United Nations Development Account Project on Developing the Capacity of ESCWA Member Countries to address the Water and Energy Nexus for Achieving Sustainable Development Goals

Final Regional Policy Workshop on the Water-Energy Nexus

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Economic and Social Commission for Western Asia

Water-Energy Nexus Operational Toolkit: Resource Efficiency Module

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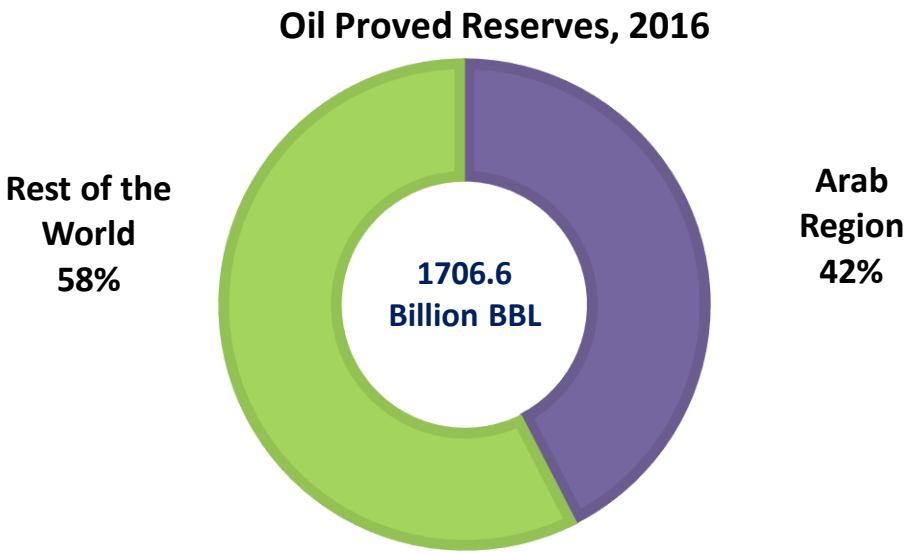
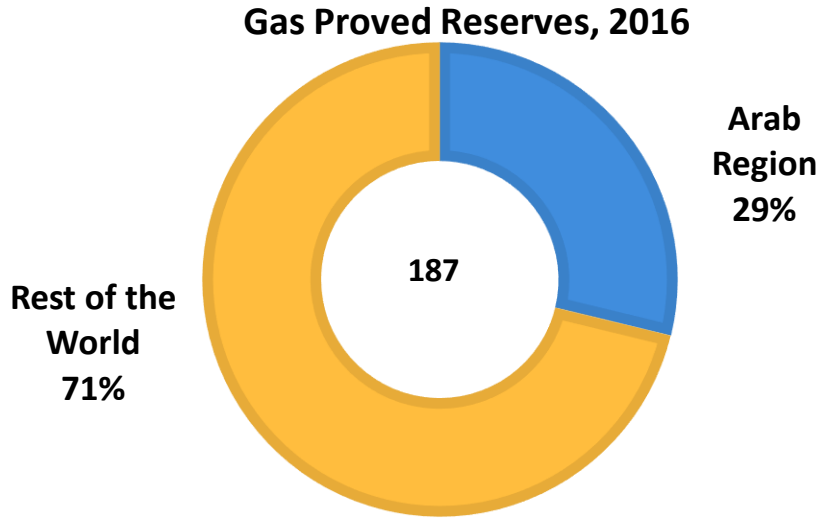
Setting the Context
Reserves Abundance in the Arab Region





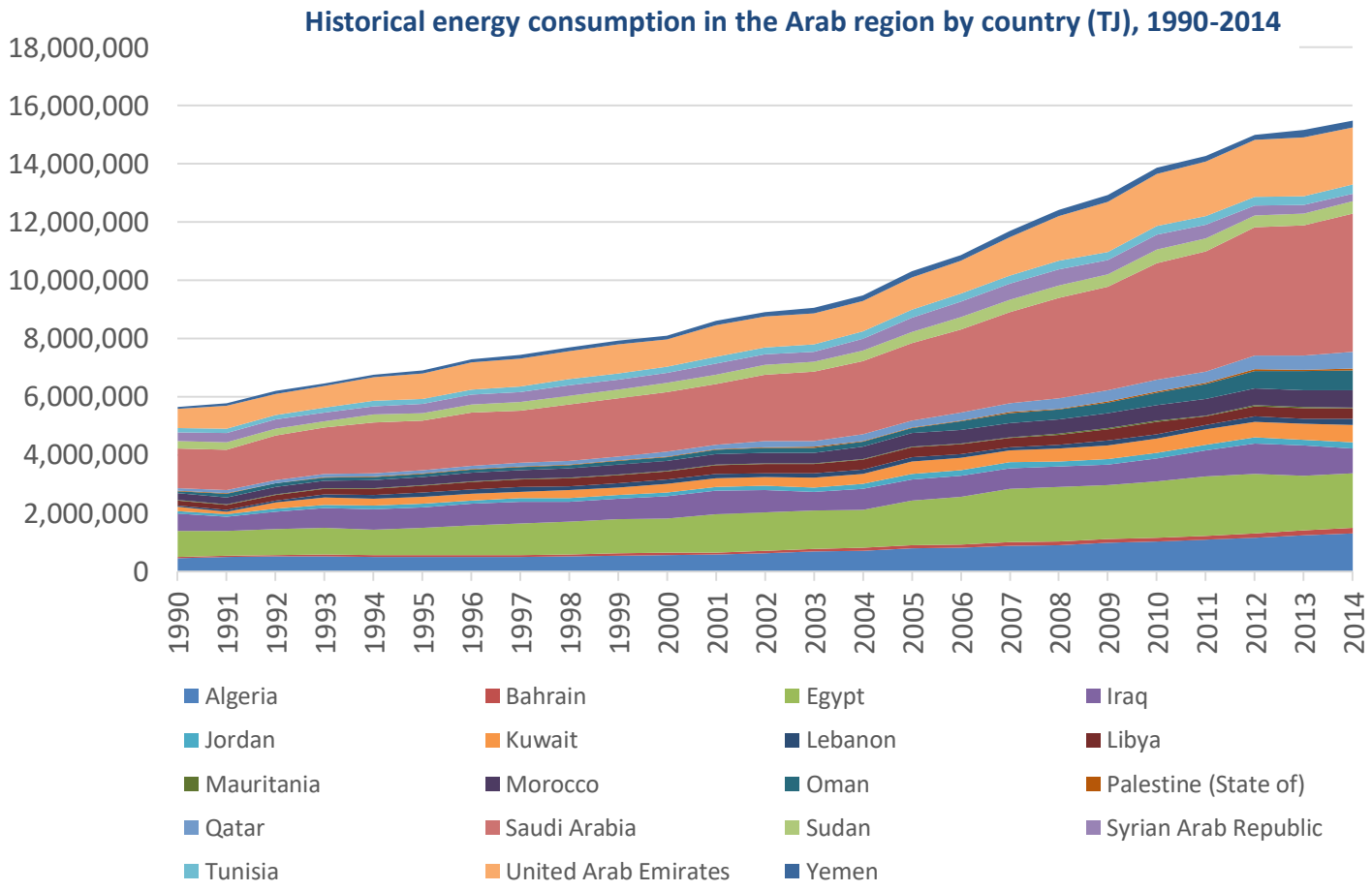
Source: OAPEC, BP statistical Review, 2017

Countries in the Arab region exhibit different energy consumption levels, but they share their reliance on fossil fuels for energy sufficiency.

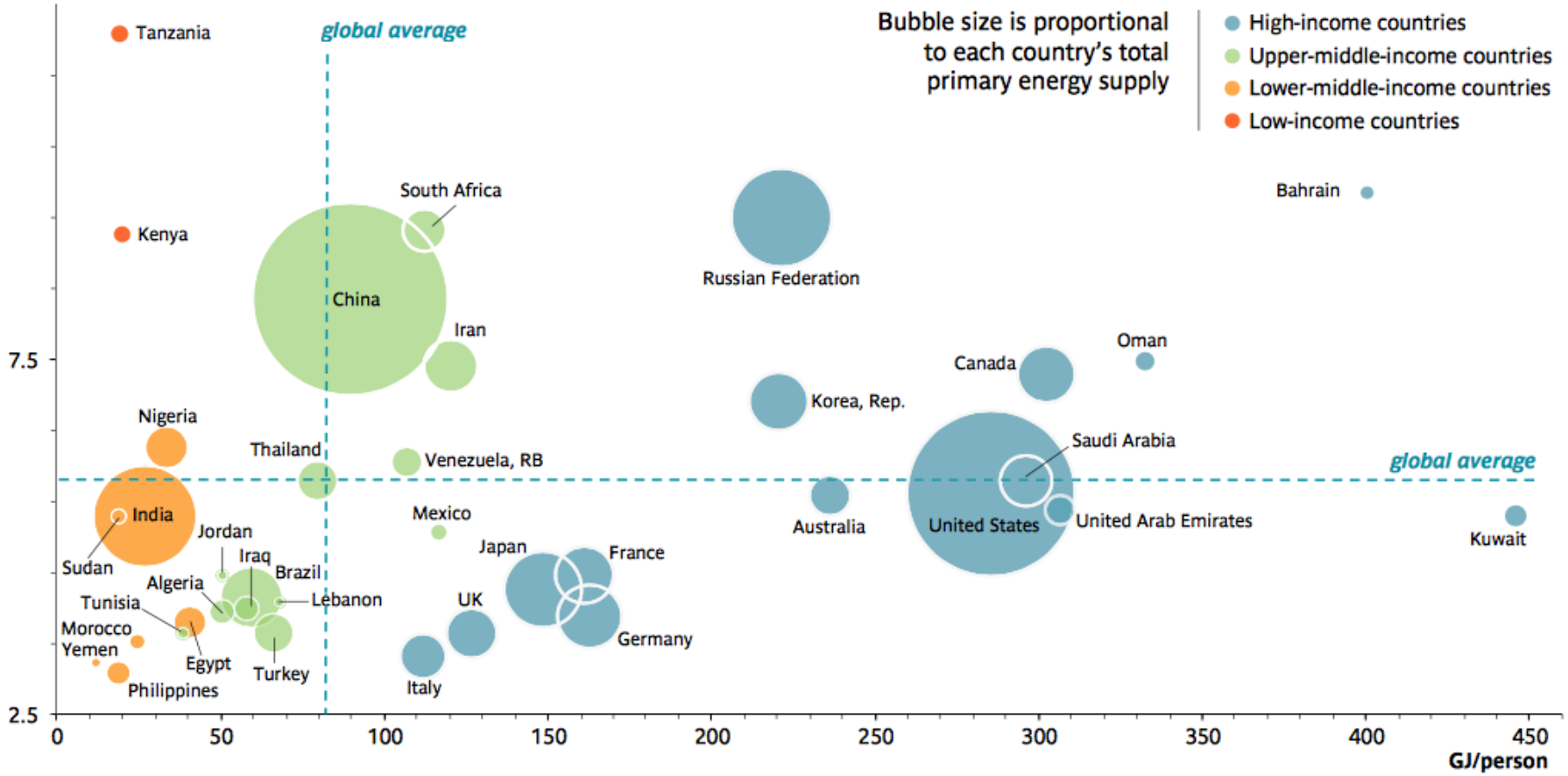
Energy consumption more than doubled in the Arab region since 1990

The Arab region is the only world region where energy intensity has been increasing, not declining since 1990

- The GCC economies are among the most energy-intensive,
- Some of the most active countries in prioritizing EE in the Arab region are net importing countries, particularly Jordan, Morocco and Tunisia.

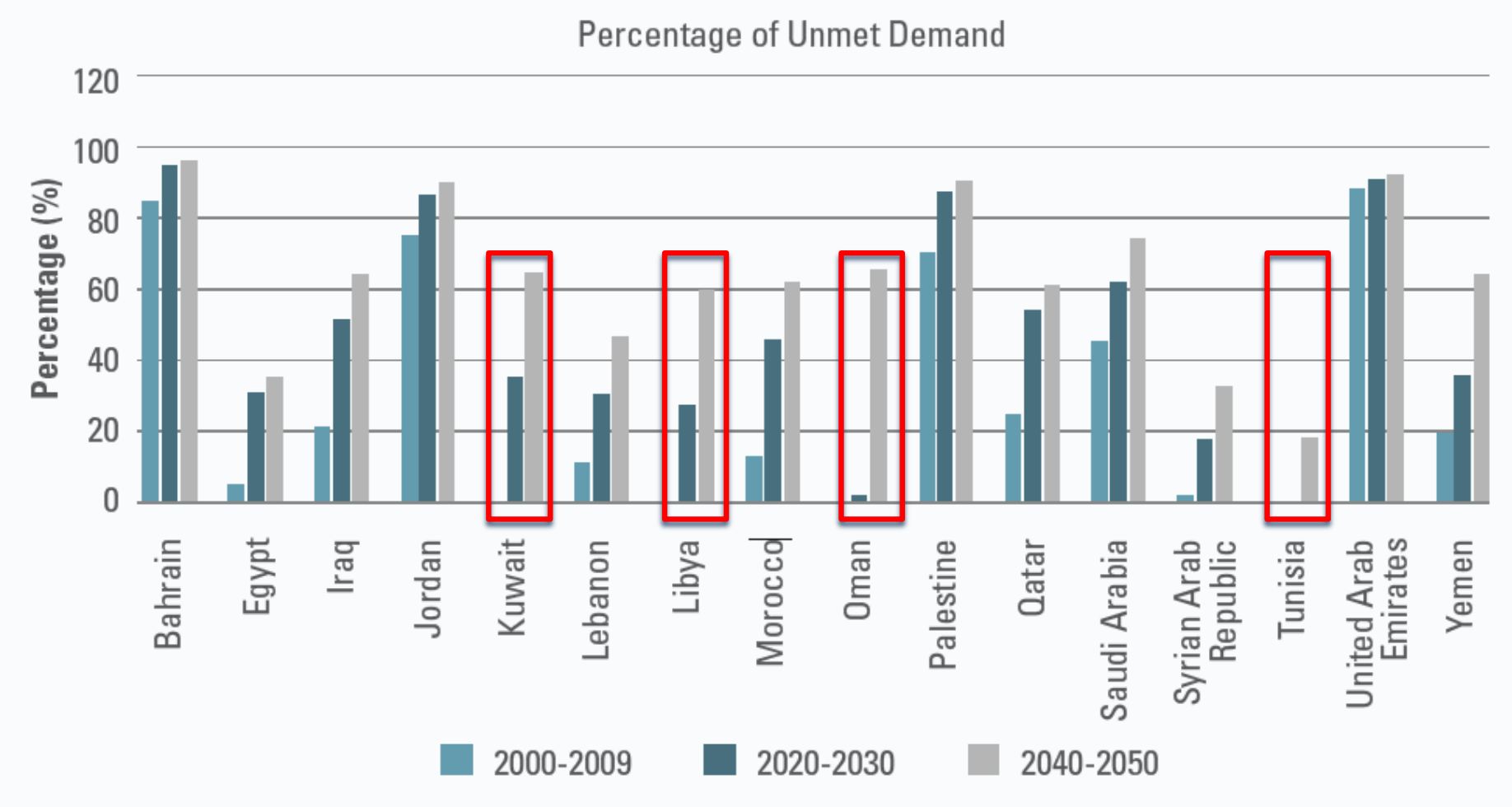


Primary energy intensity vs. primary energy consumption per capita, selected countries



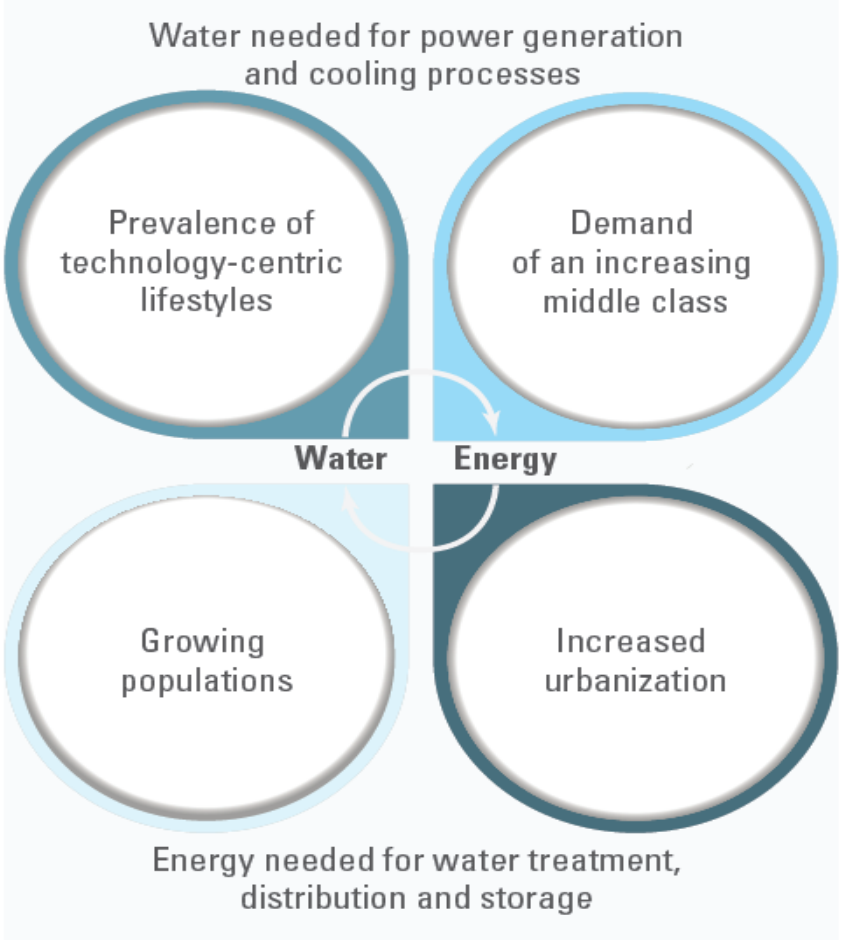
Source: World Development Indicators database; IEA database. Note: The scale does not allow depiction of Qatar, which had per capita energy consumption in 2012 of over 770 GJ per person, and energy intensity of 6 MJ/2011 USD, just above the world average.

Unmet water demand in Arab countries



Source: Created based on data from Immerzeel et al., 2011.

The Water- Energy Nexus Concept



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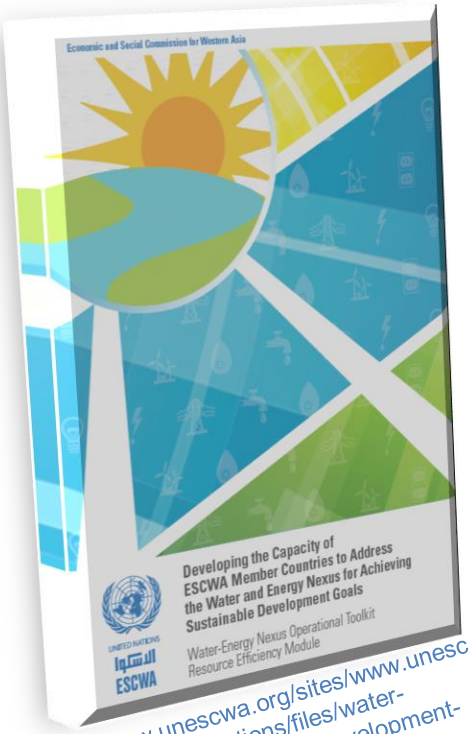
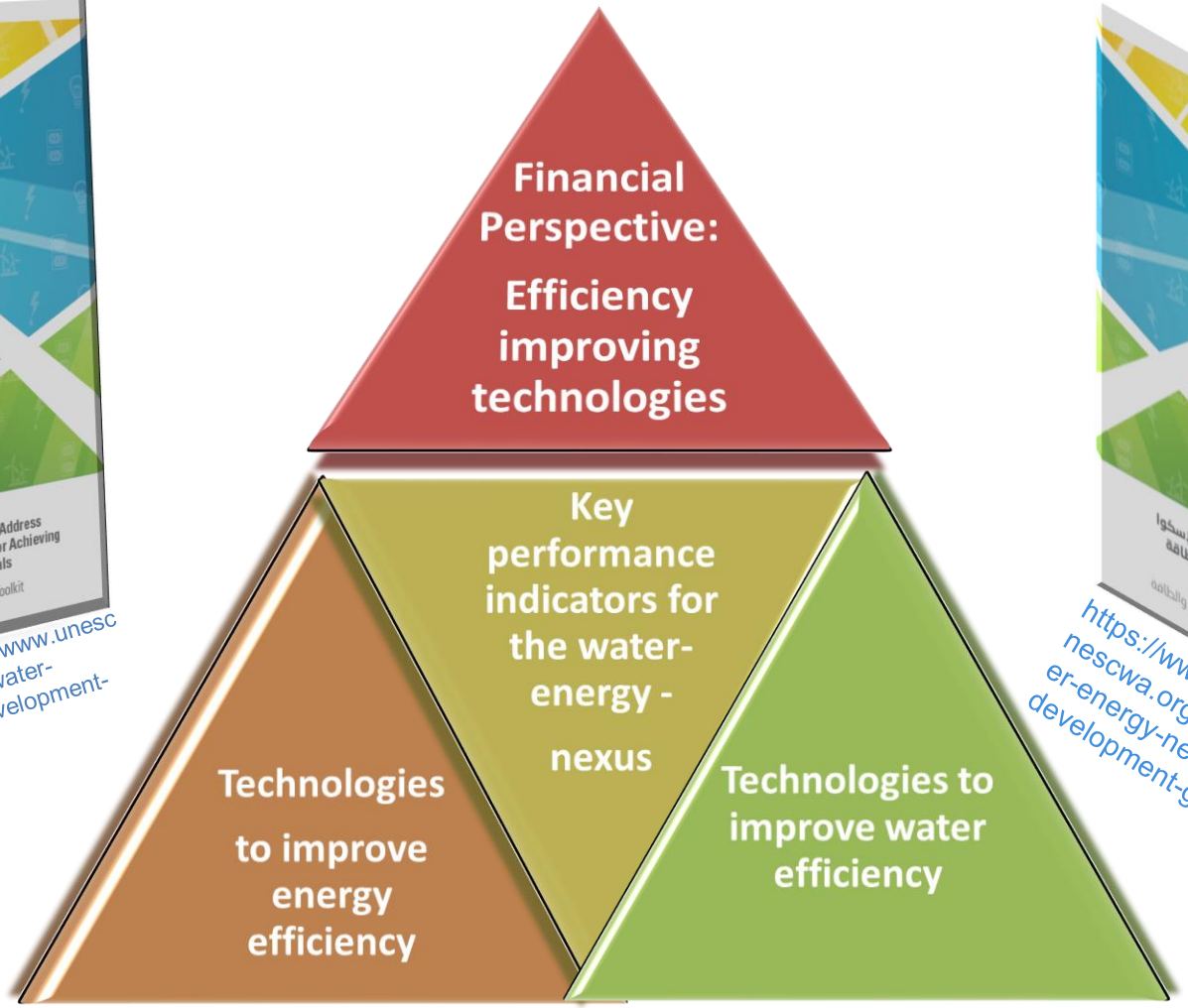
Source: ESCWA Water-Energy Nexus Operational Toolkit Resource Efficiency Module,2017

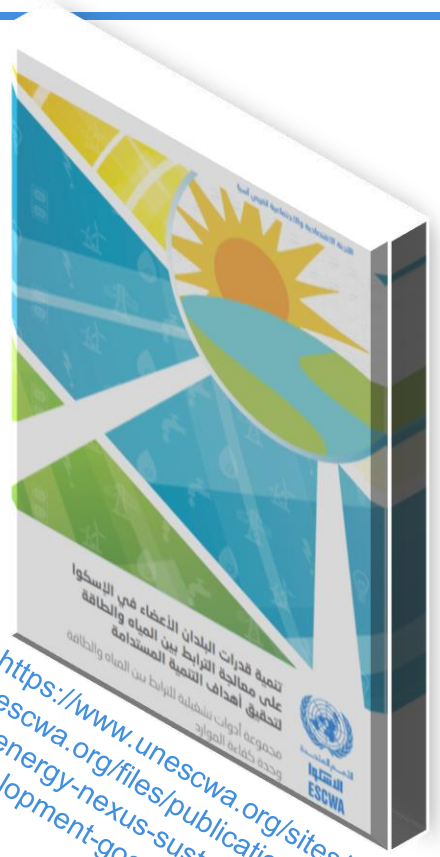
Water-Energy Nexus Operational Toolkit

Resource Efficiency Module



https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/water-energy-nexus-sustainable-development-goals-english_0.pdf

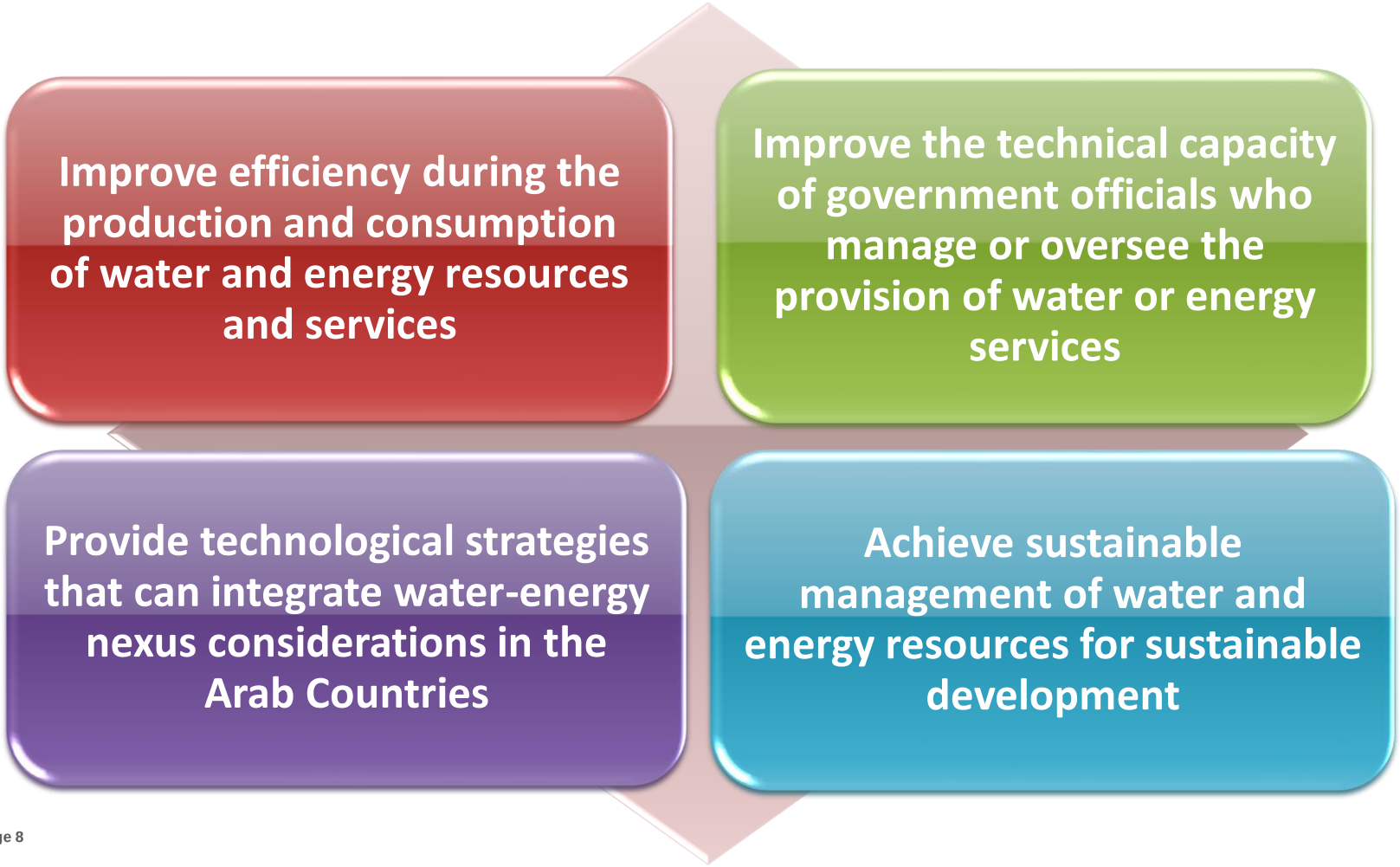




https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/water-energy-nexus-sustainable-development-goals-arabic.pdf

Water - Energy Nexus Operational Toolkit - Resource Efficiency:

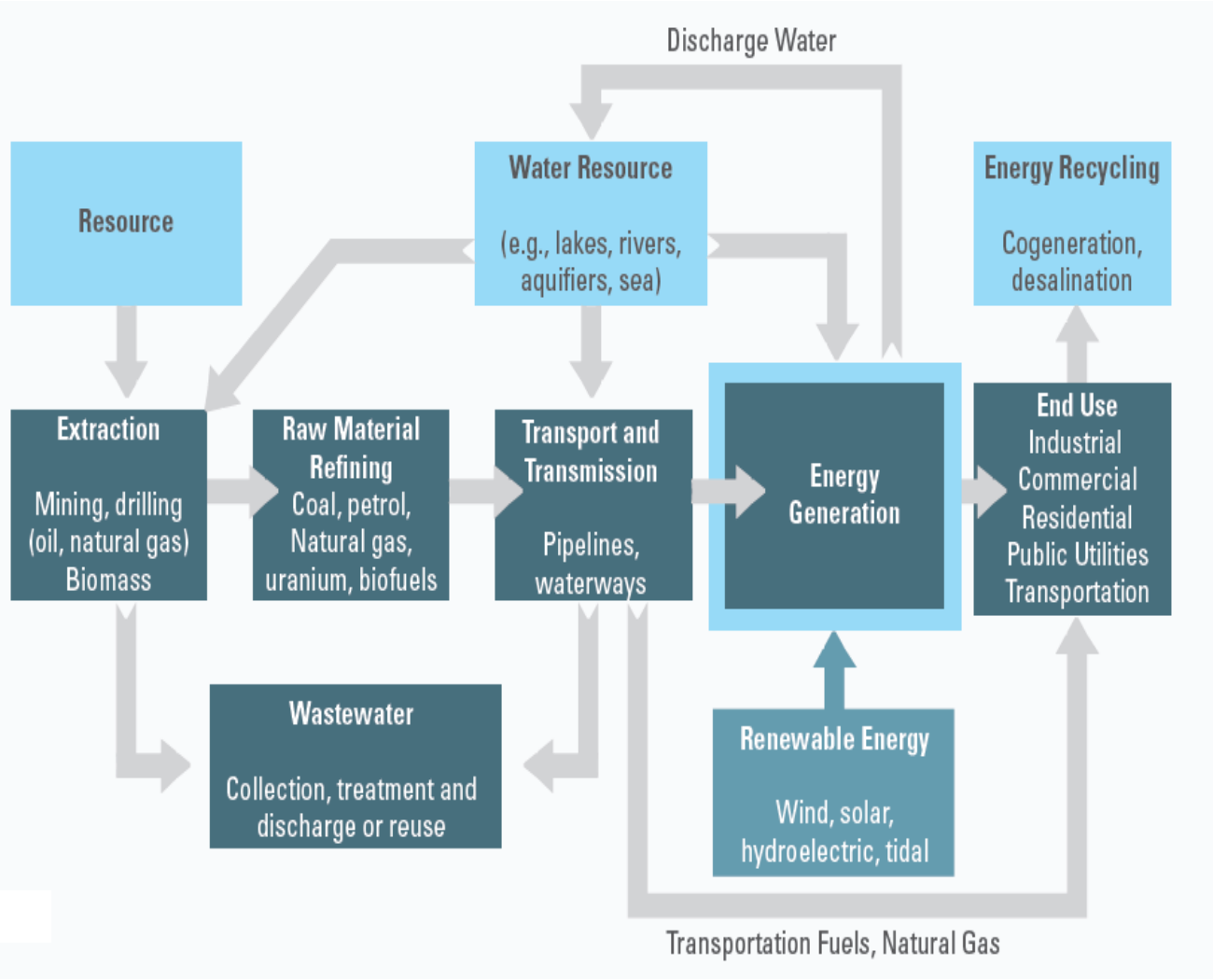
Main Objectives



Embedded water in energy

- **Energy production is the 2nd largest use of water (after agriculture).**
- **Globally, 90% of power generation is water-intensive.**
- **80% of global electricity is produced by thermal power generation.**
- **75% of all industrial water withdrawals are for power production.**

Source: Water in the West, 2013.



Water-Energy Nexus Operational Toolkit: Resource Efficiency

Technologies to improve water efficiency

- **There is no ideal efficiency solution for all ESCWA member countries.**
  - **Strategies must be assessed with reference to the respective situation.**
- **Recycling of wastewater is a strategy that can be implemented by various sectors.**
  - **As environmental standards for discharged waters become more stringent, recycling water becomes more feasible.**
- **The most energy-consuming parts of a process must be targeted.**
  - **For wastewater treatment this is aeration.**
  - **For water distribution systems this is pumping.**
- **Water consumption can be reduced in electricity generation processes by addressing various parameters.**
  - **Cooling types**
  - **Combined cycle arrangements**
- **Several technological options for more water, efficient water distribution, particularly in the agricultural sector, are becoming more popular.**
- **Intelligent systems have the potential to increase efficiencies.**
  - **They help match supply and demand.**
  - **They can have low capital costs.**

Water reuse in the Arab countries

Countries	Percentage of wastewater treated	Percentage of treated wastewater reused	Reused water as a percentage of total water withdrawn
Algeria	85.37	7.29	0.84
Bahrain	100.00	36.30	4.56
Egypt	79.79	23.33	1.02
Iraq	17.04	5.61	0.01
Jordan	94.87	91.89	10.84
Kuwait	95.60	32.64	8.54
Lebanon	1.29	50.00	0.15
Libya	7.33	100.00	0.92
Morocco	25.29	45.20	0.63
Oman	37.76	6.22	0.17
Qatar	14.86	65.15	7.82
Saudi Arabia	89.32	25.46	0.70
Syria	40.15	100.00	3.29
Tunisia	52.06	28.33	2.39
UAE	90.80	54.63	6.20
West Bank & Gaza	60.00	18.13	1.30
Yemen	62.16	13.04	0.18

Water reuse

Example: minimum estimate of potential savings from increased water efficiency in the industrial, commercial and institutional sectors of California would be sufficient to fulfil the annual water requirements of the whole city of Los Angeles

Source: Abengoa Water, 2012.

Water use in cooling processes

Water efficiency in electricity production

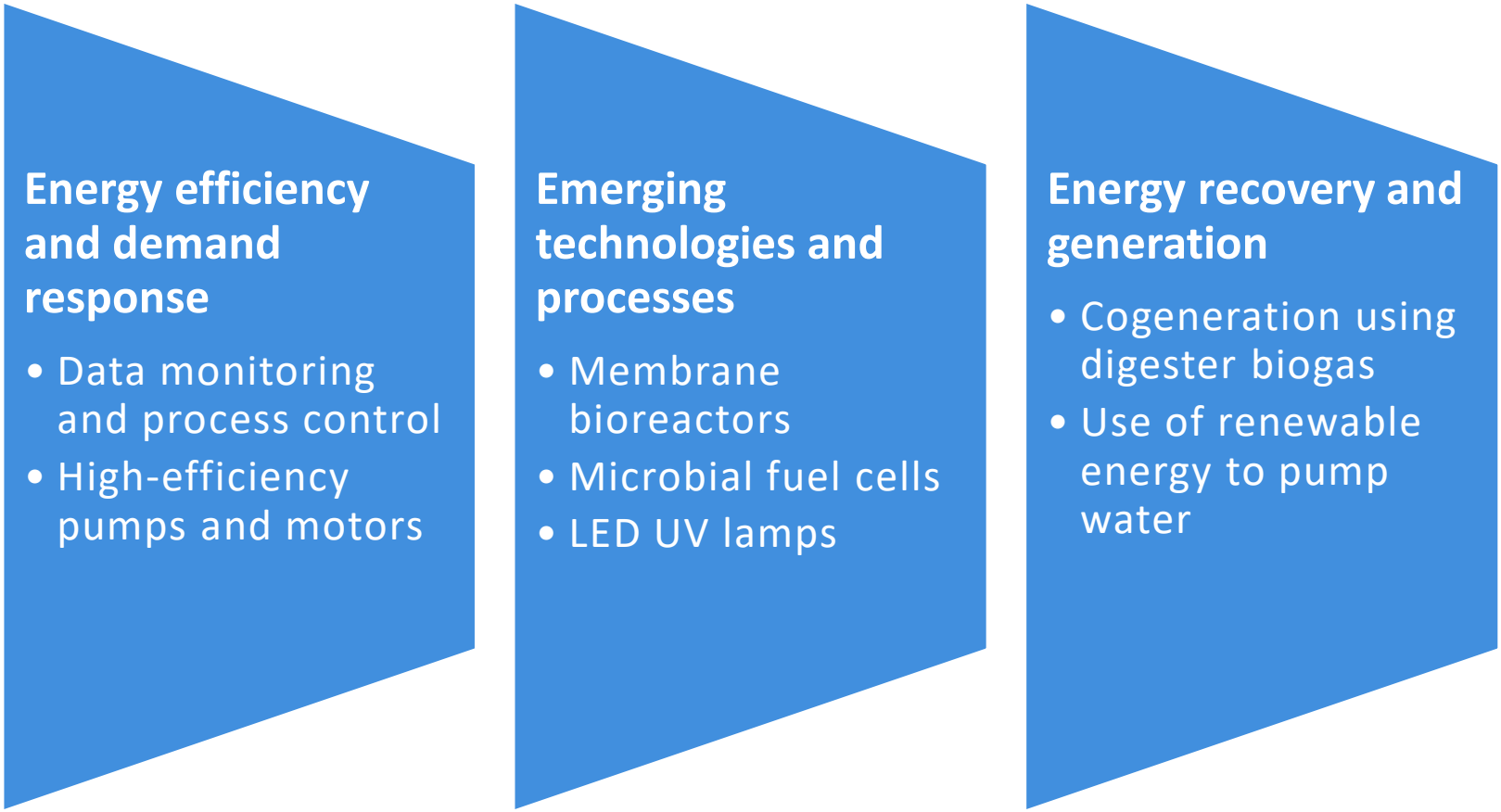
	Once-through		Recirculating		Dry-cooling	
	W	C	W	C	W	C
Coal (conventional)	20,000-50,000	100-317	500-1,200	480-1,100	N/A	N/A
Natural gas (combined cycle)	7,500-20,000	20-100	150-283	130-300	0-4	0-4
Nuclear	25,000-60,000	100-400	800-2,600	600-800	N/A	N/A

Sources: Created based on data from Macknick et al., 2012; Union of Concerned Scientists, n.d.

Unit: Gallons of water required per megawatt-hour of electricity produced
W: Withdrawal; C: Consumption.

- **Water consumption can be reduced in electricity generation processes by addressing various parameters.**
  - **Cooling types**
  - **Combined cycle arrangements**

Energy management opportunities in the water and wastewater industries



Source: Reekie, 2013

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Water-Energy Nexus Operational Toolkit: Resource Efficiency

Technologies to improve energy efficiency

- **Variation in energy savings and payback period for different strategies for the water sector.**
  - **Such variation shows the potential complexities involved in implementing these strategies due to the many parameters to be considered.**
- **Energy efficiency measures which require the least effort can be very beneficial.**
- **More energy-efficient desalination technologies can play a pivotal role in improving the overall energy consumption of the region.**
  - **RO is currently the technology of choice but there is still room for improvement.**
  - **The use RE for power desalination is rapidly being adopted in the region.**
- **Cost sharing between energy and water utilities must be facilitated in support of efficiency measures.**
  - **Water avoided costs must be considered with embedded energy analysis.**
- **By regulating tariffs more effectively:**
  - **The investment required for the adoption of more energy- and water-efficient technologies can be facilitated**
  - **End-use consumption can be better influenced.**

Water-Energy Nexus Operational Toolkit: Resource Efficiency Module

SDGs- KPIs for Resource Efficiency-W-E-Nexus

- The 2030 Agenda advances an integrated approach to SD.
- Dedicated goals and targets for water and energy with indicators for monitoring implementation.
- Dedicated indicators for energy and water efficiency with interlinkages with other targets.
- Dialogue is crucial among the various water-energy partners.
- The level of coordination and collaboration between the water and energy sectors in all stages of planning and implementation must be increased to achieve targets.
- Water and energy efficiency indicators **are vital to measure progress with respect to the water-energy nexus in the Arab countries**. **Data required for these indicators is not always available.**
- Sustainability reporting frameworks are a good steppingstone towards addressing the water and energy efficiency indicators.

Economic and Social Commission for Western Asia

Thank You

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40 YEARS