Introduction to KAPSARC

Samer AlAshgar, President
KAPSARC in Brief...

KAPSARC
King Abdullah Petroleum Studies and Research Center

- Independent, non-profit, research institution
- Focuses on energy economics, policy, technology, and the environment
- Located in Riyadh
KAPSARC in Brief...

Mission

• Advance understanding of energy challenges and opportunities
• Both domestically and globally
• Through high caliber research
• Build a platform and act as a catalyst for constructive dialogue between stakeholders

To create future value and prosperity to maximize societal benefit

Strategic Objectives

Develop relevant and sustainable frameworks that maximize economic efficiency and sustainability of energy, by identifying:

• Lowest full-cycle costs of energy provision
• Highest value created from energy access
• Understanding of the intended and unintended impacts of energy policy
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KAPSARC Facilities

As of November 2014
Board of Trustees

- H.E. Minister Ali Al-Naimi, Chairman of the Board
- H.E. Dr. Muhammad Al-Jasser, Minister of Economy and Planning
- H.E. Prof. Hashim Yamani, President of the King Abdullah City for Atomic and Renewable Energy (KA-CARE)
- Prof. Sir Keith O’Nions, Chairman of Cambridge Enterprise
- Prof. Robert Brown, President of Boston University
- Dr. Rajiv Kumar, Senior Fellow, Center for Policy Research, New Delhi
- Mr. Samer AlAshgar, President of KAPSARC

- Ultimate authority of KAPSARC
- Sets policies and approves strategic, and operational plans of the Center
International Advisory Council

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- George M. Whitesides
  Director or advisor for Rohm & Haas, Dexter Corp. and Life Technologies, U.S.A.

- Marwan Masri
  President Emeritus, Canadian Energy Research Institute (CERI), Canada

- Majid Al-Moneef
  Secretary General of the Supreme Economic Council, Kingdom of Saudi Arabia

- Daniel Yergin
  Chairman, IHS-Cambridge Energy Research Associates (IHS-CERA), U.S.A.

- Rajendra K. Pachauri
  Director General of the Energy Resources Institute (TERI), India

- H.E. Hamad S. Al-Sayari
  Former Governor of Saudi Arabian Monetary Agency (SAMA), Kingdom of Saudi Arabia

- High-ranking experts in the field of energy economics and policy
- Review the Center’s direction and critique quality and relevance of output
KAPSARC’s People

- Attract the best and brightest minds
- Emphasize meritocracy and diversity
- KAPSARC people ...

... have grown since 2012, to reach maturity by 2016

... comprise of 27% women

... and come from 17 nationalities

KAPSARC Employees
- Research
- Finance & Operations

2012: Men 9, Women 1, Total 10
YTD 2015: Men 51, Women 36, Total 87
2016: Men 80, Women 55, Total 135

KSA 38%
Americas (N&S) 23%
Europe 26%
MENA 6%
Asia 7%
Research Portfolio

**Research Programs**

**Economics of Energy Systems**
- Assessing Energy Policy

**Energy Logistics and Supply Chains**
- Energy Investment and Financing

**Energy Productivity & Transitions**
- Driver of Transportation Fuel Demand
- Impact of Energy Resources and Access on Societal Welfare

**Human Geography of Energy**
- Energy Policymaking Process
- Role of Energy in the Relationships between Countries

**Resource and Environmental Management**
- Assessing Impacts of Energy Technologies

**Research Focus Area**

**Research Portfolio**

Economics of Energy Systems
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KAPSARC “Publications” …

KAPSARC “Discussion Papers”
A KAPSARC research paper

KAPSARC “Workshop Briefs”
A short, 7-10 page, non-attributional, summary of a KAPSARC Energy Workshop

KAPSARC Tools & Data
Databases (such as policy dB, weather ... etc.) or “tools” such as models (e.g. CGE model source code or models for collective decision-making processes)
KAPSARC “Publications” ...

- Discussion Papers
- Workshop Briefs
- Tools / Data

Yearly Breakdown:

- 2013: Q1, Q2, Q3, Q4
- 2014: Q1, Q2, Q3, Q4
- 2015: Q1, Q2, Q3, Q4

Bar Chart Showing Publication Trends by Quarter.
KAPSARC Research ... Collaboration and Engagement

- With Academic, Governmental and Industrial institutions
- Local and Global
- Publications, data, models
- Joint studies
- Seminars
- Programs
  - Visiting Fellows
  - KAPSARC Energy Workshop Series
KAPSARC’s Energy Workshop Series
KAPSARC’s Energy Workshop Series

- Energy and Technology Transitions
- Bargaining Models
- Energy Productivity – (Global, GCC, MENA)
- East Africa – Local Content (Fiscal Policy, Resource Development)
- Economics of Energy Vulnerability
- Water and Energy
- Vehicle Adoption Drivers
- Energy Systems Modeling (GCC)
- Gas Markets
- Fuels Markets
- Coal Markets
- Oil Markets
- Demographics and Energy
KAPSARC’s research program

David Hobbs, Head of Research
Research Portfolio

- Economics of Energy Systems
  - Assessing Energy Policy
- Energy Markets, Fuels & Feedstocks
  - Energy Logistics and Supply Chains
- Energy Productivity & Transitions
  - Driver of Transportation Fuel Demand
- Human Geography of Energy
  - Energy Policymaking Process

- Energy Investment and Financing
- Impact of Energy Resources and Access on Societal Welfare

- Energy Impacts of Climate Change Policy
- Role of Energy in the Relationships between Countries

- Resource and Environmental Management
- Assessing Impacts of Energy Technologies

Research Programs
Research Focus Area
How long can Saudi Arabia remain an oil exporter?

Walid Matar, Research Associate
Domestic oil and natural gas consumption in Saudi Arabia

- From 1995 to 2012, the use of primary oil and natural gas in Saudi Arabia increased at an average rate of 5.1% per year.

- The share of domestic consumption in total hydrocarbon production:

  ![Graph showing the share of domestic primary energy consumption in total production from 1995 to 2011]

  **Sources:** KAPSARC, EIA

  - **1995:** 18.5%
  - **2011:** 33.7%
Extrapolation based on historical growth rates

• Some analysts have applied historical growth rates to estimate future energy consumption

• Primary oil and natural gas energy consumption in Saudi Arabia until 2040
# The role of industrial fuel prices

Current fuel prices for industrial sectors:

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>0.75 USD/MMBTU</td>
</tr>
<tr>
<td>Ethane</td>
<td></td>
</tr>
<tr>
<td>Arab Light</td>
<td>4.24 USD/barrel</td>
</tr>
<tr>
<td>Diesel</td>
<td>0.65 USD/MMBTU</td>
</tr>
<tr>
<td>Heavy Fuel Oil (360 cSt)</td>
<td>0.36 USD/MMBTU</td>
</tr>
</tbody>
</table>

Meet some social and development objectives, but create:
- Lack of economic coordination between sectors
- Inefficiencies within sectors

Policies can be designed to:
- Achieve large potential for saving fuels in the utility/industrial sectors
- Encourage the adoption of renewable and nuclear technologies
Managing transition

We assessed policy scenarios that, without immediately deregulating transfer prices, would produce comparable economic benefits and fuel savings.

- **Gradual deregulation**
  - Transfer prices of fuels are gradually raised to world oil prices (market-clearing price for natural gas) over an 8-year period

- **Implicit fuel contracts**
  - Current sectoral fuel consumptions remain at current administered prices (but are phased out), incremental purchases at deregulated prices

- **Investment credits**
  - Government pays a proportion of the investment cost for new solar and nuclear power plants
Primary oil and natural gas consumption

- Historical domestic consumption
- Current policy
- Gradual deregulation
- Investment credits/feed-in-tariffs
- Immediate deregulation
- Implicit fuel contracts
Domestic crude oil consumption

Projections from Oxford Economics

- Production
- Historical domestic consumption
- Gradual deregulation
- Implicit fuel contracts
- Investment credits/feed-in-tariffs
- Immediate deregulation

Crude oil consumption (Million barrels/day)

Year


IEEJ: May 2015. All Rights Reserved.
Power generation technology mix by 2032?

Percentage share of TWh generated:

- **2015**:
  - Nuclear: 20%
  - Wind: 30%
  - CCGT Cogen: 10%
  - Steam: 40%

- **2032**: Percentages may vary by scenario:
  - Current policy:
    - Nuclear: 10%
    - Wind: 15%
    - CCGT Cogen: 5%
    - Steam: 70%
  - Immediate deregulation:
    - Nuclear: 15%
    - Wind: 20%
    - CCGT Cogen: 10%
    - Steam: 55%
  - Gradual deregulation:
    - Nuclear: 20%
    - Wind: 25%
    - CCGT Cogen: 15%
    - Steam: 40%
  - Implicit fuel contracts:
    - Nuclear: 25%
    - Wind: 30%
    - CCGT Cogen: 20%
    - Steam: 25%
  - Investment credits/feed-in-tariffs:
    - Nuclear: 30%
    - Wind: 35%
    - CCGT Cogen: 25%
    - Steam: 5%
Putting the policy benefits into perspective
Some initiatives taken to curb oil and gas consumption

- Announced targets for alternative power generation technologies
  - 71.6 GW of renewable and nuclear generation capacity by 2032

- Implementation of demand-side efficiency measures
  - Thermal insulation of new housing units, new vehicles standards, increase in efficiency of new air-conditioning equipment, ...
Conclusions

- No reason why oil exports would be doomed to fall
- A substantial reduction in oil and gas use could be achieved as a result of altering transfer prices of fuels.
- The alternative policies generate high economic gains resulting from increased oil export.
- Policies can be designed to help facilitate the adoption of alternative technologies.

Relevant papers:
1.) Lowering Saudi Arabia's Fuel Consumption and Energy System Costs Without Increasing End Consumer Prices
2.) Modeling the Saudi Energy Economy and Its Administered Components: The KAPSARC Energy Model
Thank you
Up, Down or Sideways?
The drivers of future oil price movements

Tilak Doshi, Senior Fellow
David Hobbs, Head of Research
Content

1. Nature of East of Suez Crude Oil Markets
2. Dubai: Benchmark by Default
3. Potential impacts of ESPO on East of Suez markets
Major Oil Flows 2013 (MMBD)

Total Imports: 55.6 MMBD
Total Global Consumption: 91.3 MMBD

Source: BP 2014

ME = Middle East, AP = Asia Pacific, NA = North America, LA = South and Central America, WAF = West Africa, NAF = North Africa, FSU = Former Soviet Union, EUR = Europe, CAN = Canada, US = United States
Major Oil Flows: Declining/Unchanged v. Surging

Sources: International Energy Agency; Icap Shipping

* Narrow channels along widely used global sea routes
Russia increasingly important relative to West Africa as the marginal barrel into Asia (up to 2013)

Saudi Arabia oil exports by region: increasing dominance of Asian markets

Atlantic v. Far East markets: key differences (but Far East markets evolving with more options)

<table>
<thead>
<tr>
<th></th>
<th>Atlantic Markets</th>
<th>Far East Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot Crude Availability</td>
<td>Spot crudes compete actively with term crudes from Arabian Gulf</td>
<td>Less spot traded crude competing with term contracts.</td>
</tr>
<tr>
<td>Buyer Characteristics</td>
<td>Highly conscious of short term trading and business risks</td>
<td>Highly conscious of long term supply security risk</td>
</tr>
<tr>
<td>Supply Diversity</td>
<td>Key refining regions (USGC, Rotterdam) can access multiplicity of short and long haul crudes</td>
<td>Region massively net crude short, with heavy dependence on Middle East crude</td>
</tr>
<tr>
<td>Resilience to Grade Variation</td>
<td>Supply and demand flexible and competitive among many alternative grades (“price elastic”)</td>
<td>Less flexible supply and demand responses, less alternative grades, fewer short haul sources (“price inelastic”)</td>
</tr>
</tbody>
</table>
Content

1. Nature of East of Suez Crude Oil Markets
2. Dubai: Benchmark by Default
3. Potential impacts of ESPO on East of Suez markets
Summary Characteristics of a benchmark crude

- Freely tradable (no restrictions on re-sale)
- Adequate tradable physical base
- No dominant buyer or seller
- Adequate and known loading schedules
- Tax certainty and absence of official “influence” on trading
- Stable regulatory regime, lack of political risk or collusion
- No significant non-refining uses (e.g. direct burn for power)
- Price behavior should be proxy for marginal conditions
## Basic features of key crudes

<table>
<thead>
<tr>
<th></th>
<th>ASCI</th>
<th>WTI</th>
<th>BFOE</th>
<th>Dubai</th>
<th>Oman</th>
<th>ESPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production (MBPD)</td>
<td>735</td>
<td>300-400</td>
<td>1,220</td>
<td>60-80</td>
<td>700</td>
<td>610</td>
</tr>
<tr>
<td>Volume Spot Traded (MBPD)</td>
<td>580</td>
<td>940</td>
<td>635</td>
<td>85</td>
<td>246</td>
<td>230</td>
</tr>
<tr>
<td>Number of Spot Trades per Cal Month</td>
<td>260</td>
<td>330</td>
<td>98</td>
<td>&lt;5</td>
<td>10</td>
<td>?</td>
</tr>
<tr>
<td>Number of Spot Trades Per Day</td>
<td>13</td>
<td>16</td>
<td>5</td>
<td>&lt;1</td>
<td>&lt;1</td>
<td>?</td>
</tr>
<tr>
<td>Number of Different Spot Buyers per Cal Month</td>
<td>26</td>
<td>27</td>
<td>10</td>
<td>3</td>
<td>5</td>
<td>?</td>
</tr>
<tr>
<td>Number of Different Spot Sellers per Cal Month</td>
<td>24</td>
<td>36</td>
<td>9</td>
<td>3</td>
<td>6</td>
<td>?</td>
</tr>
<tr>
<td>Largest 3 Buyers % of Total Spot Volume</td>
<td>43%</td>
<td>38%</td>
<td>72%</td>
<td>100%</td>
<td>50%</td>
<td>?</td>
</tr>
<tr>
<td>Largest 3 Sellers % of Total Spot Volume</td>
<td>38%</td>
<td>51%</td>
<td>56%</td>
<td>100%</td>
<td>80%</td>
<td>?</td>
</tr>
</tbody>
</table>

Source: Fattouh (2011); Argus (2012)
Dubai price is a relative price market

- Platts partials window is proximate source of price discovery for Oman-Dubai average

- But Dubai is ultimately a relative price market, being set by
  - liquidity in Dubai inter-month spreads
  - Brent-Dubai EFS spreads
  - Cash Brent providing the “fixed and flat” anchor

![Diagram showing Dubai price components](image)
Dubai – a default marker crude

- From peaks of over 400 mbd in early 90s, down to current estimates of 60 mbd (about 4 cargoes/month); hardly any spot traded

- Several attempts to handle Dubai illiquidity: Oman deliverable into Dubai contract (2001); introduction of “partials” trade (2004); Upper Zakum deliverable into Dubai contract (2006); Qatar Marine and Basrah Light discussed as potential deliverable streams into Dubai contract (2012)

- Platts partials contracts increase in liquidity past 2 years but price discovery based on spot physical transactions no longer feasible

- DME Oman Futures contract primarily a means of physical delivery of Oman crude; not as price reference for ME crude exports to Asia

- Oman-Dubai MOPS assessment still the pricing basis for ME crude exports to Asia
Content

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Quality specifications of major crudes

ESPO vs typical Asian & West African sweets, ME sours and ‘sweeter’ ME

Legend:
- Middle East
- Asia-Pacific
- Russia
- West Africa
- North Sea
- United States
- United States

Gravity, API
- Sweet
- Medium
- Sour

Sulphur, %
- Sweet
- Medium
- Sour

Crudes shown:
- Cossack
- Gippsland
- Tapis
- Attaka
- Tapis
- WTI
- Forties
- Murban
- Lower Zakum
- ESPO
- Brent
- Oman
- Urals
- Murban
- Oman
- Urals
- WTI
- Forties
- ESPO
- WTI
- Forties

Regional classifications:
- Asia-Pacific
- Middle East
- North Sea
- United States
- Russia
- West Africa
ESPO and Arab Light relative to Dubai

Source: Platts (2014)
Evolution of ESPO prices

- Traded at a discount to Dubai crude in 1st half of 2010 – uncertain quality and familiarity issues

- Steadily increasing premium relative to Dubai, reaching peaks of $4 - $5.50/barrel from then onwards
  - Sweeter and lighter than Dubai, higher GPW
  - ESPO crude widely accepted by regional refiners due to proximity of Kozmino to key demand centers and stable quality specs

- ESPO now competes with Middle Eastern premium grades (e.g. Murban)
Competition in East of Suez crude market

- The “shale revolution” in North America is disrupting global oil flows
- West African crudes displaced into Europe and Asia
- Increased Latin American flows into Asia
- Asia is a focus of crude streams from West Africa, Latin America as well as Russia competing at the margin with the base-load Asian imports (~ 14 mmbpd) of Middle East crudes
- Impacts of such displacements on crude price differentials hard to assess but should not be under-estimated
ESPO as a regional benchmark?

- “ESPO may become a regional oil benchmark”  
  (IEA 2011)

- “ESPO shortlisted as potential benchmark crude”  
  (WSJ, 2012)

- “ESPO blend is a key alternative (to Dubai)”  
  (Argus, 2012)

- “(ESPO) has attributes that could...lead it to become a major flat price indicator of spot oil volumes in Asia”  
  (Platts 2011)
What is the Key Question?

- Asian buyers profess a preference for a local benchmark traded through a local hub
- Middle Eastern sellers prefer not to appear explicitly to be setting prices. They prefer to price off benchmarks
- There is a lack of a valid benchmark “East of Brent”

Will Middle Eastern producers be prepared to become explicit “price makers”?
Thank you
KAPSARC seminar

Tokyo
April 17, 2015