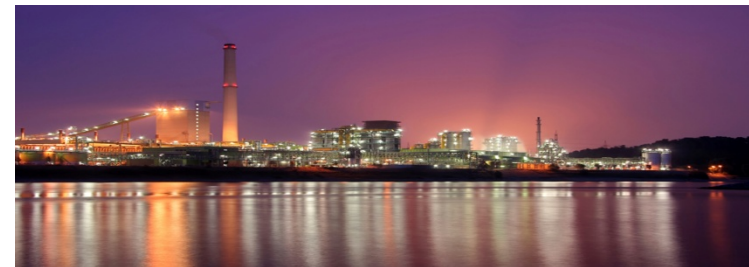


Energy, Development and Climate Change in Africa



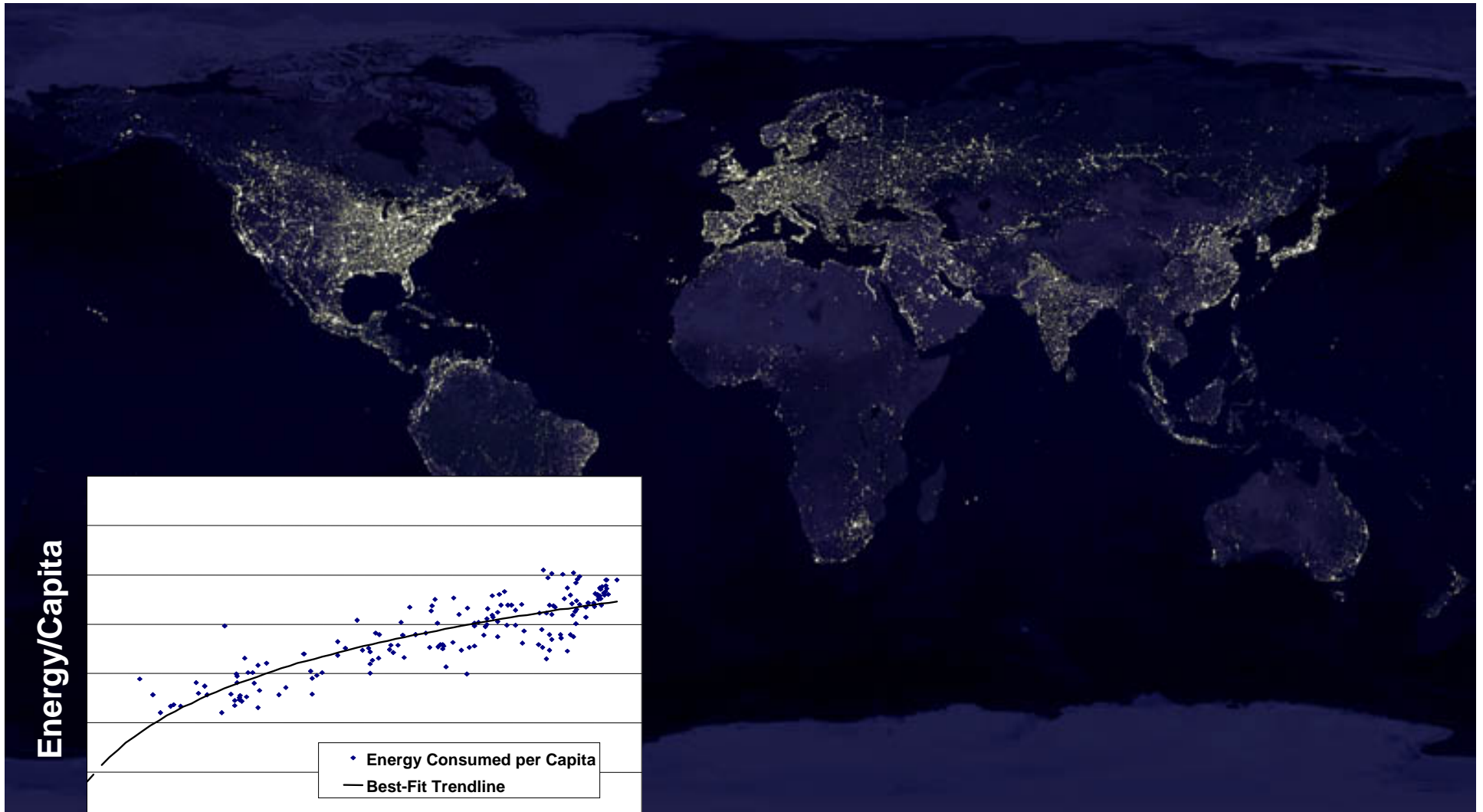
Vahid Alavian
Water and Hydropower Advisor
Africa Region
The World Bank



Outline

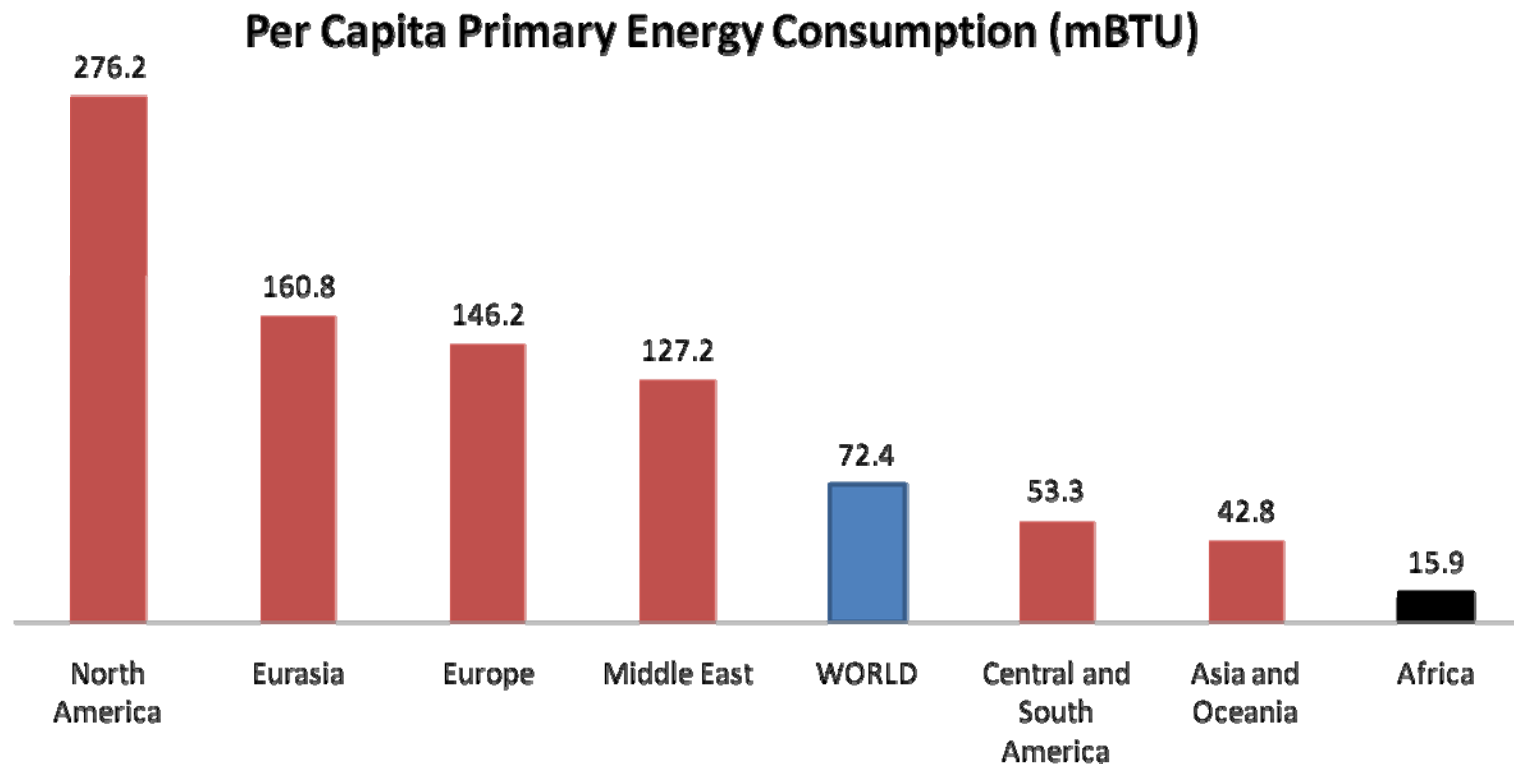
- The energy landscape
- The challenges we see
- The climate variability and change factor
- Managing the climate risks
- The World Bank energy strategy
- Summary

Energy and growth



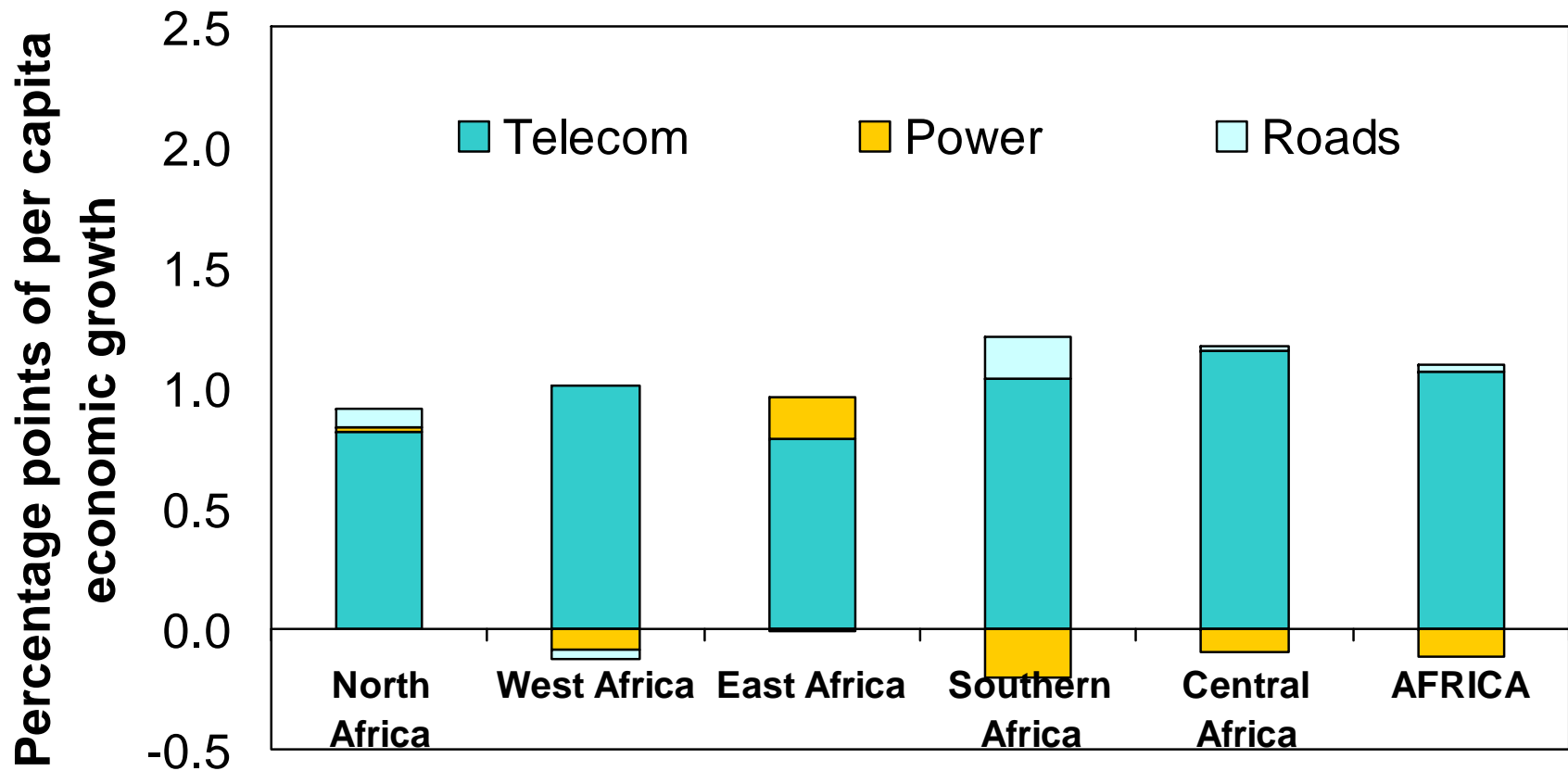
Human Development Index (HDI)

Energy inequalities contribute to regional inequalities

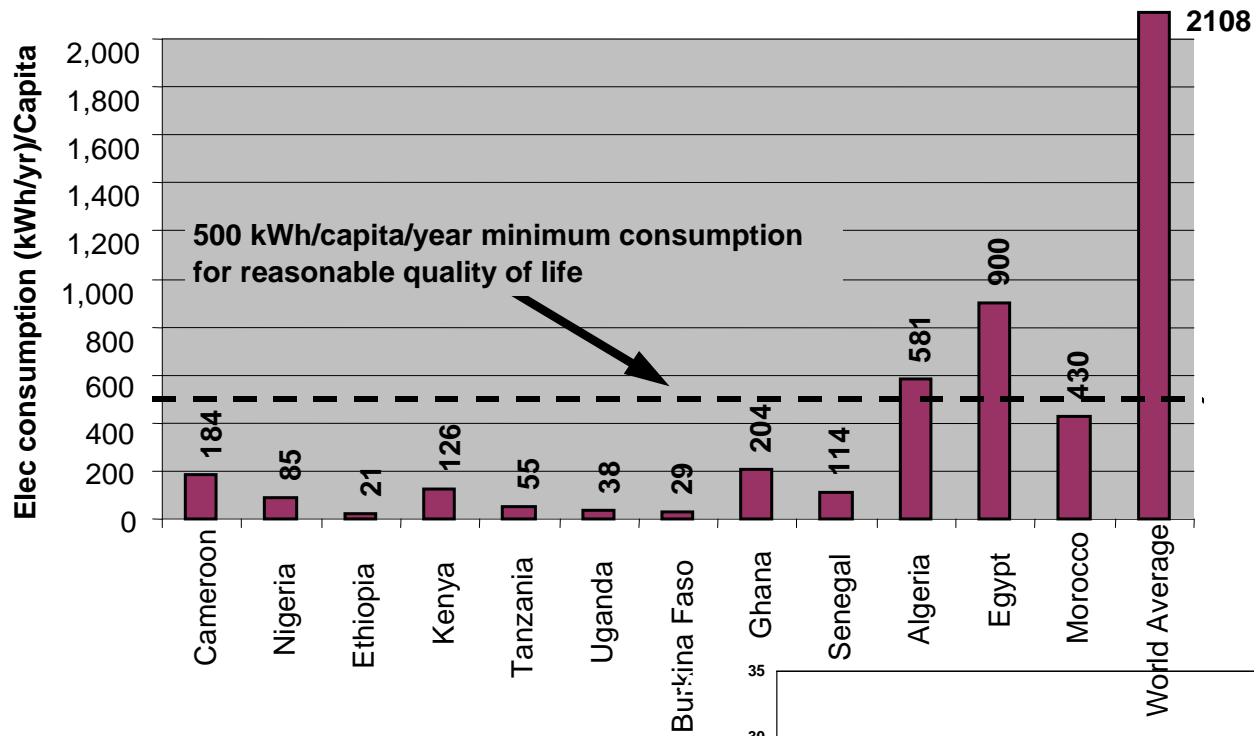


Consumption in Africa is 4.5 times lower than world average and 18 times lower than that of North America

Power shortages are a brake on economic growth and competitiveness

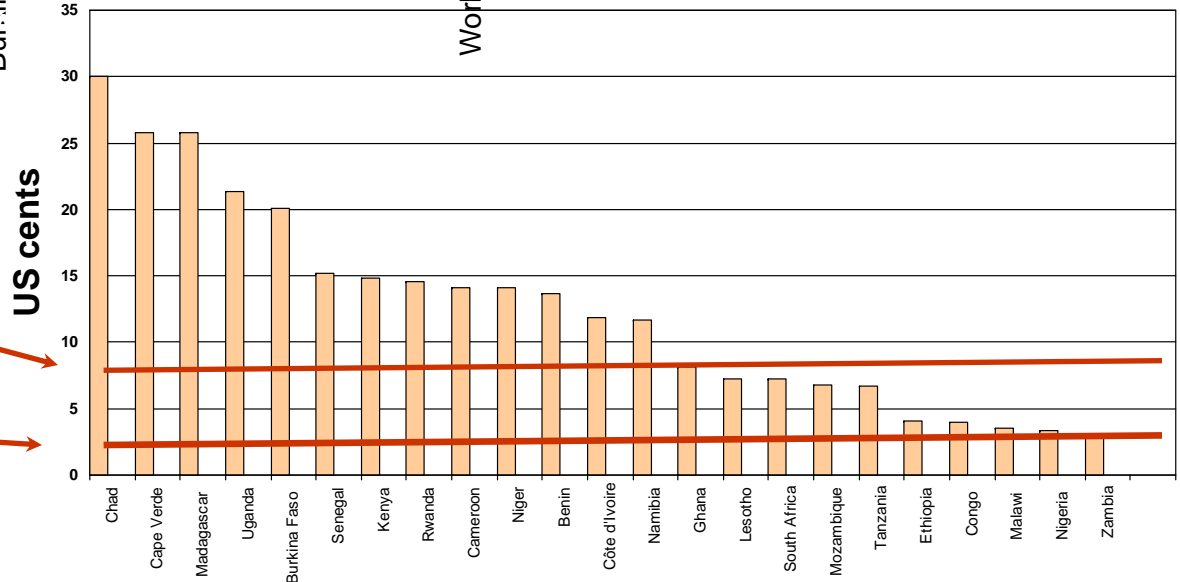


Low availability at high prices



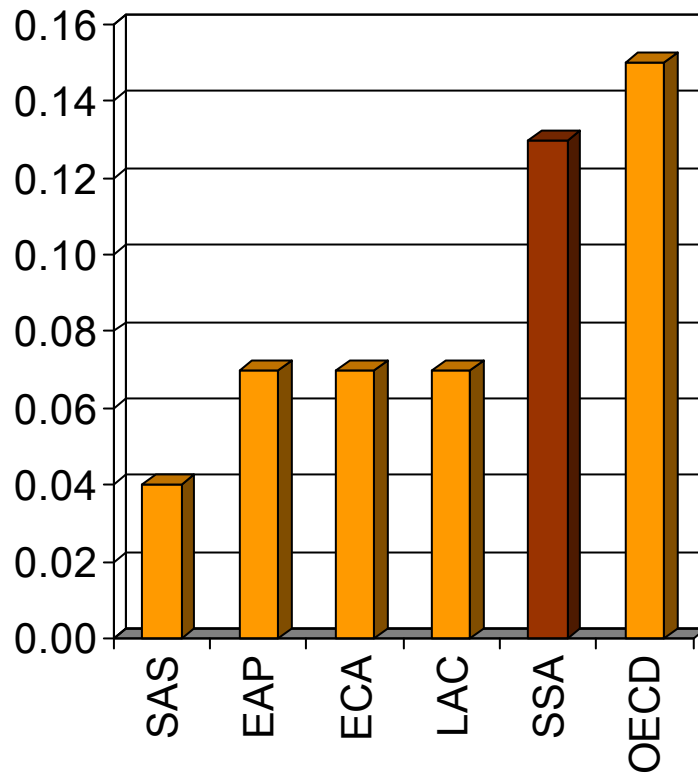
Power tariffs in other developing countries: upper bound

Power tariffs in other developing countries: lower bound

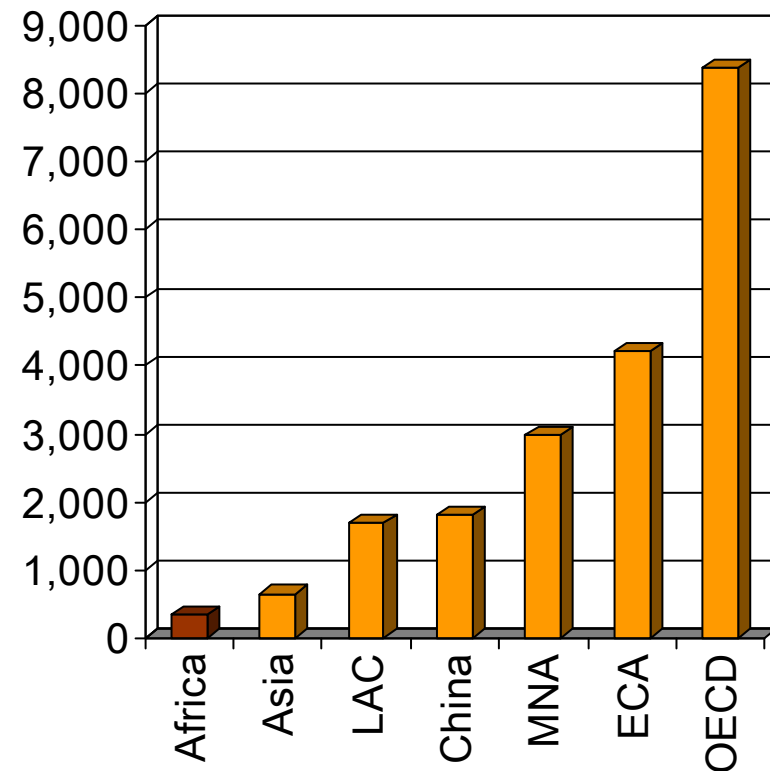


High prices, low consumption

Average tariff
(US\$ per kWh)



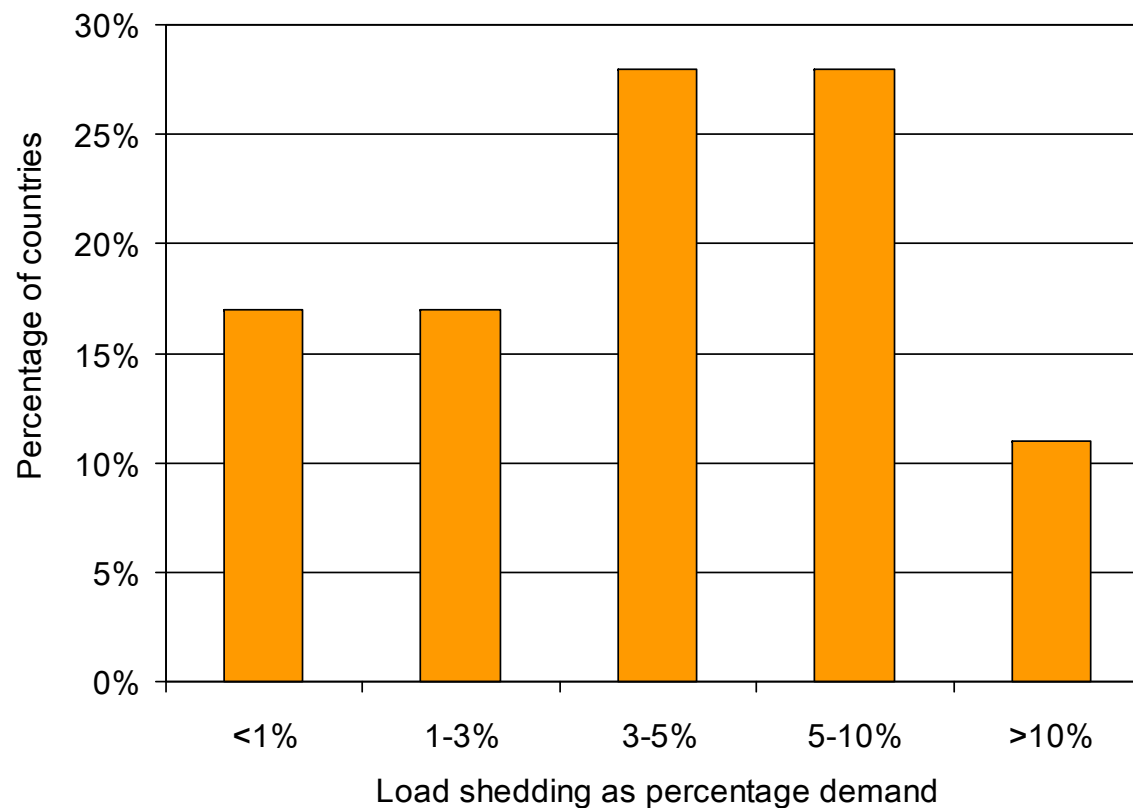
Power consumption
(kWh pc pa)



Source:

Poor reliability

Load shedding

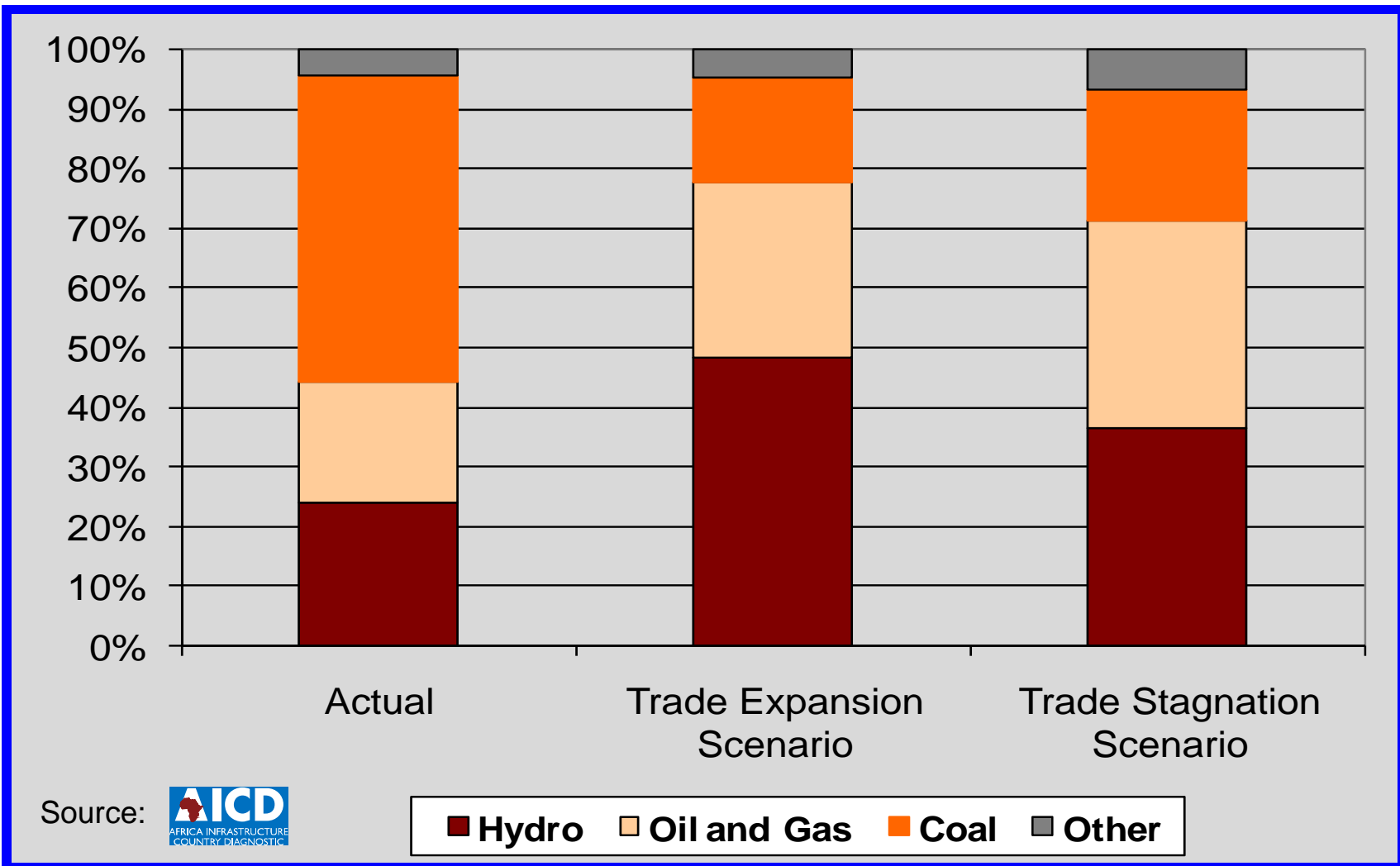


- Lost sales revenues
 - 5-6% formal sector
 - 20% informal sector
- Most large firms run generators: \$0.40/kwh

Huge power investment backlog

- To remedy this energy situation Africa needs to build
 - 7,000 MW of generation capacity per year
 - More than five million new power connections per year
 - An extensive transmission network
- The annual financing requirements are staggering
 - spending needs: US\$41 bn/yr
 - financing gap: US\$23 bn/yr

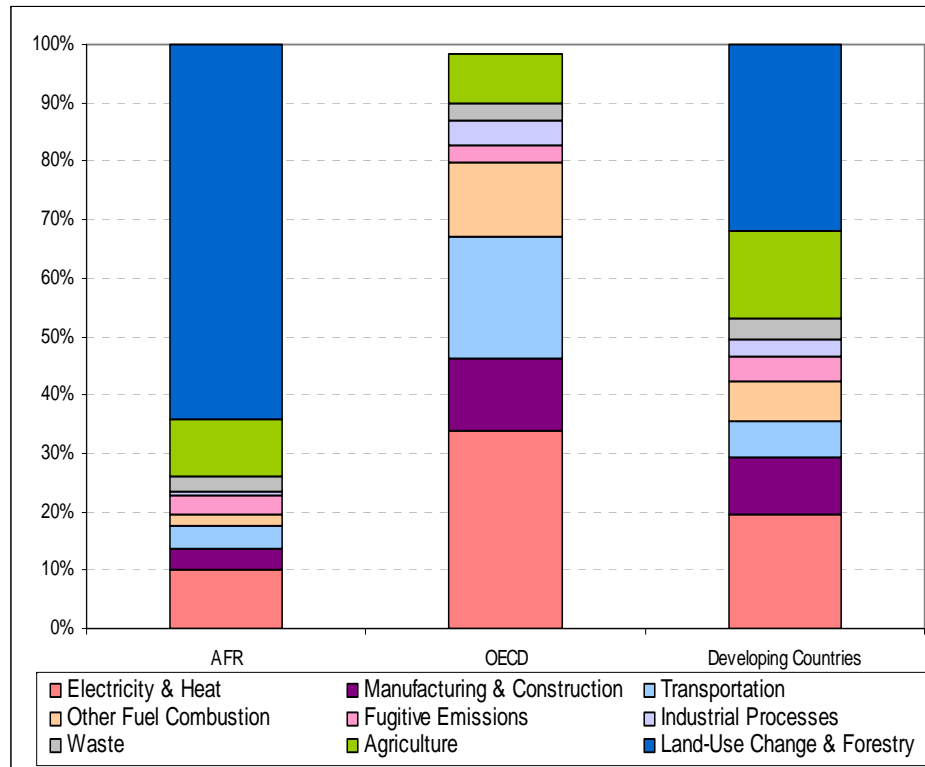
Coal is Africa's largest single source of power, but will lose ground to hydro



How is the energy and development landscape affected by climate variability and change?

- Poorest, the most vulnerable and least prepared are hit hardest – most of Africa
- Development gains so far is at risk
- Water and energy security at risk
- heavy reliance on burning wood and charcoal to meet basic energy needs means the continent continues to suffer intense deforestation.

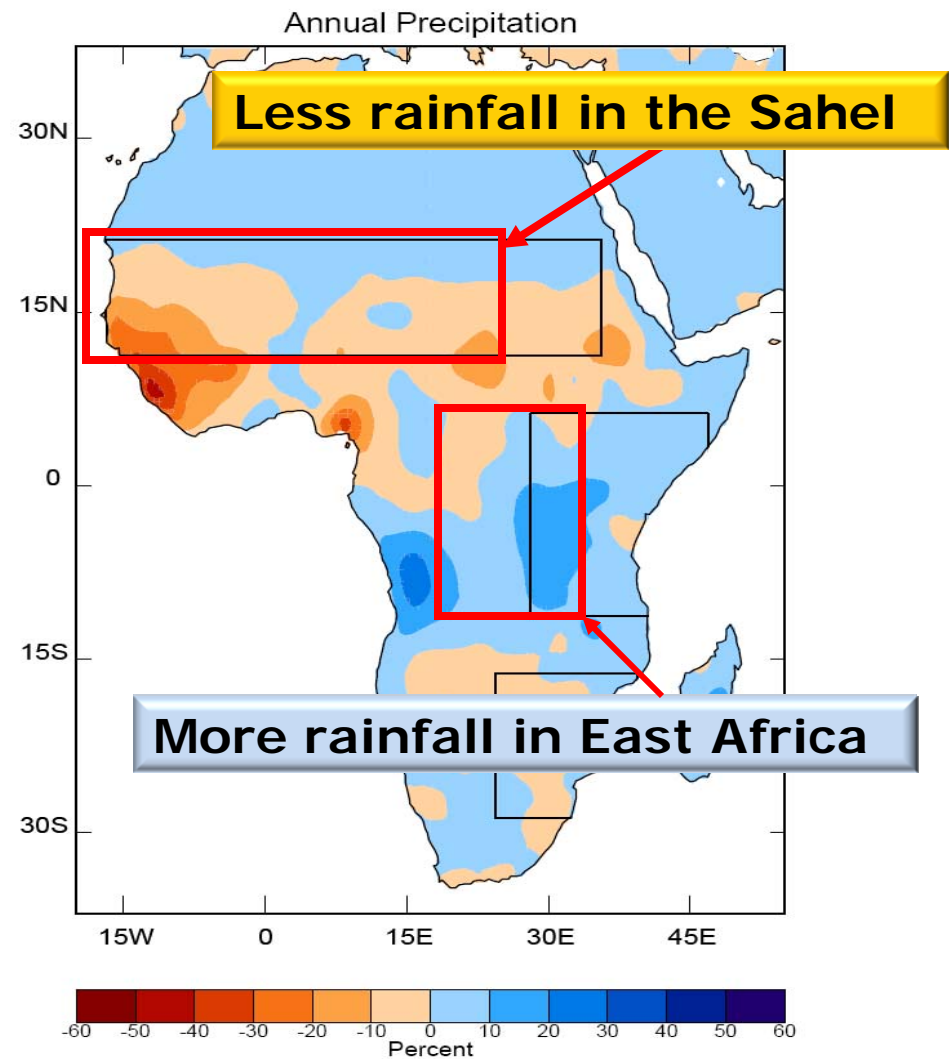
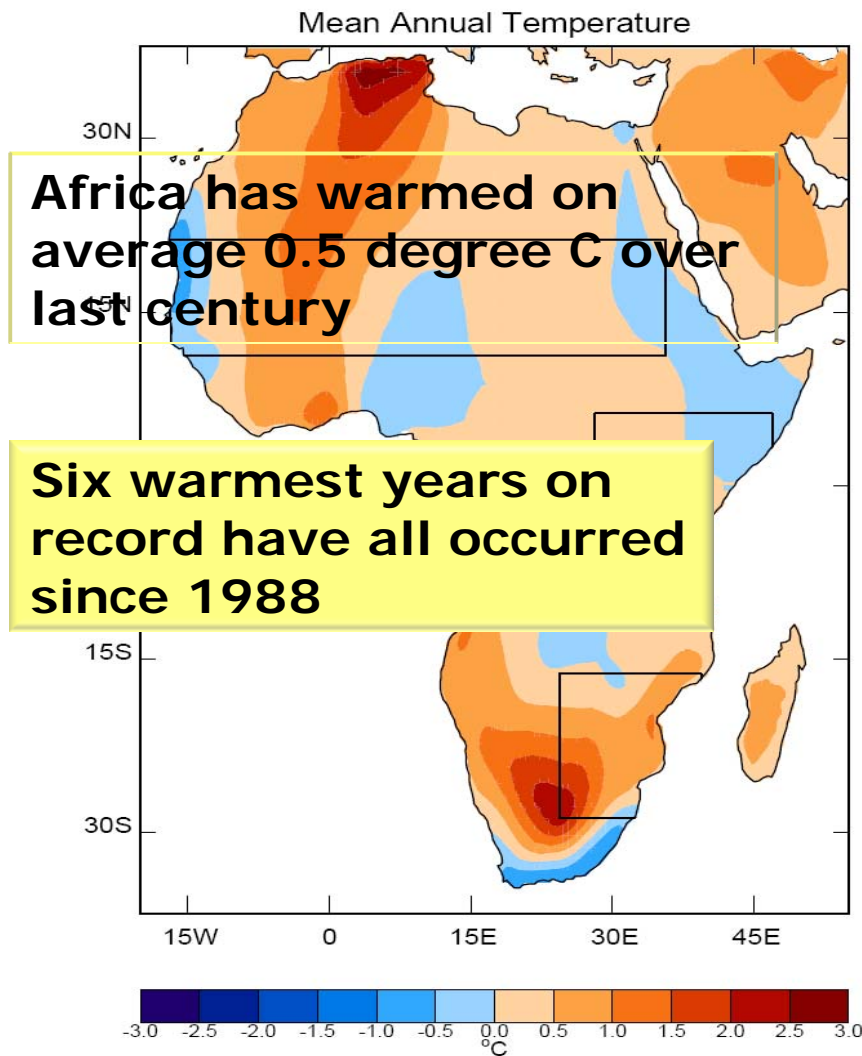
Sources of Green House Gas Emissions



- Africa: Land-use change is the largest source of GHG emissions
- Africa accounts for only 4% of CO2 emission
- Power accounts for only 10% of Africa's emissions, and (excluding RSA) <1% of global emissions
- Lack of Energy access and environmental degradation are linked

Energy generation, processing, and use contribute over 60% of the world's greenhouse gas emissions

What has already changed?



Climate change impact is mostly through water

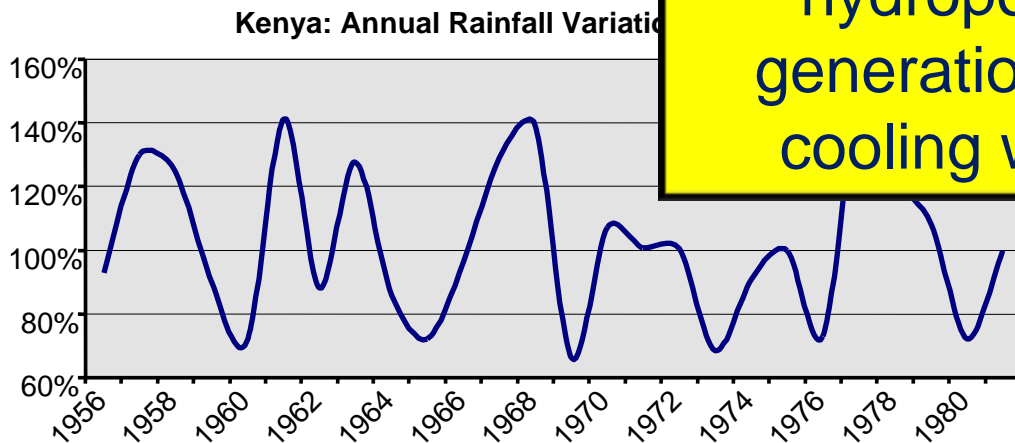
Natural legacy

- extreme variability
- 35-40% around the mean

Historical legacy

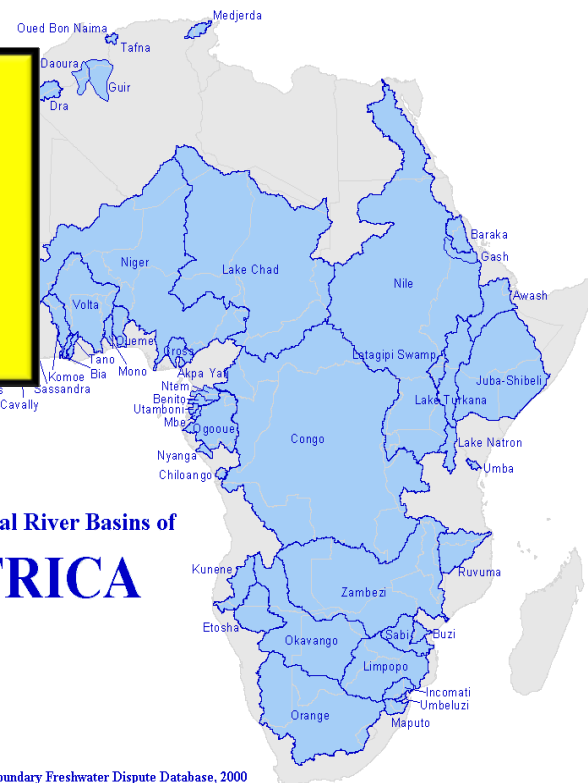
- 60+ international rivers

Impact on
hydropower
generation and
cooling water



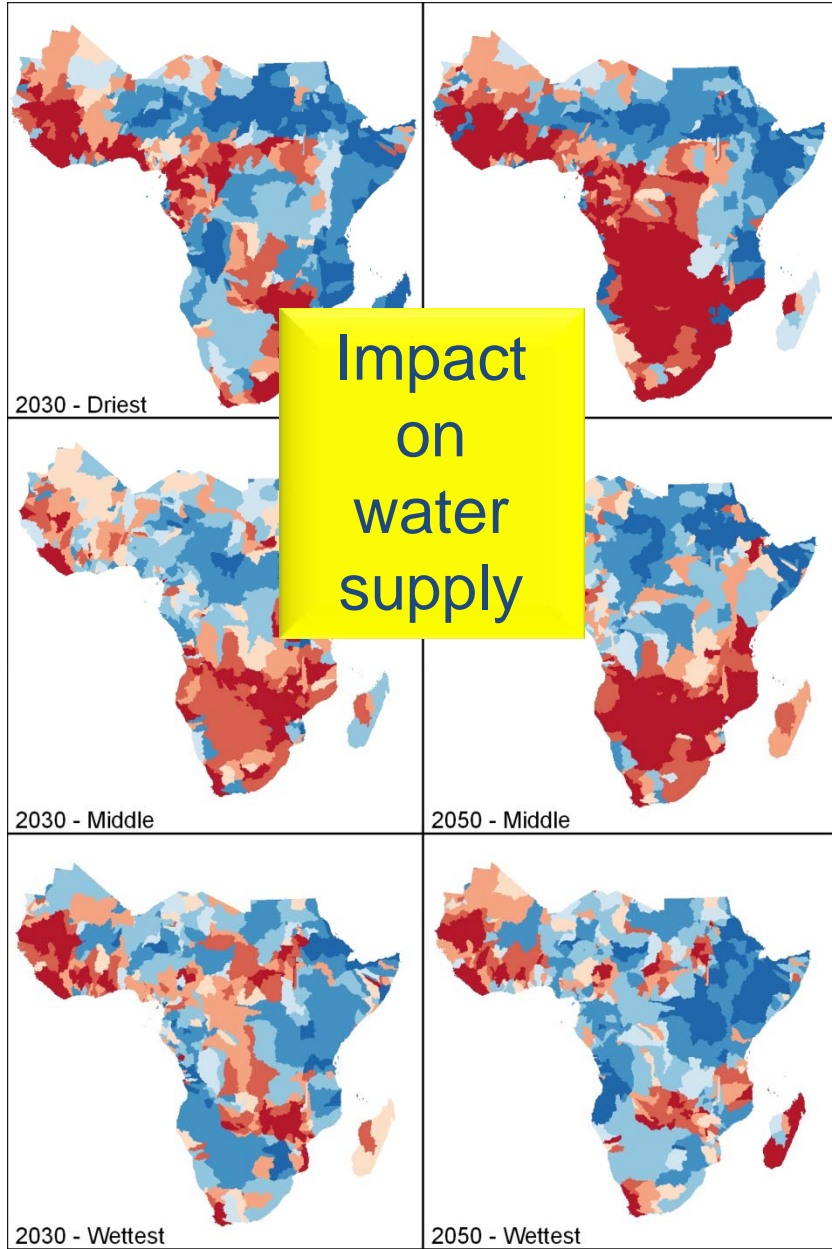
International River Basins of

AFRICA

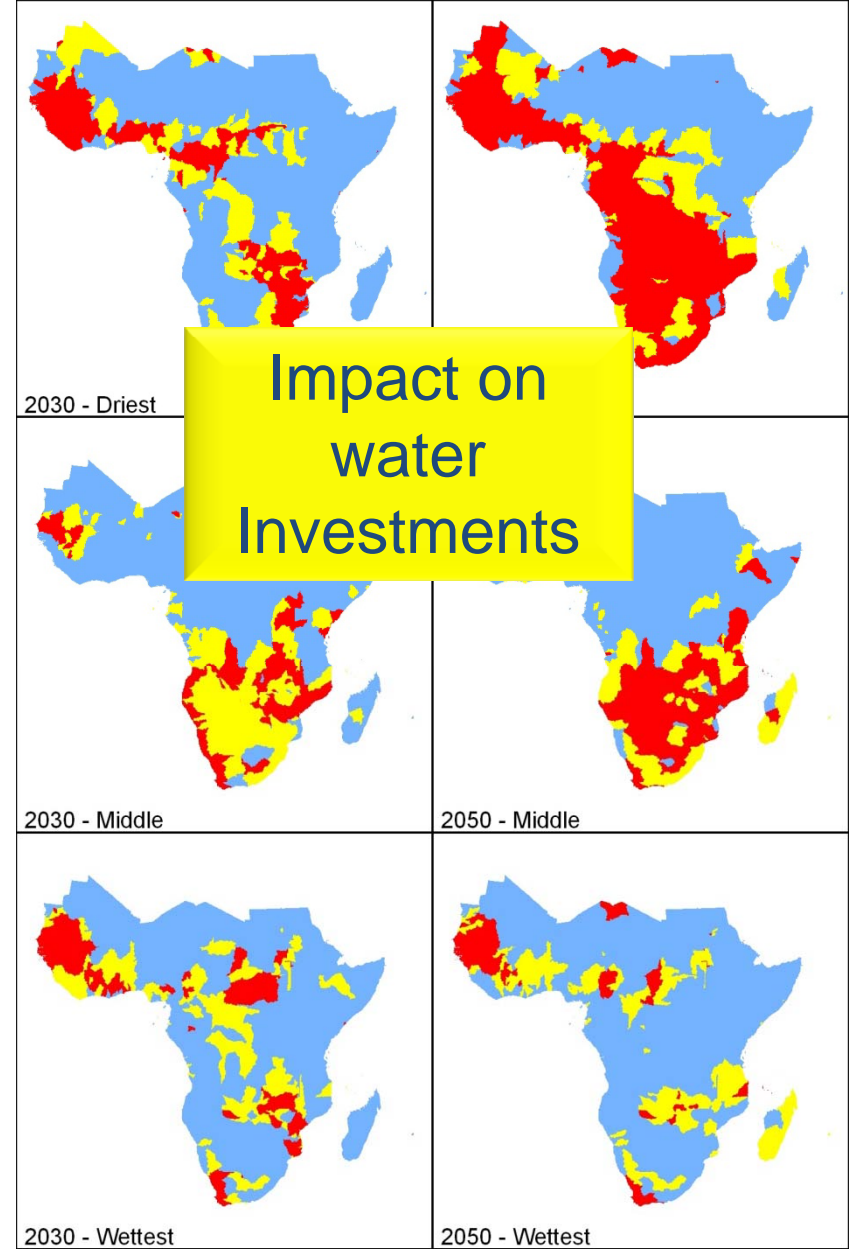


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Change in Basin Yield (%)



Climate Change Exposure Risk



A path forward



Improve Scale-up of regional generation and transmission capacity

- Develop a new generation of transformative projects, including natural gas, wind and geothermal
- Strengthen Regional Power Sector planning
- Develop regional power pools including legal & regulatory frameworks
- Support hydro projects with a focus on integrated water resources management

Regional power trade could save almost
US\$3 billion annually as well as
70 million tons of CO₂

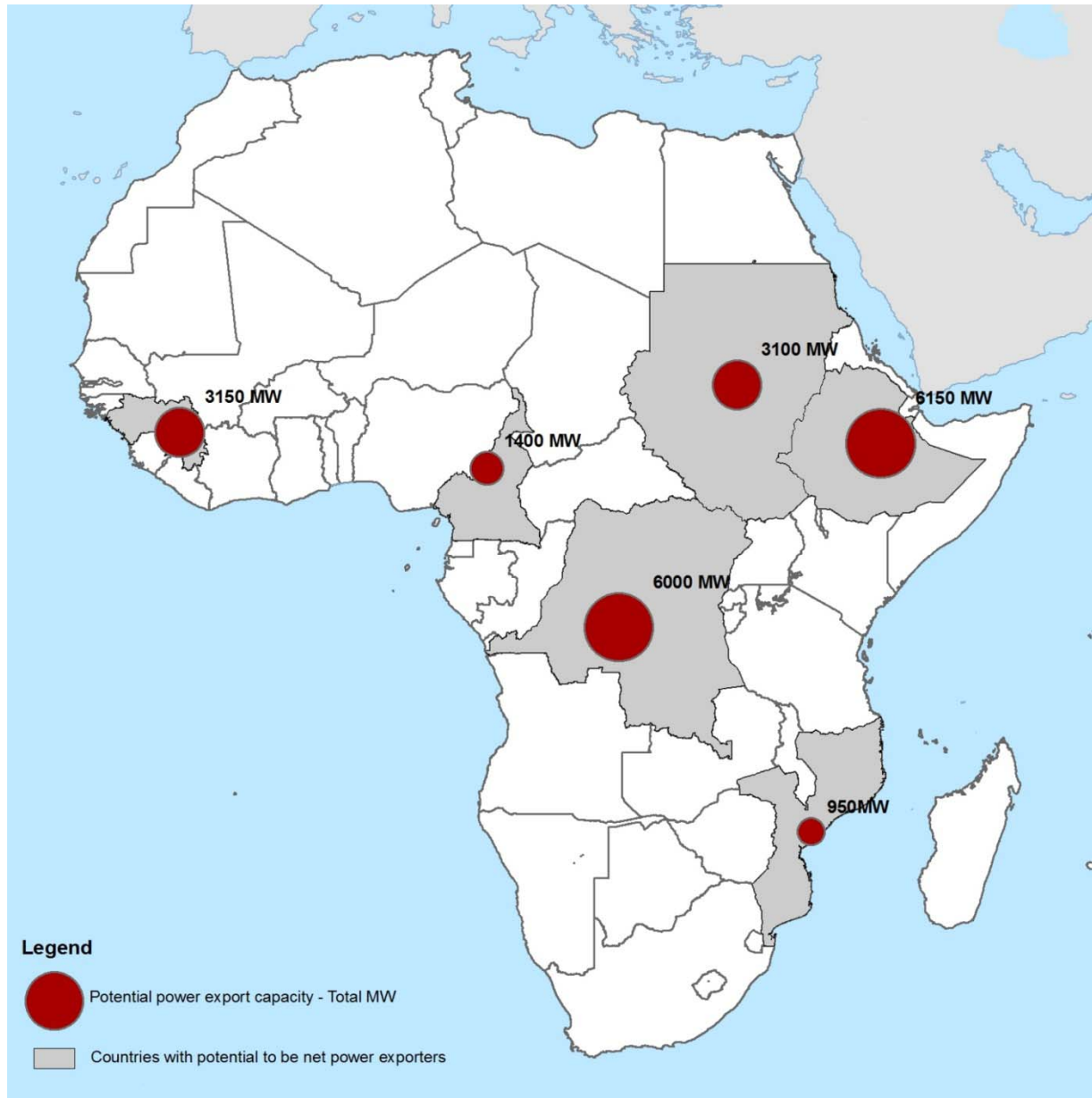
Why think regional about power?

- Africa's economic geography is a serious challenge
 - 20+ countries with populations of <5 million
 - 20+ countries with economies of <US\$5 billion
 - 60 international river basins
 - 15 landlocked countries
- That means power development must be at a regional scale
 - Most countries too small to generate power efficiently
 - Handful of countries with major hydro resources
 - Upstream decisions compromise downstream availability

Regional power trade: a necessity

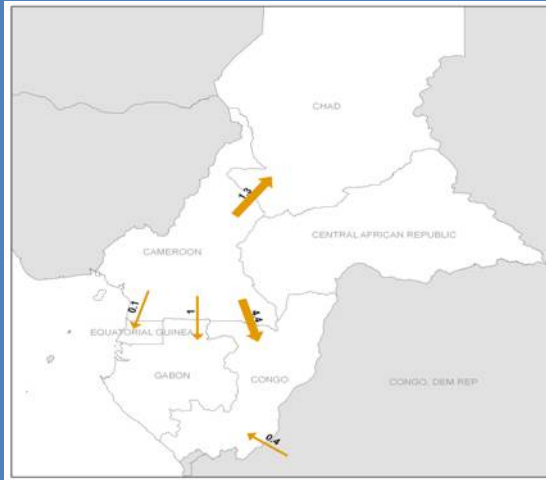
- Economies of scale in production and regional power trade would save Africa US\$2bn/yr
- Exports: dominated by hydropower (DRC, Ethiopia and Guinea)
 - Earnings could amount to 2-6% of GDP
 - Huge investments needed to become exporters
- Imports: cover >50% of needs in 16 countries
 - Savings >US\$ 0.03 per kWh or over 1% of GDP
 - IRR on inter-connections >100% pays back in <1 year

Power Export Potential

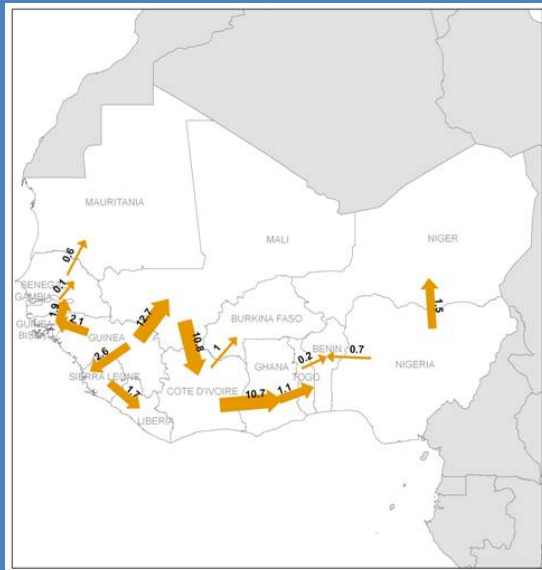
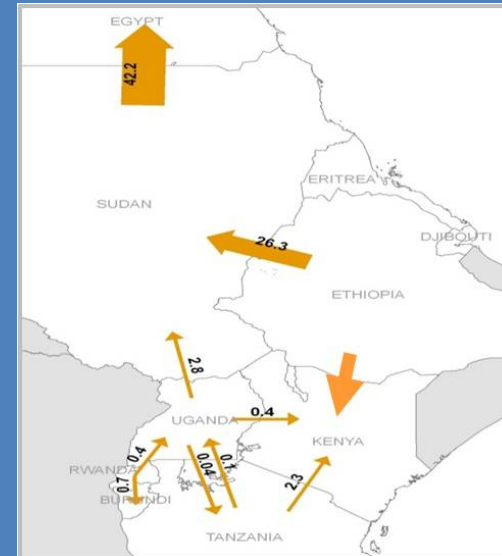


Power flows with trade expansion (TWh in 2015, mostly hydro)

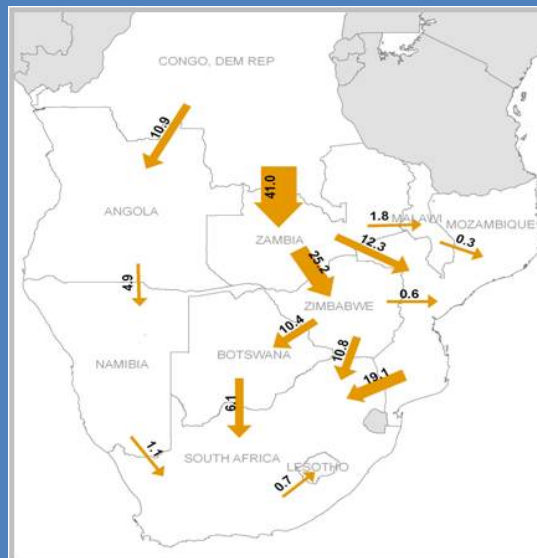
Central Africa



East Africa



West Africa

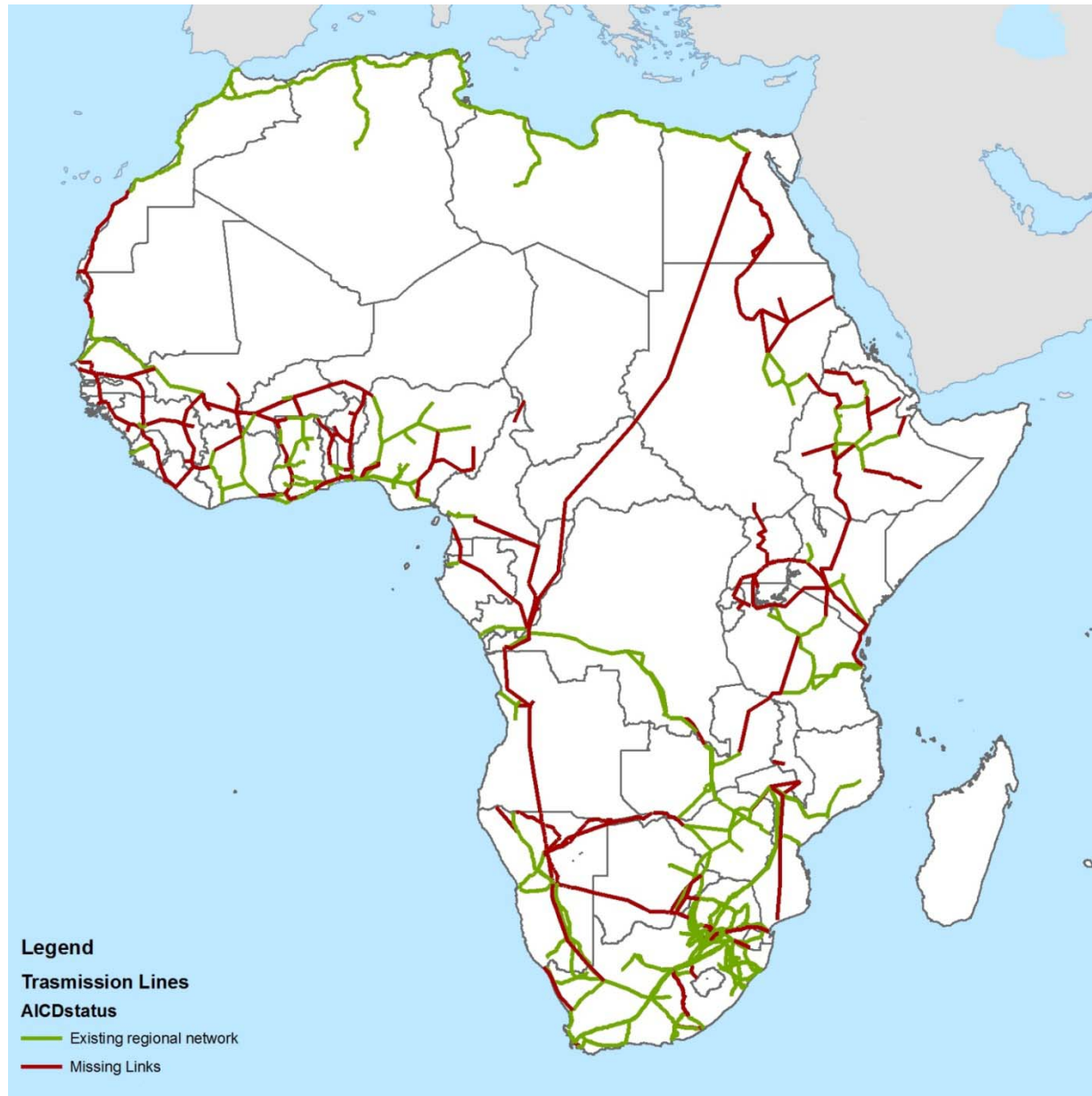


Southern Africa

Existing Regional Network



Missing links



Hydropower has high strategic value and offers a
“cleaner” development path

MITIGATION

Hydropower:

- accounts for 88% of renewable energy
- is a mature technology
- has ancillary benefits, such as system stability, peaking capability
- can store energy

ADAPTATION

Multi-purpose Hydro:

- contributes to a minimum platform of infrastructure for water security
- can help mitigate extreme events (droughts and floods)

World Bank and Hydropower

- Energy lending grew from US\$260 million in 2003 to US\$750 in 2007 and 2008.
- Energy lending in 2009 alone was US\$1.2 billion.
- Hydropower lending 2009 contained 77 active projects for total investment of about US\$ 3.5 billion (not including carbon funded).
- The portfolio is diverse: 28% storage, 48% run-of-river, 24% rehabilitation.



The World Bank is focusing on clean energy and increased access in its lending portfolio

Examples:

- Sierra Leone: Bumbuna Hydro-electric Project
- Africa Rift Valley: Geothermal Facility
- Kenya: Energy Sector Recovery Project
- South Africa: Renewable Energy Market Transformation
- Uganda: Bujagali Hydropower Project
- Cameroon: Lom Pangar Hydropower Project
- Democratic Republic of Congo: Inga 1 and 2 Rehabilitation

Summary

- Power shortages are a brake on economic growth and competitiveness. Climate change can exacerbate this.
- Infrastructure investment needs are massive and Africa faces a huge power sector financing gap. Climate issues can add to this cost.
- Power trade would help to reduce costs and facilitate a shift to cleaner energy. Reduction in carbon emission can be achieved through regional power trade.
- Scaling up hydro development for both urban and rural electrification can significantly reduce biomass fuel use and deforestation. Pricing challenge remains.
- Hydropower can play the mitigation and adaption roles in addressing climate change impacts.



Thank you!

