K.A.CARE overview

Saudi Arabia’s Sustainable Energy Program in a Nutshell
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Saudi Arabia will be witnessing a steady growth in population throughout the coming decades…

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>26.3</td>
</tr>
<tr>
<td>2010</td>
<td>27.1</td>
</tr>
<tr>
<td>2011</td>
<td>28</td>
</tr>
<tr>
<td>2012</td>
<td>28.9</td>
</tr>
<tr>
<td>2013</td>
<td>29</td>
</tr>
<tr>
<td>2014*</td>
<td>29.8</td>
</tr>
<tr>
<td>2015*</td>
<td>30.6</td>
</tr>
</tbody>
</table>

Source: EIU Report 2014

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Population pyramid

Source: CIA World Factbook 2014
…Accompanied with a rapid growth in the economy…

GDP growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Nominal GDP (SR bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1,609</td>
</tr>
<tr>
<td>2010</td>
<td>1,976</td>
</tr>
<tr>
<td>2011</td>
<td>2,511</td>
</tr>
<tr>
<td>2012</td>
<td>2,752</td>
</tr>
<tr>
<td>2013</td>
<td>2,826</td>
</tr>
<tr>
<td>2014*</td>
<td>2,864</td>
</tr>
<tr>
<td>2015*</td>
<td>3,051</td>
</tr>
</tbody>
</table>

Source: EIU Report 2014

GDP breakdown

- Mining, O&G, 51.6%
- Agriculture & Fishing, 2.1%
- Finance, Insurance, Real Estate, 10.6%
- Power & Utilities, 1.3%
- Construction, 5.5%
- Logistic & Communication, 5.5%
- Wholesale & Retail, 9.8%
- Community and other Services, 2.0%
- Manufacturing & Refining, 11.6%

Source: SAMA Annual Statistics Report 2013
... However, in order to meet the growing energy demands of the Kingdom, a sustainable energy program is required...

Total population growth and total energy demand

Domestic oil production and consumption (m barrels)

In a country where the residential sector makes up the majority of energy consumption...

Power generation and water desalination consume more than 50% of Saudi’s energy....

...Where residential consumes the majority of the utilities output

Source: Saudi Aramco June 2011
… A number of considerations have to be taken in order to identify the proper solution mechanisms that would develop a sustainable energy sector for the Kingdom…

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Mechanisms to develop a sustainable energy sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Steady population and economic growth</td>
<td>▪ The establishment of an integrated energy economic system in the Kingdom to generate electricity and desalinate water by building multi technology power plants and creating the required industrial and service based sectors to support it</td>
</tr>
<tr>
<td>▪ Increasing demand on electricity and desalinated water</td>
<td>▪ Enabling the growth of this economic sector through the support of innovation and research &amp; development and also by the development of the required human capital</td>
</tr>
<tr>
<td>▪ Maintaining the global energy market’s stability on the long term</td>
<td></td>
</tr>
<tr>
<td>▪ Guaranteeing a reliable source of income to the future generations</td>
<td></td>
</tr>
</tbody>
</table>
In 2010 a Royal decree was issued to launch King Abdullah City for Atomic and Renewable Energy (K.A.CARE), Where the Program’s parameters were carefully examined...
… Which identified sustainable power generation as a feasible alternative…
…To generate significant oil savings …

Yearly barrels of oil equivalent saved (‘000 Mboe)

![Yearly barrels of oil equivalent saved](chart)

Total barrels of oil equivalent saved (billion barrels)

![Total barrels of oil equivalent saved](chart)

Conversion rate:

1 TWh = 1 / (45% x 1.7) = 1.3 MM boe

Electricity production (in TWh)

<table>
<thead>
<tr>
<th>Nuclear program</th>
<th>RES program</th>
<th>Total Alternative energies</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,382</td>
<td>4,920</td>
<td>13,302</td>
</tr>
</tbody>
</table>

Source: K.A.CARE analysis
…And also have a wider economic impact on GDP and employment…

1. KSA gross domestic product projections are based on IMF forecasts; alternative energy impact is measured as yearly contribution to business-as-usual KSA GDP
2. Program lifecycle calculated as the time between the start of the first construction and the last decommissioning year
Source: International Monetary Fund; Oliver Wyman analysis
… Through the proper localization strategy of nuclear energy components…

Nuclear energy components targeted for localization (% of capex and opex)

1. Based on average score from market, financial, KSA impact dimensions; main drivers include NPV, IRR and payback calculations.
2. Based on average score from technology and KSA gaps dimensions; main driver is feasibility for KSA to compete globally.

Note: NNG = Non nuclear grade

Source: Oliver Wyman analysis
…as well as the localization of renewable energy components…

Renewable energy components targeted for localization (% of capex and opex)
…in a time frame that would allow the Kingdom to capture maximum value of the sustainable program
What are the initiatives KACARE is taking to achieve its targets?

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The K.A.CARE strategy covers a number of initiatives to develop sustainable power generation...

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear program</td>
<td>K.A.CARE’s strategy is to develop a range of nuclear power plant projects to sustain the base load demand. The first step is to prepare the requirements for first wave of NPPs.</td>
</tr>
<tr>
<td>Renewable energy program</td>
<td>In order to ensure the optimum efficiency in the development of the sector, a framework for energy generation and procurement is being established to allow for the most competitive renewable generation market.</td>
</tr>
<tr>
<td>Atomic regulatory framework</td>
<td>To ensure the safety and security of the nuclear power plants, an independent regulator, inline with international guidance, is being setup currently within K.A.CARE.</td>
</tr>
<tr>
<td>K.A.CARE City</td>
<td>A physical city is being developed to host the National Laboratories and the supporting cluster of sustainable energy components in collaboration with the private sector to ensure proper tenant attraction and efficiency of assets developed.</td>
</tr>
<tr>
<td>Research, Development and Innovation</td>
<td>The National Laboratories will be the anchor of the physical city micro-economy and the driver of innovative solutions towards the technologies associated with sustainable energy. It will also enhance the value chain through the commercialization of patents generated by the RDI.</td>
</tr>
</tbody>
</table>

All initiatives are developed on a sustainable economic framework that ensures efficiency and maximize impact on the energy value chain in Saudi Arabia
… All initiatives are developed to maximize public/private participation and ensure a steady growth of Saudi Arabia’s economy…

In order to ensure the sustainability of the energy program, K.A.CARE has:

- Established a framework for competitive procurement to for the renewable energy sector.

- Identified localization opportunities within the value chain of the nuclear and renewable energy industry.

- Provide a workforce development strategy through the Human Capacity Building Program that defines the required skills, competencies, and behaviors by sector and over time.
... In line with the Saudi Arabia’s energy demand projections
Beginning with the Nuclear Energy Program...

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Through careful study of the Nuclear Program requirements...

K.A.CARE is preparing for the safe, secure and efficient introduction of Nuclear Power through:

1. Preparation of the supporting infrastructure

2. Preparation of the internal requirements
The introduction of Nuclear Power is a complex procedure and as such K.A.CARE has been focusing on the supporting infrastructure necessary for its safe introduction.

- **Site preparation**
  - Understanding the characterization for each proposed site

- **Grid Impact**
  - Identifying changes to the grid necessary to accommodate NPP

- **Local Supply Chain**
  - A critical tenant of K.A.CARE’s strategy is to ensure localisation wherever possible and practical

- **Bilateral Agreements**
  - The Nuclear industry is heavily regulated worldwide and several Bilateral agreements need to be in place to facilitate its introduction
... as well as the preparation of the internal requirements

K.A.CARE has also been preparing the internal requirements that must be developed before engaging with the market to construct and operate Nuclear Power Plants.

Diagram:

- Internal Requirements
  - Owner Requirements Documentation
  - Technology Selection Criteria
  - Procurement Approach and Strategy

Human Capability Development
An independent atomic regulator is required…

An independent atomic regulator

- Laws
- Regulations
- Regulatory Guides

Revision & Validation Against IAEA Requirements
Completion, Finalization Revision & Validation
Completion Revision & Validation

Promulgation & Empowerment of regulator
Publishing by regulator
Publishing by regulator
The framework outlined:

- Regulatory approach
- Roles of Saudi Arabian atomic regulatory authority
- Saudi Arabian atomic regulatory authority divisional functions
- Required skills and competencies
- Saudi Arabian atomic regulatory authority preparatory tasks
- Approach to licensing nuclear facilities
- Partner regulators, and technical and legal support
In parallel, KACARE will be launching the Renewable Energy Program …

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… Built around a comprehensive Renewable Energy Framework …

**Procurement Process**
- Legal and Regulatory Structure
- Procurement Models
- Financial Models
- Procurement schedule & milestones
- Stakeholder analysis & integration plan
- Bid documents, manuals, application forms, & other templates

**Supporting Tools**
- Off-taker
- Clear Procurement & Communication channel
- Facilitation Services
- Other requirements

**Renewable Energy Framework**

**Sector Leverage Strategy**
- Localization
- Job creation
- Training
- Research, Development & Innovation
... That capitalizes on a sector leveraging strategy...

- The sector leveraging strategy is to deliver on the broader macroeconomic & social goals under K.A.CARE mandate
- This strategy is meant to leverage the Kingdom’s sustainable energy spend in a balanced manner to fulfill national objectives

- Localization
- Job creation
- Research, Development & Innovation
- Training
... and lays out a clear and transparent procurement process...

**Eligible Technologies**

- Solar PV
- CSP
- Wind
- Geothermal
- Waste to Energy

**Procurement Models**

- IPP
- EPC

**Procurement rounds**

Multiple procurement “rounds” conducted every 1 to 2 year periods, where K.A.CARE will identify the targets, capacities & eligible technologies for each round

**Rationale for multiple procurement rounds**

K.A.CARE will launch the Kingdom’s RE Procurement plan over several “rounds”, to enable the achievement of the following:

- Maintain consistency with K.A.CARE energy targets
- Allow for all RE related stakeholders to build their expertise required to support the program’s implementation
- To obtain lessons learned from each round & apply them to the proceeding rounds
- Allow the gradual growth of the local RE industry & international community to support the program’s implementation
- Allows validating the existing globally benchmarked prices across multiple technologies while applying these prices to the local market context

**Supporting Tools**

- Off-taker
- Single Procurement & Communication channel
- Facilitation Services
- Other requirements
… allowing for multiple technologies to be part of the energy mix to ensure optimum effectiveness and efficiency

Sustainable Energy Developers

(Facilitation)

Contract

(Procurement Leveraging Strategy)

Main Offtaker

Negotiated Prices

K.A.CARE
A physical city is being constructed that would bring together the seed cluster of the sustainable energy program…

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The City will play a central role in achieving K.A.CARE’s objectives by establishing a defined center for this new industry. This is essential for Saudi Arabia in order to develop the local value chain and human capacity required to serve the sector.

**Innovation and Capability Building**
- An innovation ecosystem mixing entrepreneurs and researchers that allows to build capabilities and enables research advancements in target sectors, fostering the development of a knowledge-based economy.

**Companies and Employment**
- A home for companies spurring the development of atomic and renewable energy sectors in the Saudi Arabia, promoting energy efficiency and resource sustainability, and contributing to the sustainable development of the country.

**Replicable Sustainable Living**
- A model to demonstrate an improved quality of life and sustainable living that can be replicated across Saudi Arabia.

**Energy Generation**
- A place to kick-start the deployment of renewable energy generation and to pilot innovations under local conditions.
… Through creating a cluster of sustainable energy research, development, and industrial development, offering a comprehensive lifestyle to its tenants…

Key city components

**R&D and Innovation Hub**
- National Labs to drive research advancement in core sectors
- Development of capabilities through graduate and technical programs

**Companies Cluster**
- State-of-the-art business facilities to host companies focused on the atomic, renewable energy, energy efficiency and resource sustainability sectors

**Residential Housing**
- Housing offering mix that caters to all income levels and preferences
- Sustainable building design and efficient energy systems to demonstrate improved sustainability

**Amenities**
- Full set of social and visitor amenities enabling an improved quality of life and economic development

**Production Engine**
- Platform for the deployment of pilots of innovative renewable energy technologies
- Light manufacturing with strong R&D ties

**Enabling Infrastructure**
- State-of-art infrastructure with the deployment of innovative and sustainable technologies (e.g., district cooling, smart canopy, transportation)
In a time line that is consistent with the Industry’s development...

<table>
<thead>
<tr>
<th></th>
<th>Phase 1A</th>
<th>Phase 1B</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Breaking</td>
<td>Yr 0</td>
<td>Yr 3</td>
<td>Yr 4</td>
</tr>
<tr>
<td>Completion Infrastructure</td>
<td>Yr 3</td>
<td>Yr 6</td>
<td>Yr 7</td>
</tr>
<tr>
<td>Start Occupancy</td>
<td>Yr 4</td>
<td>Yr 7</td>
<td>Yr 8</td>
</tr>
<tr>
<td>Completion</td>
<td>Yr 6</td>
<td>Yr 9</td>
<td>Yr 10</td>
</tr>
</tbody>
</table>
... Anchored by the National Laboratories of Research & Development of the different technologies of sustainable energy...

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… Which will play a pivotal role in the advancement of sustainable energy technologies…
…in an effort to position Saudi Arabia as a global leader of innovation in sustainable energy
For More Information, Please Visit our Website

WWW.KACARE.GOV.SA