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Envisioning participatory governance of energy transition in Jordan

Jordan is entering a critical phase in terms of planning its future electricity supply architecture. The results of a four-year collaborative study by researchers from IIASA, Jordan, and Sweden, has led to the development of several recommendations for the Jordanian energy-policy process.

- The deployment of new infrastructure projects in Jordan, whether it is renewable energies, oil shale, or nuclear, will involve a large-scale deployment of technology, which will ultimately transform the country's energy system and could even lead to societal transformation.
- The study examined the views and discourses of different stakeholder groups about the social, environmental, and economic future of Jordan in the context of risks, benefits, and costs associated with different electricity generation technologies that are currently being considered.
- The recommendations address national energy planning goals but also requirements on social and environmental sustainability at the local level.
- It is recommended that a favorable environment be created for investment into renewable energy sources and that efforts are made to involve not only stakeholders, but also members of local communities in decision-making processes on energy transition. The level of transparency of these processes and the criteria relevant to decision-making processes should also be increased.
- Energy should become an essential component of economic growth in Jordan and the reduction of energy import dependence should become an essential component of economic growth and reduction of debts.
- Green energy growth should contribute to the utilization of locally available energy resources and create impulse for economic development. This should be combined with further development of manufacturing capacities, as well as technology and knowledge transfer.
- Energy transition should be seen as an opportunity to reduce impacts from electricity generation on the environment.
- Holistic solutions are needed to address issues such as water scarcity and pressure on local water and land resources from the further deployment of electricity generation and transmission infrastructure.

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Introduction

The Hashemite Kingdom of Jordan has set targets for climate change mitigation and energy security policies. These include satisfying growing Jordanian energy demand with sustainable energy supply, while reducing dependency on energy imports that are volatile and prone to political risks.

Jordan currently has a number of choices in terms of satisfying growing energy demand as it has abundant renewable energy sources. There are also plans for the deployment of new resources like oil shale or nuclear. All of these options require careful consideration of all possible impacts, consequences, benefits, and risks from every technology.

The country is entering a critical phase for the creation of the backbone of its future electricity supply architecture. The deployment of new infrastructure projects–whether it is renewable energies, oil shale, or nuclear–will involve a large-scale deployment of technology, which will ultimately transform the country's energy system. Such a large-scale transformation process could even lead to societal transformation, where new power relations in terms of generation and redistribution of energy will be defined.

Transformation processes that manage to include the views, visions, and opinions of different stakeholder groups tend to be more sustainable, less conflict prone, and better balanced, although they sometimes require more time for stakeholder engagement.

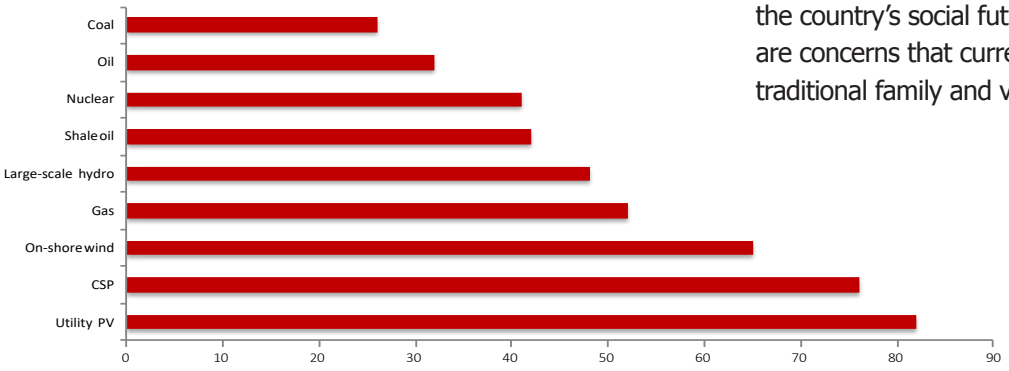

Figure 1: Individual ranking of technologies from the least- to the most favorable

Getting a balanced view

The study aimed to gain a better understanding of the visions and views of different stakeholder groups on electricity generation technologies currently being considered in Jordan. The researchers evaluated nine technologies–solar power, large scale photovoltaics (PV), wind, large-scale hydro, oil, oil shale, gas, coal, and nuclear–against a set of eleven criteria.

They engaged with stakeholders by means of various workshops, dialogues, and surveys. These dialogues included different groups, such as policymakers, members of the financing community, NGOs, local communities, young people, and academics. Figure 1 shows how respondents ranked possible technologies in a survey. Renewable energy sources such as utility PV, concentrated solar power (CSP), and onshore wind were ranked as the most favorable technologies, while nuclear, oil, and coal emerged as the least favorable.

Through multi-criteria decision-making analysis, this work brought the views of stakeholders together and in the process identified possible compromise solutions. Following the development process, the criteria were ranked according to their importance to stakeholders and relative importance in relation to other criteria.

The results indicate that the majority of stakeholder groups perceive the social, environmental, and economic future of Jordan as positive. Expectations mainly concerned the improvement of conditions for doing business and the creation of drivers and points of growth for Jordan in new industries, such as the green economy. Perceptions about the country's social future were more polarized, as there are concerns that current changes in society will destroy traditional family and value systems.

In terms of the environment, there are expectations around the transfer of environmentally friendly technologies, while the most frequently expressed concern was water scarcity and the further dynamics of this problem.

At the technology level, stakeholders pointed out concerns about certain technologies, as well as aspirations for benefits. Benefits of utility PV for instance, were connected with climate change mitigation and low cost electricity generation. At the same time, concerns were raised about intermittency risks, volatility, and the availability of storage.

The ranking of the different criteria showed that the majority of stakeholders perceived electricity system costs as the most important criteria. The safety of electricity generation was also seen as important and had a high priority for decision-makers, finance and investment stakeholders, and local communities. The majority of stakeholders saw domestic value chain integration as the least important criteria (Figure 2).

Group	Most important criteria	Least important criteria
Civil society and NGOs	Electricity system costs	Non-emission hazardous waste and domestic value chain integration
Finance and investment	Global warming potential, safety and electricity system costs	Domestic value chain integration
Academia	Electricity system costs	Global warming potential, non-emission hazardous waste and pressure on local land resources
Future decision makers	Safety and electricity system costs	Domestic value chain integration and non-emission hazardous waste
Local communities	Global warming potential, safety and electricity system cost	Domestic value chain integration
Decision-makers	Safety	Pressure on local water resources and non-emission hazardous waste

Figure 2: Ranking of criteria within six stakeholders groups

Towards a sustainable Jordanian energy sector

Three major recommendations for the Jordanian energy-policy process were developed from the results of this study.

The first is that a favorable environment should be created for investment into renewable energy sources. This should be accompanied by a reduction of investment costs and guarantees of positive socioeconomic impacts from investment into renewable energy sources for local communities. The ranking of criteria, along with stakeholder preferences, showed that the discourse about energy transition in Jordan is strongly dominated by economic aspirations and energy security concerns.

The second recommendation concerns the provision of further opportunities for participation in decision-making processes. Discussions about procedural and output justice revealed that the majority of participants felt that infrastructure projects should be used as an opportunity to make communities a better place to live rather than merely compensating them for risks to their environment and health. The view was also expressed that further efforts were needed to involve not only stakeholders, but also members of local communities in decision-making processes on energy transition. This could involve discussions about the choice of technology, as well as about possible locations for power stations and transmission infrastructure. In addition, awareness should be raised about opportunities for participation in decision-making processes, and the level of transparency in decision-making processes increased.

Third, it is recommended that conditions be established for social, environmental, and economically sustainable energy transition. Different opinions on the future of Jordan showed that Jordanian stakeholders have both hopes and concerns about the economic, social, and environmental future of the country. In terms of economic development, Jordanians want Jordan to become an economic leader in the region, as it is an attractive investment destination and has a stable and resilient economy. Energy should be seen as an essential component of this economic growth, while the reduction of energy import dependence should be a key component of economic growth and reduction of debts. The green economy could also contribute to the utilization of locally available energy resources and create impulse for economic development in the region. This should be combined with further development of manufacturing capacity, technology, and knowledge transfer.

In terms of the environment, holistic solutions are needed to address issues of water scarcity and pressure on local water and land resources from the further deployment of electricity generation and transmission infrastructure.

Jordan's energy transition should be seen as an opportunity to reduce impacts from electricity generation on the environment and change human behavior to reduce pressure on the environment due to the increased level of awareness and availability of new technologies.

Nine technologies were evaluated against a set of eleven criteria

Criteria 01: Use of domestic energy sources. This included the current and future domestic potential of each technology's energy carrier to decrease energy import dependence.

Criteria 02: Global warming potential based on the total lifecycle greenhouse gas emissions per generated kilowatt-hour (kWh).

Criteria 03: Potential for domestic value chain integration based on existing capacity to integrate domestic industries for the manufacturing of components for energy generation installations, including all project cycles such as construction, operation, and maintenance.

Criteria 04: Technology and knowledge transfer based on the effectiveness of educational policies to foster the transfer of knowledge and industrial policies to foster horizontal technology transfer.

Criteria 05: Electricity system cost, which included generation costs, as well as additional integration costs.

Criteria 06: Job creation, including the average number of jobs in person-years per megawatt (MW) during the construction period, as well as the average number of permanent jobs in operation and management.

Criteria 07: Pressure on local land resources, including land requirements in terms of hectare (ha)/MW, as well as the land value based on the suitability of land to livelihood and other services of the community.

Criteria 08: Pressure on local water resources, which included the average operational water consumption of each technology as well as the average water risk at the project site.

Criteria 09: Occurrence and manageability of non-emission hazardous waste as expressed in the disposal of non-emission hazardous waste, as well as in potential national capabilities to manage the disposal of the respective types of non-emission hazardous waste.

Criteria 10: Local air pollution and health expressed in volumes of air pollutants per MWh during the operation of power plants, and premature deaths per MWh of electricity produced.

Criteria 11: Safety based on historical immediate fatalities per MWh from severe accidents during the transport and storage of resources, and during the operation of power stations. This criterion also includes the potential of disaster risk reduction authorities to manage and mitigate risk.

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