



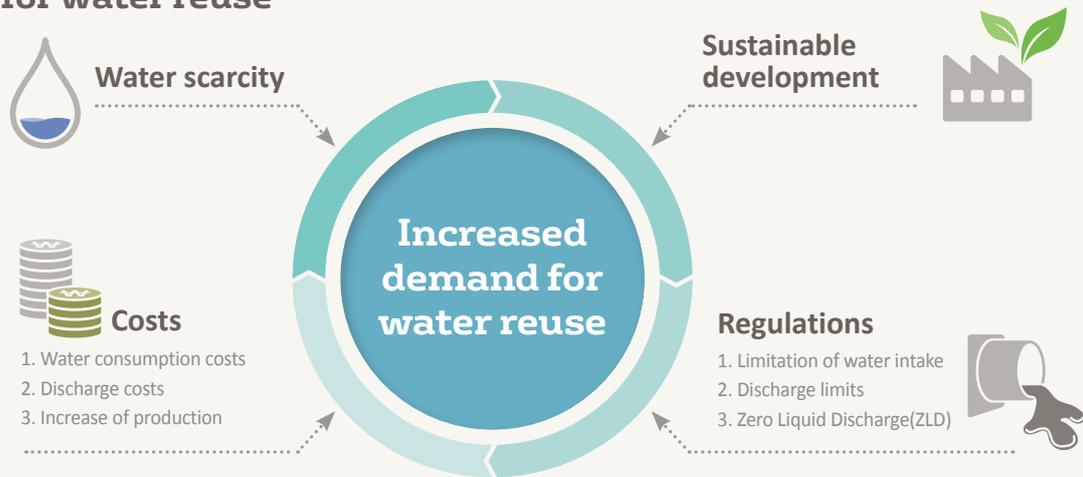
# Sustainable water management for **Recycling & Reuse**

# Industrial wastewater, a valuable resource

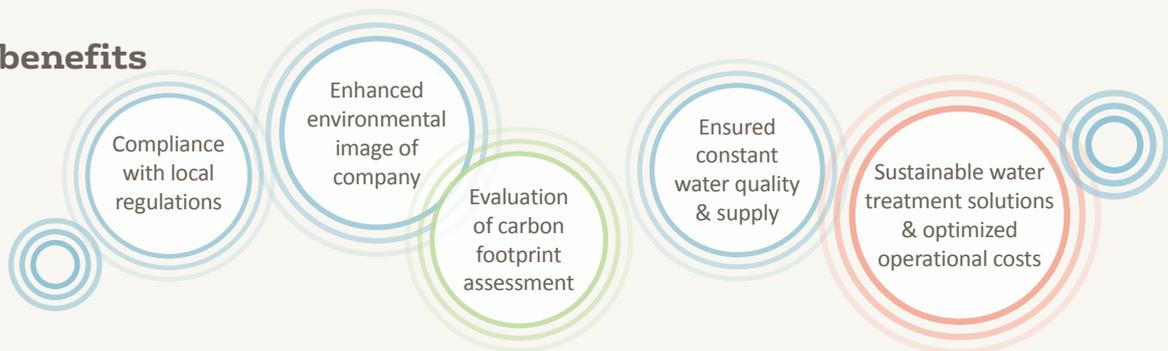


In most industries, such as Microelectronics, Pulp & Paper, Power, Food & Beverage and Oil & Gas, the high volumes of water used during the overall manufacturing process represent a significant expense. Drawing upon its worldwide experience in industrial water cycle management, Veolia has developed standard solutions for water recycling and reuse.

## Demand for water reuse



## Client benefits



## Water quality for reuse and recycling

While the quality requirements vary for the different uses, there are general commonalities across most plants for industrial water, cooling water, process water and boiler feed water.

Application for reuse and recycling	Common quality issues	Pollutants to be removed and/or controlled
Industrial water	Dissolved solid content, iron and manganese content	TSS, Fe, Mn
Cooling make-up water	Corrosion, biological growth and scaling, disinfection in case of aerosol risk	BOD, TSS, Turbidity, silica, pathogens, legionella
Boiler make-up water	Thermal exchange limitation, steam quality reduction, scaling, corrosion	Dissolved solids, hardness, alkalinity, conductivity
Process water	pH, solids, silica, dissolved solids and chloride, pollutant concentration, bacteriology, compliance with process water specification	As appropriate to the application: pH control, dissolved solids, chloride, specific pollutant concentrations

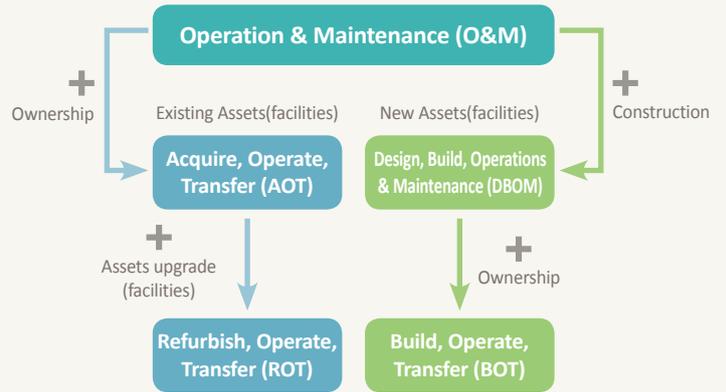
# Veolia's Offer

Providing Tailor-Made Contractual Solutions

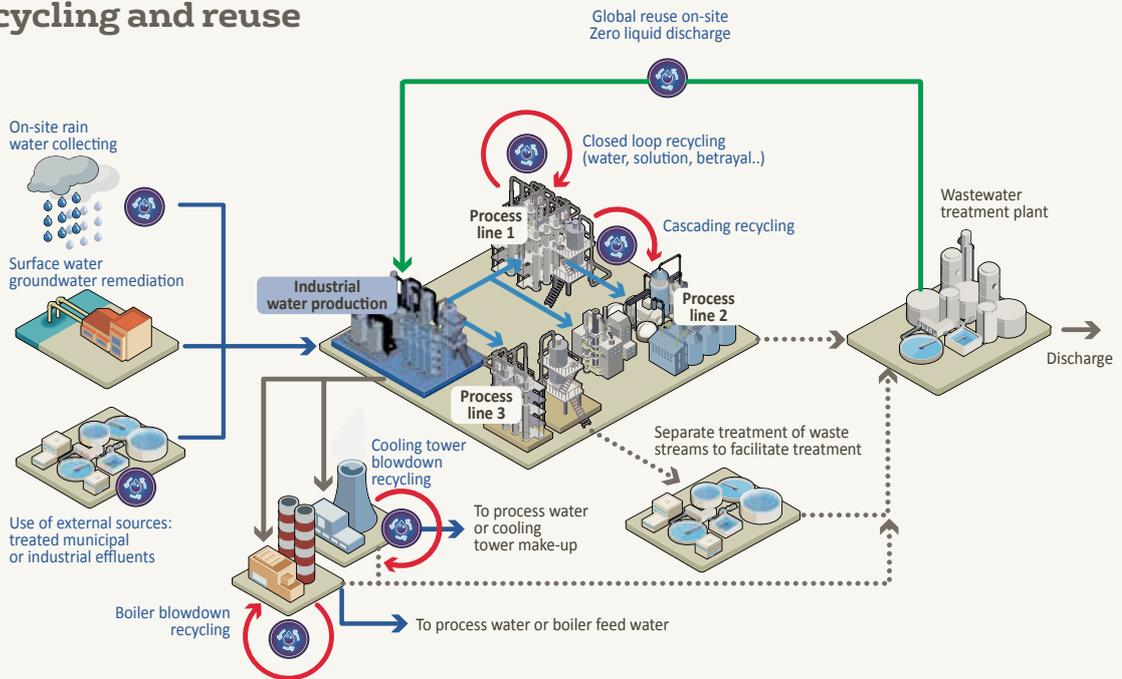


- **O&M:** Operation & Maintenance
- **DBO:** Design, Build & Operate
- **DB:** Design & Build
- **Chemical supply & services**

Veolia's O&M solutions



## On-site recycling and reuse



### Provisioning

- > Drinking water
- > Storm water
- > Drilling water
- > Desalted sea water
- > Surface water
- > Tertiary effluent

### Uses

- > Cooling water
- > Utility water
- > Boiler feed water
- > Ultra pure water
- > Process water
- > Steam production

### Rejections

- > Urban cleansing network
- > Natural environment treatments (primary, secondary tertiary)

### Water recycling

normally involves only one use, and the effluent is treated and redirected back into the same loop and for the same use. It can also be used when wastewater is treated and used again in the process.

### Water reuse

is the use of treated wastewater for beneficial purposes other than the initial use, such as cooling systems, boilers, process water, irrigation, cleaning or ground water recharge.

### Zero liquid discharge

is the total elimination of liquid waste discharge from a plant. In place of disposal, internal waste could be recycled, reused or reduced to achieve zero output of liquid waste.



# Reliable & environmental friendly solutions offered by Veolia

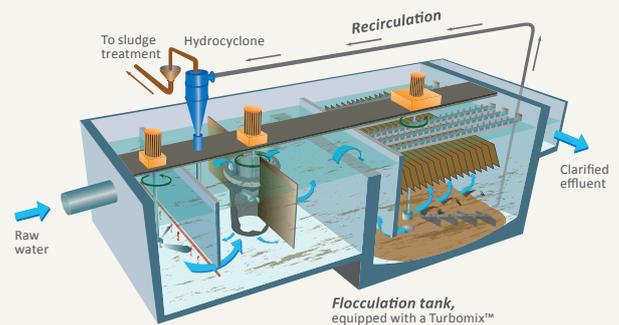


There is not a single specific technology for water REUSE.

The water reuse is very often obtained after association of several processes/technologies applied to each case such as clarification, reverse osmosis, evaporation and chemical treatment.

## Actiflo® Turbo - The ultimate clarifier

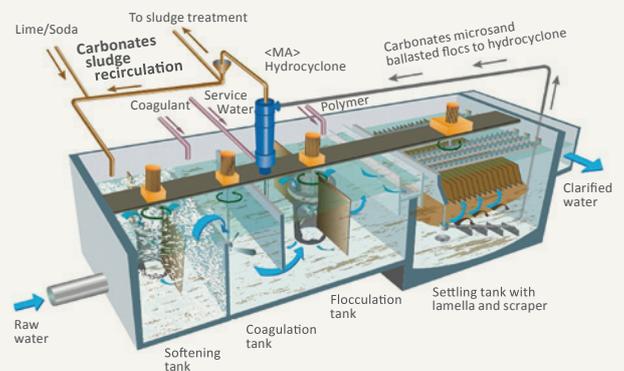
- More than 870 references worldwide
- Over 60 Actiflo® references for reuse applications
- Equipped with coagulation tank, flocculation improved with Turbomix™, a hydraulically optimized settling tank with lamella, a hydro-cyclone for micro-sand recovery
- Increased rise rate: 80m/h for industrial process water, wastewater and seawater
- Cost effectiveness: more compact compared to conventional clarifiers, very short startup time
- Industrial applications
  - Process water: General use, CTMU, pre-treatment for boiler feed, etc.
  - Wastewater: TSS, P, heavy metals, O&G, leachates and reuse



Actiflo® Turbo process

## Actiflo® Softening Process - High rate softening solutions

- Actiflo® Softening combines in a single compact treatment unit both clarification and softening operations to remove constituents such as calcium, silica, heavy metals, fluorides, suspended solids, while improving properties such as alkalinity, hardness and turbidity.
- Improve water quality and produce high quality water
- Very small footprint: Up to 10 times smaller than conventional softening processes
- High rise rate: up to 120 m/h
- Enhanced chemical precipitation with Turbomix™ reaction tank
- Minimize coagulant demand due to solids precipitation with calcium carbonates
- Sludge characteristics: up to 8% dry solids; can be easily thickened and dewatered
- Industrial applications: Power industries, water production for cooling tower make-up, water recycling for cooling tower side stream, treatment of produced water for Oil & Gas, SAGD (Steam Assisted Gravity Drainage) water treatment for reuse, wastewater treatment of flue gas desulfurization



Actiflo® Softening process

## EVALED™ - Evaporation technologies

- Low energy consumption
- Recycling of high quality distillate from heavily polluted wastewater
- High separation level
- Ideal to achieve ZLD (Zero Liquid Discharge) in combination with RO plants
- Three types of models (series)
  - EVALED™ PC  
Vacuum heat pump evaporators (150 kWh/ton)
  - EVALED™ AC  
Hot/cold water vacuum evaporators (Cogeneration)
  - EVALED™ RV  
MVR evaporators (30-50 kWh/ton)



EVALED™ PC – E series

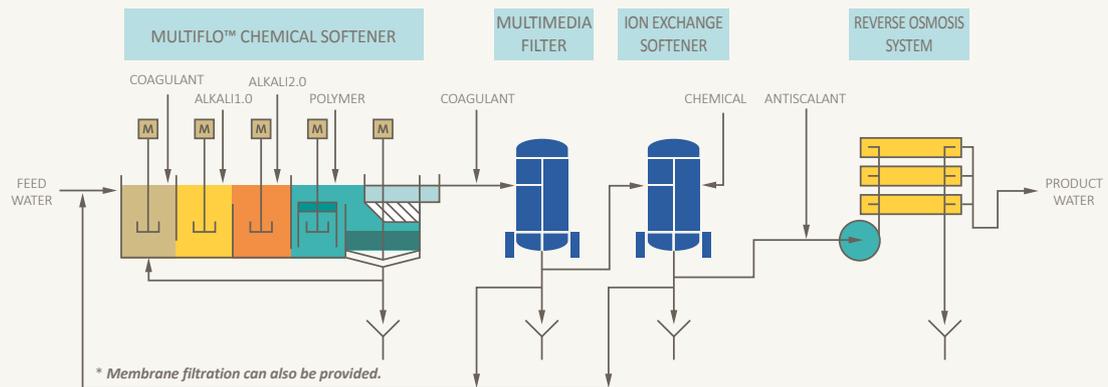
## SIRION™ Mega - Reverse Osmosis systems

- Production of high purity water
  - From 5 to 30m<sup>3</sup>/h
  - Lower operating pressure, cost savings due to low energy consumption membranes
  - 1 or 5µm pre-filtration included
  - Appropriate recirculation rinsing reduces membrane fouling
- Applications:
    - Boiler feed
    - Industrial process water
    - Cooling water
    - Reuse / recycling
    - Healthcare
    - Biotechnologies
    - Electronics
    - Hospitals
    - Chemical industry
    - Primary metals



## OPUS® Process - Reverse Osmosis membranes for high water recovery

- High Water Recovery Rates
  - Effective Fouling/Scaling Control
  - Ability to Handle Variations in Feed Water Quality
  - High Salt Rejection; Silica > 99.9%, Boron > 99.4%, TOC > 99%
  - Continuous Clean-In-Place(CIP) Process
  - Low Energy Consumption
  - Long Membrane Life
- Applications:
    - **Oil & Gas**  
Produced water treatment, refinery wastewater
    - **Mining, industrial wastewater reuse**  
ZLD Application
    - **Power**  
Cooling tower blow-down treatment, make-up water



OPUS® multiple treatment processes, involving chemical softening, media filtration, ion exchange softening and reverse osmosis technologies

## HYDREX™ Chemicals - Water treatment chemical solutions

- Protect water treatment systems against scale deposition, corrosion, fouling, etc.
- Reduce unnecessary downtime
- Ensure optimum productivity
- Prevention and reduction of environmental risks
- Energy saving
- Applications:
  - **1000 series:** Total boiler water treatment chemicals
  - **2000 series:** Cooling water treatment chemicals
  - **4000 series:** RO water treatment chemicals (Effective membrane antiscalants and cleaners approved by major membrane manufacturers)
  - **6000 series:** Drinking water and wastewater treatment chemicals
  - **7000 series:** Biocides control chemicals



# Veolia's recycling and reuse: Industrial references



## Clients' benefits offered by Veolia's O&M services

01

Reducing operation costs through reuse and recycling water treatment technologie

02

Minimizing environmental impact for sustainability

03

Offering of technology knowhow and expertise to enhance the value of resources

### Automotive



#### General Motors Cactus Plant in San Luis Potosi, Mexico

- Zero Liquid Discharge process design, basic engineering and equipment supply
- High quality water for reuse
- High recovery rate with low waste volume (convert 90% of the tertiary wastewater into reusable water)

#### General Motors Pontiac, Michigan, USA

- Operation and maintenance of the new wastewater treatment plant since 2001(DBOOM)
- Environmental regulation compliance

### Chemicals

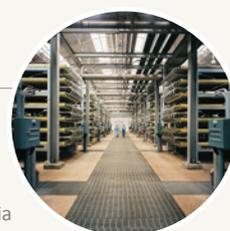


#### Air Products, Tamaqua, Pennsylvania, U.S.A

- Co-product recovery and reuse
- Significant cost savings (KOH recovery of 85% to 90%)
- Environmental benefit and recognition: the project won the 'Governor's award for Environmental Excellence for the State of Pennsylvania'

#### LG/Lotte Petrochemicals, Daesan, KOREA

- 20 years of the long-term partnership, the largest reverse osmosis units in Asia with 84,000m<sup>3</sup>/day capacity
- Demi water: 41,120m<sup>3</sup>/day, cooling water supply: 1,861,224m<sup>3</sup>/day(circulation rate basis), potable water: 5,235m<sup>3</sup>/day



### Food & Beverage



#### Sabim, Sablé-sur-Sarthe, France

- Outsourcing of the wastewater treatment facilities for the meatpacking house
- Biological treatment for grease/oil removal
- Wastewater biological treatment with aeration
- Sludge-thickening unit on a gravity table, designed to achieve 6-7% dryness



### Metals



#### Dongbu steel, Dangjin, and Incheon, Korea

- Supplying sufficient quantity of high quality cooling water for production of steel products for 15 years
- Implementing on-line monitoring of operation to assure stable operation and quality
- Cooling water: 511,872m<sup>3</sup>/day, treated wastewater: 5,376m<sup>3</sup>/day, demi water: 883m<sup>3</sup>/day
- Reusing over 50% of process water to protect the environment and reduce costs



### Pharmaceutical



#### L'Oreal BeautyCos production factory, based in Suzhou, China

- Reduction of greenhouse gas emissions, water consumption and discharged transportable waste by 50% by 2015
- Energy and chemical consumption are reduced.
- Sludge production is significantly decreased.
- Stabilization of the effluent quality and optimization allowing tertiary treatment and reuse
- The water impact index is reduced by 35%.
- By implementing a reuse system, the overall water consumption of the factory could be further reduced by 32%

#### Pfizer Nutrition, Suzhou Industrial Park, Jiangsu, China

- Full scope of performance guarantees and expertise in O&M of the wastewater treatment plant
- Innovative solution based on sludge composting and recycling for land application
- Secure a constant quality of treated effluent to allow reuse as cooling tower make-up
- Wastewater: 2,400m<sup>3</sup>/day



## Mining



### CONSOL Energy Inc., mine water treatment facility, Mannington, West Virginia

- Zero liquid waste discharge acid mine drainage water treatment facility in Northern West Virginia
- 10 year operations period, with 5 year renewal options of DBO project
- Chemical precipitation, reverse osmosis and thermal technologies
- Applying the water impact index to the mine water treatment facility to maximize the recovery of clean water



## Power



### E.D.F, Civeaux Nuclear Power Plant, France

- Partnership with Électricité de France (EDF), the one of the largest electricity producers in the world
- 2 generating units, Production: 7 billion kWh/year
- Temporary solutions for the upgrading of feeding demineralization units (secondary loop)
- Rental of mobile units, staff for the operations and maintenance, guarantee of the production levels

### APS(Arizona Public Service) Redhawk Power Station, Arlington, Arizona, U.S.A

- Providing natural-gas, coal and nuclear generated electrical power to the region
- Designed to remove water contaminants and recycle high-quality water back into the process
- Effectively recycling the waste created by cooling tower blow-down and producing high quality water while adhering to the Zero Liquid Discharge mandate

### Macquarie Generation, Bayswater Water Treatment Plants, New South Wales, Australia

- The more efficient water reuse is guaranteed by the improved water quality and the increased recycled water volume
- Design, Construct, Operations & Maintenance
- Optimize & improve the reliability and availability of existing water treatment plants
- Increased the salt removal capacity and reduced the salinity of Lake Liddell
- Capacity 2,640 MW (power station), 120 ML/day (WTPs)



## Pulp & Paper



### Smurfit-Stone Container Corporation, Hopewell, USA

- Design and build of the new evaporator system
- Production: 300,000 tons/year



### Oil and Gas, Pulp and Paper SAPREF refinery, Mondi paper mill Durban, South Africa

- Municipal wastewater reuse for process and cooling water production



## Micro-electronics



### SK hynix, Icheon - Cheongju - Gumi, South Korea

- Ultra-pure water, potable water, wastewater treatment services
- Reducing costs and protecting the environment: An average of 40% and up to 60% of the process water is recycled
- Operating state-of-the-art wastewater treatment facilities to meet legal standards on the quality of treated wastewater



### Showa Denko HD Singapore

- Water management capabilities: ultrapure water, reclaim water, wastewater, utilities
- Guarantee the consistent, high-quality and sufficient water supply
- A special facility was constructed for recycling reclaim water, and within two years of operations, the plant now uses 50% of reclaim water.

### Microelectronics Industrial area, Kranji, Singapore

- Supply of high quality water (40,000 m<sup>3</sup>/d) from municipal wastewater treatment (Cost effective solution compared to seawater desalination and transportation)

## Oil & Gas

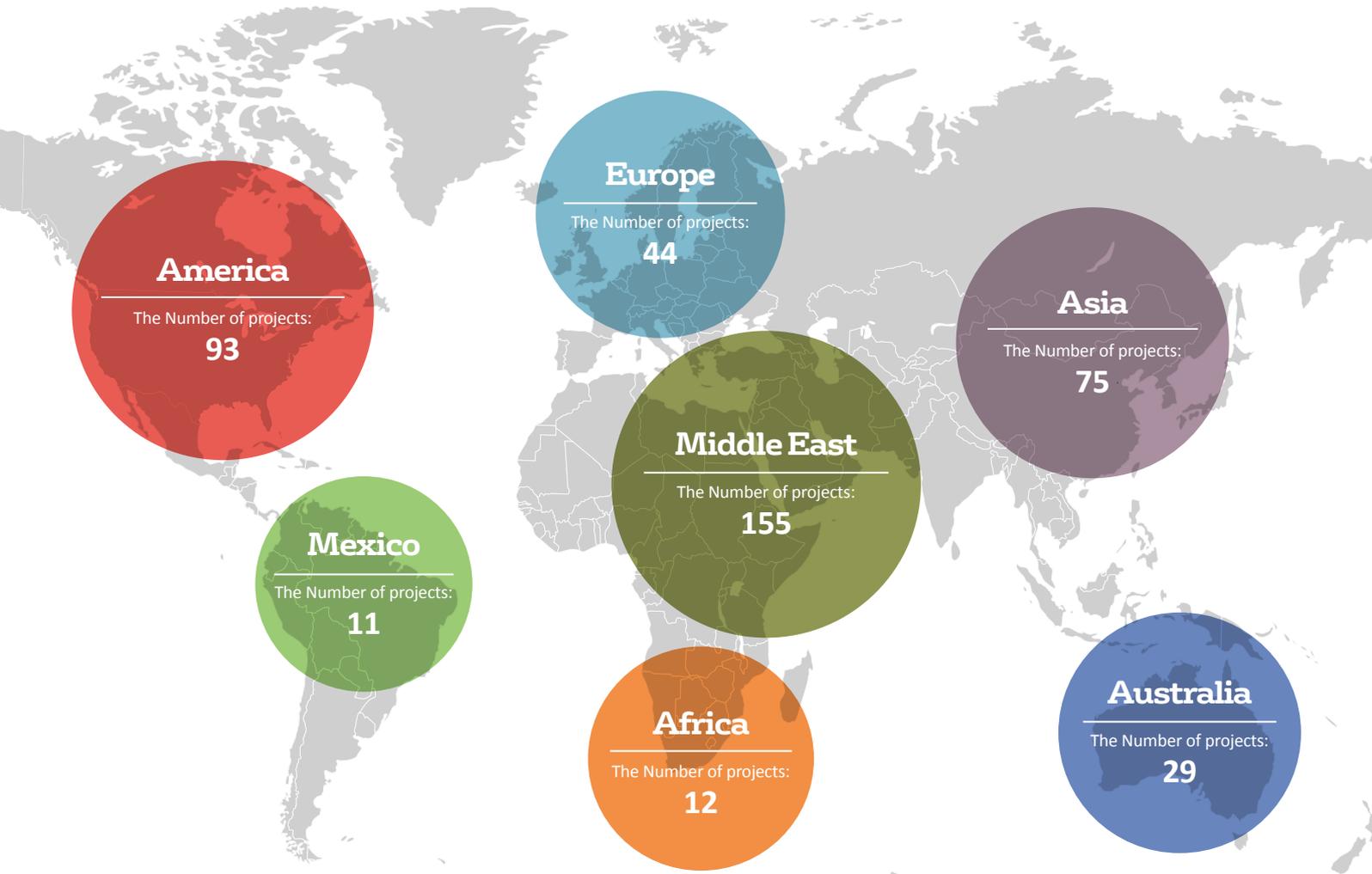


### SHELL Qatar, Pearl GTL complex, Qatar

- Design and build contract for an effluent treatment plant
- Treatment of the cooling water blow-down for reuse in the process
- Optimization of water cycle management and Zero Liquid Discharge
- Sludge treatment using evaporation and crystallization processes which allow low volume production of dewatered sludge and salt crystals



# Over 400 water recycling & reuse projects around the world by Veolia!



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