



National University of Singapore

Strategic Technology Management for Future Growth

Speaker: Professor LAU Hon-Chung



Professor LAU Hon Chung, PhD, PE

Education

- PhD, Chemical Engineering, Princeton University (1982)
- MA, Chemical Engineering, Princeton University (1979)
- BSc, Chemical Engineering, California Institute of Technology (1977)

Positions Held

- Professor, Civil & Environmental Engineering, NUS (2016-)
Senior Scientific Advisor, Institute of Chemical and Engineering Sciences, A*STAR (2017-)
- Manager, Arrow Beijing Study Center, Beijing (2012-2016)
- Chief Production Technologist, Shell International, Houston (2006-2012)
- Team Leader, Integrated Reservoir Modeling, Shell International, Houston (2001-2006)
- Staff Production Technologist, Brunei Shell Petroleum (1997-2001)
- Staff Research Production Engineer, Shell Development Company, Houston (1990-1997)
- Exchange Scientist, Royal Dutch Shell Laboratory, The Netherlands (1989-1990)
- Research Reservoir Engineer, Shell Development, Houston (1981-1989)





Understanding the Competitive Landscape in S. E. Asia



LEADING FROM ASIA





OUTLINE

- Energy outlook to 2040
- Technology implications
- Technology providers
- The Singaporean model
- Assignment
- Q&A





Energy Outlook

BP Energy Outlook 2018

<https://www.bp.com/en/global/corporate/energy-economics/energy-outlook.html>





Energy Outlook

How is this
true in S. E.
Asia?

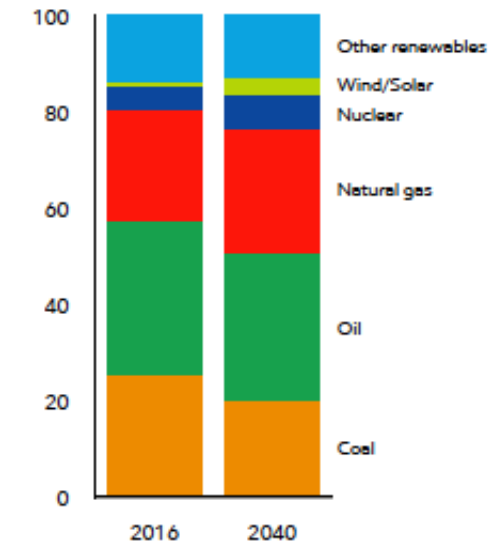




Energy Outlook up to 2040

- Between 2014 to 2040, global energy demand will rise by 25%.
- **Fossil fuels** (coal, oil, gas) will supply ~78% of world need needs through 2040.
- **Oil** will remain the world's primary fuel meeting about 1/3 of the energy demand, including 95% of transportation energy.
- **Natural gas** will be #2 fuel, as 40% of growth in energy demand will be met by natural gas.
- There will be strong growth in **nuclear and renewables**.

Global energy mix shifts to lower-carbon fuels
Percent of primary energy (%)



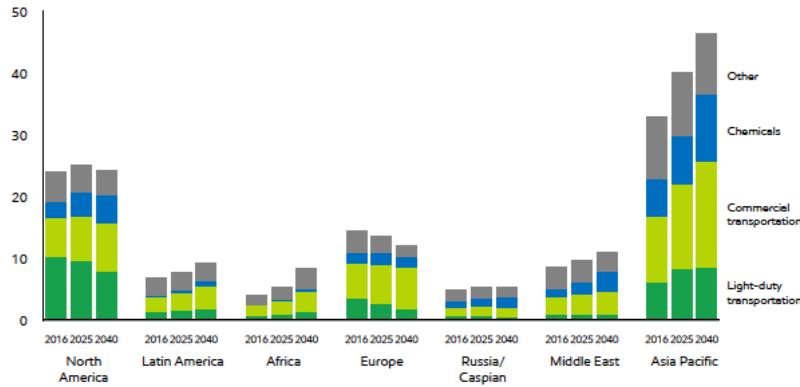
Source: *The Outlook for Energy: A View to 2040*, ExxonMobil (2016, 2018)



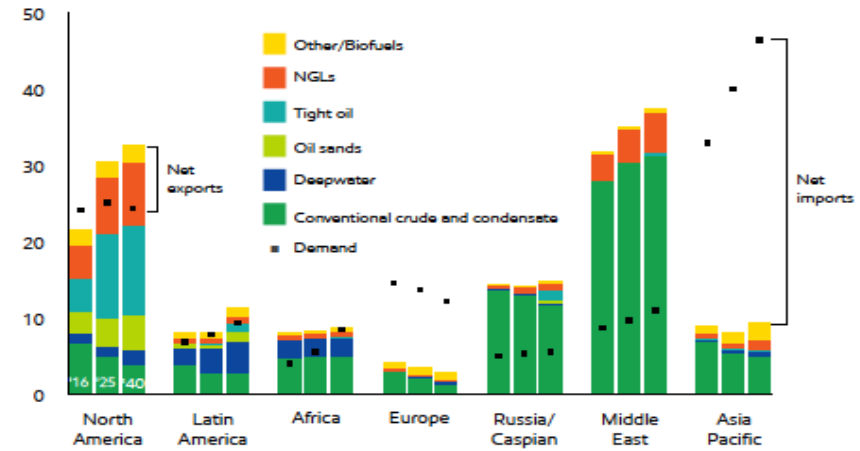
Energy Outlook up to 2040

Liquids – Demand

Liquids demands driven by transportation and chemicals
By region and sector – MBDOE



Liquids supply highlights regional diversity
By region and sector – MBDOE



Liquids (Oil)

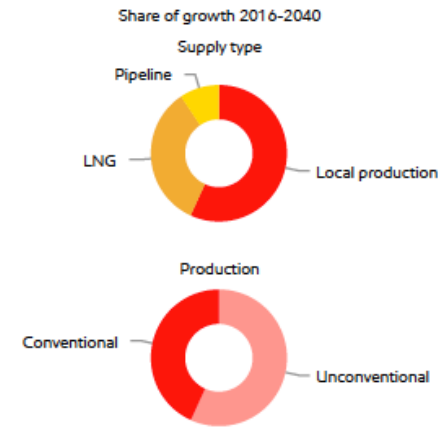
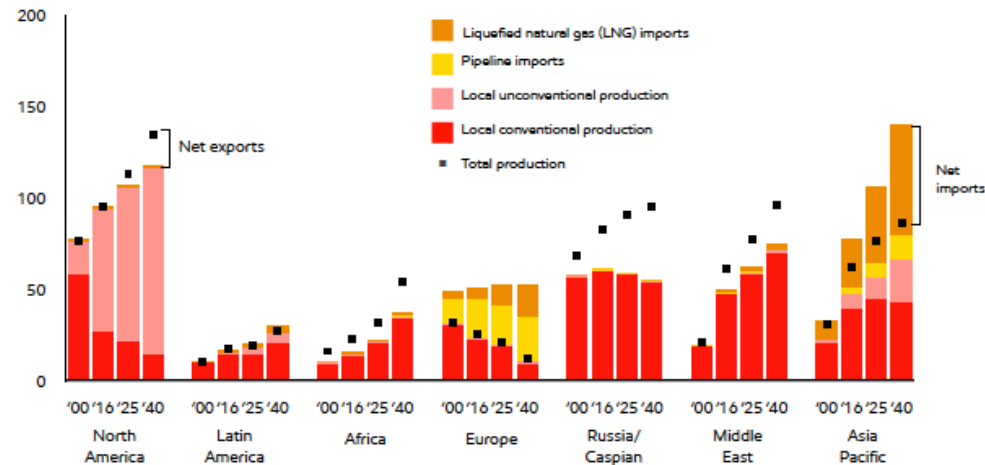
- Growth in supply will be from technology-driven tight oil, NGL, oil sands and deepwater.
- **Asia Pacific's net import of oil will rise by over 50% by 2040, as domestic production declines but demand grows.**



Energy Outlook up to 2040

Natural gas supply highlights regional diversity in meeting demand

BCFD



Gas

- Global demand for natural gas will rise by 50% between 2014-2040.
- **By 2040, Asia-Pacific will import 40%+ of gas from other regions.**



Common trends in S.E Asia oilfields

- Brown fields
- Rapid decline rate
- Need for enhanced oil recovery
- High CO₂ content gas field
- Complicated geology
- Aging infrastructure

How true is this for China?





Technology Implications

- Technology has the highest potential and greatest uncertainties in meeting future energy demands.
- Growth in oil supply will be in technology-driven tight oil, NGL, oil sands and deepwater.
- Growth in gas supply will be in technology-driven unconventional such as tight gas, shale gas, coalbed methane, and others.
- **In Asia Pacific, arresting production decline in aging fields will need technologies like Enhanced Oil Recovery (EOR), well, reservoir, facility management (WRFM) and other breakthroughs.**





Who are the technology providers for the upstream petroleum industry?

- Universities
- National laboratories
- National oil companies
- International oil companies
- Oil service companies
- Chemical companies
- Other vendors
- Other industries



How do we incentivize technology providers to invest in our country?

- Energy and tax policies
- IP protection
- Access to domestic market
- Access to regional market
- Human resources
- Skilled professionals
- Legal and political system



The Singapore Model of Attracting Foreign Investment

- Established legal system of IP protection
- Easy access to regional market
- Skilled laborers and technical professionals
- Economic Development Board to attract foreign investment
- National laboratories as a bridge between academia and industry
- Huge R&D budget for innovation and research





The Singapore Model



Government lab



IP protection



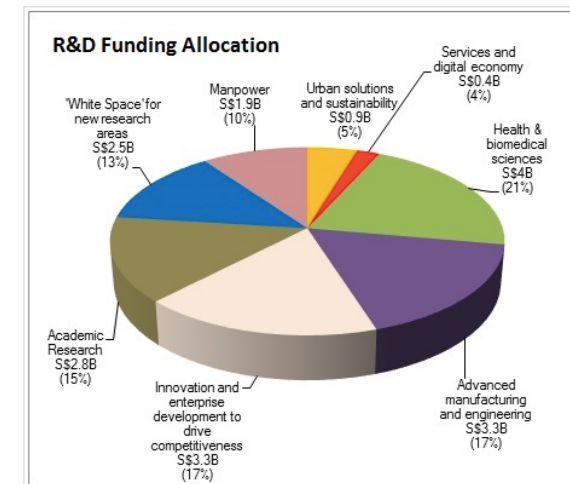
Business incentives



Access to Asia market



Talent pipeline



Source: [National Research Foundation](#)

Government R&D funding



SWOT Analysis





Questions & Answers

