Confronting Climate Change - Towards Carbon Neutral Indian Cities

New Solutions for Water Supply and Demand Side Management in a Climate Change Context

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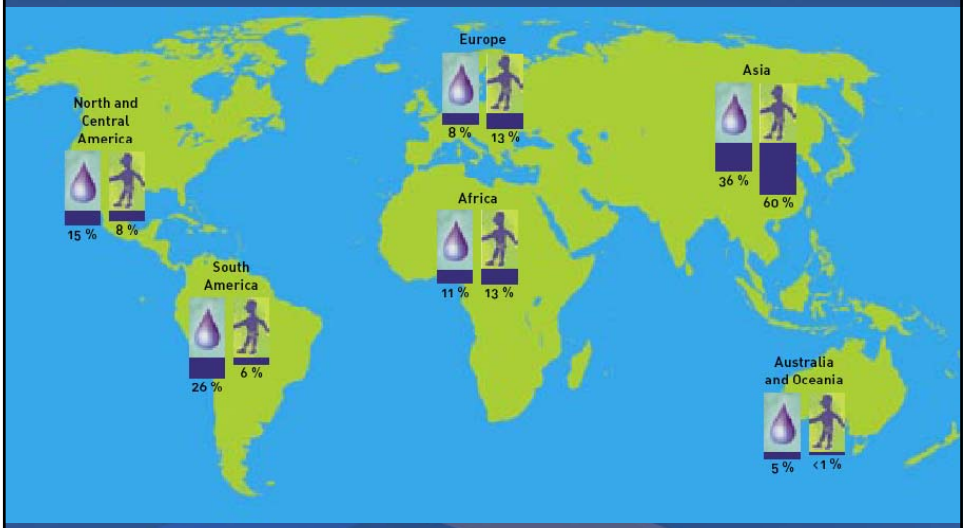
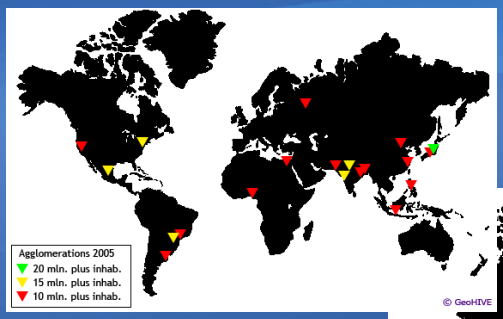
People and Water



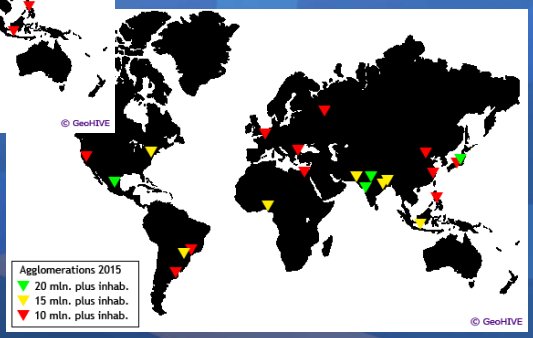
Asia: 60% of world population, 36% of world's water

The urban water challenge Growing - and thirsty - mega cities



Large cities 2005

Large cities 2015



Asia-A region with Challenges

- 1/6 world population
- 2/3 global population growth
- Increase in urban population by 60% by 2025

Serious water challenges to sustain population and economic growth, such as:

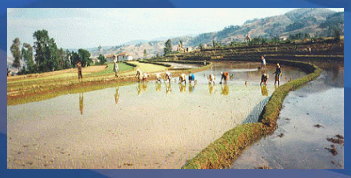
- Water for basic needs (drinking water and sanitation)
- Water for the growing cities
- Water for food
- Water for energy

- all to be affected by climate change

The food challenge- a 'real' water problem

Securing basic water needs takes 50 l/cap/day
=> a political will problem!
Securing our basic diet takes 2500 l/cap/day
=> A water problem !

Increased demand due to:
- Rising living standards
-



The energy challenge - shifting towards more hydro and biomass

- 5-8% annual growth in electricity consumption in most AP countries
- Climate change => more focus on renewable energy:
- Biomass and hydropower 96% of renewable energy => pressure on water
  - example: Planned hydropower on the Ganges
- Bio-fuel production as an energy solution, but with a significant water bill
  - 1000-2000 l water per 1 l bio-ethanol

The environment challenge- ecosystems paying the price ?

- 50% of all freshwater species disappeared in the 20th century
- Big rivers not reaching the sea (ex. Yellow river (china)
- Lake disappearing (ex. Aral Sea)

A 'good question':

Do we solve these problems by simply supplying more – at a potentially high environmental and social cost?

Or do we try to live within our means, looking for savings before going to the bank?

Water and climate change: the added challenge!

The overall picture

IPCC WG 2 Fourth Assessment Report, 2007:

5 key impacts of global warming :

- Water
- Ecosystems
- Food
- Coasts
- Health

All linked to water!

The overall picture

Global warming will "hit through water":

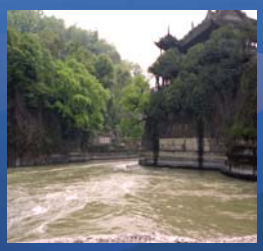
- Through climate change and the effects of e.g…
  - changes in the hydrological cycle and water balance
  - sea level rise
  - increased water temperatures

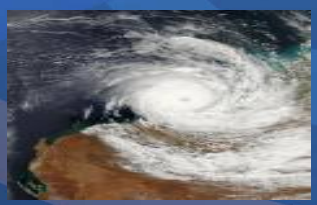
- Through increased climate variability in the
  - more serious and frequent extremes (floods, droughts, typhoons)

A message to take from the IPPC report

Energy is the focus for mitigation

Water must become focus of adaptation





Adaptation to climate change

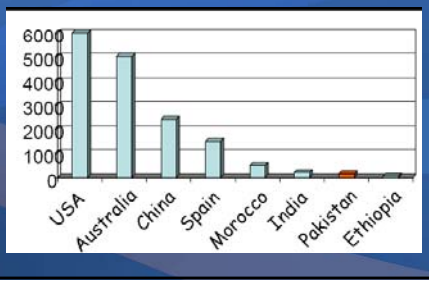
Adaptation to CC –Hard Solutions

- dams : storage to bridge the gap!!
  * 5000 cum/cap storage in Australia and the US
  * 10-20 cum/cap in many Asian countries (India nearly 200 cum/capita)
    => dams are still needed

- dikes, levees, sewer networks, drainage canals

- eco-sanitation : de-coupling water and sanitation

- desalination

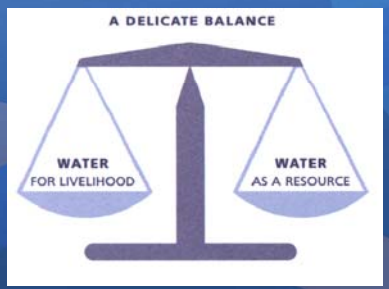


Adaptation to CC –Soft Solutions

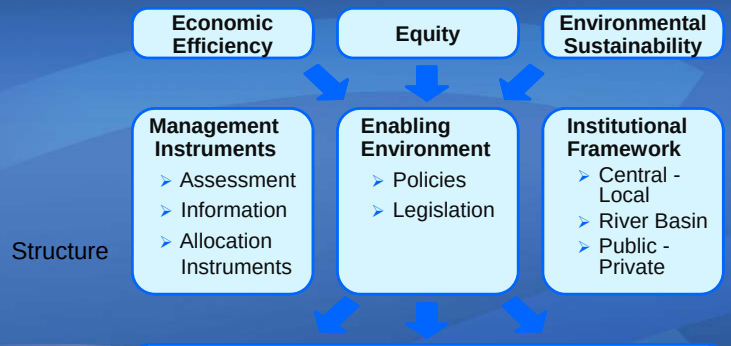
- demand management!
- efficiency (ex. crop per drop), reuse
- salt- and drought resistant crops
- watershed management
- groundwater recharge
- flood proofing, flood retentions measures, insurance etc.
- global trade / virtual water

The way forward:

Integrated Water Resources Management (IWRM)



IWRM Components



The three "E"s
The three "pillars" of IWRM

Defining Water Demand Management

Many definitions - some short ones:

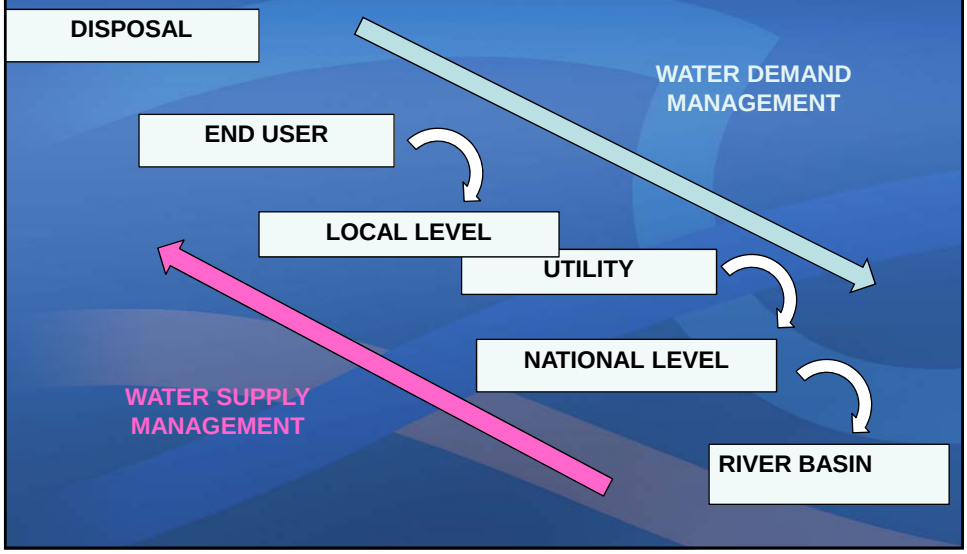
"Any measure or initiative that will result in the reduction of the expected water use or water demand"

Or simply

"… making the most of the available water"
" ... living within ones means"
" … a no-regret adaptive strategy to climate change and variability"

From source to end user

- the cascading benefits of WDM by an end user



WDM: "narrow" or "broad" definition

The "narrow" definition:

WDM influencing water demand only

The "broad" definition:

Include increased supply from non-traditional water sources:

- ✓ 3R: Recharge, Recycling, Reuse
- ✓Leakage control
- ✓Rainwater harvesting
- ✓ Desalination
- ✓Other

(=> towards IWRM)

WDM: A multi-dimensional challenge

	AGRI-CULTURE	DOMESTIC	INDUSTRY ENERGY	OTHER
AWARENESS	*Paradigm! Extension*	*Education Habits*	*CSR*	
TECNNOLOGY	*Efficiency 3R*	*Efficiency*	*Recycling*	
PLANNING-		*-- IWRM --*	… and some examples..	
REGULATION	*Restriction*	*Restriction*		*In-stream uses:* *Ecosystem Navigation Recreation*
ECONOMIC	*Pricing*	*Tariffs*		
ALLOCATION	*Markets*			
VIRTUAL WATER	*Trade*		*Trade*	

Agriculture:
How to make the change

Getting the water to the plant
- more crop per drop

by changing mind-sets in the sector
- Upgrading rain-fed agriculture
- Reforming irrigation

by mechanisms such as
- Realistic water pricing
- Investing in better technologies
- Improving farm water management
- Trade and water markets
- Regulating crop types

The virtual water trade, and water demand management

Example:

- Mexico imports grains from the USA which requires 7.1 cu.km to produce in USA
- Same amount produced in Mexico would have required 15.6 cu.km
- I.e. a water saving of 8.5 cu.km results from this trade.

Globally:

Agricultural water savings from "efficient exporters" to "inefficient importers"

- 5% of global agricultural water use

- i.e. significant gains!

Agriculture: The virtual water trade

Virtual water, or "water footprint": the amount of water embedded in products:

- Maize : 900 cum/ton
- Brown rice: 3,000 cum/ton
- Rice in India 15000 cum/ton

(45% of total water consumed for irrigation)

- Beef : 15,500 cum/ton

Total global virtual water flows:

- Total global water use : 7,450 cu.km/yr
- Total virtual water trade: 1,650 cu.km/yr , i.e. 16%
  - -- 61% crops and crop products
  - -- 17% livestock
  - -- 22% industrial

Domestic water demand management

A telling example: Brisbane Australia:

18% reduction already achieved,
30% the goal, by:

- Metering and associated pricing
- Introduction of water efficient devices
- Restrictions in garden watering
- Better plumbing
- Educational campaigns
- Lowering water pressures

Domestic water demand management -some European experiences

Metering:

- Savings from metering: 10-25%
  (- more when combined with pricing!)

Drivers of savings:

Drop in per capita water use in Copenhagen:

- 40% due to pricing
- 60% due to education

Leakage:

- Ex. France 30% -> Albania 75%
  - an obvious place to start saving!

Joint domestic and agricultural water demand management

An example: Israel:

Policy since 1990's to increasingly replace irrigation water with treated wastewater effluents
- 65% reuse by 2003

(Sewerage costs borne by city; reuse costs borne by agriculture)

Industry

The potential:
- The good old "Factor 4":
  Produce the double with half the amount of water
- Potential 90% saving by recycling/recirculation

The European "Water Stewardship" and "Aquawareness" program:
- Collaboration EWP, European Parliament, big industry

.. Corporate Social Responsibility (CSR) -> water
.. possibly towards water labeling in Europe

The Energy and Water Foot Prints are Closely related in many ways

Energy: the water footprints

Water for energy

Energy and power production requires water:
- **Thermoelectric cooling**
- **Hydropower**
- **Minerals extraction and mining**
- **Fuel production (fossil, non-fossil)**
- **Bio-fuels (-fuelling food crisis!)**

Energy for water

Water production, processing, distribution, and end-use requires energy:
- **Pumping**
- Transport
- Treatment
- Raw water (GW,SW)
- **Desalination**

Water footprints for energy development

Energy footprints for water development

Water Footprints: some everyday examples

Product	Water consumed (liters)
1 cup coffee	140
1 glass milk	200
1 liter bio-ethanol	1200
1 cotton T-shirt	2000
1 hamburger	2400
1 pair leather shoes	8000

- a great pedagogical tool for water demand management!

Environment – the silent sector..

Environmental flows to sustain ecosystems livelihoods and biodiversity:

- **A legitimate demand without a voice?**

Would WDM thinking have saved the Aral Sea..?

CONCLUSIONS

WDM and WSM

WSM and infrastructure :

- Still required! ……
  …… but costly, risky, and with social and environmental consequences
  …… and consuming energy

WDM

- Enormous potential
- A "no regret" approach, not least considering climate change

=> an obvious "low hanging fruit" to pick first

WDM

	AGRI-CULTURE	DOMESTIC	INDUSTRY ENERGY	OTHER
AWARENESS				
TECNNOLOGY				
PLANNING		*IWRM*		
REGULATION				
ECONOMIC				
ALLOCATION				
VIRTUAL WATER	?			

- think holistic and integrated
- pick the winners first

Thank you!

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