

# Technical innovative approaches to reducing urban water use

Lecture 3

Janez Susnik

# Technical innovative approaches to urban water management

- Will explore options for reducing water use in cities
- Case studies will be used to illustrate real world examples

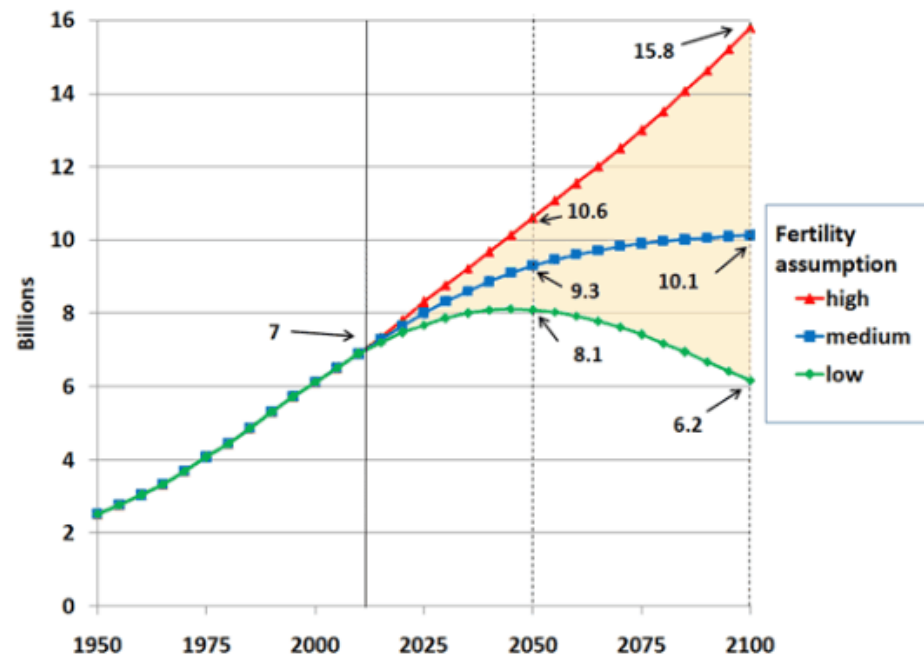
# Overview

- Why the need for reduction?
- Innovations for water supply sustainability
- Case examples

# The need for urban water use reductions

- Currently 3.5bn urban residents
- Projected to be 7bn by 2100 (today's entire global population)
- These people need sustainable water and sanitation services

UN Projections of World Population Under Three Fertility Assumptions



# The need for urban water use reductions

- Fastest urban growth in developing nations
- Water supply issues already a problem
- Climate change may lead to more erratic supply
- Financial and institutional challenges

# The need for urban water use reductions

- Many cities already unsustainably using water
- 12% of large cities transfer water across basins, moving 30bn km<sup>3</sup> a year.
- Water can be transported up to 100km to the city

# Innovations for water supply sustainability

- **Desalination - benefits**
- Decouples supply from finite and unreliable freshwater sources
- Year-round supply
- Boosts supply to water-scarce areas



# Innovations for water supply sustainability

- **Desalination - drawbacks**
- Highly energy intensive, therefore expensive
- Requires coastal location
- Pollution issues – returns very saline water to the sea



# Innovations for water supply sustainability

- **Desalination – examples**
- Arab states – using solar energy to reduce dependence on fossil fuels
- London – ‘emergency’ plant is fully operational due to demand

# Innovations for water supply sustainability

## Re-use of treated wastewater - sources

- Rain/Stormwater
- Showers/water from washing-up
- Industrial/commercial wastewater
- Water from toilets

# Innovations for water supply sustainability

## Re-use of treated wastewater - uses

- Irrigation
- Car washing
- Municipal parks/watering gardens
- Water for toilet flushing
- Drinking....

# Innovations for water supply sustainability

## Re-use of treated wastewater - benefits

- Makes use of 'waste' water that can be treated and used again
- Reduces demand on freshwater
- Reduces potential conflicts between users

# Innovations for water supply sustainability

## Re-use of treated wastewater - drawbacks

- Requires treatment and distribution infrastructure
- Energy cost
- Quality issues
- Public acceptance issues – especially if used for drinking (fear over quality)

# Innovations for water supply sustainability

## Unconventional water sources - sources

- Rainwater harvesting
- Fog-collection systems (e.g. Peru)
- Usually locally specific



# Innovations for water supply sustainability

## Unconventional water sources - benefits

- Usually small scale, sustainable solutions
- Quite often low energy requirements
- Augment 'normal' supply

# Innovations for water supply sustainability

- **Unconventional water sources - drawbacks**
- Supply can be of small volume
- Can be unreliable
- Seen more as a backup



# Innovations for water supply sustainability

## Sustainable urban drainage systems (SUDs)

- Wide variety of methods to capture and use rain and stormwater
- Reduces flood risk, improves urban water quality, lowers 'heat island' effect and supplies water

# Innovations for water supply sustainability

- **Sustainable urban drainage systems (SUDs)**
- Contributes water for non-potable uses – reduces demand and competition
- Lowers flood risk
- Can create pleasant urban environment



# Innovations for water supply sustainability

- **Sustainable urban drainage systems (SUDs)**
- Require infrastructure upgrades
- Many systems need specialist installation
- Water contribution/saving can be small if poorly designed

# Innovations for water supply sustainability

## Water pricing and social attitudes

- Tariff design to encourage water saving behaviour
- Change behaviour to make excess use unacceptable
- Develop awareness about water resources

# Innovations for water supply sustainability

## Water pricing

- Extremely challenging – how to be equitable?
- Water – a UN human right
- Poor should not be penalised
- Heavy/excessive use should be
- Socially and politically a difficult issue

# Innovations for water supply sustainability

## Water pricing

- Does mean at least cost recovery if planned well
- Services and performance can be improved
- Raises awareness – reduces demand

# Innovations for water supply sustainability

## Social attitudes

- Make people aware of pressing water issues
- Encourage saving behaviours
- Exploit peoples' 'competitive nature' (see Laskey's 2013 TED talk for an example)

# Innovations for water supply sustainability

## Social attitudes

- Extremely difficult to change
- Long term commitment required



# Innovations for water supply sustainability

## Speculative innovations

- Water and energy from sunlight and seawater
  - Proof-of-concept greenhouse in Qatar
  - Uses only sunlight and seawater
  - Generates good food yields and...
  - Energy from turbines from solar heated water and
  - Water from plant condensation and collection

# Innovations for water supply sustainability

## Speculative innovations

- Water and energy from sunlight and seawater
  - Is it scalable to cities?
  - Financial feasibility?
  - Could offer local scale solutions if further developed



# Innovations for water supply sustainability

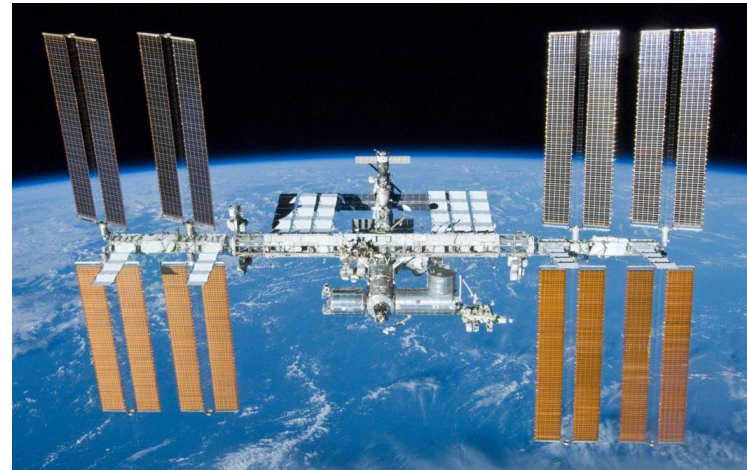
## Speculative innovations – space station technology

- Astronauts on the international space station are the most water scarce people!
- They get water from an almost 100% efficient recycling system
- Everything is recycled and reused....

# Innovations for water supply sustainability

## Speculative innovations – space station technology

- Sweat, water in respiration, urine, condensation
- Appears extreme, but shows what is possible
- Issues of scaling to cities and financial cost



# Case example - Singapore

- 'Model' city
- Advanced water supply and sanitation services
- 4-taps approach (4 different and complementary sources)
  - Transfers
  - Desalination
  - Catchment water
  - Treatment and reuse
- Also separate potable/non-potable waters



# Case example - Singapore

- Tariffs are optimally set
- Low flow showers and washing machines are mandatory
- From savings, Singapore will eliminate its dependence on water transfers by 2060.

# Case example - Lagos

- 17-20 million people. Rapid development
- 90 l cap<sup>-1</sup> day<sup>-1</sup> 88% coverage
- But treatment plant often loses power and leakage is > 30%
- Sub-standard planning and large informal settlements. Demand not fully met

# Case example - Lagos

- Estimated \$3bn required
- Sea-level rise threatens aquifer water quality
- Increasing temperatures may increase demand and reduce rainfall
- Challenge is how to provide water and wastewater services in these difficult conditions



# Case example - Lagos

- Awareness and demand reduction
- Increased system efficiency
- Locally-tailored solutions for rapidly developing (informal) settlements – both for water and energy sustainability