Presentation from

2016 World Water Week in Stockholm

www.worldwaterweek.org

Hydropower, Bioenergy and Water Resources in Sub-Saharan Africa

- Reflections and possible solutions

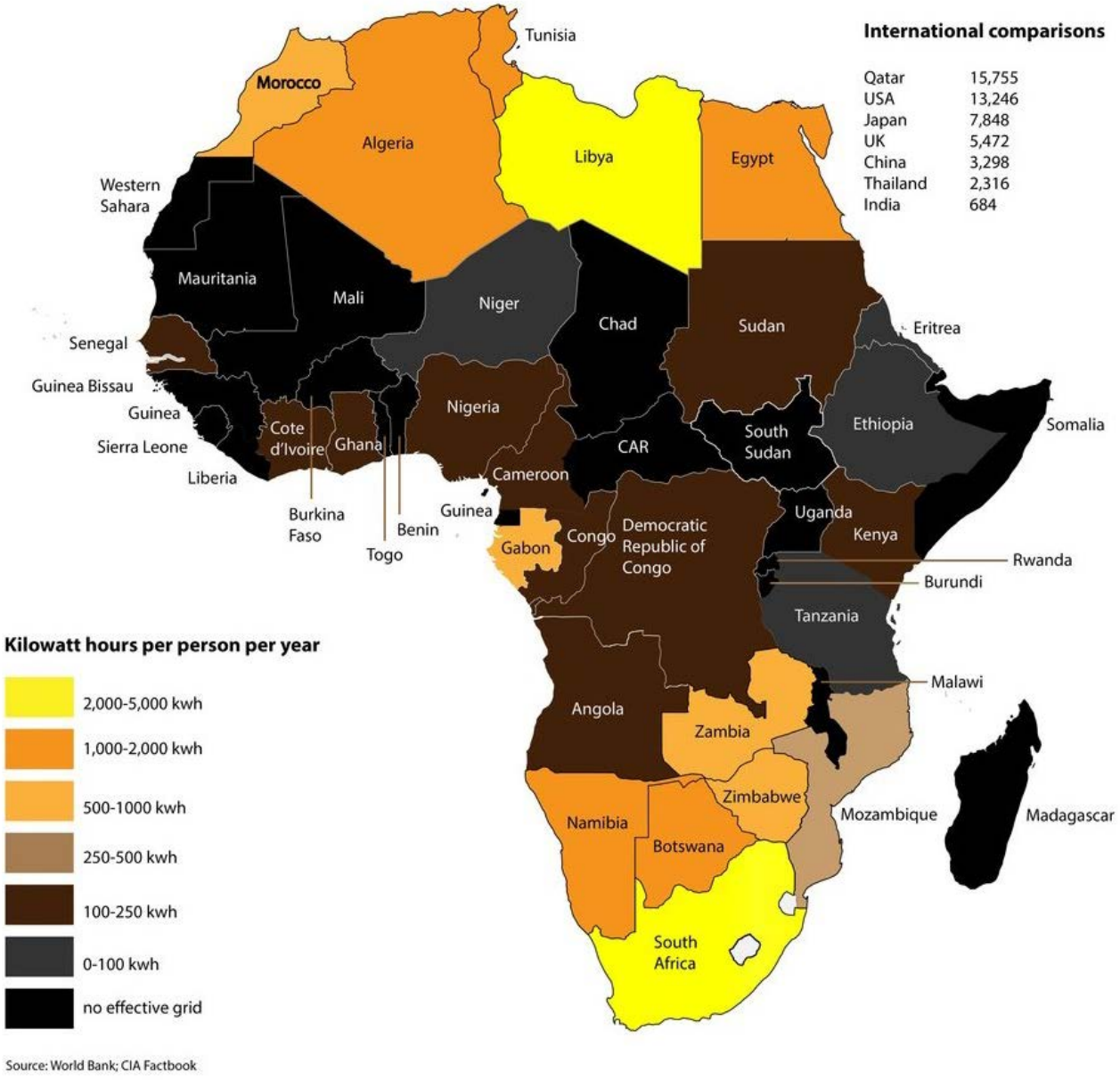
Angela Klauschen

World Water Week, Stockholm,
1st Sept. 2016

1. Energy Mix in Africa – the Big Picture

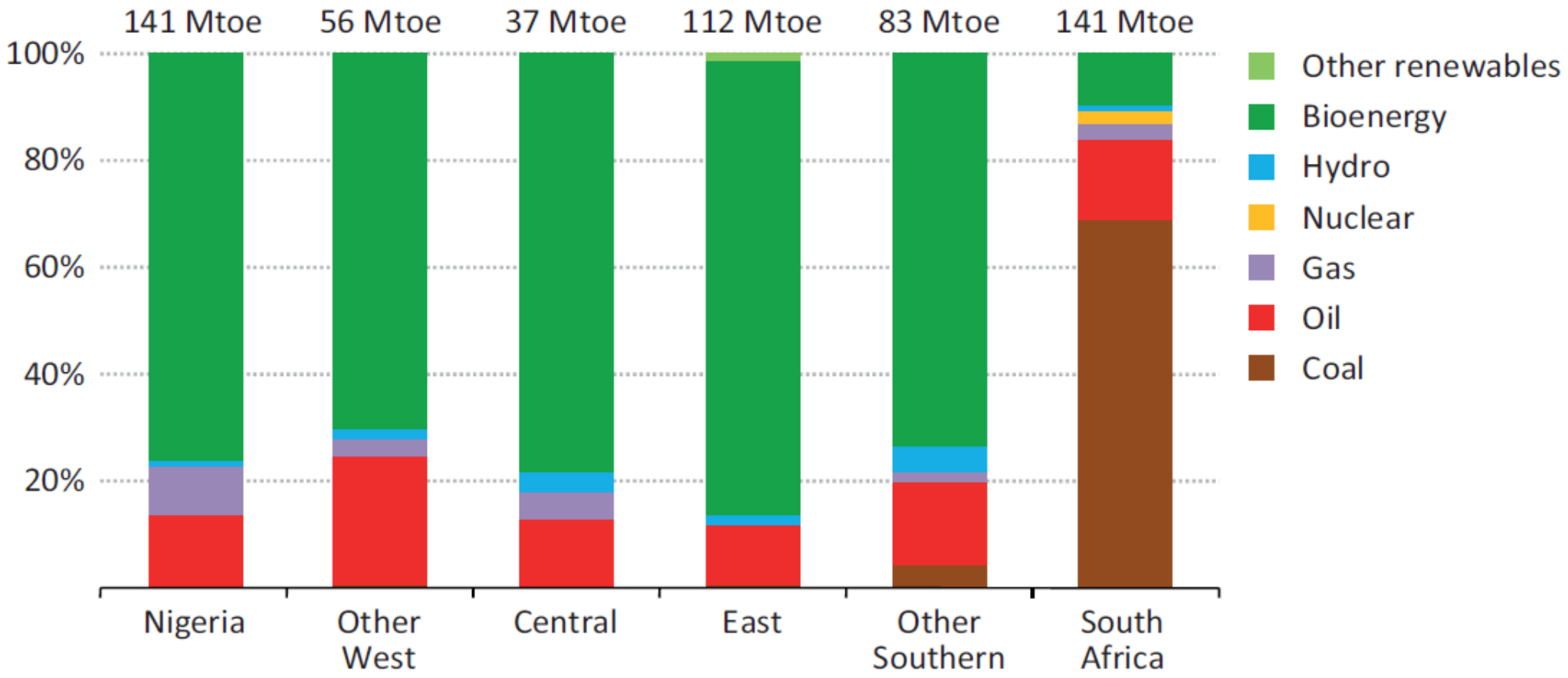
Energy Mix – The Big Picture

- 70% have **NO access to electricity**
- Only **68 GW installed capacity**, most in South Africa (60 GW)
- **< 50% of installed capacity on-grid**
- **traditional bioenergy (wood and charcoal) > 70%** (mostly for cooking) of total energy consumption, and increasing!
- Large-scale, centrally supplied electricity = very low, mainly for cities
- Oil-powered generators, solar PV off-grid (incl. solar cookers) = used mainly by small communities for lighting, small HH appliances (TV, cell phones)



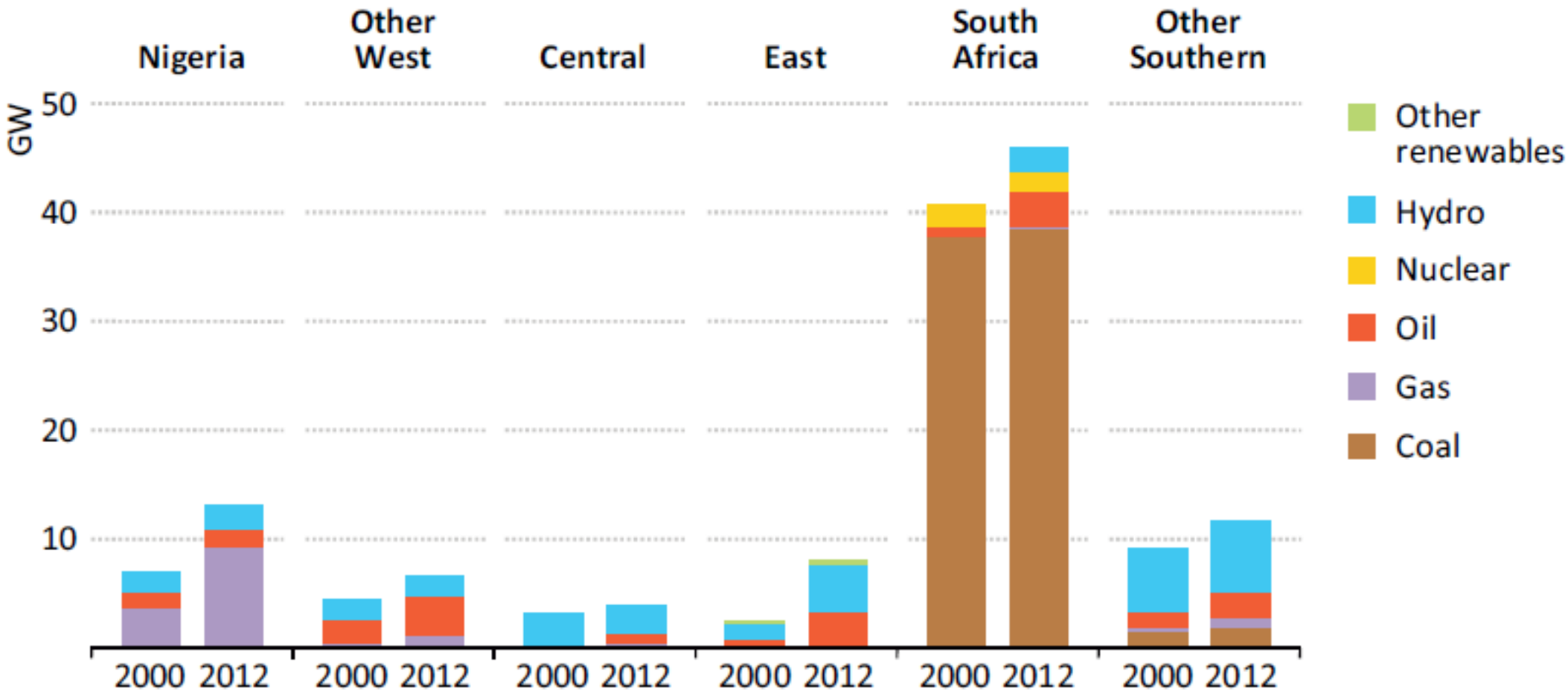
Primary Energy Mix in Sub-Saharan Africa

Figure 1.12 ▷ Sub-Saharan Africa primary energy mix by sub-region, 2012



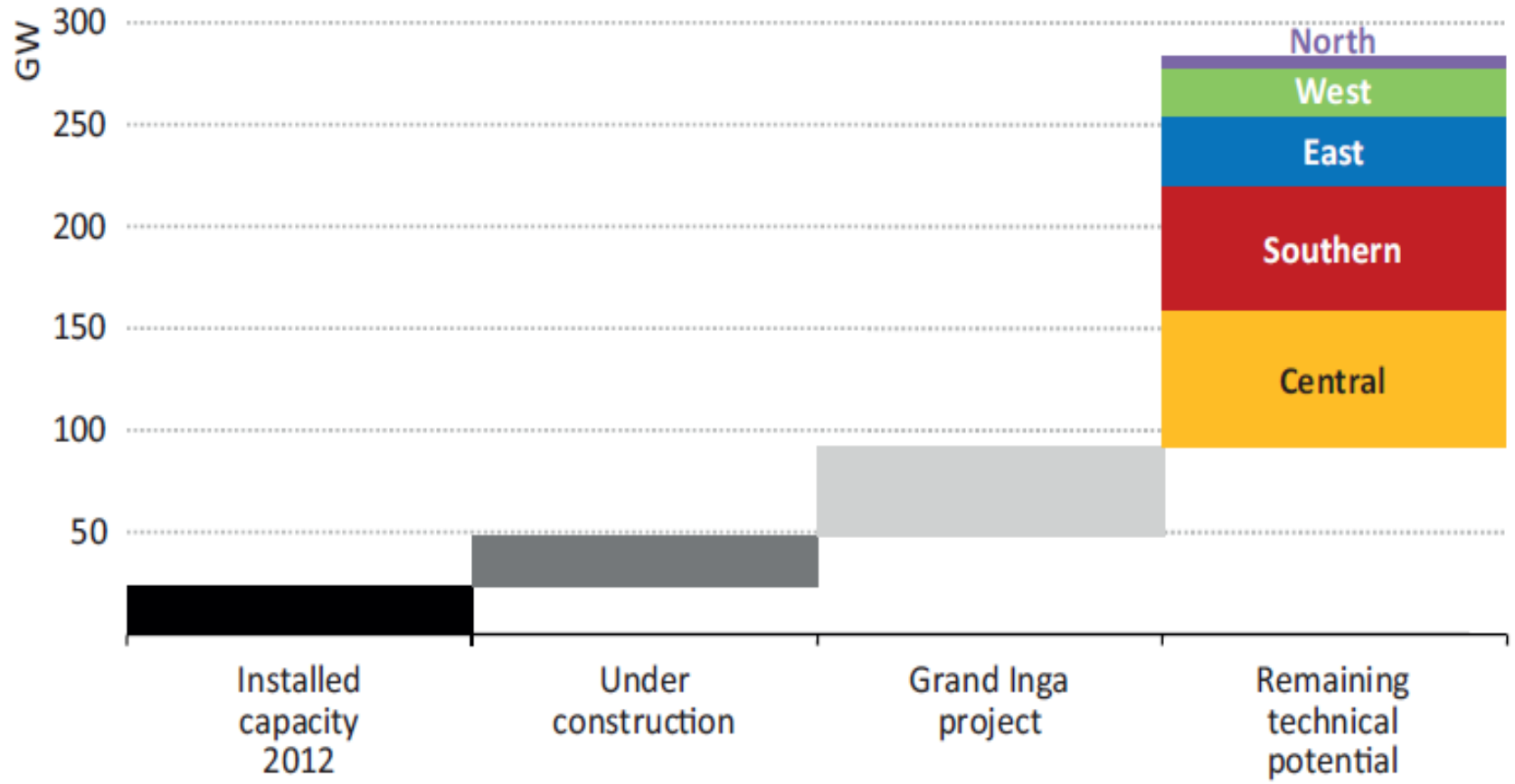
Installed Electricity Capacity (on-grid)

Figure 1.17 ▷ Installed grid-based capacity by type and sub-region



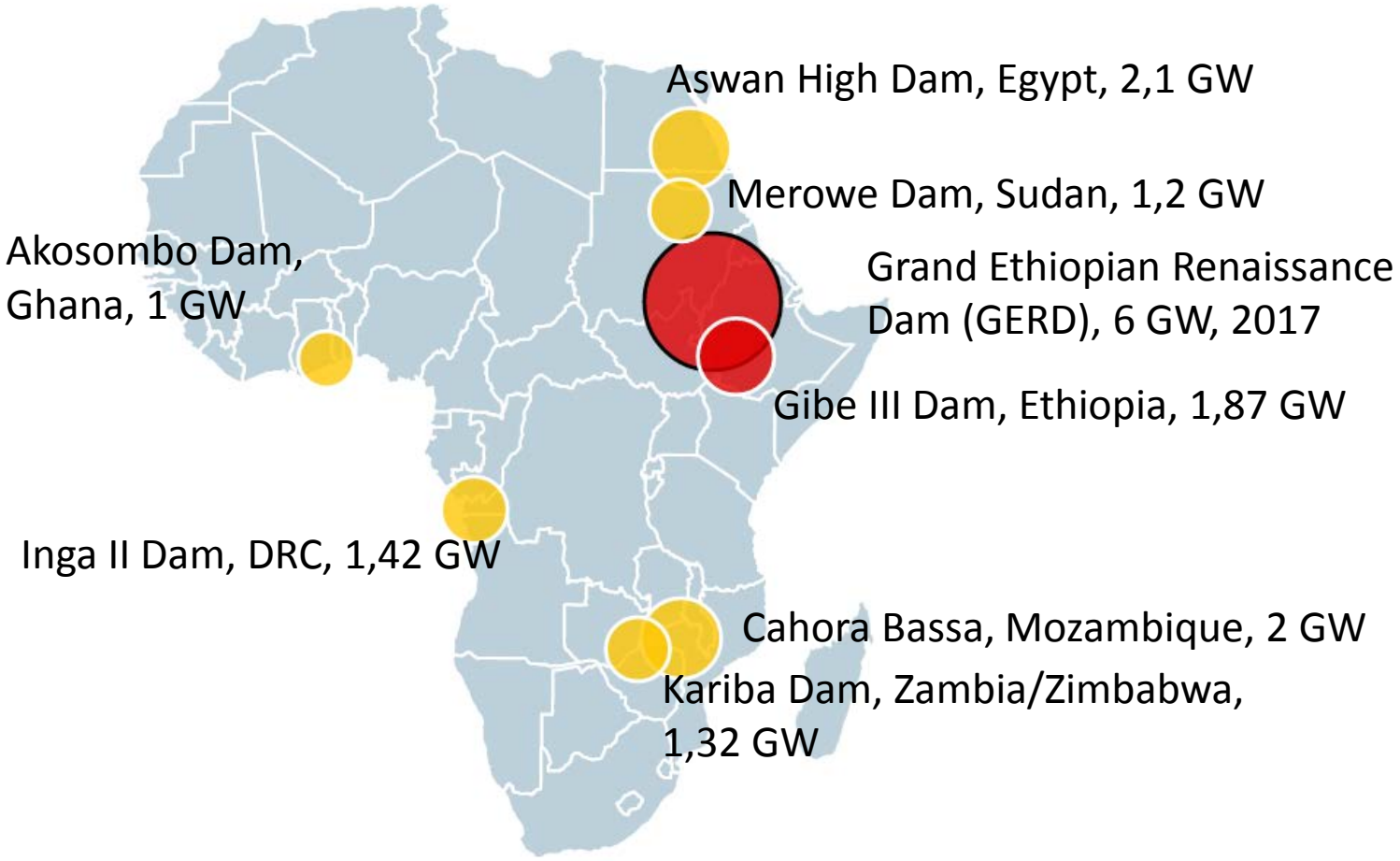
Hydropower – Installed Capacity and Potential

Figure 1.24 ▷ Existing hydropower capacity and potential in Africa



Sources: IPCC (2011); IJHD (2009) and (2010); IEA analysis.

Hydropower – Installed and Planned Capacity



Main rivers: **Nile, Congo, Niger, Orange, Senegal, Zambezi....**

= huge hydro potential

= all transboundary rivers

= total planned 27 GW

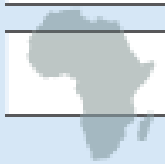
6 planned HPPs > 1 GW due by 2020:

- 3 in Ethiopia, incl. GERD
- 2 in Angola
- 1 in Mozambique

Hydropower – Installed Capacity and Potential

Table 2 **Hydropower generation and technical potential** *Source: Hydropower and Dams (2014)*

	Region	Hydro generation in 2013 or most recent/average (GWh/yr)	Technically feasible hydropower potential (GWh/yr)	Ratio between hydro generation and technically feasible hydropower potential
N	North Africa	16 728	59 693	28%
W	West Africa	19 445	101 492	19%
C	Central Africa	14 614	570 730	3%
E	East Africa	26 215	334 600	8%
S	Southern Africa	44 896	415 857	11%
	Total	**122 538**	**1 584 670**	**8%**



2. Hydropower and Bioenergy – Impacts on Water Resources

Traditional Bioenergy Impacts on Water

A vicious circle:

Fuel wood and charcoal consumption → Deforestation → Soil erosion/land degradation → Increased run off → Pollution and depletion of surface and ground water resources, incl.:

- **Pollution of drinking water** → water quality/health issues
- **Increasing water scarcity** → water shortages (incl. cities)
- **Degradation of freshwater ecosystems** → biodiversity loss (incl. fisheries)
- **Decreased climate resilience and increased disaster risk** (change in micro-climate, floods, droughts)

Hydropower Impacts on Water

Construction of dams/infrastructure → obstruction of river + modifications to natural water and sediment flows having multiple possible effects:

→ Fragmentation of FW ecosystems → Loss of fisheries → Impact on livelihoods

→Impounding of land → land-use changes → impact on economic uses

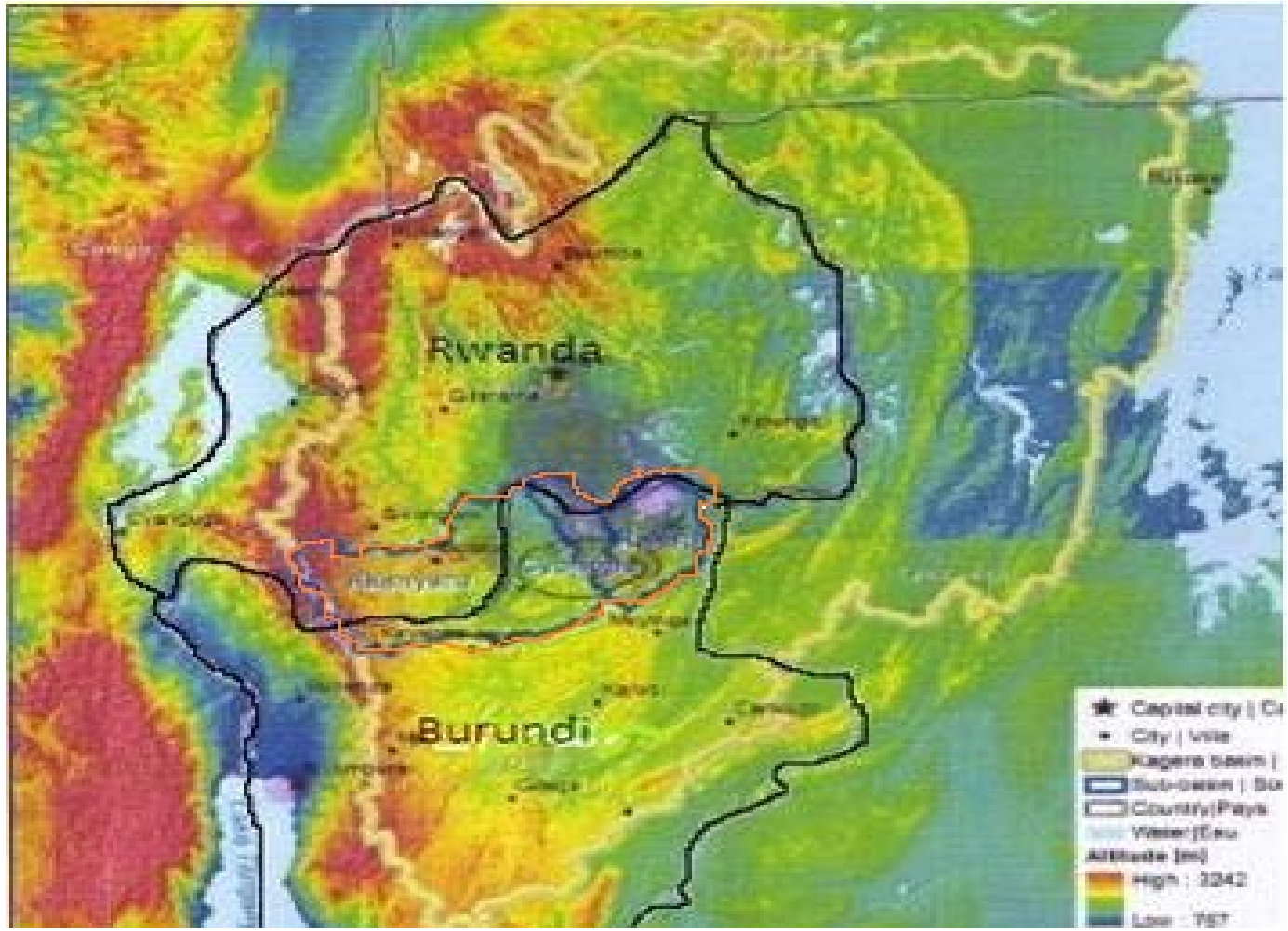
→Impact on valuable biodiversity (African ”big 5”) → loss of income sources from tourism

→Reduction of water flows → diminished water supplies for down-stream users (farmers, settlements, etc.)

→Reduction of sediment transfer→erosion of coastal deltas

3. GWP's work in the Lake Cyohoha Catchment (Burundi-Rwanda)

Lake Cyohoha Catchment Case: Challenges



Main issues: water scarcity and pollution, persistent drought, serious food insecurity, ecosystem degradation

Drivers:

- galloping population growth
- increasing need for arable land, **fuelwood/charcoa**l and over-grazing
- natural forests partly destroyed leading to severe erosion
- **soils washed from hillsides** deposited in lake, leading to siltation and disappearance of lake
- **change in micro-climate**

→ 60% of the population in Rwanda & +/- 90% of the population

→ **Lake Cyohoha almost dried up**

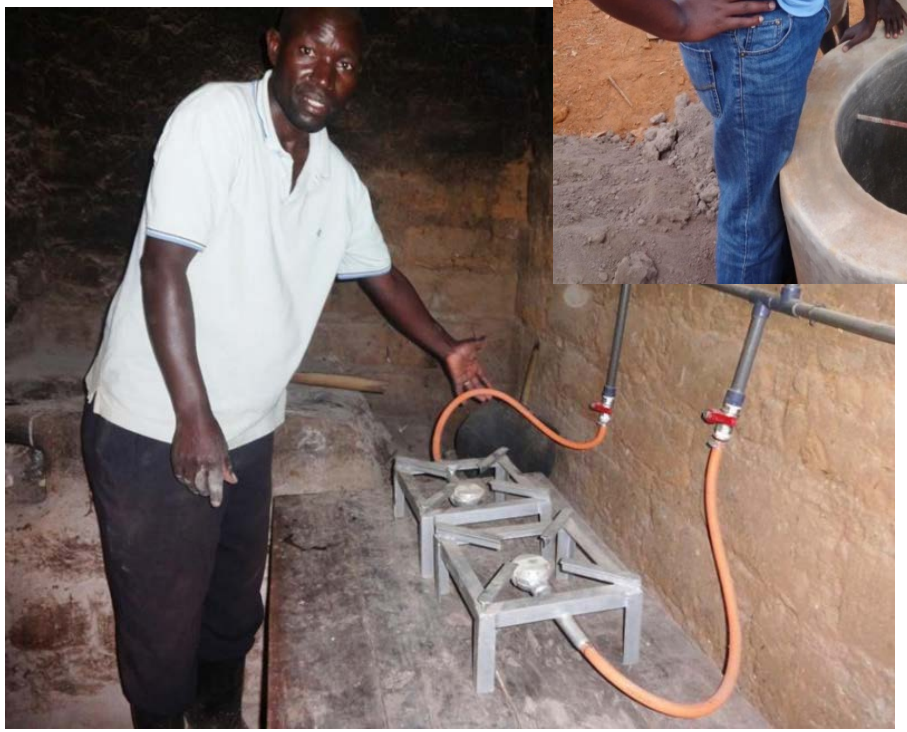
Priority Interventions	Mechanism for implementation
Strengthen/establish Community structures for managing/producing: • water points • **Need for alternative sources of energy** • **Improved cook stoves** • Parts of the catchment: buffer zone, sub-catchment • L.Cyohoha catchment • Stakeholders' platforms	Work with partners-Local Govt., NGOs, Community Groups/Associations, Private suppliers/contractors
Awareness raising, CB, training on: • Challenges: environmental degradation, climate change, water scarcity, **energy security** • Water and other NR management: importance, ownership and participation • Community structures • New approaches, methods, technologies, management	Work with partners-Local Govt., NGOs, Community Groups/Associations, Private suppliers/contractors

Addressing the water and energy security issues in the Lake Cyohoha catchment area

1. Construction of biogas digesters

- **Demo biogas digesters** built to be fed by cow dung and fecal sludges to produce **biogas energy**.

- Biogas energy **serving about 11 households with more than 118 family members** spread out in different villages.



Addressing the water and energy security issues in Lake Cyohoha catchment area

2. Construction of energy saving stoves

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

a. **energy security** measures ;

b. **decreasing deforestation** for fire wood;

c. family **income saving** by reducing expenditures for buying charcoal;

d. use of **alternative source of energy** rather than hydro - efficiency and low cost.

Conclusions reg. energy security measures in Lake Cyohoha

- **Key challenges** for communities were **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 resource management was an entry point to **promote an integrated management of water and other natural resources, and also sustainable development**

4. Way Forward and Possible Solutions

Optimizing the Water-Energy Nexus in Africa

Technical solutions – Large scale:

- Improving **operations & maintenance of installed capacity, retrofitting of** infrastructure
- **Sustainable hydropower** incl. optimal:
  - siting (River basin planning, SEAs)
  - design (BAT, BEPs, fish-friendly turbines)
  - operations (e-flows, sediment flushing)
- Mantra **"Avoid, reduce, mitigate and then compensate"** (incl. via biodiversity off-sets)

Optimizing the Water-Energy Nexus in Africa

Technical solutions – Small scale:

- **Waste-to-energy technologies**
  → sewage/biogas digesters
- **Affordable off-grid solutions** for households and remote rural communities:
  - ✓clean, improved cook stoves
  - ✓solar grills
  - ✓solar rooftop water heaters
  - ✓solar water pumps

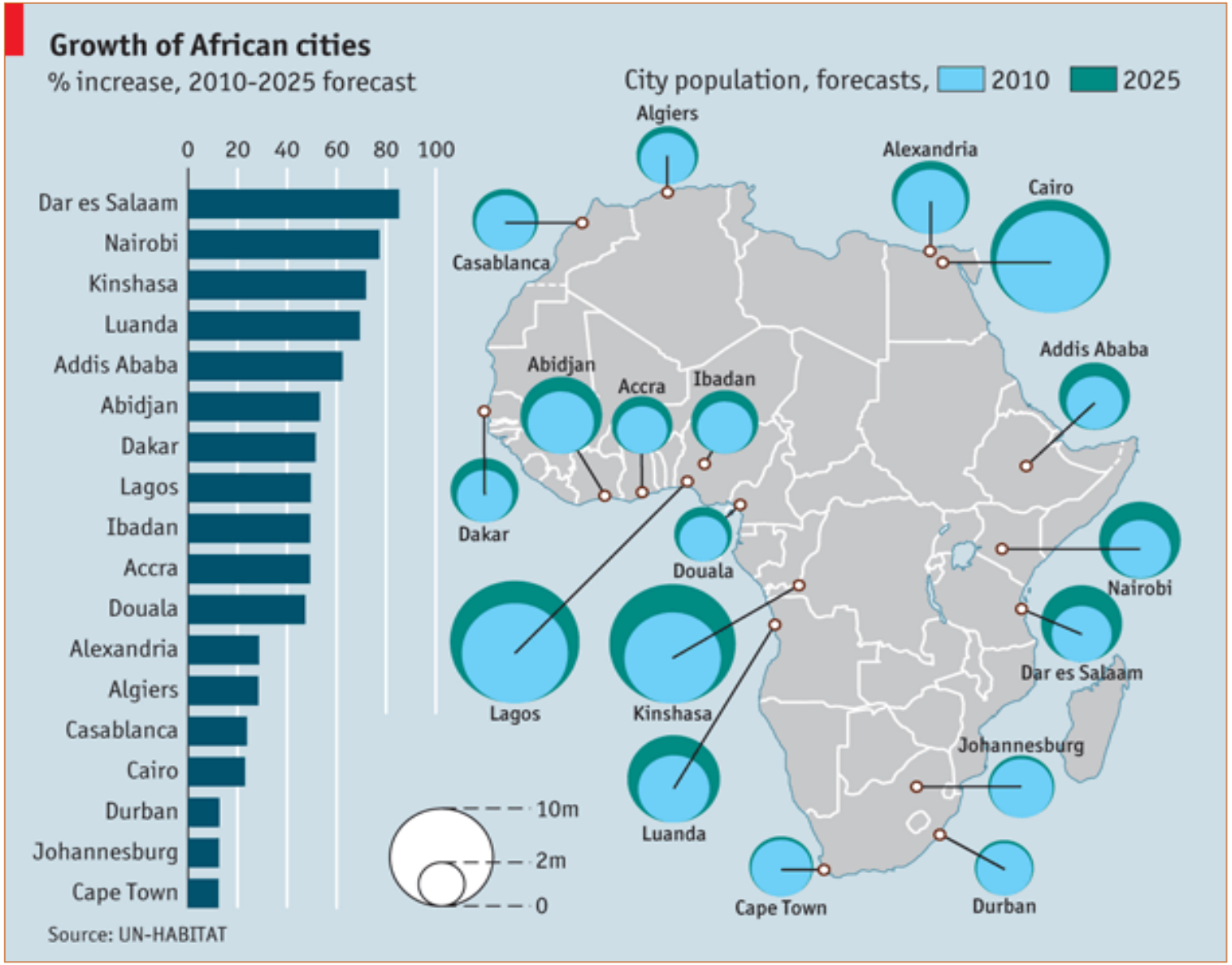
Optimizing the Water-Energy Nexus in Africa

Global Water Partnership

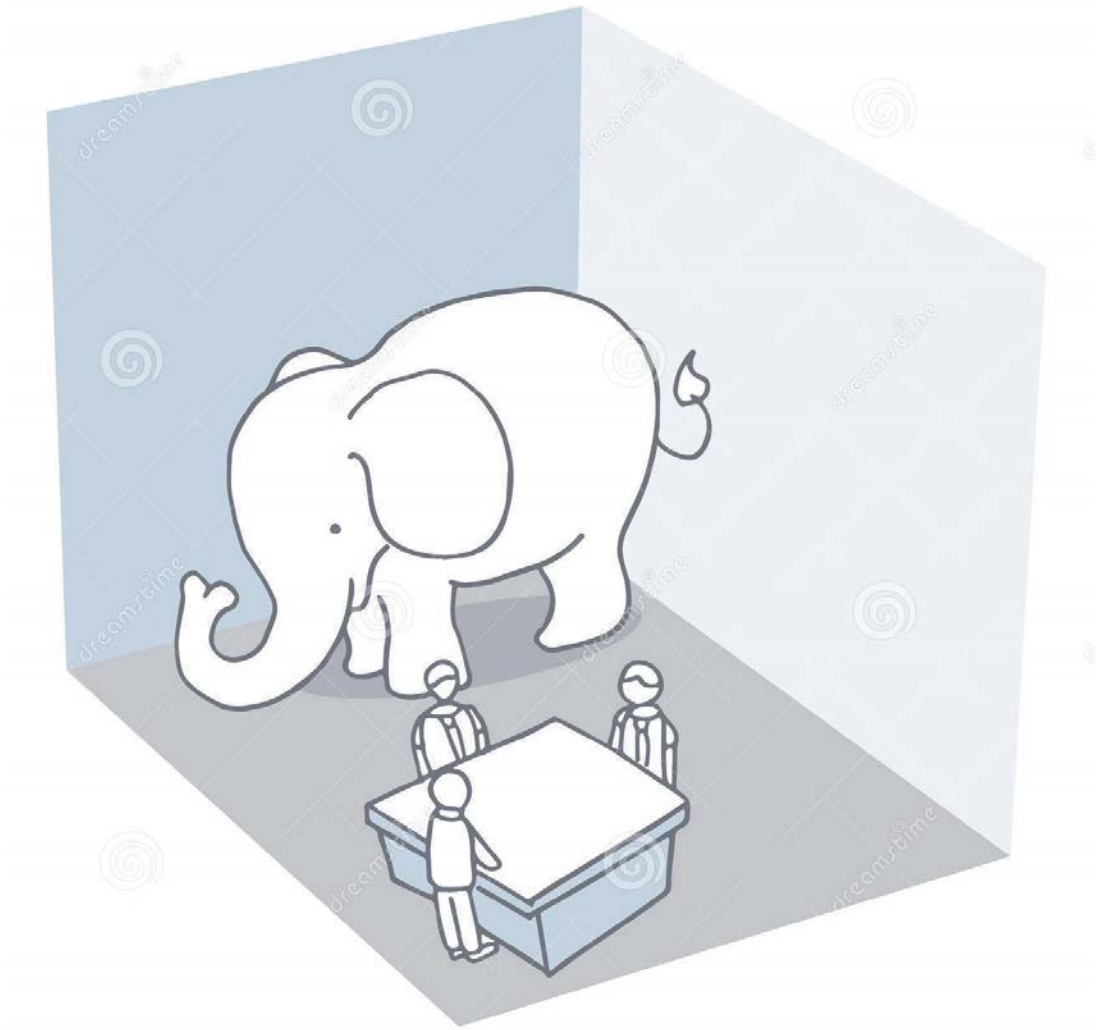
Governance, institutional solutions:

- Set up Inter-institutional, joint resource management mechanisms
- Private sector to foster innovative, tailor-made, leap-frog solutions
- Flexible but sustainable financial mechanisms to support long-term viability
- Education and consultation of communities to facilitate buy-in to modern, sophisticated infrastructure and technologies

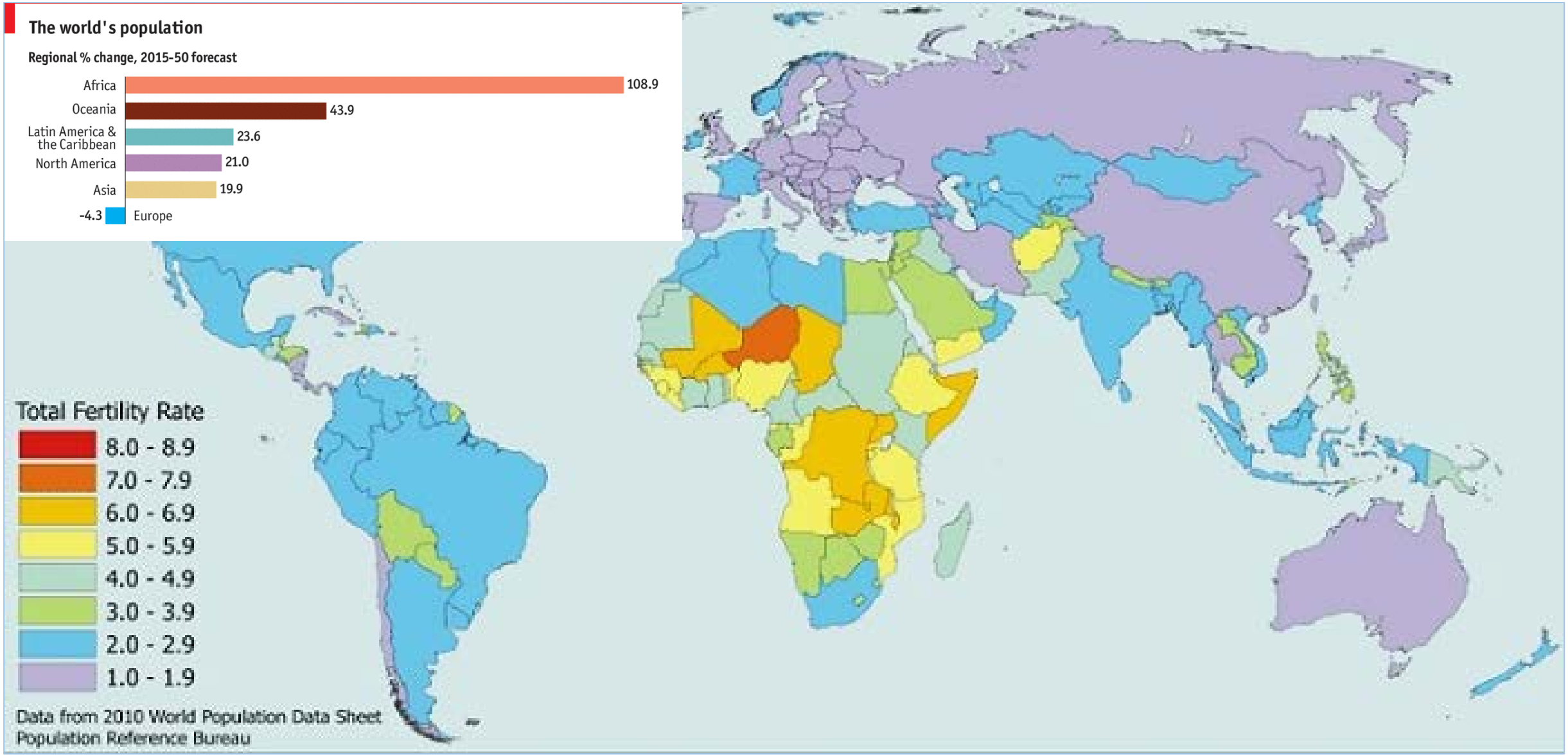
Future challenges…

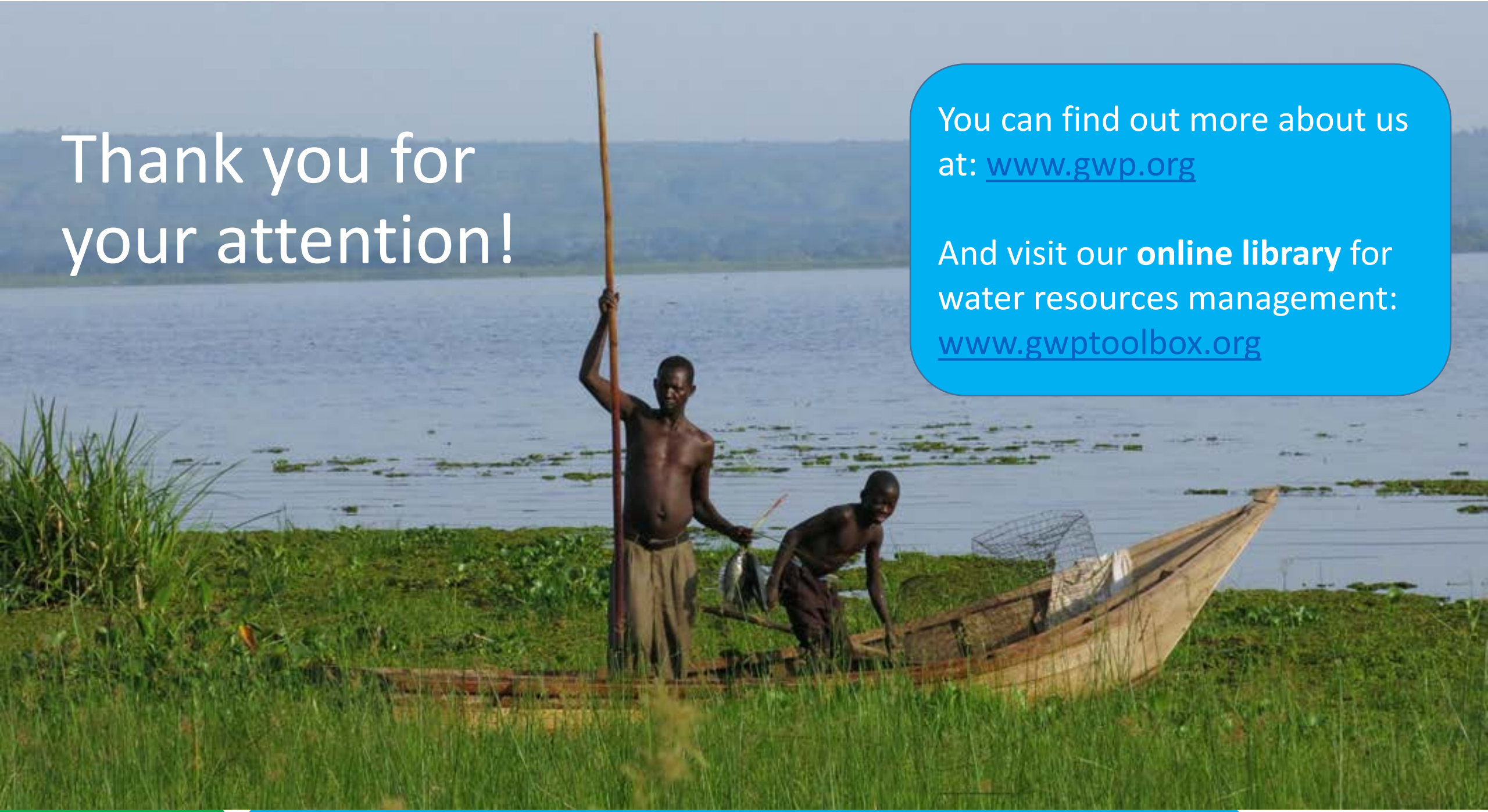


Future challenges…



Future challenges…





Thank you for your attention!

You can find out more about us at: www.gwp.org

And visit our **online library** for water resources management: www.gwptoolbox.org