Impacts of high water requirement in industries & relevance to climate change

For Bengal Chamber of Commerce & Industry
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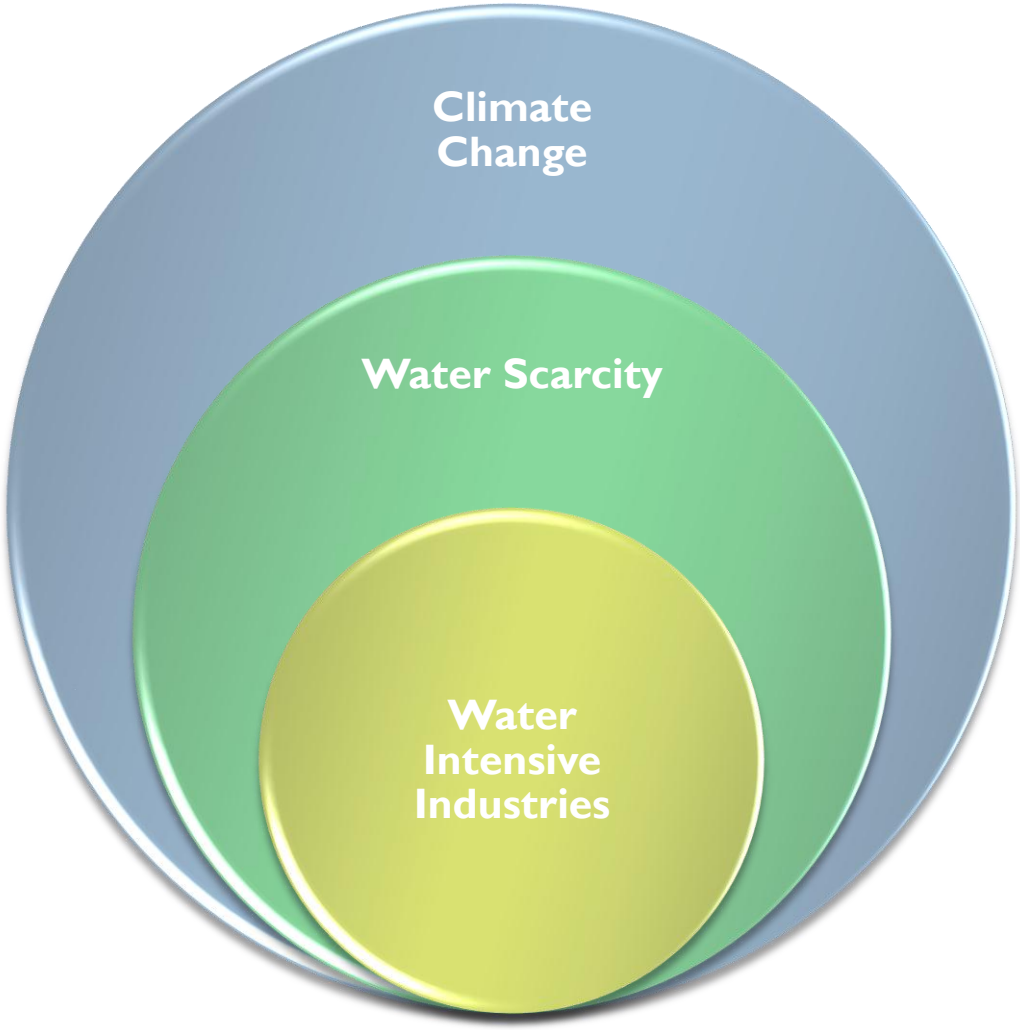
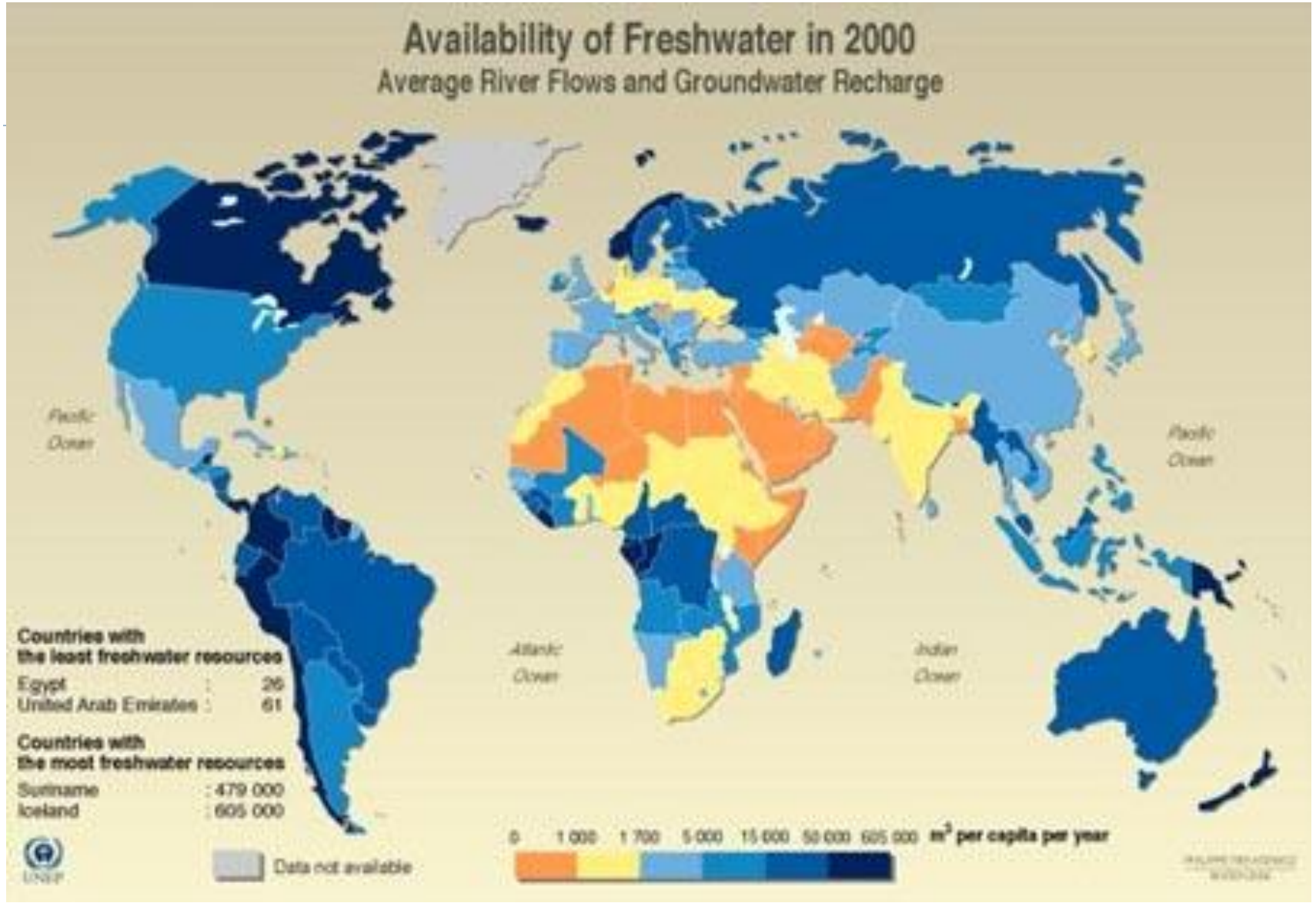
The Approach…



Introduction

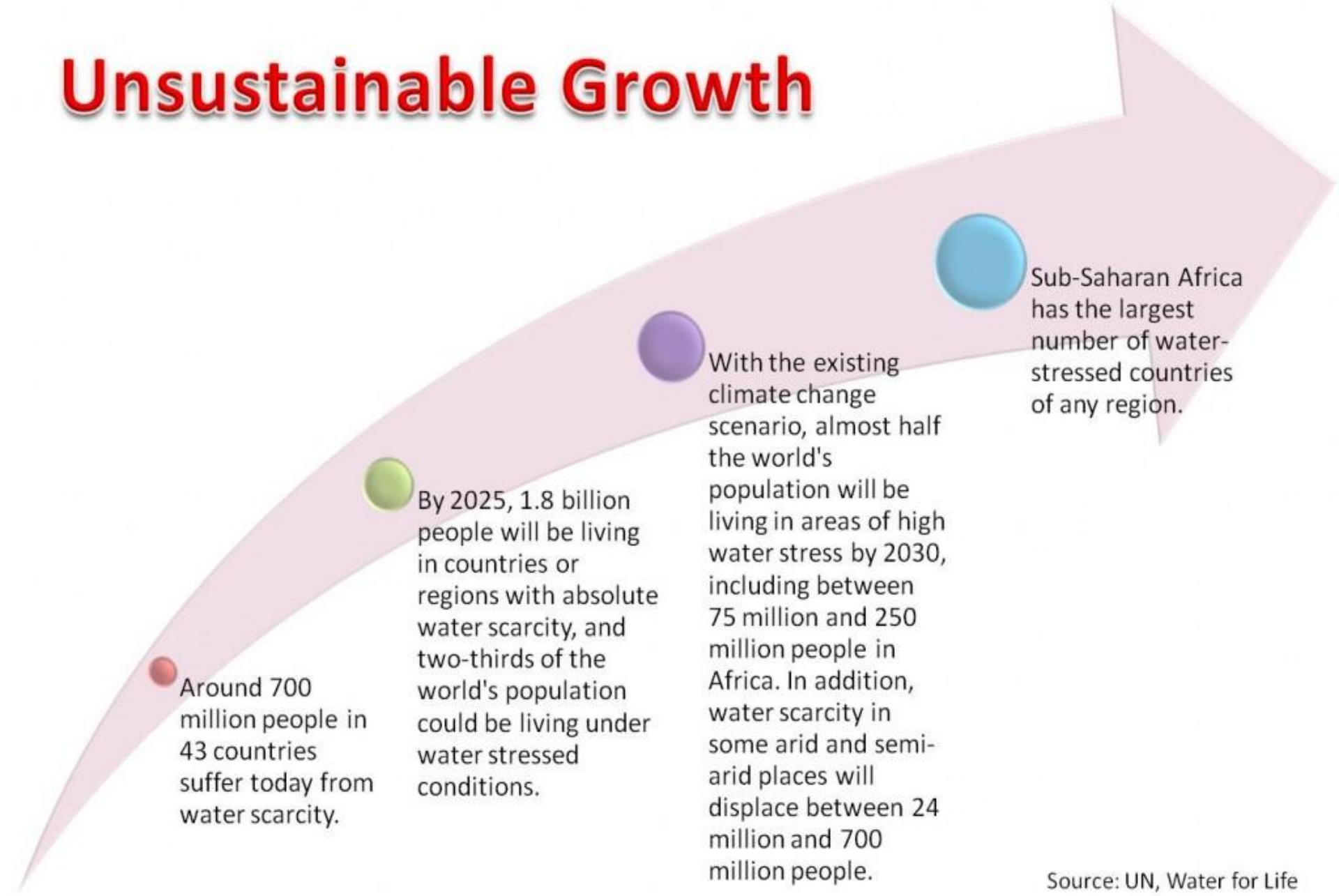
- The vast majority of the Earth's water resources are salt water, with only 2.5% being fresh water. Approximately 70% of the fresh water available on the planet is frozen in the icecaps of Antarctica and Greenland leaving the remaining 30% (equal to only 0.7% of total water resources worldwide) available for consumption. From this remaining 0.7%, roughly 87% is allocated to agricultural purposes (IPCC 2007).


Availability of Freshwater in 2000
Average River Flows and Groundwater Recharge
Pacific Ocean
Pacific Ocean
Atlantic Ocean
Indian Ocean
Countries with the least freshwater resources
Egypt : 26
United Arab Emirates : 61
Countries with the most freshwater resources
Suriname : 479 000
Iceland : 605 000
Data not available
0 1 000 1 700 5 000 15 000 50 000 605 000 m³ per capita per year

Introduction

According to the Comprehensive Assessment of Water Management in Agriculture, one in three people are already facing water shortages (2007). Around 1.2 billion people, or almost one-fifth of the world's population, live in areas of physical scarcity, while another 1.6 billion people, or almost one quarter of the world's population, live in a developing country that lacks the necessary infrastructure to take water from rivers and aquifers (known as an economic water shortage).

Unsustainable Growth



Source: UN, Water for Life

CLIMATE CHANGE & WATER

CC will increase water demand!

• Increase water demand for agriculture, primarily for irrigation, due to prolonged dry periods and severe drought. Some research estimates an over 40 percent increase in land needing irrigation by 2080.

• Increase water demand for hydration needs for billions of farm animals due to higher atmospheric temperatures.

• Increase quantities of water needed for industrial cooling due to increased atmospheric and water temperatures.

CC will impact water quality!

- Increase extreme precipitation and flooding, which will increase erosion rates and wash soil-based pollutants and toxins into waterways.
- Increase water temperatures, leading to more algal and bacterial blooms that further contaminate water supplies.
- Contribute to environmental health risks associated with water. For instance, changes in precipitation patterns are likely to increase flooding, and as a result mobilize more pathogens and contaminants. It is estimated that by 2030 the risk of diarrhea will be up to 10 percent higher in some countries due to climate change.

What IPCC says….

There are four main factors aggravating water scarcity according to the IPCC:

1. Population growth: in the last century, world population has tripled. It is expected to rise from the present 6.5 billion to 8.9 billion by 2050. Water use has been growing at more than twice the rate of population increase in the last century, and, although there is no global water scarcity as such, an increasing number of regions are chronically short of water.

2. Increased urbanization will focus on the demand for water among a more concentrated population. Asian cities alone are expected to grow by 1 billion people in the next 20 years.

3. High level of consumption: as the world becomes more developed, the amount of domestic water used by each person is expected to rise significantly.

4. Climate change will shrink the resources of freshwater.

CONCERNS OF INDUSTIRES

Where Water is not used….!

In industrial facilities, water is used in a wide range of activities.

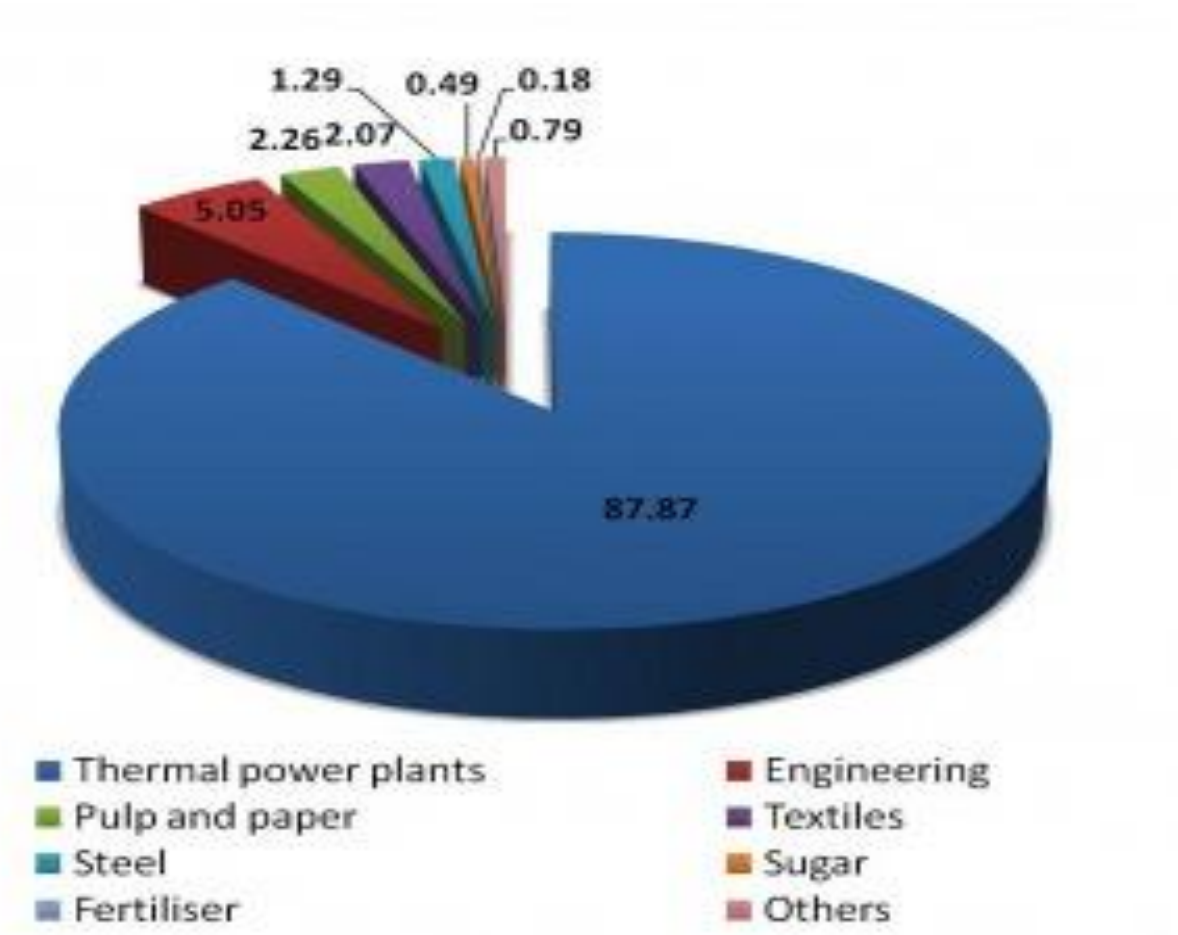
The value of water as a utility is illustrated by the following common uses:

- Incorporation in the final product
- Washing or rinsing of raw materials, intermediates, or
- final products
- Preparation of solvents or slurries
- Cleaning of equipment and space
- Removing or providing heat
- Meeting hygienic and domestic needs
- Irrigation of landscape space.

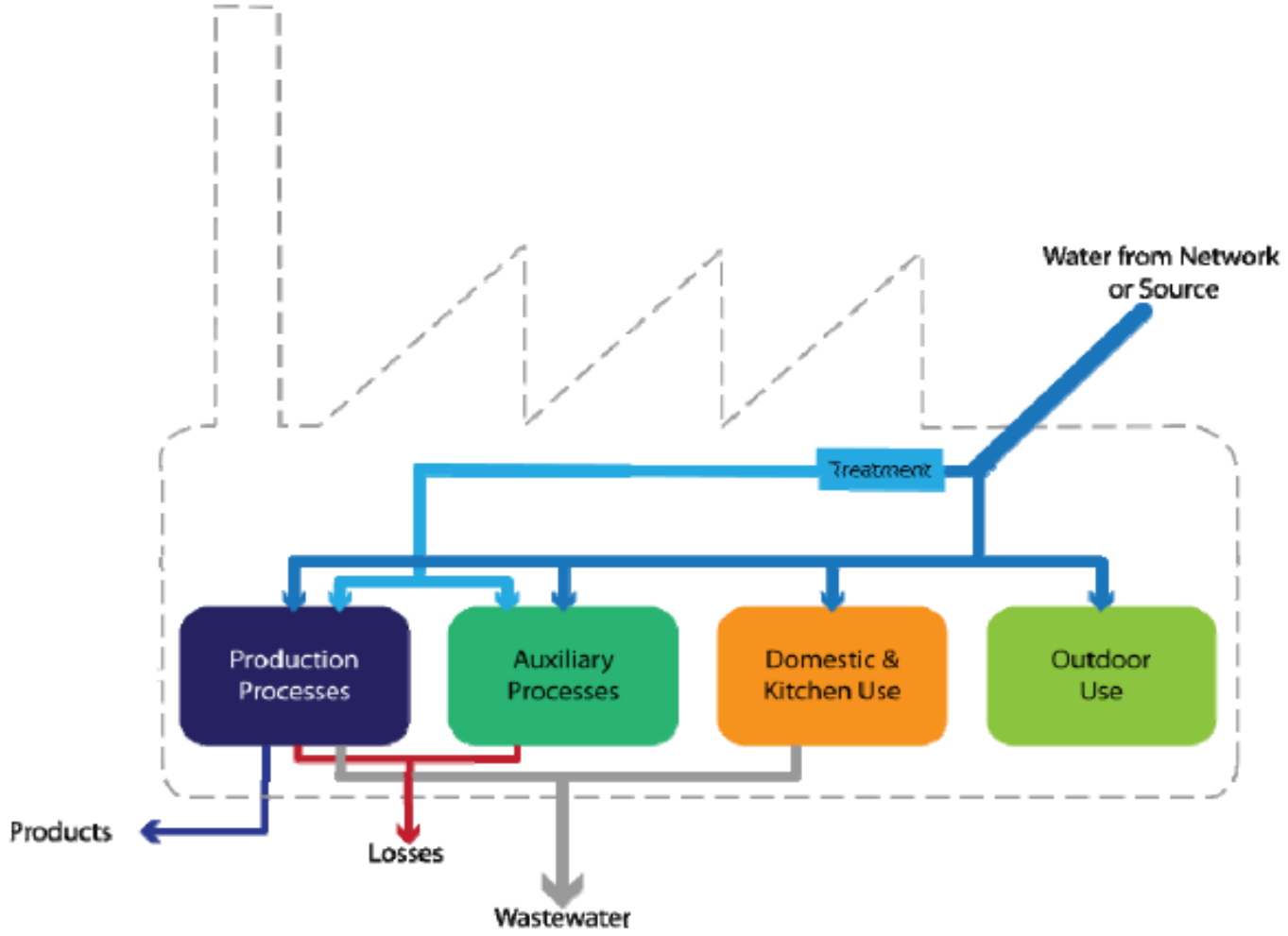
A Fact!!

Annual per capita consumption of power is expected to reach its maximum level as compared to present installed power generation capacity. As per the ministry of power, thermal power plants which are the most water-intensive industrial units, constitute around 65% of the installed power capacity in India. Industrial water consumption is expected to shoot up its growth between 2000 and 2050.

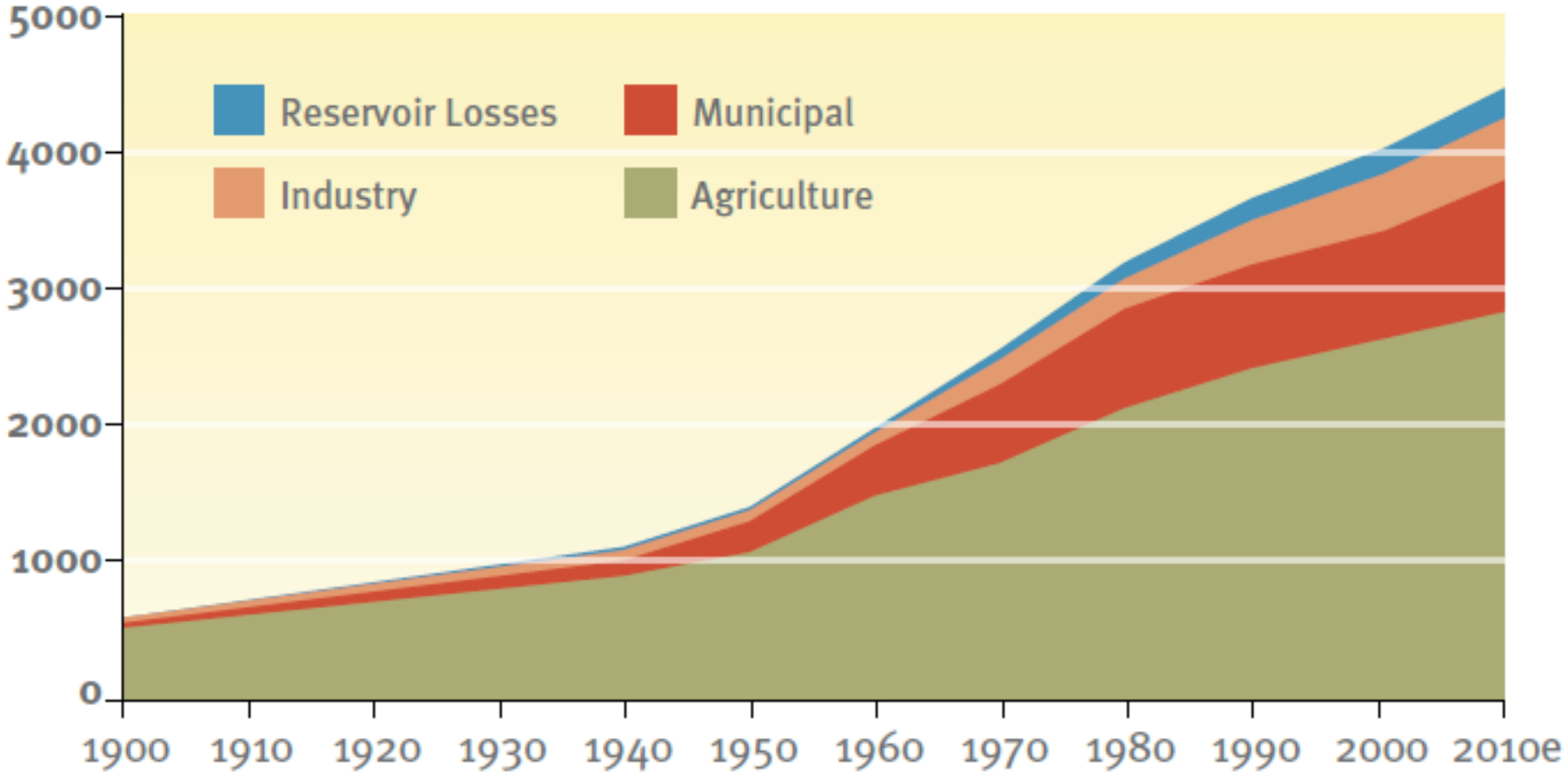
Proportion of water consumed



Water everywhere….



Water Withdrawal by Sector (in Cubic Kilometers)



The Water Industry

Water shortages are already a major issue in many regions and global warming is set to exacerbate existing problems. Industry costs will rise as the demand for tighter control and monitoring of water usage grows. Waste of water in agriculture is a major concern. "Figures show that our use of water is not sustainable and that 80 percent of abstracted water goes to agriculture," says Daniel Villesot, former head of the EU's water industry lobby.

Climate change will likely:

Increase water demand for agriculture, primarily for irrigation, due to prolonged dry periods and severe drought. Some research estimates an over 40 percent increase in irrigated land by 2080.

Increase water demand for hydration needs for billions of farm animals due to higher atmospheric temperatures.

Increase quantities of water needed for industrial cooling due to increased atmospheric and water temperatures.

Business impacts may include:

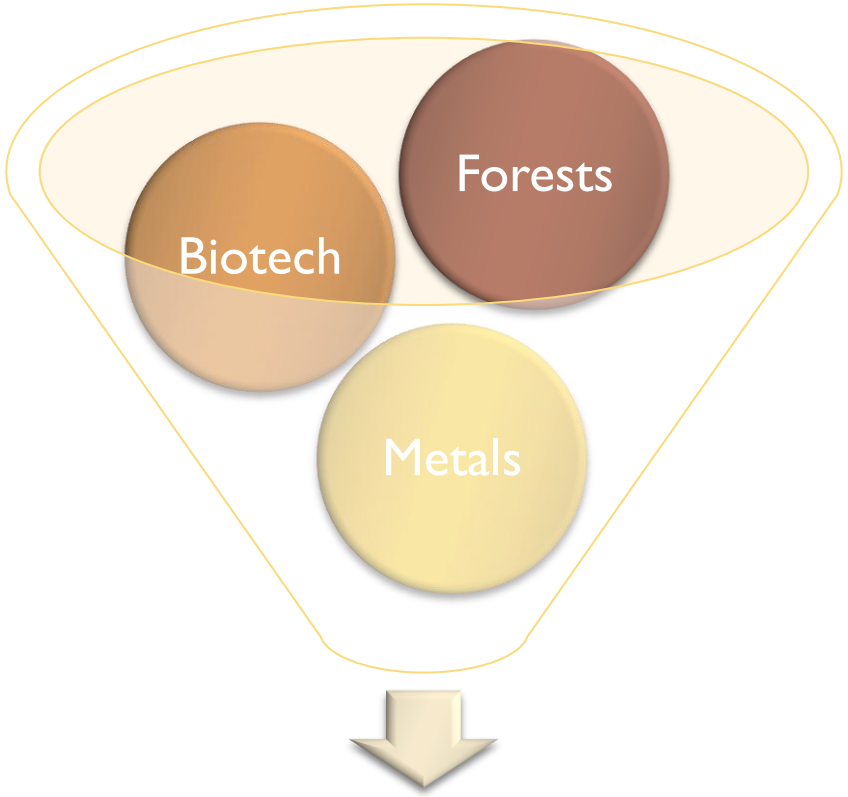
Higher costs for water

Regulatory caps for water use

Conflicts with local communities and other large-scale water users

Growing demand for water efficient products and technologies.

Sector wise Industry concerns….



Who stands where….

APPAREL

- Cotton production stage has the largest water footprint, and is most susceptible to water shortage and climate change impacts.

- Change in water supply, quality and price impacts textile manufacturing.

- Majority of manufacturing happens in water-scarce regions.

BEVERAGE

- Most significant water use is embedded in the raw material production phase. Severe drought or changes in patterns of precipitation can decrease crop yield and quality.
- Potable water is principal and non-substitutable ingredient for beverage products. Water scarcity or contamination of water sources may force bottling or manufacturing facilities to shut down or relocate.

BIOTECH/PHARMA

•High quality water is an essential input used as a main ingredient as well as in processing and cleaning, making this sector especially susceptible to changes in water availability and quality

• Production of pure/ionized water and clean steam generation is energy-intensive, making this sector susceptible to disruption or increased cost of energy supply due to water scarcity.

ELECTRIC POWER/ENERGY

•Thermal power generation requires large amounts of cooling water. Hydropower plants are at risk of decreases in water flow.

• An increase in the severity of extreme weather events will damage power generation/ distribution facilities.

• Higher atmospheric and water temperatures increases the amount of water required for cooling.

• Oil and natural gas supply may be disrupted or become more expensive due to severe weather conditions.

FOOD

- Most significant water use is embedded in crop or livestock production.

- Changes in precipitation patterns, severe drought and flooding due to climate change may decrease crop yield and quality.

- Increased temperature and dry weather due to climate change may raise water requirements for crops and livestock.

FOREST PRODUCTS

- Paper product manufacturing is very water-intensive. Increasing water scarcity and climate change may disrupt or raise cost of water supply.
- Climate change may increase risk of forest fire, due to increased temperature, drought and water shortages for fire fighting.
- Changes in precipitation patterns due to climate change may negatively affect forest growth.
- Pulp and paper manufacturing, is extremely energy-intensive, making this sector susceptible to disruption or increased cost of energy supply due to water scarcity.

METALS & MINING

- Siting of mining operations depends on location of raw material/mines. These operations cannot change their locations to adapt to water scarcity.
- Climate change is expected to increase the frequency and severity of extreme weather events. Mining operations may be disrupted by severe rain or flooding.
- Higher atmospheric and water temperature may impact process cooling and may increase the amount of water required for operation.

STATISTICS

Of wastes and wants: Water use in India			
Industrial Sector	Annual wastewater water discharge (million cubic meters) (%)	Annual consumption (million cubic meters)	Proportion of water consumed in industry
Thermal power plants	27000.9	35157.4	87.87
Engineering	1551.3	2019.9	5.05
Pulp and paper	695.7	905.8	2.26
Textiles	637.3	829.8	2.07
Steel	396.8	516.6	1.29
Sugar	149.7	194.9	0.49
Fertiliser	56.4	73.5	0.18
Others	241.3	314.2	0.78
Total	30729.2	40012.0	100.0

Note: For methodology see www.downtoearth.org.in
Source: Estimated by CSE based on the wastewater discharged data published by CPCB in "Water quality in India (Status and trends) 1990 - 2001".

Comparatively very poor: Indian industry vs Global best		
Sector	**Average water consumption in Indian industry**	**Globally best**
Thermal power plant	On an average 80 m^3/ mwh(1)	Less than 10 m3/mwh(2)
Textiles	200-250 m3/ tonne cotton cloth(3)	Less than 100 m3/ tonne cotton cloth(2)
Pulp & Paper	• Wood based mills: 150 - 200 m3 / tonne(3) • Waste paper based mills: 75 -100 m3/ tonne (3)	• Wood based mills: 50 - 75 m3 / tonne(4) • Waste paper based mills: 10-25 m3/tonne(4)
Integrated Iron & steel plant	10-80 m3 per tonne of finished product (average	5 -10 m3 per tonne of finished product. Best is around 25 m3)(practice - less than 0.1 m3 wastewater per tonne finished product(5)
Distilleries	75-200 m3/ tonne alcohol produced(6)	Data not available
Fertiliser industry	• Nitrogenous fertiliser plant - 5.0 - 20.0 m3/ tonne(3) • Straight phosphatic plant - 1.4 - 2.0 m3/ tonne(3) • Complex fertiliser - 0.2 - 5.4 m3/ tonne(3)	An effluent discharge of less than 1.5 m3/ tonne product as P2O5(2)

Source: 1. No credible data available. Estimates done by CSE from wastewater discharge data from "Water Quality in India, Status and trends (1990-2001), CPCB, MoEF" and annual electricity generation data from "Annual Report (2001-2002) on the working of state electricity boards and electricity department, Planning Commission." 2. Pollution prevention and abatement handbook, World Bank. 3. Environmental management in selected industrial sectors - status and need, CPCB & MoEF, February, 2003. 4. Green Rating of Pulp and Paper Sector, CSE. 5. Integrated Pollution Prevention and Control (IPPC), Best available techniques reference document on the production of iron. 6. Environmental performance of Alcohol industry in UP, UPPCB, 2000-2001.

Country	Industrial water use (billion cubic metres)	Industrial productivity (million US $)	Industrial water productivity (US $ / cubic metre)
Argentina	2.6	77171.0	30.0
Brazil	9.9	231442.0	23.4
India	15.0	113041.0	7.5
Korea, Rep.	2.6	249268.0	95.6
Norway	1.4	47599.0	35.0
Sweden	0.8	74703.0	92.2
Thailand	1.3	64800.0	48.9
United Kingdom	0.7	330097.0	443.7

Source: *World Bank, 2001*

PATH FORWARD

Business Risks of water & CC

• Water scarcity directly affects business operations, raw material supply, intermediate supply chain, and product use in a variety of ways. Declines or disruptions in water supply can undermine industrial and manufacturing operations where water is needed for production, irrigation, material processing, cooling and/or washing and cleaning

• Water quality risks are often overlooked but may have significant financial implications. The quality of process water is critical in many industrial production systems, and contaminated water supply may require additional investment and operational costs for pre-treatment.

• Water scarcity, changes in precipitation patterns, and glacier melt caused by climate change directly affect power generation, curtailing hydro-based power production, and also impacting any power plants that run steam turbines

Business Risks of water & CC

• Water scarcity will increase water prices. Among other factors, water scarcity is driving shifts toward full-cost pricing aimed at providing economic incentives for efficient water use.

• Water-intensive products and services face increased socio-political risks. Products and services that require large amounts of water or energy to produce or to use may be phased out by law, lose market share to less water-intensive products, or cause reputational damage for the company.

• Water scarcity, coupled with increased concern among local communities about water withdrawals, will put pressure on local authorities and policymakers to consider water reallocations, regulations, and development of water markets that cap usage, suspend permits to draw water, and lead to stricter water quality standards.

Path Forward

1. Measure water and carbon footprint throughout the value chain.
2. Assess physical, regulatory and reputational water risks associated with climate change.
3. Integrate water and climate issues into strategic business planning and operational activities.
4. Engage key stakeholders as a part of water and climate risk assessment, long-term planning and implementation activities.
5. Disclose and communicate water and carbon performance and associated risks.
6. Seek opportunities for collective action.

Measure	Explanation	Examples
Improved production planning and sequencing	Re-adjusting the production plans with a focus on minimizing water consumption.	Reduce cleaning needs by minimizing product changes; Starting from lighter shades and moving gradually to darker ones in textile dyeing.
Good housekeeping	Introducing more sensible and more resource-conscious routines in operations.	Avoiding spillages; Minimizing the transport of pollutants from one process to the next; Closely monitoring recipes in reaction batches; Performing mechanical cleaning prior to washing with water; Making sure that water does not flow unnecessarily.
Process/equipment modifications	Making modifications in processes or equipment, with relevant retrofits, if necessary.	Closing open-ended cooling or heating system; Installing level-controlled valves to avoid overflows; Installing self-shutting, trigger-controlled nozzles on hoses; Lining tank surfaces with a non-stick material.
Product/material changes	Changing feedstocks used in production or designing completely new products that lead to reduced water demand and/or less effluent generation.	Switching to water based paints; Using reactive dyes in textile dyeing; Switching over to disposable containers in beverage industry.
Replacing equipment/ technology	Substituting existing technologies with more effective and efficient ones.	Adopting in-place cleaning systems; Using high-pressure, low-volume cleaning equipment; Operating textile dyeing machinery at lower liquor ratios.