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STRATEGIC ANALYSIS  
SECURING FOOD AND ENERGY

# The impact of Phosphates on the global trade in food and energy

Babak Madadi  
CEO CGSA

Energy Institute and British Institute of Energy Economics  
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# 1. Background

Public discussion of some aspects covered in  
CGSA Research

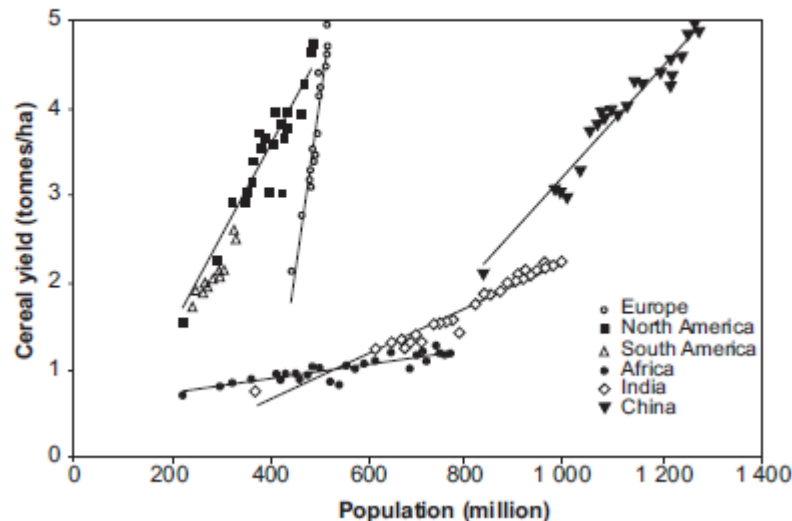
The triangular trade in Food, Fertilizer and Fuel  
The future fate of humanity

## 2. Why we need phosphates

"Humans need 1.0–1.5 g of phosphate per day" – UN FAO [1]

"About 15 kg of N, 5–6 kg of P<sub>2</sub>O<sub>5</sub> and 5–6 kg of K<sub>2</sub>O are exported from the farm with every tonne of cereal." [2]

Relationship between human population and average cereal yields in six regions



Source: FAO [5]



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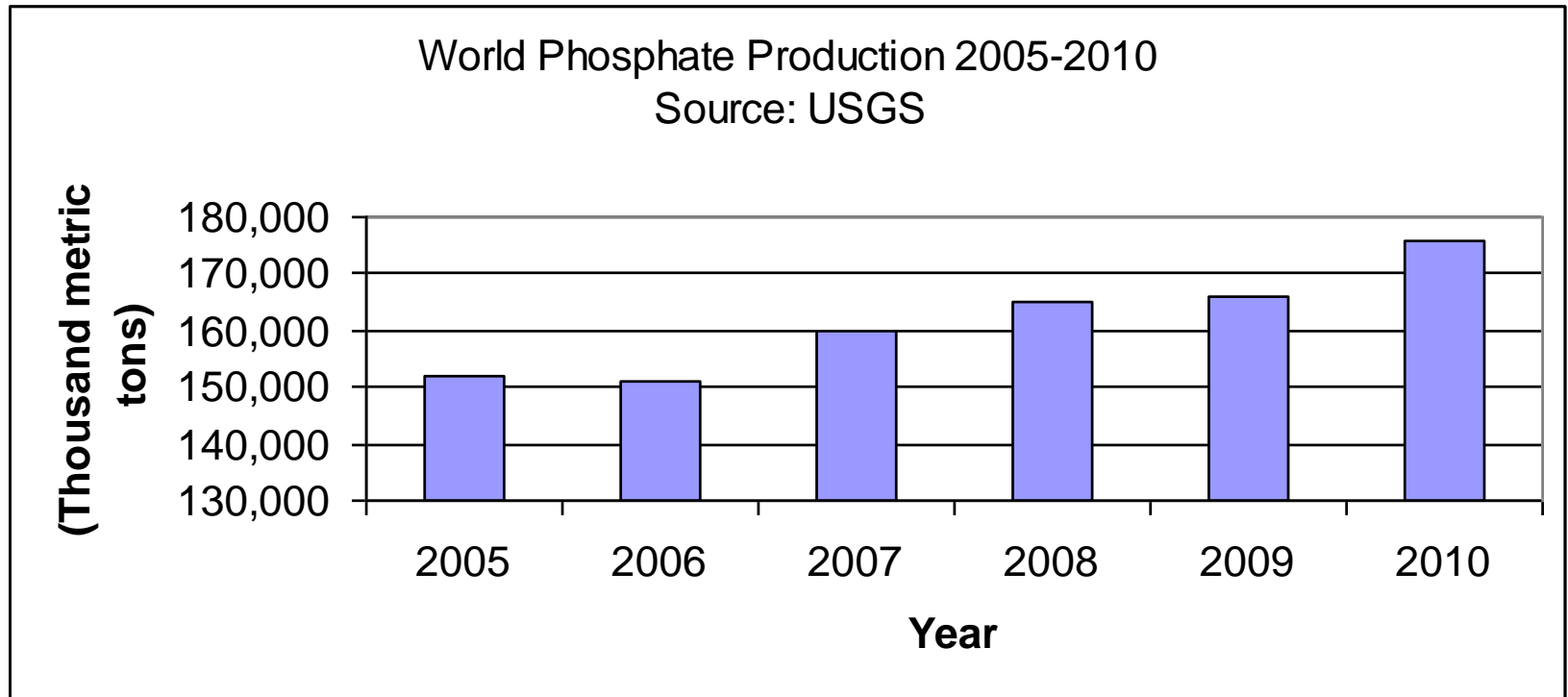
### 3. What role does phosphate play in bio-fuel production?

"Movement of nutrients within the plant depends largely upon transport through cell membranes, which requires energy to oppose the forces of osmosis. Here again, ATP and other high energy P compounds provide the needed energy." [3]

"Phosphorus is essential to all known life forms. It is the second most abundant mineral in the human body, surpassed only by calcium. It makes about 1% of today body weight and is largely confined to the skeleton in addition to an important part of the active structure of the muscles, central nervous systems and the energy circuits." [4]

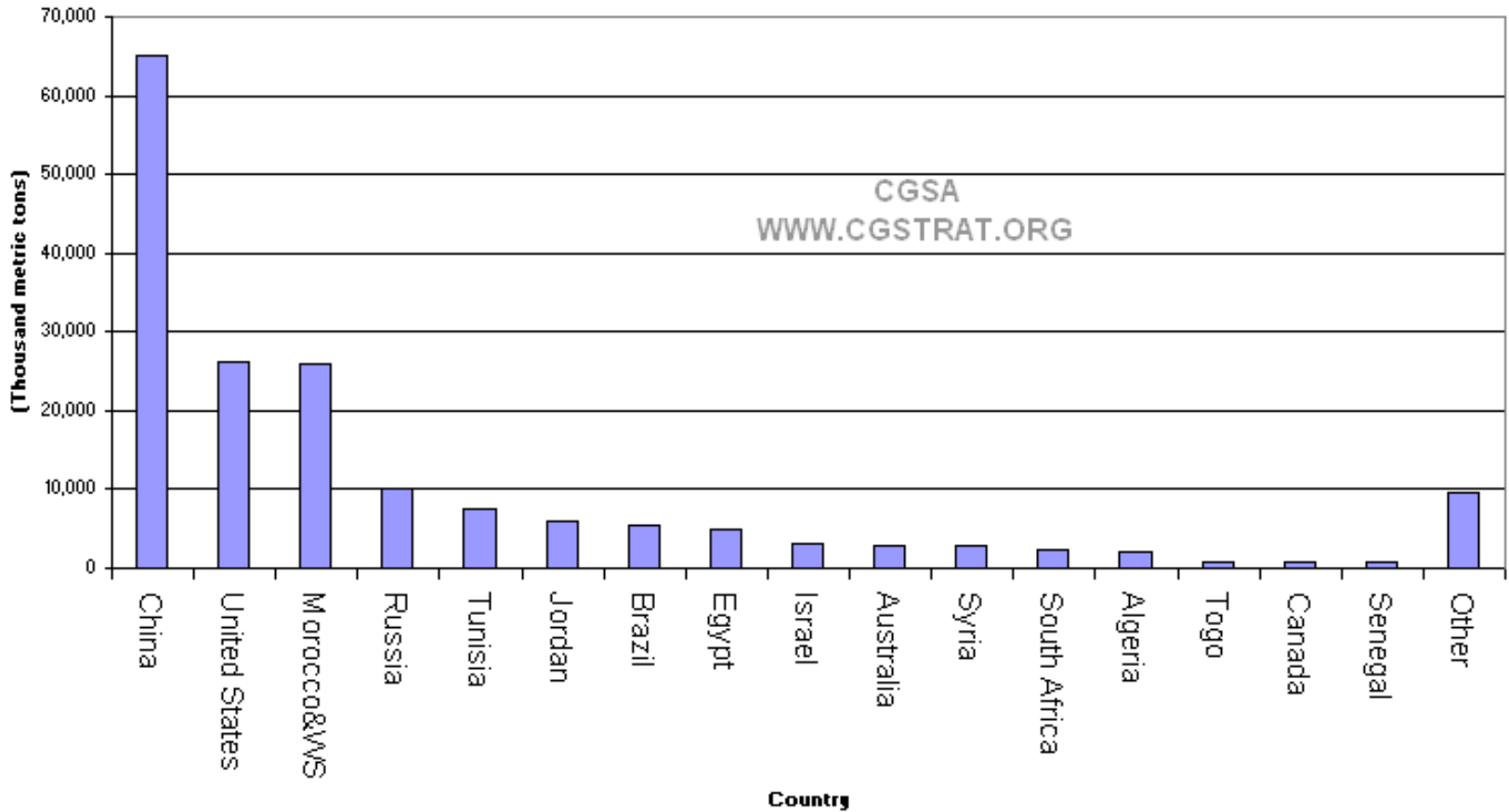
"All phosphate has to be imported into the UK and phosphate supplies are dwindling worldwide. There is growing concern about the long-term availability of this essential nutrient both for fertilisers and livestock feed." [5]

## 4. How much phosphate is produced annually?



# 5. Where is phosphate produced?

Rock Phosphate production 2010  
Source: USGS



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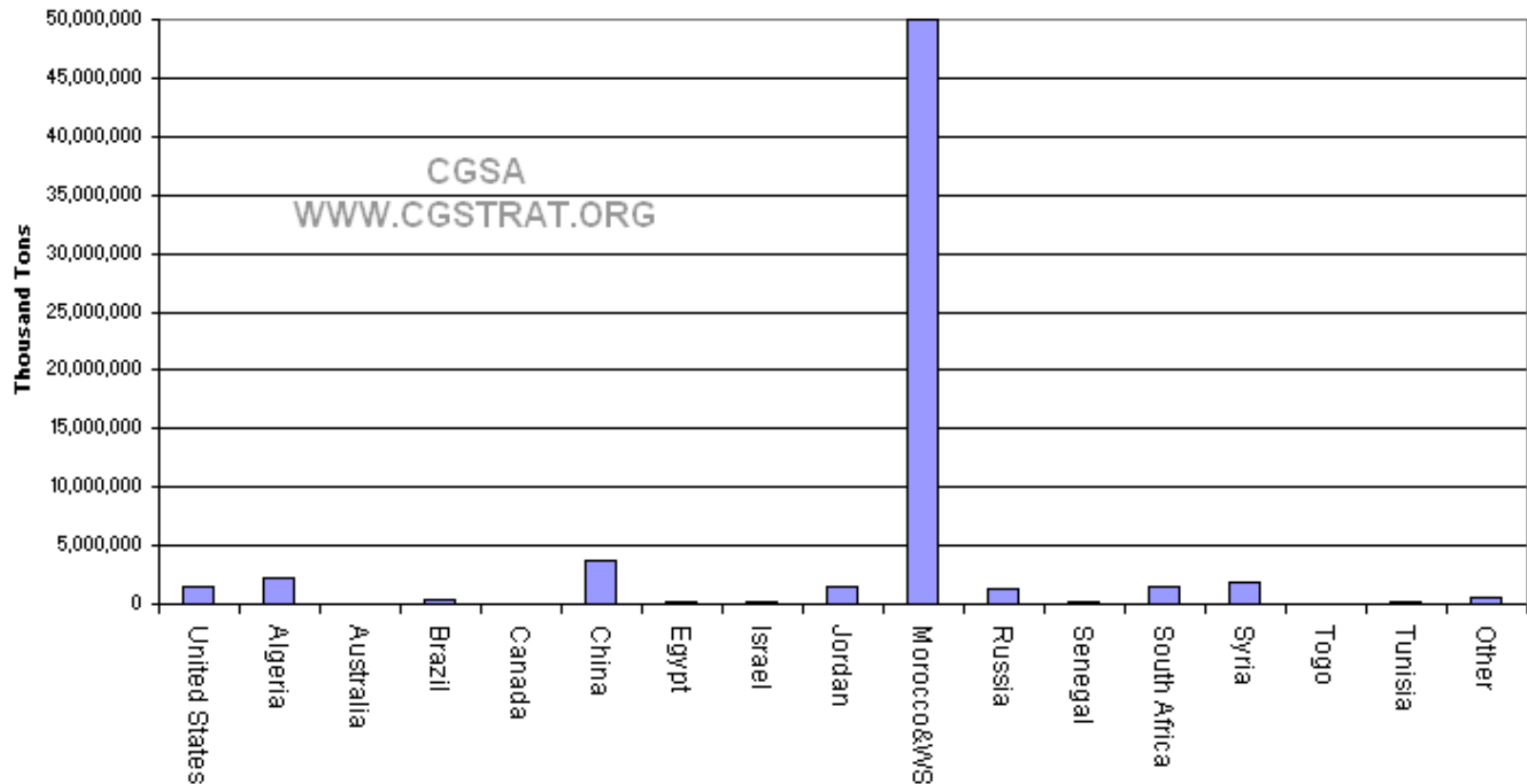




# 6. Where are the Phosphate Reserves?

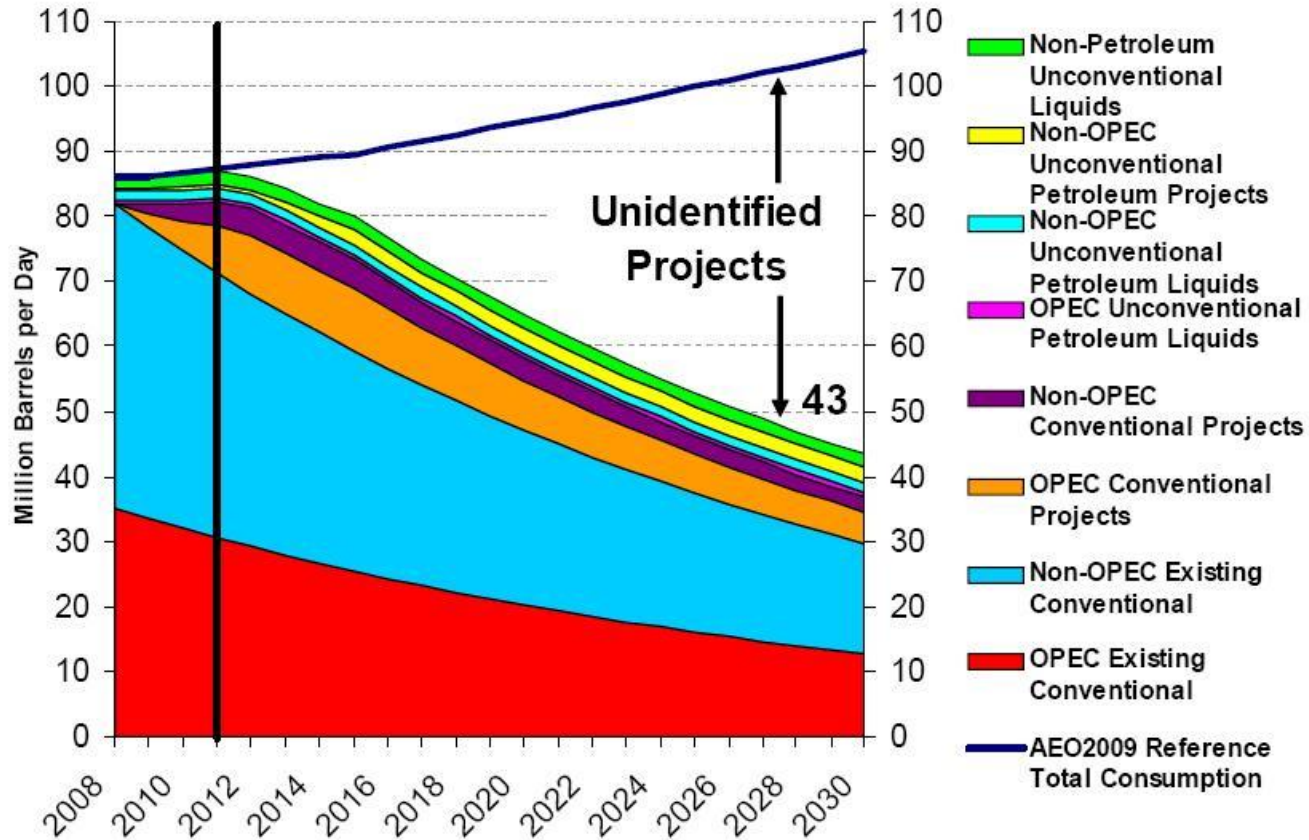
Global Phosphate Reserves

Source: USGS



# 7. Peak oil

## World's Liquid Fuels Supply



Source: EIA, AEO2009

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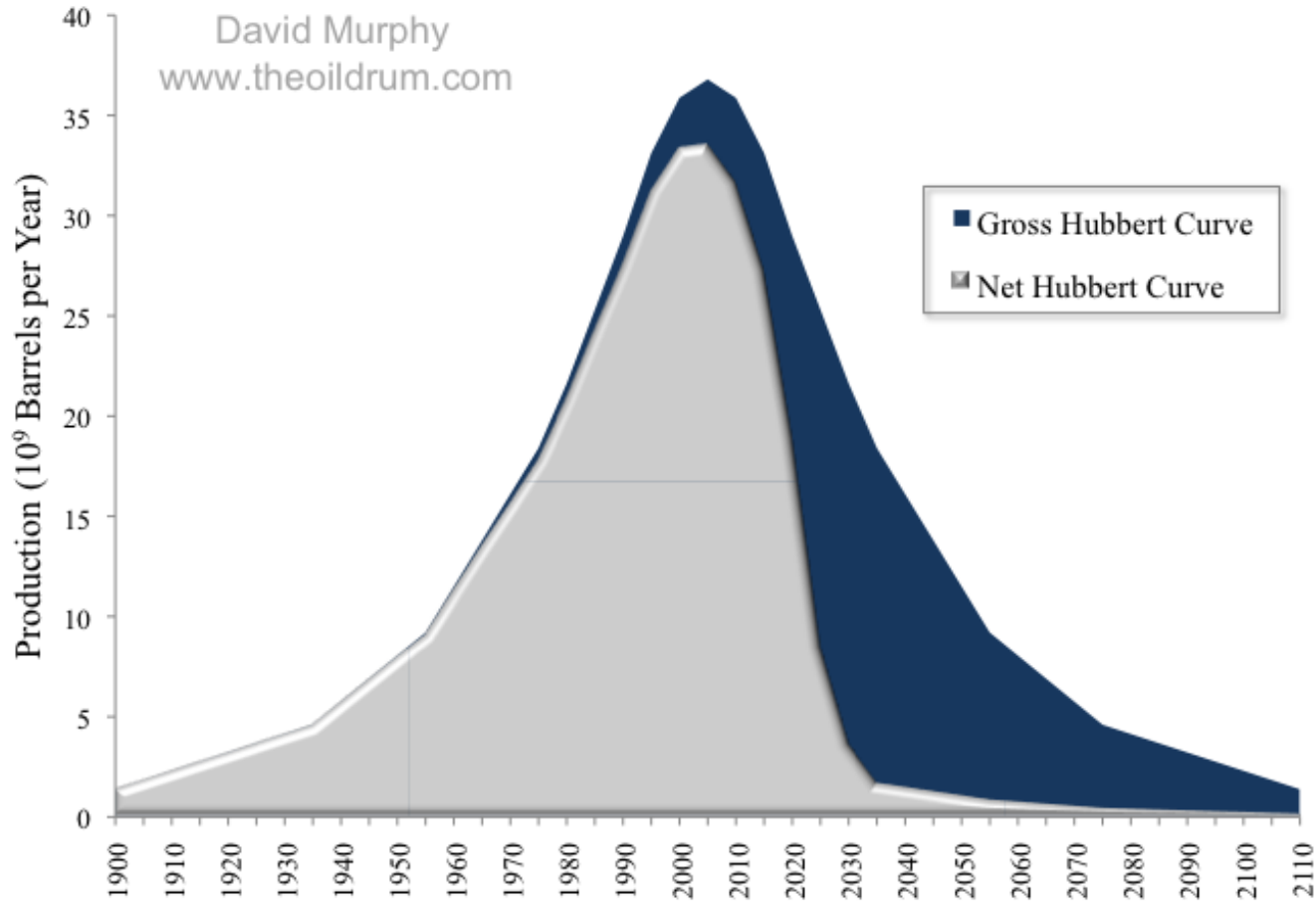


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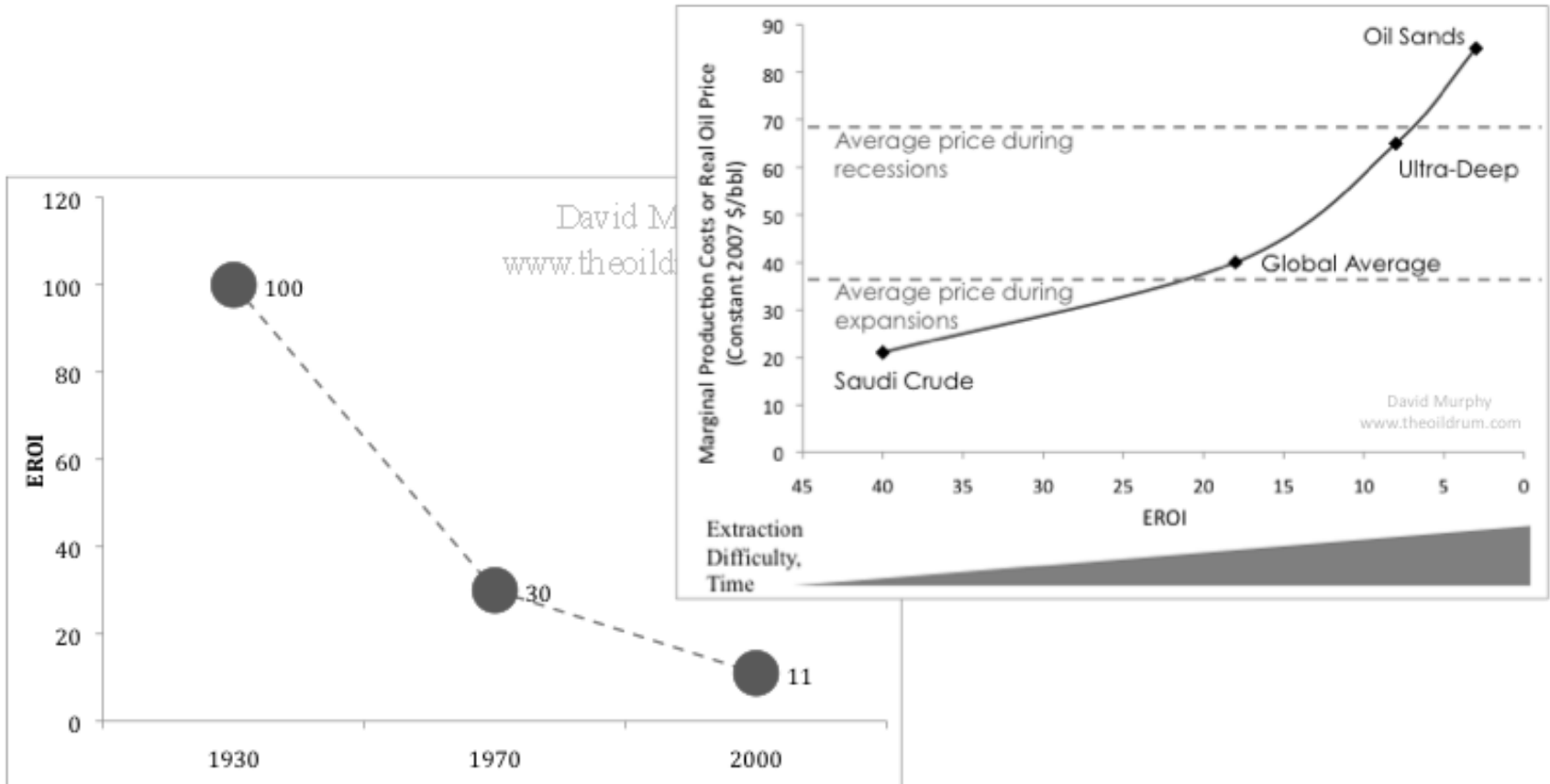
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# 8. Peak net energy



# 9. EROI



Source: [www.theoil drum.com](http://www.theoil drum.com)

# 10. Peak phosphate?

- Phosphate mining and processing is an energy intensive process.
- Production could be disrupted due to issues with global
  - Energy production
  - Agricultural output
  - Macro economics
  - Civil unrest
  - Geopolitics
- Disruption to Phosphate production could start a vicious feedback loop effecting the above.

# 11. OECD developed countries are the major global grain exporters

% Share of global Wheat exports in 2008

USA 23%

France 12%

Canada 12%

Australia 6%

Germany 5%

UK 2%

**Total 60%**

## 12. OECD developed countries are the major oil importers

Most OECD countries import 50-100% of their oil consumption.

US 65% and rising as fields rapidly deplete

Western Europe almost totally dependent on imports as North Sea depletes

Asia (Japan, Korea etc.) very dependent on oil imports e.g. Japan 100% dependent on imports.

# 13. 60-80% of global High EROI oil exports from Saharan oil exporters of Middle East and North Africa

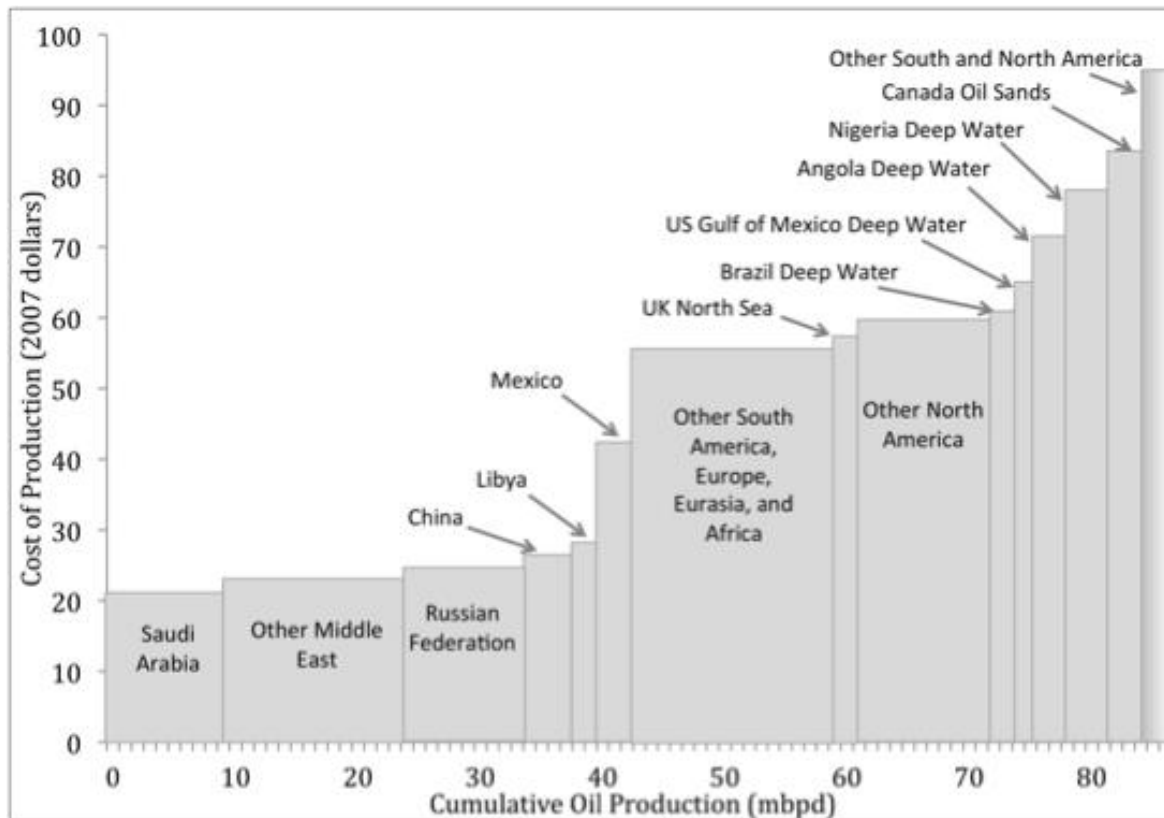


Image Source: David Murphy, CERA [6]



# 14. Saharan oil exporters are dependent on food imports

E.g. Saudi Arabia is abandoning all grain production by 2016 due to growing problems with water shortages

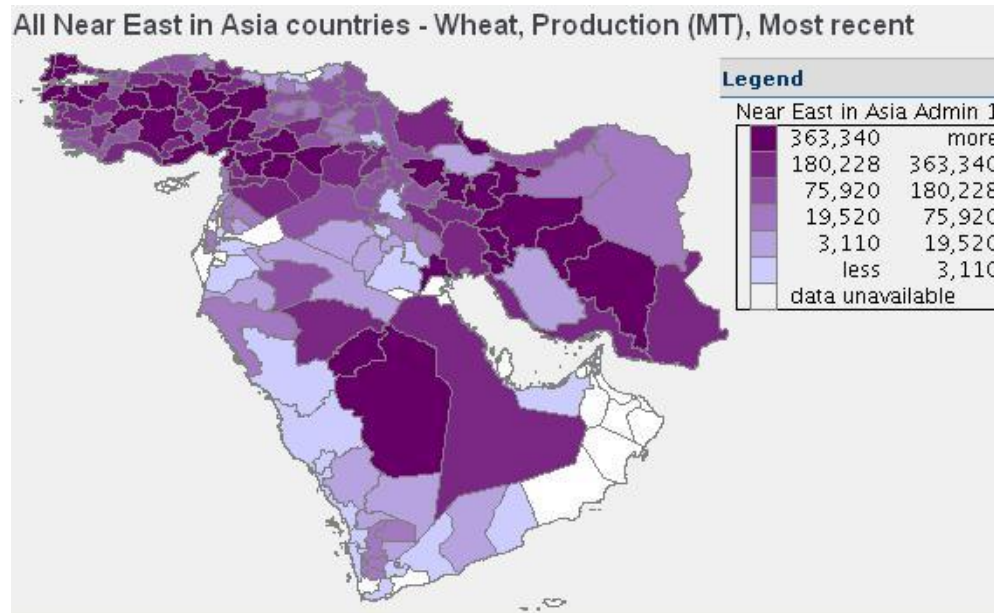
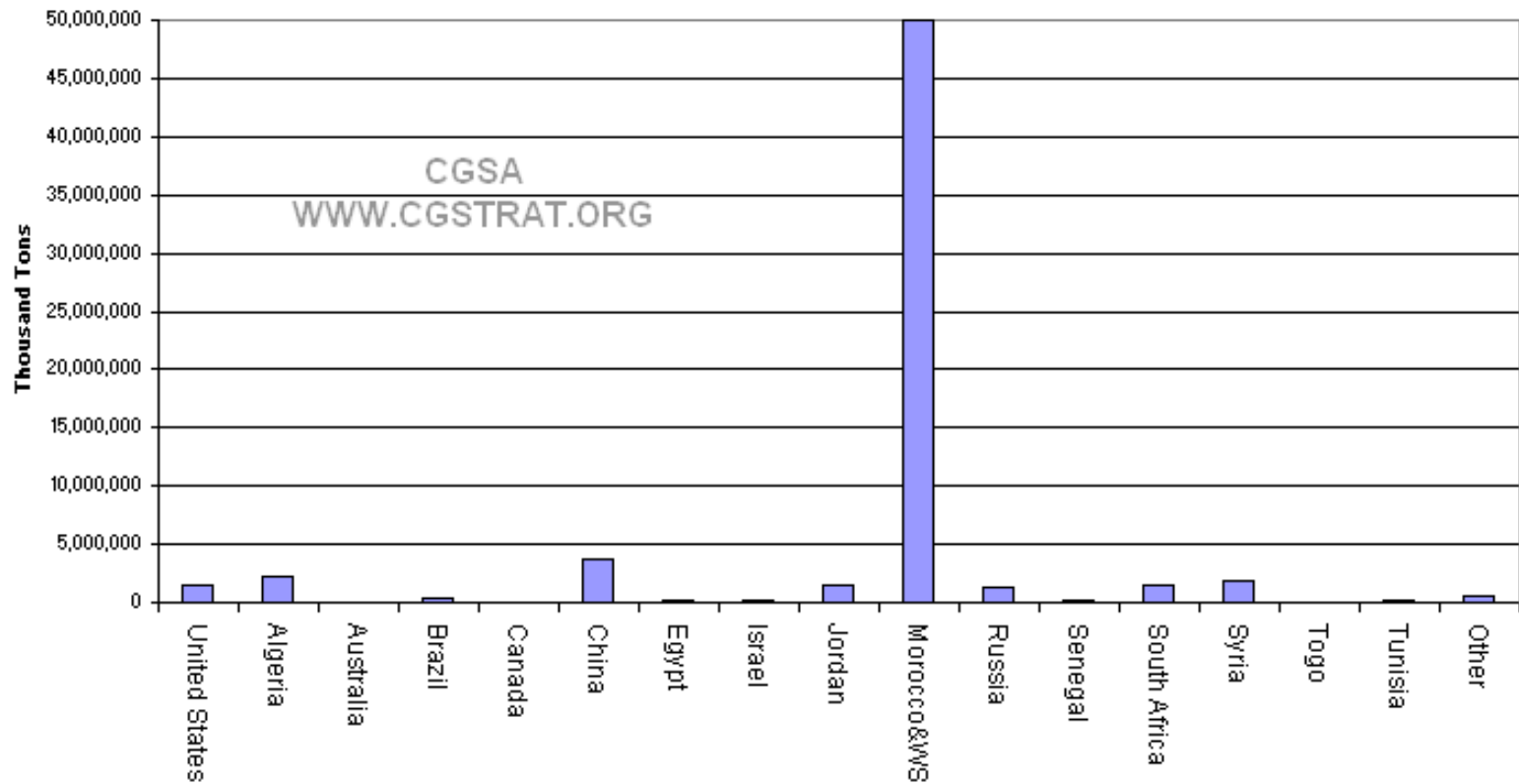


Image Source: FAO

# 15. Morocco a key link

## Global Phosphate Reserves

Source: USGS



# 16. The geopolitical and strategic implications

“Who controls the food supply controls the people; who controls the energy can control whole continents; who controls money can control the world.” —Henry Kissinger

During the exponential growth of humanity when there was a surplus of cheap resources, money probably provided the ultimate power to control. Now that high grade resources are fast depleting shortages are worsening.

"From now on any one who believes that money is more important than food or energy is not only an optimist but may soon be starving in the cold and dark" - Babak Madadi

# 17. Recommendation

## Phoenix Recovery Plan (PRP)

- Strategic Interventions at key Technical/Economic/Social points to Mitigate worst aspects of Energy/Resource challenge and buy time
- Use remaining time and resources in utilising High EROI renewable energy technologies to reduce the cost of oil production. Potentially converting up to 1 Trillion barrels of marginal resources into cheap to produce oil reserves.

# 9. References

- [1] Plant nutrition for food security A guide for integrated nutrient management, UN FAO FERTILIZER AND PLANT NUTRITION BULLETIN 16, p21
- [2] Ibid
- [3] World Production of Phosphate Rock, Better Crops/Vol. 83 (1999, No. 1) p6
- [4] Phosphorus Research Bulletin Vol. 15 (2004) p. 21
- [5] Relationship between human population and average cereal yields in six regions, Plant nutrition for food security A guide for integrated nutrient management, UN FAO FERTILIZER AND PLANT NUTRITION BULLETIN 16, p26
- [6] David Murphy, Does Peak Oil Even Matter?, The Oil Drum 17 Dec 2010, based on CERA. 2008. Ratcheting Down: Oil and the Global Credit Crisis. Cambridge Energy Research Associates.