Presentation

on

REDUCING WATER FOOTPRINT (WF) IN INDUSTRIES

By

Karishma Bist, Additional Director

FICCI - Resource Conservation & Management Group

Federation House, Tansen Marg, New Delhi-India

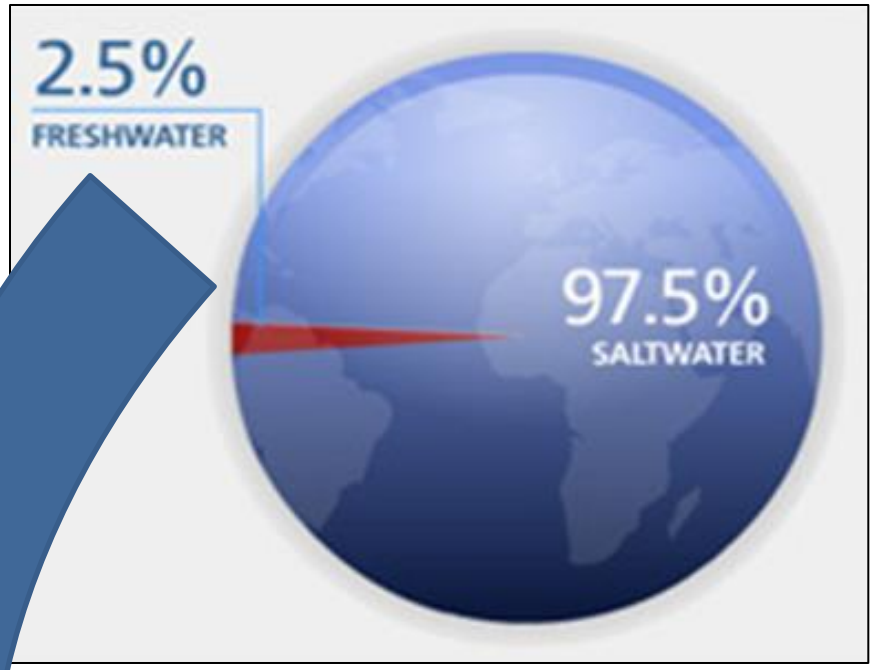
Email: Karishma.bist@ficci.com

Content

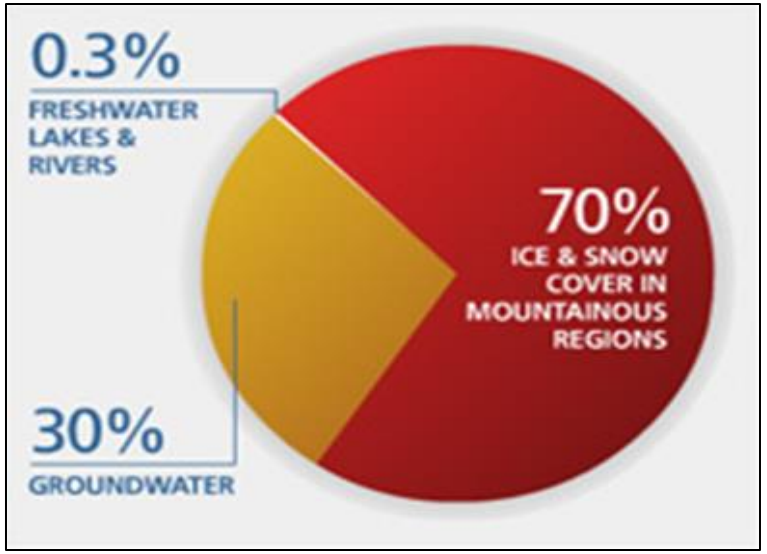
- The Global water Scenario – Issues and Challenges
- Concept of Water Footprint – Blue, Green and Grey water
- Assessment of Water Footprint for a Product
- 5 Step Strategy for reducing Water Footprint for Industry/Businesses
- Case Study
- Role of FICCI in Reducing Water Footprints

The **Global** water Scenario

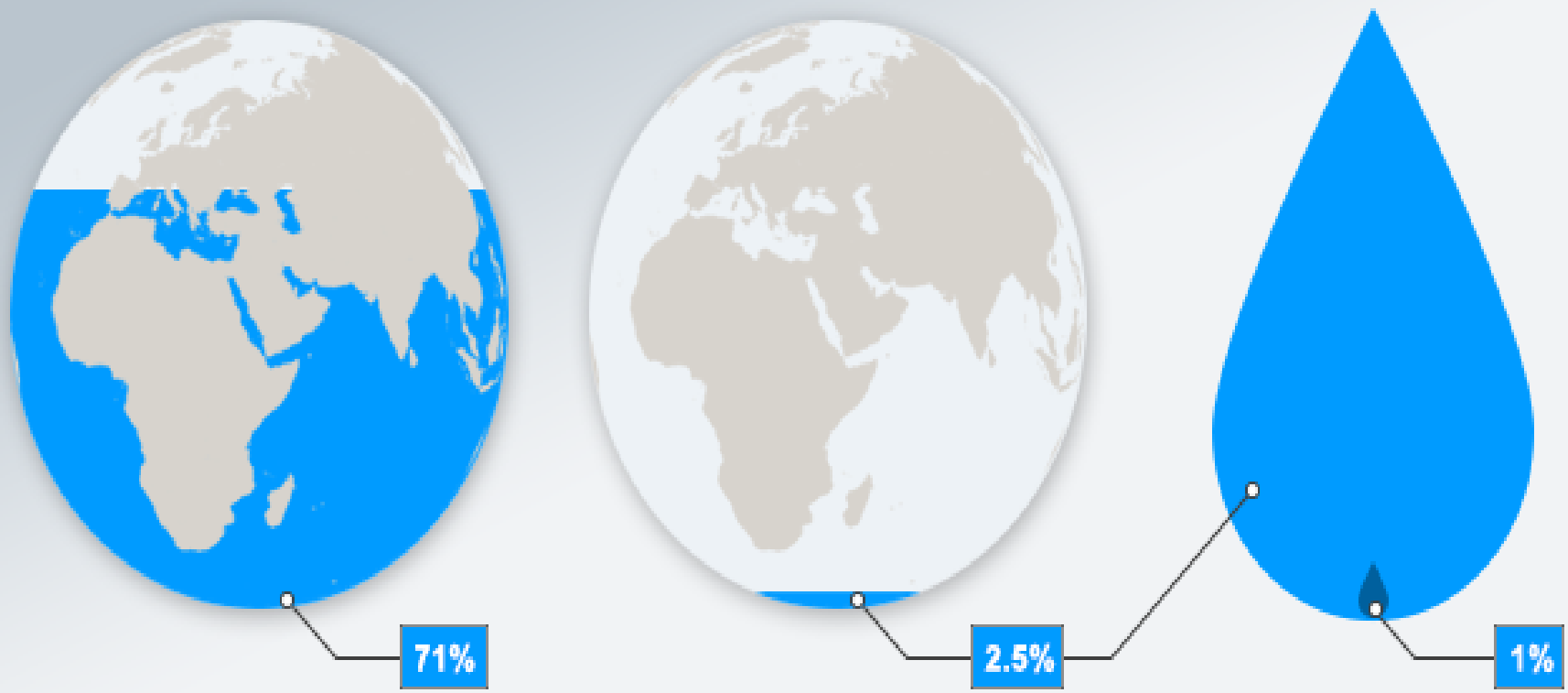
The **global** situation



The total volume of water on Earth is estimated at **1.386 billion km³**, with 97.5% being salt water and 2.5% being fresh water. Of the fresh water, only 0.3% is in liquid form on the surface.



Freshwater makes up a very small fraction of the Earth's water



Source: USGS

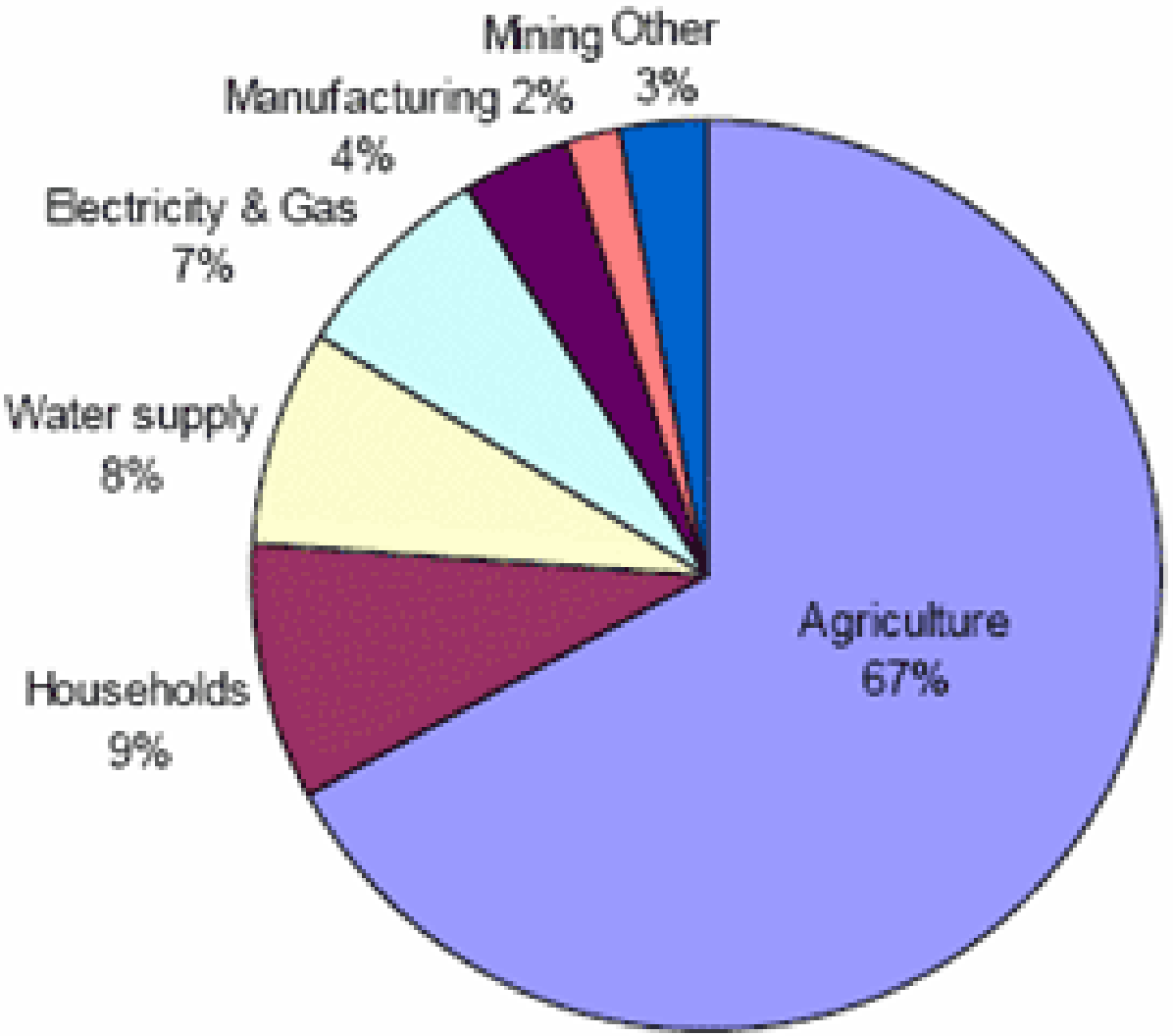
The **global** situation

- About 2.5% of the world's water is fresh – the rest is seawater and undrinkable.

- Of this 2.5%, 70% is frozen, locked up in Antarctica, the Arctic and glaciers, and not available to man.

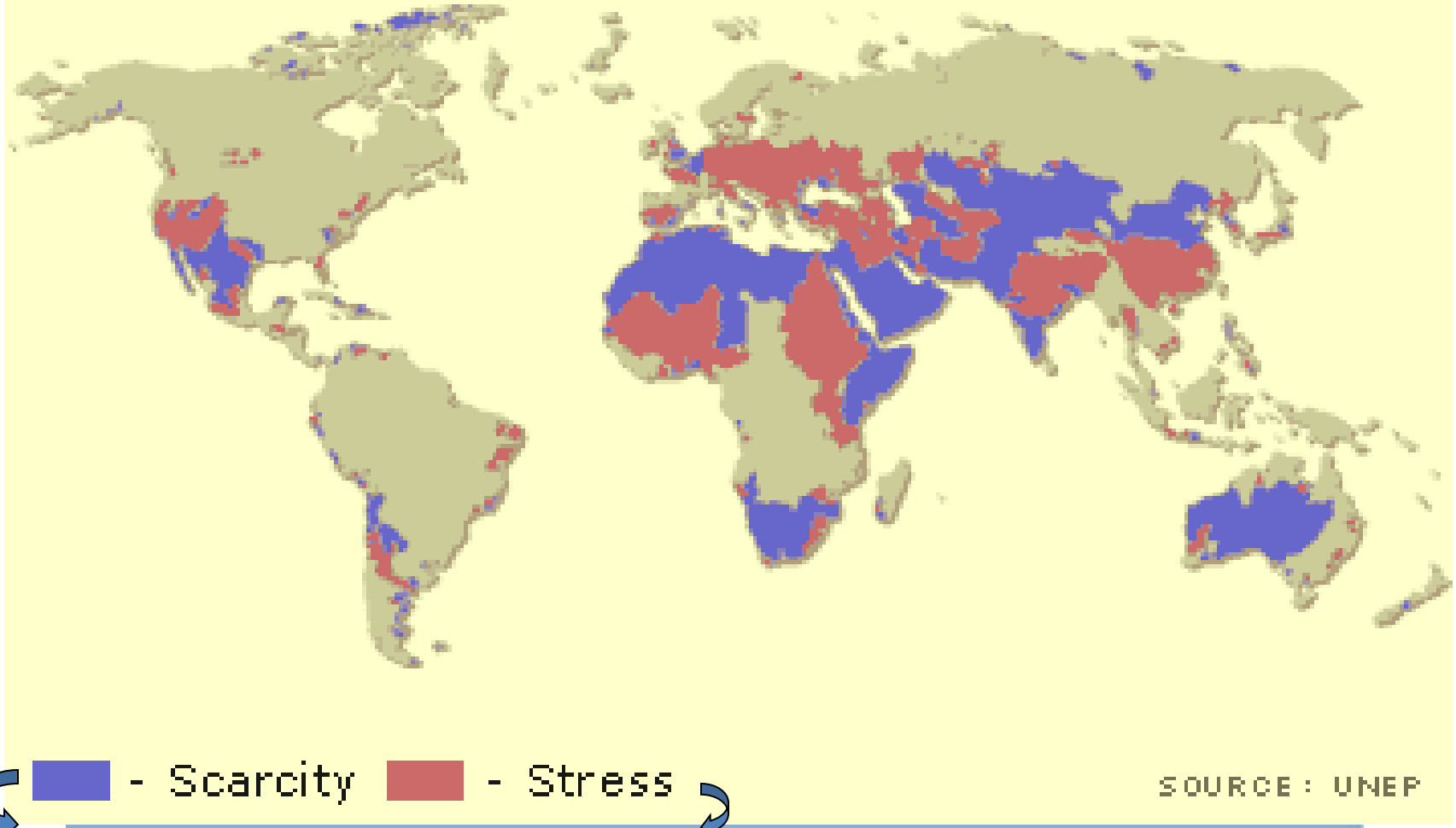
- Thus humanity must rely on remaining 30 % (freshwater, lakes, rivers & groundwater) for all of man's and ecosystem's fresh water needs.

Global Water Consumption-Sector wise



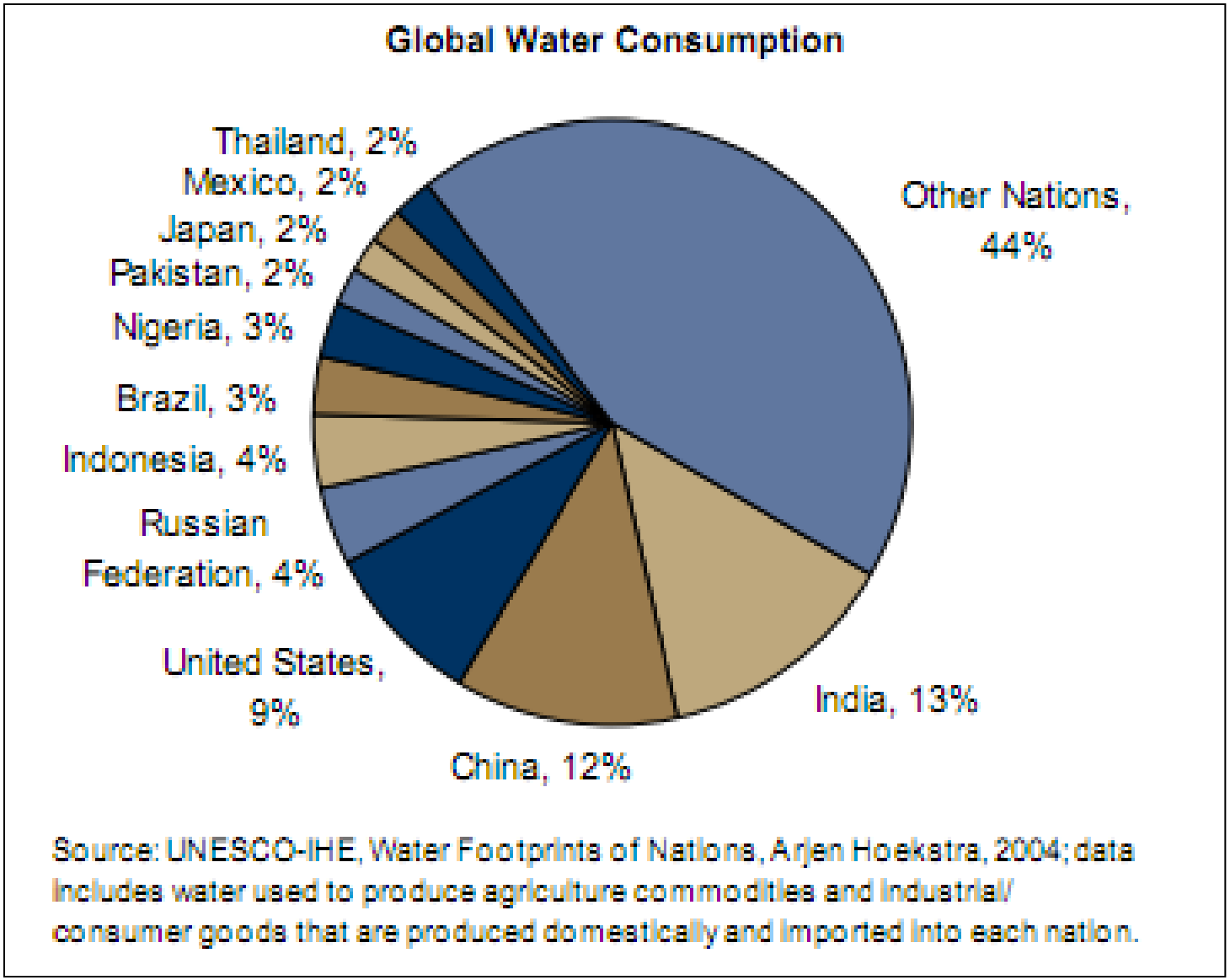
Global Water Consumption 1900 - 2025

Predicted water scarcity and stress in 2025



Condition in which the annual availability of renewable fresh water is 1,000 cubic meters or less per person in the population.

condition in which the annual availability of renewable fresh water is less than 1,700 and greater than 1,000 cubic meters per person in the population


Global Water Consumption
Thailand, 2%
Mexico, 2%
Japan, 2%
Pakistan, 2%
Nigeria, 3%
Brazil, 3%
Indonesia, 4%
Russian Federation, 4%
United States, 9%
China, 12%
India, 13%
Other Nations, 44%
Source: UNESCO-IHE, Water Footprints of Nations, Arjen Hoekstra, 2004; data includes water used to produce agriculture commodities and industrial/ consumer goods that are produced domestically and imported into each nation.

OUR CURRENT GLOBAL WATER CHALLENGES:

- ***41%*** *of the world's human population live in areas of severe water stress.*
- ***800 million*** *people lack access to safe drinking water.*
- ***2.6 billion*** *lack adequate sanitation services.*
- ***Water pollution*** *is high, especially in developing countries where up to 70% of industrial wastewater is discharged without treatment.*
- ***Effects of climate change*** *will exacerbate water problems and lead to changing and erratic rainfall patterns, droughts and floods.*

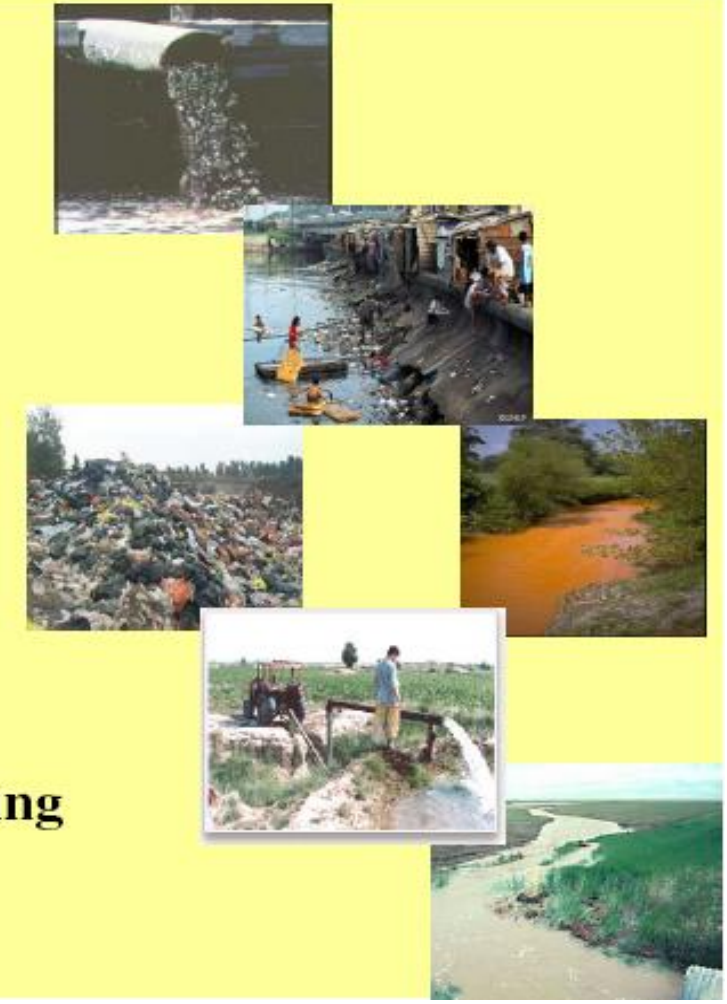
FICCI

63 million Indians do not have access to clean drinking water *(report by Water Aid, 2017)*

Water (River) Pollution

Groundwater Pollution: Sources/Causes

- Untreated Industrial Effluents
- Domestic & Sewage Discharge
- Leachates from indiscriminate dumping of solid and hazardous wastes
- Agricultural Run-off
- Over exploitation of Groundwater Resources – causing seawater intrusion
- Geological formations



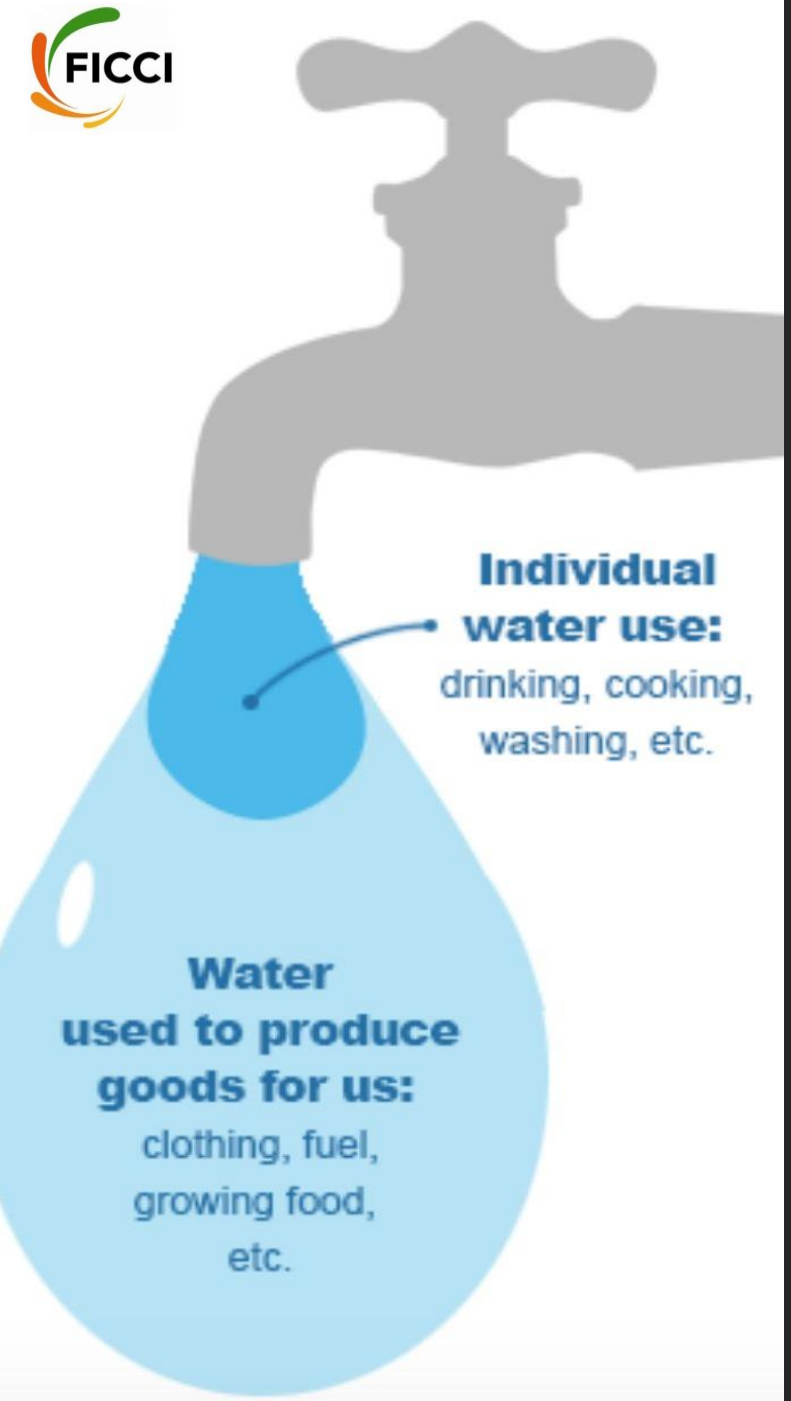
What is a ‘Water Footprint’

Concept coined by Arjen Y. Hoekstra, Professor in Water Management
University of Twente, the Netherlands

About Water Footprint

- The water footprint is an indicator of **quantity of water consumed or polluted** when producing a certain product, accounting for the water use throughout the entire **production chain**.
- It also shows the location where the consumption or pollution has occurred, thus enabling companies to see where their water use has an impact.
- Water footprints can also be calculated for individuals, communities, nations or businesses.

FICCI



Water Footprint of Individual

Water Footprint of a Product

- the volume of fresh water used to produce the product, summed over the various steps of the production chain.

- when and where the water was used:
a water footprint includes a temporal and spatial dimension.

- type of water use:
green, blue, grey water footprint.

What is Green Water Footprint?

GREEN WATER FOOTPRINT

The volume of rainwater evaporated or incorporated into the product, e.g. consumed by a crop.

What is Blue Water Footprint?

BLUE WATER FOOTPRINT

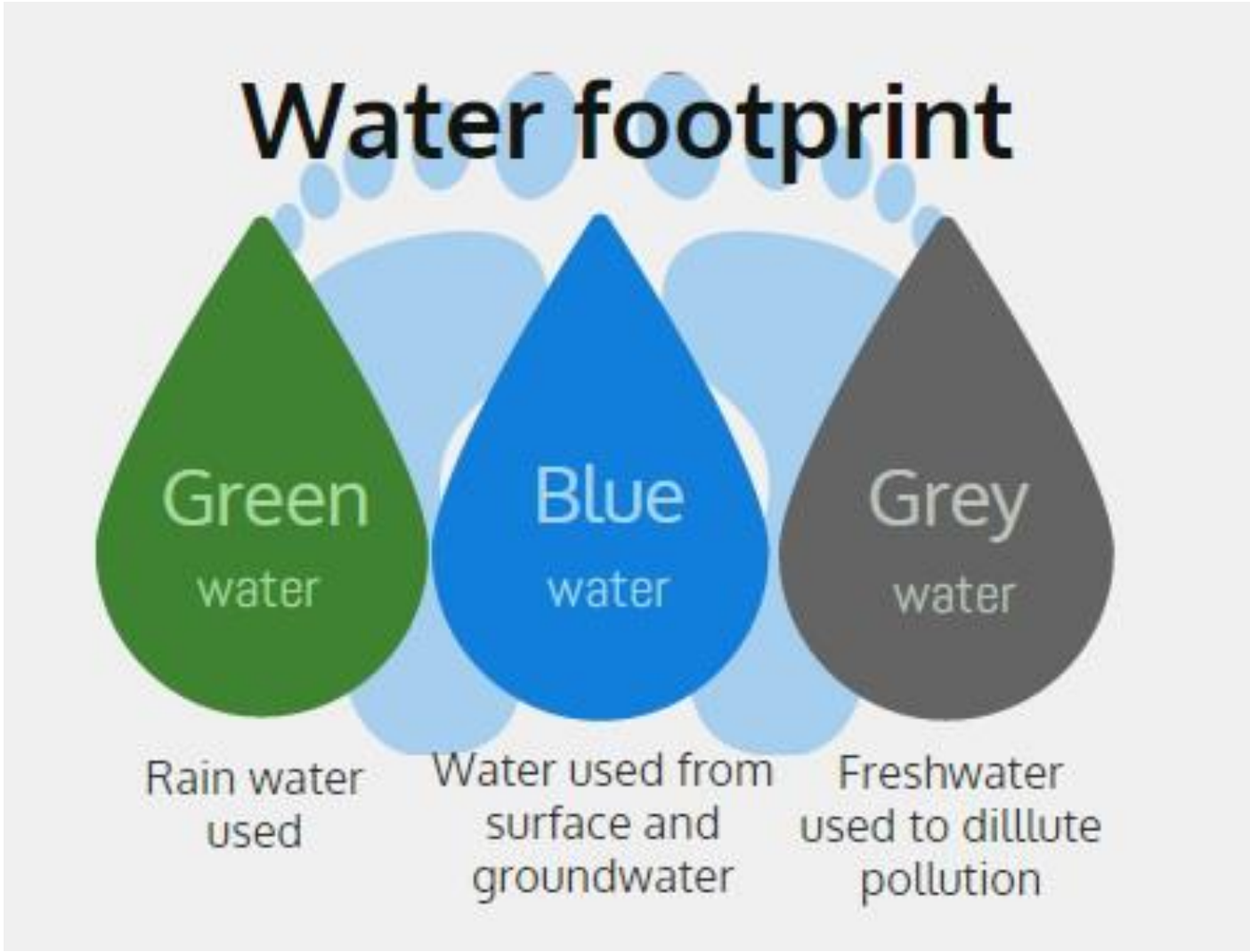
The volume of freshwater consumed from surface or groundwater sources.

What is Grey Water Footprint?

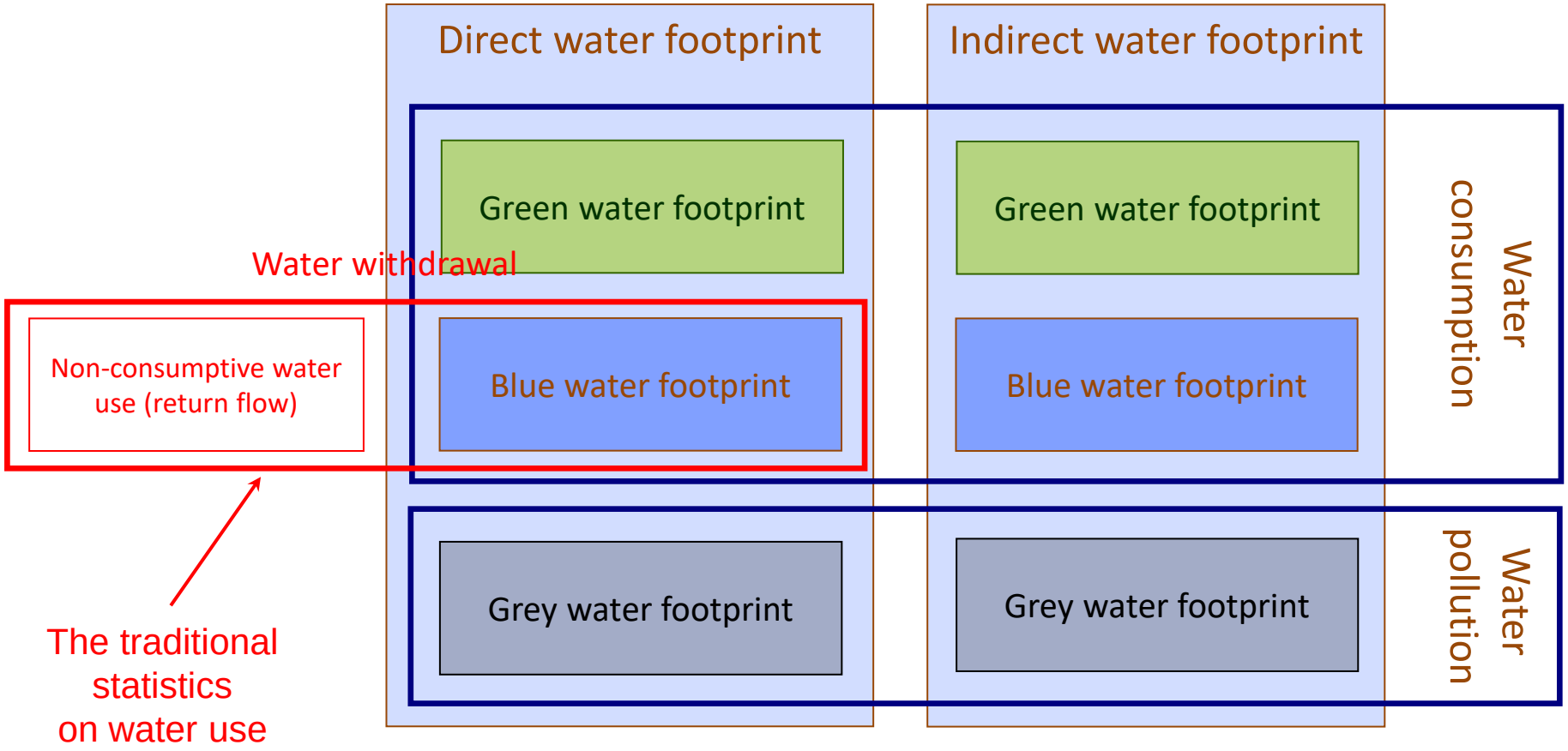
GREY WATER FOOTPRINT

The volume of water that is required to dilute the effluents from the production process in order to bring the concentration of pollutants down to such a level that relevant water quality standards are adhered to.

Volume of polluted freshwater that associates with the production of a product in its full supply chain.


Water footprint
Green
water
Blue
water
Grey
water
Rain water used
Water used from surface and groundwater
Freshwater used to dilllute pollution

Components of a water footprint



What's your Fabric Water Footprint?

FICCI

Production Chain - Cotton

- Cotton Production – Irrigation, Fertilizers and Pesticides
- Cotton Processing - Spinning and Weaving
- Grey Fabric (Wet Processing) – Washing, Bleaching, Softening and Dying etc.
- Finishing (Cutting & Stitching)
- Consumer

The average water footprint of printed cotton (for example a pair of jeans weighing 1 kg) is 11000 litres per kg

Specific Water Consumption of Textile (Cotton): 200-70 m3/ ton of product

Water Footprint of 1 Cotton T-Shirt : 2700 litres

[Hoekstra & Chapagain, 2008]

It costs about 21,000 litres of water to produce 1 kg of roasted coffee. For a standard cup of coffee we require 7 gram of roasted coffee, so that a cup of coffee costs 140 litres of water. This is a **global average** and **aggregate** number. Policy decisions should be taken on the basis of:

1. Actual water footprint of certain coffee at the precise production location.
2. Ratio green/blue/grey water footprint.
3. Local impacts of the water footprint based on local vulnerability and scarcity.

[Hoekstra & Chapagain, 2008]

[Hoekstra & Chapagain, 2008]

[Hoekstra & Chapagain, 2008]

[Hoekstra & Chapagain, 2008]

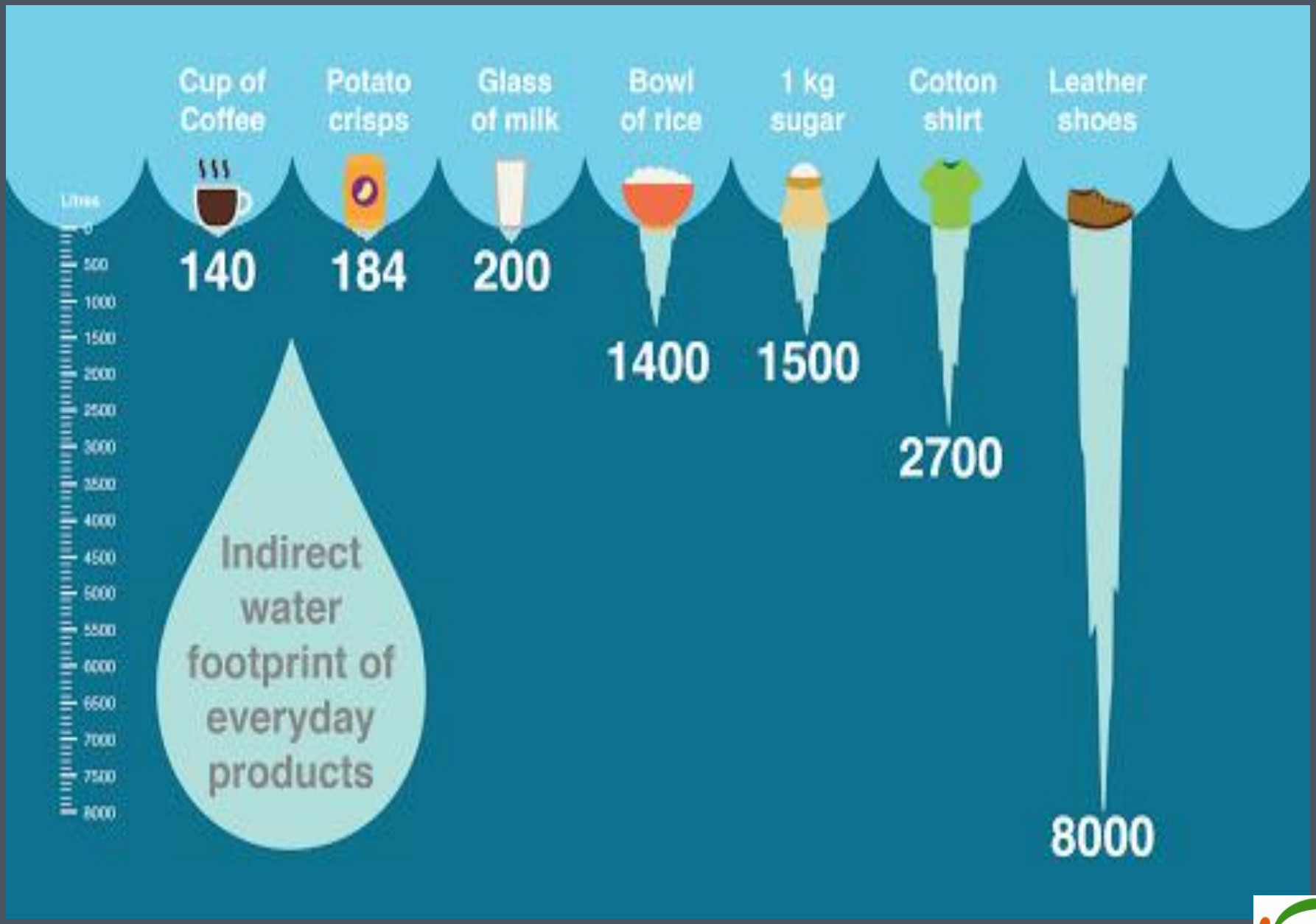
[Hoekstra & Chapagain, 2008]

[Hoekstra & Chapagain, 2008]

[Hoekstra & Chap

FICCI

FICCI


Cup of Coffee
Potato crisps
Glass of milk
Bowl of rice
1 kg sugar
Cotton shirt
Leather shoes
Litres
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
8000
140
184
200
1400
1500
2700
8000
Indirect water footprint of everyday products

Water Footprint- An Indicator

- WF is an indicator of water use that looks at both **direct and indirect water use** of a consumer or producer.
- Water use is measured in terms of **water volumes consumed** (evaporated or otherwise not returned) or **polluted.**
- Water footprint is a **geographically and temporally** explicit indicator.
- A water footprint can be calculated for a process, a product, a consumer, group of consumers (e.g. municipality, province, state or nation) or a producer (e.g. a public organization, private enterprise).

Assessing the water footprint of crop

Water footprint of a crop

- Crop water use (m^3/ha) / Crop yield (ton/ha)

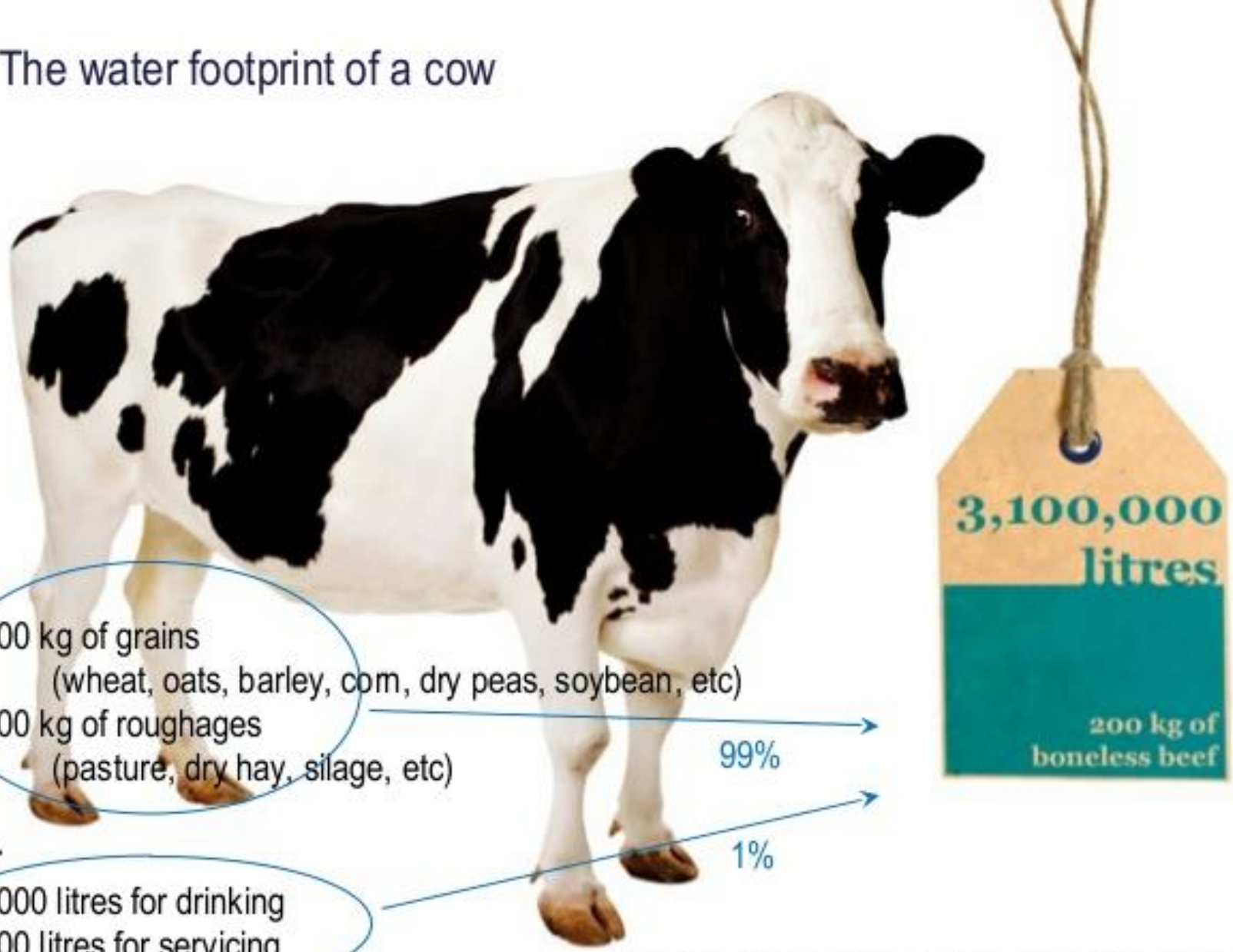
Green, Blue and Grey

Water footprint of an animal

-Sum of water for feed, water for drinking and servicing

(Green, Blue and Grey)

The water footprint of a cow



Food

- 1300 kg of grains
  (wheat, oats, barley, corn, dry peas, soybean, etc)
- 7200 kg of roughages
  (pasture, dry hay, silage, etc)

99%

Water

- 24000 litres for drinking
- 7000 litres for servicing

1%

Source: Hoekstra & Chapagain (2008) *Globalization of Water*, Blackwell, Oxford, UK

FICCI

Water footprint of a Nation

- total amount of water that is used to produce the goods and services consumed by the inhabitants of the nation.

- two components:
  - internal water footprint – inside the country.
  - external water footprint – in other countries.

Water footprint of a Nation

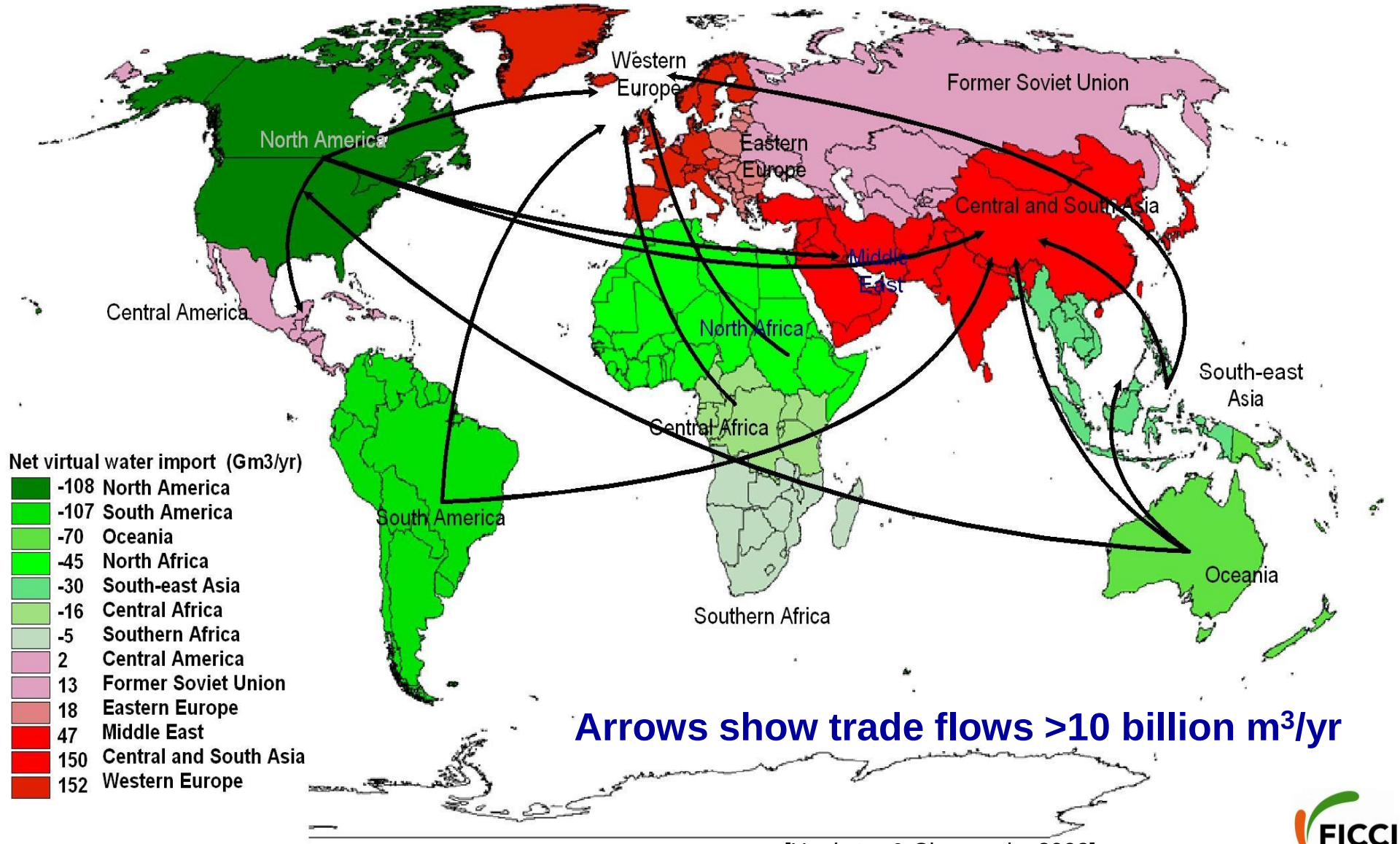
► **National water footprint =**

national water use + virtual water import - virtual water export

FICCI

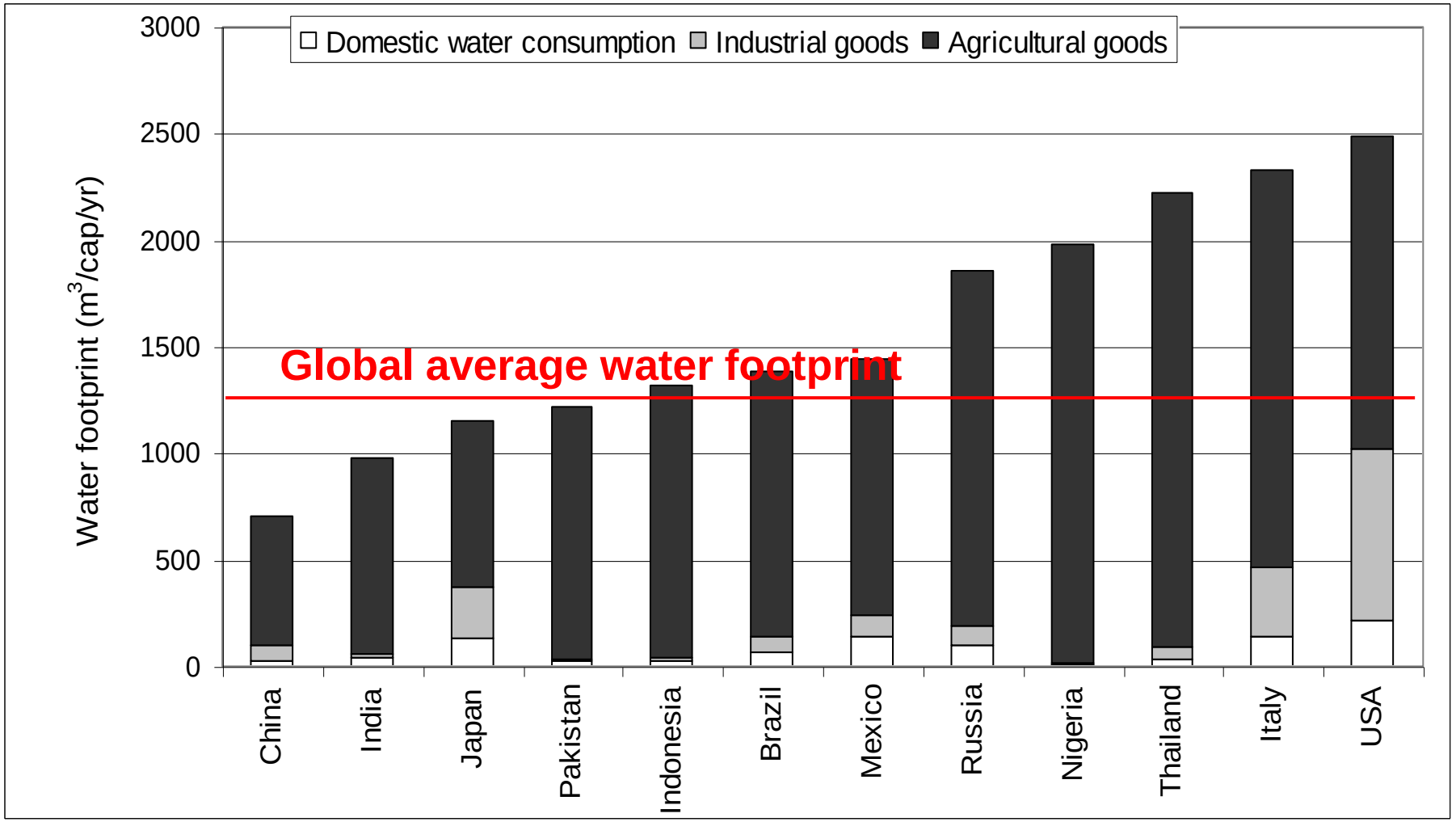
Regional virtual water balances

(only agricultural trade)



[Hoekstra & Chapagain, 2008]

Avg. Water footprint of a consumer (1387 m3/capita/yr i.e 3800 lpcd)



[Hoekstra & Chapagain, 2008]

Major determinants of a water footprint

- **Consumption characteristics**
  - Consumption volume
  - Consumption pattern
  - water use efficiency
- **Production circumstances**
  - Climate: evaporative demand at place of production
  - Agricultural practice and efficiency

Why Water Footprint Assessment: what's new

Broadening perspective:

- Intro of supply chain thinking in water management
- Highlighting the international dimension of water use & scarcity
- Connecting different players: governments & local water users, companies & consumers down the supply chain, investors.

What precisely is measured:

- *Net* instead of *gross* blue water abstraction
- Inclusion of green water consumption as well
- Inclusion of water pollution as well

FICCI

Water Footprint of an Industry / Business

Why businesses are interested

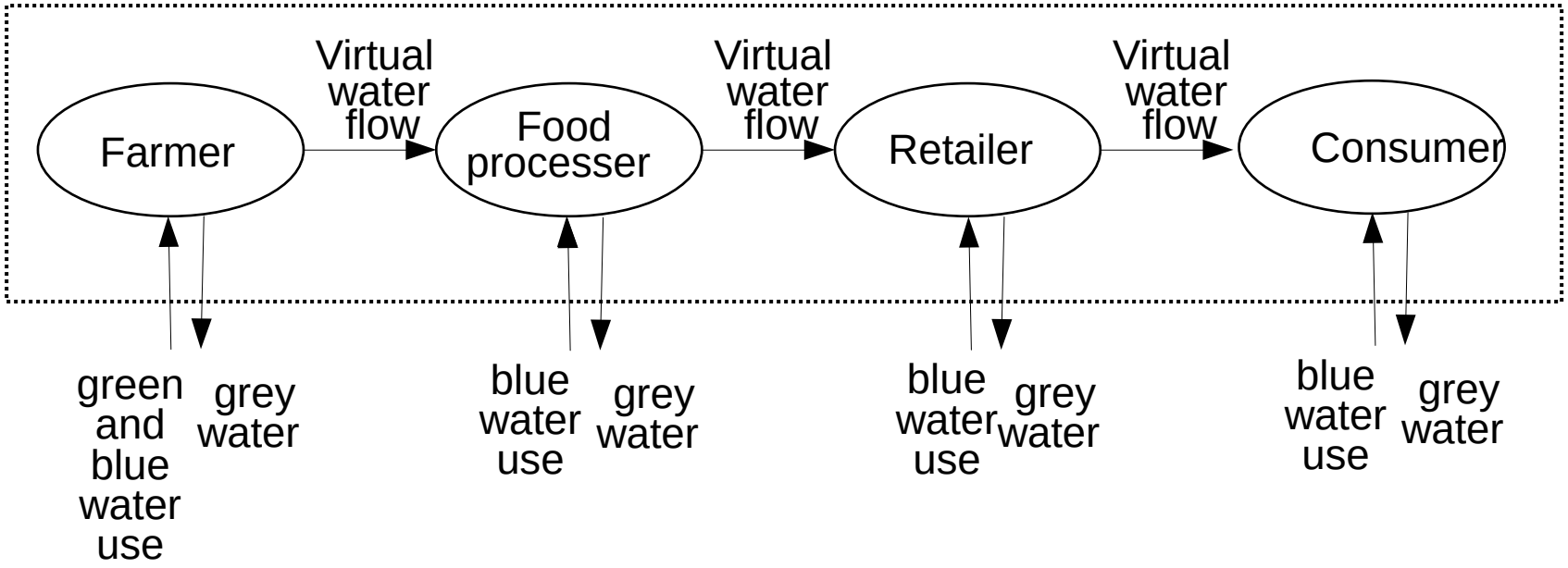
- corporate social responsibility
- corporate image / marketing perspective
- business risks related to
  - freshwater shortage for own operations
  - freshwater shortage in supply chain
- anticipate regulatory control

Water footprint of a business

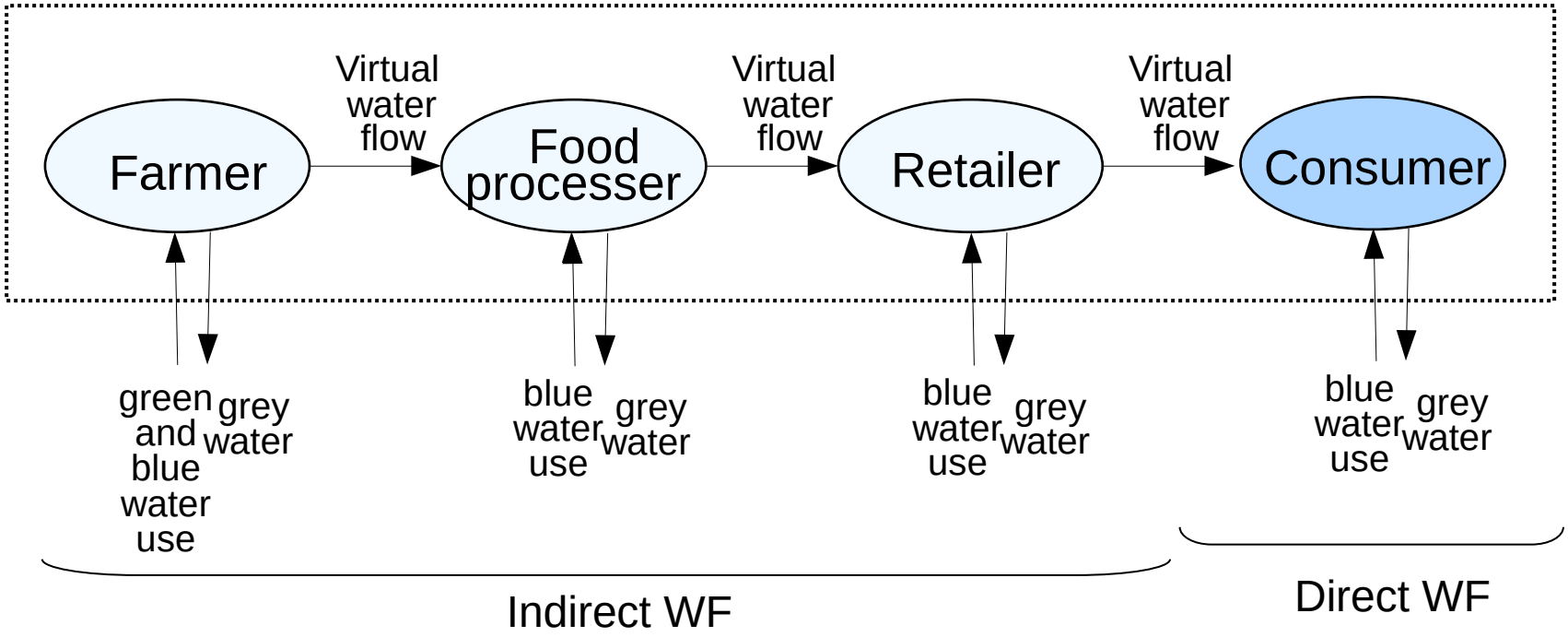
- **Operational water footprint**
- the **direct water use** by the producer – for producing, manufacturing or for supporting activities.

- **Supply-chain water footprint**
- the **indirect water use** in the producer's supply chain.

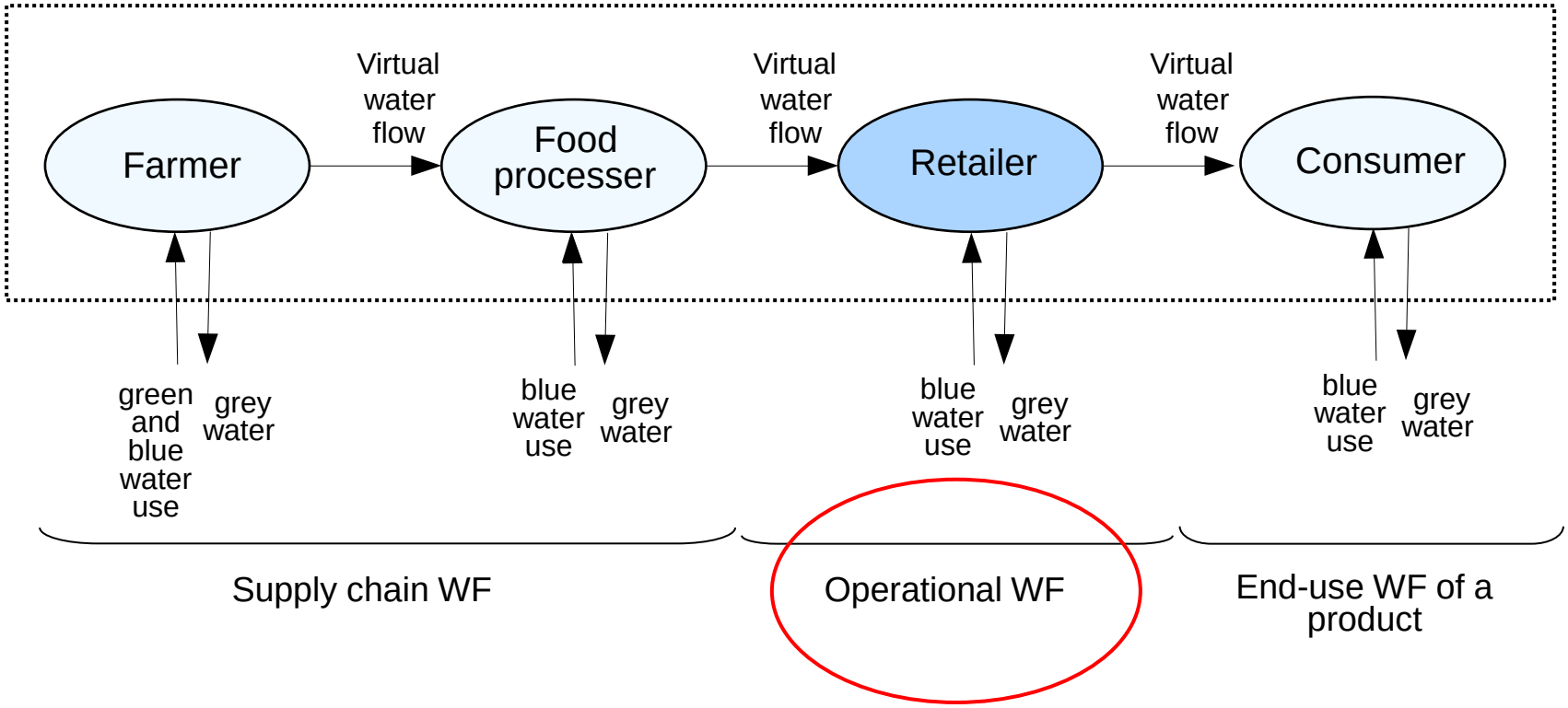
The virtual water chain



The water footprint of a consumer

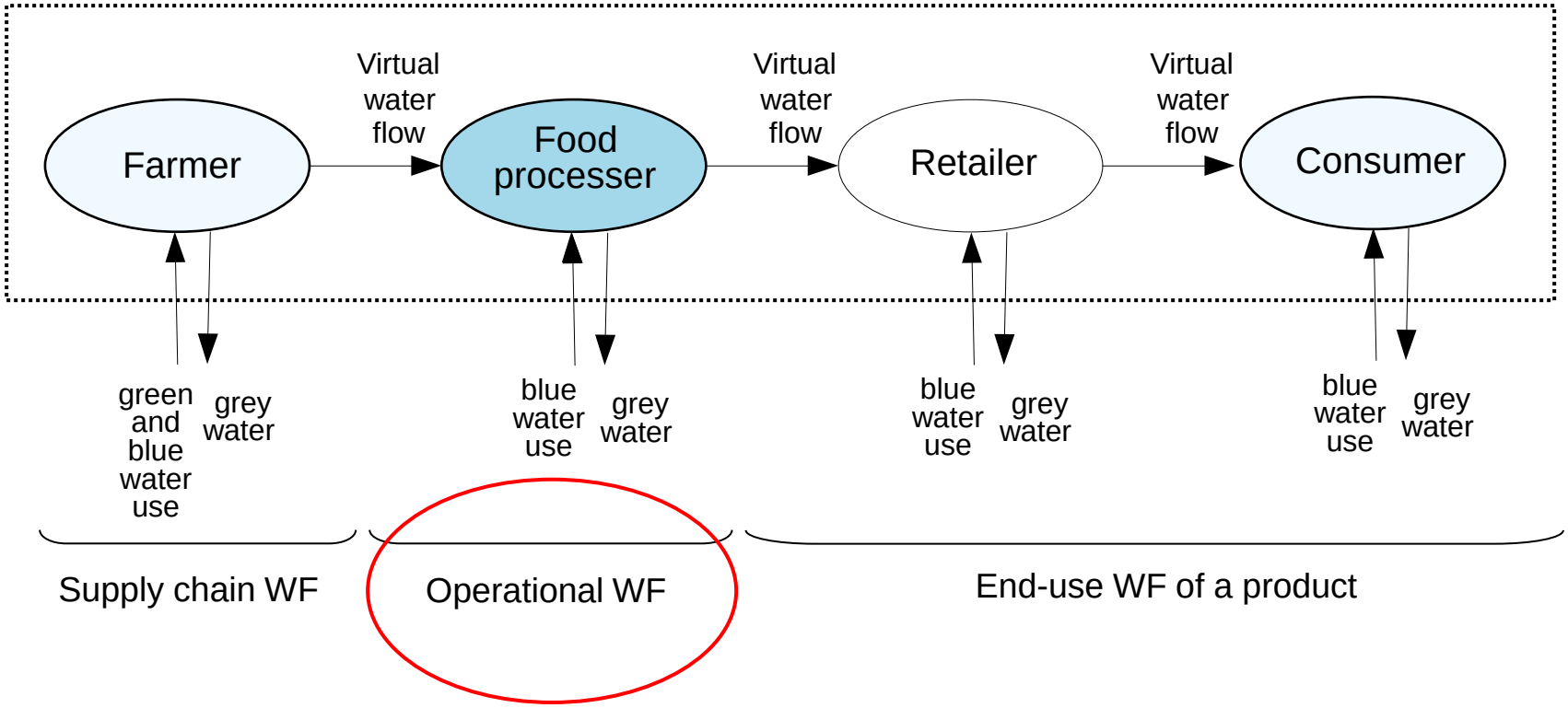


The water footprint of a retailer



The traditional statistics on corporate water use

The water footprint of a food processor



The traditional statistics on corporate water use

Water Footprint Reduction – What we can do

- Towards full water recycling in industries: zero blue water footprint
- Towards full recycling of materials and heat: zero grey water footprint

- Make rainwater more productive: lower green water footprint
- Towards supplementary or deficit irrigation & application of precision irrigation techniques: lower blue water footprint
- Towards organic or precision farming: zero grey water footprint

”Without water we cannot produce, it is that simple. So we need to manage our water responsibly and understand our processes in order to have a positive impact on local water resources.

Business perspective

- **Reduction of the operational water footprint:**

  -water saving in own operations.

- **Reduction of the supply-chain water footprint (**stakeholder-inclusive process)

  -influencing suppliers;

  -changing to other suppliers;

  -transform business model in order to incorporate or better control supply chains.

Business / Product transparency

- Global Water Footprint Standard
- Water footprint reporting/disclosure
  - Shared standards
  - Labelling of products
  - Certification of businesses
  - Benchmarking
  - Quantitative footprint reduction targets

Product Water Requirement

SUPPLIER LOCATION	CONSUMER LOCATION

Typical Shampoo
Product Water Footprint

Product water content 0.075 Ltr/100ml product

Manufacturing water. Line cleaning etc < 0.5 Ltr / 100ml product

Typical consumer use rates. 75 Ltr/100ml product (shower)

(based on Environment Agency home water use data)

Source: Boots in-house product sustainability footprint analysis

5 step Strategy to lower your company's Operational water footprint

5 step Strategy to lower your company's Operational water footprint

To effectively lower your company's water footprint, it takes **top-down commitment, employee engagement** and a methodology for **routinely measuring water use**. Follow below steps for water conservation in your plant:

- **Define water issues and the desired outcomes**
- **Create Water Management Plan**
- **Identify Water Management Best Practices with CBA**
- **Reduce current water consumption**
- **Monitor and control ongoing water-reduction efforts**

FICCI

Step 1: Define water issues and the desired outcomes

Poor Availability or Non-Availability of Fresh Water	Higher Specific Water Consumption	High Water Bills
Inconsistent Product Quality	High Effluent Discharge	Restriction on effluent Disposal to any Recipient Media
Breakdowns, Leakages & Spillages	Plan for future expansion	Corporate Image etc.

FICCI

Step 2 - Create Water Management Plan and set targets

- Conduct detailed water audit study to Create Water Management Plant and to:
  - Measure water consumption
  - Set a baseline for average water consumption
  - Map process water consumption pattern
  - Prepare water line diagram and balance
  - Estimate water management cost covering pumping, treatment, O&M, manpower etc.
  - Set realistic targets
  - Identify Water Management Best Practices

Step 3 – Identify Water Management Best Practices with Cost benefit analysis (CBA)

1. Compare your water consumption to industry benchmarks
2. Identify best practices for water conservation with required investments and pay back period
3. Discuss and short list implementable water saving schemes with techno commercial viability

FICCI

Step 4 – Reduce current water consumption

Start with small with a few quick wins that each area of the organization can easily achieve like:

- Detecting and fixing leaks in pipes, fixtures, appliances and equipment, fire hydrants etc.
- Replacing/retrofitting water fixtures with new ‘water efficient fixtures’ – taps (3-5 lpm), flushes (3/6 l/flush), showers (7 lpm) etc.
- reclaiming wastewater to meet water needs such as cooling towers, fire water makeup, irrigation or other non-potable uses
- Adopt water efficient processes/ machines

Step 5 – Monitor and control ongoing water-reduction efforts

Measure the performance of implemented scheme

Develop **monitoring and control** protocol to report water savings

Publicize key goals achievement to increase awareness among employees

Periodically ask employees for their suggestions to keep **employees engaged**

FICCI

FICCI CASE STUDY

- ***FICCI Interventions in Pulp & Paper Sector for Reduction in Water Footprint***
- ***Supported by WWF-India under living Ganga Project***

DETAILS OF PULP & PAPER UNIT (DEMONSTRATION CASE STUDY)

- The mill is producing **80 tons/day** of Paper which includes:
  - Creame Wove Paper, Construction Paper, Activity Paper, Newsprint, MG PosterPaper, Colored Paper.
- The mill was producing around 28000 TPA of Paper Products from 35000 TPA of Waste Paper.

DETAILS OF PULP & PAPER UNIT	
Mill Operating Capacity	80 TPD
Raw Water Source	Groundwater
No. of Borewells	3
Total Water Quantity Drawn	6264 KL/day

FICCI

MAIN PROBLEMS IDENTIFIED

- **Lack of water storage** facility
- **Old Pulping technology** having higher loss of fiber in the effluent
- **Non-segregation** of highly concentrated effluent streams
- **Non- Recovery of fibers** from the process water
- Lack of Water Efficient Showers
- **Difficulty in reuse/recycle of colored effluents** in the process
- **Poorly Maintained** Effluent Treatment Plant
- **Lack of Good Housekeeping** Practices

FICCI

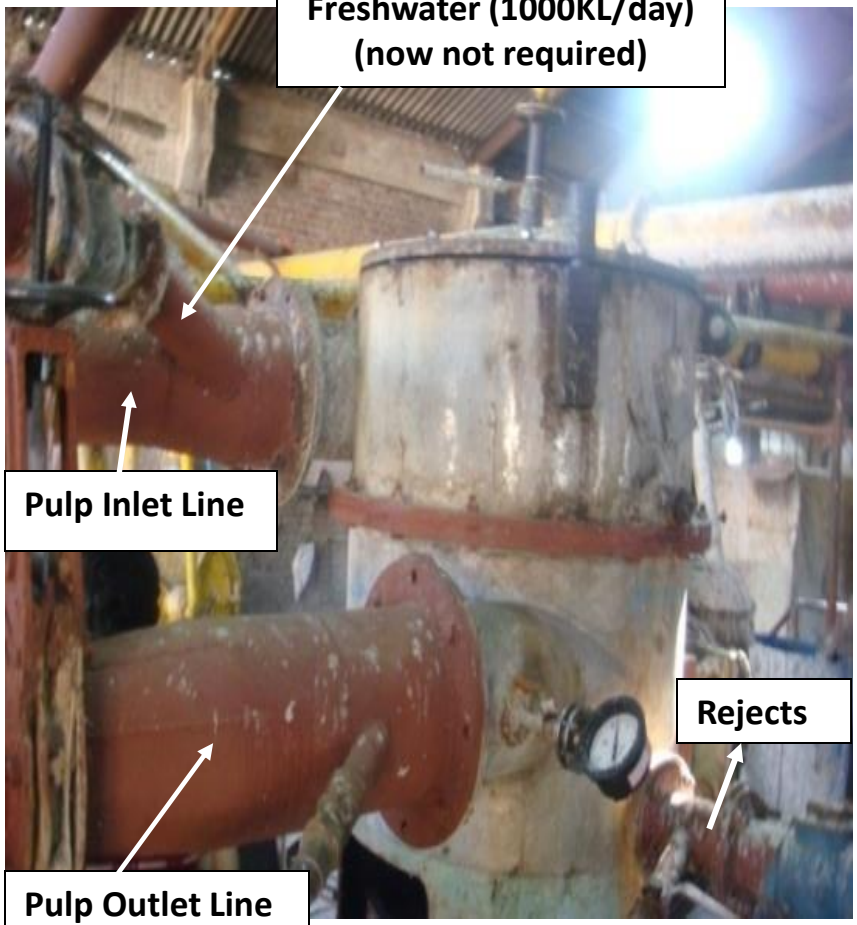
BEST MANAGEMENT PRACTICES FOR IMPLEMENTATION IN DEMONSTRATION UNIT

- Installation of Medium Consistency Screening for Pulping to replace low consistency screening
- Use of modern Fan Jet Spray Showers and Wide Angle Spray Showers in Paper Machines instead of inefficient hole showers
- Segregation & Treatment of colored wastewater before ETP for reuse/recycling in the process
- Following Better Housekeeping Practices and proper training to the workers.

1. Installation of Medium Consistency Screening technology

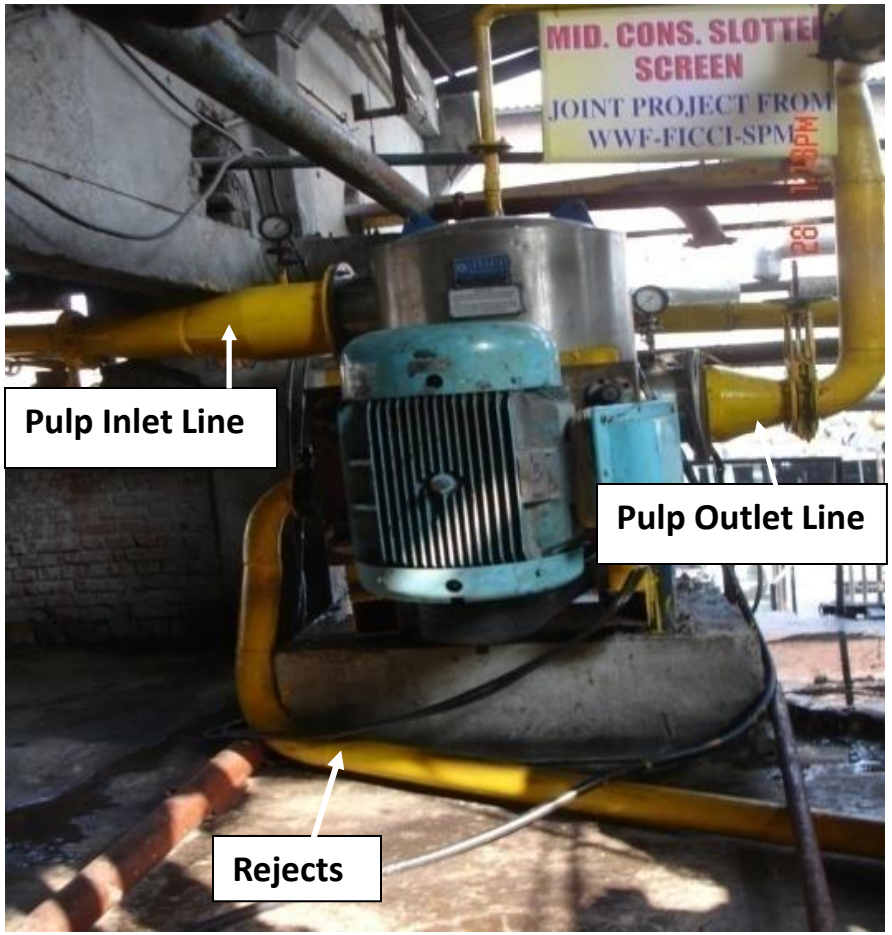
BEFORE & AFTER SCENARIO

Before Implementation



Low Consistency Pulp Screen consuming more water

After Implementation



Medium Consistency Pulp Screen consuming less water.

WATER & ENERGY SAVINGS BY MODERN PULP SCREEN

Water & Energy Savings by Modern Pulp Screen Installation			
	Water Consumption (KL/day)	**Energy Consumption**	
Details		**Borewell (H.P./day)**	**Modern Pulping Screen KWh/day**
Before Installation	3000	720	990 (60 HP)
After Installation	2000	480	490 (32.8 HP)
Savings	**1000**	**240**	**500 (33.5 HP)**

FICCI

2. Use of modern Water Efficient Fan Jet Spray Showers and Wide Angle Spray Showers

BEFORE & AFTER SCENARIO

Before Implementation

Inefficient Hole Showers consuming more water

After Implementation

Water Efficient Wide Angle Spray Showers

Water Savings & Reduction in Effluent Generation by Modern Water Efficient Showers		
Details	**Water Consumption (KL/day)**	**Effluent Generation (KL/day)**
Before Installation	1200	600
After Installation	720	360
Savings	**480**	**240**

WATER SAVINGS & REDUCTION IN EFFLUENT GENERATION BY MODERN WATER EFFICIENT SHOWERS

FICCI

3. Segregation & Treatment of colored Effluents

Before Segregation and Treatment of Colored Effluent

FICCI

COLORED DRAIN SAMPLES TESTED FOR HYPO-DOSING

Colored Wastewater Samples from different drains

Bleaching with addition of Hypo Solution

After Segregation and Treatment of Colored Effluent

Newly Constructed Channels & Pits for segregation & treatment

Hypo-dosing for colour removal

Treated Colored Effluent after Hypo-dosing

After Segregation and Treatment of Colored Effluent

New Storage Tank to provide Retention Time to treated colored effluent

Effluent Discharged to common pit

4. Training of Employees

Training to Middle Management at Pulp and Paper Unit

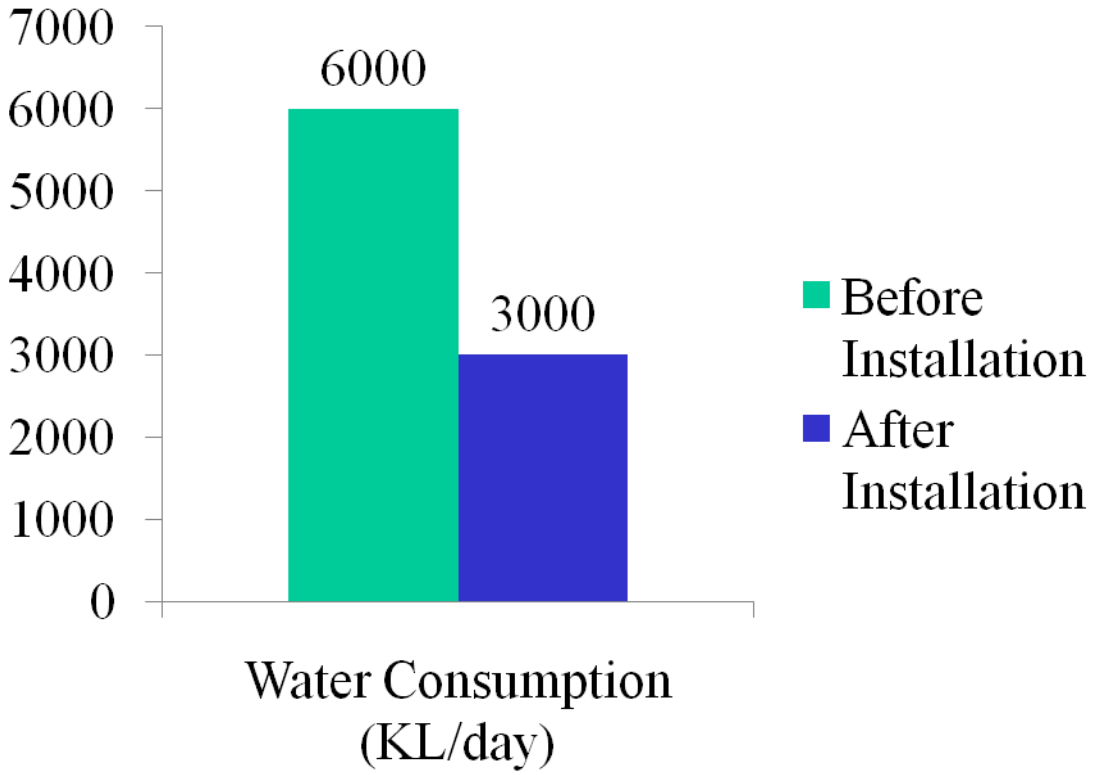
COST BENEFIT ANALYSIS OF IMPLEMENTED BEST PRACTICES

S. No.	Best Management Practices	Operational & Environmental benefits	Annual Resource Savings	Investment (Rs. In lakhs)	Annual Monetary Savings (Rs. In lakhs)	Simple Payback Period (Years)
1	**Replacement of Conventional Pulp Screen with Modern Pulp Screening Equipment having consistency 2.5%**	Uses less fresh water and energy and also, less energy would be required to pump the fresh water from the borewells	- Water Savings 3,000,00 KL - Energy Savings 226050 HP	9.5	12	0.8
2	**Replacement of conventional hole showers with modern wide angle & fan jet spray Showers at Paper Machines**	Uses less water and enable backwater recycling leading to less effluent generation & savings in effluent treatment	- Water Saving 1,440,00 KL - Reduction in backwater generation 720,00 KL	1.4	1.7	0.8
SUB-TOTAL				**15.4**	**18.9**	**0.8**

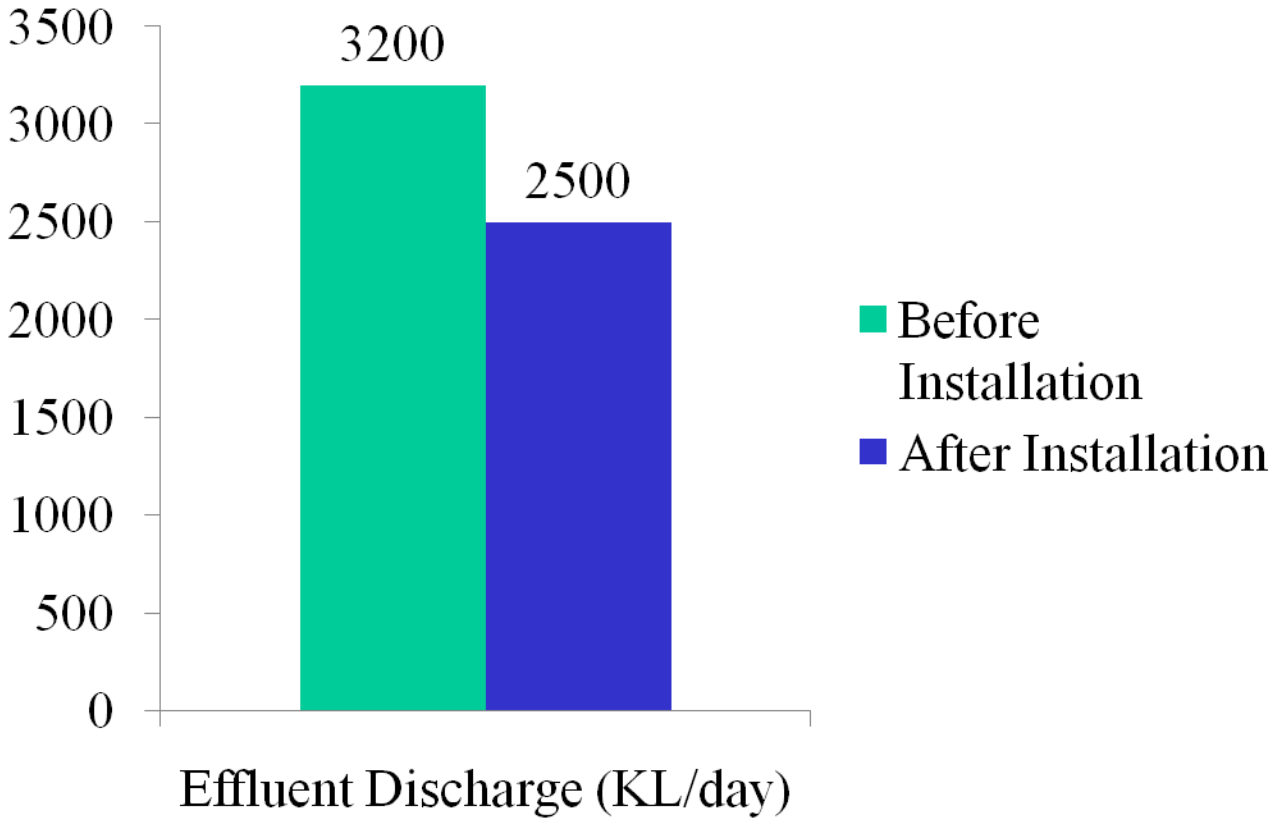
COST BENEFIT ANALYSIS OF IMPLEMENTED BEST PRACTICES

S.No.	Best Management Practices	Operational & Environmental benefits	Annual Resource Savings	Investment (Rs. In lakhs)	Annual Monetary Savings (Rs. In lakhs)	Simple Payback Period (Years)
3	**Segregation of colored effluents for colour removal before treatment & reuse**	Increased efficiency of existing ETP and improved quality of final Effluent.		4.1	Operating Cost (-7.5)	--
TOTAL				**19.5**	**11.4**	**1.7**

REDUCTION IN FRESHWATER CONSUMPTION UPTO 50%

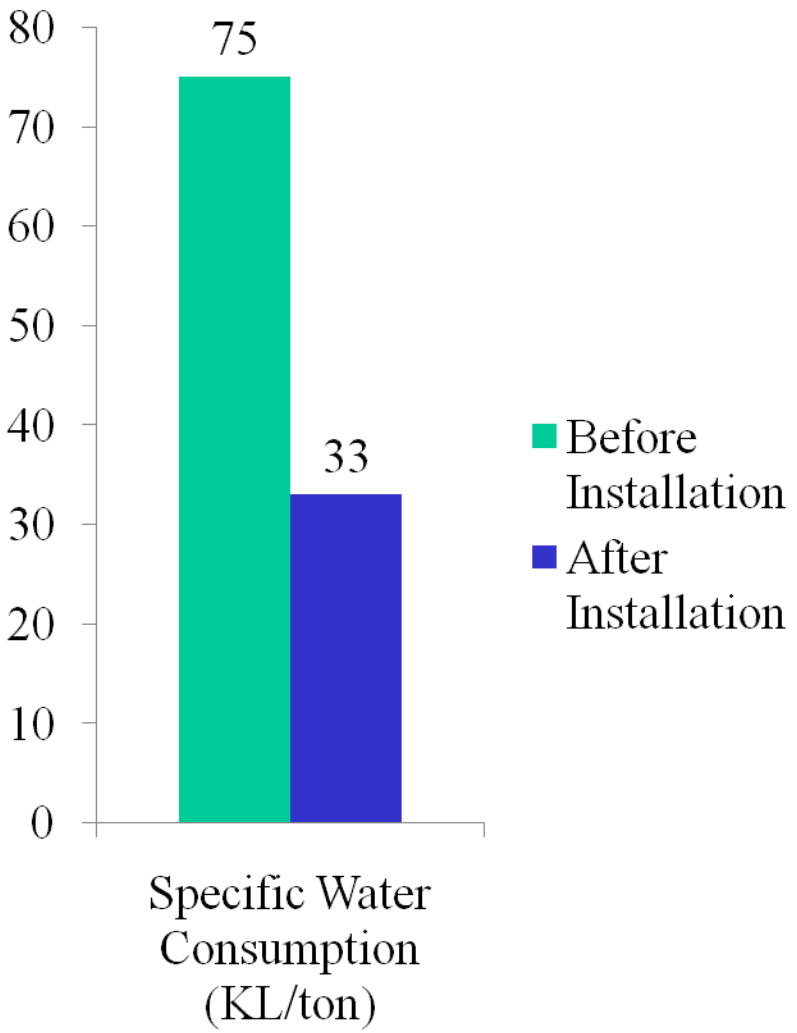


REDUCTION IN EFFLUENT GENERATION UPTO 22%



REDUCTION IN SPECIFIC WATER CONSUMPTION UPTO 56%

- The mill was consuming around 6000 KL/day of Freshwater and was producing 80 TPD of paper.
- SWC of the mill was 75 KL/Ton before FICCI Intervention.
- After intervention SWC is 33 KL/Ton (Mill consuming around 3000 KL/day of Freshwater and has also increased its production capacity to around 90 TPD).



FICCI has helped its clients in reducing their Water Footprints by reducing their freshwater consumption by 10- 50% and reducing their wastewater generation and cost reductions

Resource Conservation & Management (RCM) Group

- An Empanelled Accredited Energy Auditing Organization with Bureau of Energy Efficiency (BEE) for conducting Mandatory Energy Audits and Monitoring & Verification Audits under Energy Conservation Act 2001
- Notified Water Auditing Agency by Central Ground Water Authority, GoI

SERVICES OFFERED

Energy Efficiency and Demand Side Management

Water & Wastewater Audits

Environment Management

Occupational Health & Safety Management

National Level Studies For Policy Development

Training & Capacity Building

RCM Services helps you in

Reducing Production Costs, by reducing energy & water bills, saving resources

Reduced water footprint, by conserving water, increased recycling of water, achieving ZLD

Achieving Sustainable growth through optimum use of resources and waste minimisation

Reduced green house gas emissions by improving energy, water & resource use efficiency

Improvement in Occupational Health & Safety

FICCI

Partial List of Our Indian Clients – for Water Management Study

Water Management Audits– List of Industries

- IISCO-SAIL, Burnpur (Iron & Steel)
- Cairn India Limited, Surat and Rajasthan (Oil & Gas Exploration)
- JK Paper, Surat and Orissa (Pulp & Paper)
- Vardhman Limited, Ludhiana (Textile)
- Indian Oil Corporation Ltd., Bongaigaon (Oil Refinery)
- Birla Century, Jagadia (Textiles)
- Upper Doab Limited, Shamli (Sugar)
- Hindustan Zinc Ltd, Bhilwara (Zinc)
- ITC Limited, Munger (Cigarette Manufacturing)
- ACC Limited, Barmana, HP (Cement)
- RBI, Chennai (Government Office & Staff Quarters)
- NTPC Limited, Kayamkulam (Power Plant)
- NTPC Limited, Faridabad (Power Plant)
- Essar Steel Limited, Visakhapatnam (Iron & Steel)
- Bharat Petroleum Corporation Ltd., Mahul (Oil Refinery)
- Bharat Aluminium Company Ltd. (BALCO), (Aluminium)
- United Breweries Ltd., KBDL, Bangalore (Beverages)
- JK Lakshmi Cement Limited, Sirohi (Cement)
- Century Cement Ltd, Raipur (Cement) etc……..

RCM Activities : International

Global Footprint for Resource Conservation & Management Services

- Senegal
- Luxembourg
- Czech Republic
- Kenya
- France
- Italy
- Zambia
- India

Some of our Government & International clients

British High Commission

Thank You

We are here to serve you

Karishma Bist
Additional Director
FICCI - Resource Conservation & Management Group
Email: karishma.bist@ficci.com