



**Hashemite Kingdom of Jordan**

## *Sustainable Energy in Jordan*

**14<sup>th</sup> -16<sup>th</sup> , Cairo, Egypt**

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*Director of Electricity Department*

# *Key Challenges Facing the Energy Sector in Jordan*



*Jordan is facing a real challenge in securing its energy supply due to:*

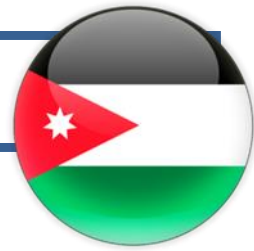
- *Almost no indigenous energy resources*
- *High dependency on imported energy  
(97% imports in 2016)*
- *volatile oil prices*

*(The energy cost amounted In 2014 to 6.3 billion US\$ which represented 17.6% of GDP at current prices, and is lessened to 3.5 billion US\$ in 2015 representing almost 10% of GDP) , and 7% in 2016.*

- *Continued increase in demand*
  - *high growth of primary energy demand (5.5% per annual)*
  - *high growth of electricity generated capacity (5.3% per annual)*



# *Energy Strategy 2015 - 2025*



*The Energy Strategy 2015 – 2025 was formulated and credence for facing the energy sector challenges through achieving the following goals:*

- *Increase local energy portion in total energy mix*
- *Decrease dependency on imported energy*
- *Achieve variety in energy forms and resources*
- *Raise energy consumption efficiency*
- *Conserve environment*



# *Overall Policies for achieving stated goals*

- *Improve the local resources utilization (natural gas, shale and uranium)*
- *Expansion projects in renewable energy*
- *Activate energy efficiency projects*
- *Enhance regional connectivity for energy and maximization its benefits*
- *Introduce the nuclear energy as substance for electricity Generation*
- *Create opportunity for private sector to invest in energy infrastructure projects*
- *Enhancing environmental protection*



# *Short-Term Solutions*



- *Increase the country's strategic oil and oil products storage capacity and development of infrastructure projects through:*
- *Construction of 100 thousand tons storage capacity for crude oil in Aqaba*
- *Construction of strategic storage capacities for light oil product with a capacity of 250-300 thousand tons, and 8 thousand tons for LPG in the middle of Jordan*
- *Construction of 6 thousand tons storage capacity for LPG*
- *Construction of strategic reserve terminal for petroleum products*
- *Rehabilitation of oil terminal*
- *Construction of LNG Jetty at Aqaba port.*



# *Medium and Long Term Solutions*



- *Continue the implementation of the country's energy strategy through:-*
  - *Maximizing the utilization of domestic resources (oil shale, natural gas, etc.)*
  - *Expanding the development of renewable energy projects*
  - *Generating electricity from nuclear energy*
  - *Enhancing regional interconnection of electricity and promoting Jordan as a regional hub*



# Oil Sector



**Increase the country's strategic oil and oil products storage capacity and development of infrastructure projects**

## **Oil terminal rehabilitation project (phase I):**

**Project Purpose :** Improve the current oil jetty and improve loading and unloading oil ships

**Type of Contract :** Turnkey Project (EPC)

- **Project Duration :** 10 months
- **Project Cost :** 20 Million JD
- **Financed by :** ADC
- **Commercial Operation:** June/2015



## **LPG Jetty :**

- **Project Purpose :** Import LPG from global market
- **Type of Contract :** EPC
- **Project Duration :** 10 months
- **Project Cost :** 17 Million JD
- **Project Financed :** MEMR
- **Commercial Operation :** 1/3/2015



# Oil & Oil Products Storage Terminals



## Aqaba Oil Terminal (100 thousand tons)

- Project Financing : Government Investment
- Project Purpose : Providing an oil storage bulk
- Project Duration : 18 months
- Project Cost : 44.1 Million JD
- Completed : 94.5%
- Expected completion : May/2017



## Aqaba LPG Terminal (6 thousand tons)

- Project Financing : Government Investment
- Project Duration : 18 month
- Project Cost : 17 Million JD
- Completed : 94.6 %
- Expected completion : May/2017



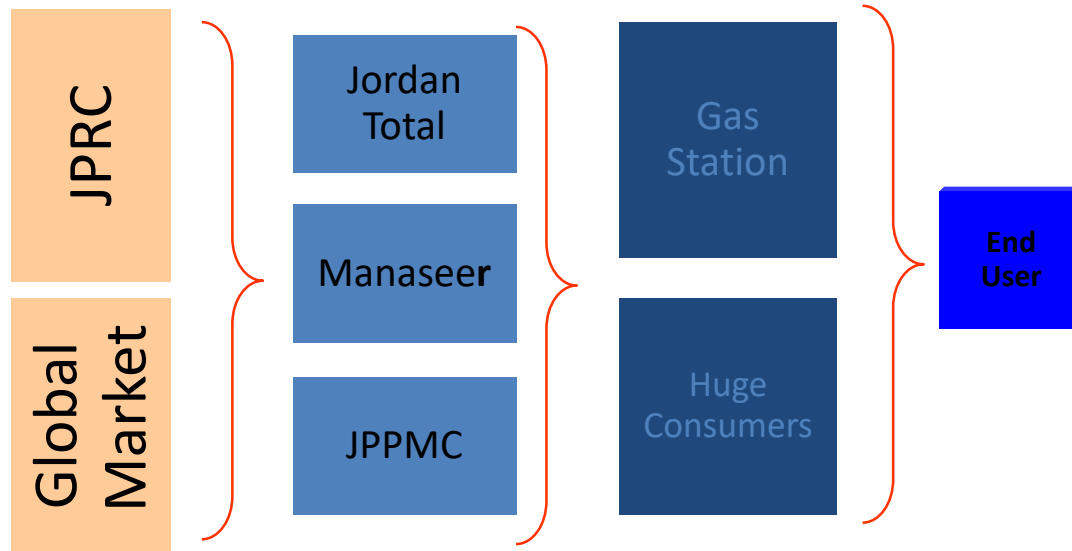
## Amman Strategic Reserve Terminal (250-300 thousand tons of light oil products & 10 thousand tons of LPG)

- Project Financing : Abu Dubai Fund
- Project Duration : 24 month
- Project Cost : 174 Million JD
- Completed : 81.8 %
- Expected completion : Jan 2017





## Establishment Structure of the Petroleum Product



- *GoJ granted licenses to three oil marketing companies (OMCs) for importing and trading of white products. One of these companies is a subsidiary of JPRC. The OMCs commenced operations on 1 May 2013.*

## **Alternatives for future supply of petroleum products in Jordan**

*Alternative 1: Support JPRC to implement the fourth expansion and upgrading project.*

*Alternative 2: Ceasing crude oil refining activities at the refinery and allow them to practice other activities.*

*Alternative 3: Opening the market for new refineries .*

*Alternative 4: The refinery will operate on a commercial basis after 1/5/2018 & the guarantee of profit for JPRC will be stopped.*

# *Natural Gas Sector*



## Jordan LNG Project



### The objectives of Jordan LNG project:

- Diversify the sources of natural gas.
- Meet the needs of power plants and Industries.
- Reduce the cost of used fuel in power plants.
- Compensate any shortage or interruption of natural gas supply from Egypt.



# Natural Gas Sector

## Floating Storage and Re-gasification Unit (FSRU)

- **MEMR** signed the FSRU Lease Agreement with **Golar LNG Ltd.** on 31 Jul 2013 which has been selected through a competitive tender process.
- The FSRU “**Golar Eskimo**” has been arrived to the LNG port in Aqaba on 25 May 2015 loading with LNG commissioning cargo that supplied from Qatar.
- The FSRU Lease Agreement has been transferred to **NEPCO** under the Novation Agreement signed on 25 Aug 2015.



The FSRU “Golar Eskimo”



# Natural Gas Sector

## LNG Supply

- The Sales and Purchase Agreement (SPA) has been signed with **Shell International** on 21 Jan 2015 to supply Jordan with 150 MMscf/d for (5) years.



- **NEPCO** was selected **shell International** in October 2015 as a preferred bidder through a competitive tender, to supply Jordan with 150 MMscf/d in Mid-term contract for the period of (2016-2017).
- Moreover, **NEPCO** has purchased LNG cargoes from spot market through a competitive tenders raised in 2015 & 2016.

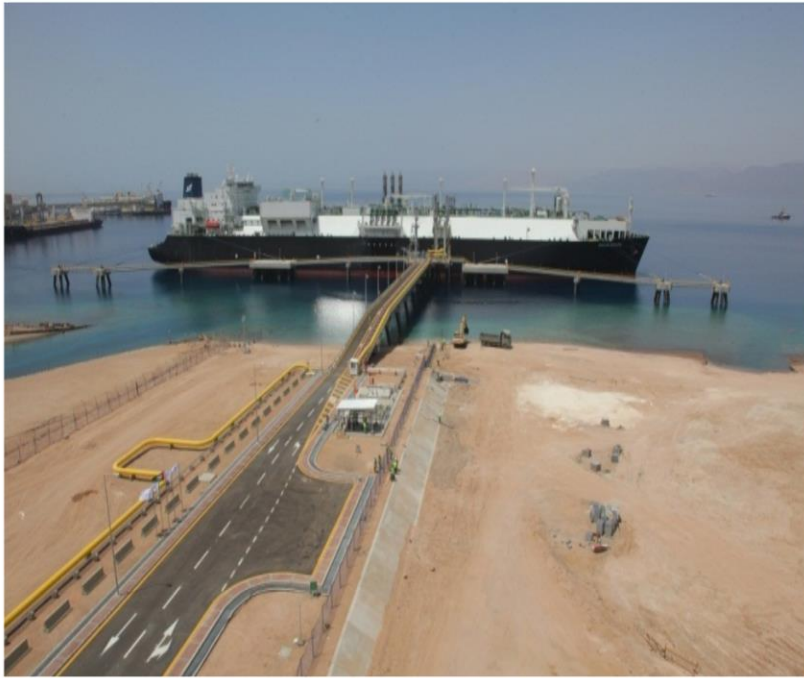


# Natural Gas Sector



## Gas Transportation:

- The Gas Transportation Agreement (GTA) and Tie-In Agreement were signed by **MEMR, NEPCO & Fajr Co.** on 6 Mar 2014.
- The LNG project in Aqaba has been connected with the Arab Gas Pipeline on 15 May 2015 to supply the power plants with its needs of natural gas.



The LNG Project connected with Arab Gas Pipeline



# Natural Gas Sector

## The Infrastructure for the project

- **The Aqaba Development Corporation (ADC)** has been assigned to construct the Jetty for LNG project in accordance to the cabinet decision no. 189 on 26 May 2012.
- **ADC** was signed EPC contract with **(BAM-MAG)** on 23 Dec 2013, and commenced the infrastructure on 21 Jan 2014.



LNG Aqaba Port



# Natural Gas Sector

## Infrastructure for LNG Port

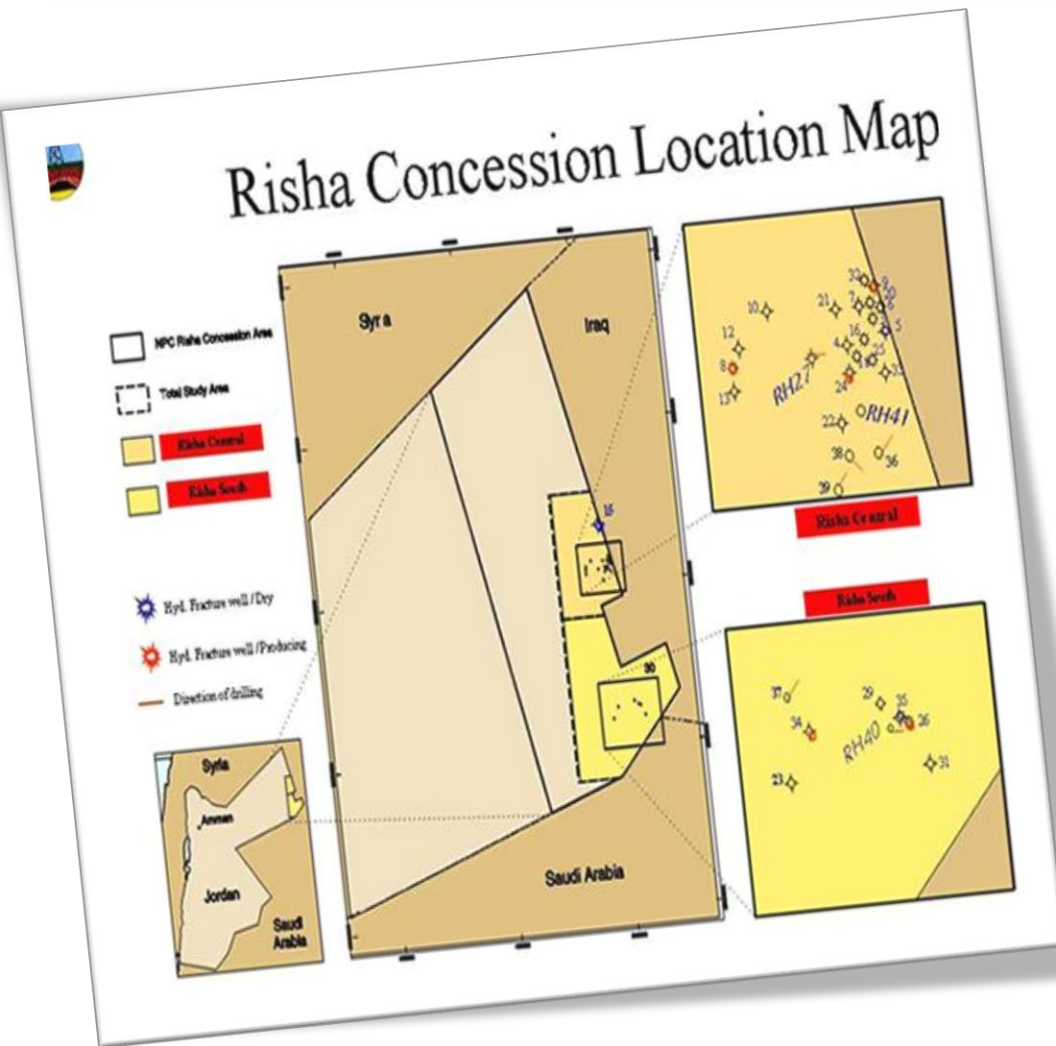
- The LNG port project in Aqaba has been funded from **The Kuwait Fund for Arab Economic Development (KFAED)** with (46.5) million JD. Also, it has been financing with additional worth (11.6) million JD from the treasury.
- The LNG port project has been executed with its facilities at Aqaba by **ADC**, and starting the commercial operation of the project on 12 Jul 2015.





# Natural Gas Sector

## Development of the Risha Gas Field



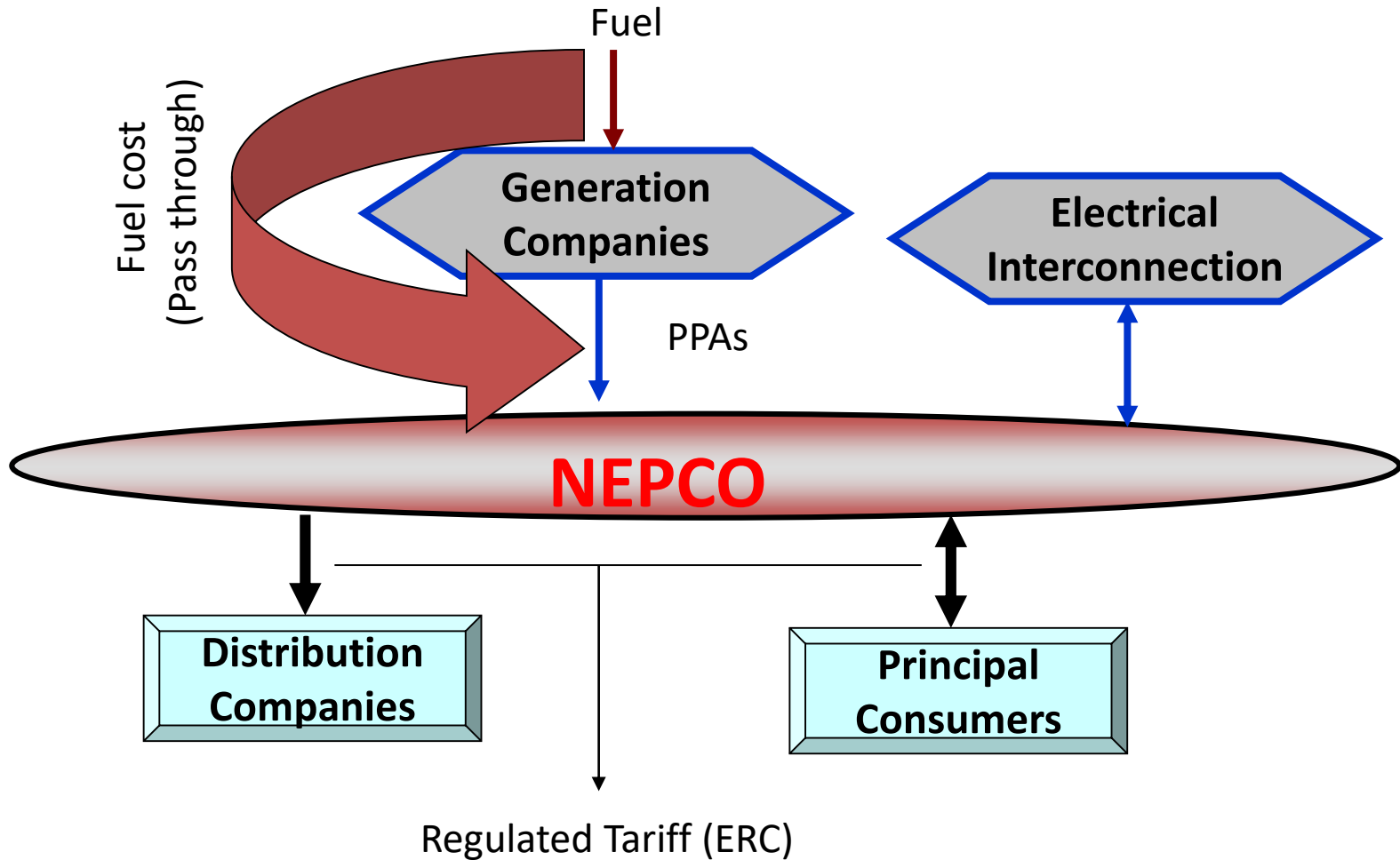
- The average of the natural gas production 11 MM scf/d in 2016.
- **The National Petroleum Company (NPC)** still Implements the plans to develop the Risha Field to raise its production of natural gas to 50 MMscf/d as a 1<sup>st</sup> stage.
- **The National Petroleum Company (NPC)** has signed a Production Sharing Agreement with the **IPG company** on 29 March 2016 to supplement and develop the company's facilities and its expansion plans in the concession area.



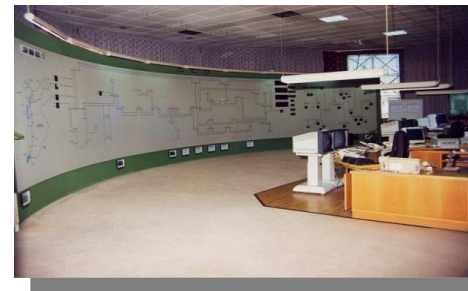
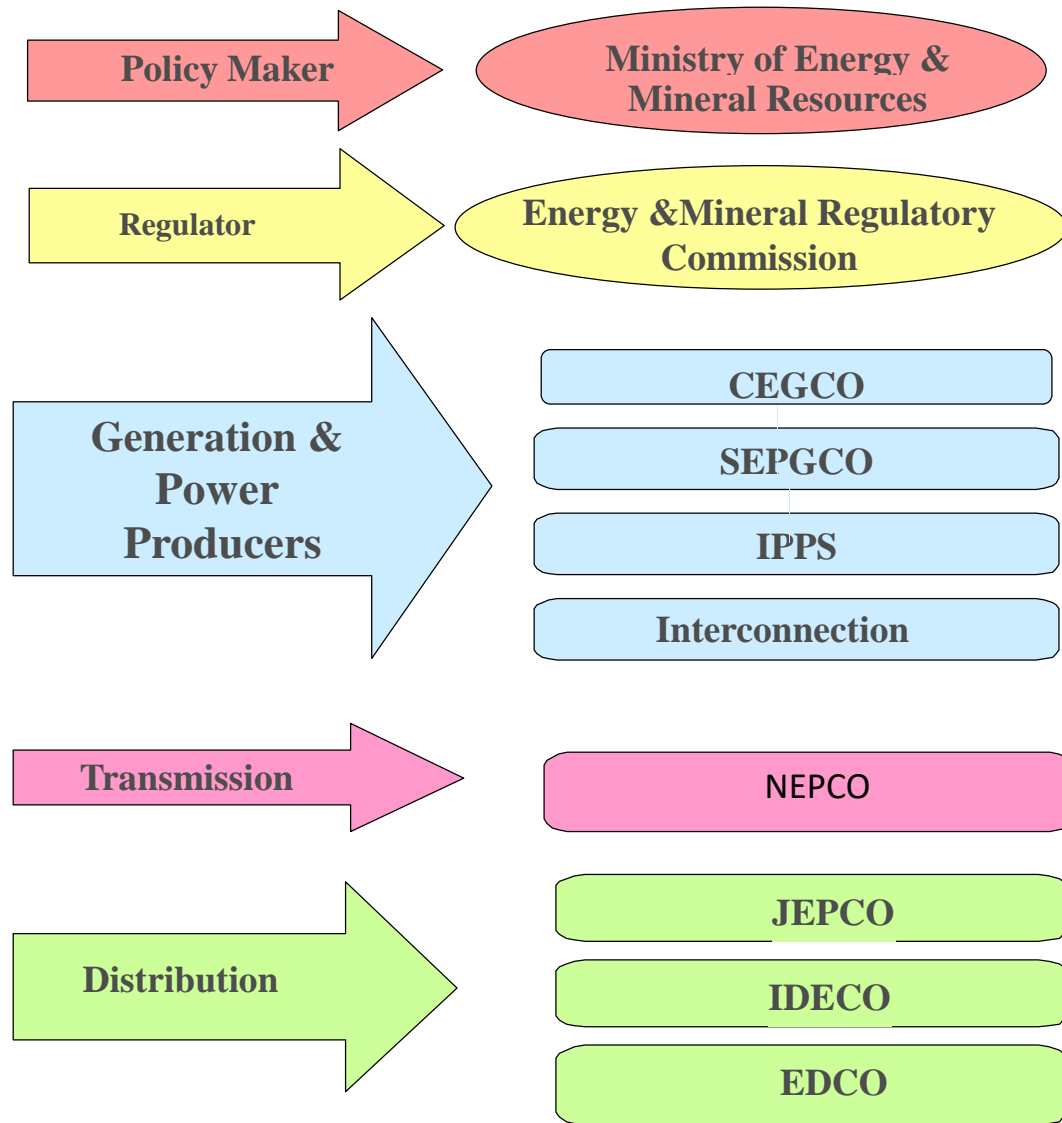
# Electricity sector



## Single Buyer Model



# Electricity sector





## Independent Power Projects (IPP):-

### **The First IPP Project (IPP1):**

- 370 MW Gas Turbine, Combined Cycle Technology.
- Implemented by a consortium of U.S.A. Company AES Corp. and Japanese company Mitsui.
- Cost : 300 million US dollars.
- The project was run commercially on 26/8/2009.



### **The Second IPP Project (IPP2):**

- 373 MW Gas Turbine, Combined Cycle Technology.
- Implemented by a consortium of Korean company KEPCO Corp. and Saudian Company Xenel.
- Cost: 470 million US dollars.
- The project was run commercially on 31/12/2011.

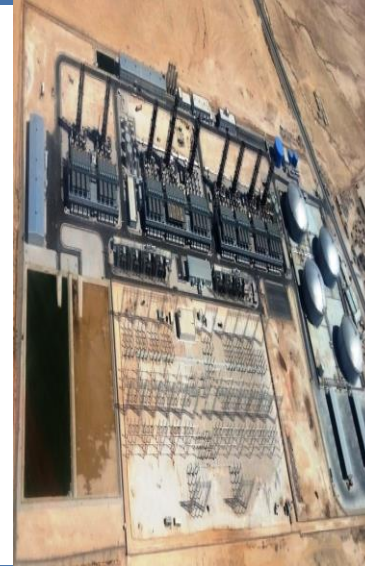




## Independent Power Projects (IPP)

### Third IPP Project (IPP3):

- 573 MW Diesel Engine Technology.
- Implemented by a consortium of the Korean Company KEPCO and Mitsubishi of Japan and Wartsela of Finland.
- Owned by a private Company (Amman Asia Electric Power Company).
- cost : 778 million US dollars.
- The project consists of 38 diesel engine with 15 MW for each drive (burn heavy fuel, diesel oil and natural gas).
- first phase of 240 MW, second phase of 210 MW ,third phase with 120 MW.
- Commercial operation : 23/10/2014



### Fourth IPP Project (IPP4):

- 240MW Diesel Engine Technology.
- Implemented by a consortium of U.S.A. Company AES Corp. and Japanese Company Mitsui.
- Owned by a private company (AES Leavent).
- Cost: 370 million US dollars.
- consists of 16 diesel engine with 15 MW for each drive (burn heavy fuel, diesel oil and natural gas).
- Commercial operation : 11/7/2014





*Hussein Thermal Power Plant which was fully decommissioned on 31 October 2015 will be repowered by construction a new facility combined cycle with capacity of 485 MW burning natural gas/ light fuel oil. This project will be developed by ACWA Power with total capacity cost of 470 Million US\$. The commercial operation is expected to be on the second half of 2018.*



## Jordan's Power System 2016

*Peak Load: 3165 MW*

*Generated Energy: 19172 Gwh*

*Imported Energy : 334 GWh*

*Exported Energy : 46 GWh*

*Available Capacity: 3620 MW*

*Losses Percentage : 13.77 %*

*Average consumption per capita : 1701 KWh*

*Electrification Rate: 100%*

*Number of Consumers : 2,061,000*

*Number of Employees in Electricity Companies : 8141*



## Jordan's Power System 2016

### *Electricity Consumed by sectors :*

<i>Household</i>	<b>45%</b>
<i>Industrial</i>	<b>23%</b>
<i>Commercial</i>	<b>15%</b>
<i>Water Pumping</i>	<b>15%</b>
<i>Street lighting</i>	<b>2%</b>



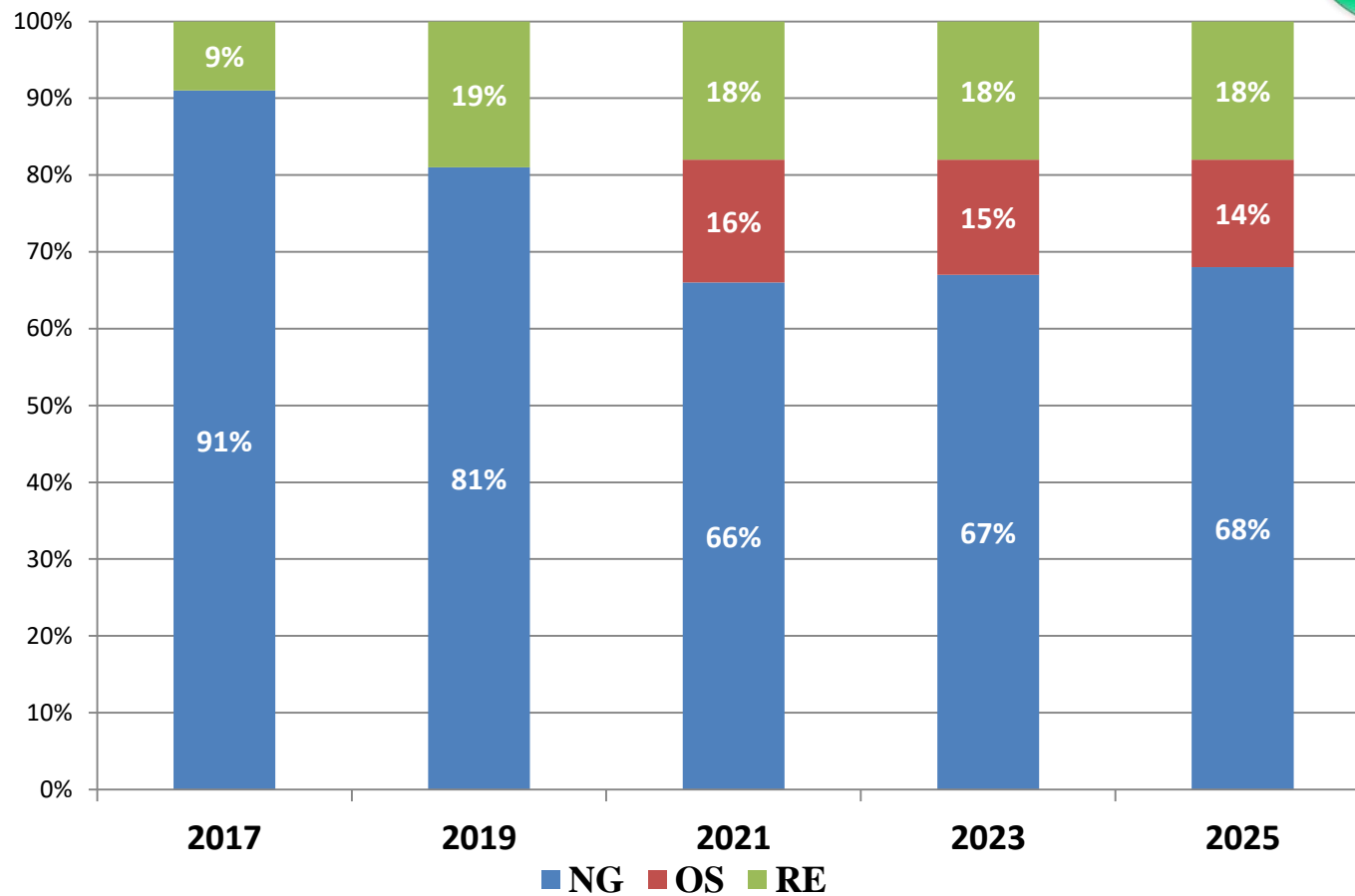


## Jordan's Power System 2016

### *Final Energy Consumption by sectors :*

<i>Household</i>	<i>20%</i>
<i>Industrial</i>	<i>16%</i>
<i>Transport</i>	<i>48%</i>
<i>Services &amp; others</i>	<i>16%</i>

# *Contribution of the Energy Resources in Electricity Generation 2017-2025*



# *Oil Shale Sector*

## **Oil Shale Investment Opportunities**

- *Jordan is blessed with huge Oil Shale Resources and ranked fourth in the world.*
- *Jordan has more than 70 billion tons of near surface reserves of more than 7 billion ton oil equivalent.*
- *The National Energy Strategy has included Oil Shale as an alternative energy source to contribute 14% to the energy mix by the Year 2020.*
- *Oil Shale can be exploited by different methods:*
  - *Direct combustion to produce electricity.*
  - *Surface retorting to produce oil.*
- *GOJ, and Eesti Energia agreed to develop, design, finance, construct, operate and maintain a 470 MW oil shale fired power plant together with the Mine and the Water Extraction Assets on a build, own and operate basis. The project achieved FC on 16/3/2017 . COD will be on 2020 .*



# *Rural Electrification*

*Rural Electrification project was established on 1977 .*

*Goals :*

- *Electrification the remote villages , rural communities and poor families.*
- *Development ,create jobs ,reduce poverty, unemployment and support agriculture.*

*The project was electrified during the period from 1999-2017 around 91976 houses with more than 515 thousand inhabitation with total cost around 146 US\$.*





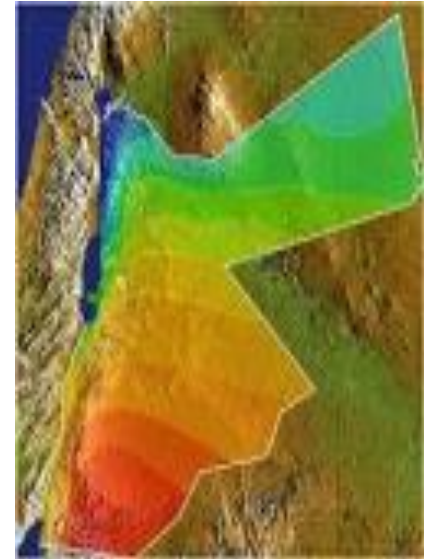
*Renewable Energy  
Program in Jordan*



# Renewable Energy Sector

*A target of 10% renewable energy input into the energy mix by 2020 is set in the National Energy Strategy, mainly aiming for about 800MW of Wind Energy and 800MW Solar Energy. To achieve this target:-*

- The Renewable Energy and Energy Efficiency Law was passed as a permanent Law in 2012 and amended in 2014.*
- This law allows investors to identify and develop grid-connected electricity production projects through the so called unsolicited or direct proposal submission.*
- The Bylaw of Direct Proposals of Renewable Energy Projects has been issued in Mid 2015.*
- A well-founded reference price list (ceiling prices) for different Renewable technologies was set by the EMRC.*
- Net- Metering for small RE Systems (Roof Tops) with Fixed Purchase Prices for Excess Power.*
- Tax Incentive regime, a By-Law was issued on Tax exemptions for RE and EE systems and Equipment.*
- Grid Expansion and Reinforcement Plans are ongoing (Green Corridor Project).*
- The Jordan Renewable Energy and Energy Efficiency Fund has been established, which aims to channel financial resources to that end.*



# *Renewable Energy Sector*

## Renewable Energy Development Schemes

*About 1335 MW of Wind and Solar PV projects are currently under development in Jordan, 400MW currently operational.*

*There is a policy of **4-tracks-approach** to develop renewables:*

- *Direct Proposals schemes*
- *Competitive Bidding process*
- *EPC Turn-Key projects*
- *Small Scale RE Schemes (Net Metering)*



# Renewable Energy Sector

## Renewable Energy Projects

- *About 1335 MW of Wind and Solar PV projects are currently under development in Jordan as follows:*

117 MW / JWPC Wind / Tafila  
Direct Proposal / Operational Sep 2015

5 MW / Azraq Solar PV Spanish Grant / EPC  
Operational Apr 2015

80 MW / Ma'an Wind / Gulf Grant / EPC  
- 66 MW Operational Sep 2016  
- 14 MW Under Construction

90 MW / Fujeij Wind/Direct Proposal  
Under Construction

330 MW / Wind  
Direct Proposals Round I  
Under Financial Close

10 MW / Philadelphia Solar PV Mafraq /  
Direct Proposal  
Operational Oct2015

200 MW / Solar PV  
Direct Proposals Round I  
Operational 2016

103 MW / Qweira Solar PV  
Gulf Grant / EPC / Under Construction

200 MW / Masdar Solar PV  
Governmental Initiative  
Under Financial Close

200 MW / Solar PV  
Direct Proposals Round II  
Under Financial Close

**1335  
MW**





# Renewable Energy Sector

## Operational Projects

### Direct Proposals Scheme/ Round 1:

#	Type	Capacity	Location	Project(s) Information & Current Status
1	Wind	117 MW	Tafila	<ul style="list-style-type: none"><li>• BOO Project for Jordan Wind Company (JWPC). VESTAS machines.</li><li>• Project Agreements along with the successful financial closure have been completed by the end of 2013</li><li>• COD by 16 September 2015.</li></ul>
2	PV Solar	10 MW	Mafraq	<ul style="list-style-type: none"><li>• BOO for the local PV manufacturing company “Philadelphia-Solar”.</li><li>• Connected to distribution company.</li><li>• COD by 22 October 2015.</li></ul>



# Renewable Energy Sector

## Operational Projects: Spanish Grants

#	Type	Capacity	Location	Project(s) Information & Current Status
3	PV Solar	5 MW	Azraq	<ul style="list-style-type: none"><li>• Debt Swap Grant &amp; Soft loan.</li><li>• EPC projects, awarded to Spanish companies</li><li>• operational since Mid April 2015</li></ul>

## Projects Under Construction: Gulf Grants

#	Type	Capacity	Location	Project(s) Information & Current Status
1	PV Solar	103 MW	Al Quweira/ Aqaba	<ul style="list-style-type: none"><li>• EPC Project</li><li>• Funded by Abu Dhabi Fund</li><li>• 15 Bidders were qualified</li><li>• 7 proposals were received by the deadline (26 July 2015)</li><li>• Negotiation with the 1<sup>st</sup> ranked bidder completed</li><li>• Project Agreement signed in December 2015</li><li>• To be operational by end of 2017</li></ul>



# Renewable Energy Sector

## Projects Under Construction: Gulf Grant

#	Type	Capacity	Location	Project(s) Information
2	Wind	80 MW	Maan	<ul style="list-style-type: none"> <li>Funded through a Grant from the “Kuwait Fund For Arab Economic Development”</li> <li>EPC project, awarded to the Spanish company “Elecnor”, using GAMESA machines.</li> <li>66 MW operational on Sep. 2016</li> <li>Complete operational by End of 2016</li> </ul>

## Projects Under Construction: Direct Proposals Scheme/ Round 1:

#	Type	Capacity	Location	Project(s) Information
3	Direct Proposal Round 1/ PV Solar	200 MW total	10 projects in Maan Area , 1 in Aqaba, 1 in Mafraq	<ul style="list-style-type: none"> <li>(12) PV solar proposals were received in March 2013 with total capacity of (200) MW.</li> <li>PPAs signed in March 2014.</li> <li>Reached Financial Close in May 2015</li> <li>Operational since Oct. 2016</li> </ul>
4	Wind	89 MW	Fujeij / Shobak	<ul style="list-style-type: none"> <li>On 30 November 2014, KEPCO submitted a direct proposal for this project</li> <li>PPA signed in December 2015.</li> <li>Operational in 2018</li> </ul>



# Renewable Energy Sector

## Projects Under Financial Closure: Direct Proposals Scheme/ Round 1:

#	Type	Capacity	Location	Project(s) Information
1	Direct Proposal Round 1/ Wind	330 MW	5 projects in the South	<ul style="list-style-type: none"> <li>Proposals have been submitted by 30/09/2014</li> <li>PPA signed for five projects.</li> <li>Operational in 2018-2019</li> </ul>

## Projects Under Financial Closure : Direct Proposals Scheme/ Round 2:

#	Type	Capacity	Location	Project(s) Information & Current Status
2	PV Solar	200 MW total (50 MW each)	North, East and Middle Jordan	<ul style="list-style-type: none"> <li>Encouraging prices were proposed.</li> <li>PPAs signed for 4 projects.</li> <li>To be operational by end of 2017.</li> </ul>

## Projects Under Financial Closure : Direct Proposals Scheme:

#	Type	Capacity	Location	Project(s) Information & Current Status
3	PV Solar	200 MW	Mowaqar	<ul style="list-style-type: none"> <li>Masdar Solar PV</li> <li>Governmental Initiative</li> <li>Operational in 2018</li> </ul>



# *Renewable Energy Sector*

## Small Scale RE Projects

- *Small scale consumers has been given the opportunity to generate their own electricity and sell the extra (if any) to the distribution utilities at a fixed tariff.*
- *This covers consumers from different sectors like residential, industrial, commercial, agricultural...etc.*
- *Currently about 72.5MW installed capacity(rooftop systems/Net Metering ),In addition to 10MW Through Wheeling System .*



# *Renewable Energy Sector*

## Motivation/Promotion for Renewable Energy Projects

- *Securing energy supply.*
- *Establishing new project companies to run and operate RE projects.*
- *More employment in RE sector (remote regions).*
- *Establishing new RE industries especially PV solar.*
- *Encouraging investors to maximize the local content in their projects (enjoy more incentives).*
- *More development in the less developed areas in Jordan in terms of socio-economic and employment aspects.*



# *Renewable Energy Sector*

## **Template Contractual Documents**

(Transparent Process – Minimum Risk- Less cost)

- *Jordan has laid down the necessary Policy and Regulatory framework for Renewable Energy, and is ready now to attract and receive commercial investments.*
- *Grid reinforcement (Green Corridor) is undergoing by NEPCO in order to install more RE Capacities*
- *Instructions for developing RE projects (IRPP)*
- *Prequalification requirements*
- *Power Purchase Agreement (PPA)*
- *Land Lease Agreement (LLA)*
- *Government Guarantee Agreement (GGA)*



# Tafila Wind Project (JWPC)





# *Tafila Wind Project (JWPC)*



# *Philadelphia 10 MW Solar PV Project at Mafraq*



# *Azraq Solar PV Projects*



# *Ma'an Wind Project*



# *Arabia One (Ennera) at Ma'an*



- *JREEEF was established by the RE&EEL in 2012 .*
- *Bylaw was issued in 2015 to ensures effective and transparent management of the fund*

## **Objectives**

- *Support investments in renewable energy resources to conserve and/or generate energy and in energy efficiency.*
- *Support stakeholders to implement renewable energy and energy efficiency*
- *Improve the availability of financing for renewable energy and energy efficiency projects.*
- *Cooperate with local and international financial institutions who are also supporting renewable energy and energy efficiency.*

## *Plan 2015-2018*

### *Install*

*45 thousand solar heaters*

*500 thousand LED lamps*

*50 thousand PV cells to households via EDC .*

### *Implemented projects :*

- Installation of 2,500 solar water heating units in cooperation with Jordan River Foundation of JDs 1.4 million local societies.*
- Household PV project: 2 KW capacity systems installed in 500 houses*
- 51 thousand LED lamps were distributed in Zaatari Syrian Refugees Camp and surrounding areas.*
- Launching installation 20,000 solar heaters in 2017*



## **Expected Impacts**

- *Reduced subsidy flows to low –usage households*
- *Reduced fuel imports and energy demand growth*
- *Growing stature of Jordan’s clean energy presence throughout the region*
- *Employment opportunities in the energy efficiency and renewable energy sectors*
- *Higher awareness of energy-saving opportunities and their importance to the Kingdom*





*Thank you*

