World Water Industry

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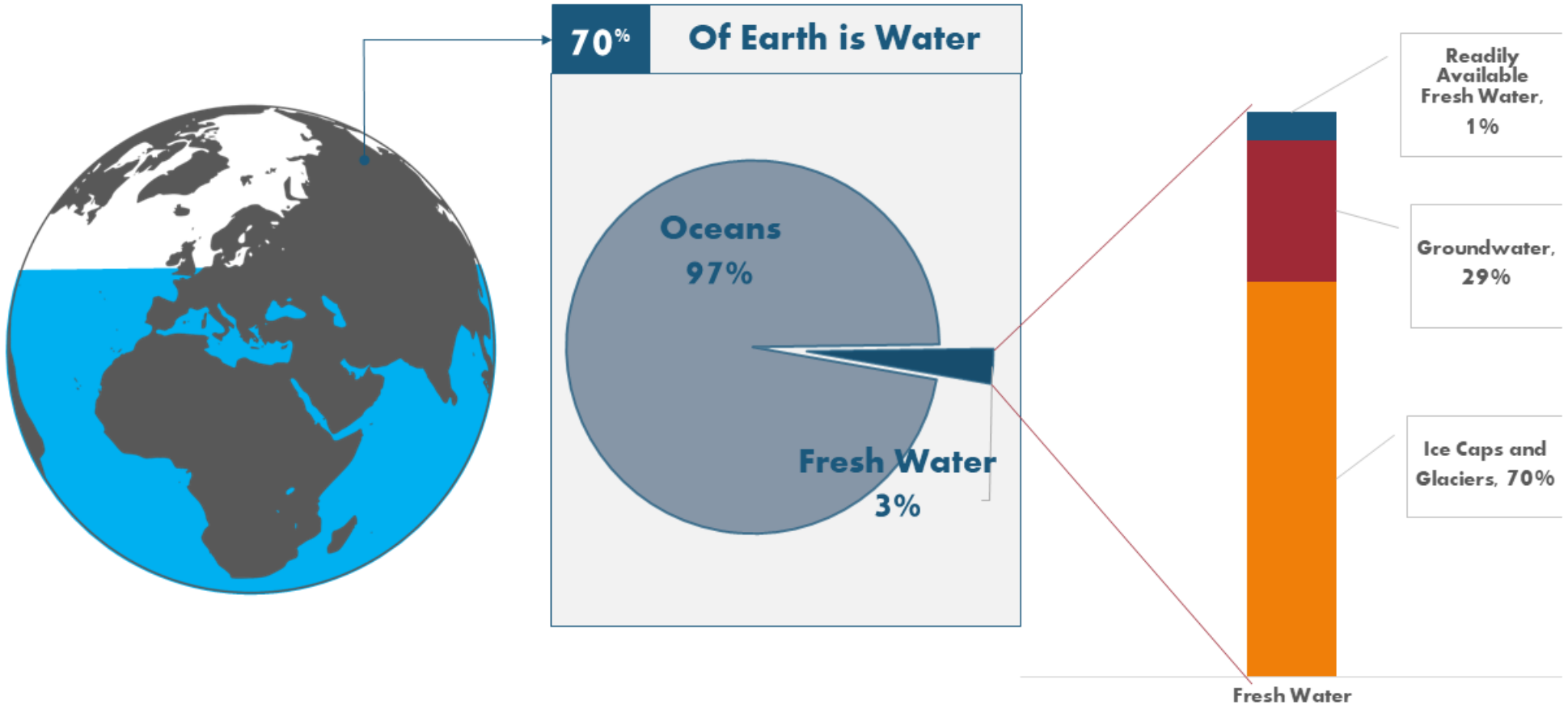
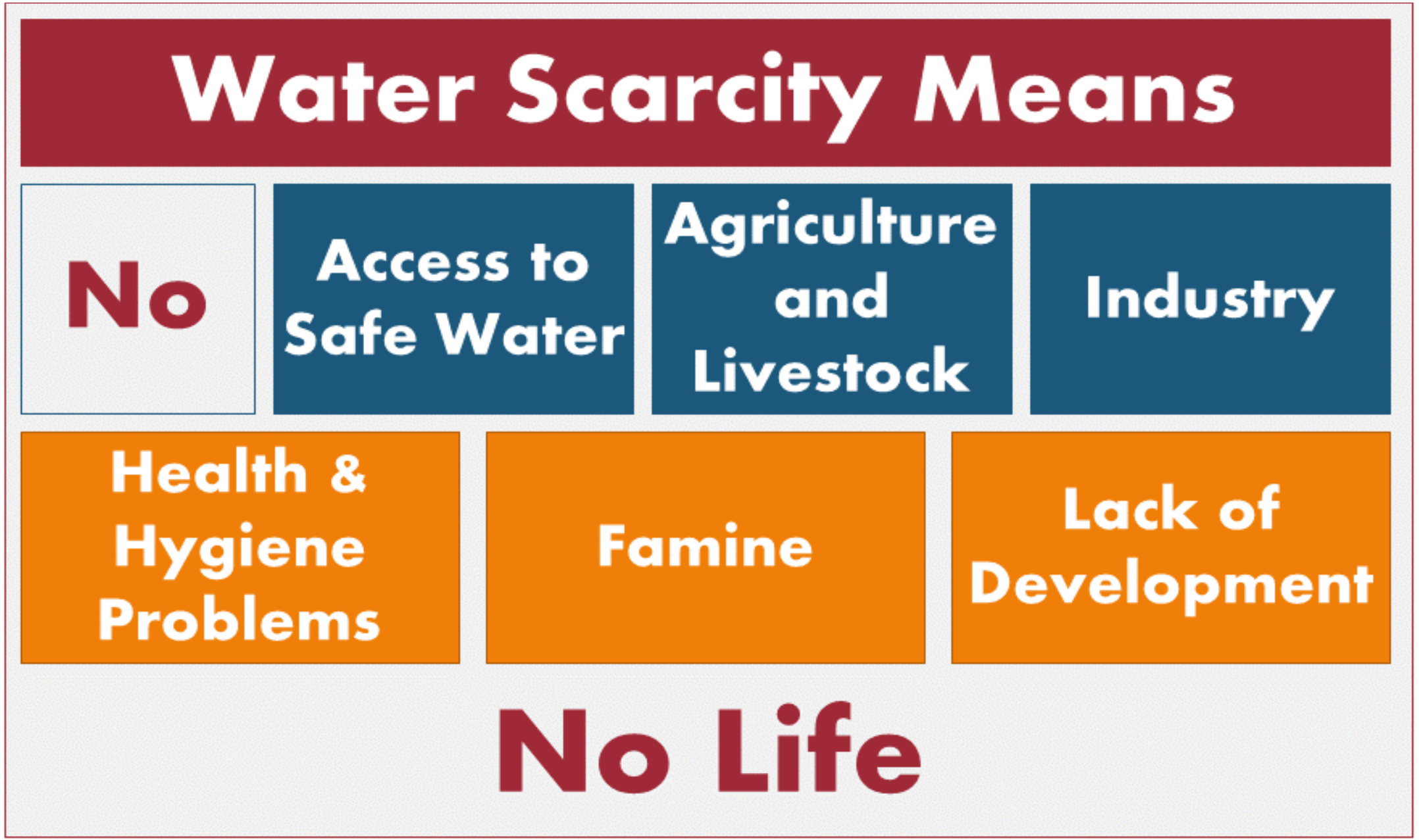
Agenda

- Introduction
- Importance of water.
- Water scarcity and security
- Global water status
- Virtual water and Water footprint
- New technology and new ways to face water challenges

Why Water is Life?



Only 0.007% of Earth's water can be readily used


Water Scarcity Means
No
Access to Safe Water
Agriculture and Livestock
Industry
Health & Hygiene Problems
Famine
Lack of Development
No Life

Facts and Figures

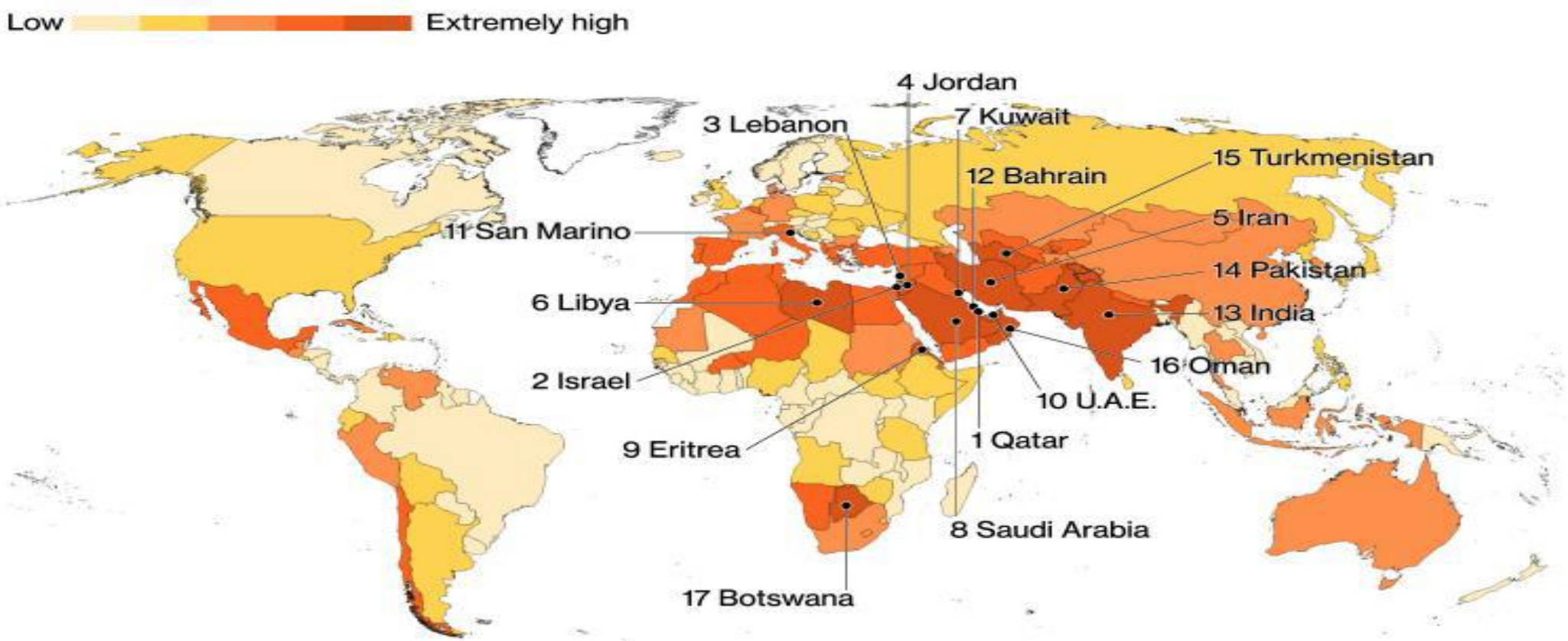
4 Billion	**≈ 2/3 of world population, face severe water scarcity for at least a month/year**
2 Billion	**Live in countries with inadequate water supply**

Facts and Figures

1/2 Of world population expected to live in areas facing extreme water stress by 2025

25% Of children worldwide will face extremely high water stress by 2040

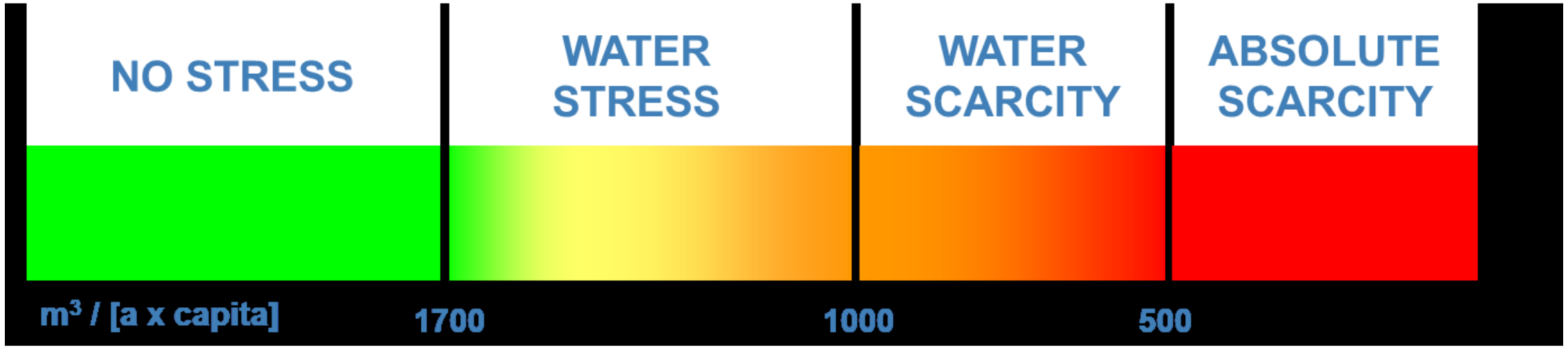
Global water scarcity



Note: Data on water withdrawal, available water and groundwater are used to calculate baseline water stress.
Source: World Resources Institute's Aqueduct Water Risk Atlas

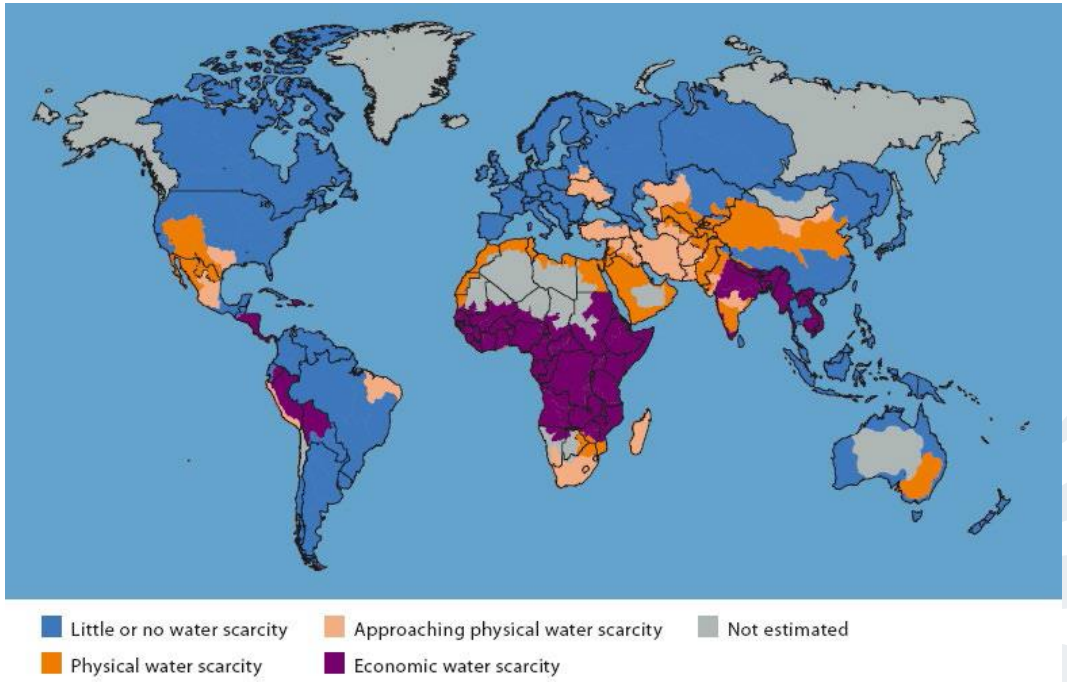
Water shortages affect 88 developing countries that are home to half of the world's population.

The Falkenmark Indicator



Physical water scarcity occurs when there is not enough water to meet all demands.

Economic water scarcity is caused by a lack of investment in water or a lack of human capacity to satisfy the demand for water, even in places where water is abundant.



One-Third of SDGs Depends on water

SDGs are directly related to water scarcity

Daily Human Water Consumption

Item	Volume (lit/day /person)
Minimum Drinking Water Requirement	*5*
Basic Requirements for Sanitation	*20*
Basic Water Requirements for Bathing	*15*
Basic Requirement for Food Preparation	*10*
Total Demand	***50***

(Kalbermatten et al., 1982; Gleick 1993)

Hidden Water

Visualizing the **hidden water** use behind products can help in **understanding** the global character of fresh water and in **quantifying** the effects of **consumption** and **trade** on water resources use.

Hoekstra and Chapagain (2008)

Water Footprint

- The water footprint of a product is an **empirical indicator** of how much **water is consumed** and **polluted, when and where,** measured over the whole supply chain of the product.
- The water footprint is a ***multidimensional*** indicator, showing ***volumes*** but also making explicit the ***type of water use*** (consumptive use of ***rainwater, surface water or groundwater, or pollution of water***) and the ***location and timing*** of water use.

Water Footprint - Components

1 The green water footprint

refers to consumption of green water resources (rainwater; before it becomes run-off)

2 The blue water footprint

refers to consumption of ***blue water resources (surface and groundwater)*** *along the supply chain of a product*

3 The grey water footprint

refers to pollution and is defined as the ***volume of freshwater that is required to assimilate the load of pollutants*** *given natural background concentrations and existing ambient water quality standards*

It is the volume of rainwater consumed during Production. It is most relevant for agricultural and forestry product.

Green water footprint

It is the volume of surface and ground water consumed during production.it shows the amount of ground water or surface water that is nor retuned to the catchment.

Blue water footprint

It is the volume of water that is required to dilute pollutants from the production process so that the quality of the water remains above the established water quality standard.it is an indicator of fresh water pollution

Grey water footprint

Water Footprint – why?

The goal of assessing water footprints is to:

-analyze how human activities or specific products relate to issues of water scarcity and pollution

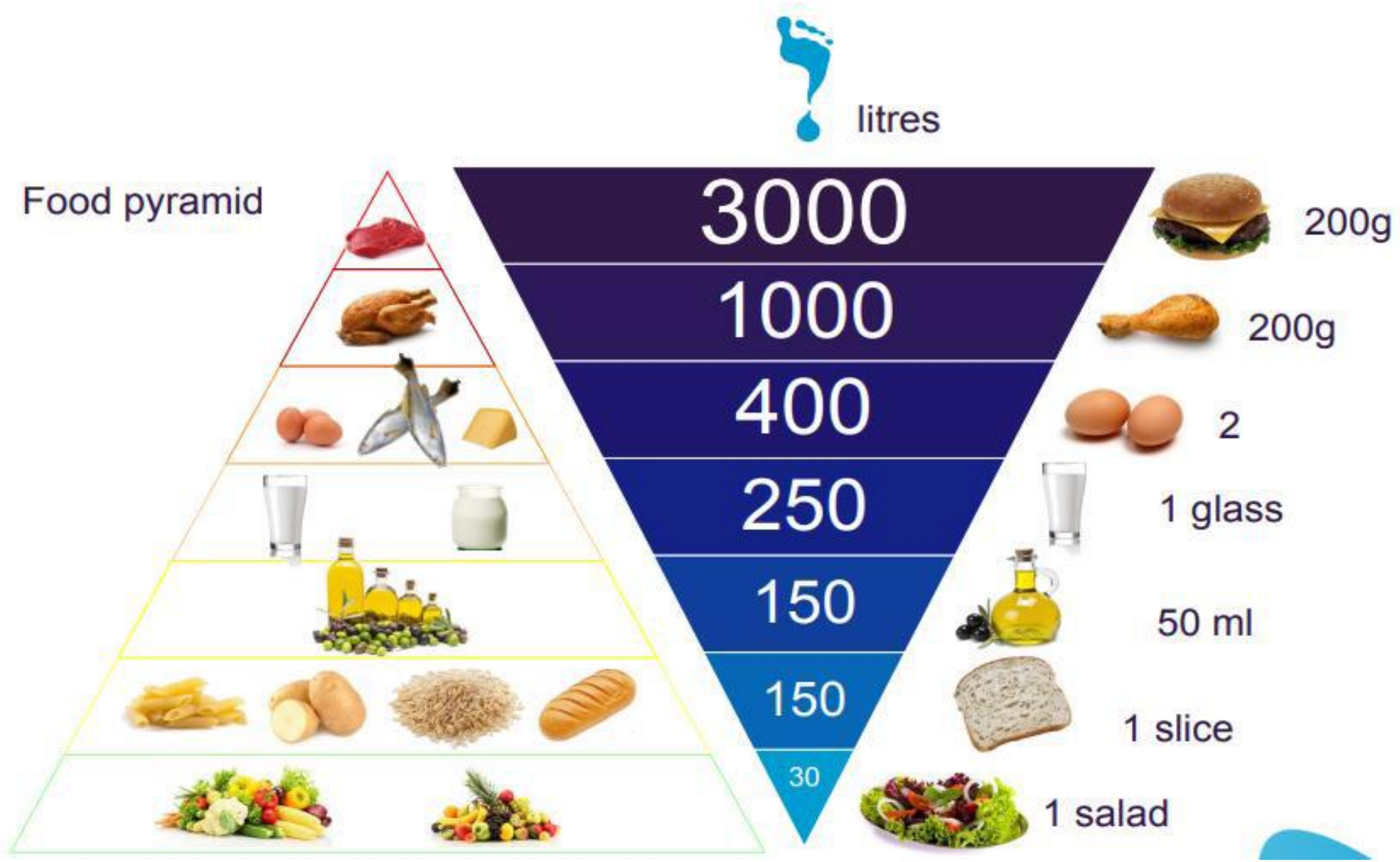
-to see how activities and products can become more sustainable from a water perspective


140
LITERS


2400
LITERS


4500
LITERS/300g

http://www.eniscuola.net/en/mediateca/water-footprint-of-food/


litres
Food pyramid
3000
1000
400
250
150
150
30
200g
200g
2
1 glass
50 ml
1 slice
1 salad

Virtual Water

- Sometimes called “Embedded water”
- The terms “virtual-water content” refers to the water volume embodied in the product alone

Difference between water footprint and Virtual Water

Water footprint has a broader scope than virtual water

The water footprint concept does not simply refer only to a water volume, as in the case of the term ‘virtual water content’ of a product

The water footprint concept has a wider application

–of a consumer: water footprints of the goods and services consumed,

–of a producer (business, manufacturer, service provider): water footprint of the goods and services produced.

The water footprint is a multidimensional indicator, not only referring to a water volume used, but also making explicit **where** the water footprint is located, **what source** of water is used and **when** the water is used

The additional information is crucial in order to assess the local impacts of the water footprint of a product.

The relation between the different sorts of water footprints

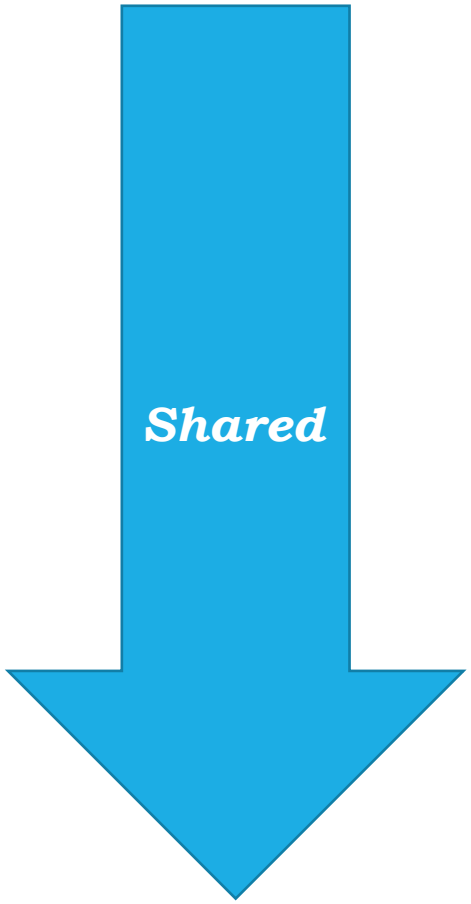
The ***water footprint of a product*** = the sum of the ***water footprints of the process steps*** taken to produce the product (considering the whole production and supply chain).

- The ***water footprint of a consumer*** = the sum of the water footprints of ***all products consumed*** by the consumer.

- The ***water footprint of a community*** = the sum of the ***water footprints of its members***.

- The water footprint of ***national consumption*** = the ***sum of the water footprints of its inhabitants***.

Responsibilities



Consumers are responsible for their water footprint including all what they consume indirect resource use related to their ***consumption pattern***. They should take action to ensure their water footprint is sustainable

Governments cannot withdraw from their responsibility to put ***proper regulations*** and ***incentives*** in place to ensure ***sustainable consumption and production (SCP)***.

Investors should include considerations of sustainable water use into their ***investment decisions***.

Producers will be ***forced to deliver sustainable products*** when consumers take action towards sustainable water footprint.

Where is Water?

https://www.youtube.com/watch?v=b1f-G6v3voA
(5:30 min)

Reducing the water footprint of humanity
What is possible?

Possible Water Footprint Reduction

	Agriculture	Industry
Green water footprint	Decrease green water footprint (m3/ton) by ***increasing green water productivity*** (ton/m3) in rain-fed agriculture.	Irrelevant
Blue water footprint	Decrease blue water footprint (m3/ton) by ***increasing blue water productivity (ton/m3)*** in irrigated agriculture. Decrease ratio blue/green water footprint. Decrease global blue water footprint (for example, by 50 %).	***Zero blue water footprint***: no losses through ***evaporation*** – ***full recycling*** – only blue water footprint related to the ***incorporation of water into a product cannot be avoided***.
Grey water footprint	Reduced use of ***artificial fertilizers*** and pesticides; more effective application. Grey water footprint can go to ***zero through organic farming***.	Zero grey water footprint: no pollution – ***full recycling***, recapturing heat from heated effluents and treatment of remaining return flows.

The water footprint of a consumer is sustainable when:

(i) the total remains below the consumer's ***fair share,***
(ii) no component of the total water footprint is located in a ***hotspot***, and
(iii) no component of the total water footprint can be reduced or avoided altogether.

Reducing the direct footprint:

*installing water-saving **toilets**, applying a water saving **showerhead**, turning off **the tap** during teeth brushing, **using less water in the garden** and by not disposing of medicines, paints or other pollutants through the sink.*

Reducing the indirect water footprint:

*Option 1: change the **consumption pattern***
*Option 2: is to **select the product** based on their water footprint and location of production.*

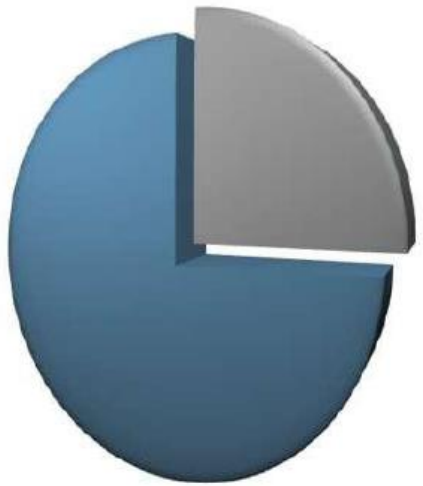
Direct water footprint

3%

Indirect water footprint

97%

Household Sustainable Water Consumption



A quarter of all the clean water that enters your home…

A single load of laundry:
40 gallons

One toilet flush
uses 3 gallons

1 gallon = 3.78 liter

Brushing with the tap running:

4 gallons

(Brushing with the tap off:)

0.25 gallons

Now, Estimate the number of times you do the following on a day you are at home:

- Shower
- Flush the toilet
- Brush your teeth
- Shave
- Do a load of laundry
- Run the dishwasher

Measures to Save Household Water Consumption

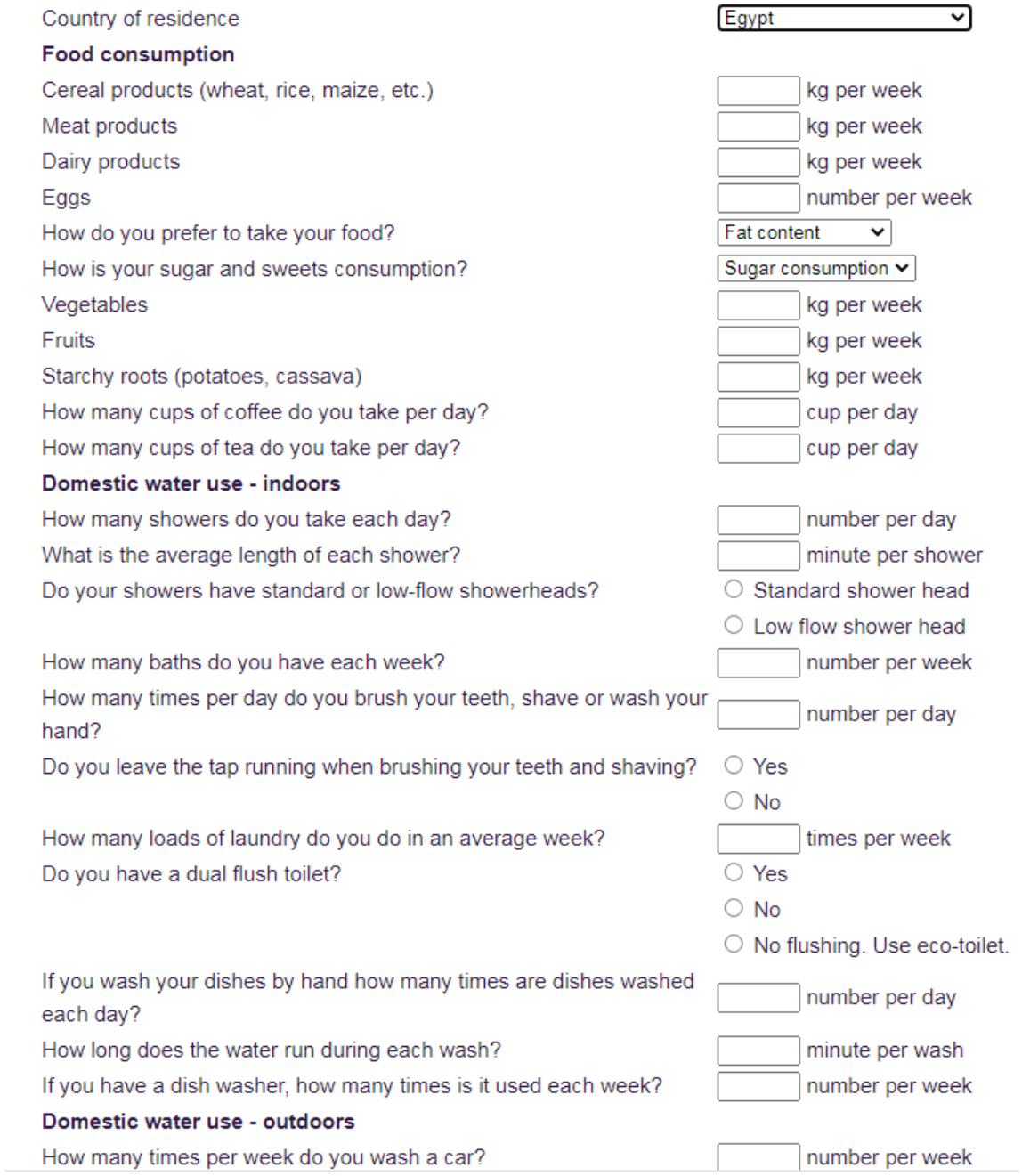
- Fix dripping taps
- Use dual flush button in toilets and aerator faucets in taps
- Segregate grey water from black water (Have a bath and water the garden with the water you bathed in)
- Wash vegetables or fruits in a bowl
- Don`t leave the water on while brushing your teeth

Consumers – what can be done?

- Be aware of your personal water footprint
- Make choices about what you eat and buy
- Don’t waste food; don’t buy things you don’t need
- Save water at home
- Tell your family and friends about the water footprint
- Check out the personal water footprint calculator: http://aquapath-project.eu/calculator/calculator.html

Personal water footprint calculator

https://waterfootprint.org/en/resources/interactive-tools/personal-water-footprint-calculator/



Country of residence: Egypt

Food consumption

- Cereal products (wheat, rice, maize, etc.) ____ kg per week
- Meat products ____ kg per week
- Dairy products ____ kg per week
- Eggs ____ number per week
- How do you prefer to take your food? Fat content
- How is your sugar and sweets consumption? Sugar consumption
- Vegetables ____ kg per week
- Fruits ____ kg per week
- Starchy roots (potatoes, cassava) ____ kg per week
- How many cups of coffee do you take per day? ____ cup per day
- How many cups of tea do you take per day? ____ cup per day

Domestic water use - indoors

- How many showers do you take each day? ____ number per day
- What is the average length of each shower? ____ minute per shower
- Do your showers have standard or low-flow showerheads? ○ Standard shower head ○ Low flow shower head
- How many baths do you have each week? ____ number per week
- How many times per day do you brush your teeth, shave or wash your hand? ____ number per day
- Do you leave the tap running when brushing your teeth and shaving? ○ Yes ○ No
- How many loads of laundry do you do in an average week? ____ times per week
- Do you have a dual flush toilet? ○ Yes ○ No ○ No flushing. Use eco-toilet.
- If you wash your dishes by hand how many times are dishes washed each day? ____ number per day
- How long does the water run during each wash? ____ minute per wash
- If you have a dish washer, how many times is it used each week? ____ number per week

Domestic water use - outdoors

- How many times per week do you wash a car? ____ number per week

Efforts to face water challenges

- Improving the efficiency of water use
- implementing technologies for water reuse
- tapping nontraditional sources of freshwater

- **Governments**

Possible Actions

The governmental aim to use freshwater resources in a way that is environmentally sustainable, socially equitable and economically efficient, needs to be reflected in the ***government's water policy, but also in the government's environmental, agricultural, industrial, energy, trade and foreign policy.***

Import of virtual water in a water-scarce nation can relieve the pressure on the nation's own water resources.

nations should ***export products*** in which they possess a relative or comparative advantage in production, while they should import products in which they possess a comparative disadvantage.

creating awareness of the ***water volumes*** needed to produce the ***various goods***, thus providing an idea of which goods impact most on the water system and where water savings could be achieved

Virtual Water Balance (Market share)

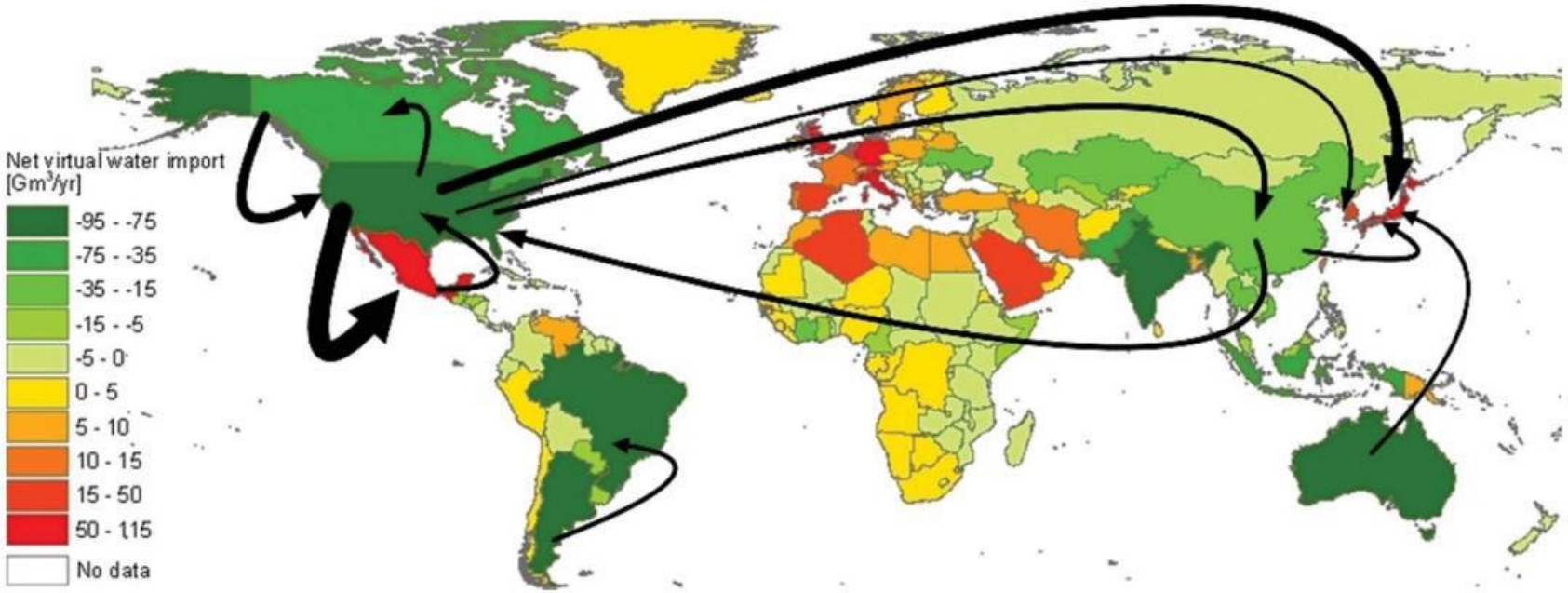
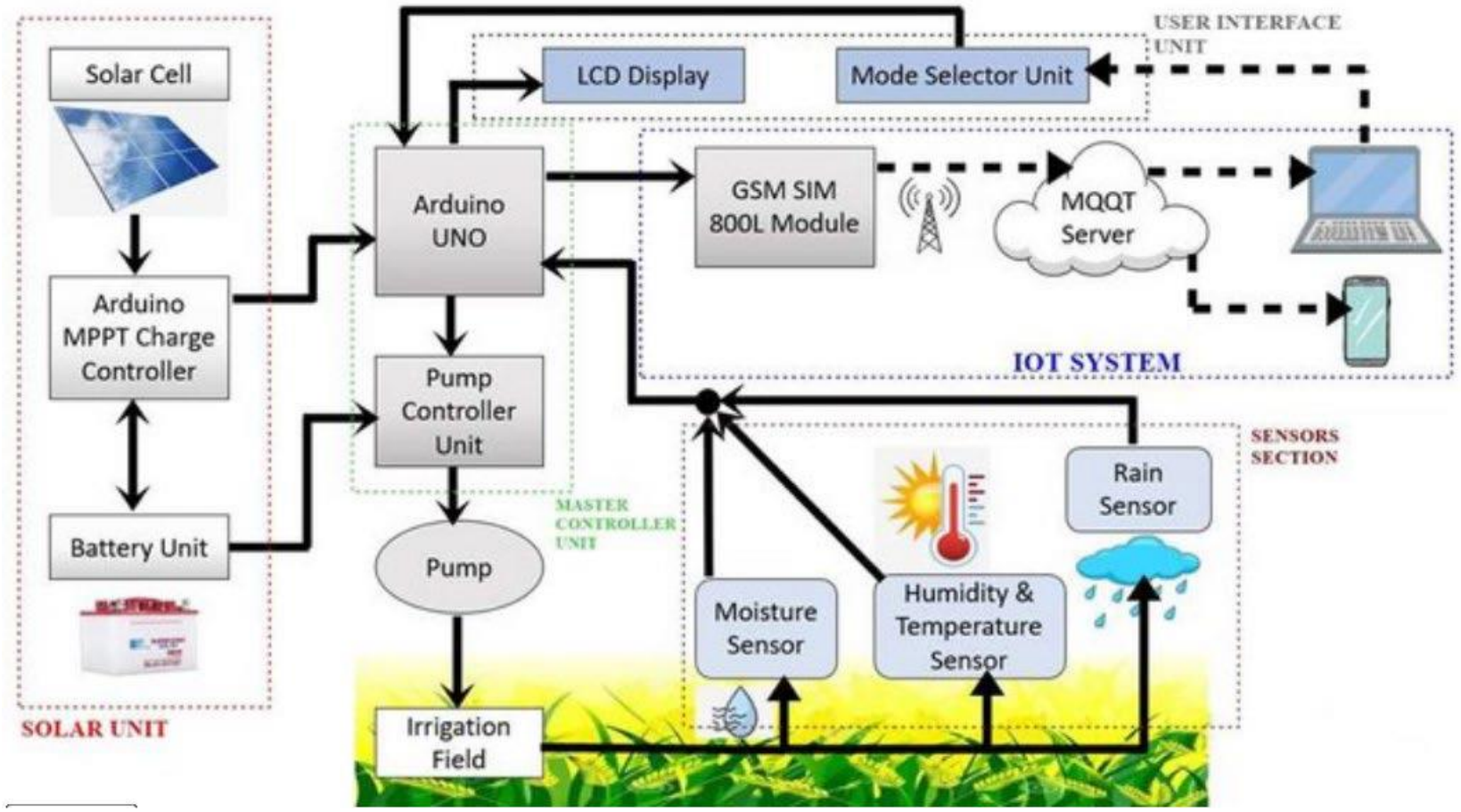


Fig. 2 Virtual water balance per country related to trade in agricultural and industrial products over the period 1996–2005. Net exporters are shown in green and net importers in red. The arrows show the biggest gross international virtual water flows (>15 GM^3/yr); the fatter the arrow, the bigger the virtual water flow.
Source: Mekonnen, M.M. and Hoekstra, A.Y. (2011).[15]

Smart irrigation



National Project For Canal Rehabilitation

Tertiary Canals Rehabilitation

Before

After

Before

After





Awareness Conferences – Shifting to Modern Irrigation




Awareness Campaigns (On Farm level)

Flood Irrigation

Shifting to

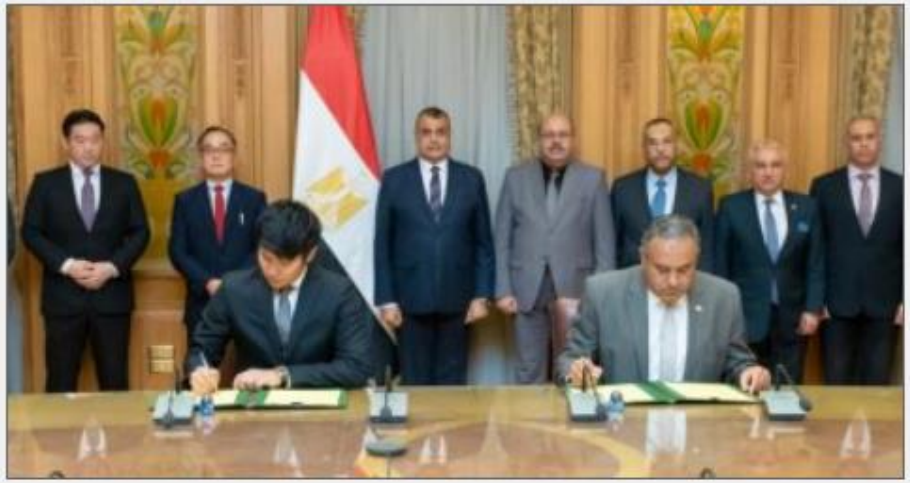
Modern and Smart Irrigation

Non-Conventional Water Resources Examples

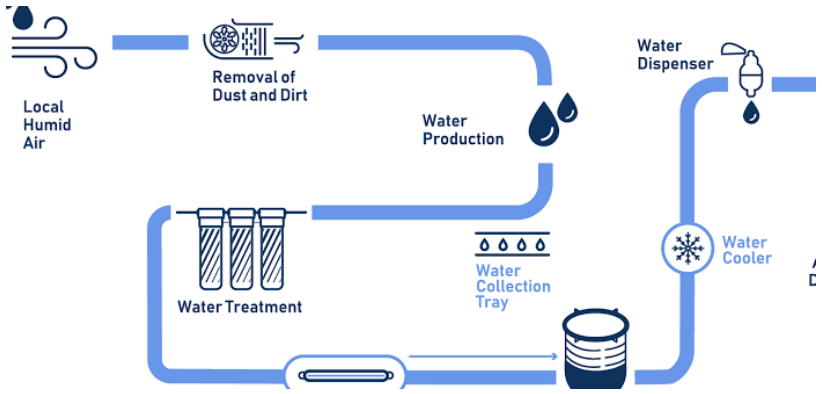
- Desalination
  - Ground Water
  - Sea Water
- Wastewater
  - Agricultural Drainage
  - Sewage
  - Industrial Wastewater
  - Increasing Efficiency of existing plants

الإنتاج الحربى: بروتوكول مع شركة يابانية لتصنيع جهاز يستخلص الماء من الهواء

الأربعاء، 16 نوفمبر 2022 10:59 ص



خلال توقيع البروتوكول

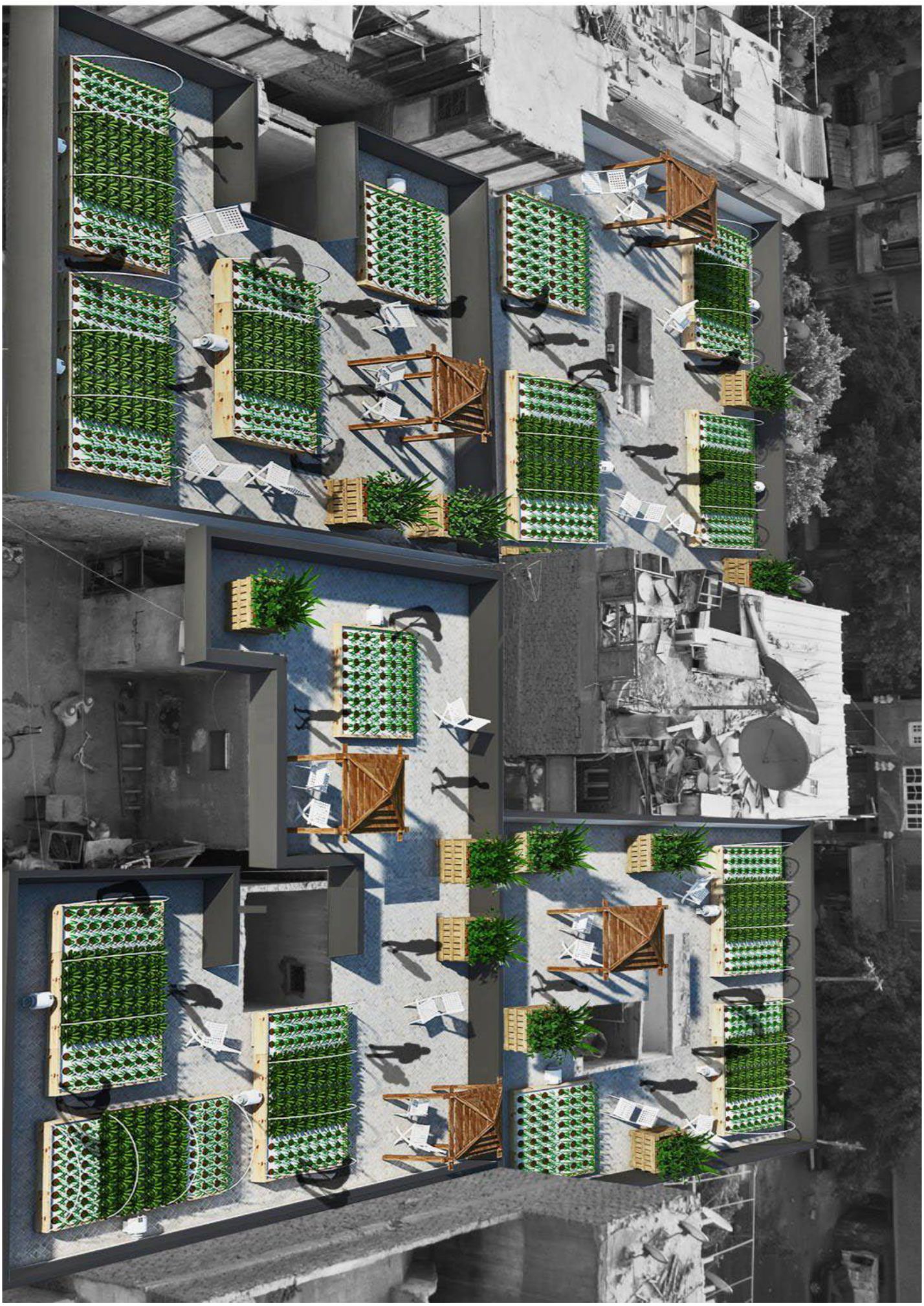


20XX

presentation title

Current Situation

Proposed Studies



Paper link: https://rdcu.be/c5BM6

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presentation title

- New technology and approach used in water reuse

Water Treatment Process

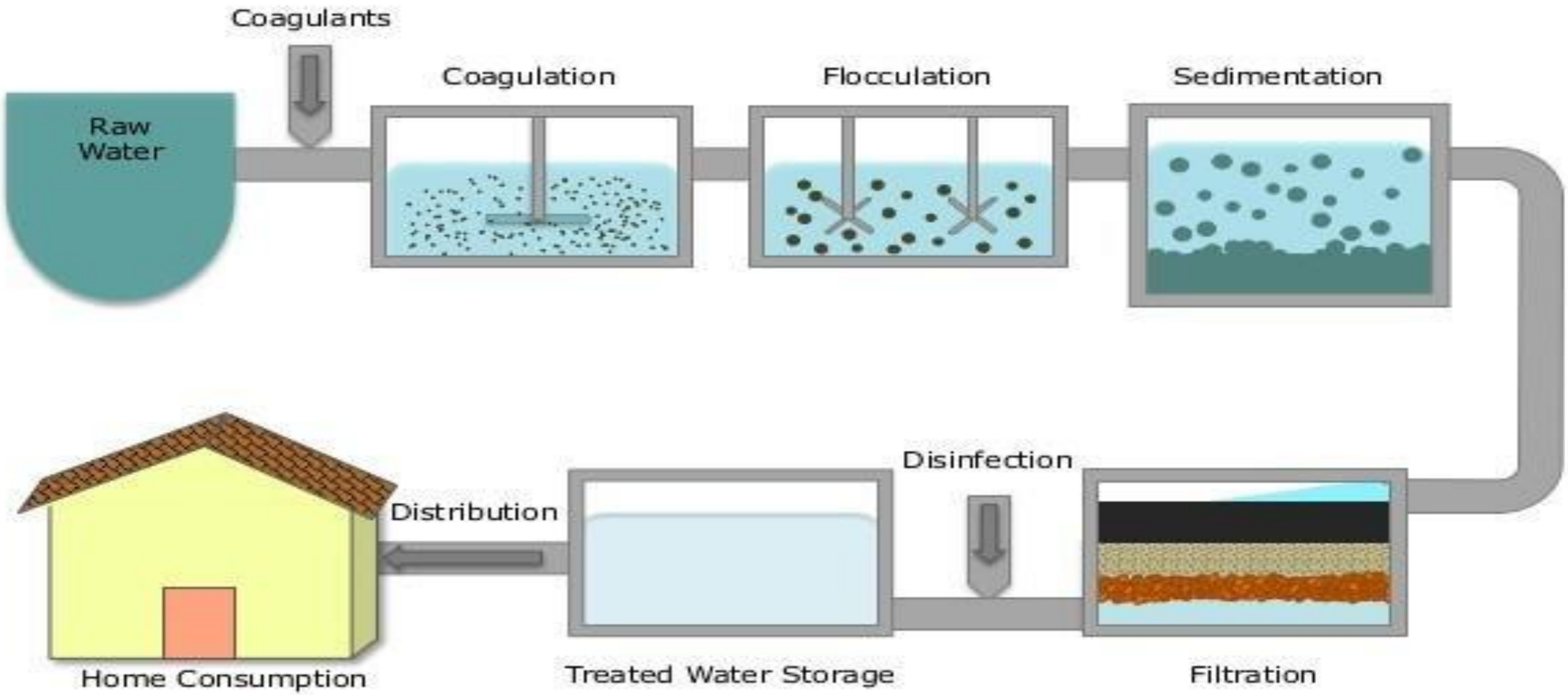


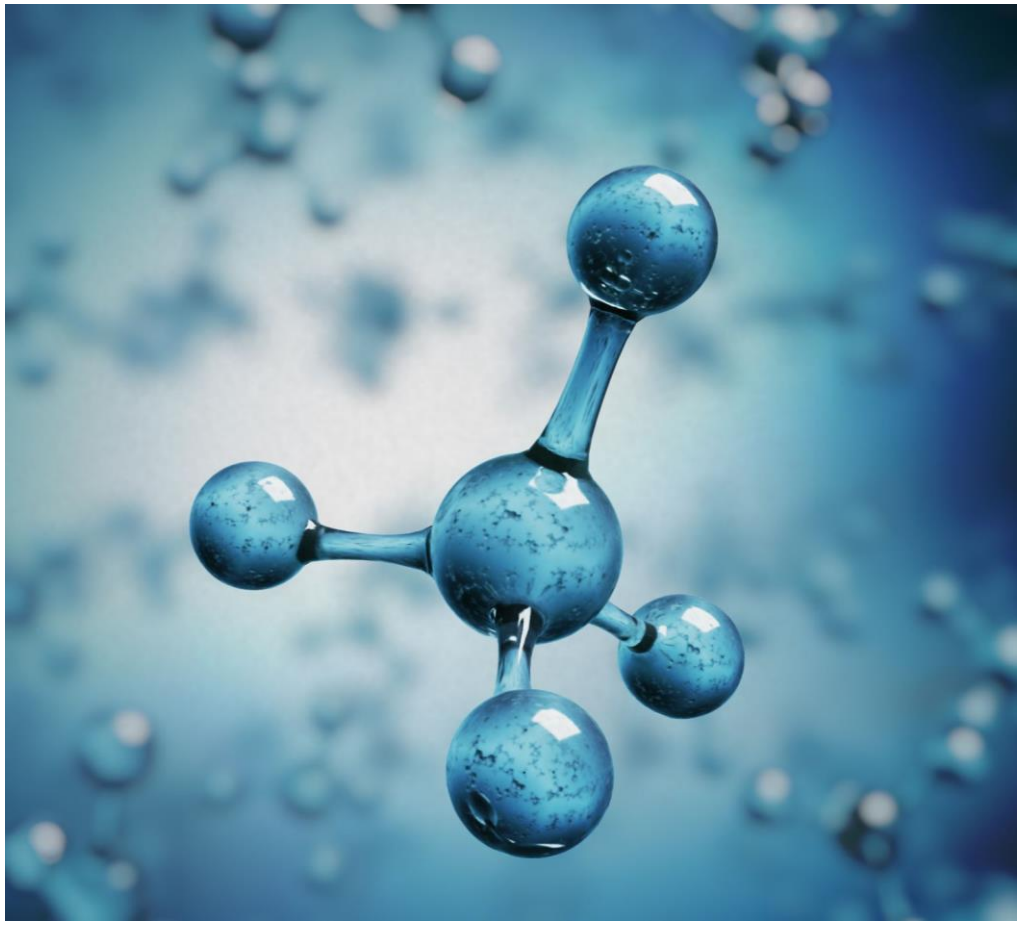
TABLE 3-16
Typical composition of untreated domestic wastewater

Contaminants	Unit	Concentration		
		Weak	Medium	Strong
Solids, total (TS)	mg/L	350	720	1200
Dissolved, total (TDS)	mg/L	250	500	850
Fixed	mg/L	145	300	525
Volatile	mg/L	105	200	325
Suspended solids (SS)	mg/L	100	220	350
Fixed	mg/L	20	55	75
Volatile	mg/L	80	165	275
Settleable solids	mL/L	5	10	20
Biochemical oxygen demand, mg/L: 5-day, 20°C (BOD_5, 20°C)	mg/L	110	220	400
Total organic carbon (TOC)	mg/L	80	160	290
Chemical oxygen demand (COD)	mg/L	250	500	1000
Nitrogen (total as N)	mg/L	20	40	85
Organic	mg/L	8	15	35
Free ammonia	mg/L	12	25	50
Nitrites	mg/L	0	0	0
Nitrates	mg/L	0	0	0
Phosphorus (total as P)	mg/L	4	8	15
Organic	mg/L	1	3	5
Inorganic	mg/L	3	5	10
Chlorides[a]	mg/L	30	50	100
Sulfate[a]	mg/L	20	30	50
Alkalinity (as $CaCO_3$)	mg/L	50	100	200
Grease	mg/L	50	100	150
Total coliform[b]	no/100 mL	10^6–10^7	10^7–10^8	10^8–10^9
Volatile organic compounds (VOCs)	μg/L	<100	100–400	>400

[a] Values should be increased by amount present in domestic water supply.
[b] See Table 3-18 for typical values for other microorganisms.
Note: 1.8(°C) + 32 = °F.

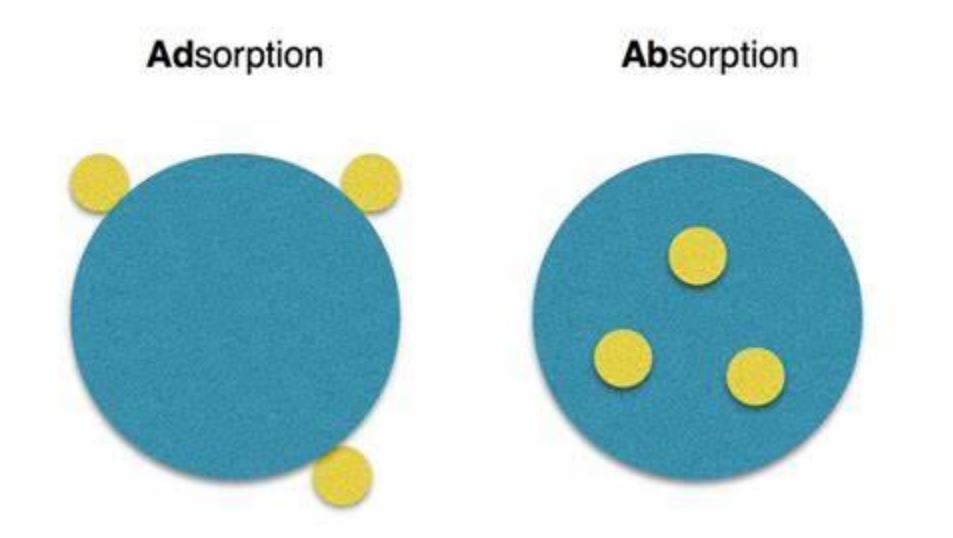
Basic Water Quality Parameters

- pH
- Electrical conductivity (EC)
- Turbidity
- Dissolved oxygen (DO)
- Biochemical oxygen demand (BOD)
- Temperature
- Solids
- Alkalinity
- hardness



Adsorption

Organic and inorganic contaminants can be removed from water through the adsorption process. Adsorption of a substance involves its accumulation onto the surface of a solid called the adsorbent. Adsorbents can include stationary media, such as activated carbon, ion exchange resins, or metal oxides. Adsorbents can also include aluminum or ferric chloride floc that forms during coagulation. This floc can adsorb organics such as organic carbon and inorganics such as arsenic.



OPEN ACCESS PEER-REVIEWED CHAPTER

Removal of Heavy Metals from Wastewater by Adsorption

WRITTEN BY

Int J Environ Res Public Health. 2012 May; 9(5): 1757–1770. PMCID: PMC3386586
Published online 2012 May 7. doi: 10.3390/ijerph9051757 PMID: 22754471

Adsorption of Cr(VI) and Speciation of Cr(VI) and Cr(III) in Aqueous Solutions Using Chemically Modified Chitosan

Jun Dai,[1,2] FengLian Ren,[1,*] and ChunYuan Tao[2]

Magdalena Blachnio, Anna Derylo-Marczewska and Malgorzata Seczkowska

Submitted: May 14th, 2019 , Reviewed: July 19th, 2019 , Published: August 20th, 2019

DOI: 10.5772/intechopen.88726

What are the specializations that could have more potential?

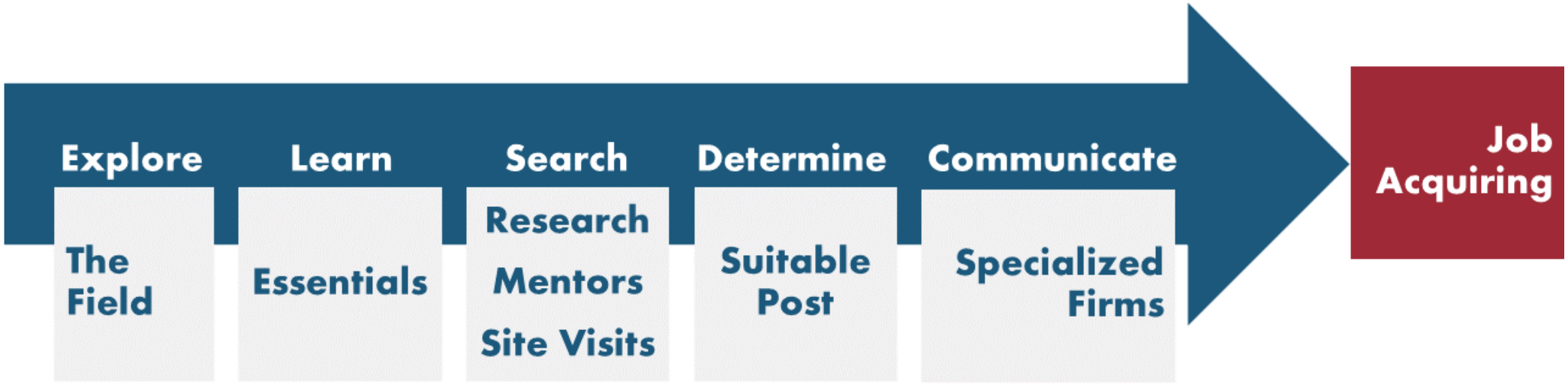
Every Engineering Track has an opportunity in the field, with some essential skills

- Mechanical Engineering
- Chemical Engineering
- Civil Engineering
- Electrical Engineering

Essential Skills

Personal	Discipline | Responsibility | Learning | Cooperative
Knowledge	Information Tech | Language | Driving
Abilities	Problem Solving | Conflict Handling | Time Mngmt.

Action Plan


Explore
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