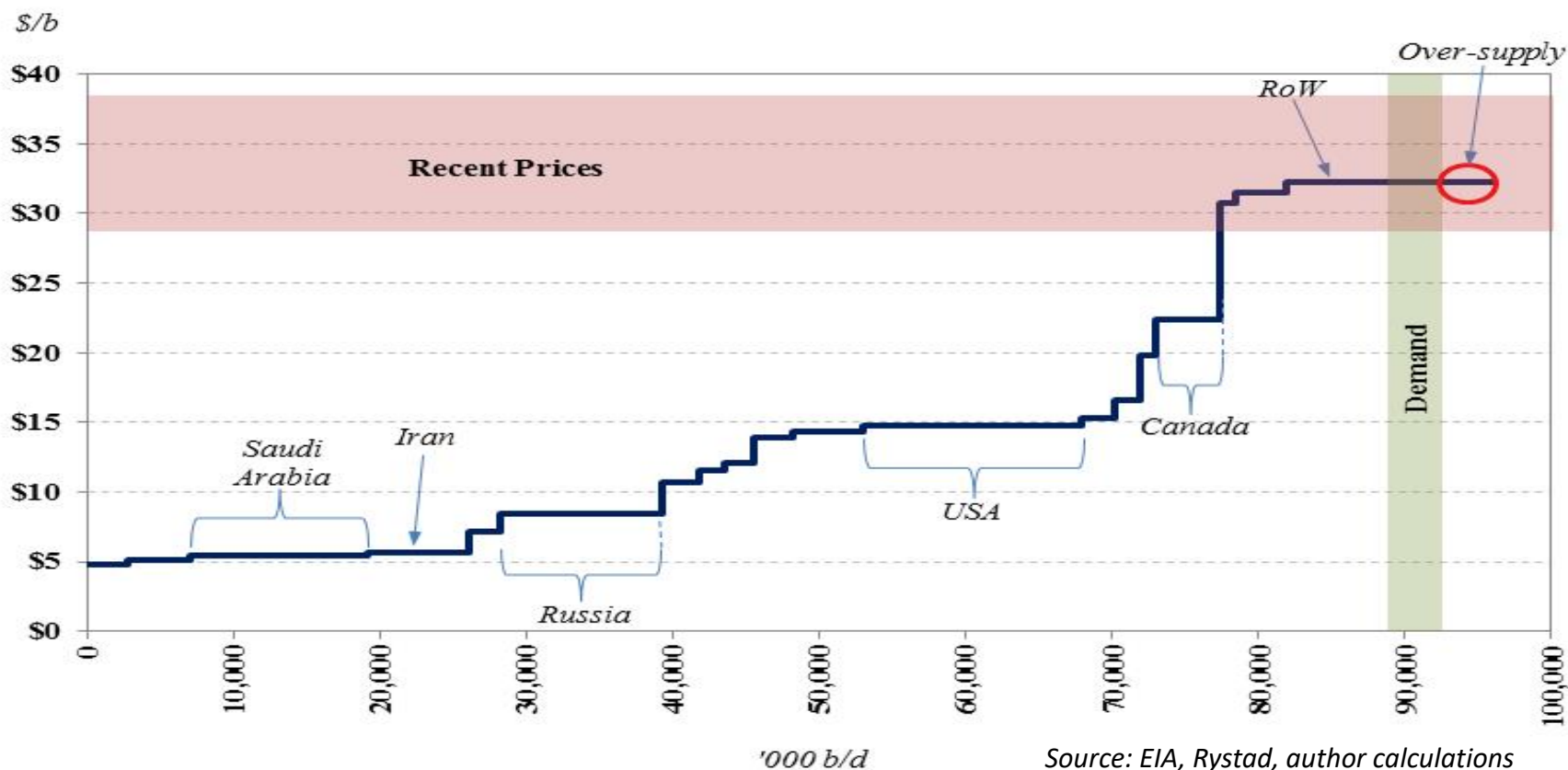
- Demand declined in the developed economies of the OECD, while it grew in developing economies in South America, the Middle East, and especially Asia.
- In fact, Asian demand growth accounted for over 80% of the increase in global demand, with China comprising just over three-fifths of that increase.
- However, signs of global demand weakness emerged over the last couple of years, setting the stage for a price adjustment.



Source: BP

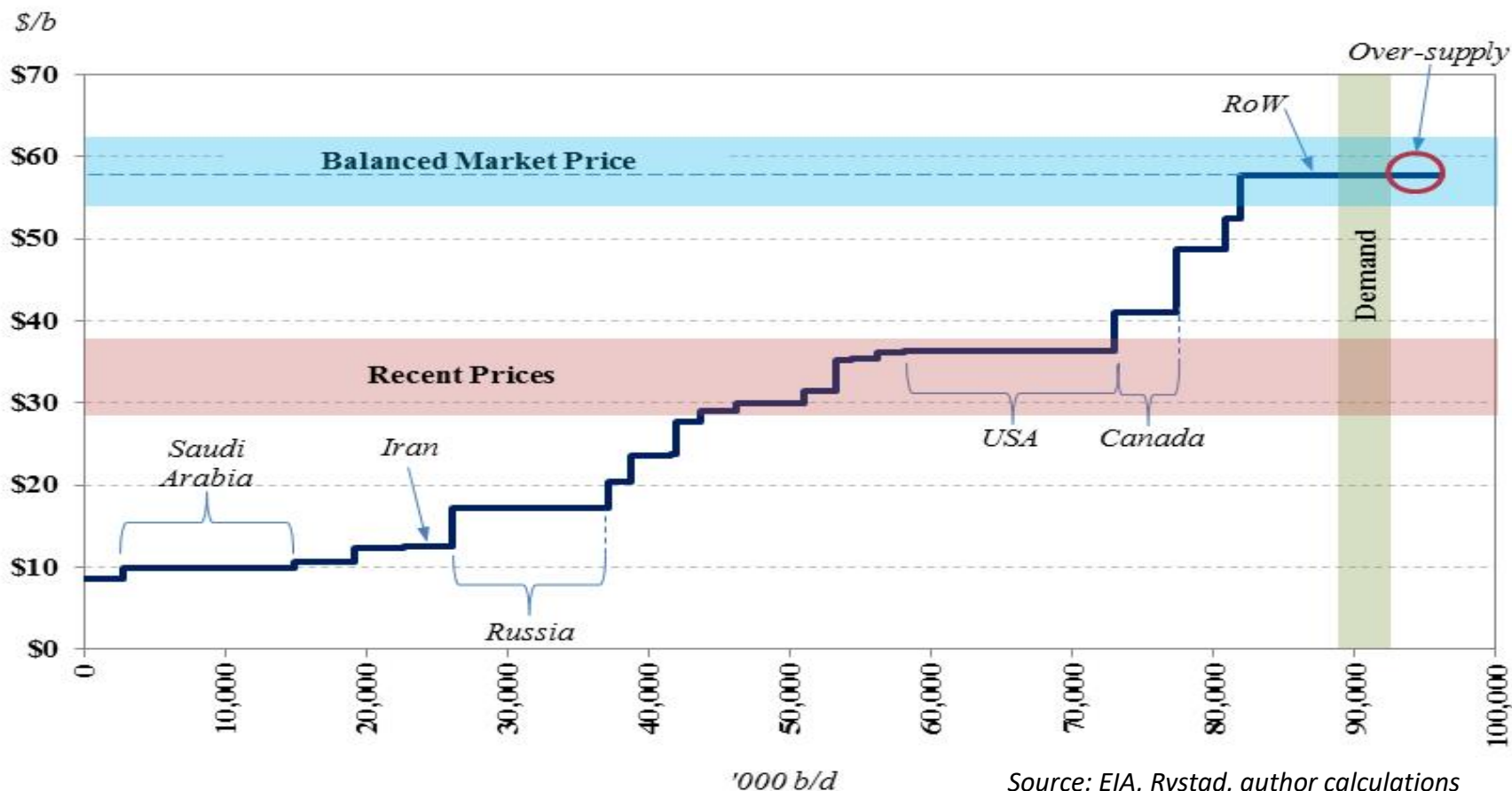
Near Term Price

- Unexpected demand lulls result in inventory builds and price collapse. Previously expended capital continues to operate as long as variable costs are covered. But, low price will not incentivize new investment until output decline and demand recovery eliminate the inventory overhang.



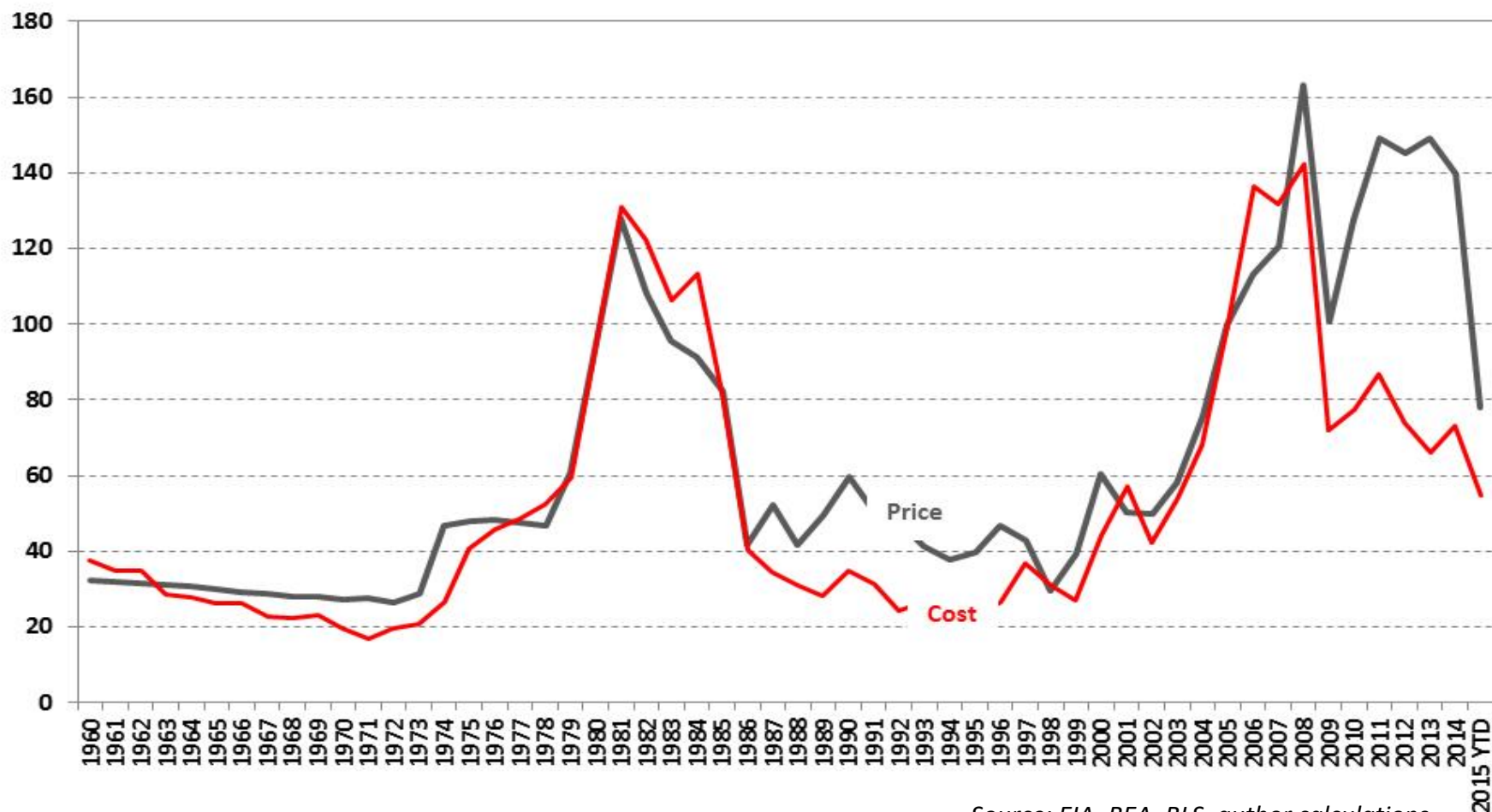
Long Term Price and New Investment

- Price must recover to incentivize new investment. But, to what level?
- Cost is dynamic; so understanding the drivers of cost is critical. The graph below is a snapshot... in reality costs change with fundamental drivers.



Oil Price versus Cost (Real, \$/b vs \$/b)

Index,
2005=100



Source: EIA, BEA, BLS, author calculations

Dynamic Costs over the Long Run

- Supply-demand imbalances trigger price and investment cycles.
- Predicting price is inexact, but understanding the factors involved provides insight and opportunity. The long run is dynamic!

