

World Energy Outlook

Presented to the International Energy Forum

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About KAPSARC



Establishment

By a Ministerial Council Order in 2007, to create a non-profit global institution dedicated to independent research into economics, policy, technology and the environment, across all types of energy.

Mission

To advance the understanding of energy challenges and opportunities, through unbiased, independent, and high-caliber research for the benefit of society.

Governance

Funded by an endowment to foster objective research, supervised by a respected Board of Trustees, and guided by a globally recognized Advisory Council.



KAPSARC research initiatives

- 1. Productivity and Economic Diversification in Saudi Arabia
- 2. Energy and Economic Vulnerability
- 3. Evaluation of Public Investment Projects: The Opportunity Costs of Oil and Gas in Saudi Arabia
- 4. Future of Transportation and Fuel Demand
 - Freight Movement
 - Personal Mobility

- 5. Future of Global Oil Markets
- 6. Future of Natural Gas Markets Including Potential Saudi Linkages to Global Markets
- 7. Regional Energy Markets: GCC Market Integration and Policy Drivers of Demand in China and India
 - GCC Market Integration
 - Policy Drivers of Demand in China
 - Policy Drivers of Demand in India

- 8. Electricity Sector Transitions
- 9. Climate Change Policies and Governance

10. Models, Data and Tools

- KGEMM model for policy analysis in the Kingdom
- KEM model for policy analysis in the Kingdom
- KTAB toolkit models of collective decisionmaking processes
- Energy data portal and web apps



KAPSARC today





Insights into the Energy Future



Economic growth expected to be strong, especially in the non-OECD nations

Average annual percent change in real GDP by region, 2015–40



Source: EIA, IEO 2018 – Reference Case



Energy consumption generally grows with GDP



Source: OPEC World Oil Outlook 2017



Energy use rises for all fuels other than coal

Petroleum and natural gas dominate the outlook – unless technology surprises

World energy consumption by energy source



quadrillion Btu

Source: Energy Information Administration, International Energy Outlook 2018 – Reference Case



Electricity demand dominates growth

Electricity makes up 40% of the rise in final consumption to 2040 – the same share of growth that oil took for the last 25 years; China and India lead the regional pattern



Electricity demand growth by selected region

Source: International Energy Agency, World Energy Outlook 2017



Renewables and natural gas provide much of the growth in electricity generation

percent



World net electricity generation by fuel trillion kilowatthours

100% liquids 90% nuclear 80% natural gas 70% 60% 50% coal 40% 30% 20% renewables 10% 0% 2010 2015 2020 2025 2030 2035 2040

Share of net electricity generation



Source: EIA, IEO 2017 - Reference Case

Global oil demand forecasts vary widely

Uncertainties in policy choices, economic outlook, technology shifts, and resource estimates lead to large variations in oil demand forecasts



Source: KAPSARC based on IEA, OPEC, IEEJ, EIA, BP, Shell, and Rystad data



Era of oil is not yet over

If tight oil plateaus (2020s) and non-OPEC production growth as a whole slows, reliance on the Middle East grows and the need for large-scale oil investment continues, even with electric cars



Change in global oil demand by sector

Source: International Energy Agency, World Energy Outlook 2017

Electric car fleet – the view depends on what you include

Electric car fleet – IEA View ...it looks like (and is) huge growth



Source: International Energy Agency, World Energy Outlook 2017

Electric car fleet – BP View ...don't forget the conventional fleet

Billion vehicles



Source: BP Energy Outlook 2018; ICE vehicles includes hybrid vehicles which do not plug into the powergrid



Oil's role in the transition to a lower carbon economy

Transportation Factors

- Aviation demand growing
- Shipping and heavy transport exploring LNG and H₂
- Passenger vehicles

EV penetration growing but may not reduce oil demand significantly

Improvements in the fuel efficiency of (ICE) and hybrid technologies driving down demand Electricity demand growing indefinitely with population and prosperity

Power Generation

- Renewables share increasing but seasonality and storage are major hurdles
- Natural gas offers additional flexibility but oil still attractive relative to coal

 Demand for petrochemicals is forecast for 3% annual growth led by emerging markets

Industrial Factors

- Integration of refining and petrochemicals is rising on costs, efficiency, flexibility, and security
- High level of interest from Japan to import H₂ made from hydrocarbons

Source: KAPSARC



Insights Into Oil Inventories and Global Oil Balances



Key messages from KAPSARC's inventory assessment

Energy security paradigm is changing from physical availability to price volatility

Level of inventories and net flows alone do not indicate whether oil markets are rebalanced

- 'Return to rolling 5 year average' too simplistic.
- The function of inventories, not just their level, is changing

'Velocity' of oil matters – the four basic inventory states defined by combinations of inflows and outflows

KAPSARC developing 'Stability of Outlook' indicators

- Equilibrium levels of capital expenditure (\$/bbl/d of capacity)
- Mid-merit storage profitability relative to other storage options
- 'Voice of the trader'



OECD Commercial Oil Inventory vs.



Source: IHS Markit and Rystad Energy



The \$200b annual value of OPEC's spare capacity to the global economy

The counterfactual scenario shown below is based on estimates of the monthly oil prices that would have prevailed from 2005 to 2014 had OPEC not used its spare capacity to offset shocks



OPEC's spare capacity reduces oil price volatility

Source: OPEC's impact on oil price volatility: The role of spare capacity; *The Energy Journal*, Volume 39, Number 2, April 2018, pp. 173-196. Axel Pierru (KAPSARC), James Smith (SMU), and Tamim Zamrik (KAPSARC)



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