Oil Shale Investments in Jordan
“Outlooks and Challenges”

ESCWA Fossil Fuels Experts Team
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The three recognized major forms of fossil fuels are: **Coal, Natural Gas and Crude Oil**.

**Oil Shale** is a recent Fossil Fuel to be commercially recognized!
- Fossil fuels supply **about 80%** of the world’s energy. “Carbon” is the basic element in the fossil fuels that has a considerable role in CO2 production and Climate Change impact.

- The energy transition is a way to shift the global energy sector **from fossil-based** to a lower-carbon or **zero-carbon** by **the second half** of the current century to limit the **Climate Change** impact.

- Energy transition is not new to the world, first transition was by the introduction of coal in the mid 19th century, then by oil in the mid 20th century and nuclear power in the 1970s, although these new forms of energy added to, rather than replaced existing sources.

- In **2035** with the **2°C scenario** of the Paris Agreement, **fossil fuels will account for a total of 64% of the world’s energy mix** (versus 81% in 1990) and which means that a part of the current known fossil fuels reserves will be untouched rather than depleted.

- Anyway, shifting to new energy sources **will take time**. In the meantime, fossil fuels should be used in the most **efficient and environmentally** responsible way possible.
Oil Proved Reserves, 2015

Total proved oil reserves, measured in barrels. Proved reserves is generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.

Source: BP Statistical Review

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Coal Proved Reserves, 2015

Total proved coal reserves, measured in tonnes. Proved reserves is generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.

Source: BP Statistical Review
Natural Gas Proved Reserves, 2015

Total proved gas reserves, measured in trillion cubic metres. Proved reserves is generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.
Years of fossil fuel reserves left

Years of global coal, oil and natural gas left, reported as the reserves-to-product (R/P) ratio which measures the number of years of production left based on known reserves and annual production levels in 2015. Note that these values can change with time based on the discovery of new reserves, and changes in annual production.

- Coal: 114 years
- Natural Gas: 52.8 years
- Oil: 50.7 years


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Oil Shale Investment Projects Main Challenges

“Difficult financing of the investment projects”

- **Volatile** crude oil market **price**, **feasibility** of the investment is dependent on the cost of oil production.
- Regional **instability**.
- Oil Shale Processing Technologies are **resource dependent** and with different approaches and economics and need to be well studied and developed to suit the resource.
- In the minds of investors and financiers its an **Immature industry**.
- Negative impression about the **environmental impact** of the industry has formed a barrier for potential financiers.
- The World is going towards **cleaner energy** solutions according to the **Paris Agreement** and driving their **strategies** in the context of the **Energy Transition** and **Climate-related risks**.
Fossil Fuels and CO2 emissions in Jordan

- **CO2 emissions:** Jordan is a Non Annex 1 country in the Kyoto Agreement and strongly committed to mitigate climate change impacts according to Paris Agreement, it has **no implications** on the greenhouse gas emissions and can benefit from Carbon credits.
# Environmental Laws and Standards of the Oil Shale Commercial Projects in Jordan

<table>
<thead>
<tr>
<th>Environmental Health and Safety World Bank Group Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>INEPI Standards on Social and Environmental Sustainability (IFC)</td>
</tr>
<tr>
<td>Jordan Environmental Law</td>
</tr>
<tr>
<td>Equator Principles</td>
</tr>
</tbody>
</table>

The guidelines cover various aspects of environmental and health standards, including:

- **Environmental Impact Assessment (EIA) Regulations**
- **Equator Principles**
- **Jordan Environmental Law**
- **International Finance Corporation’s Performance Standards on Social and Environmental Sustainability (IFC)**
- **Environmental Health and Safety World Bank Group Guidelines**

- **ELVs of Controlled Substances as stated in SRCA**

The project must comply with these standards to ensure sustainability and environmental impact assessment.

**Equator Principles**

These principles are adopted by many multinational corporations and organizations involved in the oil and gas sector. They aim to promote sustainable development and protect the environment and human rights.

**International Finance Corporation’s Performance Standards on Social and Environmental Sustainability (IFC)**

These standards are developed by the International Finance Corporation (IFC) and provide a framework for ensuring that projects funded by the organization comply with environmental and social standards.

**Environmental Impact Assessment (EIA) Regulations**

These regulations require that projects be assessed for their potential environmental impacts before they are implemented. The assessment helps to identify and mitigate any adverse effects on the environment.

**Jordan Environmental Law**

The Jordanian Environmental Law sets the legislative framework for environmental protection and ensures that projects comply with environmental standards.

**ELVs of Controlled Substances as stated in SRCA**

Environmental Limit Values (ELVs) are established for controlled substances to limit their adverse environmental impacts. These values are used as a basis for the assessment of projects.

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**Equator Principles**

**International Finance Corporation’s Performance Standards on Social and Environmental Sustainability (IFC)**

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**Jordan Environmental Law**

**ELVs of Controlled Substances as stated in SRCA**

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Carbon Dioxide Emissions Factor, kg CO₂ per MWh

Carbon dioxide (CO₂) emissions factor, measured in kilograms of CO₂ produced per megawatt-hour (MWh) of energy produced from a given fossil fuel source.

- Charcoal: 403.2 kgCO₂
- Coke: 385.2 kgCO₂
- Oil Shale & Tar Sands: 385.2 kgCO₂
- Peat: 381.6 kgCO₂
- Lignite: 363.6 kgCO₂
- Anthracite: 353.88 kgCO₂
- Sub-Bituminous Coal: 345.96 kgCO₂
- Bitumen: 290.52 kgCO₂
- Diesel Oil: 266.76 kgCO₂
- Crude Oil: 263.88 kgCO₂
- Shale Oil: 263.88 kgCO₂
- Aviation Gasoline: 252 kgCO₂
- Jet Gasoline: 252 kgCO₂
- Motor Gasoline: 249.48 kgCO₂
- Natural Gas: 201.96 kgCO₂

Source: Intergovernmental Panel on Climate Change (IPCC)
A Glance at History
Oil Price Evolution
(Past Lapses and Future Outlook)
Crude Oil Price Evolution

Peak interest in Oil Shale research studies in Jordan

Peak Interest in Oil Shale Investment in Jordan

Min=9.440 (11 Dec 1998); Max=141.070 (4 Jul 2008)
Cost for Producing Unconventional Oil

Chart 15: The highest cost producers in the Permian start to feel the pain by not being able to cover their costs

US shale oil breakeven prices

- Granite Wash (oil)
- Bone Spring
- Miss Lime
- Wolfcamp Del
- Bakken South
- Eagle Ford Center (cond)
- Spraberry Vt
- Wolfcamp South
- Granite Wash (cond)
- Wolfbone Vt
- Barnett Liquids
- Yeso
- Eagle Ford West (cond)
- Cana Stack
- Cline
- NE Weld
- Wolfcamp North
- Cana Woodford
- Bakken Core
- Permian Central Vt
- Wattenberg Hz
- Utica (cond)
- Eagle Ford East (cond)

Source: BofA Merrill Lynch Global Commodities Research

$/bbl

[Graph showing the breakeven prices for different shale oil regions, with the prices ranging from 30 to 80 $/bbl]
“Breakeven” Price of Oil (Dollars/Barrel)

Conventional oil is 30% of world oil reserves. Production costs of unconventional oil are much higher.

Source: International Energy Agency

Nominal US Dollars

Real 2010 US Dollars


104.1  96.2  50.8  43.0  59.9  62.7  65.6  68.6  71.9  75.3  78.8  82.6
Important to Note!

In general about the Unconventional Investment Projects:

• Unconventional investment projects are recognized for their long term phases along their life time which may take a decade long of exploitation and appraisal to decide whether the project is feasible or not.

• Nearly 1T$ in Capex is at risk for unconventional projects with oil price below 65-75$ (Goldman Sachs, Dec 2014)

• In 2014-2015, 68 projects had final investment decision postponed (Wood Mackenzie, Feb 2016)

• Unconventional projects Companies consider mainly to cost cutting, operational efficiency, technologies development and extension of project execution timeline.
How to Survive and Withstand Low Oil Price Environment for Longer Period of Time in Oil Shale Investment Projects in Jordan

- All Oil Shale Companies working in Jordan and till mid of 2015 were progressing according to their work schedules and according to their contractual commitments through the Concession Agreements and Memoranda of Understanding.

- It is wise for parties” Government and Companies” to consider how to mitigate such impact through Oil Price different scenarios in their economic studies and risk management options before taking their final development decision.

- Working on developing their projects on reasonable pricing and marketing for the oil produced and other by-products.
• Government may support in **promoting** the investment projects to attract financers to reduce the impact of the **geopolitical instability** in the region and **support** the only one indigenous resource exploitation for energy production.

• **Extend exploration and appraisal phases** to suit the nature of the unconventional resource.

• Ensure **stability and predictability** of oil shale **regulations**, **permitting**, **taxation** and other investment policy parameters.

• Allowing the exploitation of **other minerals** or resources available in the concession area to enhance the economics of the oil shale projects.

• Allowing Companies to produce other **By-Products** and produce **electricity** as a by-product for plant use.