

GE Power & Water
Water & Process Technologies

Water Reuse Solutions



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NACWA

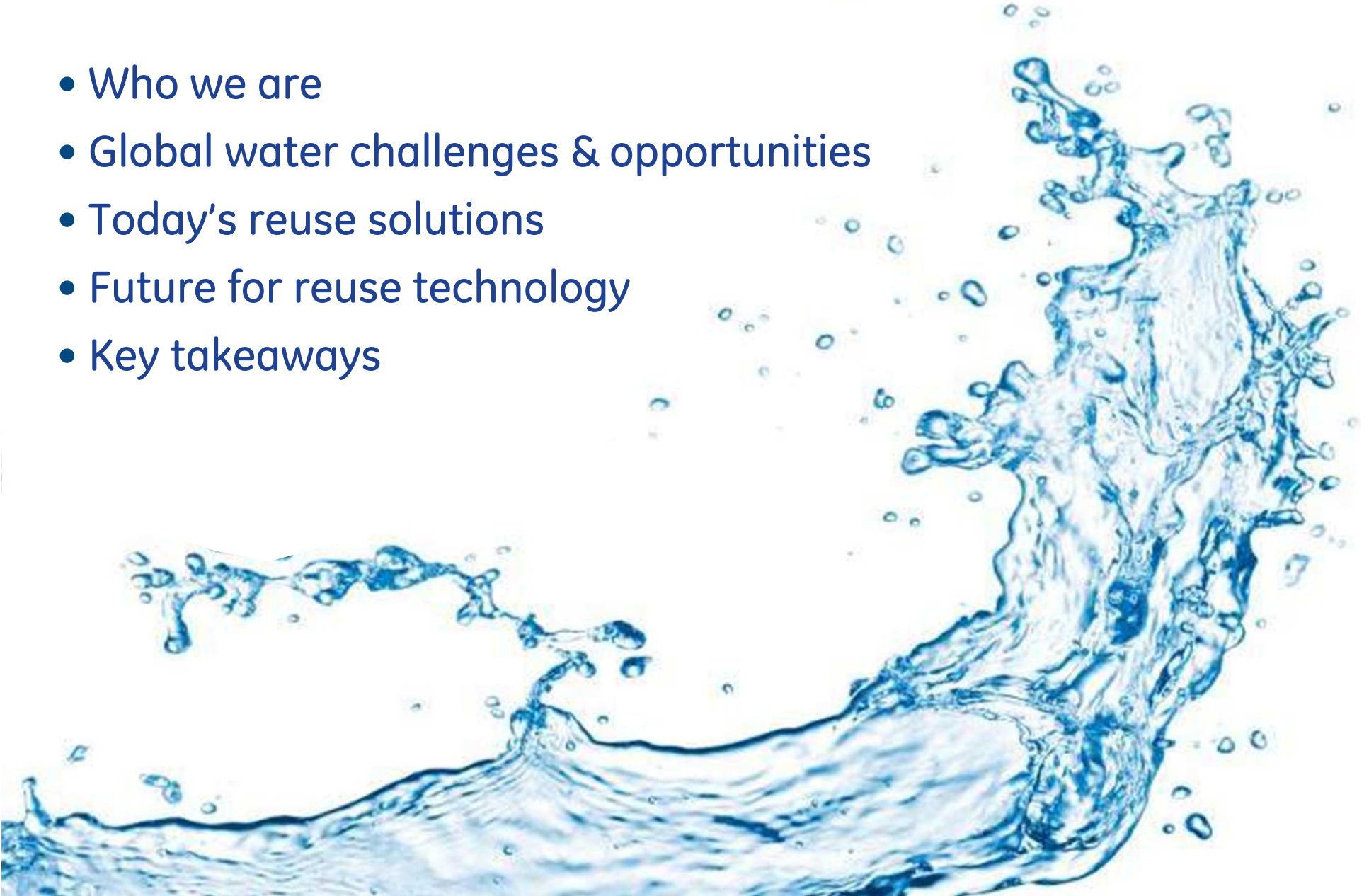
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imagination at work

Agenda

- Who we are
- Global water challenges & opportunities
- Today's reuse solutions
- Future for reuse technology
- Key takeaways



GE Energy businesses

ecomaginationSM

82,000 employees - 140 countries

25% world's electricity from GE technology



Power & Water

- Thermal power gen
- Renewables
- Gas Engines
- Nuclear
- Gasification
- **Water treatment**
- **Process chemicals**

Energy Services

- Maintenance agreements
- Smart Grid
- Field services
- Parts and repairs
- Optimization technologies
- Plant management

Oil & Gas

- Drilling/production for ... land, offshore, subsea
- LNG and pipelines
- Refining/petrochemical
- Industrial power gen
- Complete lifecycle services



GE Power & Water

ecomaginationSM

Diverse technologies

Power



- Heavy duty gas turbines
- Aeroderivative gas turbines
- Generators
- Steam turbines
- Combined cycle systems
- Jenbacher gas engines
- Wind turbines
- Solar
- Gasification
- Nuclear

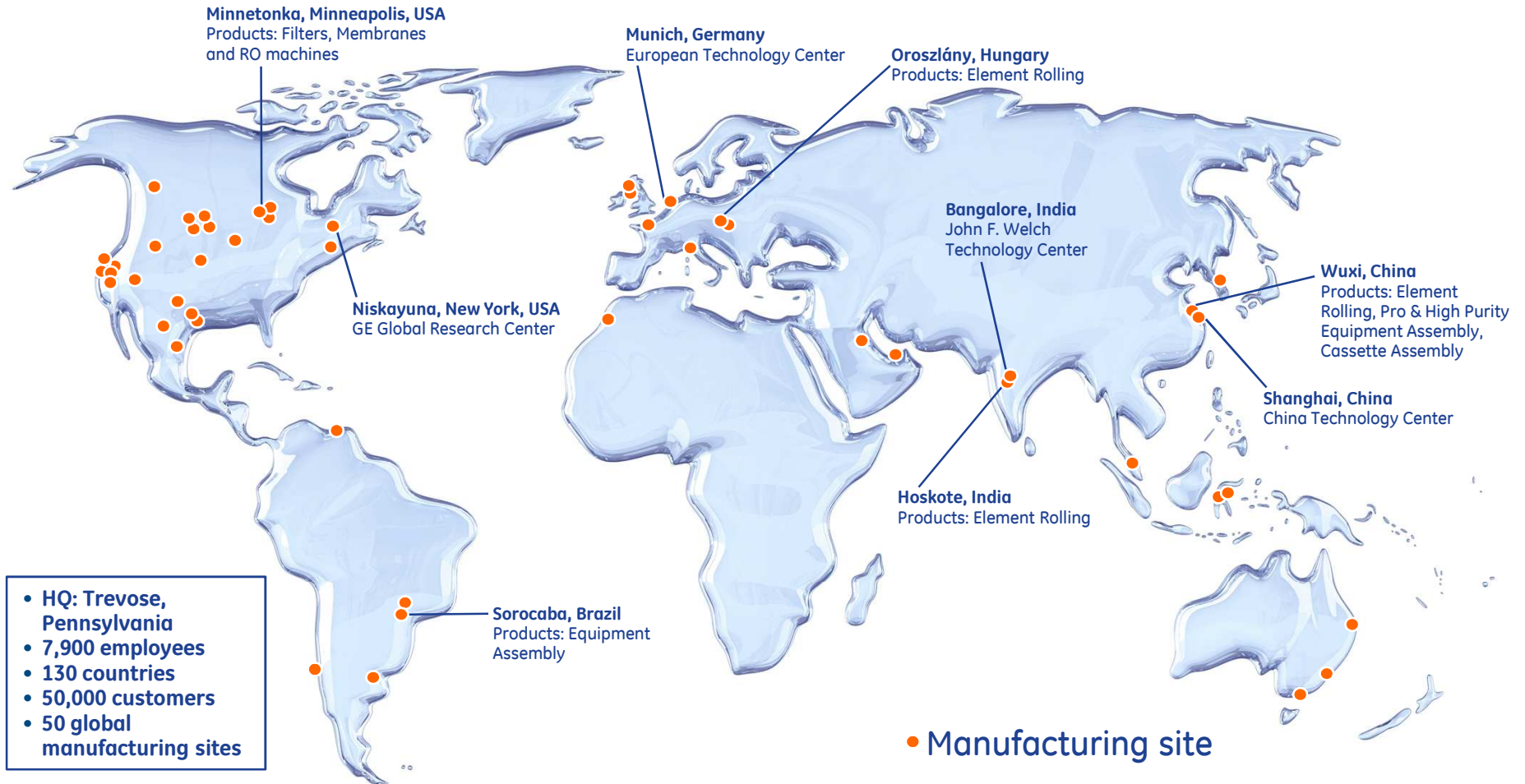
Water



- Water/Process chemicals & services
- Potable water membranes & systems
- Wastewater & reuse membranes & systems
- Mobile Water/Outsourced water
- Chemical feed, monitoring & diagnostics



Global footprint



Strong global footprint with local expertise

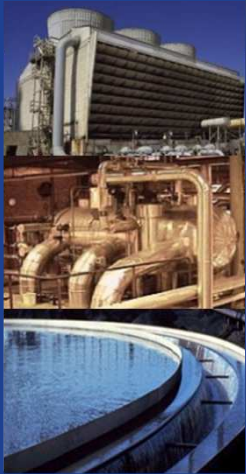





Images denote major manufacturing facilities

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Broadest portfolio

Chemical & Monitoring Solutions

Water Services	Chemical Process	Industrial Process
		
Analytical and Monitoring Solutions		
		

Engineered Systems

Ultrafiltration / MBR / ABMet		
Reverse Osmosis / Electrodialysis		
Thermal / Zero Liquid Discharge		
Water Outsourcing / Mobile		
Filters & Membranes		

Global water challenges

Availability

- Growing population and industry
- Climate change and draught

Quality

- Deteriorating water quality
- Increased industrial pollution

Environmental

- Stricter regulation on discharge/withdrawal
- Water reuse incentives and mandates

Energy

- Energy to increase ~30% by 2030
- Demand for water to increase ~40%

Growing water scarcity and impairment

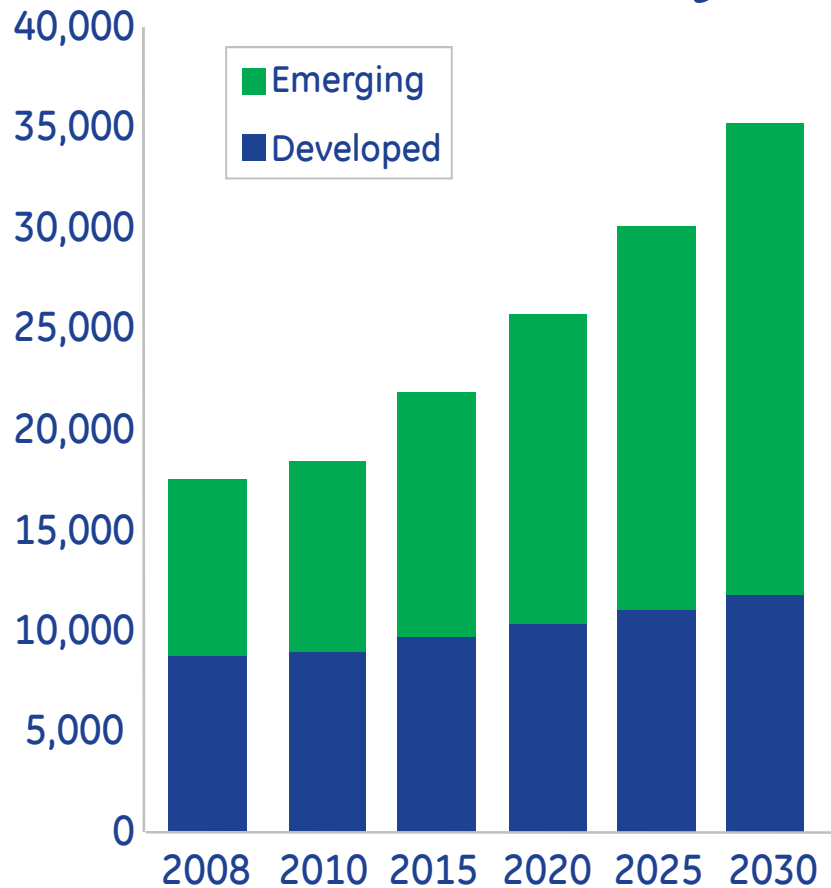


Global 2030 needs

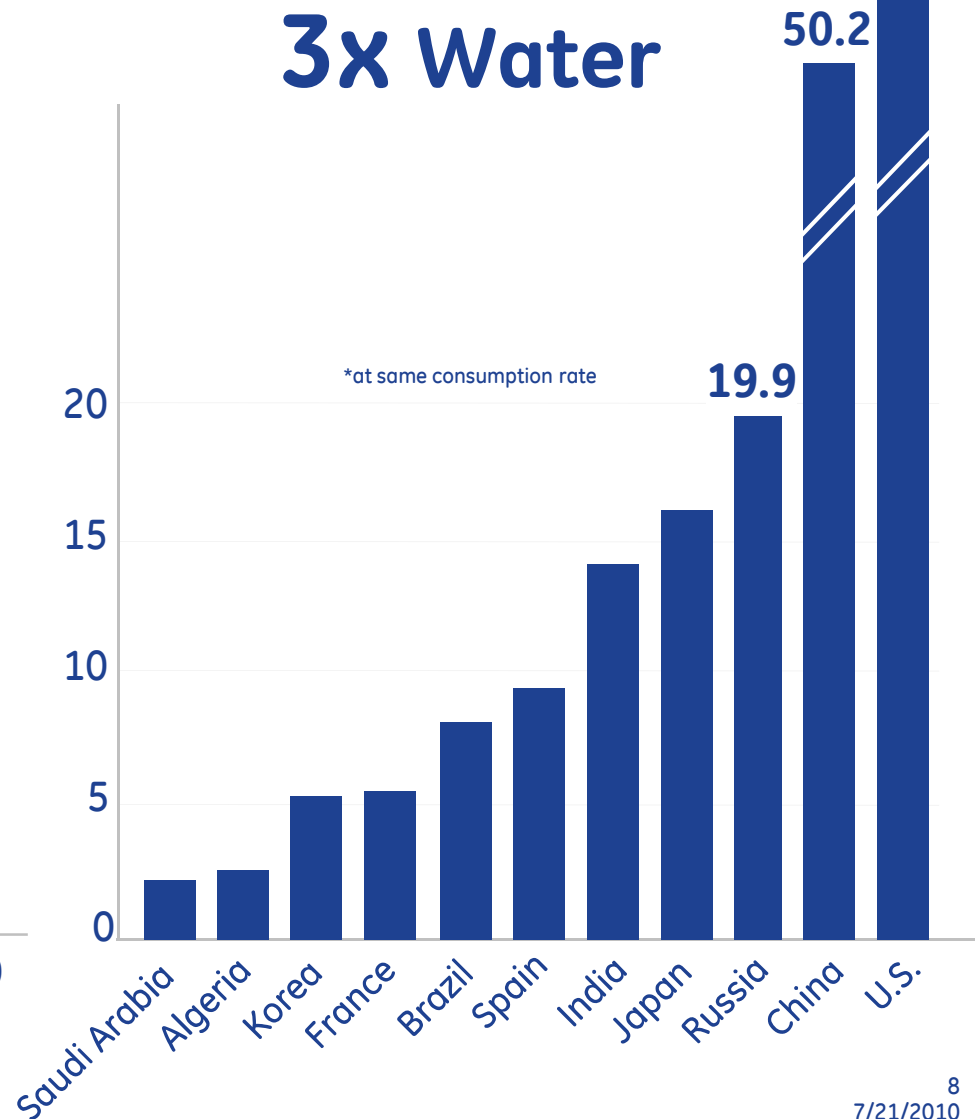
Billions of kW hours

(In billion cubic meters)

2x Electricity



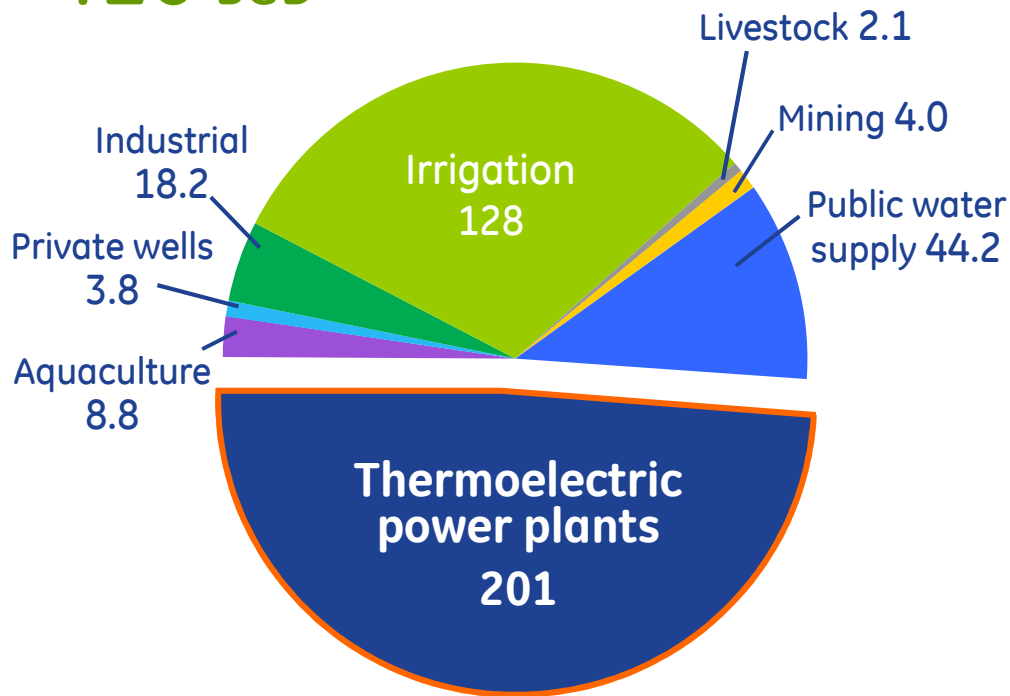
3x Water



The power/water nexus

U.S. total water withdrawals today
Billion gallons per day (BGD)

410 BGD



Source: GE analysis

50%
US water usage
due to power plants

30%
worlds population
water constrained today ...
60% by 2025

Power **1st** to be
curtailed in a
water scarce world

Carbon emissions and water scarcity challenges interlinked

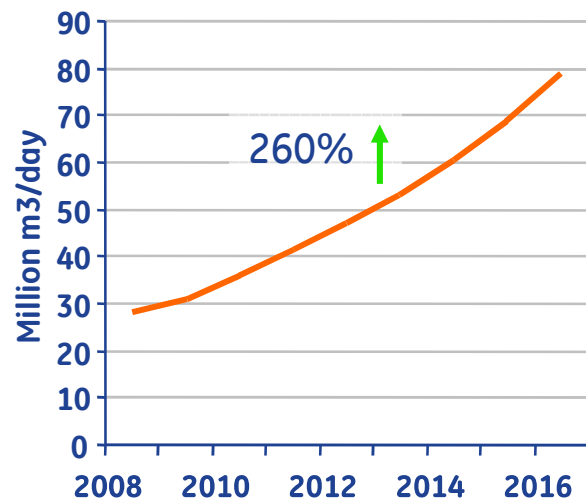


Source: The 2030 Water Resources Group, Centre for
Environmental Systems Research, University of Kassel



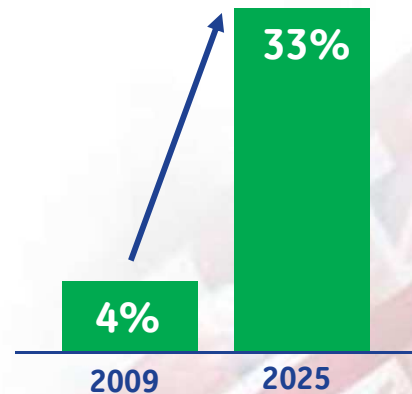
Scarcity driving reuse and policy

Demand for advanced treatment technologies



Total Global Tertiary or Better Reuse Capacity

Supporting reuse growth over next decade



Global Treated Wastewater % Reused

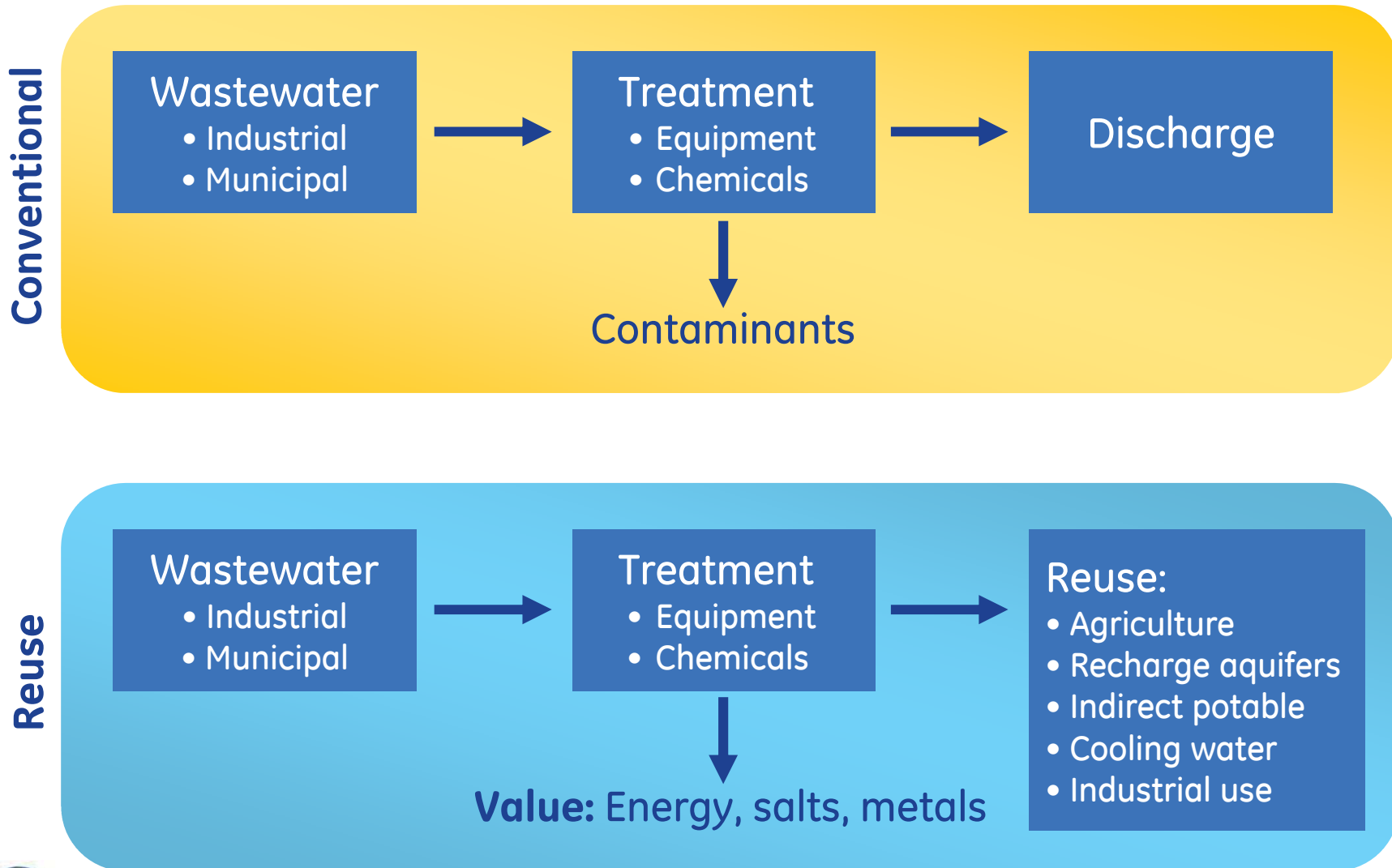
Across the globe in developed and developing nations

Country	% reuse today*	Target/ Goal	Year
U.S.	11%		
China	14%	25%	2015
Spain	11%	40%	2015
Egypt	32%		
Australia	4%	12%	2015
Syria	12%		
Israel	85%	90%	2016
Singapore	35%		
Kuwait	91%		
Saudi	11%	65%	2016
India	<1%	5%	2016
Global	4%	33%	2025

% water reuse

World governments and industry looking to reuse

What is reuse?



Investing in future reuse technology



Increasing Value for Recovery

- Water priced at true cost to supply, encouraging reuse
- Energy and materials cost expected to trend upward

What Drives Reuse?

Past: Water scarcity and environmental regulation

Future: Value recovery & continued regulation

Case Studies



imagination at work

Creating “NEWater” in Singapore

Challenge: Inadequate supplies of renewable fresh water

Solution: Treat and reuse wastewater effluent for local industry

Bedok NEWater Factory

- Transforming wastewater into high quality industrial feedwater and potable water
- The final product is termed “NEWater”
 - Initially used as a feed for the electronics industry, wafer fabrication plants, and commercial building cooling towers
- A growing percentage is released back into local reservoirs for indirect potable reuse applications



Creating new water sources in Kuwait

Challenge: Insufficient quality water for irrigation and human consumption
Solution: Purify wastewater for irrigation, use fresh water for drinking

Sulaibiya plant - Kuwait City

- Water produced for irrigation
- Frees up fresh water for human consumption
- 375,000 cubic meters/day (100 MM gal/day)
- World's largest membrane based wastewater filtration project

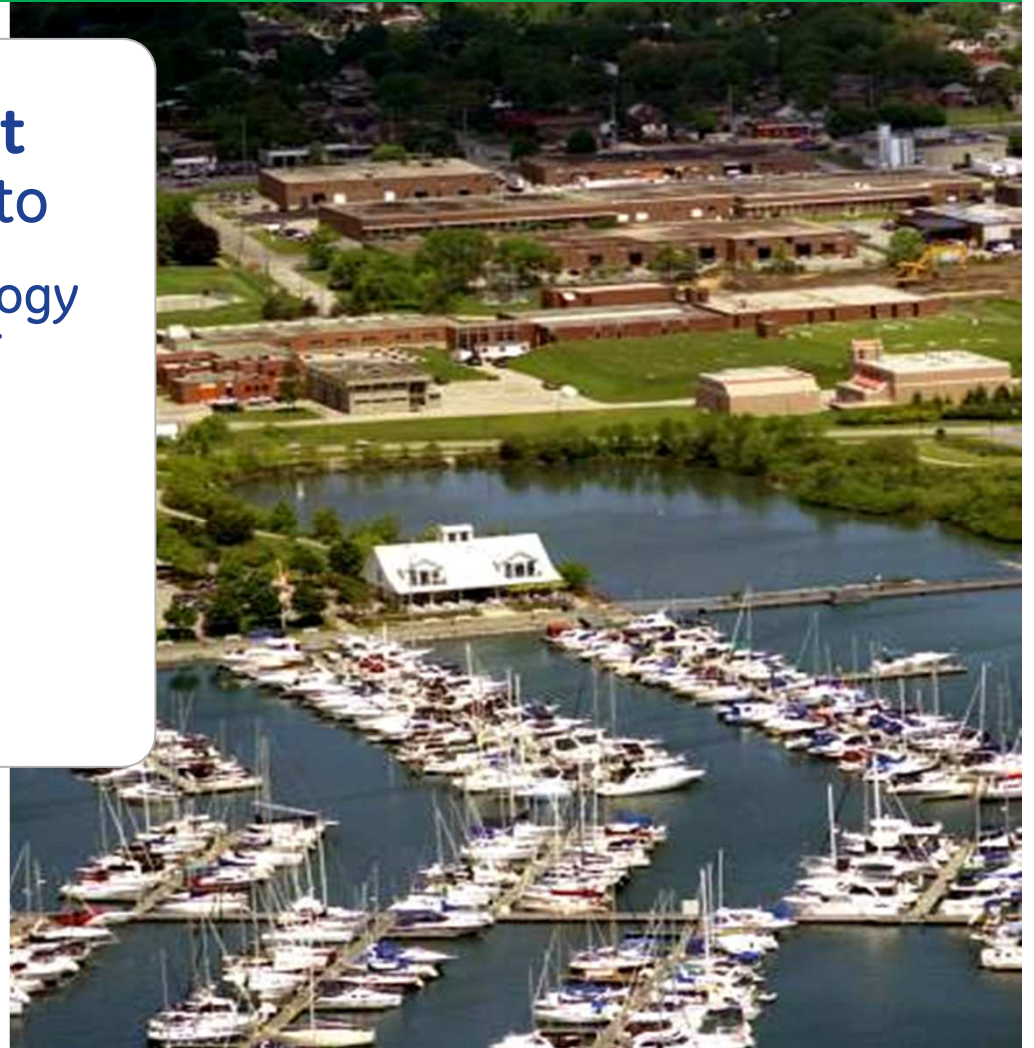


Protecting public health in Canada

Challenge: Increasing regulation challenges local municipality
Solution: Ultrafiltration solution exceeds water quality criteria

Lakeview Water Treatment Plant expansion near Toronto

- Municipality choose UF technology to protect public health with UF physical barrier
- UF technology meets new stringent water quality criteria
- 100 MGD capacity



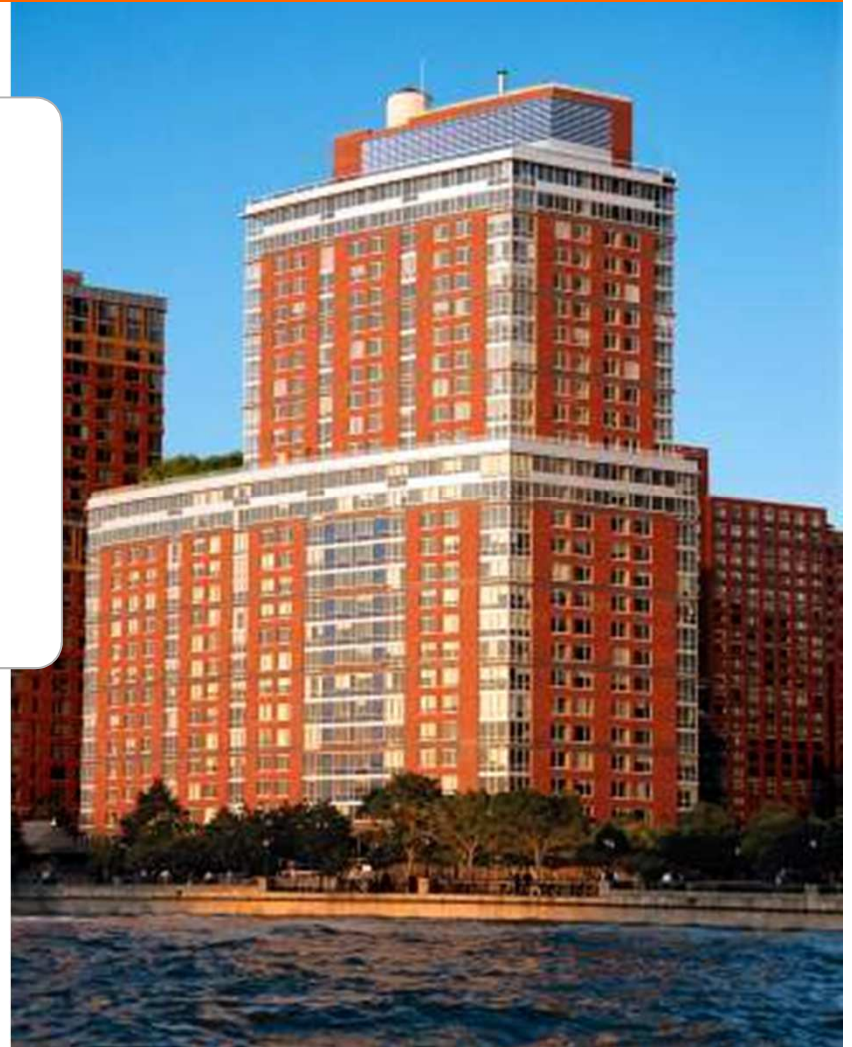
Sustainable development leadership

Challenge: Challenge to meet sustainable development in NYC

Solution: Complete water recycle system exceeds expectations

Solaire Luxury Towers in Battery Park, New York City

- Set the global standard for on-site water reuse systems
- Up to 98% of water is recycled in the building for toilet flush water, laundry water and irrigation



Water scarcity solutions in Australia

Challenge: Water scarcity prevented plant expansion

Solution: Water reuse solution met demand and enabled expansion

BP Luggage Point, Australia expanding operations

- 14,000 m³/day of reuse water (3.7 MM gal/day)
- Water used for cooling and fire fighting
- Replaced previously potable water application



New life for old infrastructure in Italy

Challenge: Insufficient quality water for irrigation and human consumption
Solution: Purify wastewater for irrigation, use fresh water for drinking

Brescia Municipal Wastewater

- Capacity expanded 4x in the same footprint with Ultrafiltration
- 11 million gallons per day of continuous flow
- Effluent quality dramatically increased to meet new discharge regulations
- Replaced conventional technology



Do you see the wastewater reuse plant?

Challenge: Blend wastewater treatment plant into community
Solution: Complete wastewater solution in a “home”

Duckett Creek in Missouri, U.S.

- This 8,000 sq. ft. facility provides wastewater treatment to 1,400 homes
- Integrated UF/MBR purifies wastewater for local community without massive infrastructure



Key Takeaways

- ✓ Double digit water reuse project growth globally
- ✓ Technology exists today to reuse water from any source...ongoing optimization
- ✓ Future is minimizing “cost to treat” by recovering value from concentrate streams

