

Global Conference

"Rural Energy Access: A Nexus Approach to Sustainable Development and Poverty Eradication"

Energy and Water Nexus

Opportunities and technical solutions to address poor access to water and energy through better understanding of the water & energy nexus

Addis Ababa, Ethiopia, on 4-6 December 2013

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Presentation Outline

- **Access to water and sanitation: Global/Regional trends**
- **Access to energy: Global/Regional trends**
- **Water and Energy nexus in East Africa**
- **Practical examples of the Nexus Approach in water & energy :**
 - Mini-hydro feasibility studies for water supply in Kisii, Kenya
 - Waste water to energy: biogas potential in the region
 - Wind energy potential for water supply
 - Energy demand management: energy audit
 - Promotion of improved cook stoves in water catchment areas
- **Historic technical solutions of the water-energy-food nexus from Syria, Egypt and Europe**
- **Recommendations**

Global/Regional trends:

Access to clean Water and Sanitation facilities



Global trends:

According to the Joint Monitoring Program (UNICEF/WHO):

- 780 million people do not have access to safe drinking water;
- 2.5 billion people do not use improved sanitation facilities;
- Close to 1 billion people are undernourished.

Regional trends:

- Only 61 % of the population in Sub Saharan Africa have access to clean water.
- Many African countries are not on track to meet the MDG drinking water target.

Country	Access to clean water (%)	Access to Sanitation facilities (%)
Burundi	72	46
Kenya	59	32
Rwanda	65	55
Tanzania	53	10
Uganda	72	34

Global/Regional trends: Access to modern energy

Global trends:

According to data from the World Bank and the International Energy Agency:

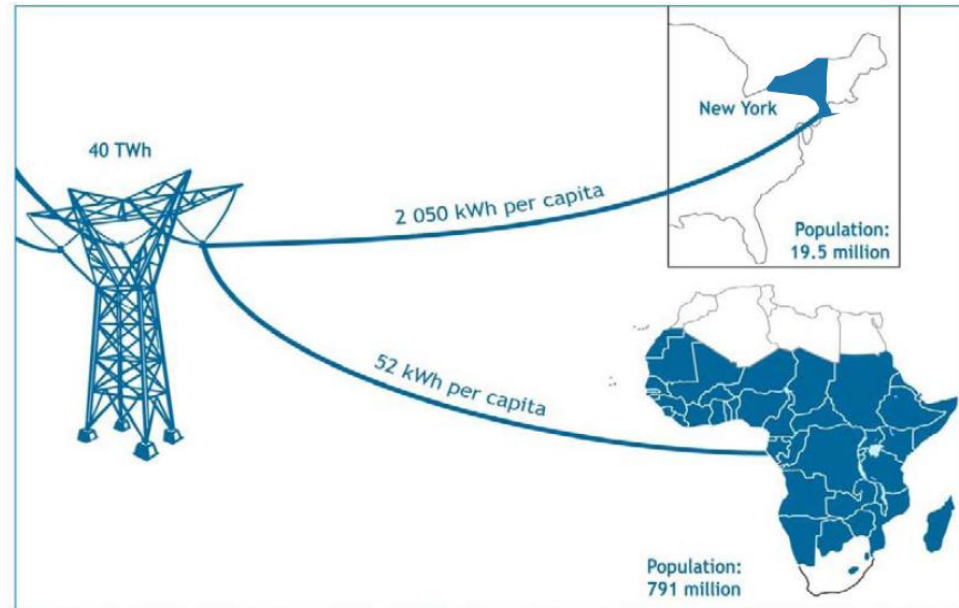
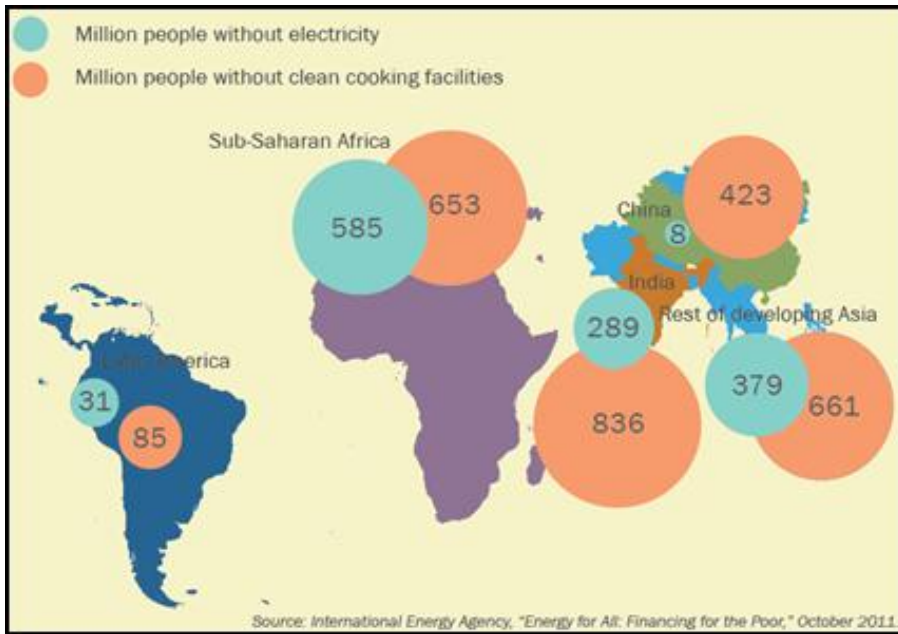
- 1.3 billion people around the world lack access to electricity;
- 2.6 billion people still rely on the traditional use of biomass for cooking.

Regional trends:

- Only 28 % of the population in SSA have access to electricity – excluding South Africa - and with SA, 31%.

Country	Access to electricity (%)	Per capita electricity consumption (kWh/y)
Burundi	2	23
Kenya	16	147
Rwanda	14	55
Tanzania	14	86
Uganda	9	66
South Africa	75	4532
China	99.4	2631

Global/Regional trends: Access to modern energy



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Electricity consumption in New York and Sub-Saharan Africa

- Residential electricity consumption in SSA, excluding South Africa, is roughly equivalent to consumption in New York.
- 19.5 million inhabitants of New York consume in a year almost the same quantity of electricity, 40TWh, as the 791 million people in SSA

There is a strong correlation between energy access and poverty - People who have access to energy also enjoy better living condition.

Water & Energy Nexus in East Africa

- Water operators in much African countries spend between **60 - 70 %** of their revenue on energy to supply water;
- Water Utilities are **high energy users**, much of which comes from fossil fuels which is imported.
- 50 % of energy generation in the region are from fossil fuel;
- The cost of water is directly related to the cost of the embody energy;
- Addressing the high cost of energy in water will directly make water affordable;
- There is a strong interdependencies across the water and energy sectors. The 2 sectors are inextricably linked, and actions in one area more often have impacts in the others.
- A nexus approach helps to move beyond silos and ivory towers that preclude interdisciplinary solutions, thus increasing opportunities for mutually beneficial responses and enhancing the potential for cooperation between and among all sectors.



Practical examples of the Nexus Approach in water & energy: Feasibility study for Mini - Hydropower plant for water pumping



- Despite being connected to the Municipal water network, **some residents** of Kisii town in Kenya **have not received water for the last 10 years**
- The town's water supply and distribution system is **inadequate**: power outages and **intermittent water supplies**
- The **electricity bill** accounts to **70 %** of the revenue collected
- UN-Habitat has conducted a **feasibility study** for the construction of a **200 kW micro hydropower** plant to generate enough **energy** for the pumping station
- The study concludes that the future power station will effectively **stabilize operations of the pumping station** and **reduce electricity bill by 79 %**
- The **payback period** of the investment **is 6 years.**

Practical examples of the Nexus Approach in water, energy: Feasibility study on the use of waste water to generate energy – Homa Bay



- Chronic water shortages due to **high cost** and **unreliability** of **electricity**;
- Elaborate **water rationing** time table;
- The water utility spends up to **75 % of its revenue** on **electricity bills** alone;
- The **low revenue base does not allow** proper **operations** and **maintenance**;
- The city sewage system requires **electrical pumping** that is costly to run and maintain;
- UN-Habitat has conducted a **feasibility study on the use of municipal organic waste to produce biogas and generate electricity for water supply**;
- The study show that the organic waste generated in this small town from fish factories, city sewage system could generate enough biogas to produce energy – electricity – needed to supply water to the citizens .

Practical examples of the Nexus Approach in water & energy: Biogas system to address poor sanitation and generate energy in Kigali prison



- The construction of the biogas plant at the prison of Kigali, Rwanda has cut down the demand for biomass for cooking by 60 %.
- The use of biogas also reduce significantly the water demand for sanitation.
- The effluent from the plant is used for food production.

Practical examples of the Nexus Approach in water, energy: Wind Energy potential in the Lake Victoria region



- Lake Victoria region is endowed with moderate winds that could be used to supply water.
- This will reduce the high cost of energy from imported fossil fuel and also the time spent by households to fetch water every day.
- UN-Habitat has conducted **a feasibility study on the use of wind energy in the region for water supply and food production.**
- There is a need to transfer **appropriate and affordable technology of wind pump** in the region through training and demonstration.

Practical examples of the Nexus Approach in water & energy: Promotion of improved cook stoves in water catchment areas



- Rural population rely heavily on biomass for cooking and heating.
- Cooking is done on traditional “three-stone-fire” that wastes significant amount of heat – energy;
- Improved cook stoves reduce heat losses and use firewood more efficiently.
- Encroaching water tower and catchment areas in search of fire wood for cooking has reduced the water retention capacity resulting in scarcity of water supply.
- Promoting the use of improved cook stove reduces the demand for firewood for cooking.



Practical examples of the Nexus Approach in water & energy

Historic technical solutions of water & energy nexus in Syria



- In Hama, Syria there are over 200 waterwheels that use the kinetic energy of the river to lift water up to 30 m high for domestic water supply and food production.
- This application has been in use for 2 millennium. It is the first known renewable energy technology that uses water power to pump water.



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Practical examples of the Nexus Approach in water & energy

Historic technical solutions of water – energy nexus in Egypt

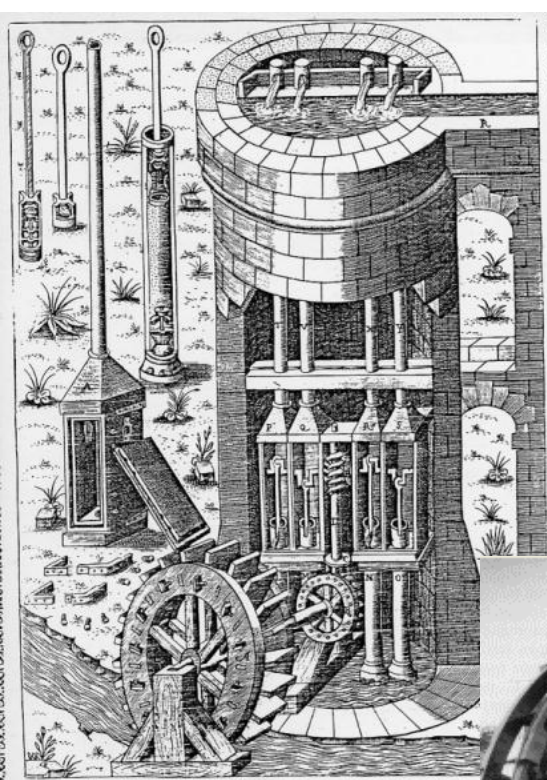


- The region of El-Feium is known as the granary of Egypt.
- Despite receiving only **three days of rain** annually, El Feium enjoys **food security**.
- Farmers use the power of the River Nile to lift water and irrigate their crops.
- **Time tested water technologies!**



Practical examples of the Nexus Approach in water & energy

Historic technical solutions of water & energy nexus Europe



- The water & energy nexus have been in used in Europe for centuries.
- Most of the historic civil engineering manuals contain illustrations showing how to pump water using the energy from the flow of the river.
- These are low cost and time tested technology that enhances pro-poor access to water supply.
- **This are affordable technologies that can be used in rural areas for water supply, irrigation and food productions.**

Recommendations



- Conventional energies used in services delivery are mainly **fossil fuel** and electricity from the national grid.
- The **increasing cost of energy is the limiting factor** to rural communities which most of the time rely on their muscular energy for their basic needs.
- Most rural areas do not have **electricity access, but they are endowed with huge renewable energy potentials** that could address their basic service needs.
- With an **annual population increase of 3 %**, there is a huge gap between the supply and demand of energy.
- In order to reduce the cost of water, there is a need to address energy access issues. Alternative energies using locally available source of energies are the best solution.
- **Alternative sources of energy offer greater opportunities for pro-poor access to water for domestic consumption and irrigation.**
- **A nexus perspective increases the understanding of the interdependencies across the water & energy: we cannot address each sector individually.**

THANK YOU FOR YOUR ATTENTION!

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