

THE WATER-ENERGY NEXUS

SESSION 1. EARTHCHECK INNER CIRCLE FORUM, 2015

CENTARA GRAND, CENTRALWORLD, BANGKOK, THAILAND

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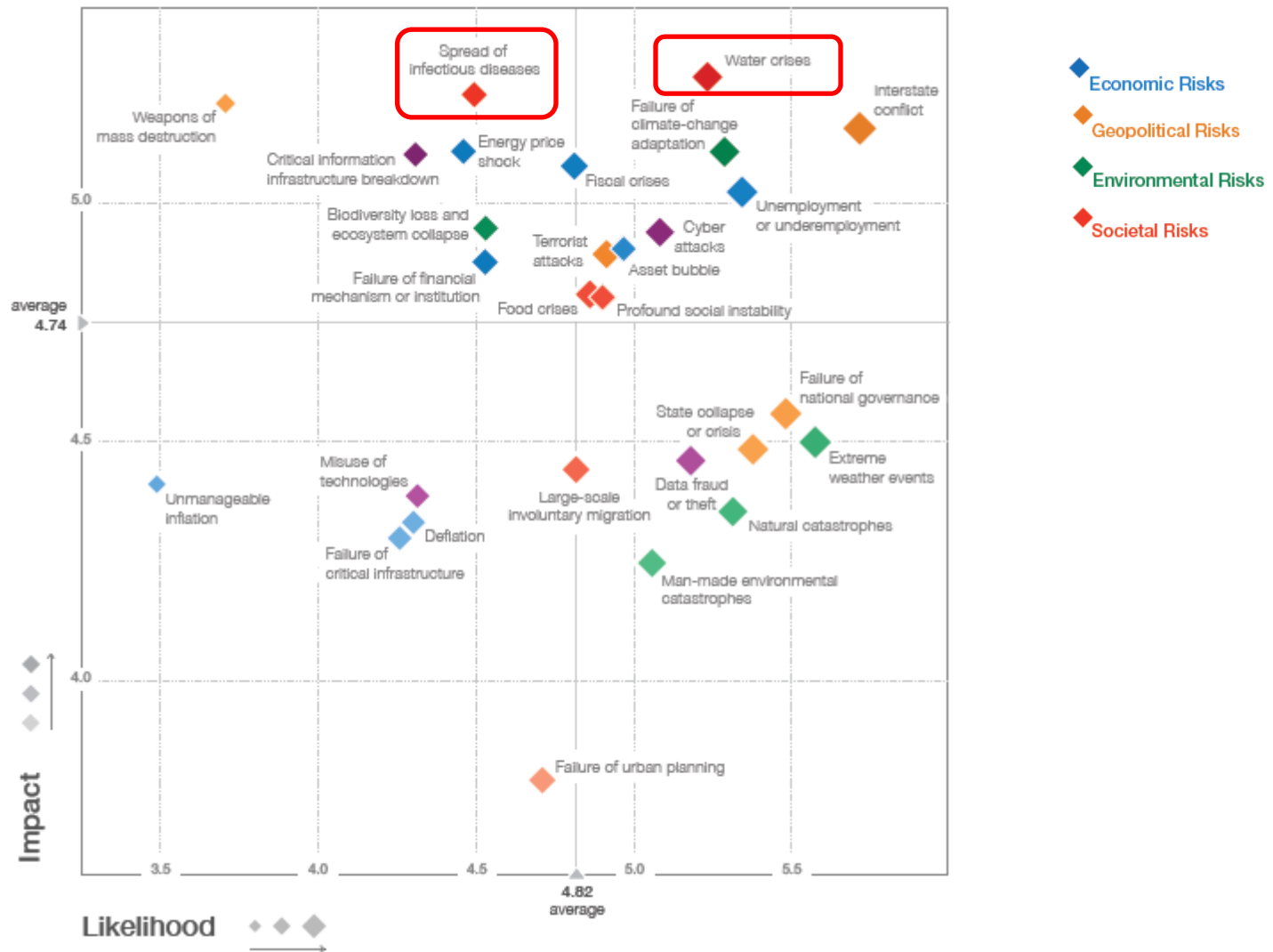
April 22, 2015

OUTLINE

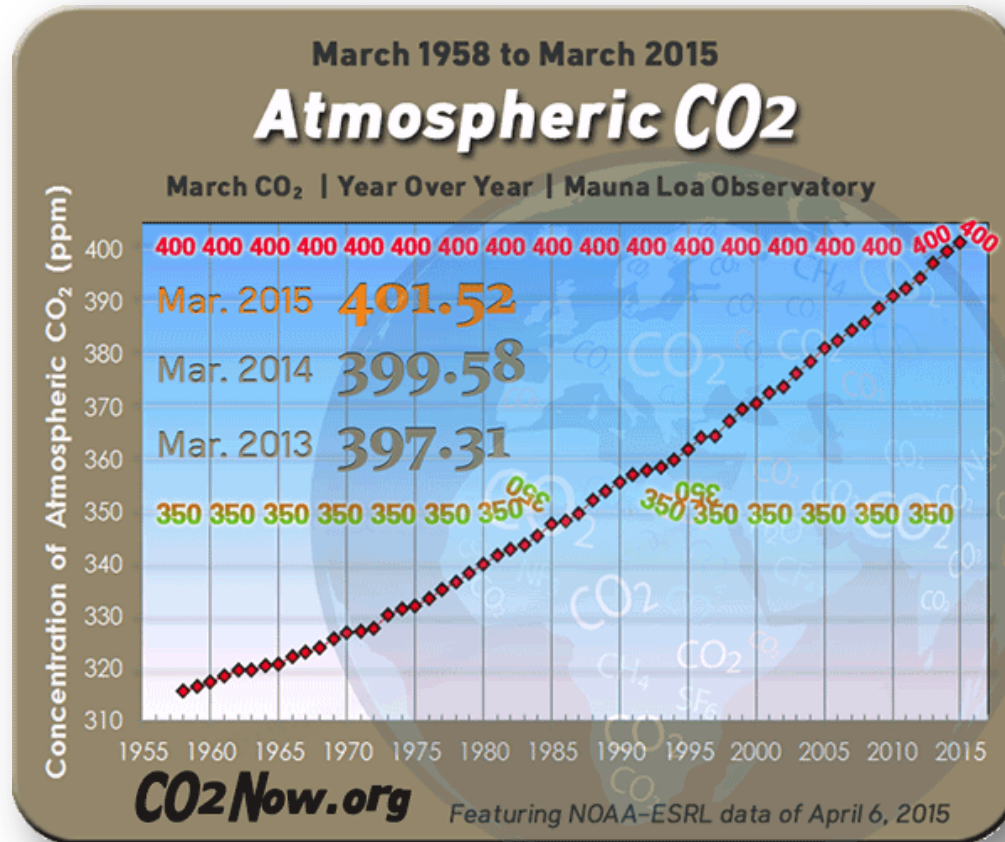
- **2015 Global Risk Landscape**
- Climate Change
- Upstream Collision
- Productivity in Commerce
- On-Premise Nexus
- Downstream Collision
- Innovation Opportunities
- Key Take-Aways



GLOBAL RISK LANDSCAPE



CLIMATE CHANGE- TRENDS



April 20, 2015: Globally, March 2015 marks the highest March surface temperature since global temperature records began in 1880.

CLIMATE CHANGE & FOOD SECURITY

The future of food and farming: 2050s

By 2050, climatic impacts on food security will be unmistakable. There are likely to be 9 billion people on the planet, most people will live in cities and demand for food will increase significantly.

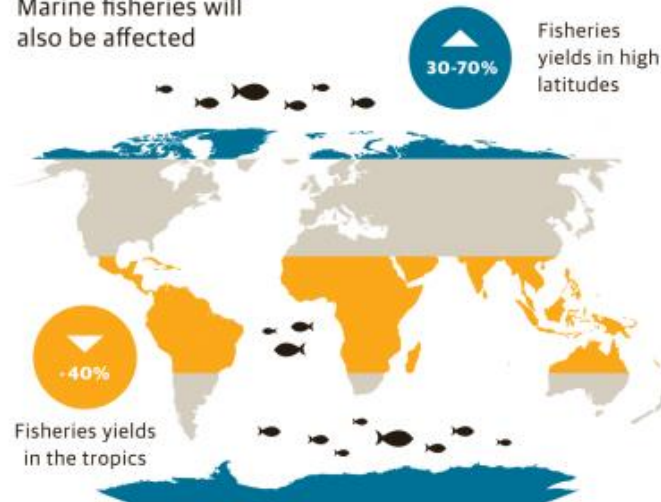


Widespread impacts on food and farming are highly likely

Average decline in yields for eight major crops across Africa and South Asia



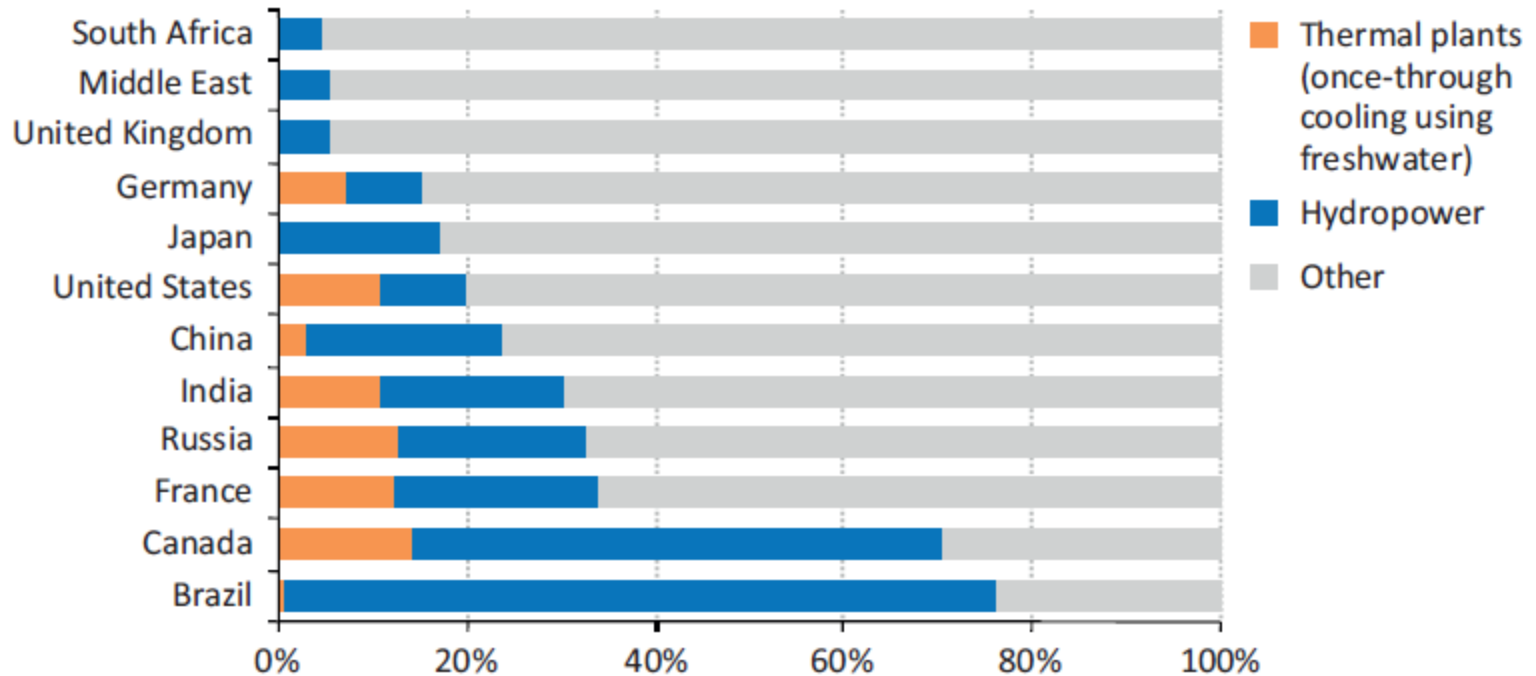
Marine fisheries will also be affected



UPSTREAM ENERGY-WATER COLLISION

- **Thirst for Power**
 - electricity for one load of laundry, 3-10x more water than is used to wash the clothes.
- **Withdrawal Symptoms**
 - freshwater withdrawn to cool power plants is roughly the same as that for crop irrigation.
- **In Hot Water**
 - coal and nuclear plants report releasing water at peak temperatures of 100°F or more.
- **High and Dry**
 - water troubles shut down power plants, due to shortage or ambient water temperature.
- **Wet Renewables**
 - low C can mean low water - or not (CSP, biofuels, hydroelectric, geothermal)
- **MPG or GPM**
 - water footprint of biofuels- 20 GPM (corn ethanol), 1 GPM cellulosic, 0.1 GPM gasoline.
- **The Flip Side**
 - California uses 19 percent of its electricity and 32 percent of its natural gas for water.

POWER SHARE- FRESHWATER DEPENDENCE

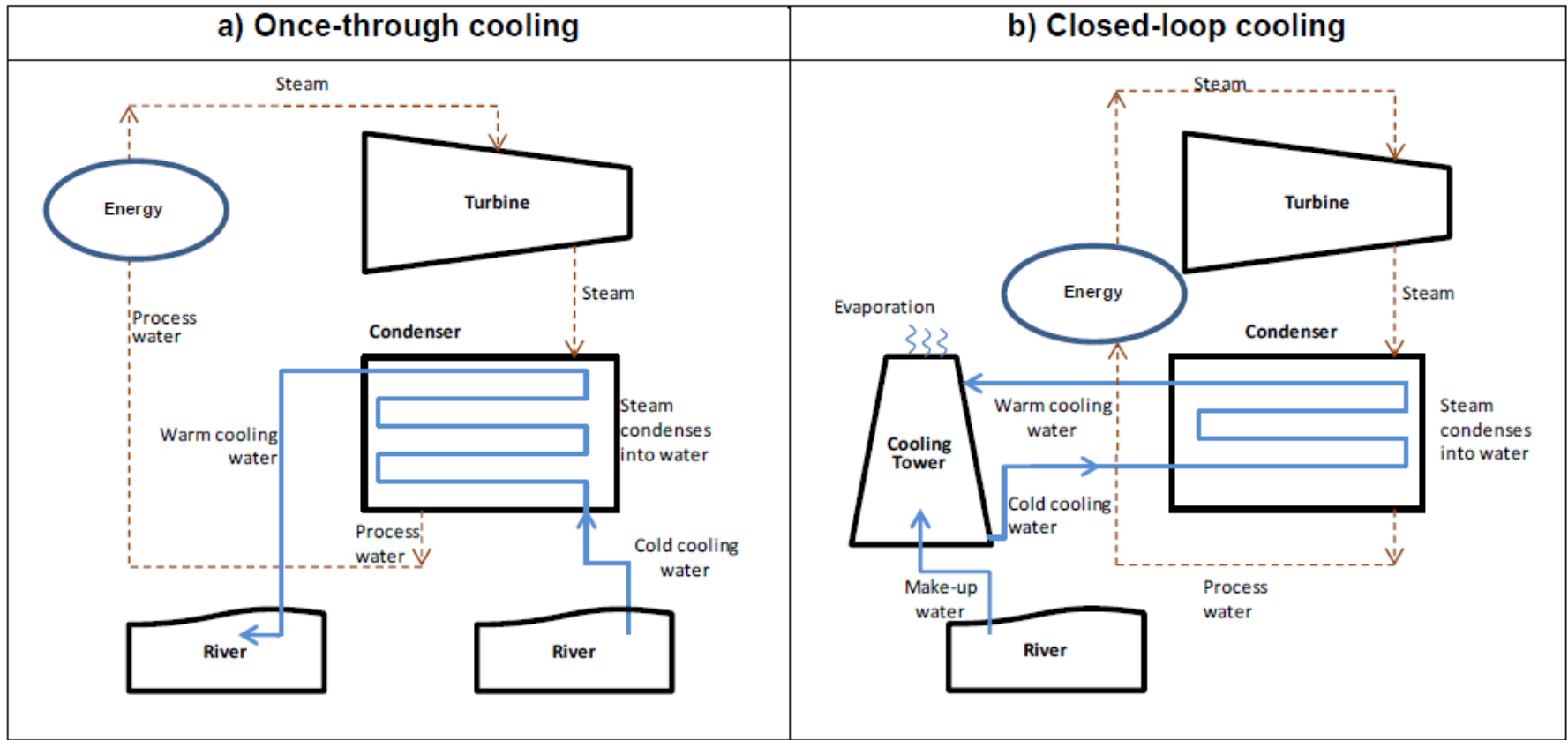


Share of power generation capacity with freshwater once-through cooling and hydro in selected countries, 2010

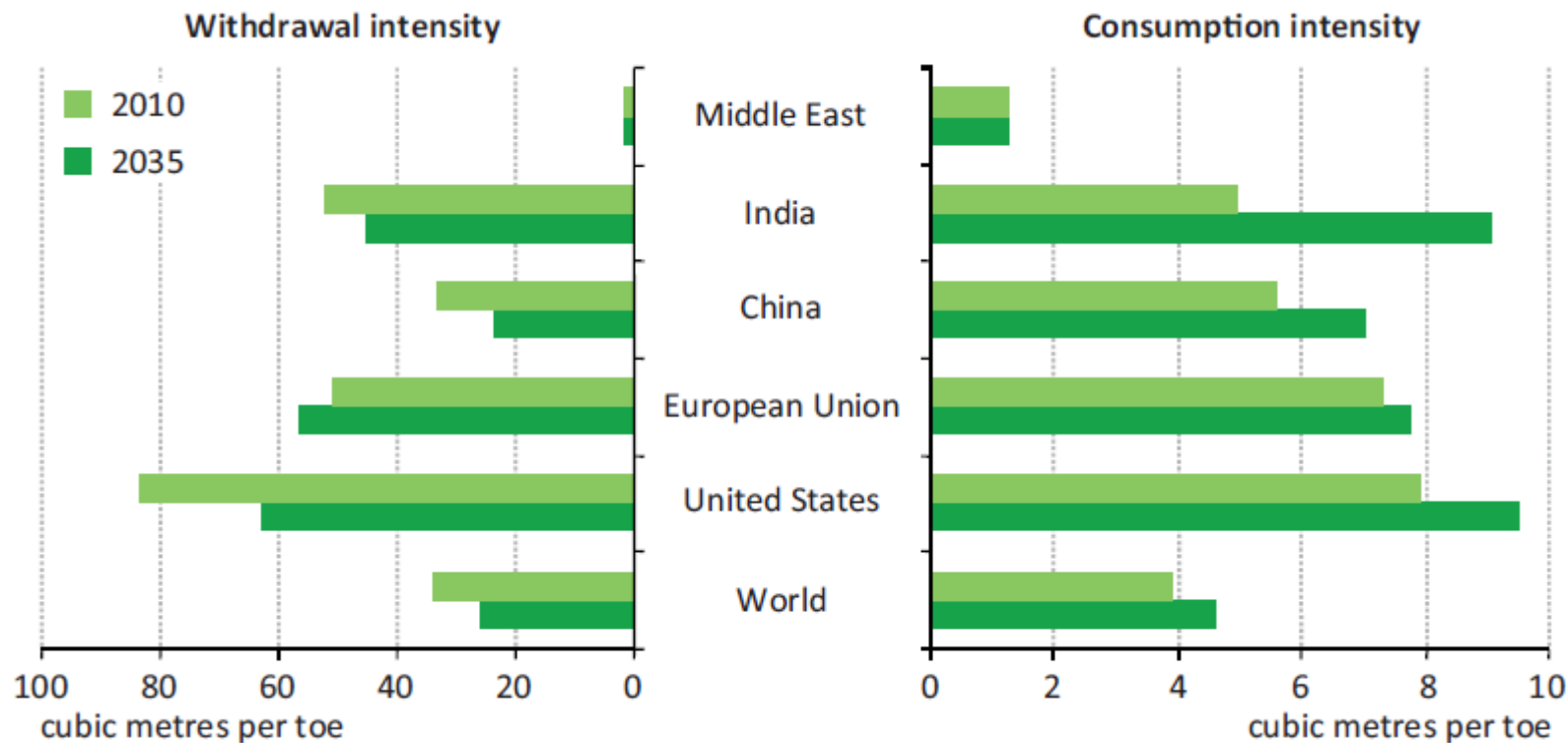
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WATER & ENERGY IN COOLING



POWER SHARE- WITHDRAWAL & CONSUMPTION



Water intensity of energy production for selected regions of the world, if water efficient cooling methods are implemented

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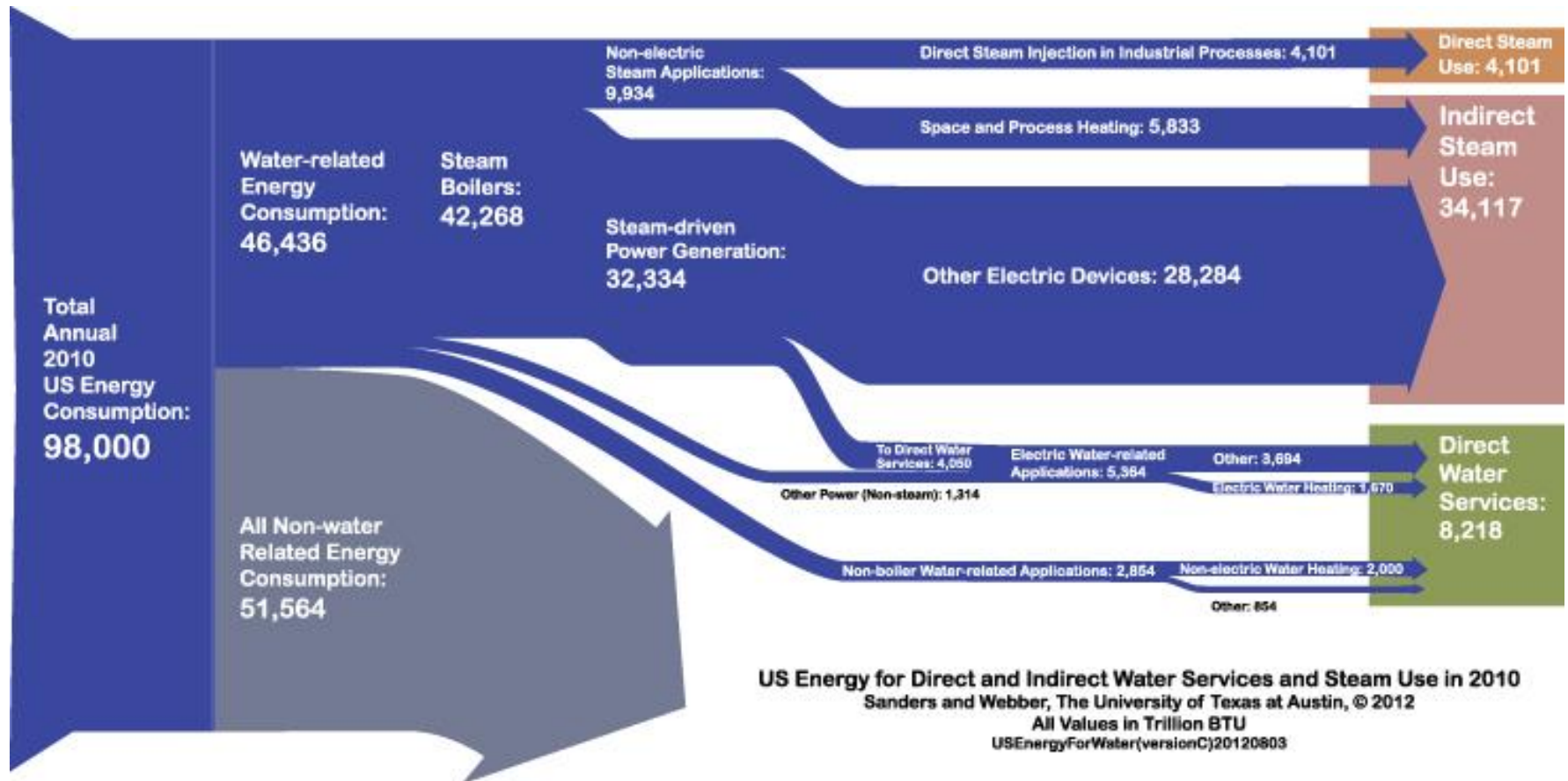
ENERGY PRODUCTION & WATER QUALITY

	Process	Connection to Water Quality	Connection to Water Quantity
Energy Extraction & Production	Oil and gas exploration	Impact on shallow groundwater quality	Water for drilling, completion, and fracturing
	Oil and gas production	Produced water can affect surface and groundwater	Large volume of produced, impaired water
	Coal and uranium mining	Tailings and drainage can affect surface water and groundwater	Mining operations can generate large quantities of water
Refining & Processing	Traditional oil and gas refining	End use can affect water quality	Water needed to refine oil and gas
	Biofuels and ethanol	Refinery wastewater treatment	Water for growing and refining
	Synfuels and hydrogen	Wastewater treatment	Water for synthesis or steam reforming

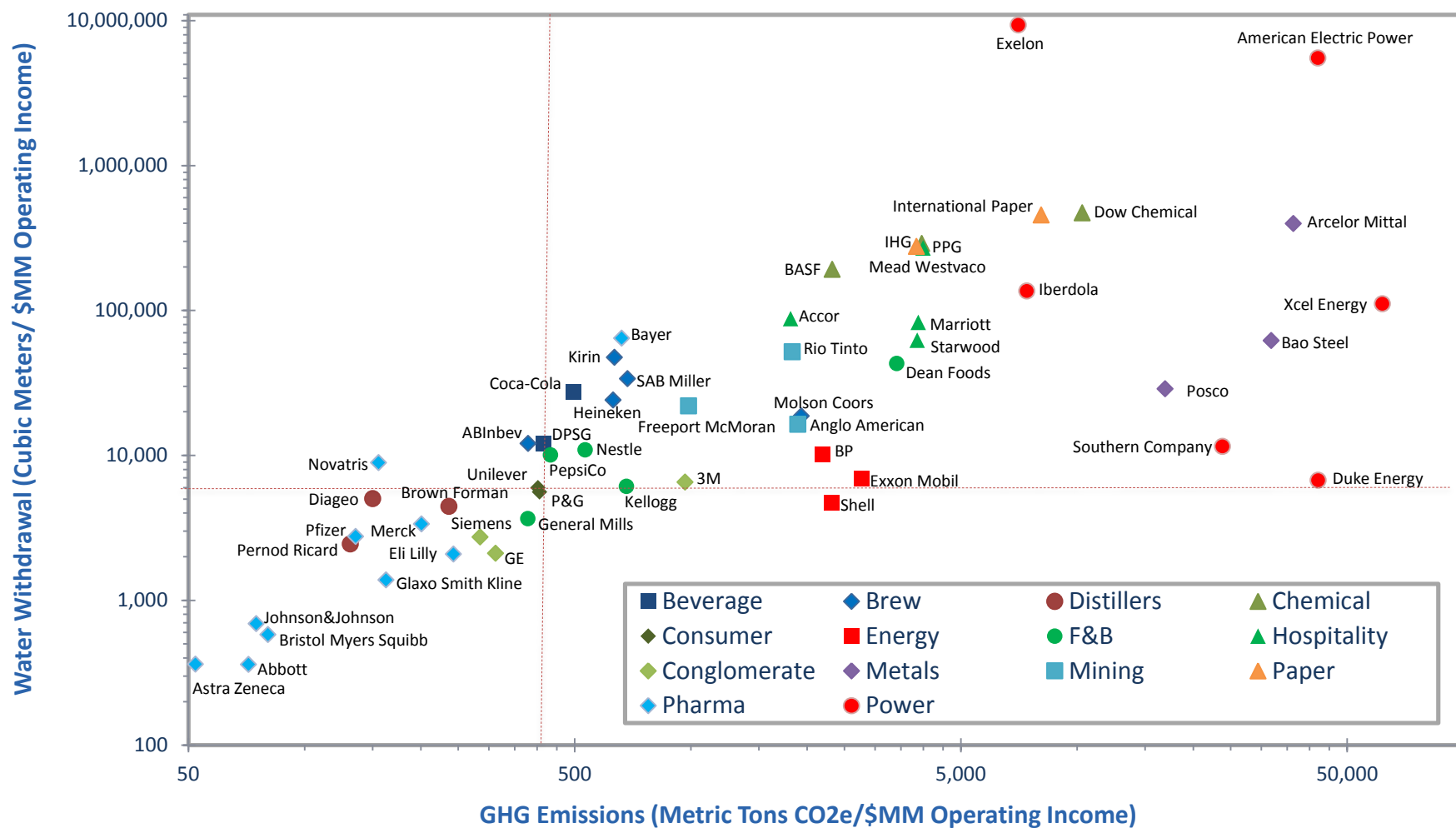
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ENERGY EMBEDDED IN WATER

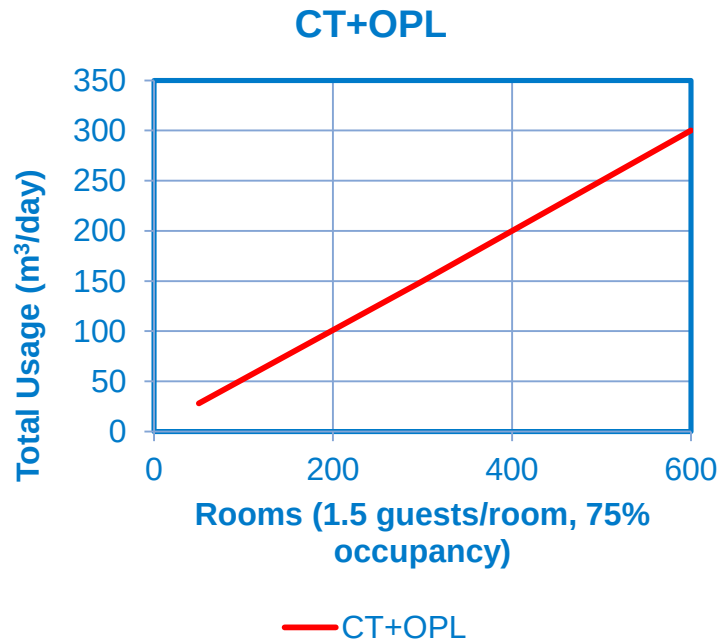


ENERGY & WATER PRODUCTIVITY IN COMMERCE

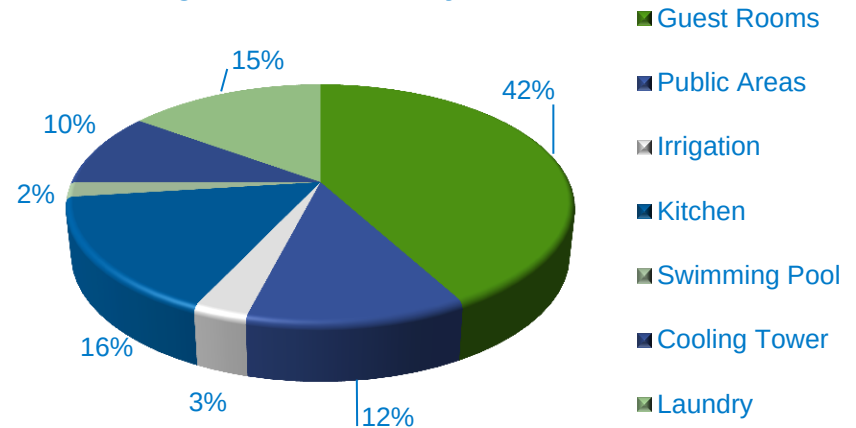


WATER USE IN FULL-SERVICE LODGING

- A full-service hotel has 300 rooms with 1.5 guests/room and 75% occupancy typically consumes 150m³ of water/day
- A full-service hotel has a cooling tower (CT) and on premise laundry (OPL)



With Cooling Tower & Laundry



WATER-ENERGY NEXUS: LAUNDRY

Ecolab's **Aquanomic/ Ensure Laundry Programs** deliver clean, white, and soft results while saving water and energy. Both the Smart Wash process and best-practice optimization reduce the number of rinse cycles, and low temperature chemistry reduces the wash water temperature to 40°C.



Performance Factors (water and energy savings per unit solid product)

- 33 m³ of water savings per 4 x 9 lb case
- 1,700 kWh of energy savings per 4 x 9 lb case

@\$0.575/m³  \$19 in water savings
WATER

@4.4c/kWh  \$75 in energy savings
ENERGY

WATER-ENERGY NEXUS: WAREWASHING

Ecolab's **Apex Warewashing System** delivers superior results with sustainable low phosphorus products and non-corrosive, color-coded chemistry to enhance user safety. The Apex controller also reduces rewashing, saving water and energy.



Performance Factors (water and energy savings per unit solid product)

- 0.9 m³ of water savings per 4 x 6.5 lb case
- 103 kWh of energy savings per 4 x 6.5 lb case

@\$0.575/m³  \$0.52 in water savings

WATER

@4.4c/kWh  \$4.53 in energy savings

ENERGY

WATER-ENERGY NEXUS: FLOOR CARE

Ecolab's **Wash'n Walk® Floor Cleaner** uses cool water dilution and a “no-rinse” formula to reduce slips and falls due to greasy floors. It also saves large amounts of rinse water and the energy needed to heat normal floor wash water.



Performance Factors (water and energy savings per unit solid product)

- 6 m³ of water savings per case
- 363 kWh of energy savings per case

@\$0.575/m³  \$3.45 in water savings

WATER

@4.4c/kWh  \$16 in energy savings

ENERGY

OPTIMIZING WATER AND ENERGY USE

It Matters to our Customers that we can leverage our chemistry beyond core outcomes-

Process water is Valuable 'Energy-Rich' Water: heated, chilled, filtered, treated, conveyed,disposed

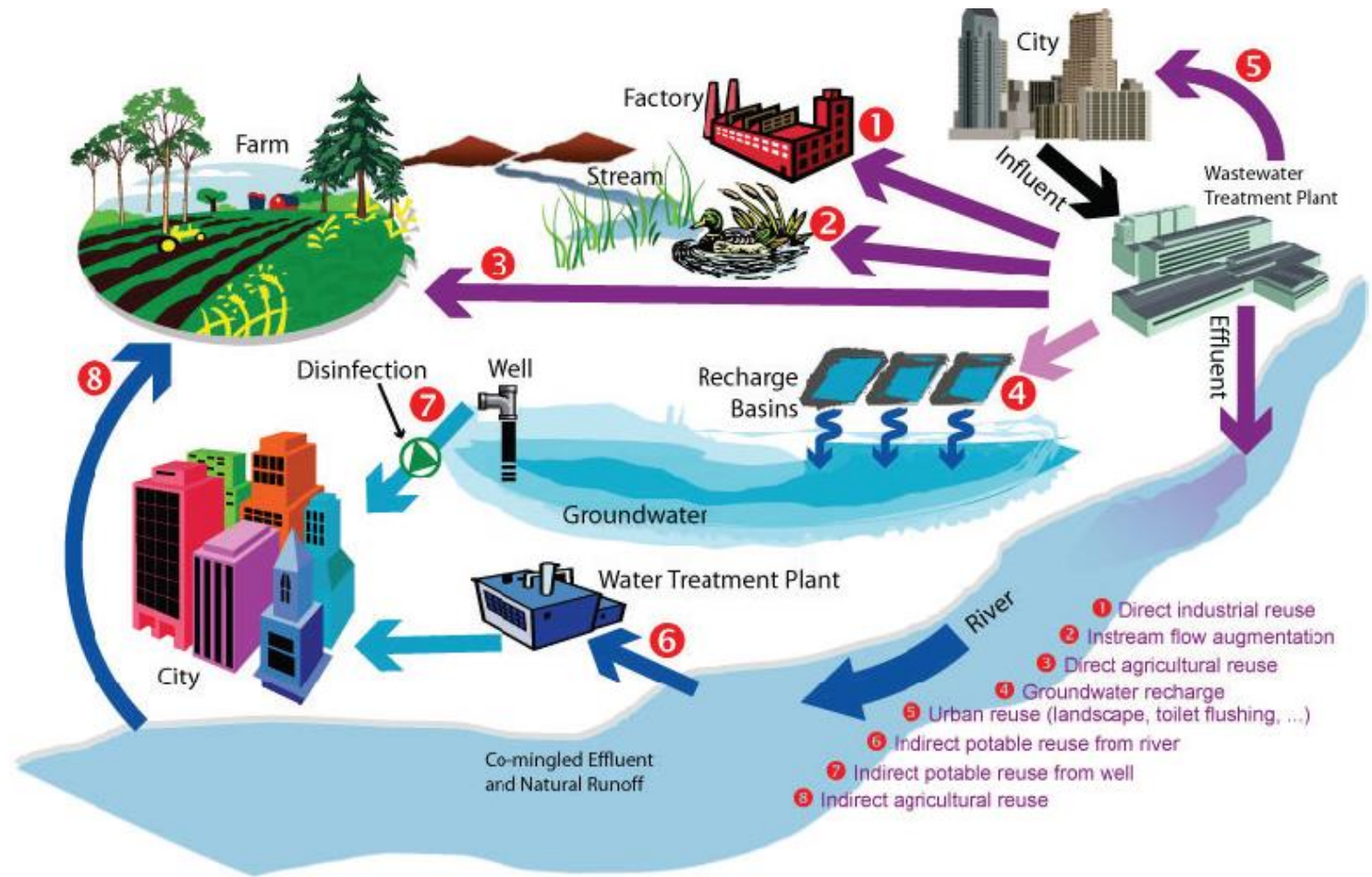
Big leverage: Water + Energy Spend >> chemical spend

▲ 300-Room Hotel:

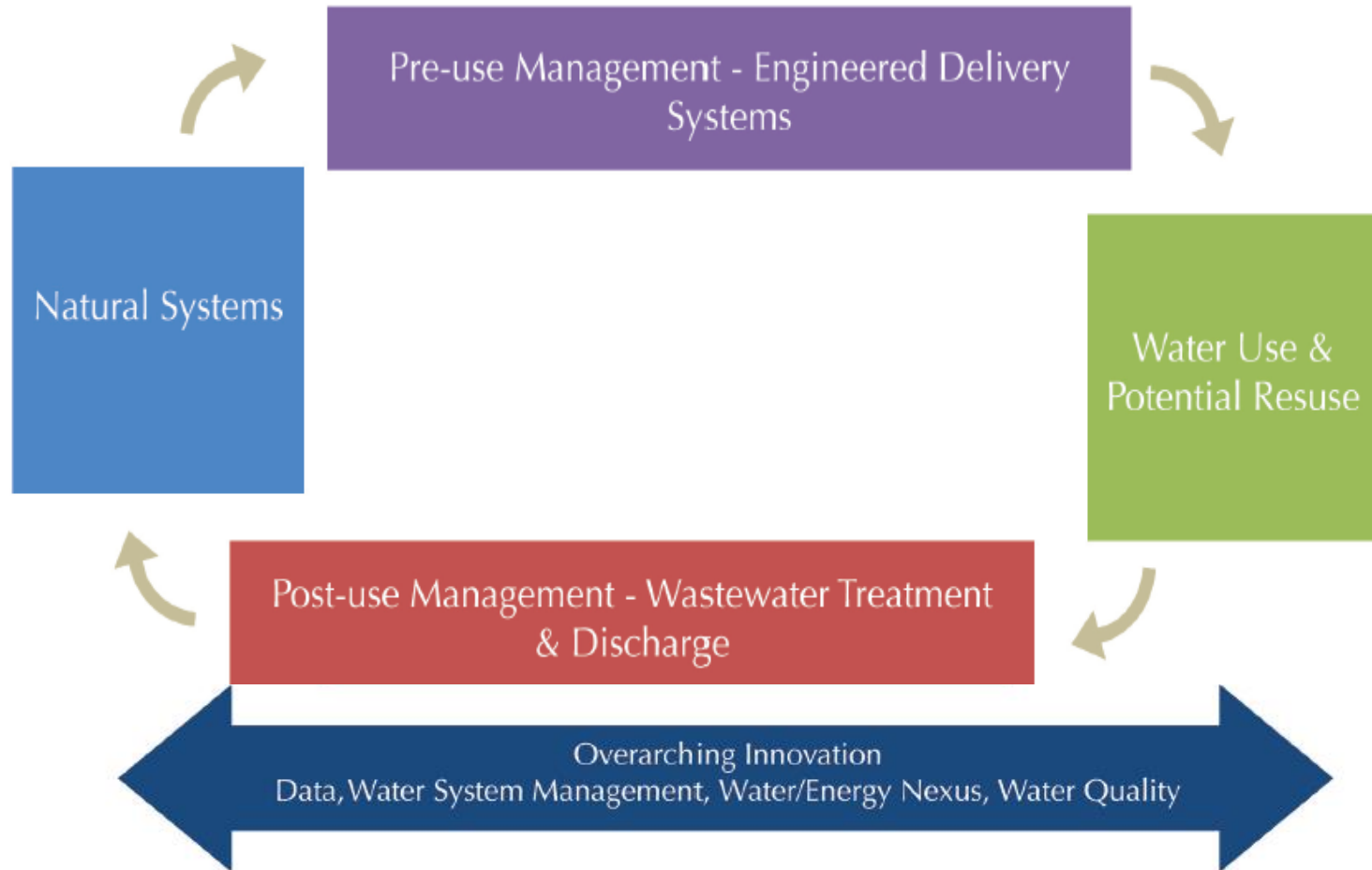
- **\$667K/yr** water & energy spend, 33K/yr chemical spend
- Cooling: \$165K, 44x chemical spend
- Rooms: \$48K, 9x chemical spend
- Laundry: \$24K, 3x chemical spend
- Kitchen: \$24K, 2x chemical spend
- Pool: \$7K, 1x chemical spend
- Other: \$399K, no chemical spend



DOWNSTREAM ENERGY-WATER COLLISION



OPPORTUNITIES FOR INNOVATION



KEY TAKE-AWAYS

- **Upstream Nexus**

- Primary Energy
- Power Purchase
 - Water in Energy- Quality and Quantity Impacts
 - Energy in Water- Climate Change Impacts

- **In-Stream Nexus**

- Utilities: Facility Cooling
- Services: Laundry, Warewashing, Facility Care
 - Quantify and Monetize Value of embedded energy in water savings

- **Downstream Nexus**

- Water Reuse
 - Consider energy implications of point of reuse
 - Impact of green and grey infrastructure

DISCUSSIONS

