



Why Reuse?



Pure Innovation.

Categories of Reuse

Unrestricted Urban Reuse “Parks, Playgrounds...”

Restricted Urban Reuse “Golf Courses, Cemeteries...”

Agriculture Reuse – Food Crops “for human consumption

Agriculture Reuse – Non-Food Crops “fodder, seed crops...”

Industrial Reuse “Cooling systems, process water...”

Groundwater Reuse “Discharge into infiltration basins, ponds...”

Indirect Potable Reuse “Discharge into surface water...”



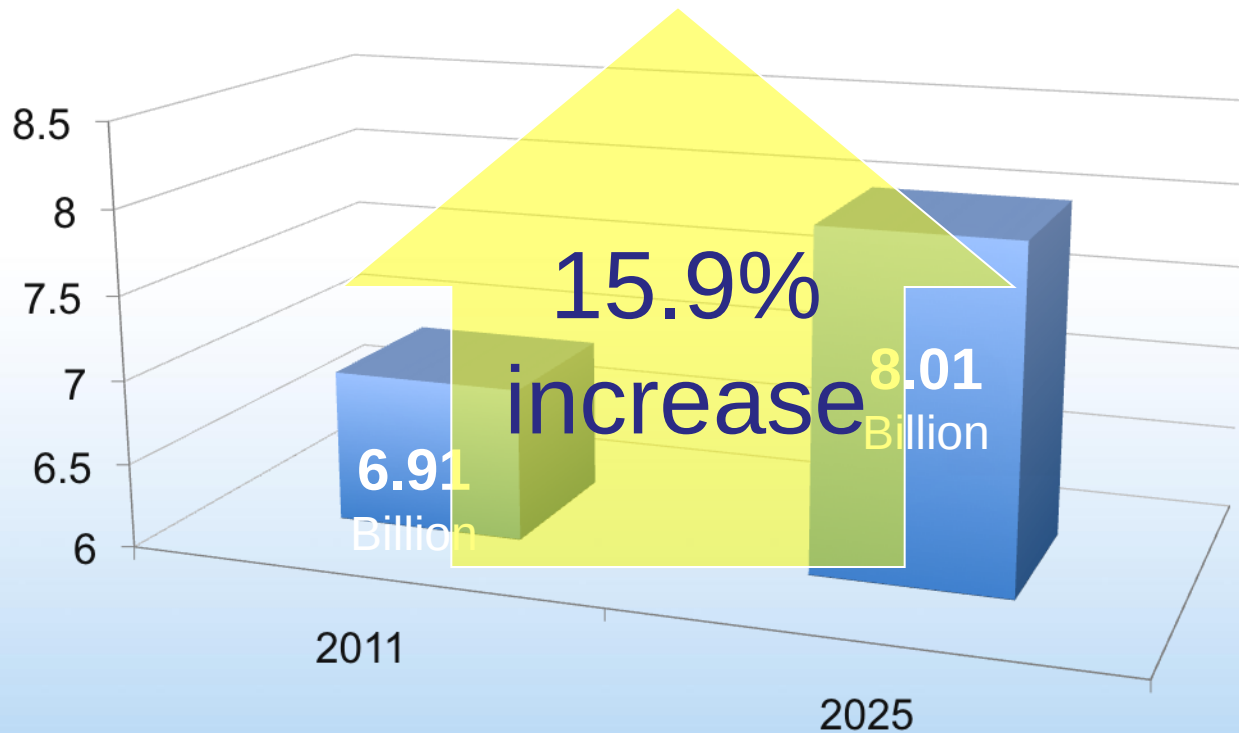


Drivers for Reuse:



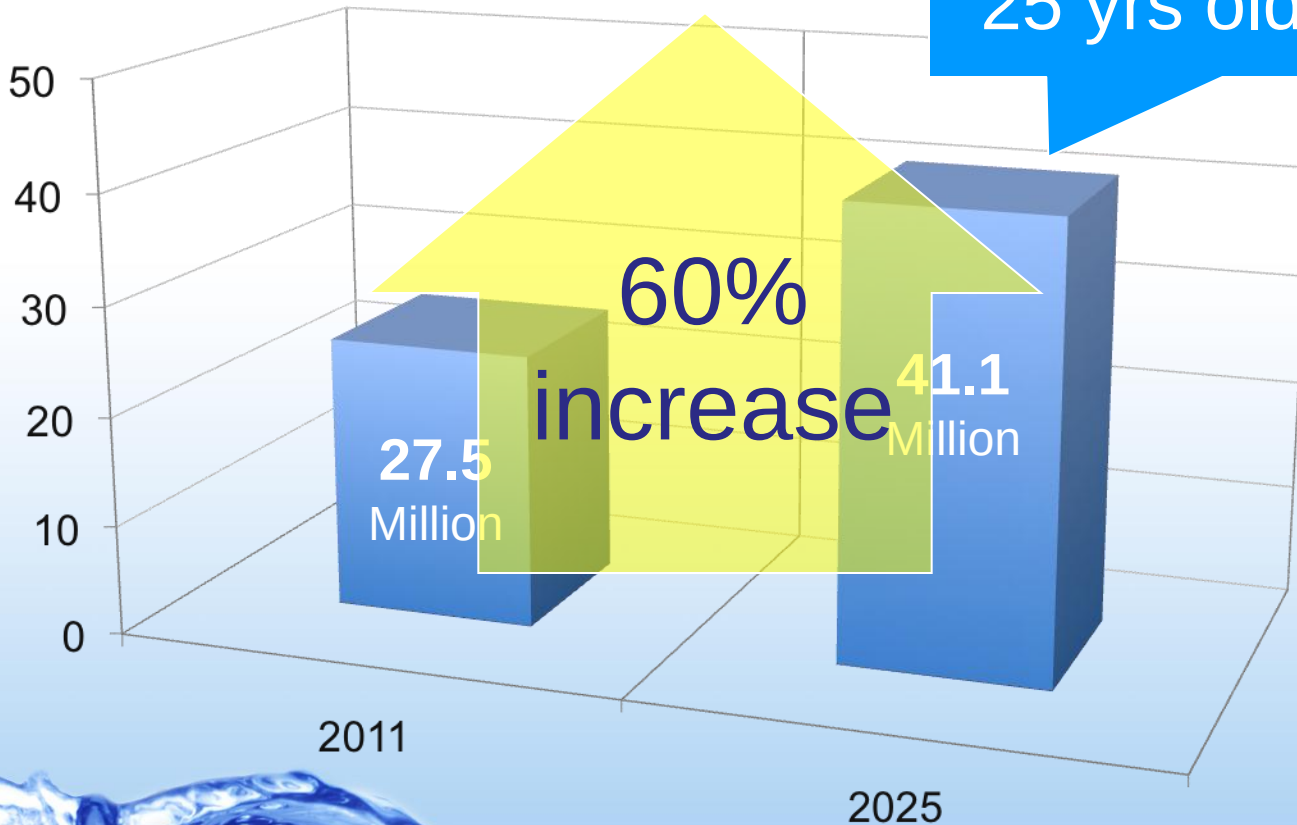
Population Growth

Population Growth



Population Growth

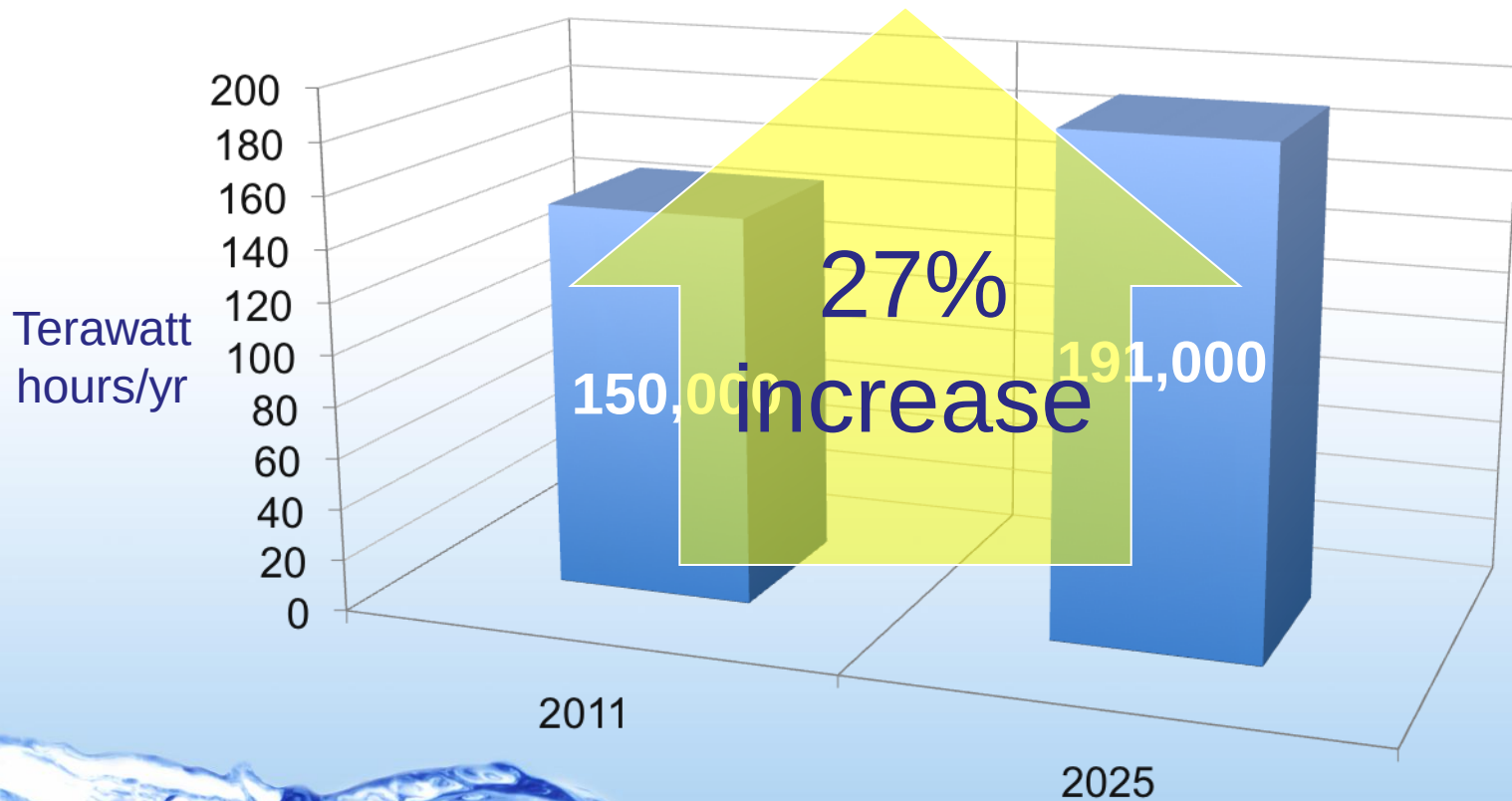
60% of population
under the age of
25 yrs old



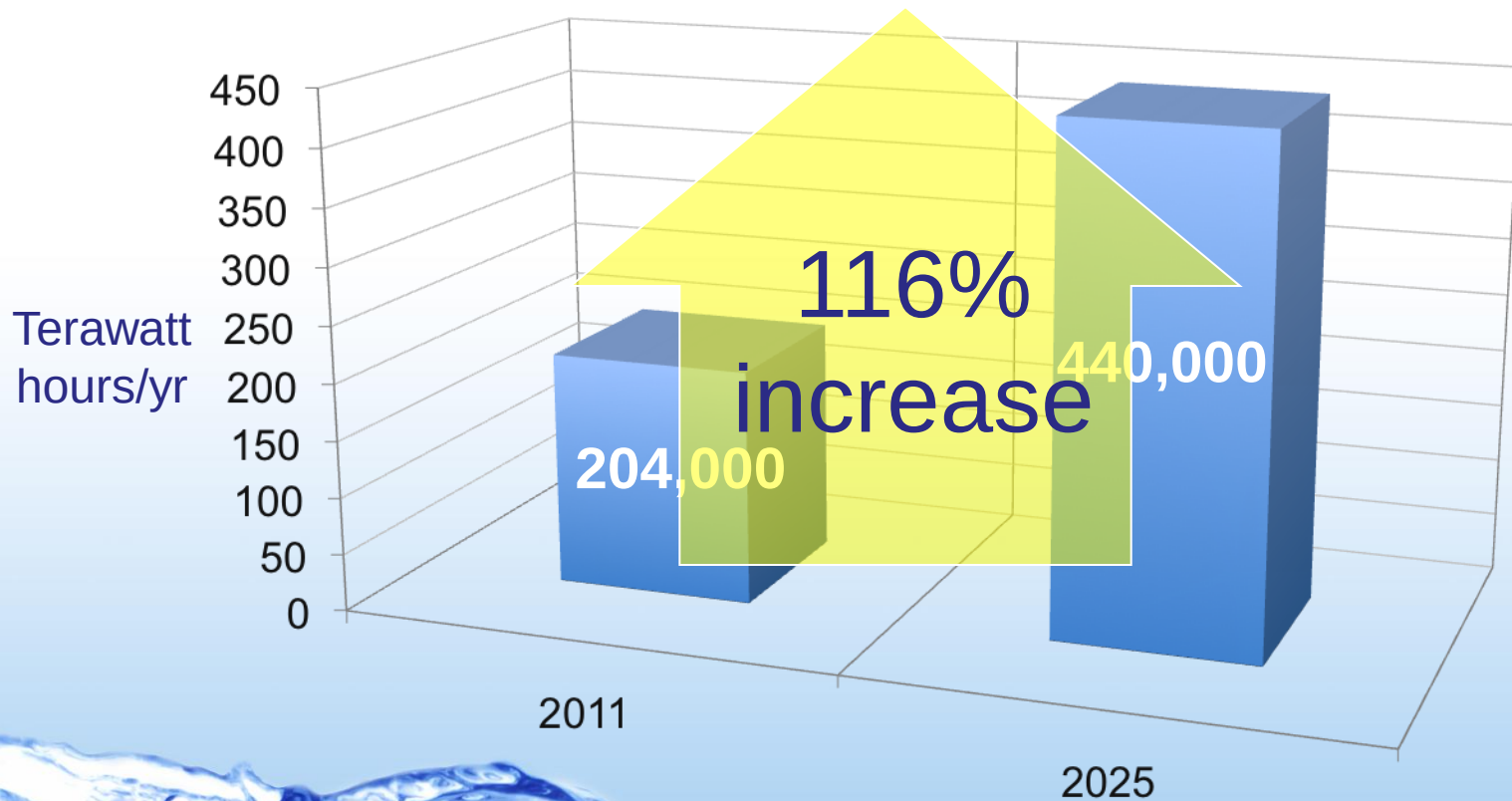


Greater Energy Needs

Energy Demands



Energy Demands



Energy & Water are Co-Dependent

Water is
required in the
production of
Energy



Energy is required
for treating &
pumping water

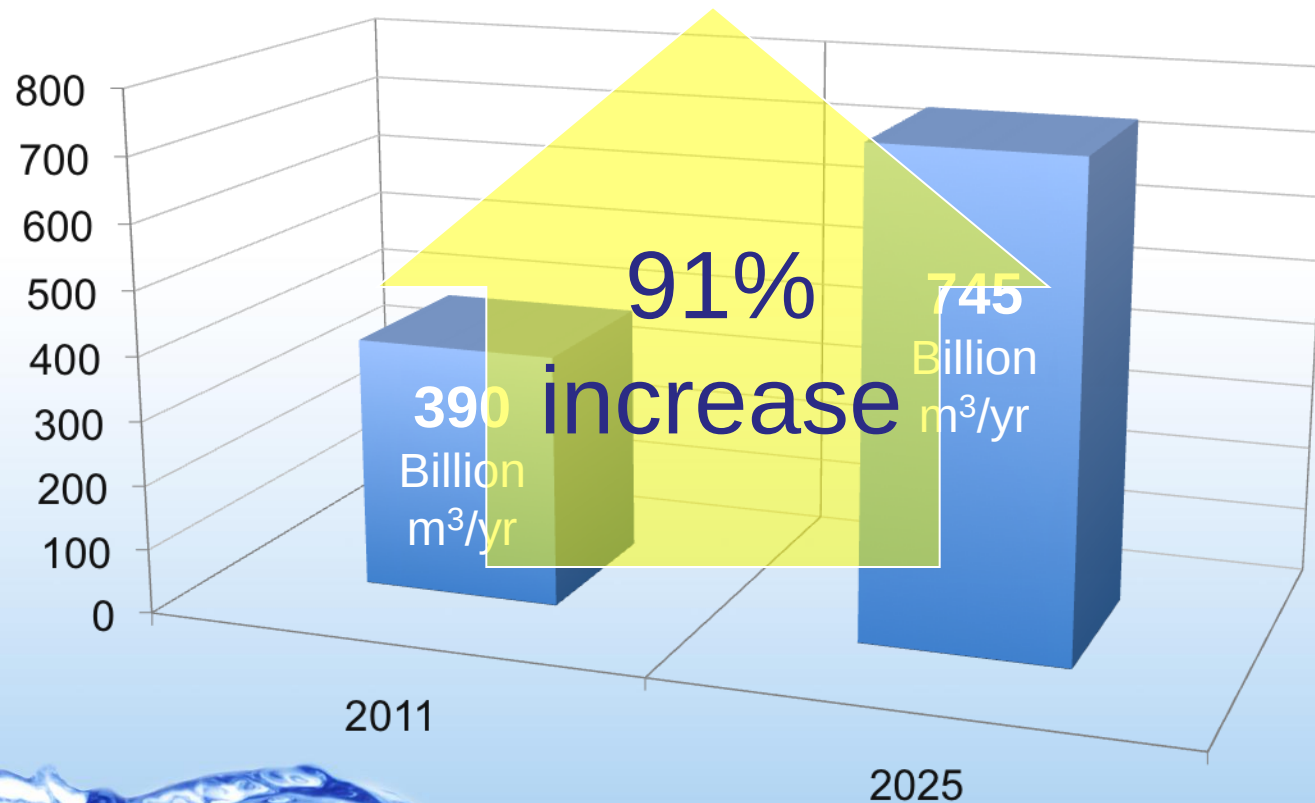




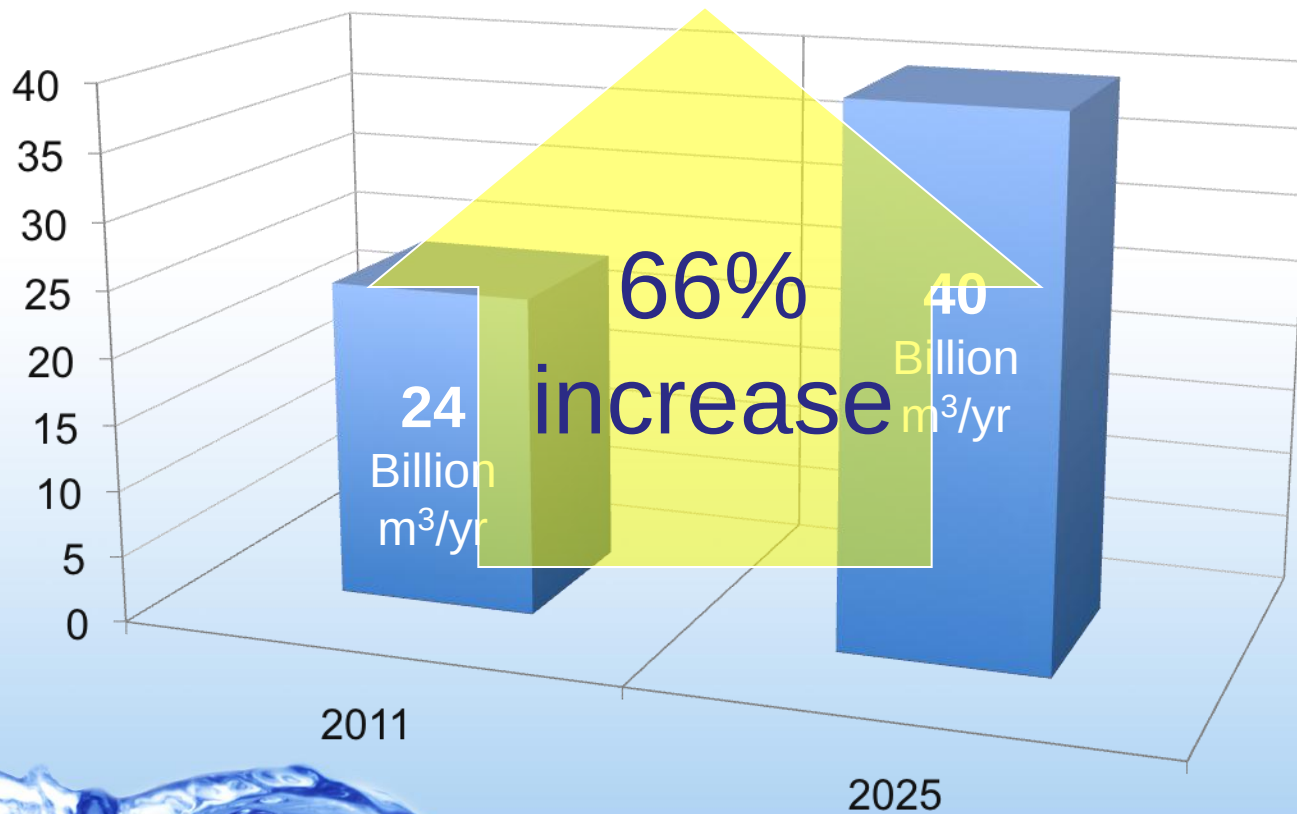
istockphoto

Compounded Water Demands

Water Production (Global)



Water Production (Saudi Arabia)





Modernization

The image shows a city skyline, likely New York City, with several skyscrapers visible. The sky is a deep, hazy orange, suggesting a sunset or sunrise, or perhaps a hazy day. A bright, glowing orb (the sun or moon) is positioned low on the right side of the horizon, creating a lens flare effect. The overall atmosphere is somber and dramatic, fitting the theme of global climate change.

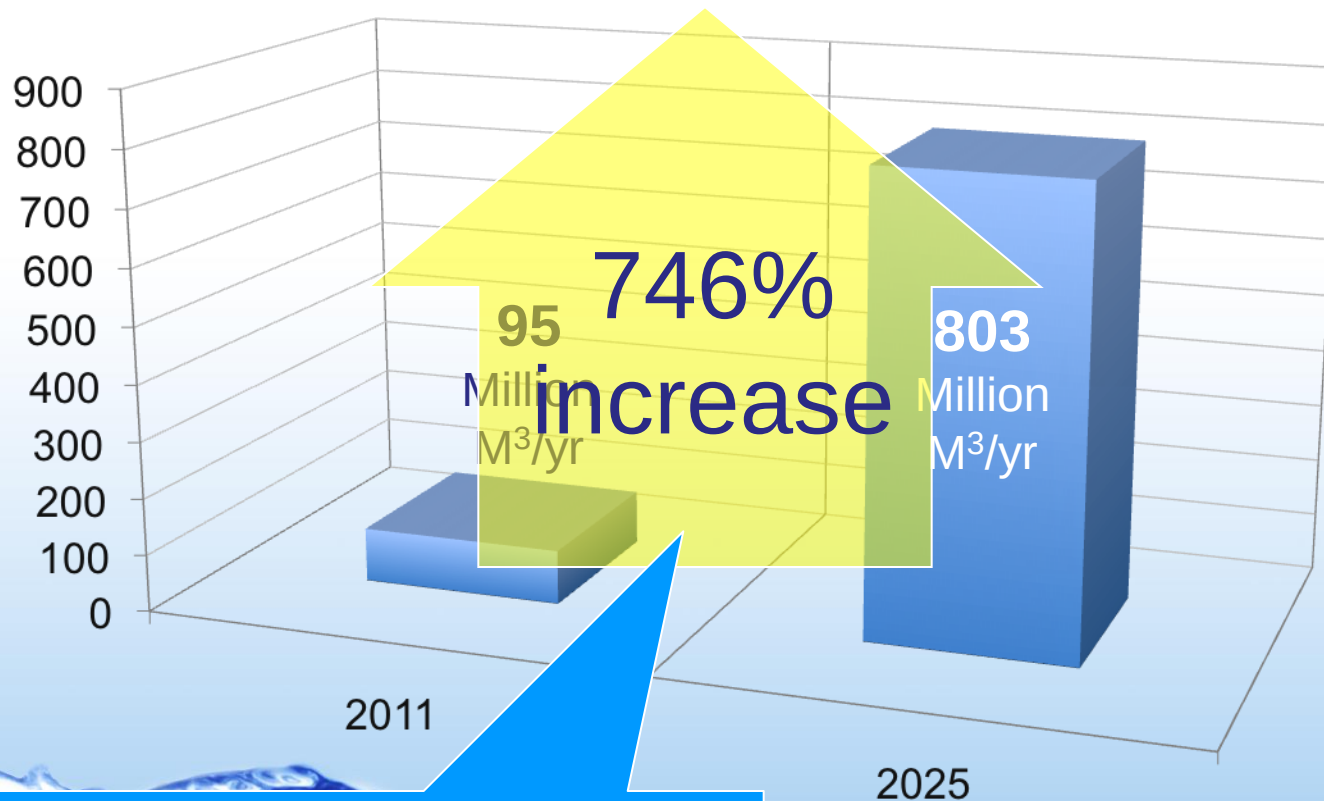
Global Climate Change

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Increased Agricultural Demand

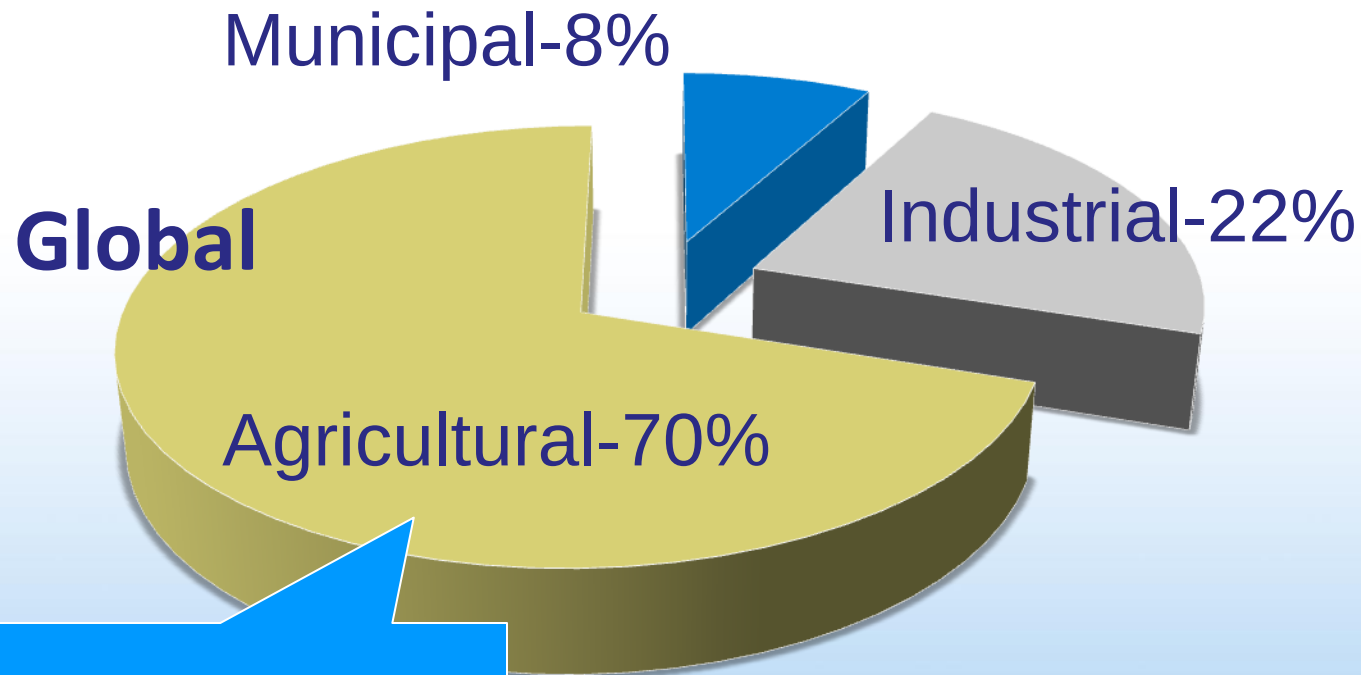
Projected Reuse Growth



2 Million m³/day increase.



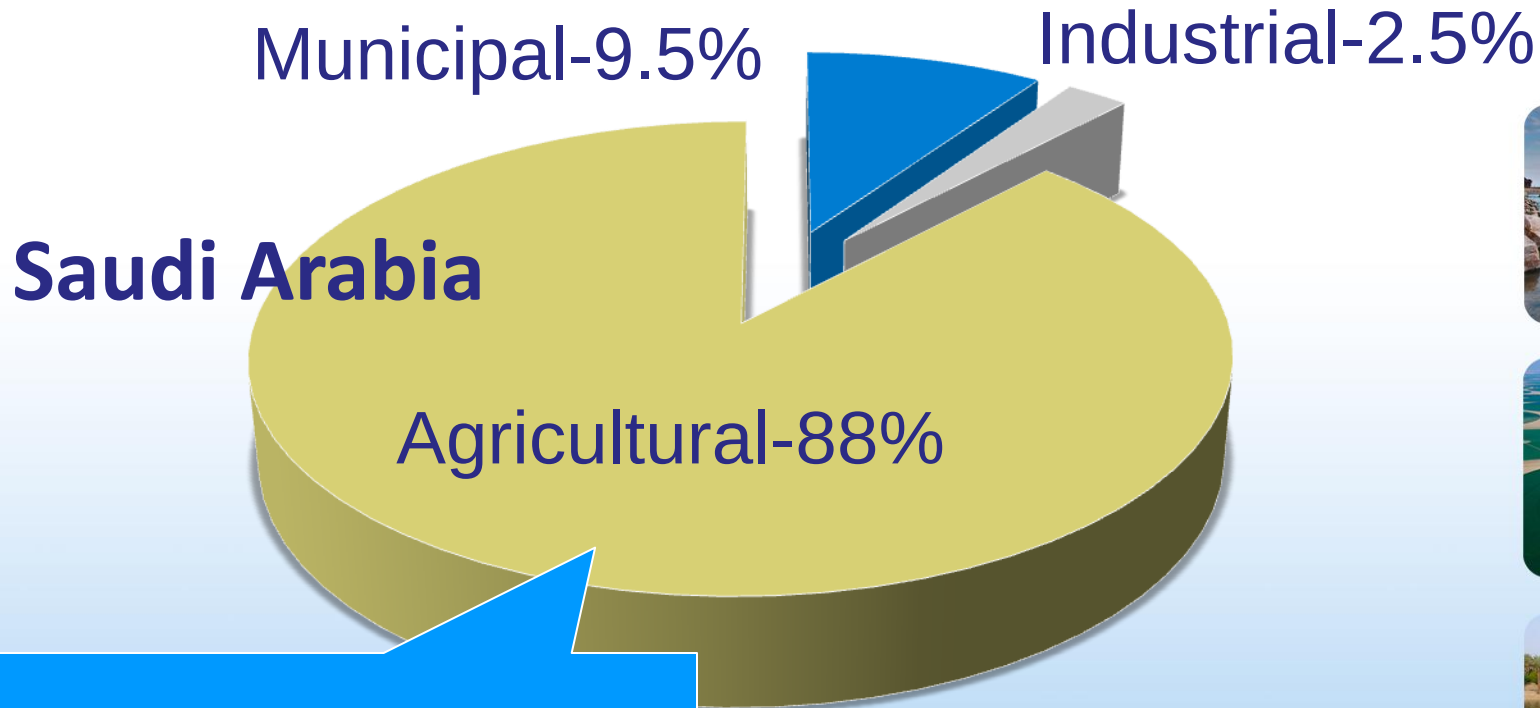
Water Consumption Analysis



Nearly 92% of the Global Water usage can be subsidized with Reuse water



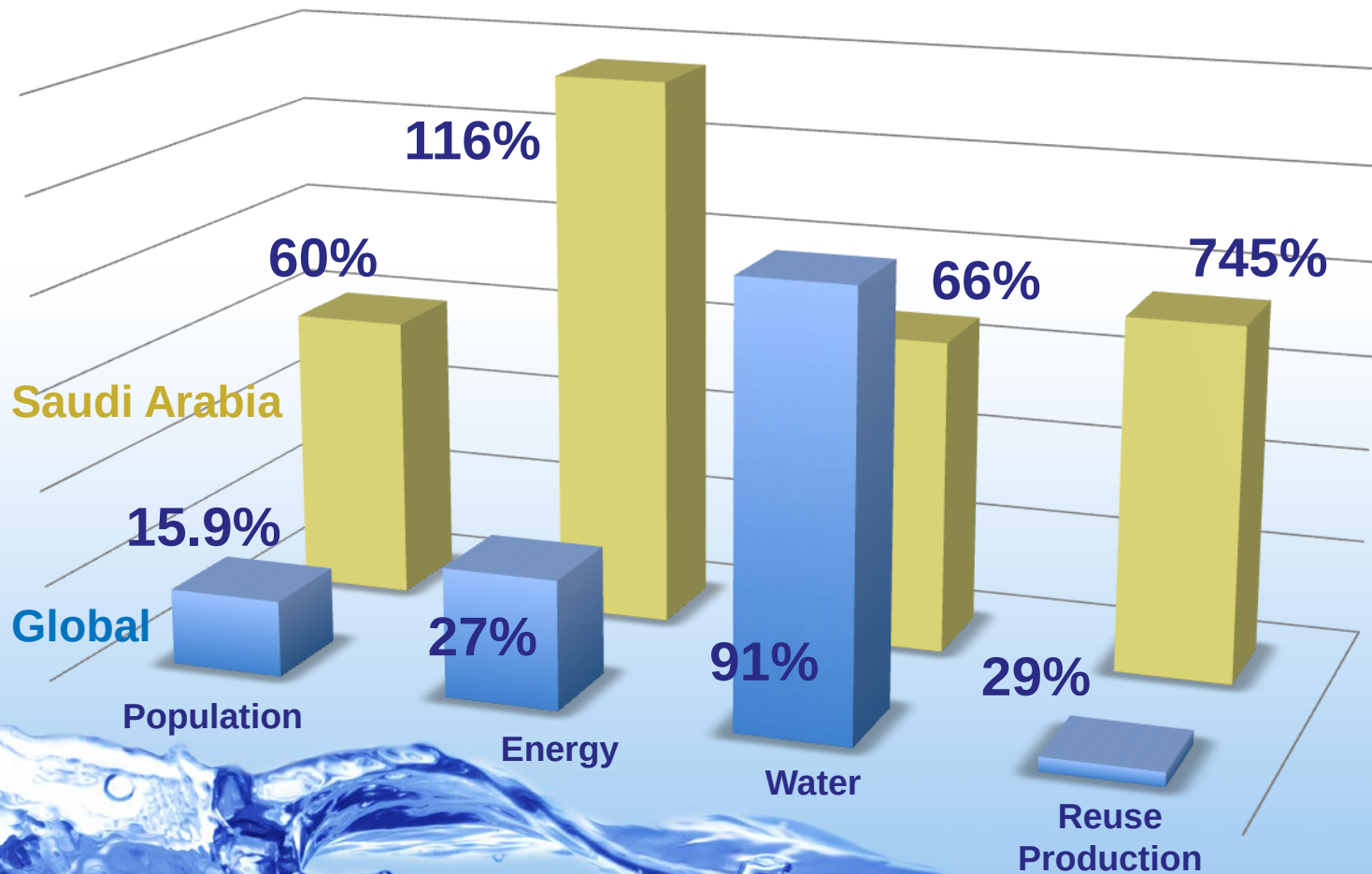
Water Consumption Analysis



Nearly 90.5% of the Country's water usage can be subsidized with Reuse water



Growth Globally vs. Saudi Arabia



- What Quality is Required for Reuse Water?



Water Reuse Standards

(Unrestricted Reuse)

	Saudi Arabia	Title 22 (U.S.)
pH	6 – 8.5	6 – 8.5
Total Suspended Solids	10 mg/L	5 mg/L
Turbidity	5 NTU	2 NTU
Total Dissolved Solids	2500 mg/L	2500 mg/L
Biochemical Oxygen Demand	40 mgO ₂ /L	40 mgO ₂ /L
Nitrate Nitrogen	10 mgN/L	10 mgN/L
Ammonia Nitrogen	5 mgN/L	5 mgN/L
Fecal Coliform	2.2 cfu/100ml	2.2 cfu/100ml
Parasitic Eggs	1.0 egg/L	No detects



Quality Reuse Technologies

The conversion of salt water to fresh water so it is suitable for human consumption



Quality Reuse Technologies

A combination of technologies—Micro-Filtration and Reverse Osmosis (MF-RO) used to treat water for human consumption



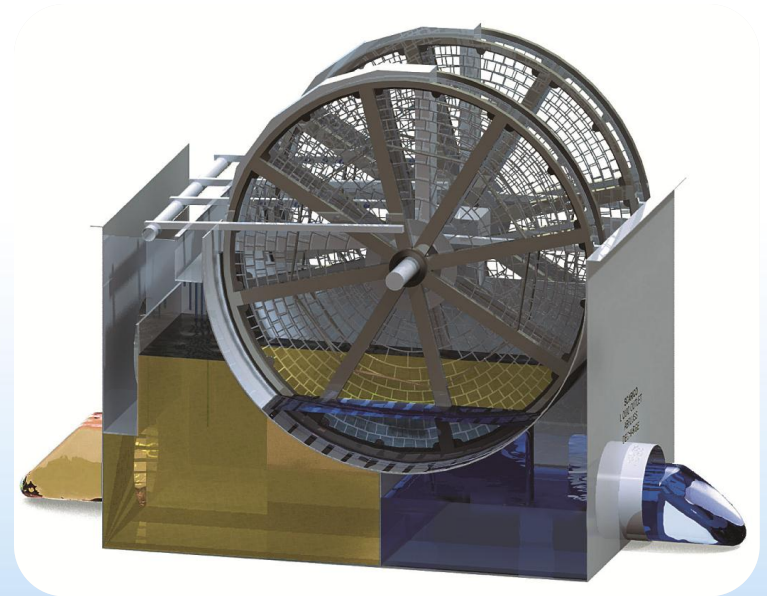
Quality Reuse Technologies

Immersed Bio Membrane (MBR) treatment pulls treated water through membranes, leaving solids behind

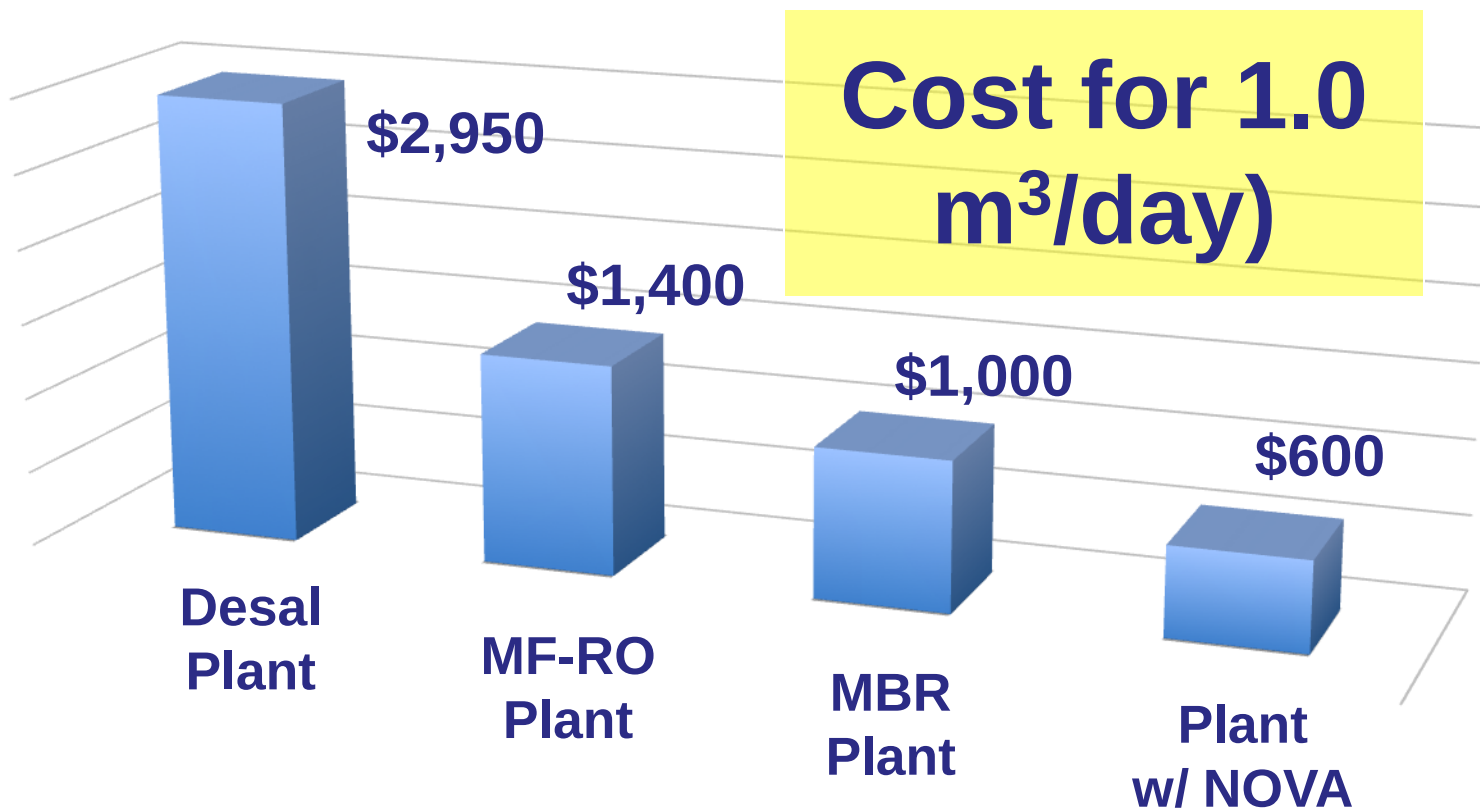


Quality Reuse Technologies

Conventional treatment process with the addition of NOVA's tertiary disk filter.

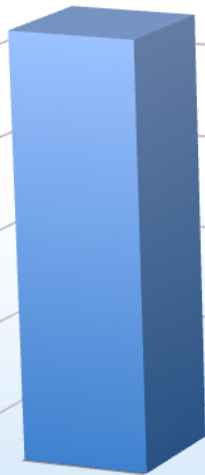


Purchase Price (Capital Cost)



Operation & Maintenance Cost (O&M)

**Cost per
1.0 m³**



\$2.27

**Desal
Plant**

\$0.89

**MF-RO
Plant**

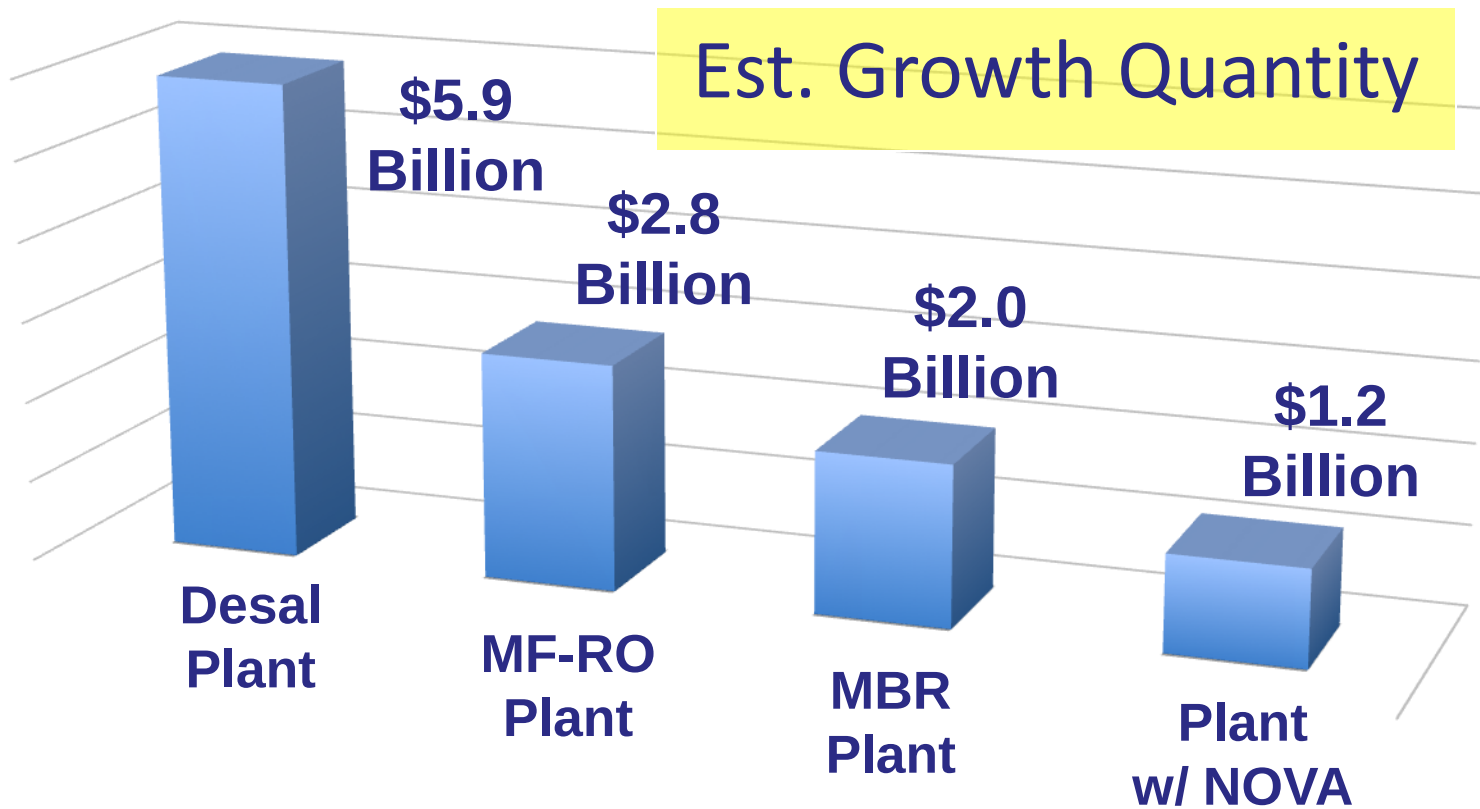
\$0.51

**MBR
Plant**

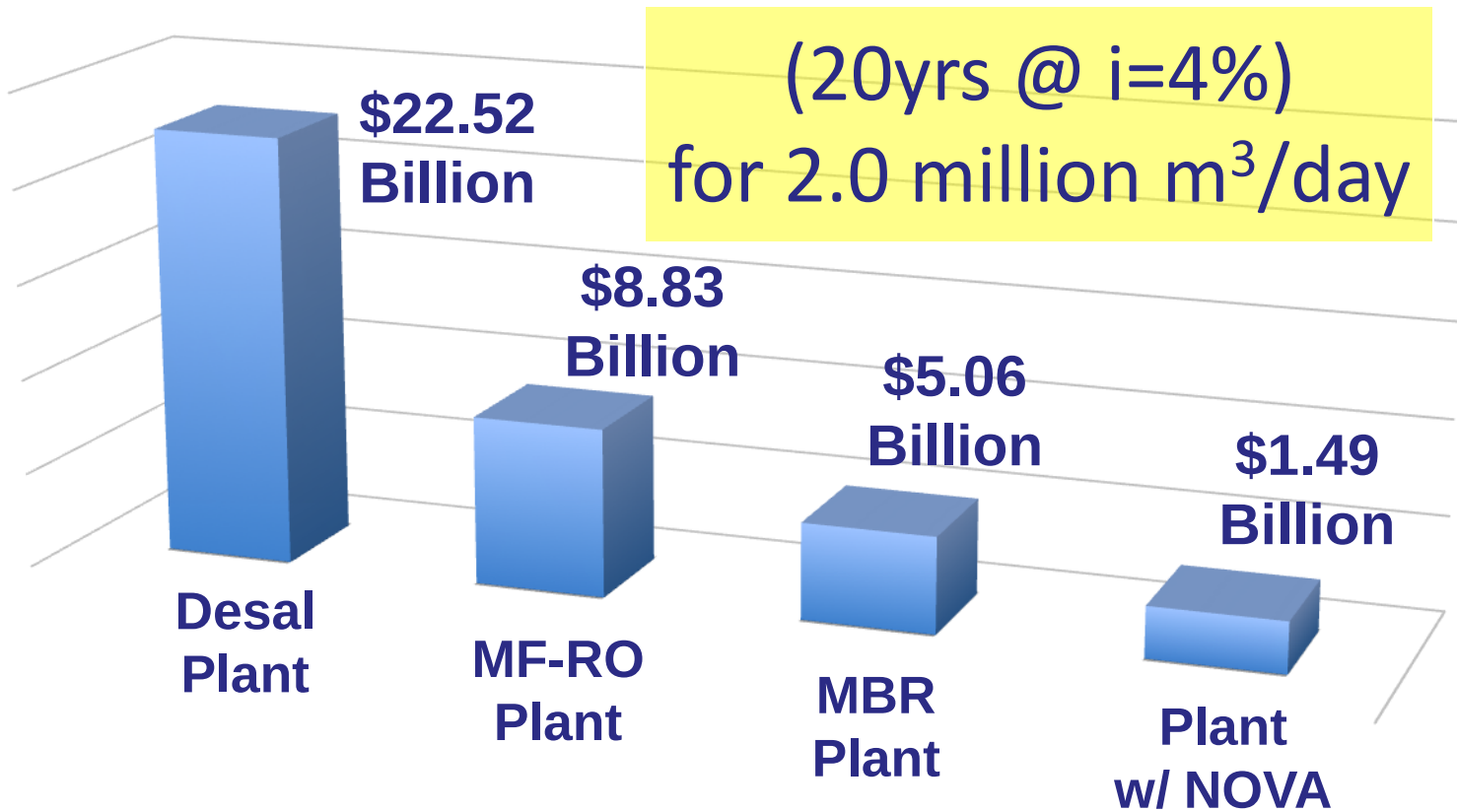
\$0.15

**Plant
w/ NOVA**

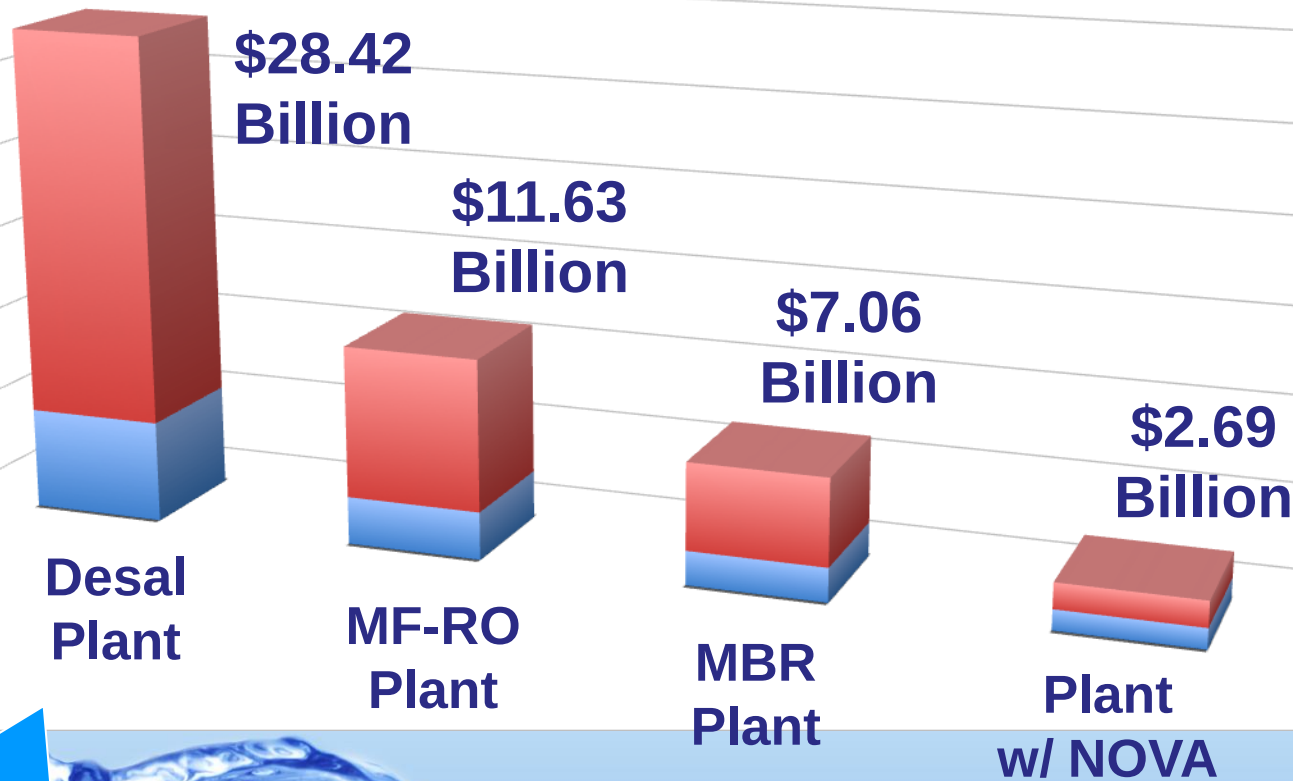




20M Lf C l C

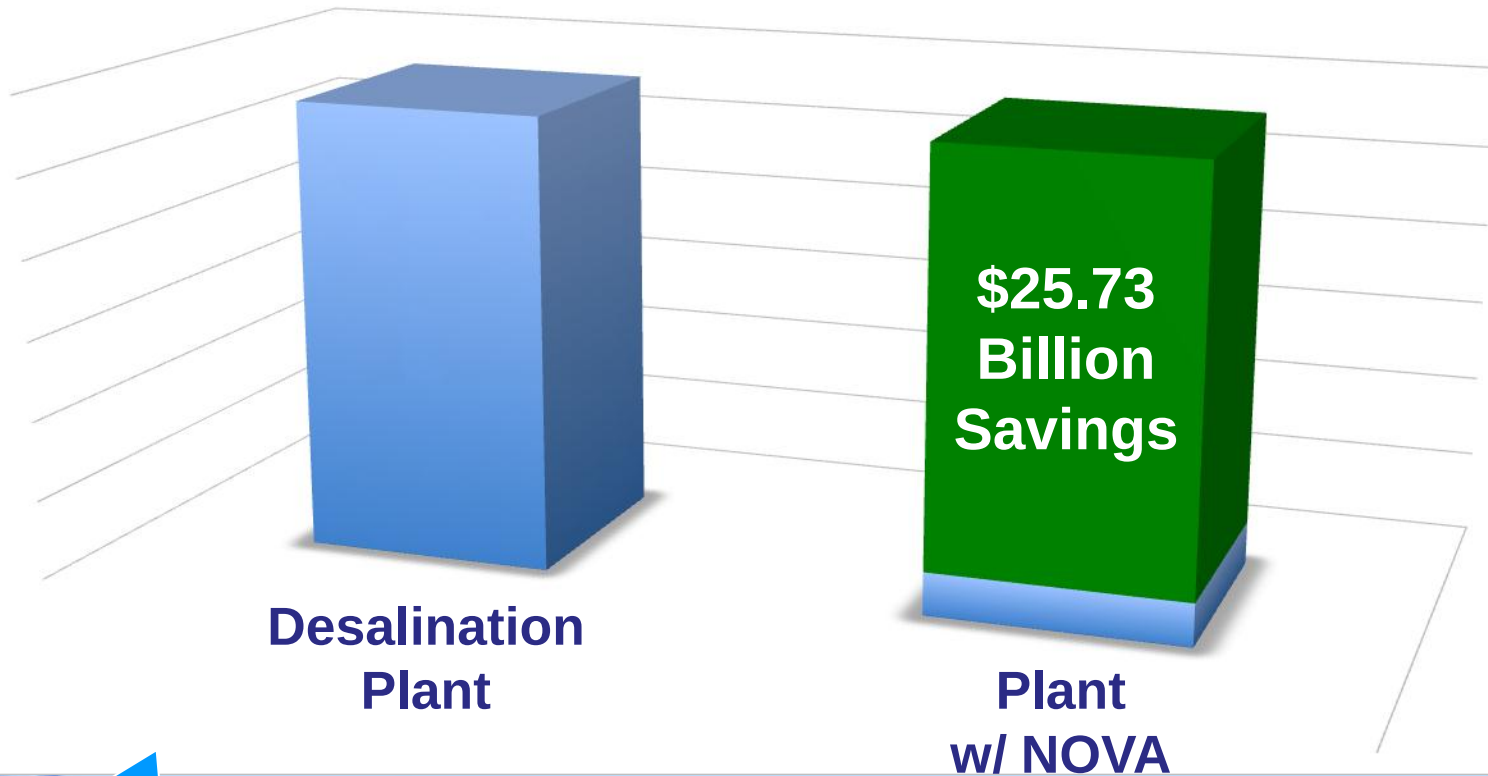


Final Economic Comparison



Capital and O&M
Life Cycle Cost

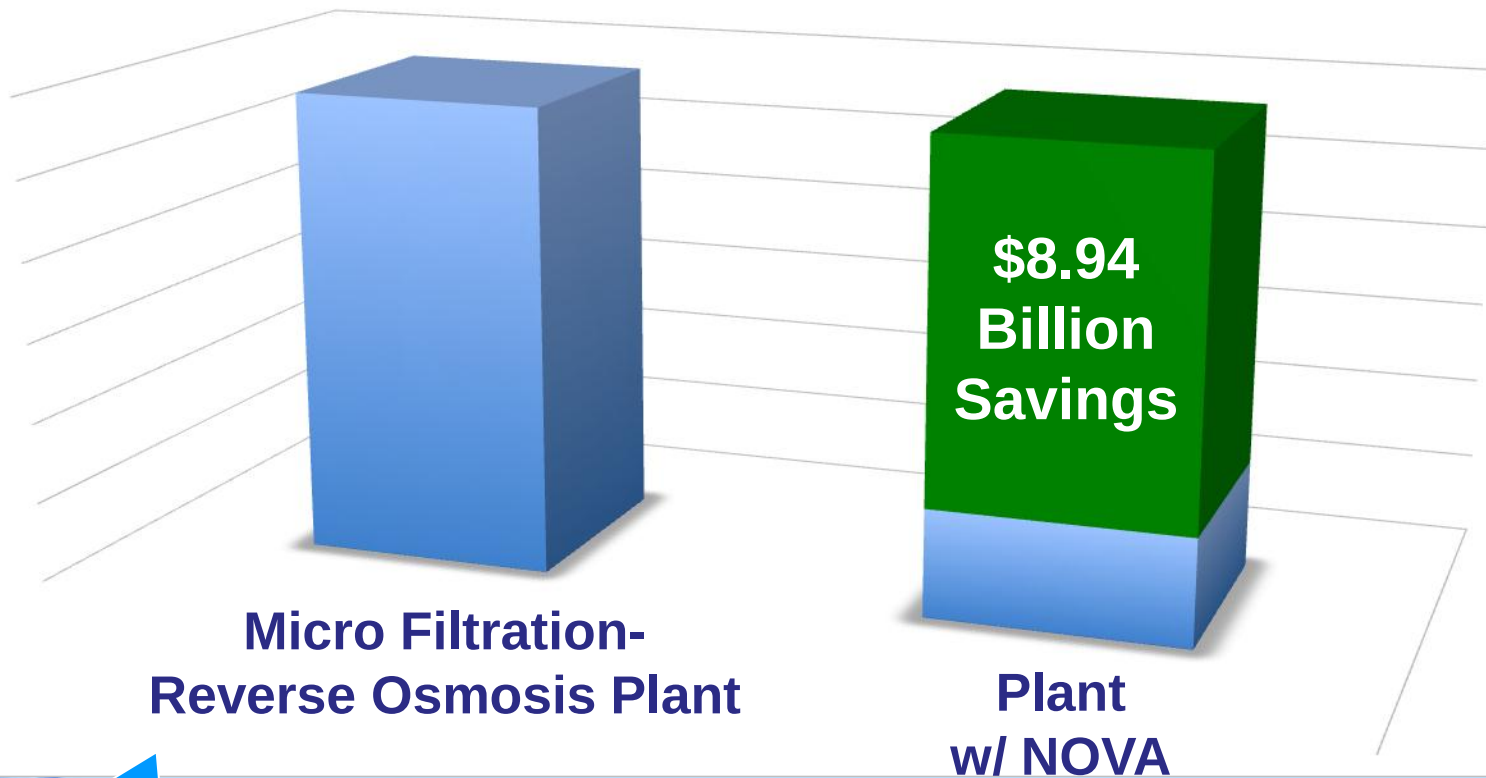
Desalination vs. NOVA



Capital and O&M
Life Cycle Cost



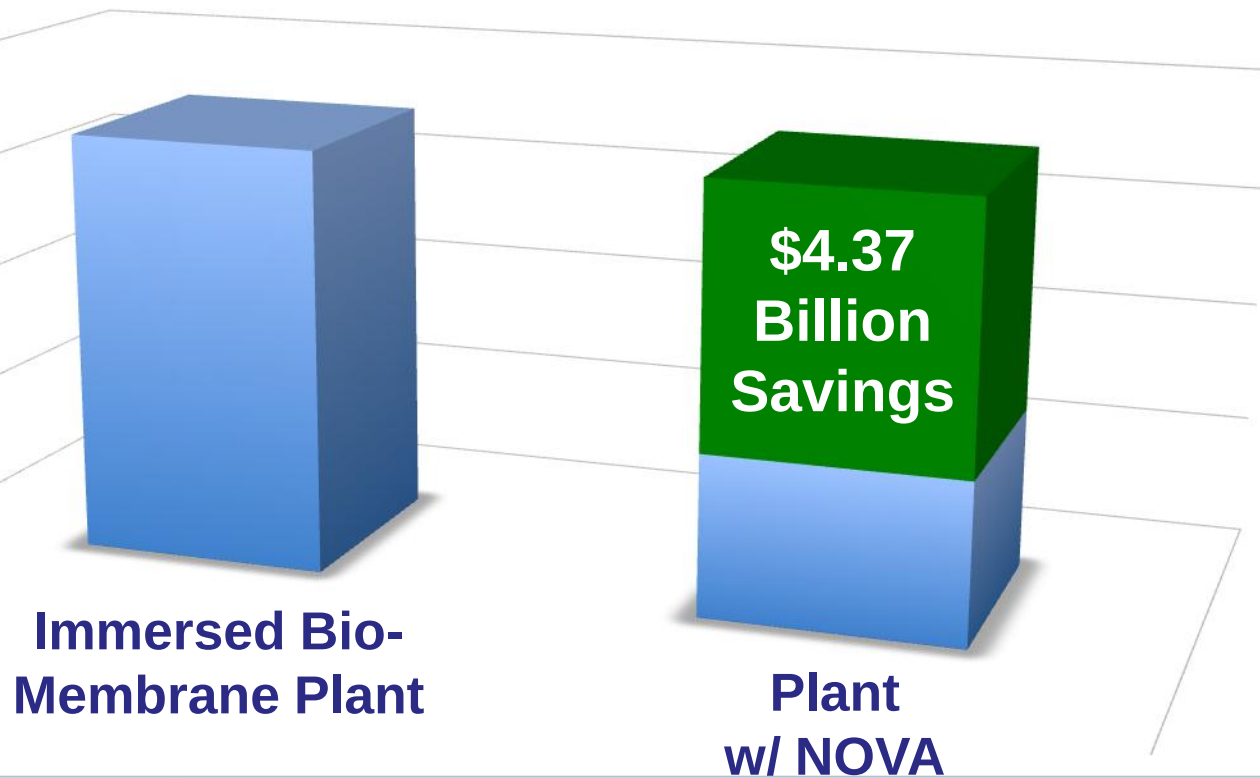
MF-RO vs. NOVA



Capital and O&M
Life Cycle Cost



MBR vs. NOVA



Capital and O&M
Life Cycle Cost





Global Reuse Goals



Preservation and conservation
of water resources, including
surface water and groundwater

A wide-angle photograph of a waterfront park. In the foreground, a large, flat, light-colored stone slab sits on a rocky shore. To the left, a body of water with dark blue-green hues flows. To the right, a series of wide, light-colored stone steps lead up from the water. Numerous people are gathered in the park; some are sitting on the steps, while others are standing or walking near the water. The background is filled with a dense line of tall palm trees under a clear, pale blue sky. A small, distant airplane is visible in the upper right portion of the sky.

Protect human health
and the environment

Manage quality and quantity of
water, while reducing demand
on fresh water supplies



A close-up photograph of two hands cupped together, catching water falling from above. The water is splashing and creating many small droplets and bubbles. The background is a blurred green, suggesting foliage. The lighting is bright, highlighting the texture of the water and the skin.

Manage quality and quantity of
water, while reducing demand
on fresh water supplies



Available water supplies for
Agricultural, Industrial, Energy,
and Landscape demands

A high-speed photograph of a glass of water being splashed, with the text 'Q&A' overlaid in the center. The water is captured in mid-air, creating a crown-like shape with many droplets. The background is a solid light blue.

Q&A