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Applied Systems Analysis

International Water Energy Food and Environment (WEFE) NEXUS Governance Examples and Lessons Learned

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Methodology

Aim: to identify good practices in water energy food and environment nexus which are suitable for conditions of Jordan

- Development of criteria for countries selection
- Case study of three countries
- Stakeholders interviews

Process of Country Selection Criteria

Process



- 1- Project team drafted an initial set of criteria and potential countries to explore
- 2- Consultation period with stakeholders by email and virtual interviews
- 3- Feedback was collected, analyzed and supported the development of new updated criteria

Consulted Stakeholders' Groups

- Ministry of Energy and Mineral Resources
- Ministry of Water and Irrigation
- Water Authority of Jordan
- Jordan Valley Authority
- Energy & Minerals Regulatory Commission
- EDAMA Association
- GIZ-Jordan
- German Development Bank
- World Bank
- Friedrich-Ebert-Stiftung Jordan & Iraq

Country Selection Criteria

Water and Energy Resource Criteria (availability, dependence, losses, infrastructure services)	<ol style="list-style-type: none"> 1. Water scarcity 2. Energy dependence 3. Water per capita 4. Energy per capita 5. Non-revenue water 6. Water losses 	<ol style="list-style-type: none"> 7. Energy losses 8. Climate (dry, hot with large number of sunny days) 9. Infrastructural development 10. Services coverage (%) 11. Desalination plans 12. Renewable energy plans
Economic/Financial Criteria	<ol style="list-style-type: none"> 1. Level of development 2. Sources of financing 3. Energy costs of the water sector 	<ol style="list-style-type: none"> 4. Electricity tariffs differentiated by time of use (TOU) 5. Water cost
Governance Criteria	<ol style="list-style-type: none"> 1. Relevance and how topical for the country is WEN/ existing WEN sector coupling and planning 2. Water and Energy governance structure 3. Role of central government agencies versus basin organizations 4. Operators of energy and water systems (centralized vs. decentralized) 	
Regional Cooperation Criteria	<ol style="list-style-type: none"> 1. Neighboring countries' cooperation in water and energy 	
Food/Agricultural related Criteria	<ol style="list-style-type: none"> 1. Agriculture needs for water 2. Agriculture needs for energy 	

- General agreement that Jordan has specific conditions which are different to another country or region
- Each country has its unique context in terms of water and energy sources availability, geography, population density and culture, among others

Interviewed Stakeholders

- **In-depth qualitative interviews** in August-September with key stakeholders from WEFE sectors
- **Questions on topics including:**
 - *Sectoral challenges*
 - *Barriers for cross-sector cooperation*
 - *Success stories*
 - *Suggestions for improved governance structures and mechanisms*
 - *Decision making challenges*

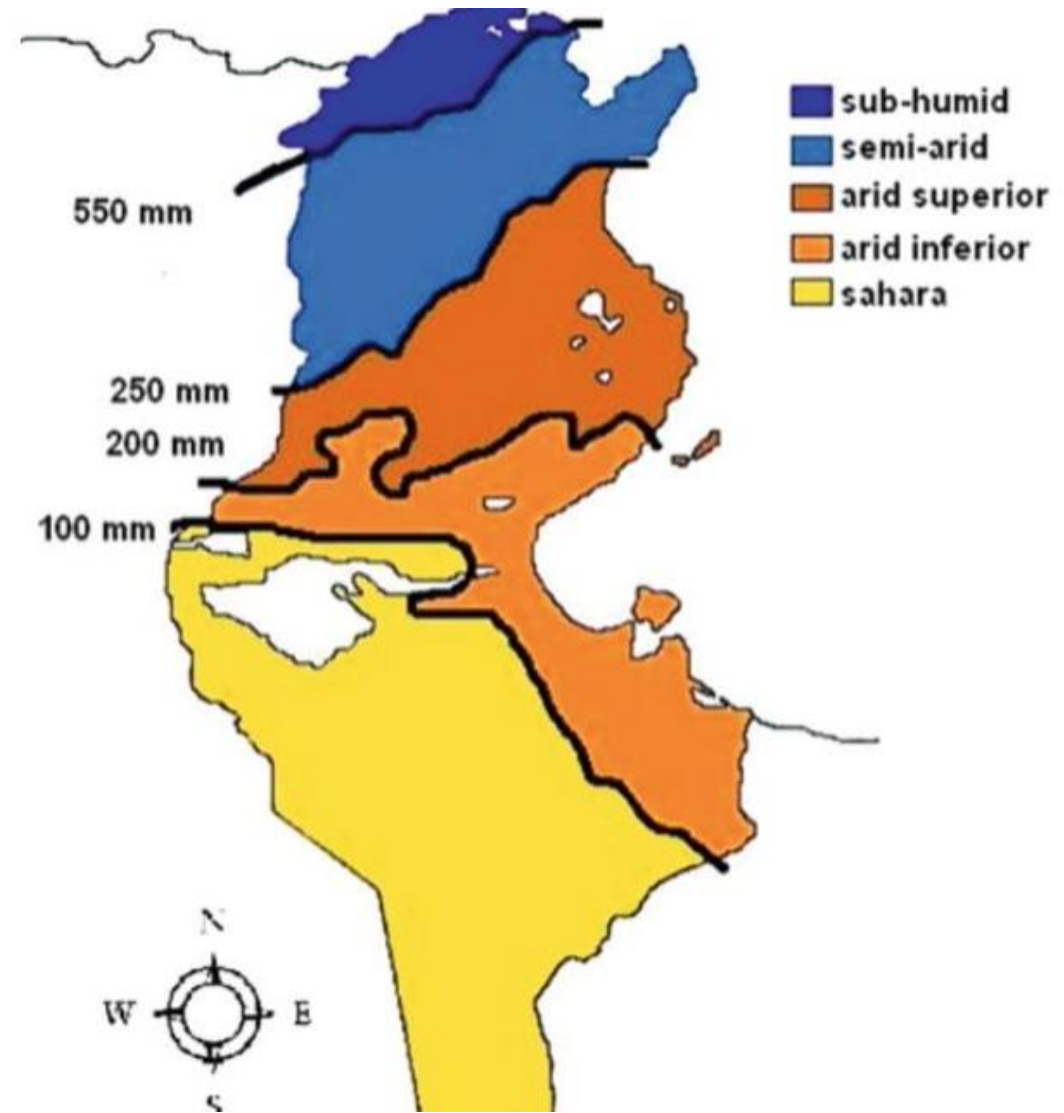
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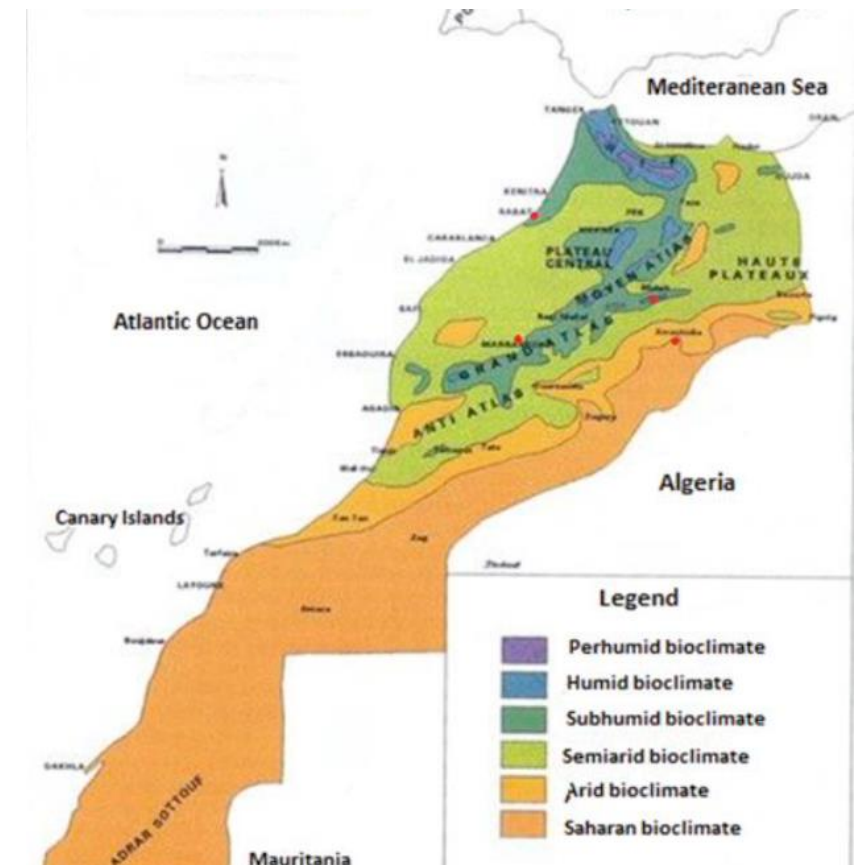
Tunisia

- Highly water scarce
- Overexploitation of groundwater resources
- Uneven water availability in different geographic regions
- Water supply is intermittent, and rural areas populations have less access to safely managed water sources
- Growing demand for water and energy
- Intensive water conveyance projects over long distances
- High levels of non-revenue water stemming from aging water infrastructure
- Limited renewable water resources
- High levels of non-revenue water stemming from aging water infrastructure
- Agriculture sector in both countries makes up the majority of water demand
- Desertification and overgrazing



Morocco

- Water availability differs greatly geographically and annually
- Majority of Morocco's water resources come from surface water, with only 20% coming from groundwater
- Groundwater supplies 40% of the irrigated area in Morocco and provides drinking water to most of the rural population
- Agriculture consumes 87% of Morocco's water
- Phosphate production is potentially a large consumer
- Water losses due to aging water storage infrastructure although Jordan is mostly concerned about aging distribution infrastructure, while Morocco is concerned about aging dams and inefficient irrigation conveyance
- Morocco focused on increasing water storage capacity through dams and storage infrastructure
- Morocco's water strategy has focused on capturing domestic surface water resources and providing water for agriculture and other industries
- Morocco governs the water sector with a far more decentralized manner compared to Jordan, with much of the responsibility at the regional level

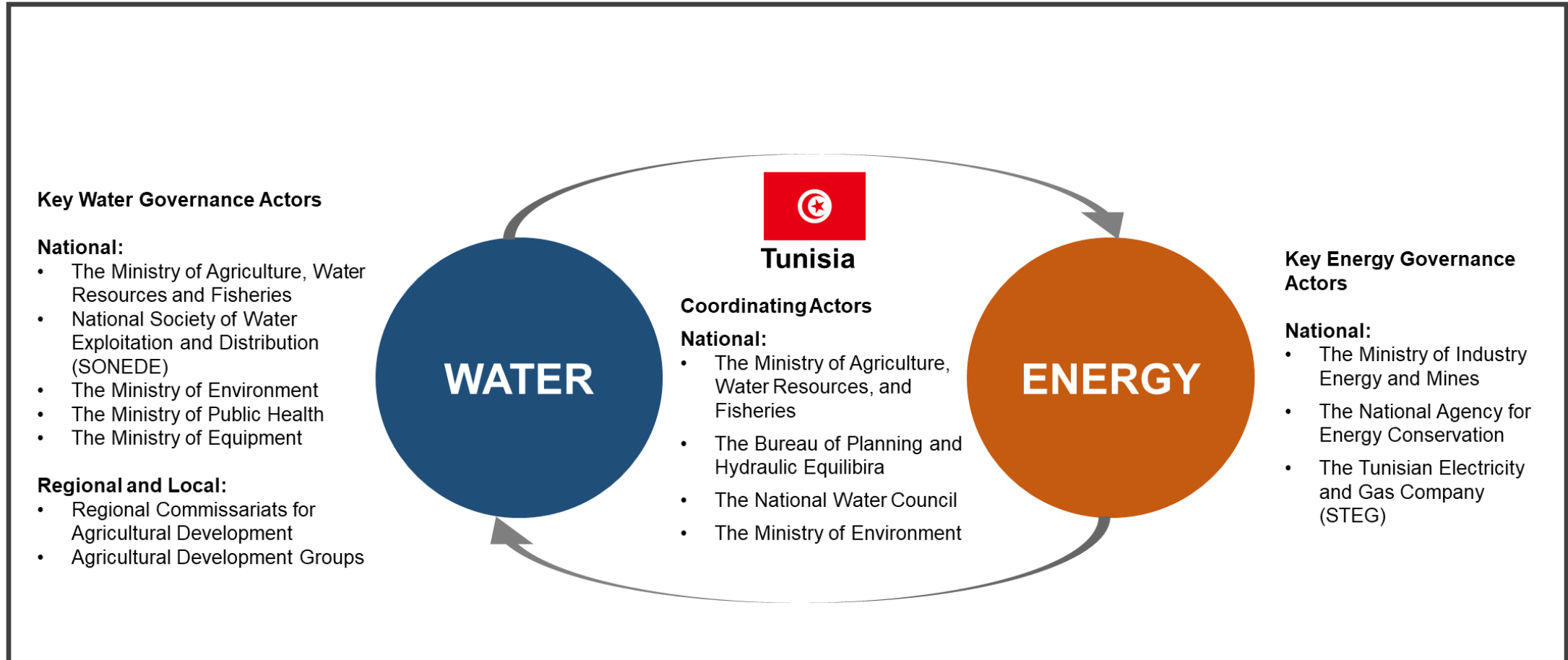


Singapore

- Heavy reliance on rainwater resulted in inconsistent water provision
- Demand for water is expected to double by 2060
- Singapore does not have an agriculture industry, so most of its water resources go towards industrial uses
- 5% unaccounted-for water losses
- Desalination is one of the main water sources, five desalination plants operate in Singapore
- Water agreements with Malaysia



Tunisia: elements of integration in areas where responsibilities overlap. Example: agriculture and water are under one ministry



Morocco: decentralization and strong involvement of local stakeholders

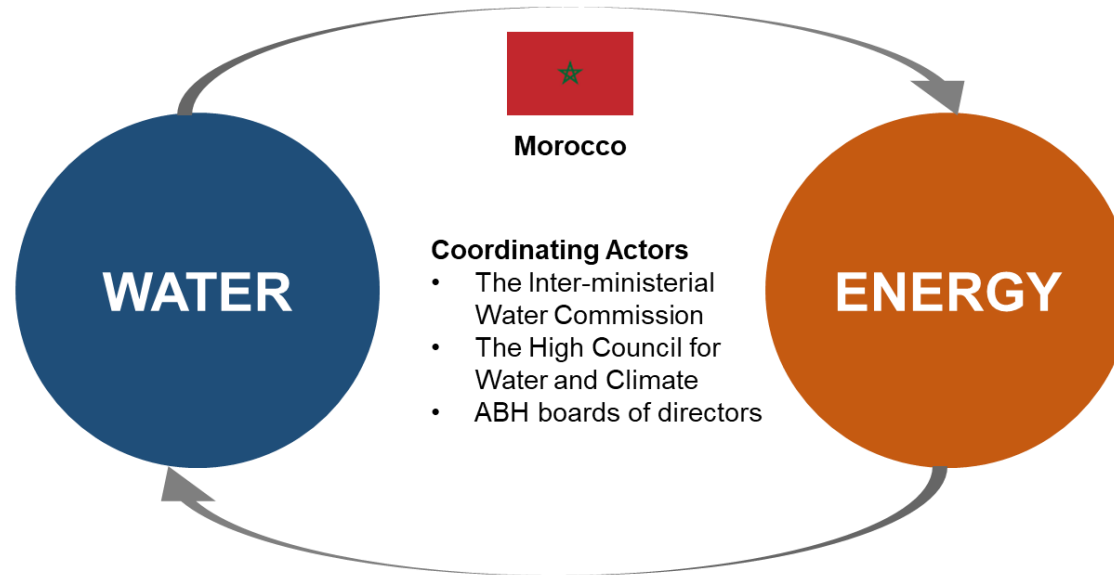
Key Water Governance Actors

National:

- The Ministry of Equipment, Transport, Logistics and Water
- The National Council for the Environment
- The National Drought Observatory
- The Ministry of Interior (water and Wastewater Direction)
- The National Office of Electricity and Drinking Water (ONEE)

Regional and local:

- Ten River Basin Agencies



Key Energy Governance Actors

National:

- Ministry of Energy Transition and Sustainable Development
- Ministry of the Interior
- Ministry of General Affairs and Governance
- The Moroccan Agency for Sustainable Energy
- The Moroccan Agency of Energy Efficiency
- The National Energy Regulatory Agency
- The National Office of Electricity and Drinking Water (ONEE)

Good practices



Inter-ministerial commissions (made up of representatives of all the ministerial departments related to water, including the ministry in charge of energy)



High Council for Water and Climate in charge of formulating the orientations of national water and policy

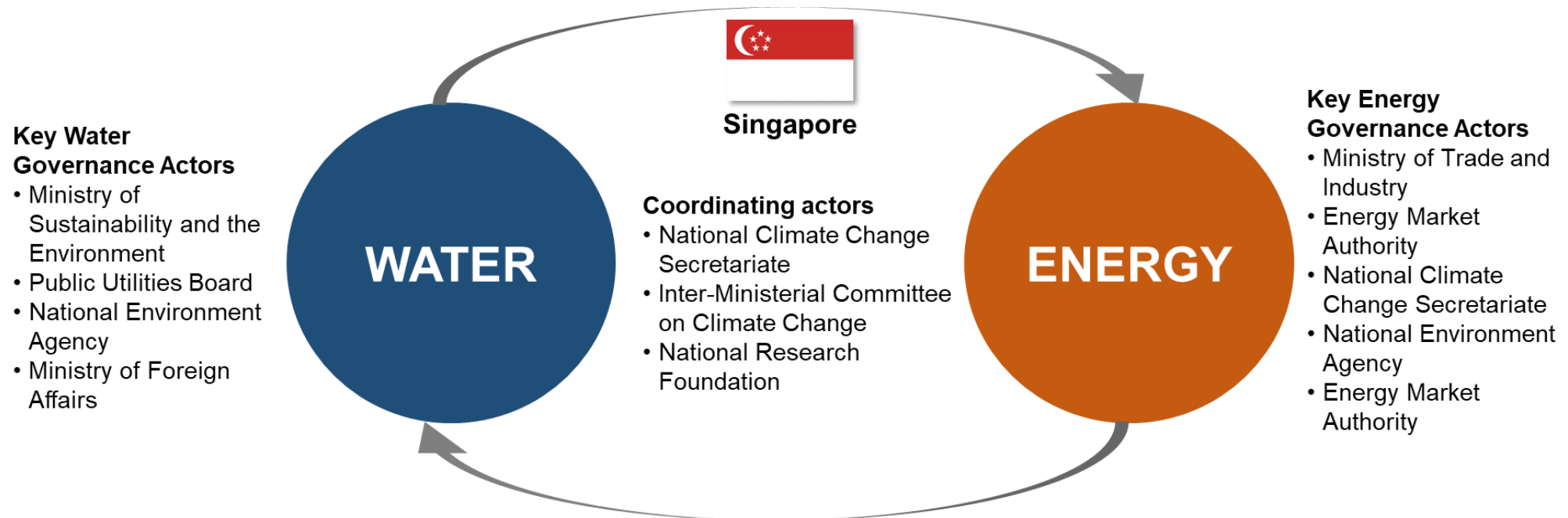


Boards of directors, chaired by the Secretariat of State in charge of Water composed of a maximum of two-thirds – representatives of government authorities related to drinking water, hydroelectric energy, and irrigation, and one-third – representatives from the river basin council, regional councils, professional organizations, and water user organizations



Private Public Partnerships

Singapore: Ministry of Sustainability and Environment, energy transition as integration driver



Example: Good Practices and Lessons Learned

Decentralized Water Governance

- 10 River Basin Agencies (ABH) were created in 2016
- The ABHs are responsible for water quality, sanitation, monitoring, and developing local water management and water shortage management plans



Morocco

Pros

- ABH boards of directors must be made up of both local/regional and national representatives
- Decentralized water governance reflects religious traditions and customs from the French Protectorate period—water usage has always been tied to local land

Cons

- ABHs were formerly hydrological engineering entities and have little training on public engagement, which hinders communication with farmers and locals
- Many ABHs do not have necessary resources to adequately manage and monitor water consumption

Public-Private Partnerships in the Energy and Water Sectors

- Many successful projects are the result of PPPs, such as non-conventional water infrastructure projects
- The state energy company is required to purchase any excess energy produced by private energy developers—this can be very costly

Conclusion

- Water-Energy-Food-Environment (WEFE) nexus highlights the interconnectedness and interdependencies between water, energy, food, and the environment
- Actions and decisions in one sector can have significant impacts on others
- Integrated approaches that consider the trade-offs and synergies between these sectors are needed

- Good practices:
 - Water and agriculture at one ministry
 - Renewable energy in agriculture
 - Water-energy efficiency measures
 - Integration where overlaps of responsibilities exist
 - Integrated water resource management
 - Circular economy approach
 - Decentralisation and integration at local level
 - Energy transition and sustainable development as drivers of integration
 - Climate smart agriculture

- Different countries incorporating different dimensions of integrative governance between WEFE sectors
- No example of a country with a comprehensive WEFE gov framework and mechanisms, making Jordan a unique example and a pioneer in adopting such framework