



Presentation from  
**2015 World Water  
Week in Stockholm**

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# Optimizing Water and Energy Management in Cities

Selected cases from Africa and beyond

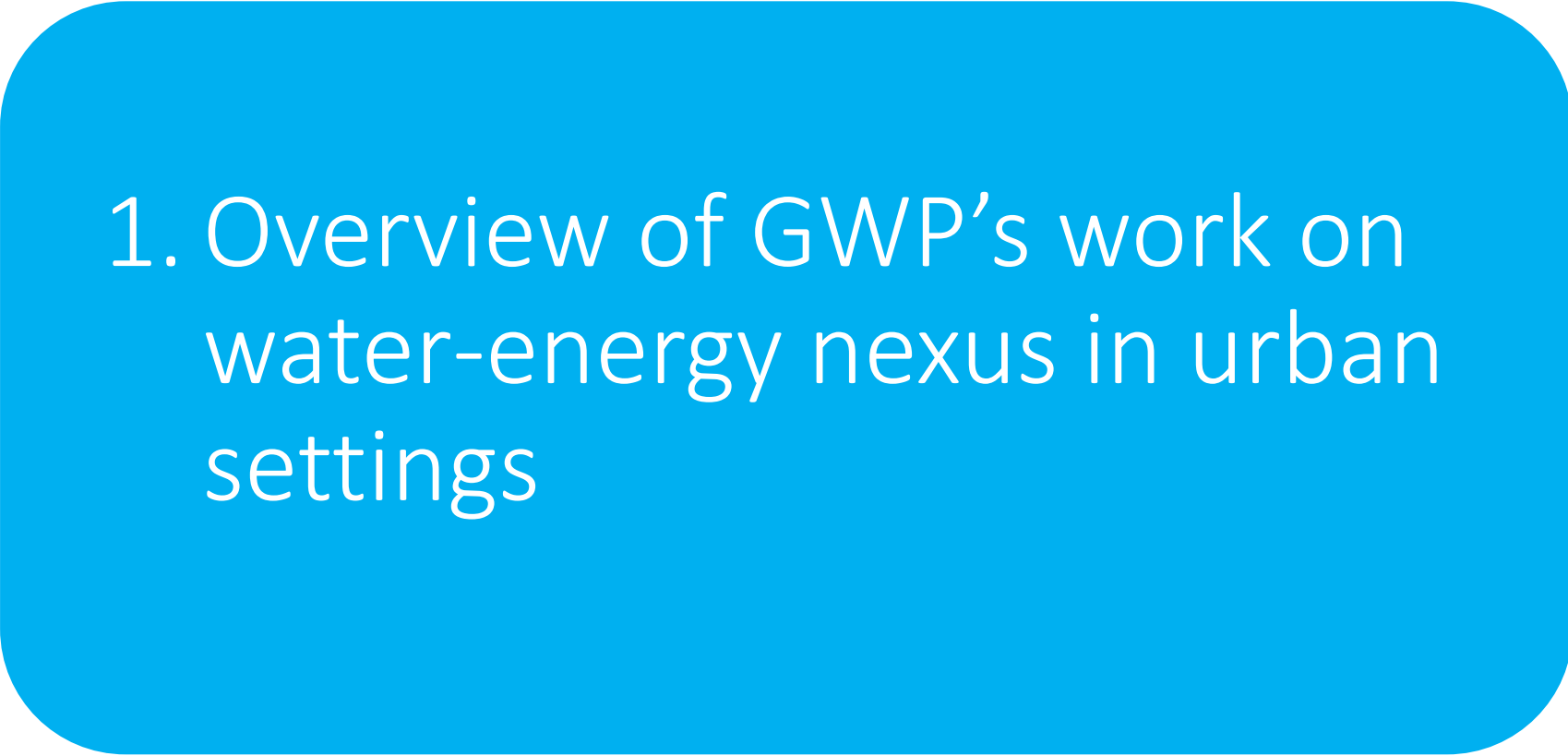

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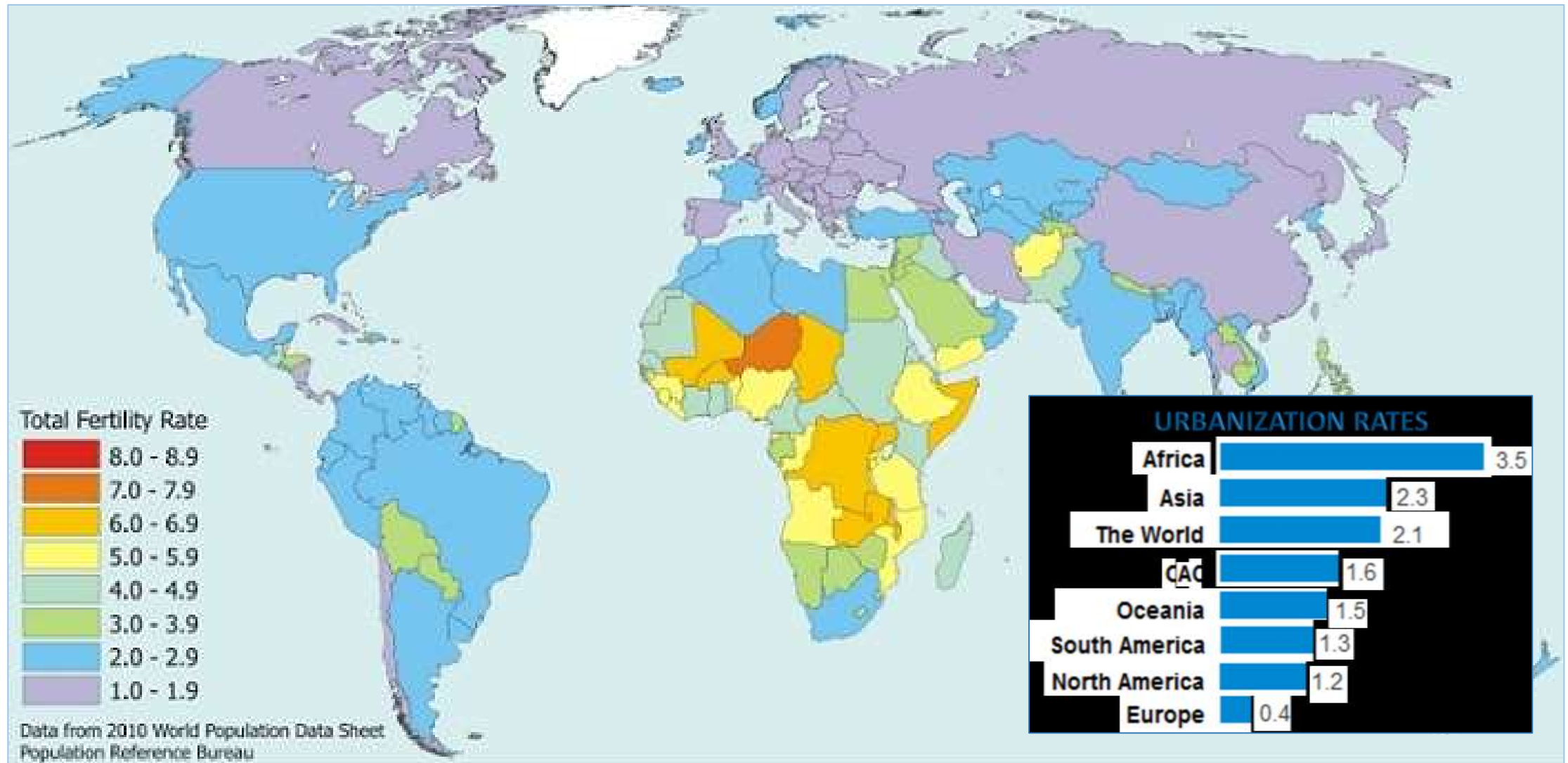
1. Overview of GWP's work on water-energy nexus in urban settings
2. Selected cases
3. Conclusions – Way forward



# 1. Overview of GWP's work on water-energy nexus in urban settings



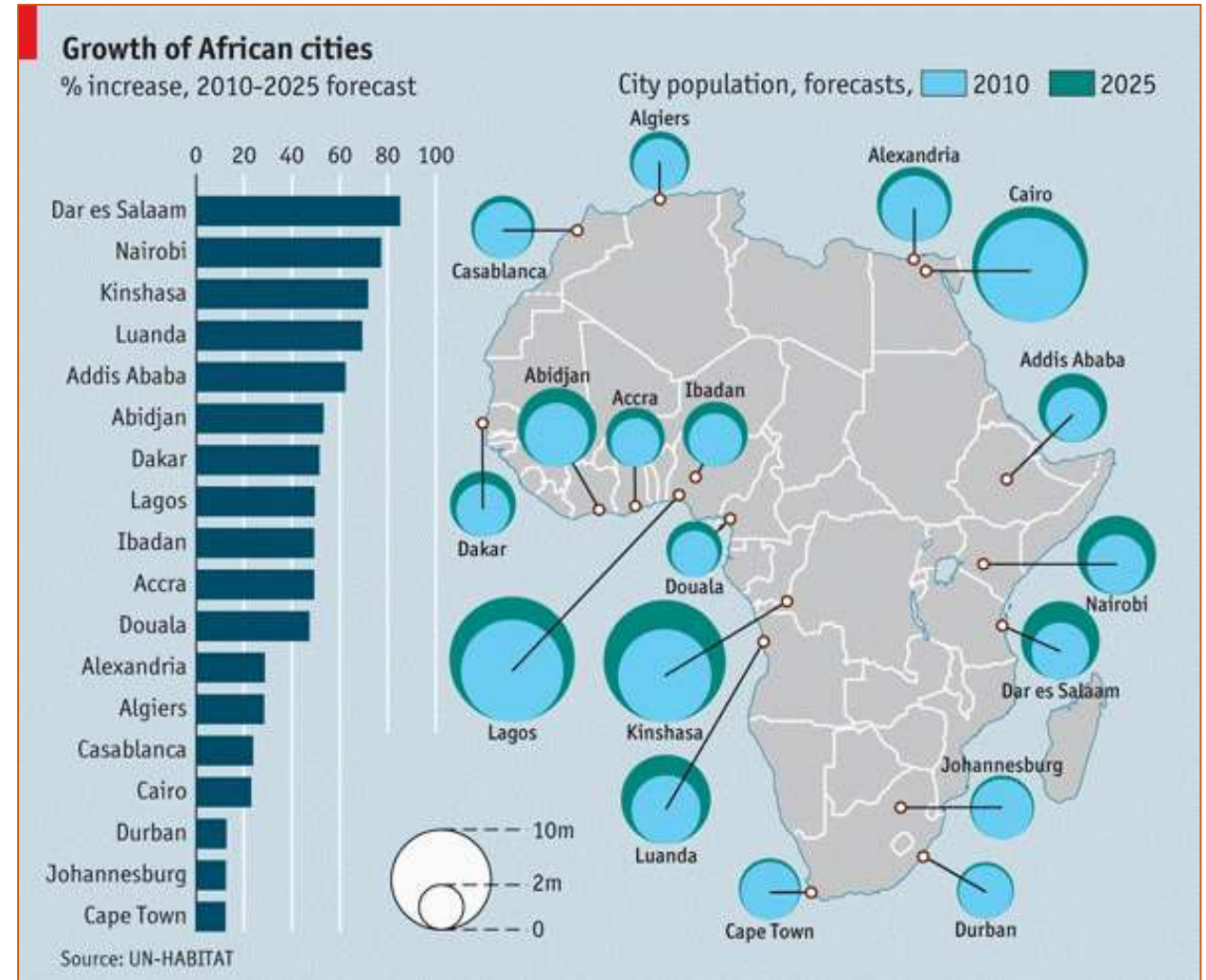
# Population growth, urbanisation, nexus





# Emerging mega-cities in Africa

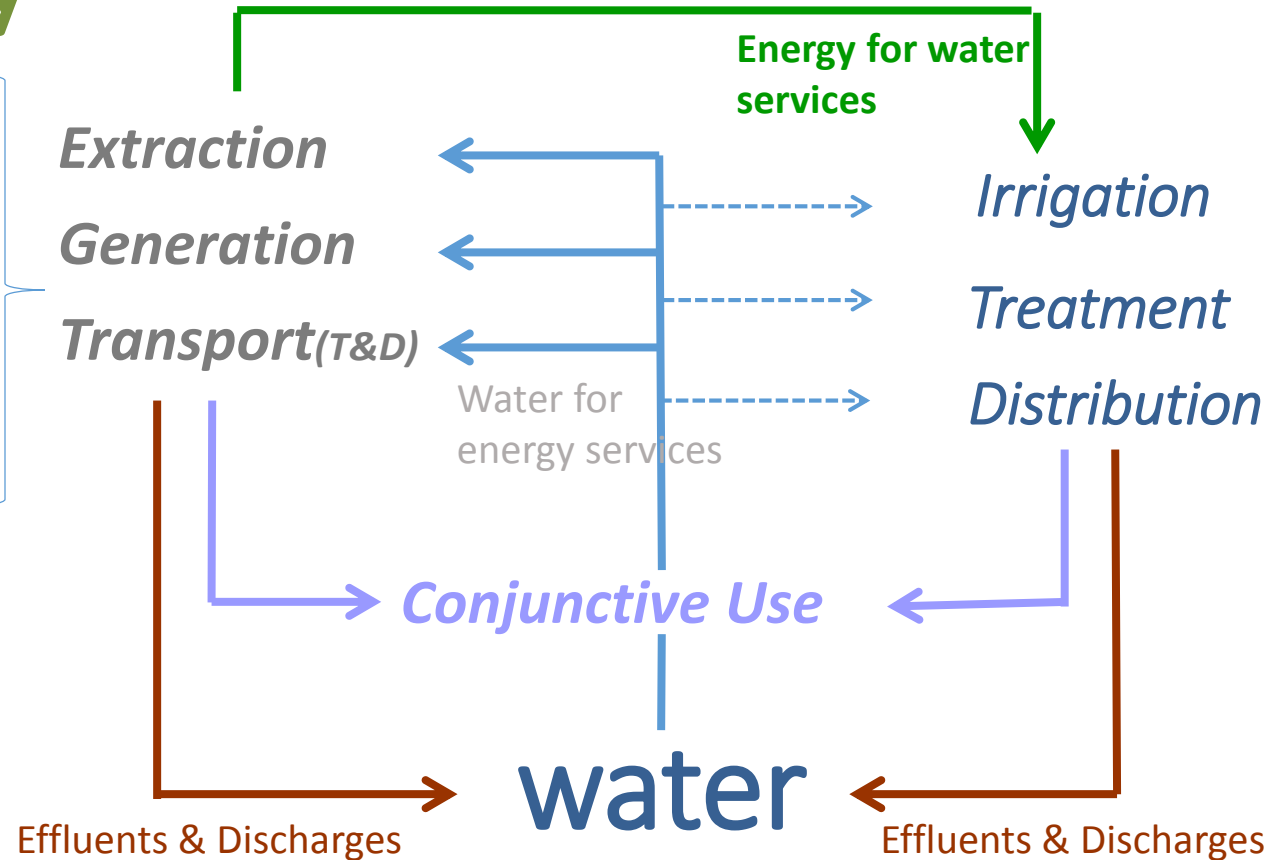
- By 2016 > 500 million Africans living in urban centres
- 65 cities with > 1 mill. people by 2016
- By 2030, Africa to host 3 of 10 world's largest cities
- Africa more urbanized (40%) than India (30%) and almost as urbanized as China (45%)
- Addressing urban dwellers' needs in water and energy a huge challenge



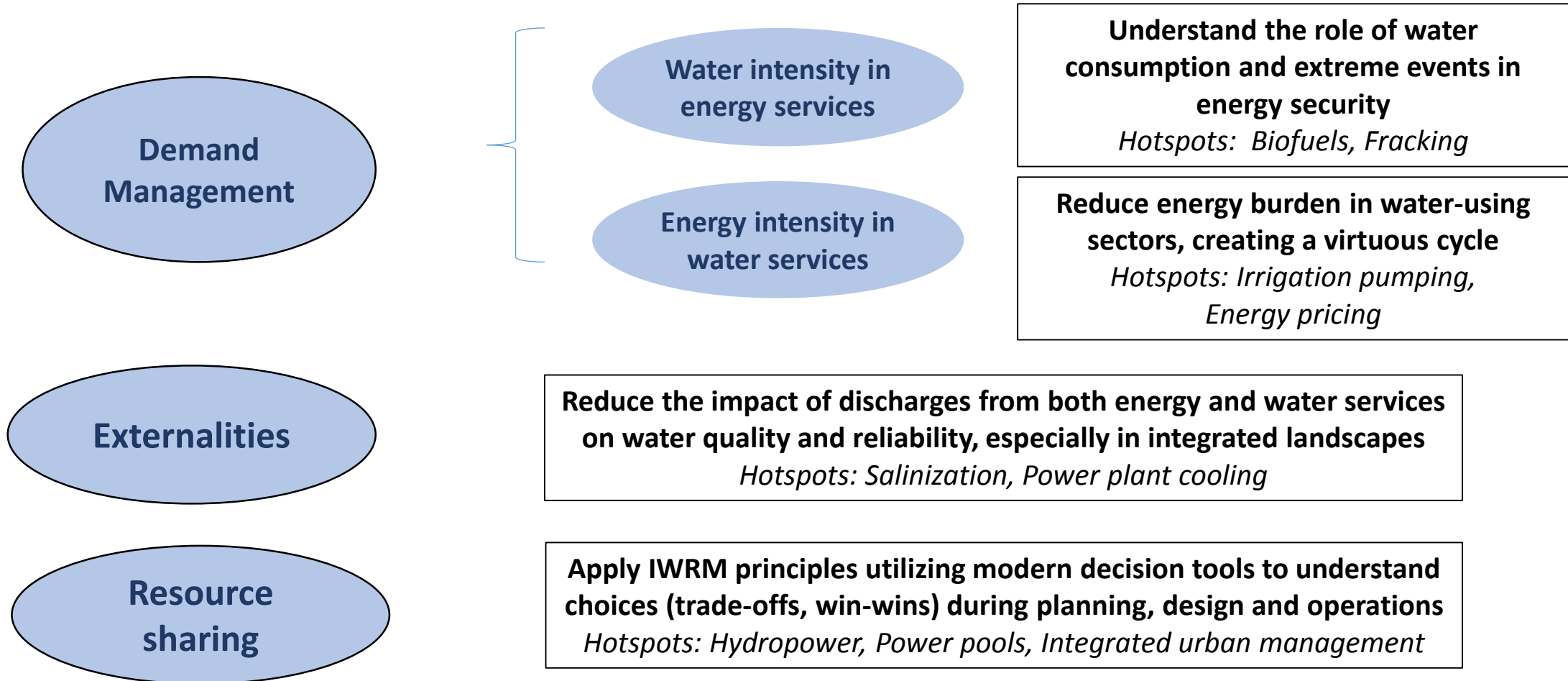
# Mapping the energy-water inter-linkages

## energy

*Biofuels*  
*Thermal*  
*Nuclear*  
*Renewables*  
*Geothermal*  
*Hydropower*



# Developing an integrated energy-water management (IEWM) framework

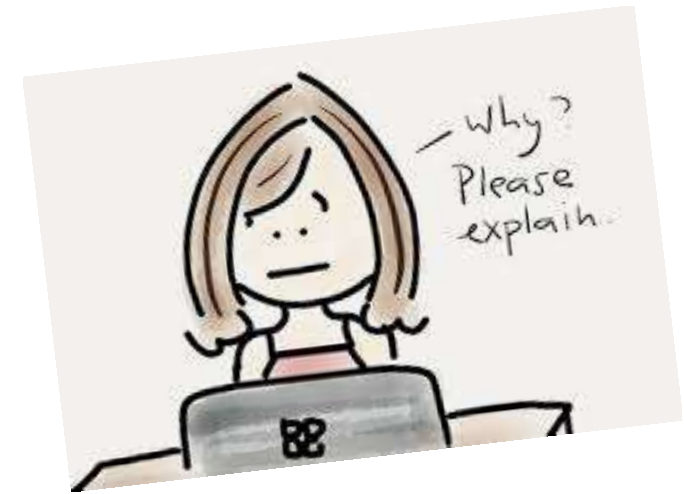




# Developing meaningful institutional inter-action

... between two different worlds...

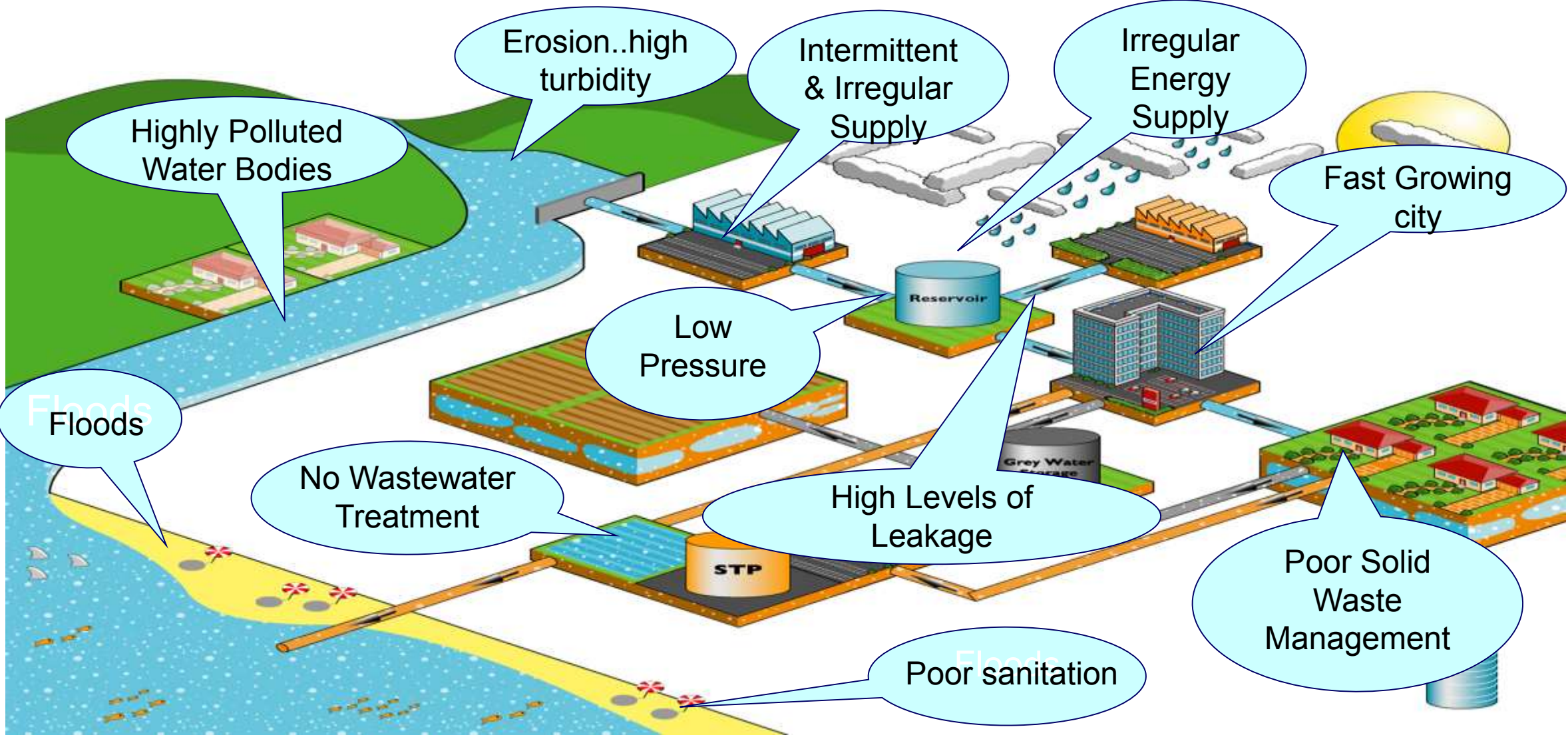
Energy 'sector'	Water 'sector'
<ul style="list-style-type: none"><li>• Plant manager</li><li>• Utility/Company</li><li>• Dispatchers/Distribution</li><li>• Regulator</li><li>• Power pools</li><li>• Ministry of Energy</li><li>• <i>Cttee on Water Resources</i></li><li>• <i>Cttee on Climate Change</i></li><li>• <i>Cttee on Sustainable Dev.</i></li></ul>	<ul style="list-style-type: none"><li>• Farmers</li><li>• Water user associations</li><li>• Water authorities</li><li>• Private suppliers</li><li>• Basin organization</li><li>• Ministry of "Water"</li><li>• <i>Cttee on Water Resources</i></li><li>• <i>Cttee on Climate Change</i></li><li>• <i>Cttee on Sustainable Dev.</i></li></ul>



... and overcoming the challenges:


- different languages
- different spatial scales
- different priorities and incentives
- different market and political status
- deep uncertainty and unpredictability

# Addressing additional complexity in cities...





## 2. Selected cases

- Sewage-to-energy project in Dakar, Senegal
  - Integrating water and energy dimension in the Master Plan of Kinshasa, DR of Congo
  - Addressing energy security in local communities of Bughesera Catchment, Burundi-Rwanda
  - Rooftop solar water heaters in Mediterranean cities
- 



# Case 1: Sewage-to-energy project in Dakar, Senegal





# Case 1: Sewage-to-energy project in Dakar, Senegal

## Overall objective:

- **Reuse of sewage sludge as fuel** to create added value to sewage by-products
- Foster improved management of the **independent sanitation sector** in Senegal



Population	Population (2012)	*Accès à l'assainissement (%)	Technologies	OMD (2015) %
Villages Dispersés (<10K)	7,498 925	49,00	Vip latrines	63
Villages (10K - 50K)	815,663	49,00	Latrines	63
Petites villes (50K - 100K)	361,217	89,00	Fosses étanches, fosses septiques, VIP, Pit Latrine, Latrine	78
Grandes villes (100K - 500K)	1,786 430	89,00	Fosses étanches, fosses septiques, VIP, Pit Latrine, Latrine, égouts	78
Villes (>500K)	2,539 273	89,00	Fosses étanches, fosses septiques, VIP, Pit Latrine, Latrine, égouts	78
Population totale	13,001 508	73,00		



# Case 1: Sewage-to-energy project in Dakar, Senegal

## Specific aims:

- Demonstrate that dried sludge has a calorific value comparable to solid fuels (wood, coal, etc.)
- **Optimise drying processes** to improve the quality of the dried sludge
- build a **pilote furnace to burn sludge** and create sufficient heat for used oils to reach temperature of 360°C
- Monitor the furnace's performances, quality and quantity-wise
- Characterize and quantify the **combustion residues**





## Case 2: Integrating water and energy dimension in the Master Plan of Kinshasa, DR of Congo



# Case 2: Integrating water and energy dimension in the Master Plan of Kinshasa



- 64% water supply coverage
- 10% community-managed
- Only septic tanks and latrines
- Waste mostly discharged into rivers

**2014**  
**10 mill.**  
**inhabitants**

➔

**2030**  
**15 mill.**  
**inhabitants**





# Case 2: Integrating water and energy dimension in the Master Plan of Kinshasa

## Project objectives:

- Address sanitation needs of Kinshasa
- Identify financing means

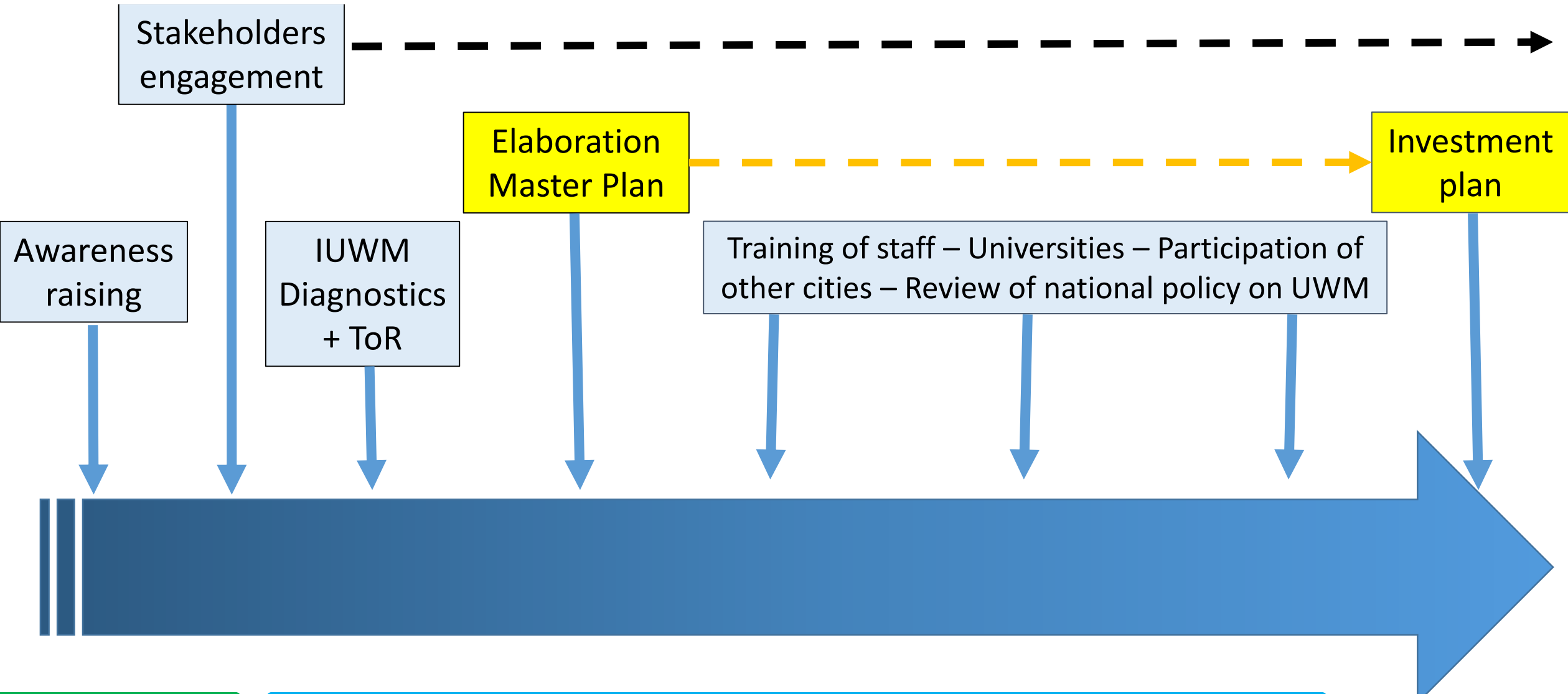
## Means:

- Water as a resource (grey water, biogas...) to help communities cover cost/price of water
- Creation of business opportunities
- Development of ToR for Kinshasa's Master Plan

**Partners:** African Water Facility, GWP



# Case 2: Integrating water and energy dimension in the Master Plan of Kinshasa



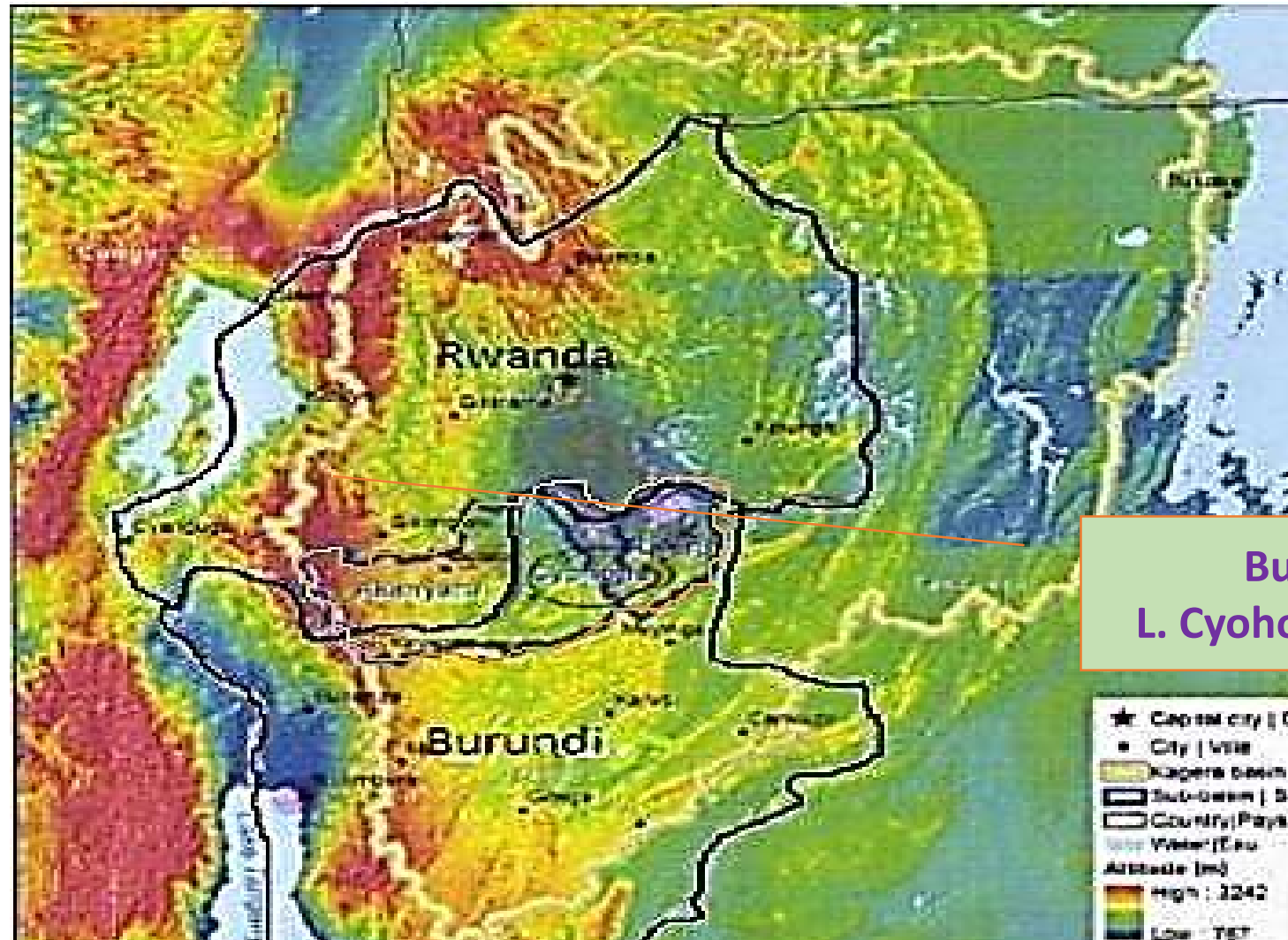




## Case 3: Addressing energy security in local communities, Bughesera Catchment, Burundi-Rwanda



# Case 3: Addressing energy security in local communities, Bughesera catchment



**Bughesera region:  
L. Cyohoha catchment-demo.**

# Case 3: Addressing energy security in local communities, Bughesera catchment



Priority Interventions	Mechanism for implementation
<b>Water:</b> Extending water supply systems to communities	Work with partners-Utility, local government Private suppliers/contactors
<b>Energy:</b> Introduce improved cooker stoves, biogas, afforestation to increase the forestry cover	Work with partners (CONCERN), community groups/associations (Women groups), private suppliers/contractors
<b>Food security:</b> new agronomic practices	Work with partners-Local Govt. office Community groups/associations
<b>Environment:</b> Lake Cyohoha buffer zone protection, upper catchment protection	Work with partners-RENGOF, Community Associations, Youth Group

# Case 3: Addressing energy security in local communities, Bughesera catchment



Priority Interventions	Mechanism for implementation
<p><b><i>Strengthen/establish Community structures for managing/producing:</i></b></p> <ul style="list-style-type: none"> <li>• water points</li> <li>• <b>Need for alternative sources of energy</b></li> <li>• <b>Improved cook stoves</b></li> <li>• Parts of the catchment: buffer zone, sub-catchment</li> <li>• L.Cyohoha catchment</li> <li>• Stakeholders' platforms</li> </ul>	<p>Work with partners-Local Govt., NGOs, Community Groups/Associations, Private suppliers/contractors</p>
<p><b><i>Awareness raising, CB, training on:</i></b></p> <ul style="list-style-type: none"> <li>• Challenges: environmental degradation, climate change, water scarcity, <b>energy security</b></li> <li>• Water and other NR management: importance, ownership and participation</li> <li>• Community structures</li> <li>• New approaches, methods, technologies, management</li> </ul>	<p>Work with partners-Local Govt., NGOs, Community Groups/Associations, Private suppliers/contractors</p>

# Case 3: Addressing energy security in local communities, Bughesera catchment

## 1. Construction of biogas digesters

- **Demo biogas digesters** built to be fed by cow dung and fecal sludges to produce **biogas energy**.
- **2 cooking stoves and 1 light bulb** installed in each HH's kitchen.
- Biogas energy **serving about 11 households with more than 118 family members** spread out in different villages.





# Case 3: Addressing energy security in local communities, Bughesera catchment

## 2. Construction of energy saving stoves

Hundred of households supported with improved cook stoves as part of:

- energy security** measures
- decreasing deforestation** for fire wood
- family **income saving** by reducing expenditures for buying charcoal
- use of **alternative source of energy** rather than hydro - efficiency and low cost.



# Case 3: Addressing energy security in local communities, Bughesera catchment

## Conclusions:

- **Key challenges** for communities: **poor access to fuel wood, use of inefficient and traditional cookers, poor level of awareness**
- Energy issues as **part of integrated management of water and other natural resources** in the catchment
- Energy security considered **throughout the process**: situational analysis, identification of interventions and taking actions
- Addressing **energy challenges** considered as **part of adaptation strategy**
- Water resources management was an entry point to **promote an integrated management of water and other natural resources**, and to **sustainable development**



## Case 4: Rooftop solar water heaters in Mediterranean cities



# Case 4: Rooftop solar water heaters in Mediterranean cities

## Concept:

- save conventional energy and money, making use of abundant sun in the region
- use flat roofes in modern urban dwellings to save space

**Result:** a sustainable, **cost- and resource-efficient** solution for HHs (savings est. at 2 mill. barrels oil or 320km<sup>3</sup> per year in Israel)

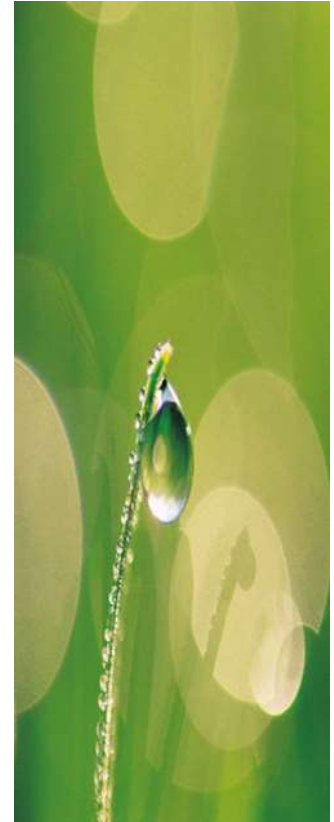
**Geographic scope:** Israel, Cyprus and Greece per capita leaders (> 30%–40% homes equipped) in solar water heaters use. Spain 1<sup>st</sup> with compulsory installation of PV in new buildings, and 2<sup>nd</sup> for solar water heating systems

In 1953, launch of Israel's 1st commercial manufacturer. Now world leader with 85% of the HHs equipped (3% primary national energy consumption)





# 4. Conclusions – Way forward





# Some opportunities, many challenges...

## Opportunities

- **Resource-sharing and conjunctive use** at source of water and energy in urban planning for new/small cities, leading to significant efficiency gains
- **Significant savings through multi-purpose infrastructure** and coordinated operations
- Possibility to design **semi-decentralised systems** (WTPs, SWTPs, PPs) and off-grid for smaller communities
- Integration of **features in architecture** (bioclimatic, saving devices, Solar PV on roofs, etc.)

## Challenges

- Extremely **rapid pace of urbanisation** a challenge for urban planners to anticipate number of HHs to be served and extent of geographic coverage
- Sheer **number and size of megapolis** in e.g. Asia, Africa, Latin America where a posteriori adjustments are difficult
- **Size and extent of infrastructure needed** for the delivery of services to the consumer (grids, water distribution systems, sewage systems)
- Securing sufficient **water and energy supply from outside** towards big urban areas

# No “one size fits all” solution...

- **Key stakeholders** – urban planners, water managers, energy utilities, etc. – need to cooperate for suitable solutions and to coordinate action
- **Inter-institutional mechanisms** to be set up and take into account future challenges in a dynamic world (rapid urbanisation, climate change...)
- High-tech, **state-of-the art private sector** to be involved to help foster innovative, tailor-made, leap-frog solutions
- **Flexible and sustainable financial mechanisms** to support long-term viability
- **Education and consultation of citizens and urban dwellers** to facilitate buy-in to modern, sophisticated infrastructure and technologies
- **Keeping it simple and affordable**, especially in rural, remote areas...

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your attention!

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