EFFICIENCY-IMPROVING TECHNOLOGIES: FINANCIAL PERSPECTIVE

Water-Energy Nexus Operational Toolkit : Resource Efficiency

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Economic and Social Commission for Western Asia

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Outline

Savings due to various technologies

Economic incentives for more efficient consumer use

Key messages

Savings due to various technologies

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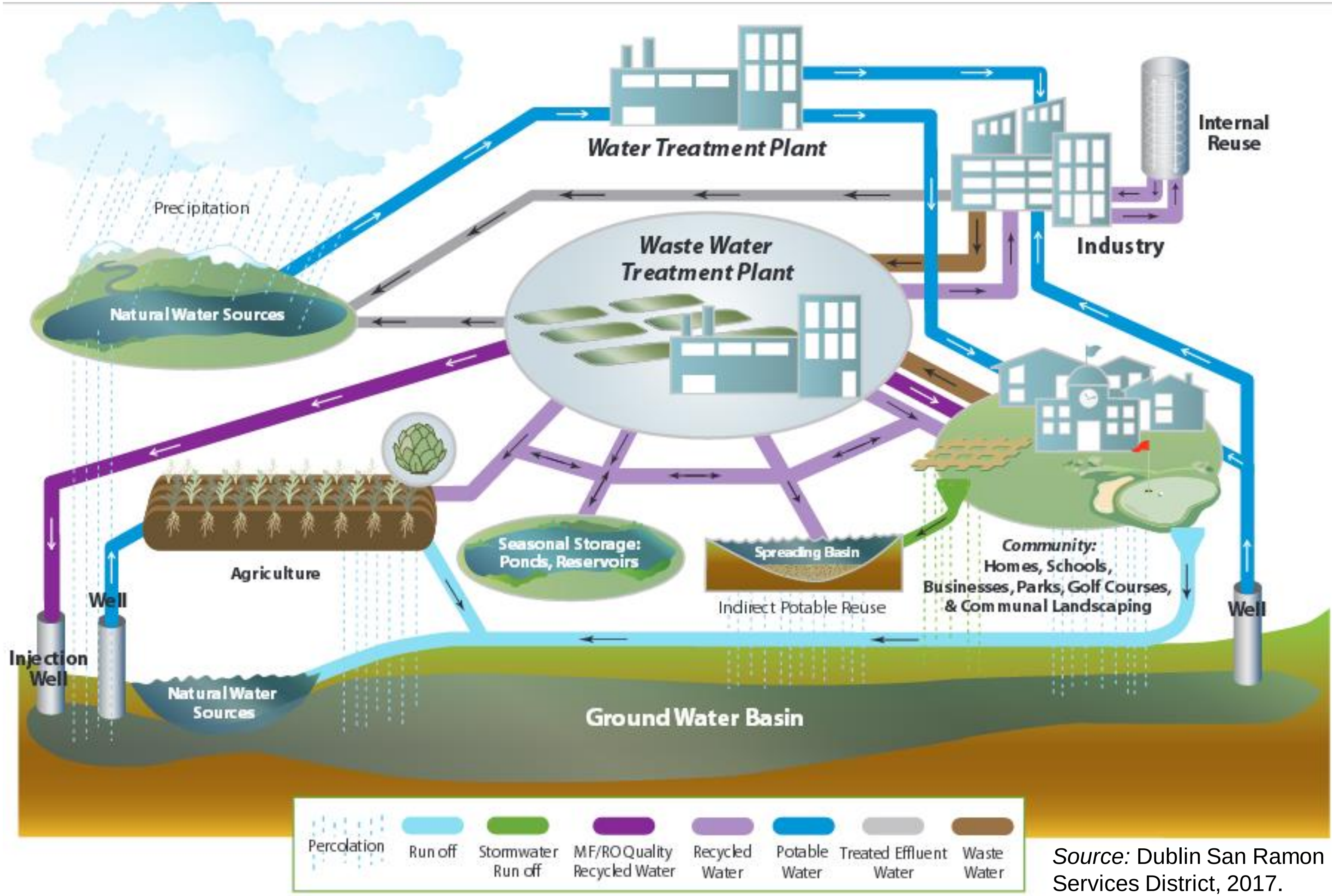
Typical energy savings and payback periods for best practices

Best practices	Typical energy savings of unit of process (%)	Typical payback years
General		
Real-time energy monitoring	5-20	Variable
Electric peak reduction	Variable	< 1
Electric motors: install high efficiency motors	5-10	< 2
Electric motors: variable frequency drive applications	10-40	0.5-5
Pumps: optimize pump system efficiency	15-30	0.25-3
Wastewater		
Staging of treatment capacity	10-30	<2
Optimize aeration system	30-70	3-7
Fine-bubble aeration	20-75	1-5
Variable blower air flow rate	15-50	< 3
Dissolved oxygen control	20-50	2-3
Blower technology options	10-25	1-7
Biosolids mixing options in aerobic digesters	10-50	1-3
Anoxic zone mixing options	25-50	3-5



Source: Dublin San Ramon Services District, 2017.

Large-scale commercial desalination

Process	Thermal energy kWh/m³	Electrical energy kWh/m³	Total energy kWh/m³	Investment cost US$/m³/d	Total water cost US$/m³
MSF	7.5-12	2.5-4	10-16	1200-2500	0.8-1.5
MED	4-7	1.5-2	5.5-9	900-2000	0.7-1.2
SWRO	-	3-4	3-4	900-2500	0.5-1.2
BWRO	-	0.5-2.5	0.5-2.5	300-1200	0.2-0.4

- Costs of different technologies are site-specific and fuel-specific.
- In general, compared to membrane-based desalination processes, thermal-based desalination processes:
  - Use more expensive materials and equipment.
  - Require more chemicals.

Energy savings through CAPEX & OPEX reduction with higher productivity membranes

Reduce feed pressure

- OPEX reduction

Higher flux operation at same recovery

- CAPEX reduction

Increase plant output and recovery

- OPEX and CAPEX reduction

Source: Busch and Mickols, 2004.

Savings due to various technologies

Integrating water and energy efficiency measures

Source: Cutter et al., 2014.

Measure	Cost ($)	Savings: End-use energy (kWh)	Savings: Water (Gallons per day (GPD))	Useful life (years)	Benefit /cost ratio
LED lighting	206	336		12	1.8
Clothes washer (single family)	205	110	17	10	0.5
High efficiency toilet - low use	265		20	20	0.6
High efficiency toilet - high use	265		60	20	1.4
Weather based irrigation controller - small	300		72	10	0.5
Weather based irrigation controller - large	700		629	10	3.6

Findings of the case study:

- Cost-effective opportunities for efficiency tend to be overlooked without an integrated water-energy cost-effectiveness framework.
- Several measures fail cost-effectiveness tests when viewed from an energy or water utility perspective alone, but they pass under an integrated approach.

Economic incentives for more efficient consumer use

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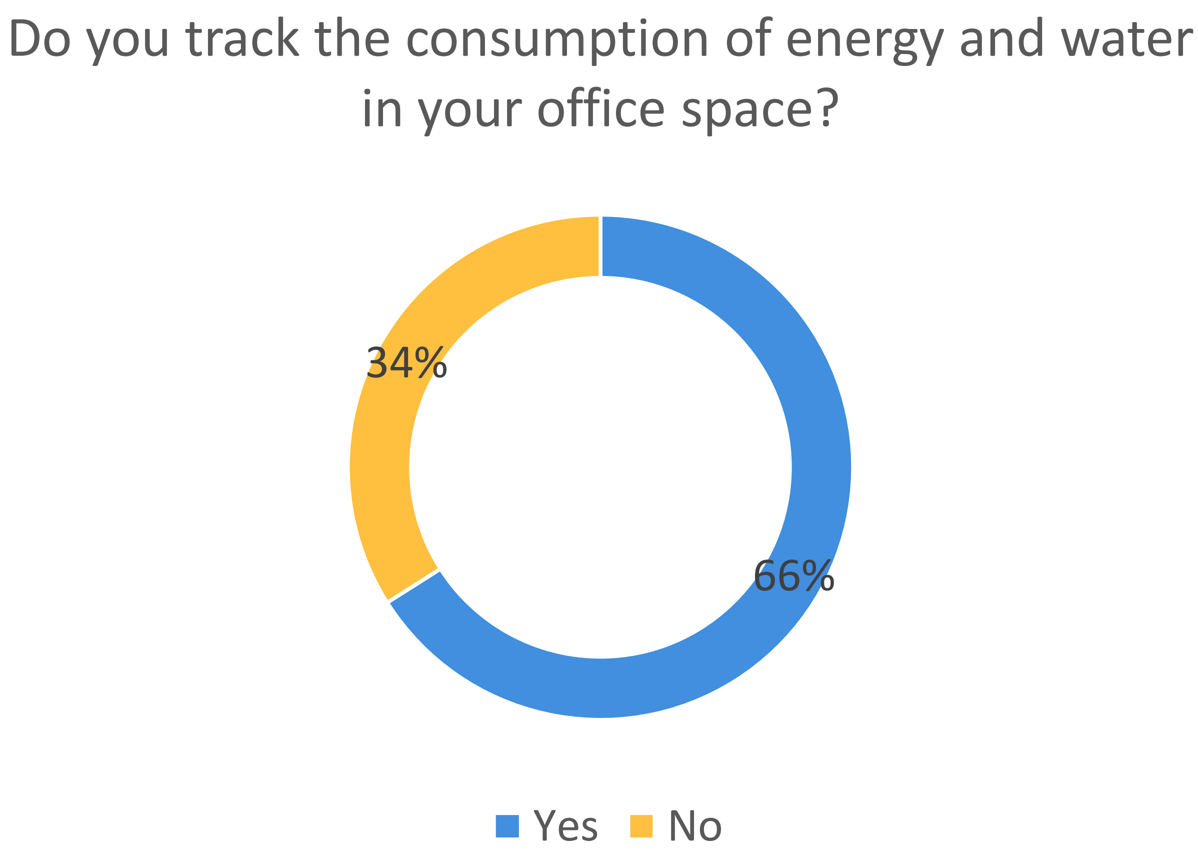
The UAE private sector



Source: Rouchdy and Alam, 2015.

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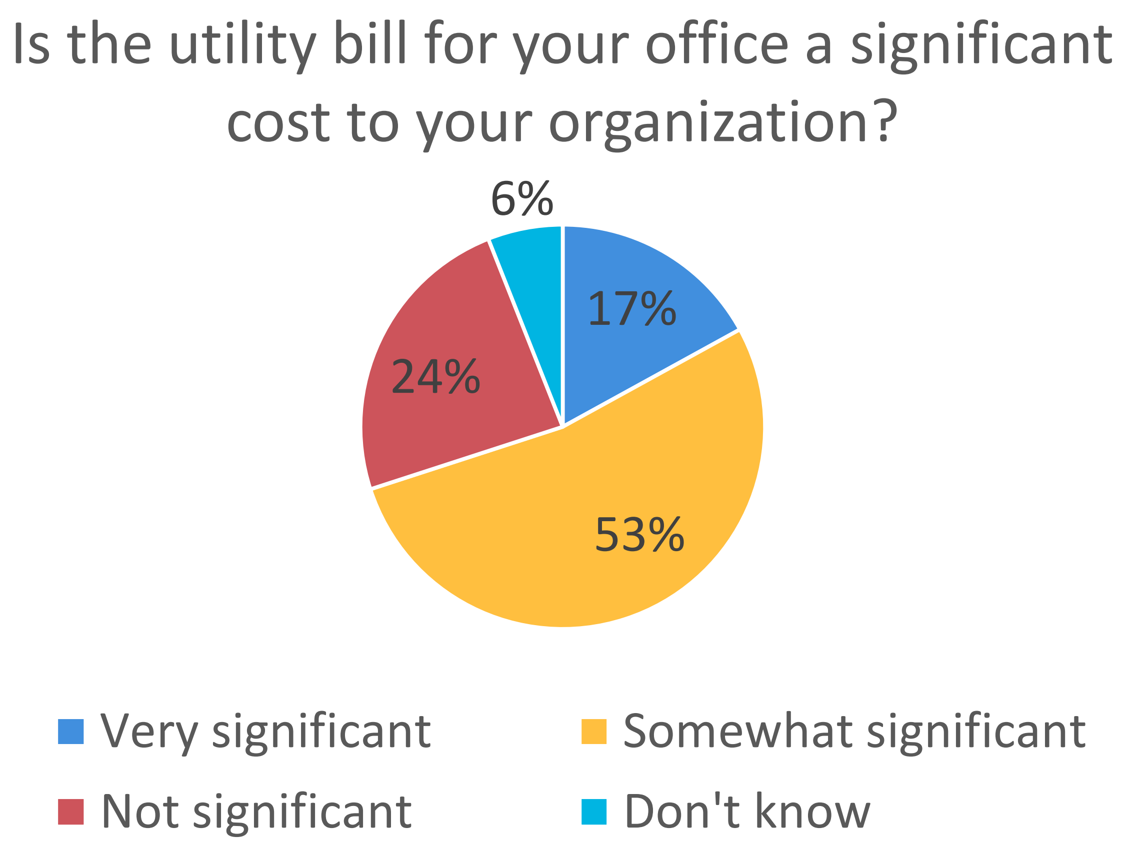
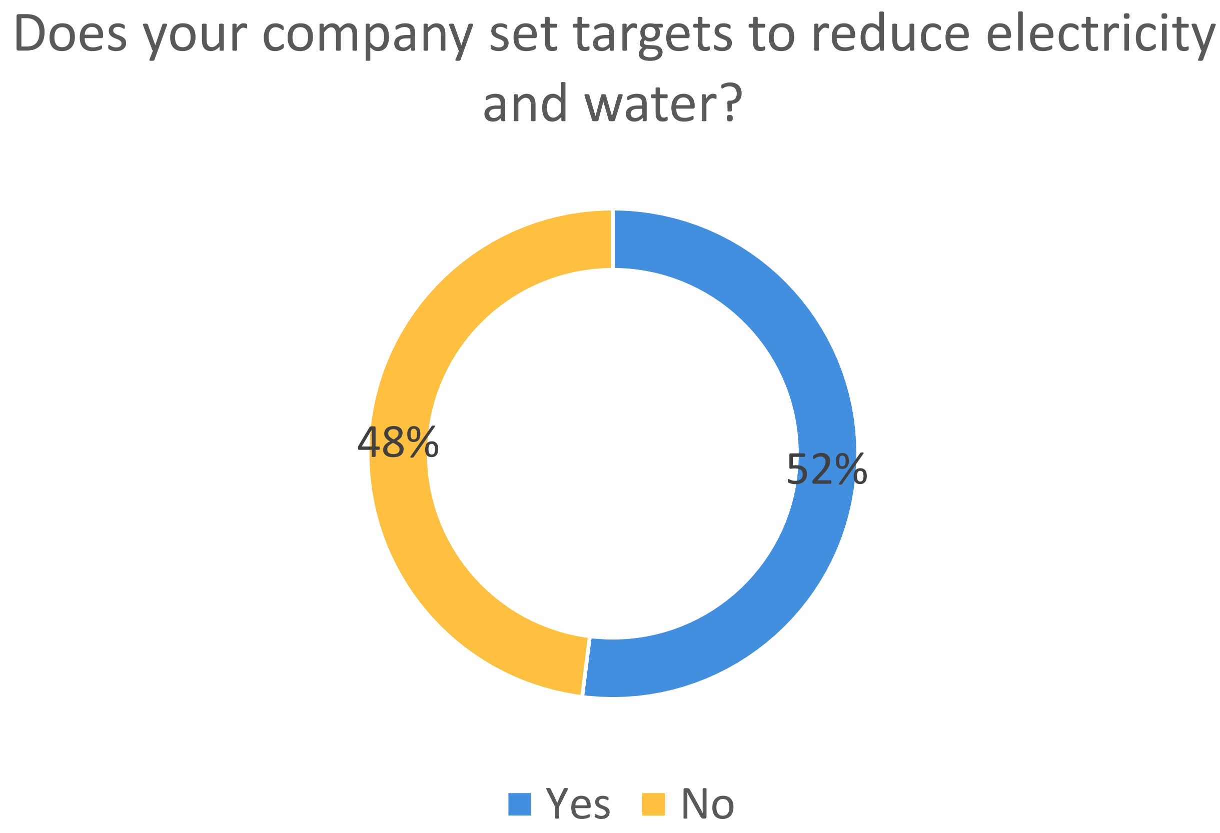


Source: Rouchdy and Alam, 2015.

The UAE private sector



Source: Rouchdy and Alam, 2015.

Economic incentives for more efficient consumer use

The UAE private sector

Source: Rouchdy and Alam, 2015.

Key messages

- There tends to be much 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.

- 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.

THANK YOU

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