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Rosenberg International Forum on Water Policy

Water for Residential Sector: Socio-Economic Welfare and Environmental Costs

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Introduction

The role of water pricing

Wastewater reuse: investing in the re-use infrastructure

Water transfers & water markets

Environmental costs related to desalination

Urban Water Security

Water pricing

What if the water price < cost of water?

- 88% of Americans are paying less for water than it costs to produce (2023)
- In Tunisia the water utility is recovering only 70% of the cost of water
  - 30% subsidy goes to the above middle class
- In Oman +$300 million subsidy for water annually
  - Most of it goes to the middle and above middle class
- In Algeria users pay less than 10% of the cost

Consequences

- Lack of maintenance
  - High leakages
  - Corrosion affecting the quality
- Lack of investments
  - Leaving part of the demand unsatisfied

How water users respond to quality degradation?

When a public utility fails to take collective action, users tend to act individually

- Purchase of water purifiers
- Bottled water

Example from Tunisia

1. It is much more economically

Efficient to improve quality by the

Water Utility: Cost recovery is the min

2. Reconsidering pricing method

Income Category	Monthly tap water bill **Dinars**	Monthly spending on bottled water **Dinars**	Share of water bill in income	Share of bottled water in income
Lowest 750	**32**	**25**	**4.23%**	**3.30%**
1250	40	31	3.19%	2.47%
2000	47	47	2.34%	2.37%
3250	48	64	1.48%	1.98%
5000	54	88	1.08%	1.76%
Highest 6000	**46**	**55**	**0.76%**	**0.92%**

Very low rate of treated wastewater reuse

Wastewater is not available where needed. It is far from the farms

- Farmers are not opposed to the utilization of properly treated wastewater

Cost of delivery is very high

Reuse is viable if infrastructure costs are covered by public funds

Why do we invest public funds in building dams, yet we hesitate to use public funds for the development of re-use infrastructure, despite its economic feasibility?

In a world with limited resources, it is imperative to make investments in re-use infrastructure

- The availability of wastewater is not contingent on climate conditions

Water transfers, water markets & virtual water

Water transfers from agriculture to urban users should not come at the expense of farmers

Developing water markets

- Farmers sell raw water to water utility & Wastewater treatment plant sells TWW to farmers
  - Sustaining food security
  - Improved adaptation to drought conditions

Fodder crops import and animal feed imports start to be at risk

- Fodder production moved from Saudi Arabia to California to Arizona
  - Arizona sued the producing company for depleting the groundwater…

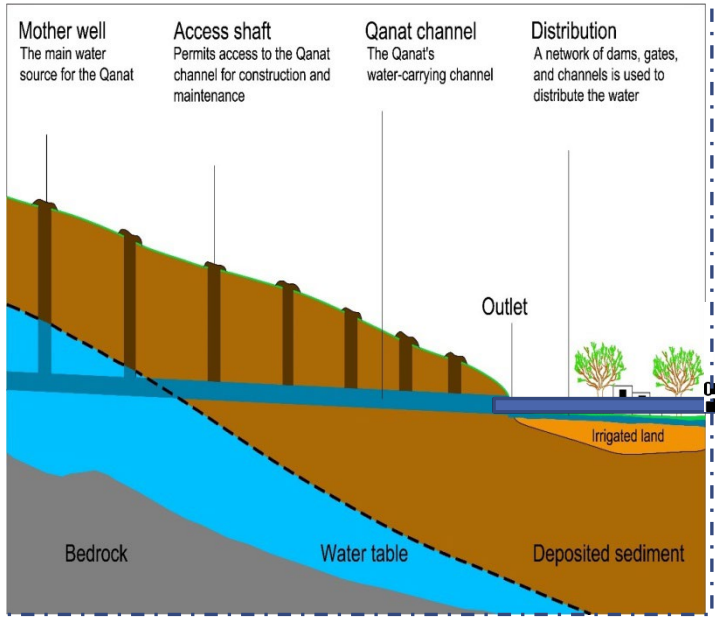
Need to decrease the volumes of water for food production

Reducing food waste in developed/developing countries

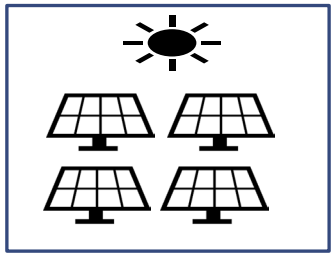
- Targeting food price subsidies

Smart irrigation technology adoption


Legend
Barka Desalination Project
Falaj Daris
Barka Desalination Project
176.3 km
Falaj Daris
Nizwa
700 m elevation above sea level
Google Earth

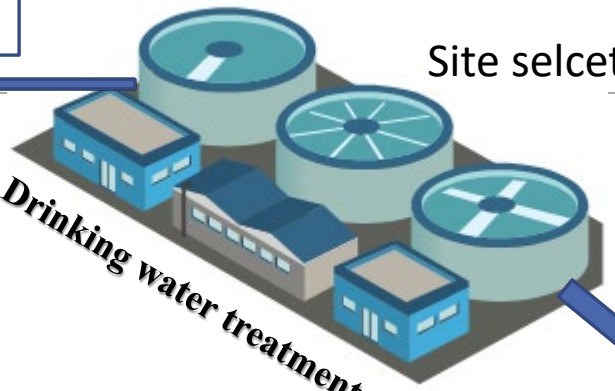


Solar Panel Site selcetion



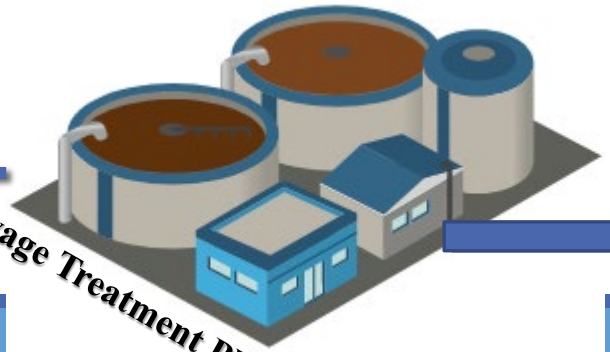
Min observed flows

Site selcetion



Drinking water treatment plant

Water Market



Sewage Treatment Plant

Environmental impact of desalination: GCC

- Brine disposal
  - Simulations on the Gulf Sea estimated that by 2050 significant impacts on species persistence, biodiversity, fisheries productivity and coastal communities.
    - The prediction for the Gulf continuing to provide abundant natural resources is poor.
  - Diversification of the GCC economy will be at risk
- Countries at risk: Kuwait, UAE, Qatar, Bahrain
  - KSA: Lesser degree since it has access to the Red Sea
- Cost of zero brine discharge is $\$5/m^3$

Strategies to cut down the negative externalities of the desalination

1. **Reduce** the per capita water demand;
2. **Re-use** water at household level and organizations levels: Grey water
3. **Recycle water** by increasing the rate of treated wastewater re-use;
4. **Regulations**: more stringent regulations and standards for permitted thermal, salt and chemical discharges in the marine environment;
5. **Renewables:** integrating renewable resources in the desalination process and in the pumping systems of the urban water network
6. **Research**: Fund research programs that address the process of desalination including reduction and valorization of the brine, the use of chemicals in the process;

Integrated Management of groundwater and desalinated Water

The net benefit from storage and recovery estimated at $17.80 million/year

Original Paper | Published: 15 January 2021

Optimization of storage and recovery of seasonal surplus desalinated water in a coastal aquifer

Slim Zekri, Chefi Triki, Ali Al-Maktoumi & Mohammad Reza Bazargan-Lari

Arabian Journal of Geosciences **14**, Article number: 100 (2021) | Cite this article

Published: 30 July 2021

A Probabilistic Multiperiod Simulation–Optimization Approach for Dynamic Coastal Aquifer Management

Ali Al-Maktoumi, Mohammad Mahdi Rajabi, Slim Zekri & Chefi Triki

Water Resources Management **35**, 3447–3462 (2021) | Cite this article

Integrated groundwater and desalinated Water Management in Qatar

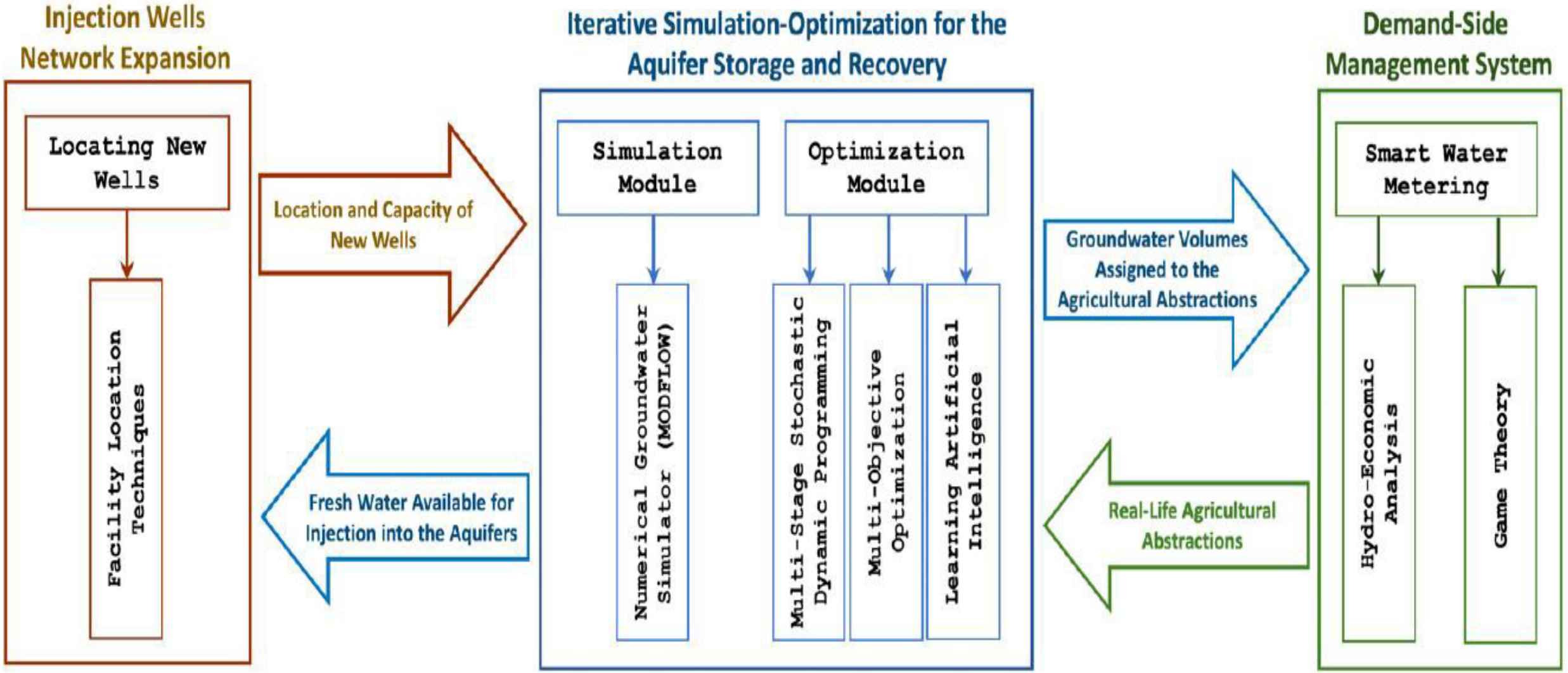
- Excess design capacity of desalination plants
  - 19.5%
  - 162 Mm3
  - Annual cost: $137 Million
- Concrete storage: ONE centralized Mega Reservoir capacity 27 Mm3
- 7 days water security
  - Investment cost $167/$m^3$ to create storage capacity

Managed Aquifer Recharge

1. **Improve water security**
2. **Reduce the cost of water security**

- **Use Aquifer Storage and Recovery**
  - **Storage capacity is free Vs 4.5 Billion $ of investment**
  - **Maintenance costs are expected to be smaller**
- **Smart Water Metering to control farmers pumping**
- **Multi-Period Aquifer Management**

Methodology



Conclusions

- Potential gains are substantial
- Annual saving of the excess desalinated water estimated at $137 million
- Larger storage capacity for free
- 10 times improved water security going from 7 days to 73 days
- Protection of the aquifer from subsidence
- Protection of the aquifer from seawater intrusion
- Reduced operating and management expenditures
- Controlled Agricultural pumping

Thank you