Supporting Partner:

PUB SINGAPORE WATER EXCHANGE

Jointly organised by:

Singapore Environment Council

SWA SINGAPORE WATER ASSOCIATION

Hybrid

Water – Food – Energy Nexus
Towards a Circular Business Economy

GUEST OF HONOUR:

SMS Dr. Amy Khor

Ministry of Sustainability and the Environment

Tuesday, 11 Jan 2022

SGT 10am to 11:30am

Supporting Partner:

Jointly organised by:

Water – Food – Energy Nexus – Towards a Circular Business Economy

Tuesday, 11th January 2022, 10am

WELCOME ADDRESS

Mr Charles Quek

Vice-President (General Affairs)

Singapore Water Association

Supporting Partner:

PUB SINGAPORE WATER EXCHANGE

Jointly organised by:

Singapore Environment Council

SWA SINGAPORE WATER ASSOCIATION

Water – Food – Energy Nexus – Towards a Circular Business Economy

Tuesday, 11th January 2022, 10am

KEYNOTE MESSAGE

Ms Isabella Huang-Loh

Chair

Singapore Environment Council

Supporting Partner:

Jointly organised by:

Water – Food – Energy Nexus – Towards a Circular Business Economy

Tuesday, 11th January 2022, 10am

OPENING REMARKS

Guest of Honour

SMS Dr Amy Khor

Ministry of Sustainability and the Environment

Supporting Partner:

Jointly organised by:

MOU Signing Ceremony

Tuesday, 11th January 2022, 10am

SEC Representatives:

Ms. Isabella Huang-Loh

Chair
Singapore Environment Council

Ms. Jen Teo

Executive Director
Singapore Environment Council

Ceremony Witness:

Dr. Amy Khor

Senior Minister of State
Ministry of Sustainability & the Environment

SWA Representaives:

Mr. Charles Quek

Vice-President (General Affairs)
Singapore Water Association

Mr. Kunal Shah

Council Member
Chair of Sustainability Task Force
Singapore Water Association

Supporting Partner:

Jointly organised by:

Water – Food – Energy Nexus – Towards a Circular Business Economy

Tuesday, 11th January 2022, 10am

Dr Augustine Quek

Senior Engineer

Singapore Environment Council

Water-Food-Energy Nexus: Towards Business Circular Economy

Singapore Environment Council

11th Jan 2022

Singapore Environment Council

Agenda

- Context and Challenges
- Water Footprint in the Water Food Energy Nexus
- Nexus Thinking
- Driver for Green Growth - Eco-certifications and Green Labels

Singapore Environment Council

Context and Challenges

FOOD

70%
of all freshwater withdrawals were by agricultural sector.

60%
increase in food production will be needed by 2050 to keep up with growing population.

CITIES & INDUSTRIES

55%
increase in global water demand by 2050, mostly in cities

400%
increase in water demand by manufacturing sector by 2050 (from 2000 baseline).

WATER & ENERGY

15%
of freshwater withdrawals globally are for the production of electricity.

5-30%
of total operating cost of water and wastewater utilities are from energy use.

ECOSYSTEM

$20 trillion
loss per year in ecosystem services due to pollution and change in land use

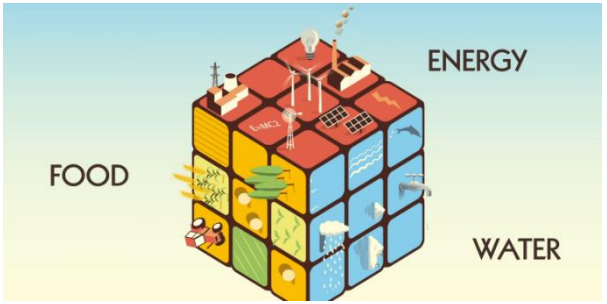
$125 trillion
economic value provided by ecosystem services to global economy in 2011

Water and Circular Economy: A White Paper (Arup)

Singapore Environment Council

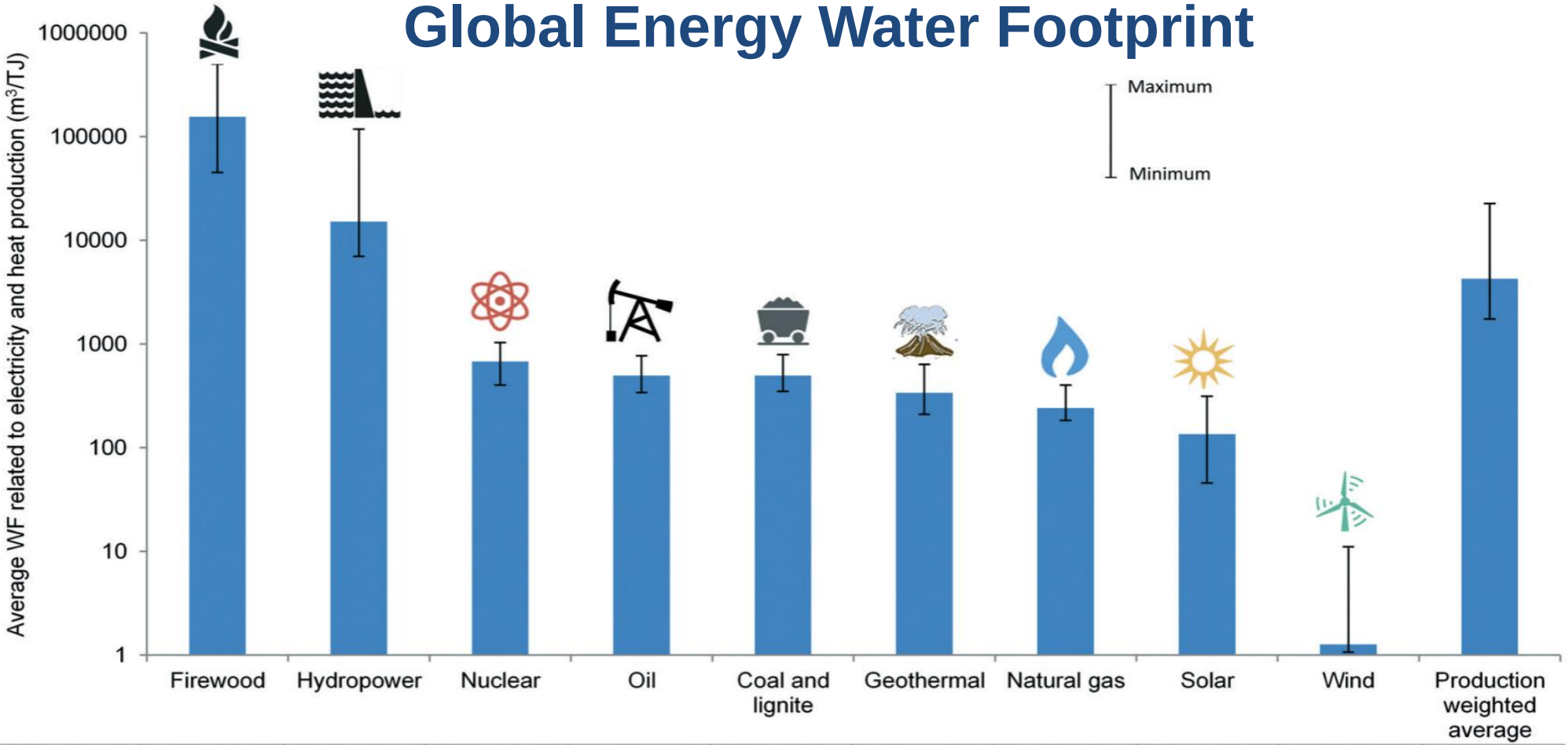
Why is this important?

- Water an enabler for socioeconomic development (e.g. agriculture production, energy generation, industry, manufacturing)
- Climate change has resulted in water access challenges (scarcity, floods etc.)
- Increasing urbanization has intensified water use
- Unsustainable operations (fossil energy, waste from water plants) leading to increasing costs



Singapore Environment Council

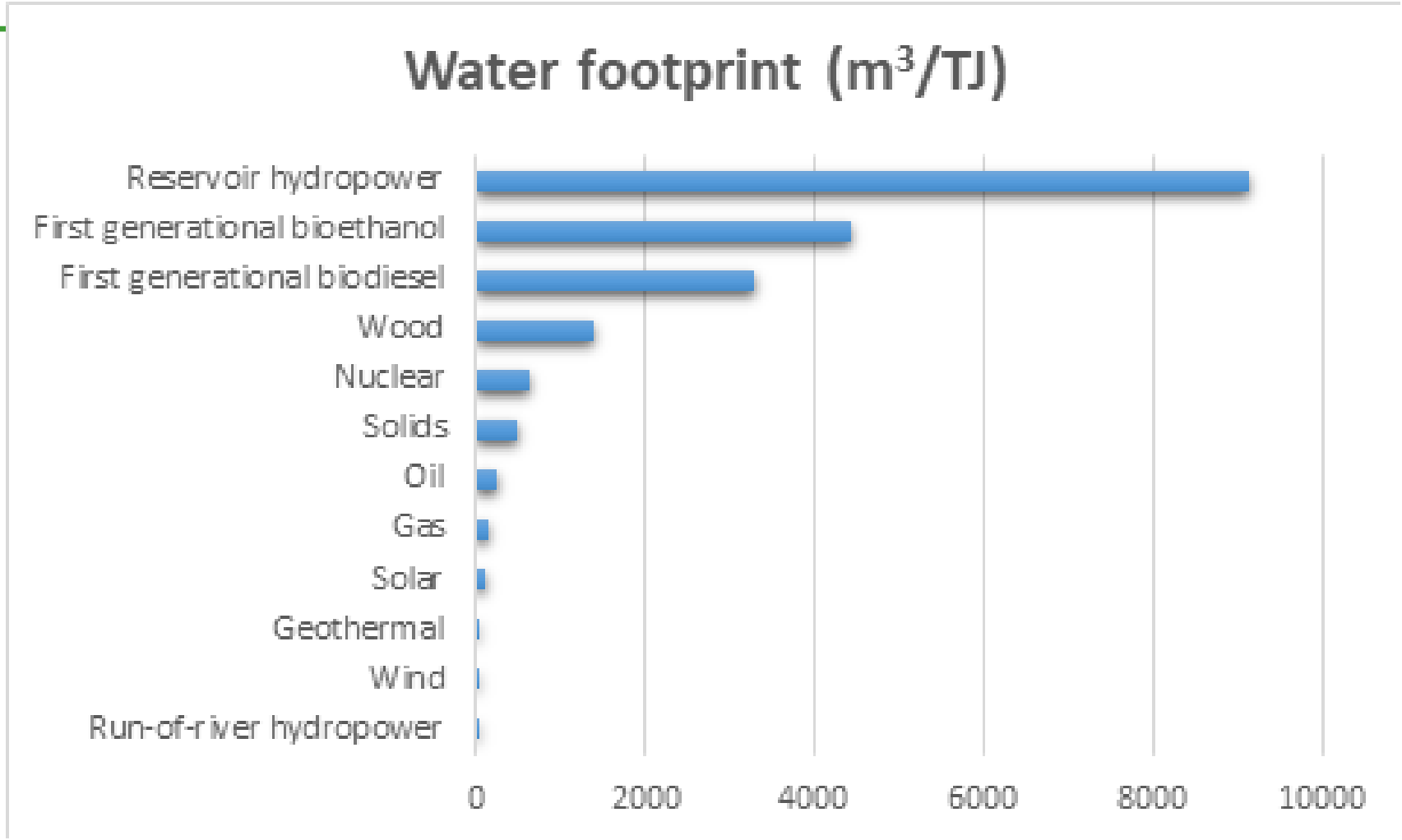
Global Energy Water Footprint



Operation	400	15100	610	440	440	340	240	50	0.2	2410
Construction	0.4	0.3	0.3	1.1	1.1	2.1	1.1	90	1.1	1.0
Fuel supply	156000	0	68	55	54	0	6	0	0	1830

Average consumptive WF per unit of electricity and heat produced (m^3 TJe^{-1}) for the period 2008–2012. The scale is logarithmic. The ranges shown reflect minimum and maximum values per energy source. The values in the table represent the WF (m^3 TJ^{-1}) for the three main stages of the electricity and heat production chain

Singapore Environment Council

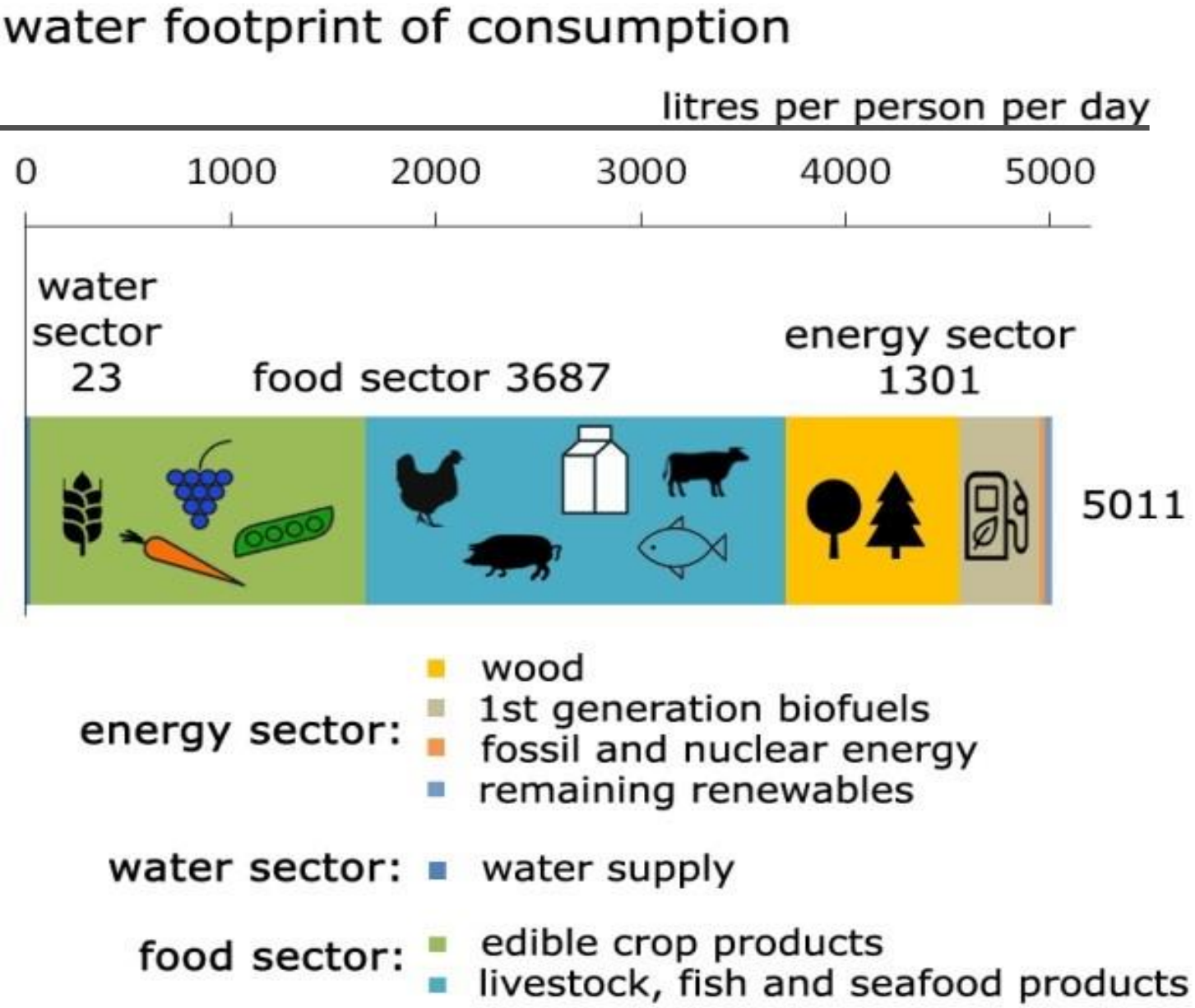


Average water footprint related to energy production in the EU without including soil moisture. With soil moisture the water footprint of 1st generational biodiesel is 137 624 m3/TJ, of wood 61 762 m3/TJ and of 1st generational bioethanol is 61 032 m3/TJ. ©EU, 2019

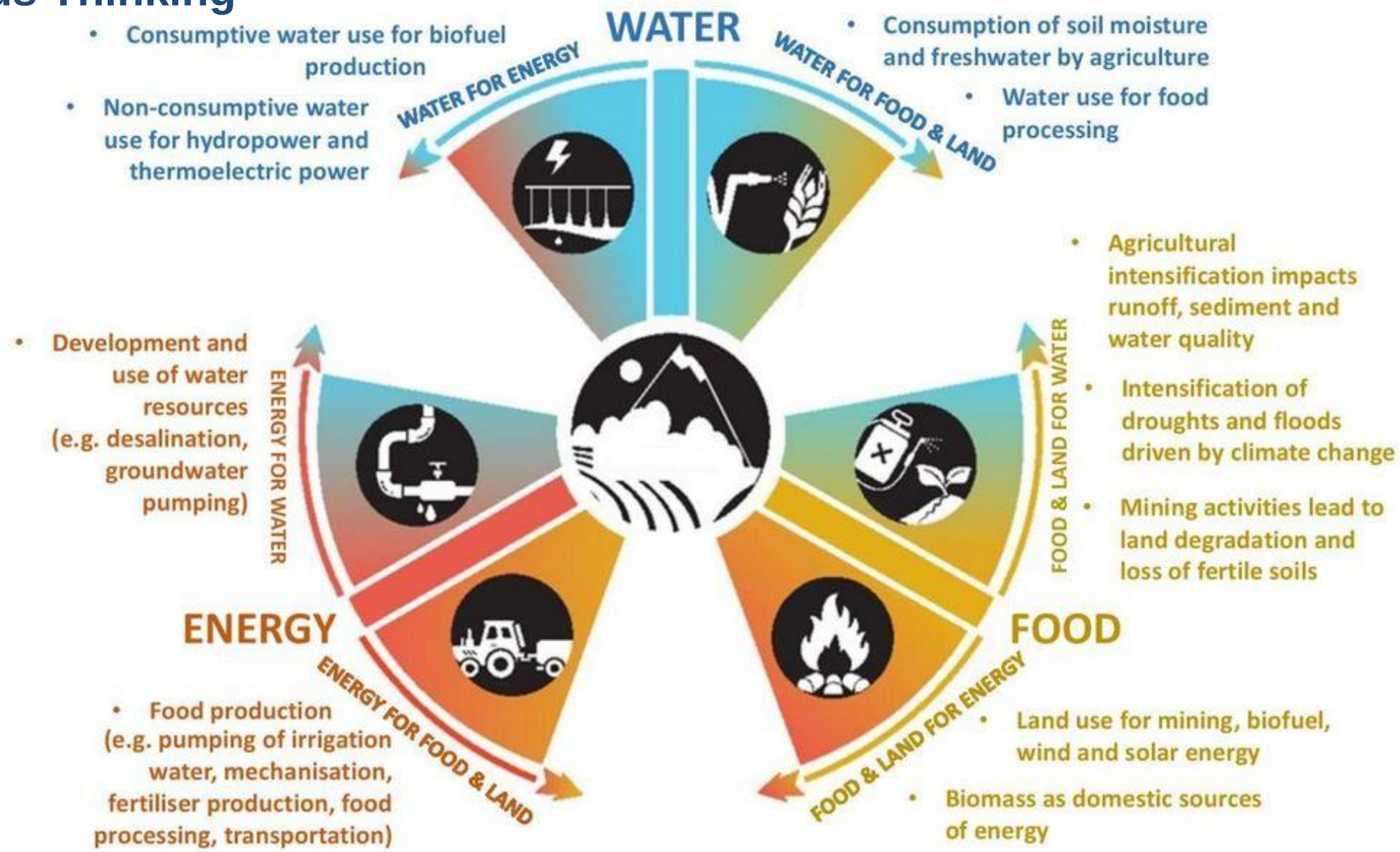
Singapore Environment Council

Total Footprint

The water footprint of consumption in the EU in for the water, food and energy sectors. ©EU, 2019



Nexus Thinking



SEC Eco-certified / Advisory Companies

- Food – Coffee Bean, Culina, Merci Marcel, Grand Hyatt
- Energy – Shell Eastern, YTL Power, Pacific Light
- Water – Evoqua Water Technologies, Hobart International, Boustead

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Driver for Green Growth: SEC's Eco-certifications & Green Labels

Singapore Environment Council

Singapore Environment Council

- Training Programs
  - Short courses (topical, ~90 minutes)
  - Corporate Sustainability (funded by Enterprise Singapore)
- Certifications Programs
  - Eco-certificates
  - Green Label (Singapore Green Labeling Scheme)
- Advisory Program
  - Environmental Assessment, include GHG emissions reduction
  - Corporate Advisory, Mandatory Packaging Reporting (MPR)

SEC Training Programs

1. Short courses: 90 minutes each

Climate Change and Carbon Management

Green Energy and Energy Management

Circular Economy and Waste Management

Green Supply Chains and Eco-labelling

2. Corporate Sustainability Program -16 hours

Putting Sustainability into Business Practice: Core Concepts, ESG, Risks, Strategies, Analyses + Self Assessment Tool

https://sec.org.sg/sustainability-training-interest/

SEC's Eco-Certs & Green Labels

- Assesses quantitative and qualitative environmental performance indicators
- Gap analysis to nudge companies towards **sustainable operations** (energy, water, waste) leading to increasing **cost savings**
- Access to green finance to support your sustainability initiatives

Singapore Environment Council

SEC Green Label Certification: SGLS

Introduction

17065

- Launched in ***1992*** by then ***Minister of Environment***, Ahmad Mattar
- Administered by SEC since 1999
- ***Type-1 Ecolabel*** certified in compliance with ***ISO 14024*** and accredited under ***ISO 17065***
- ***2-years*** validity

International MOUs & MRAs

- Japan Environment Association (2015)
- China Environmental United Certification Center (2014)
- Ecological Movement Uzbekistan (2012)

* *ISO 17065 is only for paint and paper*

Criteria

Fit for use	•Proof of quality and ability to perform its intended use
Prohibited hazardous substances	•Proof of absence of hazardous substances, e.g. specific heavy metals, phthalates, halogenated organic substances
Life cycle considerations	•Declaration of material content, recycled % and sources
Environmental, safety, health & quality management	•ISO 14001, ISO 45001, ISO 9001 or declaration
Manufacturing practices	•Declaration of proper storage of raw materials and waste management

✓ **To be certified, accredited lab test reports are required to assure compliance with limits set**

Enabling Green Procurement Across Extensive Range of Products

Building Products

- Cement and Precast Concrete
- Brick
- Tile /Ceramics
- Paints and Surface Coatings
- Carpets
- Adhesives and Sealants
- Panel Board
- Surface Covering
- Insulators
- Textiles
- Flooring
- Pipes
- Doors
- Compact Fluorescent Lamp (Modular)
- LED Lights

Office Supplies & Equipment

- Paper
- Correction Fluid and Tapes
- Copying, Fax machines, Printers and Multi-Functional Devices
- Office Furniture
- Ink and Toner Cartridges
- Laptop
- Monitor
- Projector

Personal Care

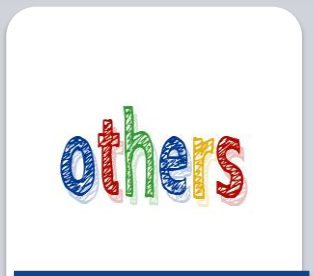
- Hair spray/Gel/ Mousse
- Deodorant Stick/Roller/Spray
- Shaving Foam & Cream
- Cosmetics
- Sanitizer
- Face Mask

Household Appliances

- Food Packaging, Crockery and Cutlery
- Dishwashers
- Electric Kettles
- Espresso & Coffee Machines
- Gas Cookers and Gas- Fired Appliances
- Hot Water Storage Tanks
- Oxo-biodegradable plastic products
- Oven
- Microwave

Cleaning Products

- Detergents
- Floor Cleaners
- Industrial and Institutional Cleaner
- Surface Cleaners
- Hand Soaps



Others

- Soil Improver, Growing Media, Aggregate & Mulch
- Product made from Recycled and or sustainable content
- Products with recycled and or sustainable content
- Biodegradable Products
- Environmental Innovative Products
- Fire Extinguishers
- Automobile Tyres
- Termiticides
- Eco-friendly products
- Hand Driers

Singapore Environment Council

Enabling Businesses and Organizations Towards a Low Carbon Footprint

KEY PRIORITIES

Eco Ambassador Training

TRAINING & EDUCATION

Green Label & Eco Certification

Green Label

or

Enhanced Green Label

or

Eco Certification

Consultation & Assessment

Carbon Emissions Monitoring and Reduction

GreenDNA Certification

- Corporate Sustainability
- Awareness and Capability Building

SGLS, SGLS+, Eco Office, Eco Shop, Eco F&B, Eco Event, Eco Integrated Logistics + Health Check

Environmental Sustainability Advisory
GHG Calculator

Source: https://sec.org.sg/greendna/

Singapore Environment Council

Singapore Environment Council

THANK YOU

www.sec.org.sg

+65 6337 6062

SingaporeEnvironmentCouncil

@SECSingapore

Singapore Environment Council

Supporting Partner:

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Jointly organised by:

Singapore Environment Council

SWA SINGAPORE WATER ASSOCIATION

Water – Food – Energy Nexus – Towards a Circular Business Economy

Tuesday, 11th January 2022, 10am

Water – Food – Energy Nexus: Challenges & Opportunities Landscape

Mr Kunal Shah

Council Member

Chair of Sustainability Task Force

Singapore Water Association

WATER – FOOD – ENERGY NEXUS – Water's role !!

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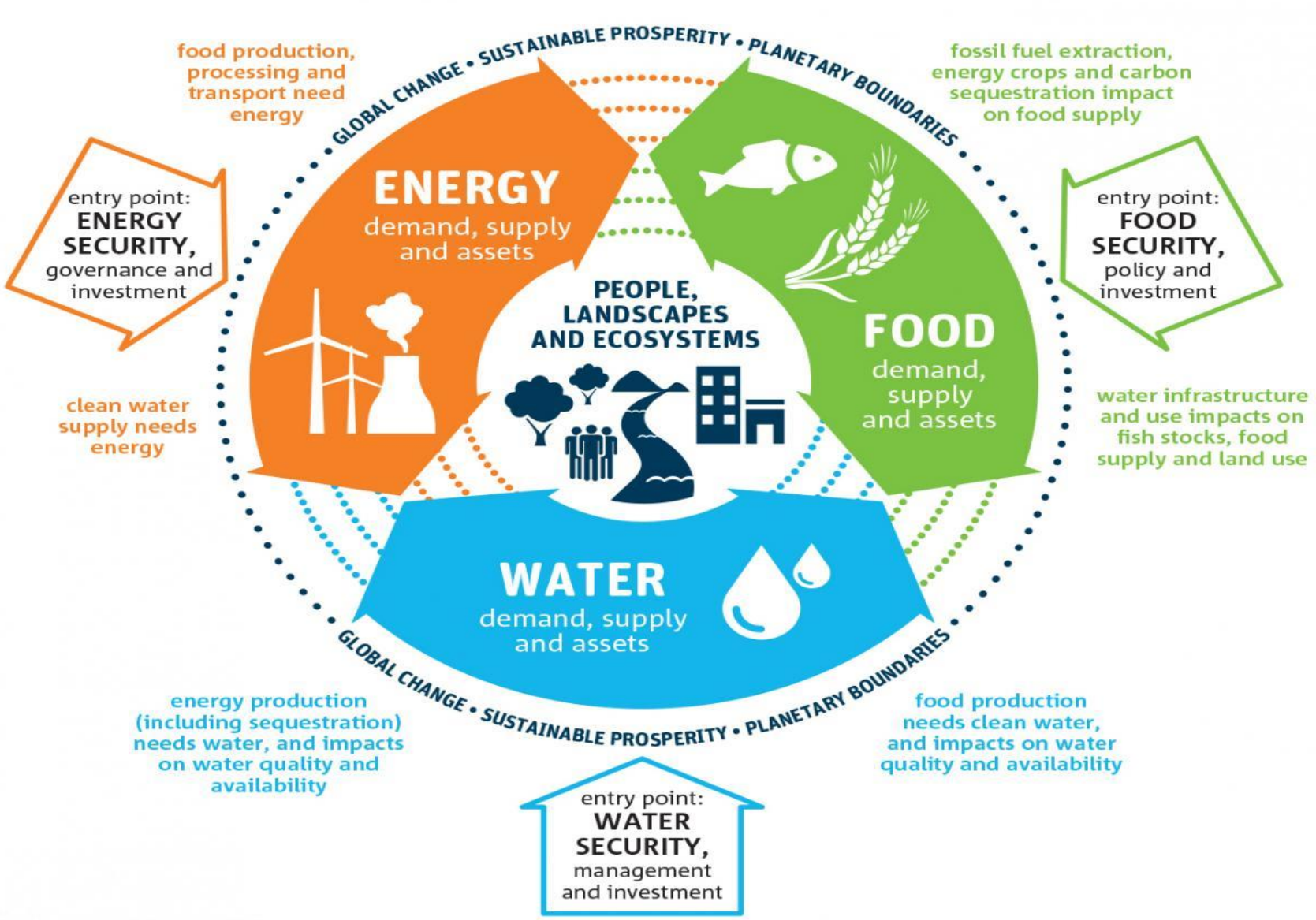

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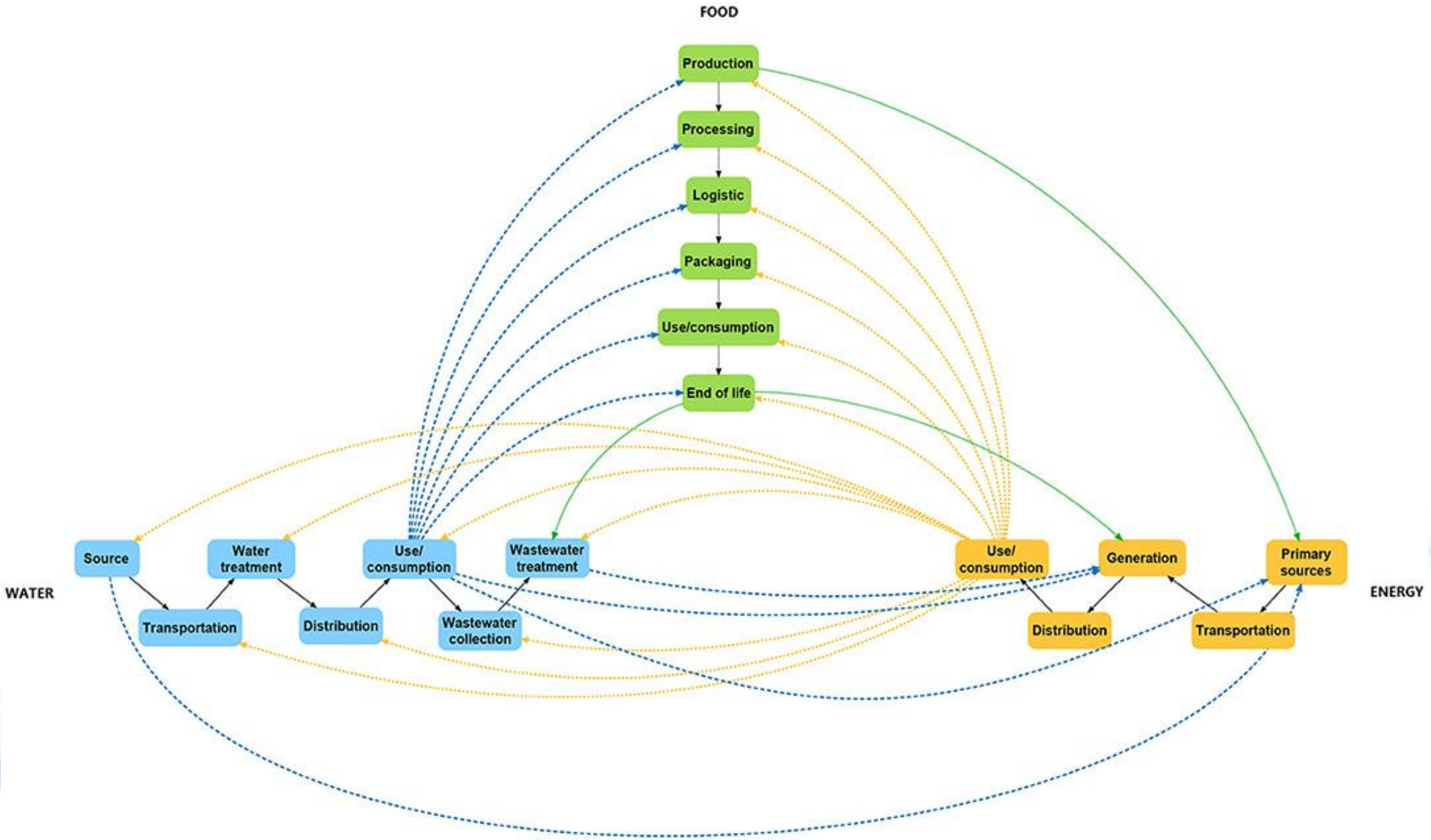
FOOD
Production
Processing
Logistic
Packaging
Use/consumption
End of life
WATER
Source
Water treatment
Use/ consumption
Wastewater treatment
Transportation
Distribution
Wastewater collection
Use/ consumption
Generation
Primary sources
Distribution
Transportation
ENERGY

Issues

- Too much water
- Too little water
- Too much or too little water at the wrong time…
- Hurricanes/ Typhoons
- GHG emissions
- Food security – shortage – agri productivity – soil condition
- Waste volumes
- Energy Requirements – Global volatility !!

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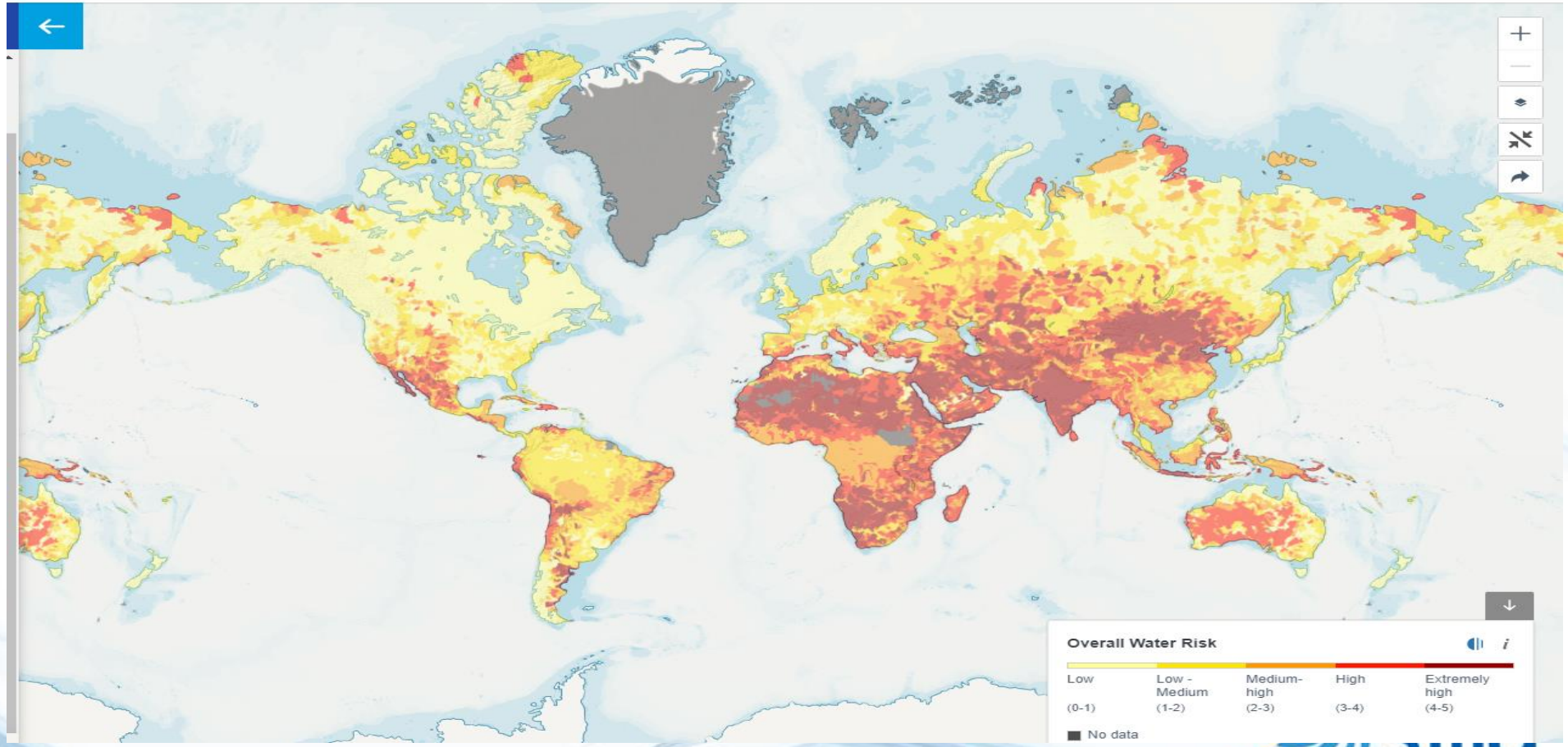
Water Risk Global – clubbed with Global warming



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Carbon Negative

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AND

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Water Positive

Water-positive pledges **aim to help companies align with UN goals for people to have adequate access to clean water while also securing their own water supply….**

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The Zenwen Dam in southern Taiwan, March 2021. The island experienced its worst drought in decades this year – a crisis that threatened an already acute global semiconductor shortage. Photograph: Sam Yeh/AFP/Getty Images

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Facts

- It is estimated that more than 50% of the global population will be living in an area of water scarcity by 2050.
- Increases in demand for water are estimated at
  - 40%-50% across the food chain,
  - 50%-70% for the municipal and industrial sector, and
  - by 85% for the energy sector.
- *Further, the World Bank indicated that water scarcity, exacerbated by climate change, is so significant that it has the potential to cost some regions up to 6% of their GDP*.

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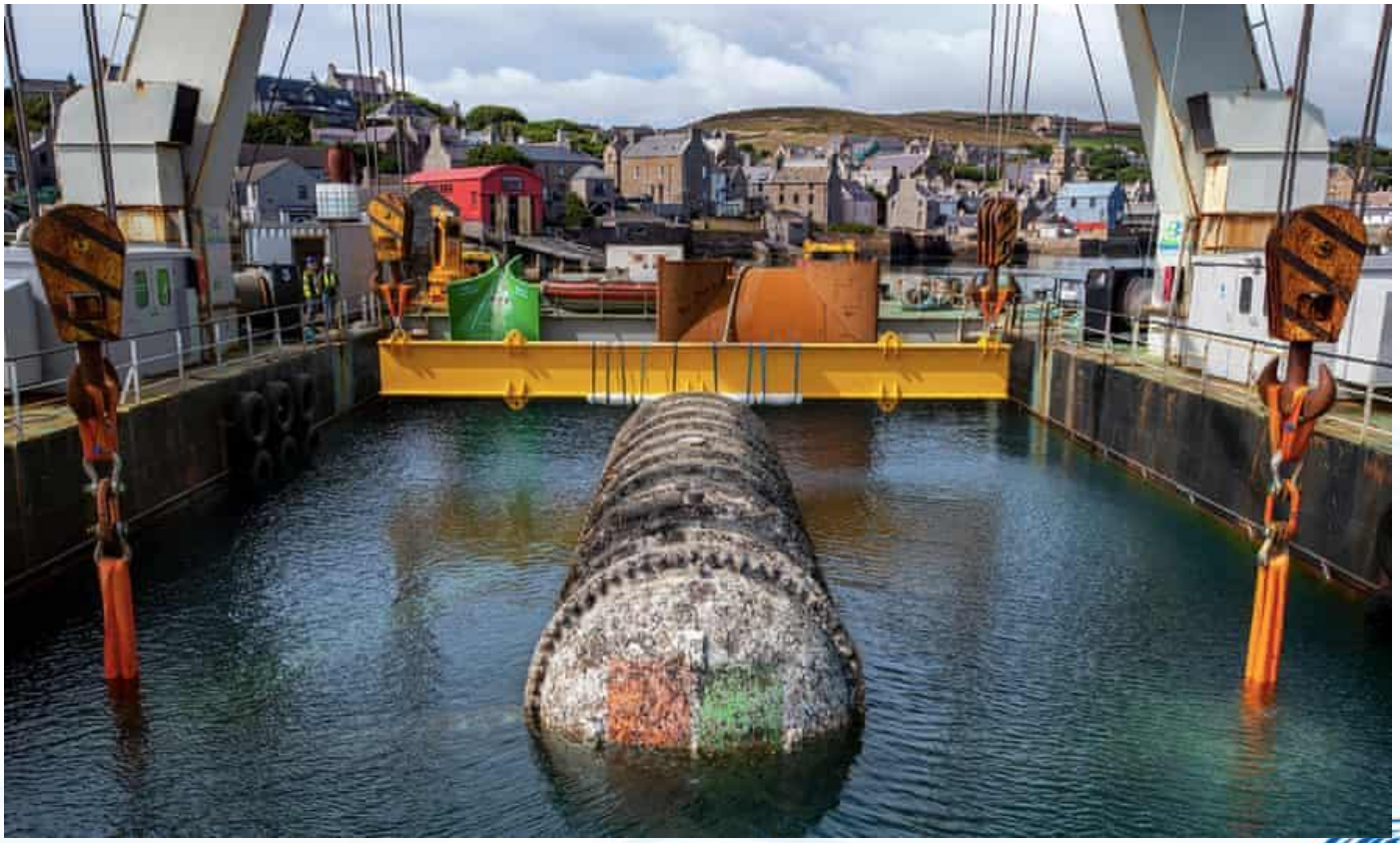
Cooling requirements for tons of Data



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Global Commitments

- Microsoft, Google, Facebook, PepsiCo – by 2030
- BP – 2035
- GAP - 2050

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Water is an essential enabler for energy production

- Currently about 10 percent of that fresh water is used in energy production. But it could increase by nearly 60 percent by 2040. **And if not properly managed, the fuels and technologies used to achieve the energy transition will not only increase water stress but be limited by water availability.**
- Low-carbon technologies like hydrogen, renewable fuels, batteries, pumped storage hydropower, nuclear, and carbon capture all have unique water needs.

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Water in the Energy Transition

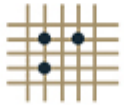
Water in the **E**nergy **T**ransition

Water is a critical enabler for the energy transition.

We develop sustainable, cost-effective water strategies to help our clients in the following areas:

Geothermal, hydro & ocean power

- Permitting and design services for pumped storage hydro dams



Distributed energy, EV & storage

- Mine water solutions for the critical components of battery production
- Water for battery production
- Integration into District Energy systems

Hydrogen

- Sourcing and permitting supply
- Producing high purity water for electrolyzer and cooling

Biodiesel

- Optimized wastewater treatment for biodiesel feedstock pretreatment
- Integration into biodiesel refinery WWTP for polishing

Renewable Natural Gas (RNG)

- Optimizing and stabilizing RNG production via anaerobic digestion of waste
- Improved residuals management on RNG projects

Carbon capture utilization & storage

- Water for capture and cooling
- Wastewater and residuals management
- Hydrogeology services

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Hydrogen relies on water

- An electrolyzer of 100 megawatts (MW) capacity consumes roughly 500 tonnes of water per day (tpd) and produces roughly 50 tpd of hydrogen. That's about six olympic-sized swimming pools of water use every month. If the system is water cooled, it requires at least twice the amount of water.

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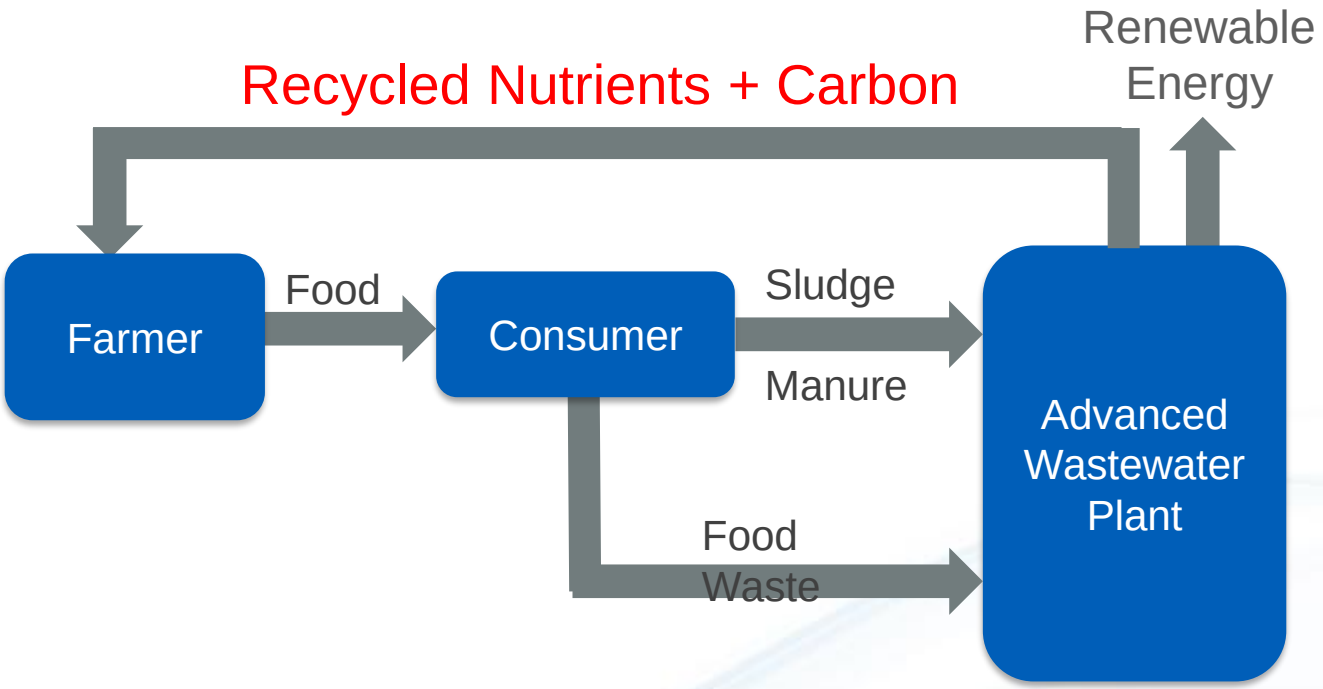
Carbon capture is another integral part of the energy transition

- Carbon capture technologies have critical water demands for cooling and **chemical** process support, especially for heat rejection due to absorption and compression operations.
- When a carbon capture process is added onto an existing power plant, it will increase total water consumption substantially.

Recycling Organic Waste Reduces Greenhouses Gases and Makes



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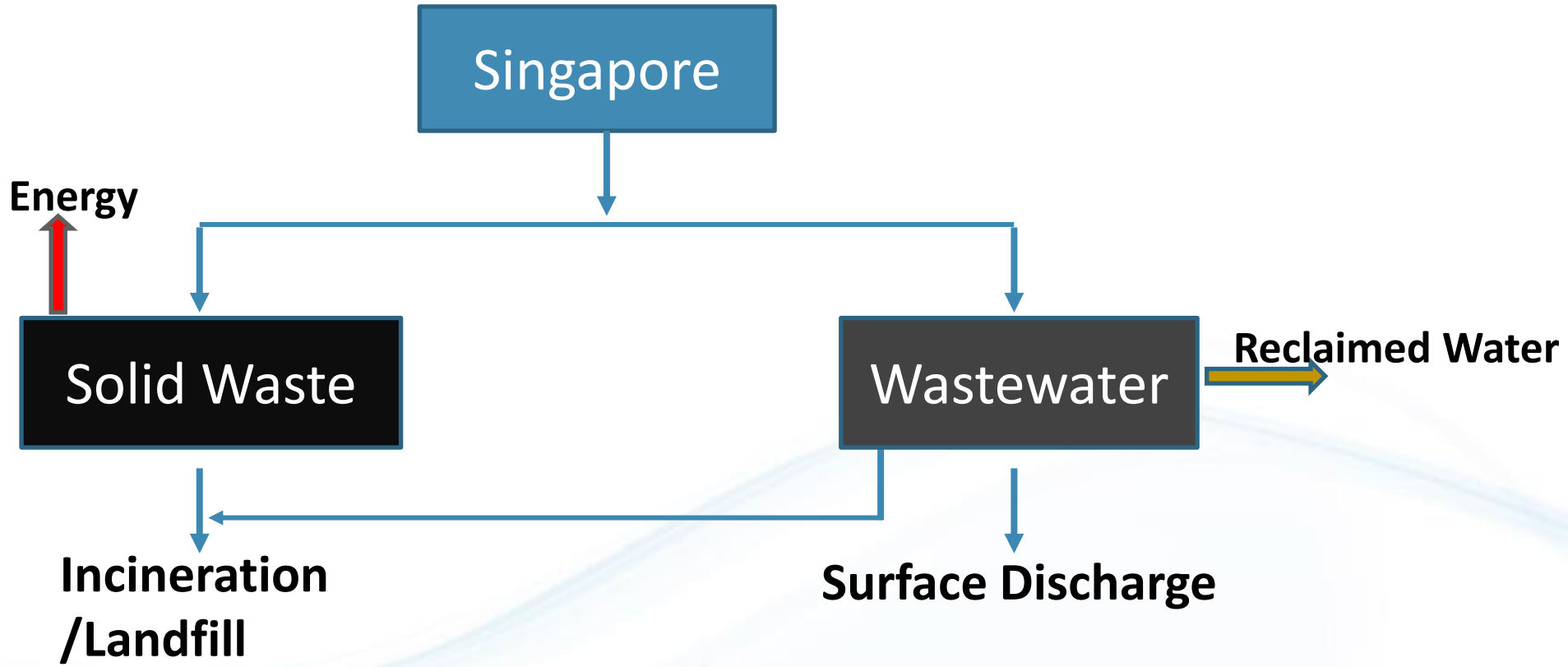
Singapore's Current Model for Urban Waste



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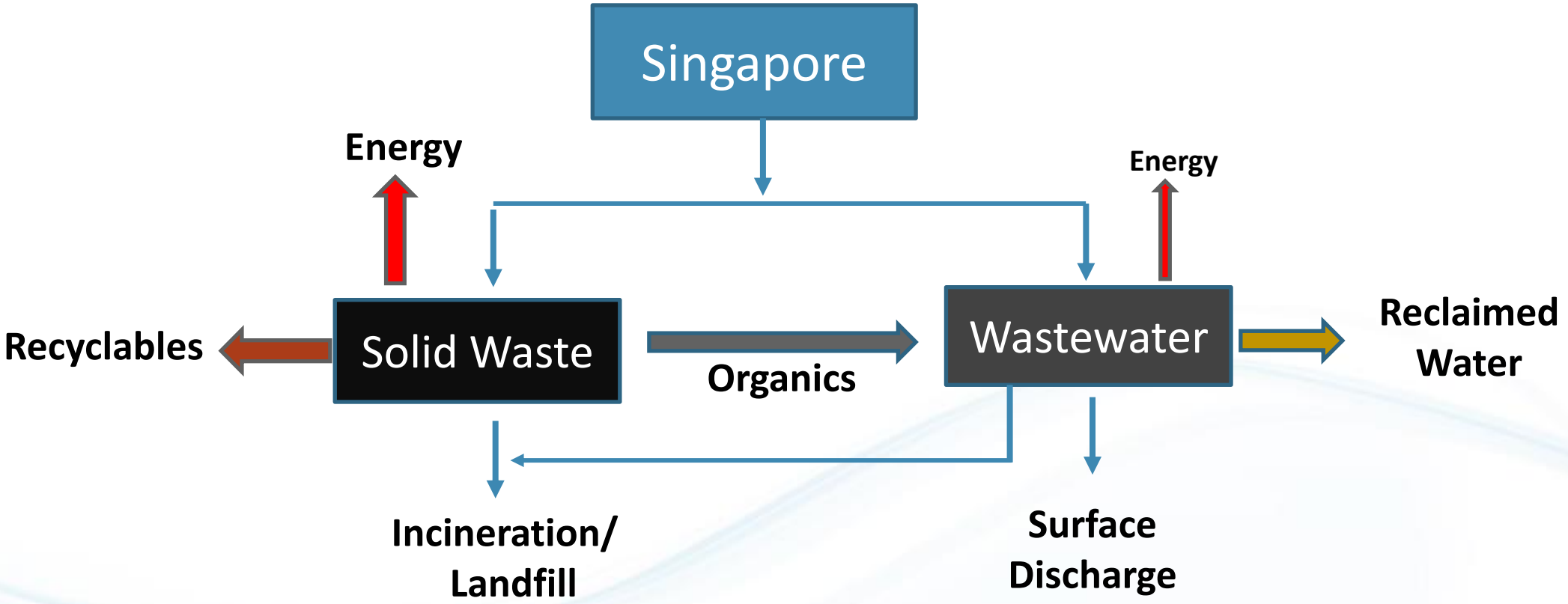
Anaergia

Singapore's Model for Urban Waste – The Near Future



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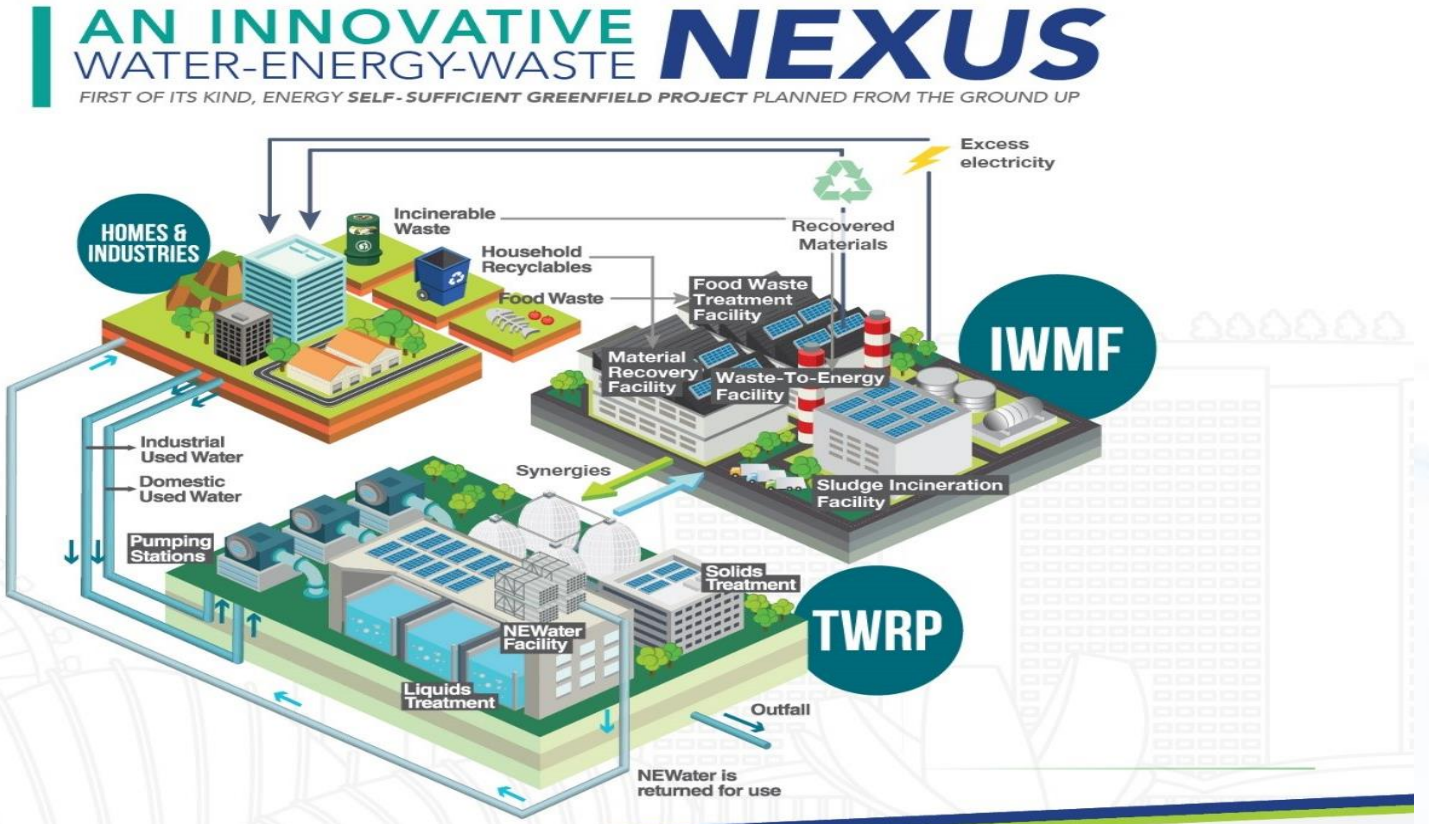
Anaergia

The Tuas Nexus……



TUAS NEXUS

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Opportunities

- Recycle of wastewater and waste
- Organic fertilizer from waste
- Vertical farming/ Urban farming – Decentralized farming
- Renewable Fuels
- Renewable Energy
- Energy Transition – Carbon Capture, Storage and conversion
- Energy Efficiency
- Carbon negative/ Water positive Data centers/ Buildings, cities…..

SOLUTIONS

SINGAPORE WATER ASSOCIATION


OUR PLANET HAS TWO LUNGS ONE IS GREEN
THE OTHER IS BLUE

Supporting Partner:

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Jointly organised by:

Singapore Environment Council

SWA SINGAPORE WATER ASSOCIATION

Water – Food – Energy Nexus – Towards a Circular Business Economy

Tuesday, 11th January 2022, 10am

What is Sustainability to Evoqua?

Mr Govindan Alagappan

Managing Director

Evoqua Water Technologies

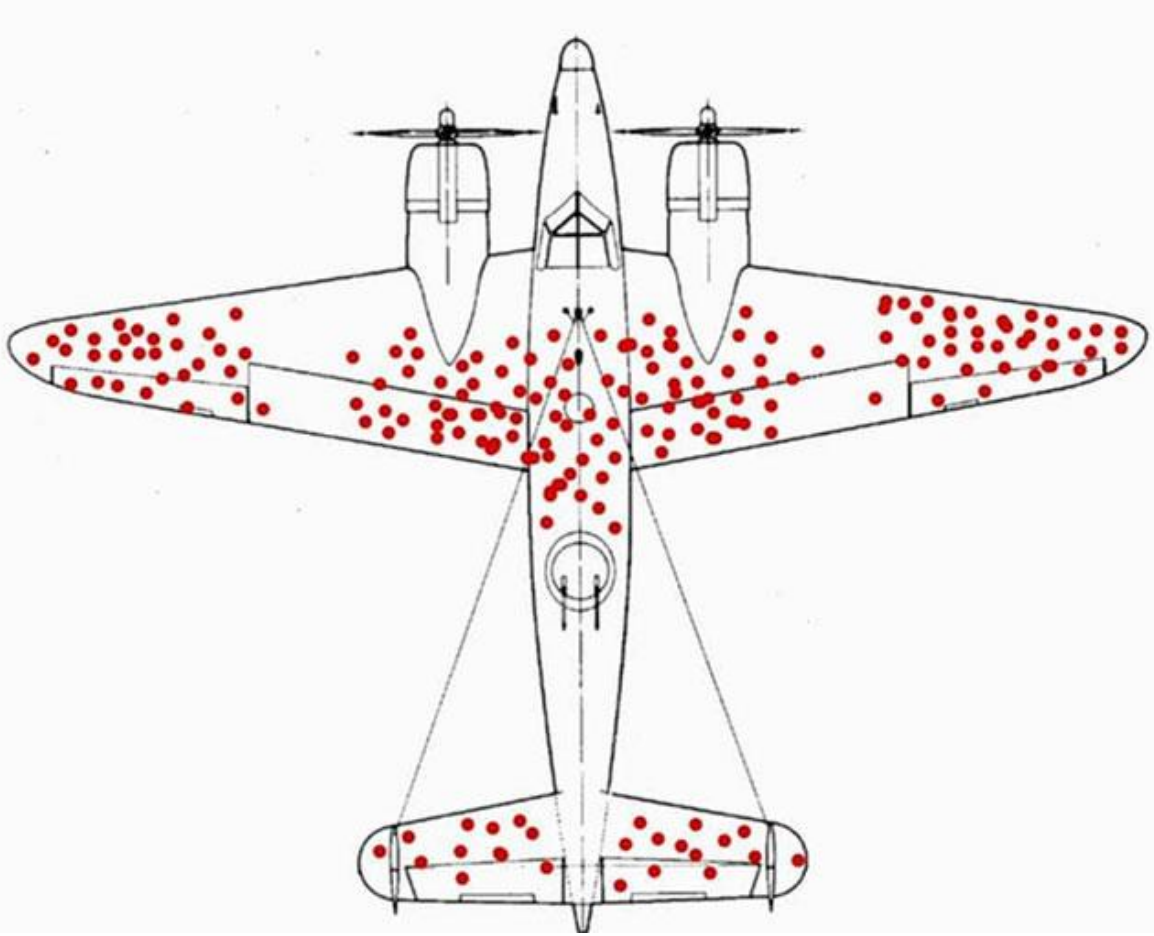
WHAT IS SUSTAINABILITY TO EVOQUA?

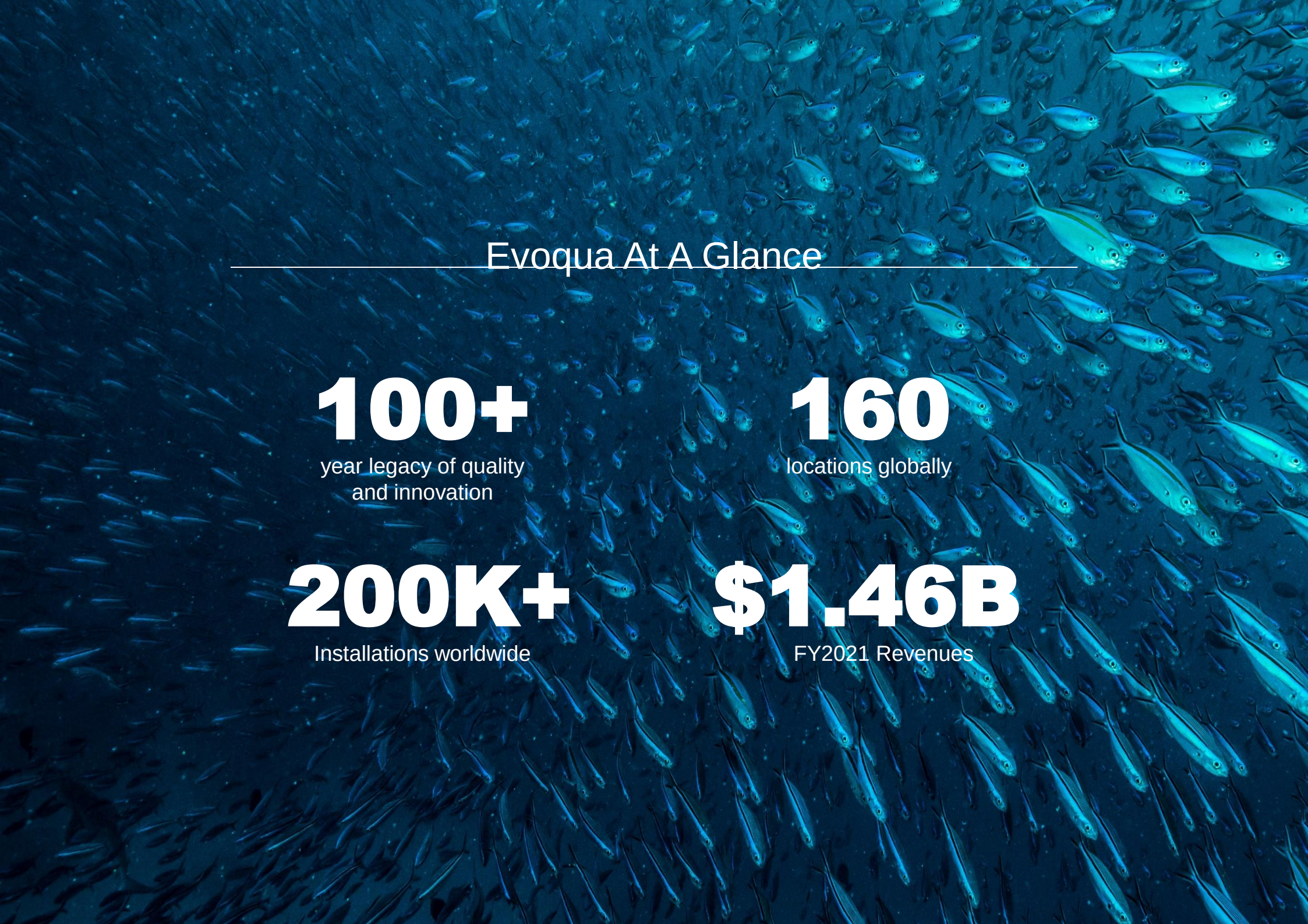
JANUARY 2022

Presented by

Govindan Alagappan, Managing Director

A Different Perspective on Sustainability





Evoqua At A Glance

100+
year legacy of quality and innovation

160
locations globally

200K+
Installations worldwide

$1.46B
FY2021 Revenues

Evoqua making waves

EVOQUA NAMED AS “DIGITAL WATER COMPANY OF THE YEAR" BY GWI IN 2019

The Global Water Awards ceremony recognizes the key achievements in the water industry. Evoqua emerged as the innovative digital technology leader in the water industry with our Water One® success.

EVOQUA EARNS PLACE ON 2021 CLEAN200™ LIST

The Clean200 list is an annual recognition of publicly traded companies that are leading the way with solutions for the transition to a clean energy future.

EVOQUA HONORED WITH FROST & SULLIVAN GLOBAL COMPANY OF THE YEAR FOR SUSTAINABILITY IN WATER TECHNOLOGY

Evoqua has been recognized for our next-generation technologies, pragmatic approach to sustainability, commitment to innovate and support environmental and social impact.

> Our dedication to sustainability and our promise for a better tomorrow is deeply rooted in Evoqua. Enabling a more sustainable water system for future generations is both our opportunity and our responsibility. We are proud to be recognized by Frost and Sullivan for the positive impact we make for our customers each day and deliver on our brand promise of **Transforming Water. Enriching Life.**
>
> Ron Keating, CEO

EVOQUA WATER TECHNOLOGIES

Sustainability

Sustainability is where the **E**nvironment, **E**conomic prosperity and social **E**quity meet

Understanding Our Impact

HANDPRINT

Enabling our customers to become more sustainable through our solutions and services offerings.

FOOTPRINT

Evoqua's responsibility to become more sustainable in our internal operations.

Understanding our Stakeholders

- Customers
- Investors
- Employees

EVOQUA WATER TECHNOLOGIES

Sustainability in action

Recent customer wins

OUR HANDPRINT

Enabling our customers to become more sustainable through our solutions and service offerings

CLEANER WATER TO IMPROVE HEALTH OF FISH

In FY21, we developed a sustainable solution for our **aquaculture technology** customer's fish farm in Singapore to better manage the sea water conditions of their tanks and improve fish's health. The overall solution includes our media filtration technology, Pacific Ozone and ATG UV systems, enabled with remote monitoring capabilities and preventive maintenance from Evoqua. The healthier water conditions are expected to help produce approximately **350 tons of sea bass and red snapper annually**.

REMOVAL OF PFAS FROM DRINKING WATER

In FY21, we were awarded another **order from a municipal drinking water treatment plant** in California to provide a turn-key solution with a 3-year service contract to remove PFAS chemicals. Evoqua's solution includes 6 vessels, ion exchange media, and service through 2024. The 3-year service contract also includes extended service for our previously installed granular activated carbon solution on another well site, which is also online to treat PFAS and other emerging contaminants.

BUILDING MORE RESILIENT WASTEWATER TREATMENT WITH INNOVATION

In FY21, BioMag® and CoMag® systems have received market acceptance. With their small footprint, remarkable resilience to input changes, and contaminant removal capabilities, customers know they can rely on the treatment provided by our Ballasted Technologies. These technologies just surpassed **100 Billion Gallons of wastewater treated**. These technologies treat the wastewater for nearly **500,000 people every day.**

WATER REUSE TO MEET COMMUNITY NEEDS

In FY20, after facing community drought in Southern California, we helped Air Products save up to **75 million gallons** of water/year. Our Brine Recovery RO enables water reuse that is monitored in real time via our digital Link2Site® system to ensure performance, reduce freshwater withdrawal, and build resilience into the business.

This Public Private Partnership is helping Air Products to meet their 2020 Sustainability Goals.

Sustainability in action

OUR FOOTPRINT

Evoqua's responsibility to become more sustainable in our internal operations

Our commitment to sustainability

Sustainability is one of our core values. We are working to be more sustainable within our own operations and in how we enable our customers to meet their sustainability goals.

In 2020, we achieved a

30% reduction in accident totals

compared to 2019[2]

Sustainability is our business model

Our offerings are aligned with the UN Sustainable Development Goals[1]

3 GOOD HEALTH AND WELL-BEING	We provide solutions and services to support disinfection and sanitization.
6 CLEAN WATER AND SANITATION	We are committed to ensuring safe, clean and reliable water quality and quantity.
7 AFFORDABLE AND CLEAN ENERGY	We know traditional water treatment can be energy intensive, that's why ensure our solutions are energy efficient and produce renewable energy from wastewater through anaerobic digestion.
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	Through integrated Smart Water solutions, we are able to achieve water, energy, product and service efficiency.
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	We are proud to offer solutions to reduce water stress through water reuse and recycling technologies.
13 CLIMATE ACTION	To mitigate the effects of extreme weather, we have one of the largest fleets of temporary and rapid response mobile units in North America.

(1) Use of the SDG logos or icons does not imply the endorsement of the United Nations. Learn more: https://www.un.org/sustainabledevelopment

(2) Accidents are represented as OSHA defined recordable accidents.

EVOQUA WATER TECHNOLOGIES

Sustainability and Innovation Hub

- 18,000 square foot facility
- Hands-on demonstration and training area
- Pilot testing environment
- State-of-the-art laboratory
- Collaborative workspace designed to accelerate technology evaluations in real world applications
- Develop integrated solutions to tackle complex water challenges

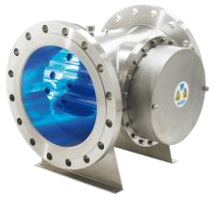
EVOQUA WATER TECHNOLOGIES

Sustainability in the Verticals

Our Technology to Support the Sustainability Goals of the Verticals

Aquaculture

Pacific Ozone™
PGS Peak



UV Systems

VAF™ Screen Filters

Microelectronics

CEDI IonPure®
VNX Ultra

UV Treatment
ETS-UV™ VX-MAXI

Renewables

ADI-BVF Reactor

MAGNETO
Ti-based
Anodes

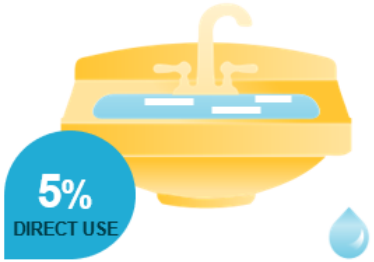
MKIV CTE
Cells

MKIV CTE Cells

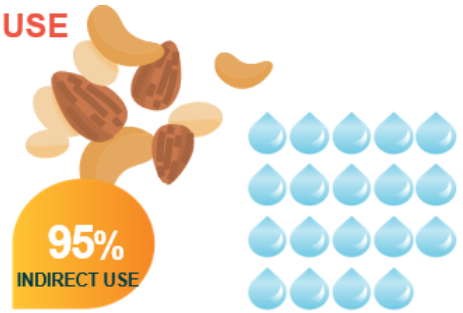
EVOQUA WATER TECHNOLOGIES

WATER TRIVIA

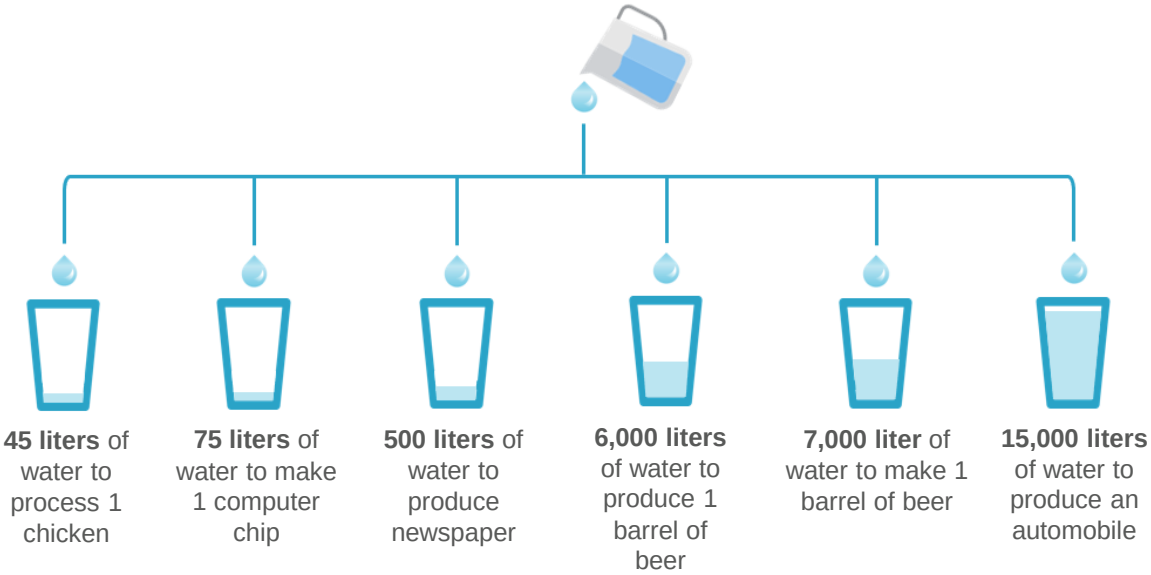
DIRECT & INDIRECT WATER USE



5% of our water use is direct:
Water that we use for showering, cleaning and cooking.



Remaining 95% is our "hidden" or indirect water footprint:
Water that is used to produce the food that we eat, energy that we consume, and products that we buy.



45 liters of water to process 1 chicken

75 liters of water to make 1 computer chip

500 liters of water to produce newspaper

6,000 liters of water to produce 1 barrel of beer

7,000 liter of water to make 1 barrel of beer

15,000 liters of water to produce an automobile

Every action, no matter how small, moves us closer to a more sustainable future that transforms water and enriches life.

evoqua

WATER TECHNOLOGIES

THANK YOU!

Supporting Partners:

Jointly organised by:

Water – Food – Energy Nexus – Towards a Circular Business Economy

Tuesday, 11th January 2022, 10am

Q & A

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THANK YOU