



*The 26th INPRO Dialogue Forum on the Deployment of Nuclear Energy Systems
for Applications Beyond Electricity*

SMRs for Sustainability: *Jordan Case Study on Non-Electric Applications*

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"Sustainable development is development that meets the needs of the present, without compromising the ability of future generations to meet their own needs"

United Nations, Report of the World Commission on Environment and Development: Our Common Future ('Brundtland Report') (1987)

United Nations



Report of the World Commission on Environment and Development

Our Common Future



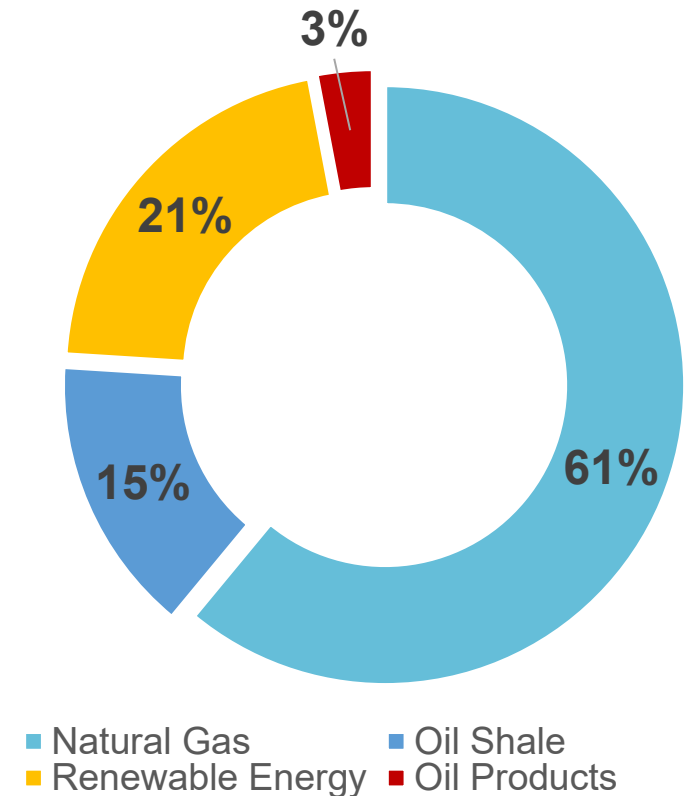
**United Nations
1987**

Energy-Related Challenges Facing Jordan

▪ Electricity Generation

- Heavy dependency on imported energy to cover energy needs.
- Current electricity generation mix:
 - **Natural gas from the Mediterranean sea** (1.6 trillion cubic feet over a period of 15 years ends in **2031**).
 - **Liquefied Natural Gas (LNG)**: only short-term contracts are secured.
 - **Renewable sources** (solar and wind).
 - **Oil shale** (470 MW Power Plant) *started recently*
 - 30-year power purchase agreement.
 - Capital investment of **2.1 Billion USD**.

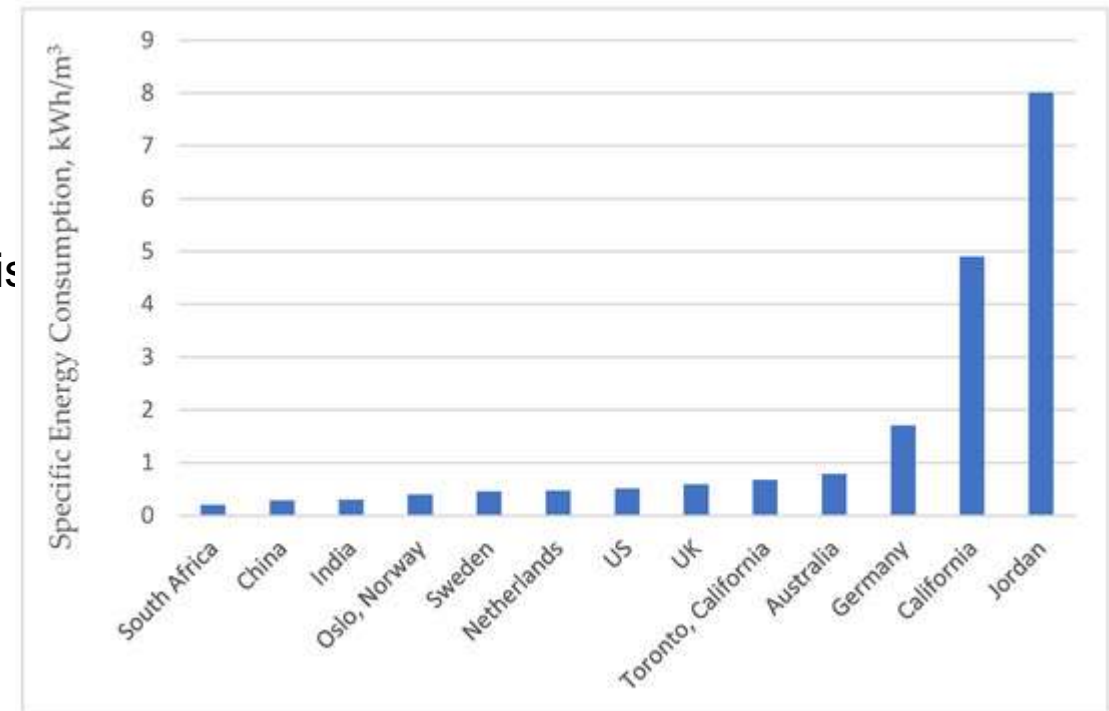
- Current installed capacity is **6063 MW** and peak load is **3770 MW**.
- After 2030,
 - Alternatives for natural gas should be considered.
 - Decommissioning of several conventional and renewable power stations.



Energy-Related Challenges Facing Jordan

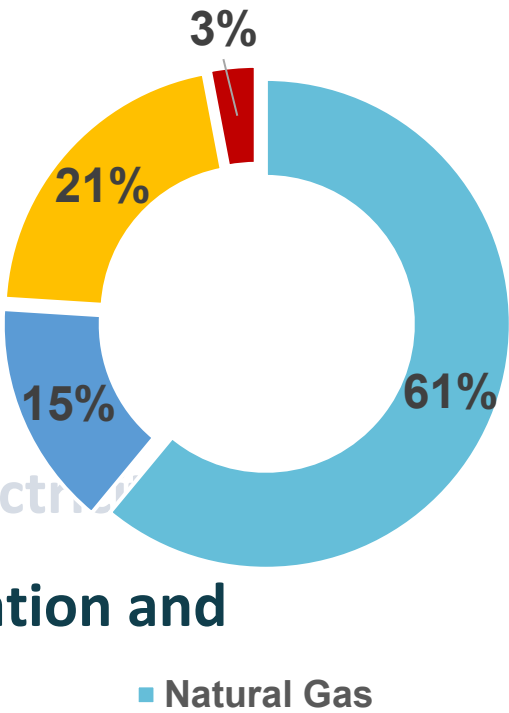
■ Water Desalination

- Jordan has one of the lowest water availability per capita levels in the world (61 m³/capita/year). There is also a supply-demand deficit.
- **Desalination** of sea water is considered the most important and vital supply in near future.
 - **Aqaba-Amman Water Desalination and Conveyance Project (AAWDCP)**
 - 300 million cubic meters per year (MCM/year) will be desalinated from the Red Sea in Aqaba and then pumped approximately 450 km to Amman.
 - **The power required is around 320 MW.**
 - The project is expected to start operation in 2030.
 - The capacity of the project is expected to increase in 2035.
- Energy component of water desalination and conveyance is
- A base-load, reliable, and scalable energy source is required post **2030** to ensure the success of the desalination and conveyance projects in Jordan.



Opportunities of SMRs in Jordan

- ❑ Low capital costs and initial investment
- ❑ Compatible with the small electricity grid
- ❑ Deployable post 2030
- ❑ Low cooling water requirements
- ❑ Scalable to match the gradual increase in electricity demand
- ❑ Increase power demand from water desalination and conveyance
- ❑ Decommissioning of several conventional and renewable power stations
- ❑ Expiration of natural gas import agreements in 2031



The integration of SMRs for power generation and desalination represents a promising approach to addressing the country's dual challenges of energy and water scarcity. Such technological advancements could potentially enhance Jordan's energy security while providing a sustainable solution to its water resource deficiencies.



Initiate a project to identify and evaluate the technical and economics of nuclear-powered desalination system in Jordan to produce 250-400 MCM annually of fresh water.

JAEC Pillars

Human Resources Development

- Jordan Research and Training Reactor (JRTR)
- Jordan Sub-critical Assembly
- SEASME

Nuclear Power Plant Project

- Electricity Production
- **Water Desalination**

Uranium Project

- Exploration
- Mining
- Production



JAEC Pillars

Human Resources Development

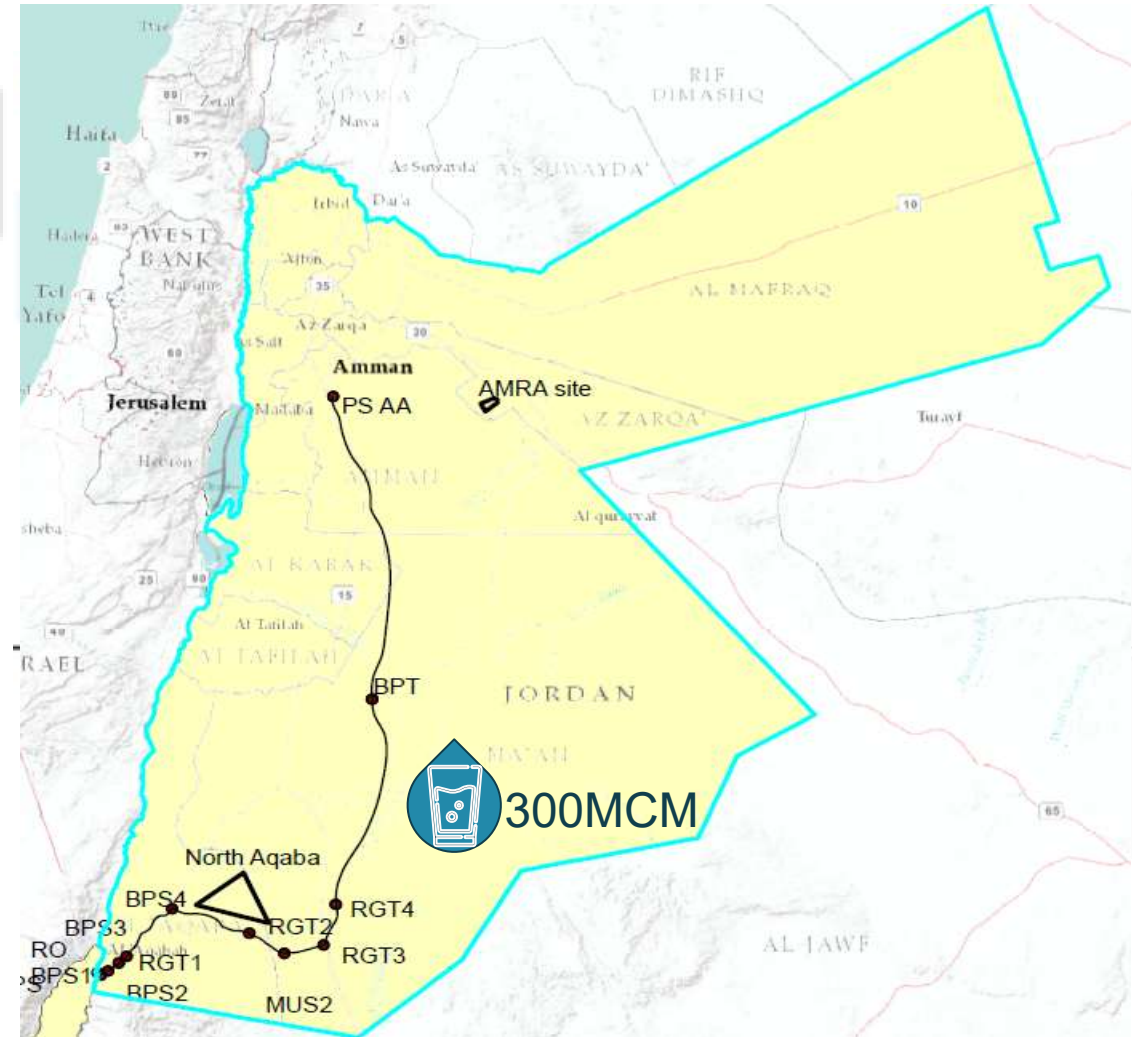
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Nuclear Power Plant Project

- Electricity Production
- **Water Desalination**

Uranium Project

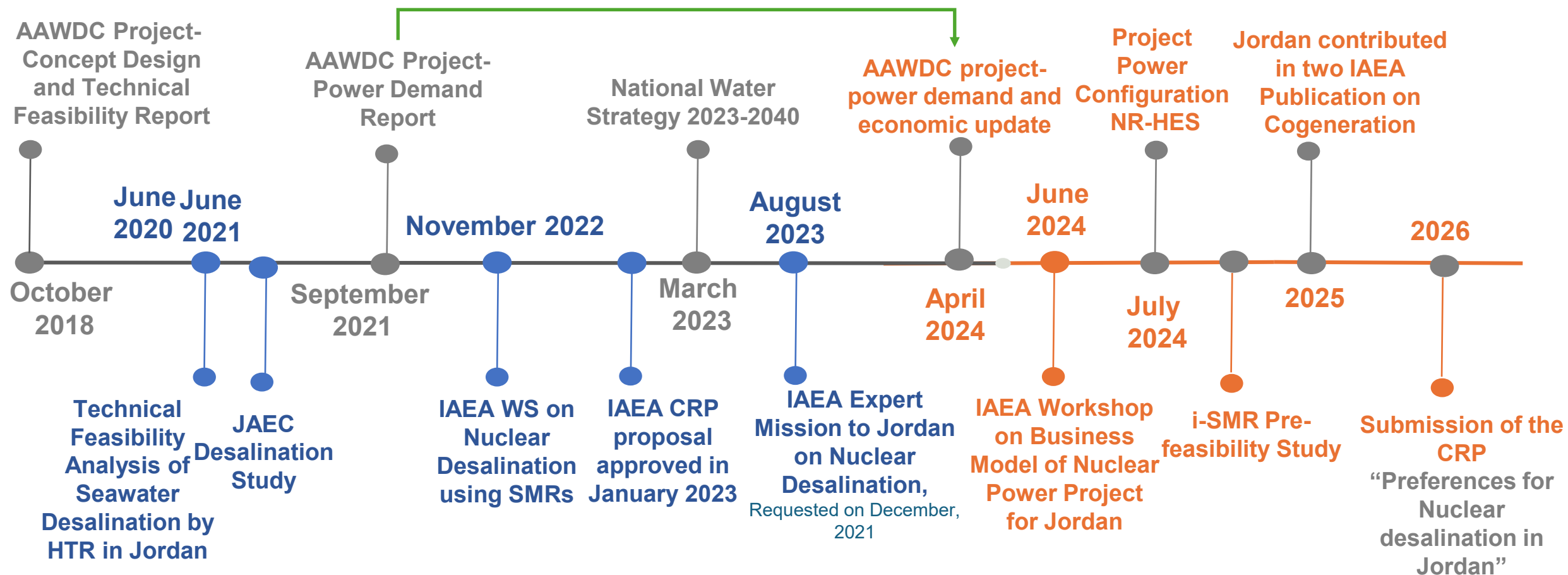
- Exploration
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‘Jordan's uranium mining project is a "model" for mining initiatives in the region’ IAEA Deputy Director Hua Liu said



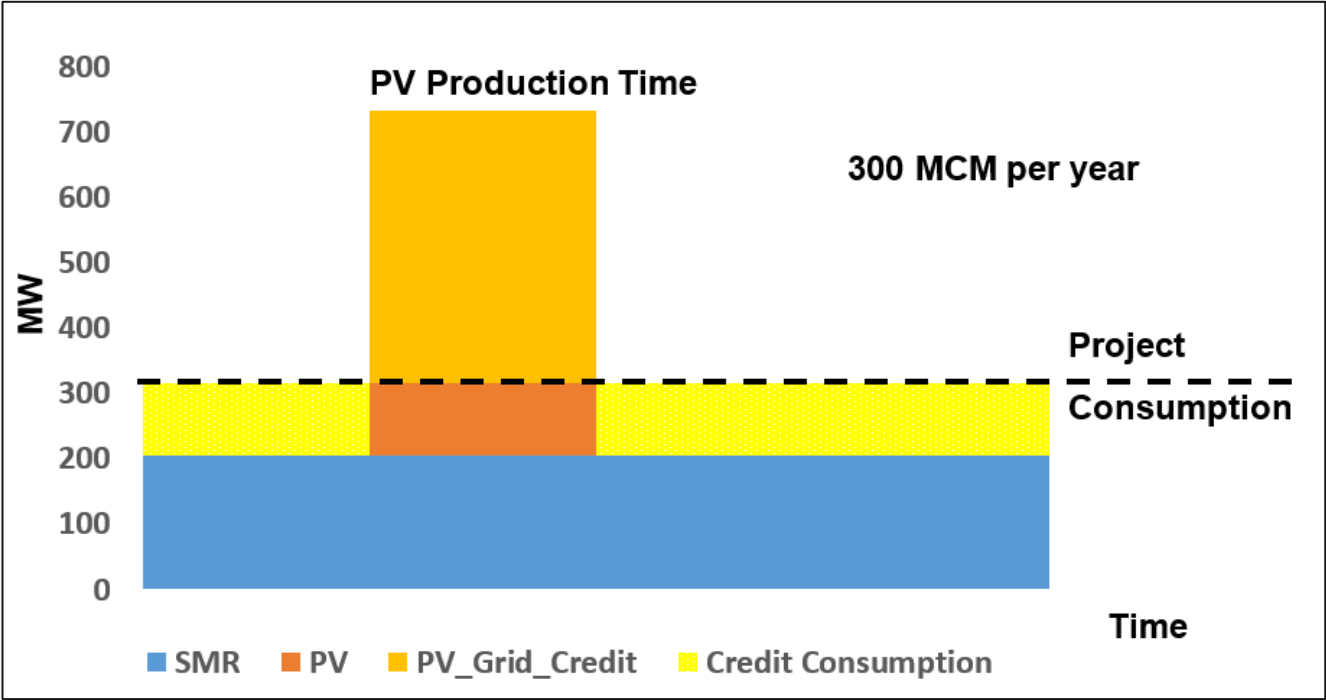
Nuclear Desalination Progress and Activities in Jordan



N-R Synergy for dual-use power and desalination

Project annual electricity consumption and electricity cost

Project Annual Consumption	GWh	%	cent/kWh
SMR	1624	56%	9
PV	1283	44%	3
Total Consumption	2907	100%	6.4



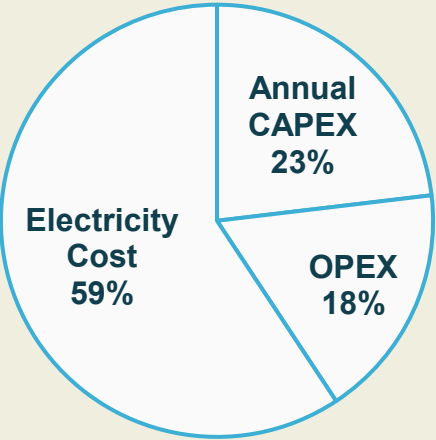
Water Cost – Primary Scenario

Item	Unit	Intake+RO	Conveyance	Total
CAPEX	US\$ million	\$675	\$1,084	\$1,758
Life time	Year	30	30	30
WACC	%	4.0%	4.0%	4.0%
Annual CAPEX	US\$ million/year	\$39	\$63	\$102
OPEX	US\$ million/year	\$49	\$34	\$83
Electricity Cost	US\$ million/year	\$123	\$182	\$305
Water Cost	US\$ million/year	\$212	\$278	\$490
Water Cost	US\$/CM	\$0.705	\$0.928	\$1.633

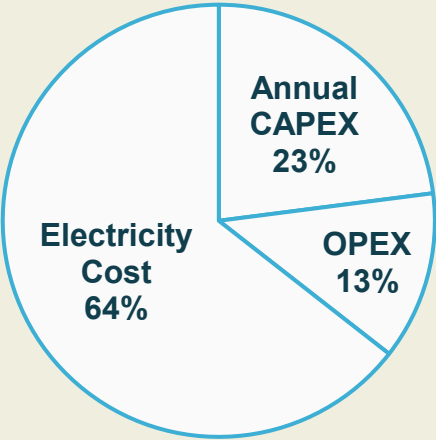
Institution Background Experience in The CRP Subject Topic

Water Cost Breakdown

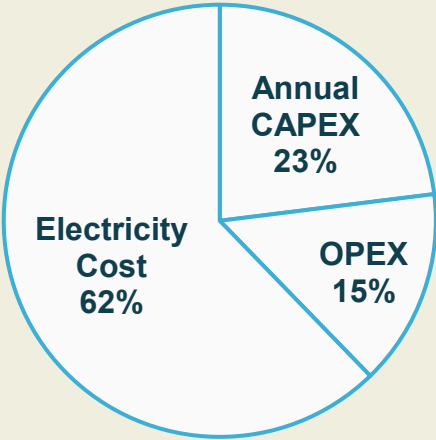
RO+IPS



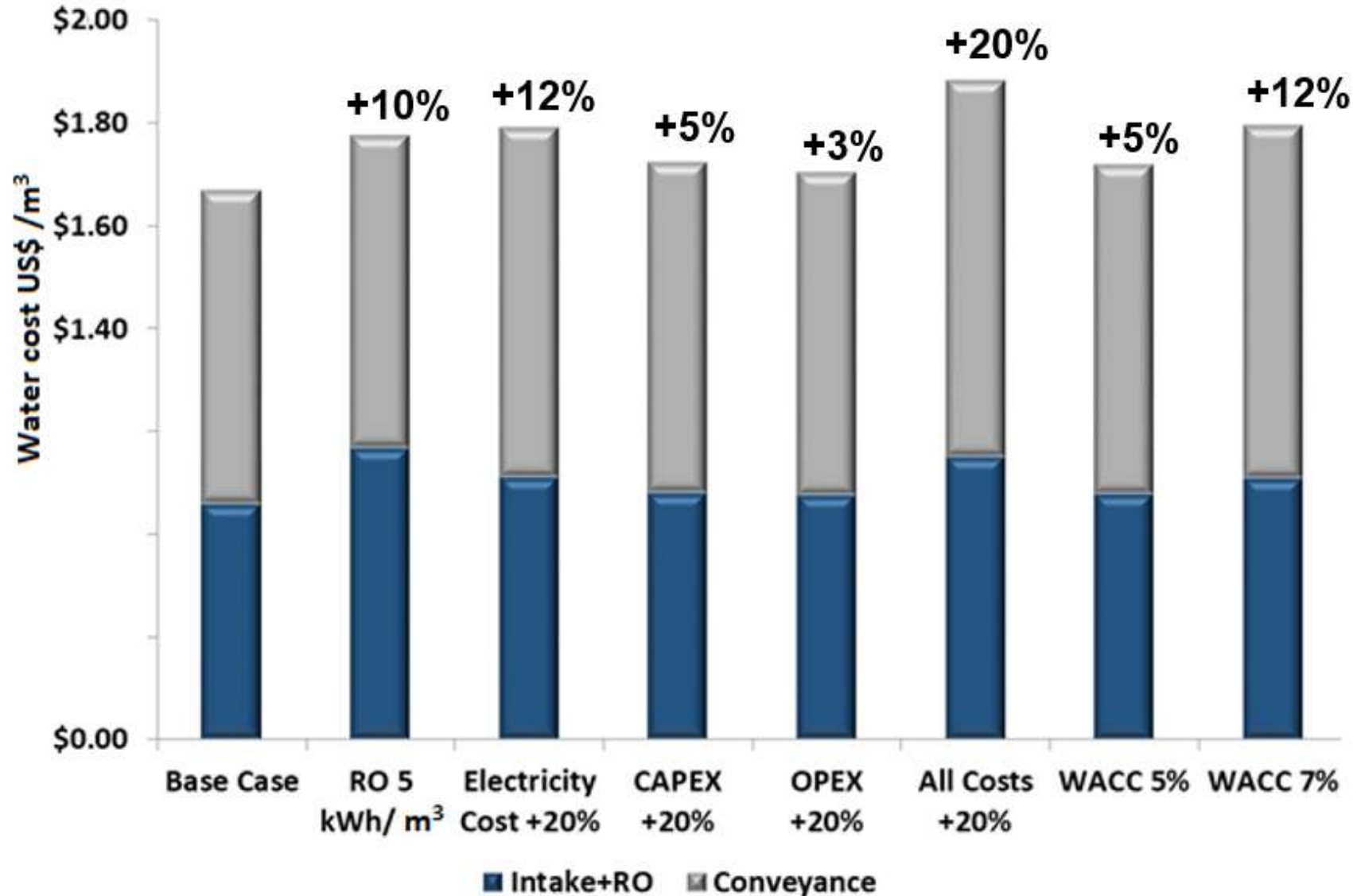
CONVEYANCE



TOTAL

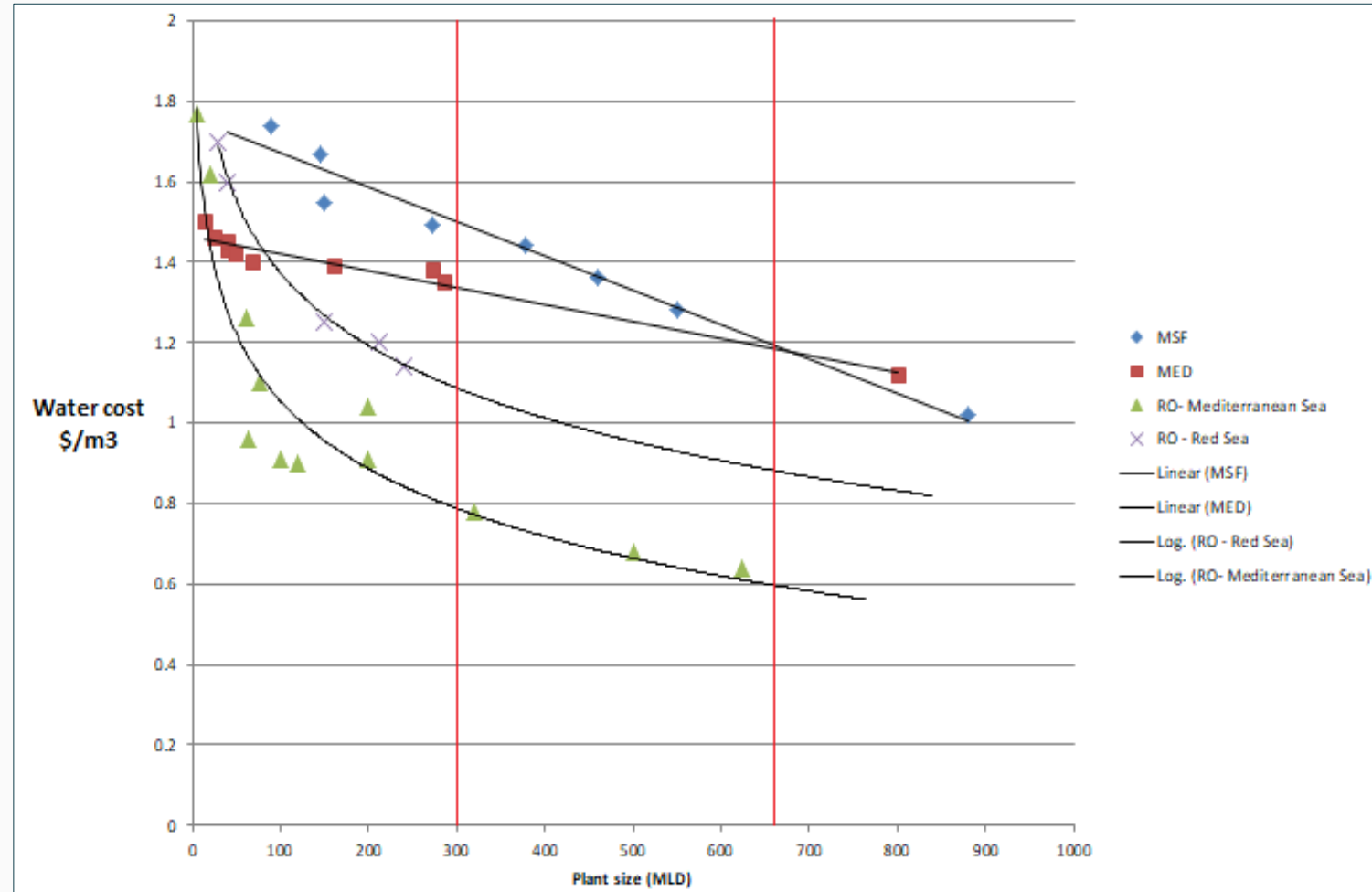


Sensitivity Analysis of Water Cost



Is It Competitive?

Water cost vs. Desalination plant size based on a database of about 60 desalination plants, constructed over the past 20 years



SUSTAINABLE DEVELOPMENT GOALS



The development of water and energy infrastructure in the country, improving access to safe drinking water, and reducing water scarcity in the country by securing 300 MCM of freshwater, the project directly supports SDG 6, Clean Water and Sanitation



8 DECENT WORK AND ECONOMIC GROWTH



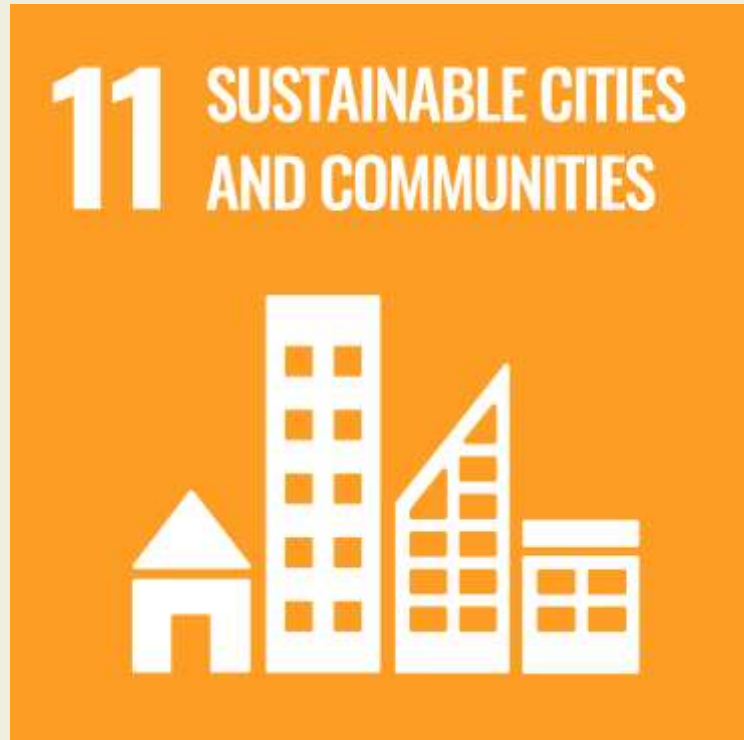
by creating employment opportunities during construction, operation, and associated industrial activities, which align with national needs for investments in the green economy.



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



The configuration of the project, particularly the deployment the SMR, innovation nuclear technology, promotes SDG 9, Industry, Innovation and Infrastructure.



The project contributes to SDG 11, Sustainable Cities and Communities, by strengthening long-term water security in major Jordanian cities that currently experience extended periods of scheduled water cut



The use of nuclear and renewable energy sources lowering greenhouse gas emissions compared with conventional desalination systems powered by fossil fuels in desalination supports SDG 13, Climate Action.



17 PARTNERSHIPS FOR THE GOALS



Such a project configuration includes SMR and a large-scale desalination plant fosters international cooperation, technology transfer, and strategic partnerships, thereby contributing to SDG 17, Partnerships for the Goals.

Thank you

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