Social and environmental benefits of hydropower

The Canada-Africa Chamber of Business
Chambre commerciale Canada-Afrique

Power Infrastructure in Africa

24 October 2017

HATCH

Powering Africa

- The region has one of the lowest electrification rates in the world
- OECD estimates that 600 million Africans are energy poor and populations are continuing to grow faster than access to electricity is improving
- Diesel generators still make up a large part of energy consumption
- Dependence on biomass has led to severe deforestation in some countries and negative health impacts from emissions
- Lack of reliable power reduces private investment

Governments need significant private capital flows to design, build, finance, and operate new power infrastructure

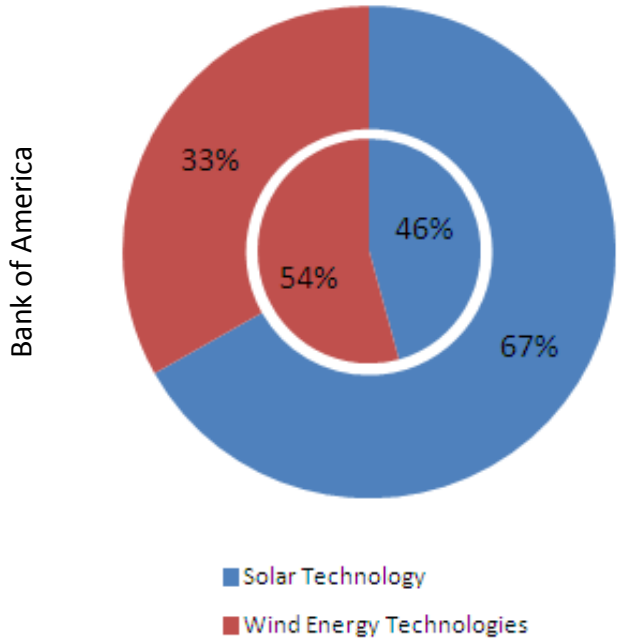
The opportunity for renewables

- African nations are among the most vulnerable to impacts of climate change (AfDB)
- Urgent need for climate change adaptation and "sustainable infrastructure“, such as clean energy
- Full potential for renewable energy projects in Africa not yet realized

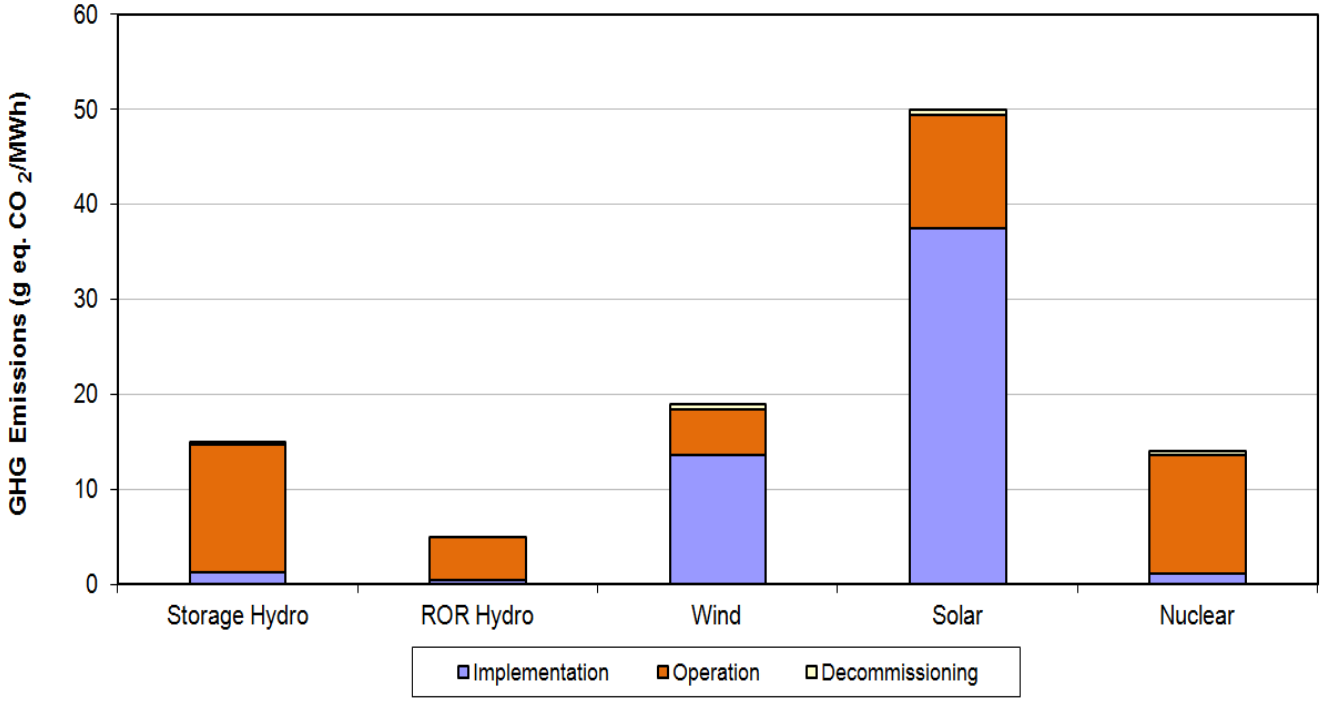
Generation	Hydro	Wind	Bioenergy	Solar	Geothermal	Marine	Total
Africa	119	8	3	4	4	<1	137
Asia	1 577	229	122	94	24	<1	2 044
Central America & Caribbean	24	4	4	1	4		37
Eurasia	248	12	1	0	4	<1	265
Europe	562	306	179	110	12	<1	1 168
Middle East	20	0	0	2	0		22
North America	633	226	82	38	25	<1	1 033
Oceania	40	14	4	6	8	<1	72
South America	642	27	61	2	<1	<1	732
World total	**3 893**	**826**	**456**	**256**	**81**	**1**	**5 512**

Source: African Development Bank (AfDB)

The power of water



Comparison of Life Cycle Emissions



General Analysis

Outer Graph: Breakdown of Spend

Inner Graph: Breakdown of GHG emissions reduced

The relationship between investment and reductions is not 1:1. For example, based on these results, for every $1.50 of spend in Solar you get the same GHG emissions reductions for every $0.60 spent on Wind.

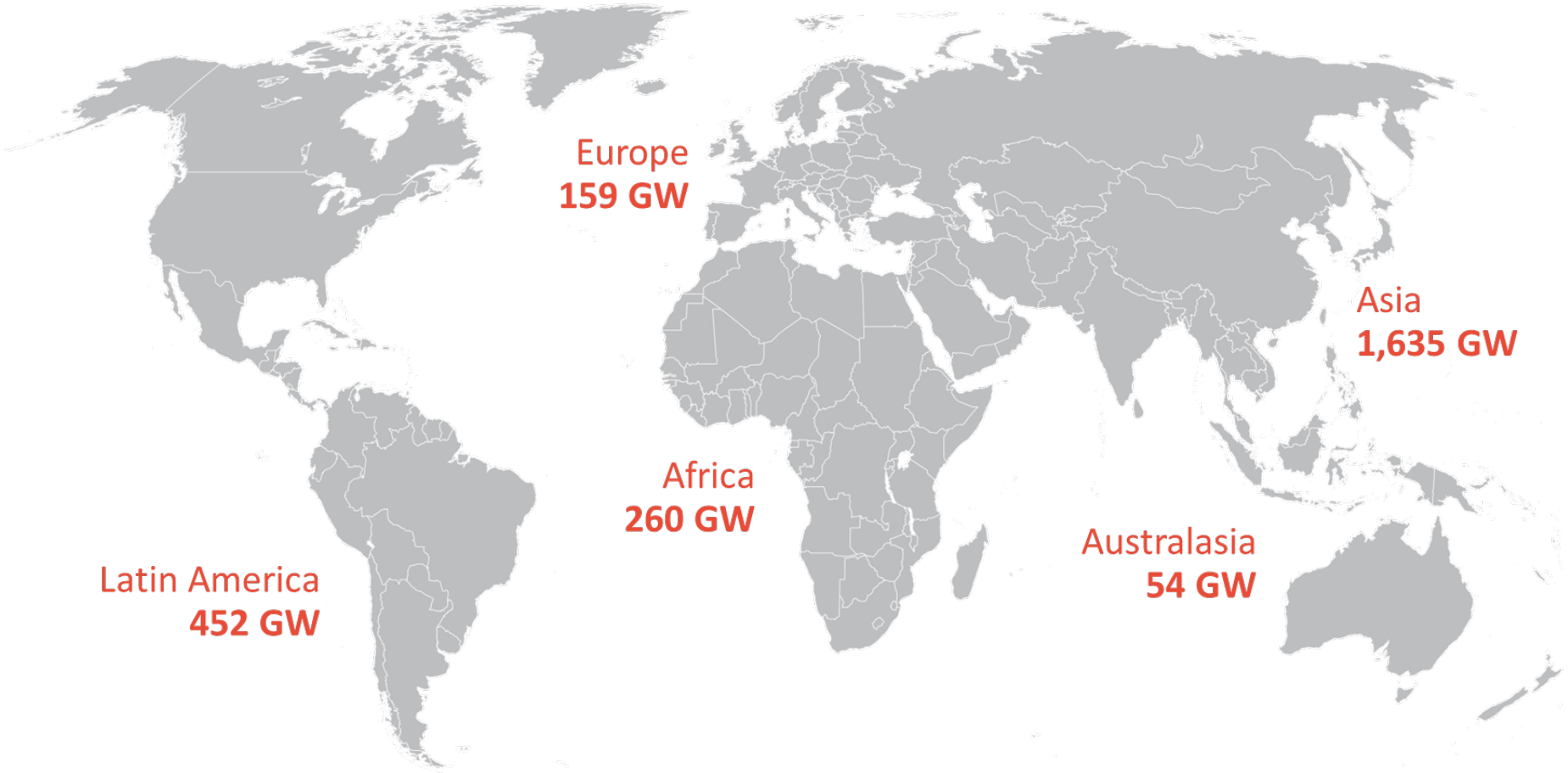
Renewables emissions reduced by two orders of magnitude compared to coal

Run of river Hydro provides the greatest benefits

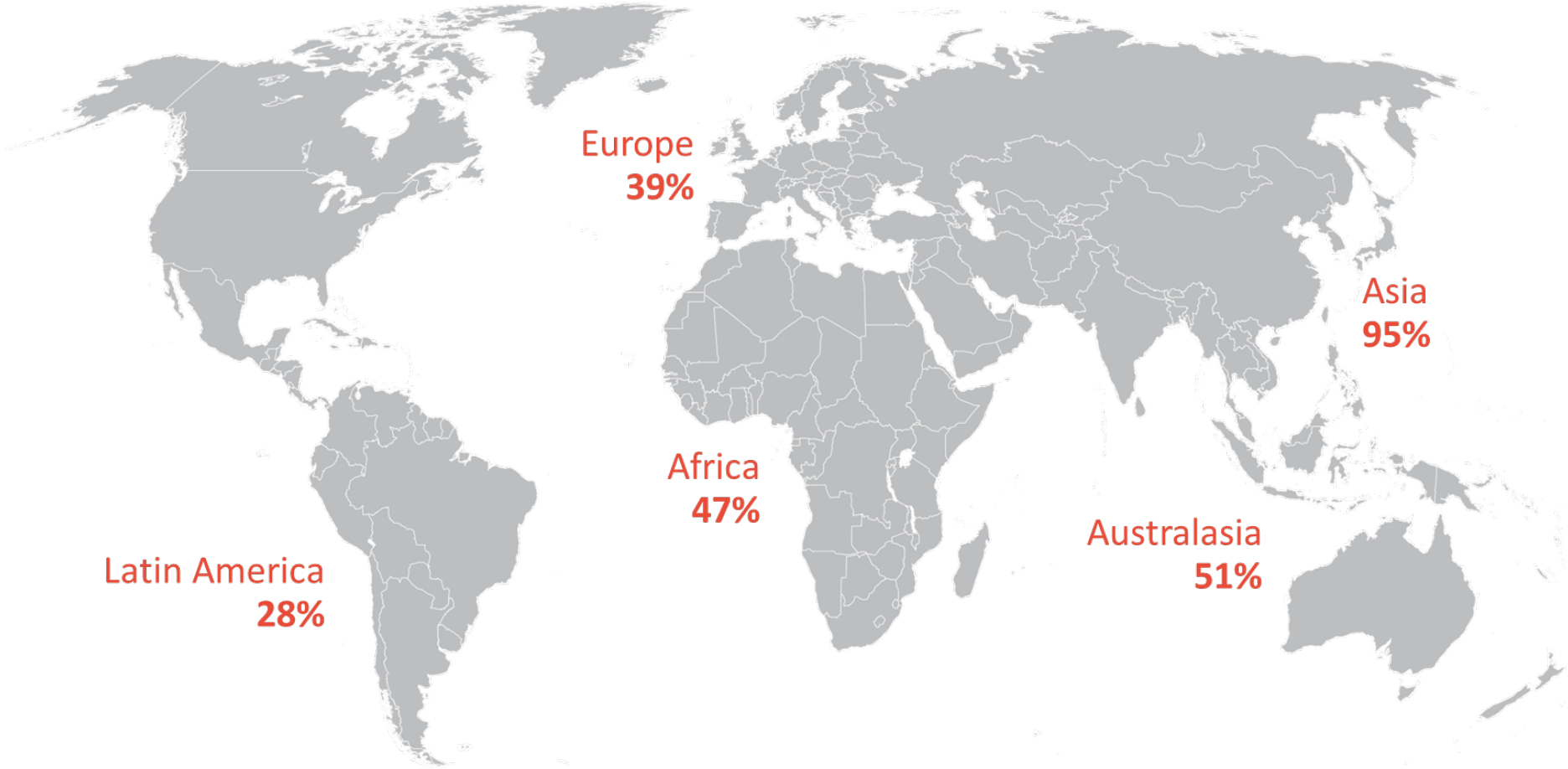
Wind, storage hydro and Nuclear approximately equal

Solar less effective but still beneficial (and becoming more

Undeveloped waterpower



GHG emission reductions achieved by replacing existing fossil fuel generation



Mechanisms to finance environmental outcomes

- Most African countries have ratified the Paris Agreement with GHG emission reduction commitments: Sustainable alternatives to fossil fuel-based power production will need to be developed and financed
- New financing mechanisms are available to help countries meet these commitments e.g., green bonds, which provide access to a new base of investors looking for exposure to green assets
    - Innovative financing mechanisms are being designed to help offset risks e.g., IFC and Amundi issued a joint US$2 billion fund to buy green bonds issued by emerging market banks
- Sustainable finance funds are being introduced to scale up green finance e.g., AfDB's African Climate Change Fund
- A sovereign green bond can help bring down the cost of capital for green projects by attracting new investors and mobilize private capital towards sustainable development
- Lack of legacy fossil fuel infrastructure can enable countries to develop without the same level of environmental harm as developed Western countries
- Nigeria is the first African country to issue a green bond
- Government involvement is critical for this nascent financial market to succeed!

https://www.environmental-finance.com/content/analysis/stimulating-green-finance-in-africa.html

And the problem for hydro

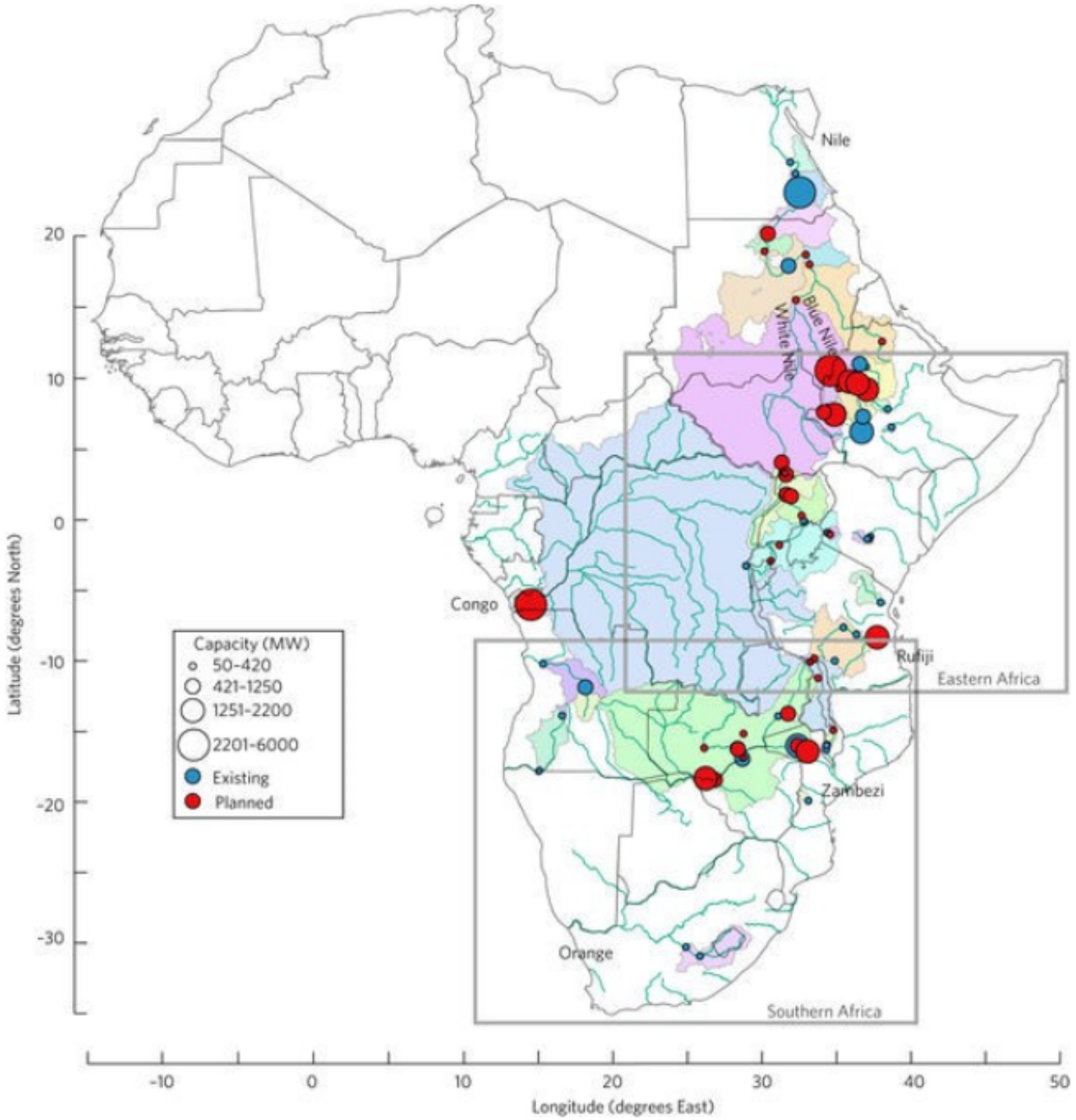
- Provision of climate change adaptation services through flood and drought management
  - Returns from hydropower provide an economic justification for multipurpose water storage, which can then be used to provide additional benefits such as irrigation to support local livelihoods and improve food security *(Department for International Development)*
- Role in maintaining grid stability and reliability
- **However,** financing hydropower through green bonds is controversial due to potential **negative impacts**:
  - Loss of habitat/biodiversity
  - loss of agricultural land
  - Loss of cultural assets
  - Displacement of people
  - Weak social/environmental impact assessment
- **And risks:**
  - Dependency on precipitation and streamflow (in Africa, multiple hydro projects planned on a few rivers)
  - Exposure and vulnerability to natural disasters
- **Therefore,** hydropower projects > 50 MW (and sometimes > 25 MW) are often considered ineligible

Landscape of hydro power in Africa

- Existing hydropower dams
- Planned to 2030 (> 50 MW)
- Boundaries used to calculate rainfall clusters

Shaded areas represent the main basins upstream of the hydropower dams

Source: Nature Energy volume 2 (2017)



New guidance

- Working with stakeholders, the International Hydropower Association (IHA) is seeking international agreement on climate compatible criteria for hydropower projects
- Criteria is to be approved by the Climate Bonds Initiative (CBI) through the Hydropower Technical Working Group (TWG)and accepted by the hydropower sector
- Hydropower Sector Climate Resilience Guidelines developed by the World Bank
- Guidelines to be tested throughout 2018 supported by the IHA, World Bank and EBRD

Measures to address impacts…

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- Up-front planning and assessment of potential sites
- Effective consultation, mitigation and accommodation
- Realistic project implementation schedules
- Environmental constraints in construction schedules
- Well-planned baseline studies with agency input
- Ongoing and meaningful consultation with stakeholders
- Ecologically sustainable environmental flows
- Fish passage structures / habitat creation
- Compensation for physical or economic involuntary resettlement

Climate change

1. Conduct a climate change risk screening to determine extent of project's vulnerability
2. Incorporate a climate change lens into project risks and opportunities register
3. Conduct a quantitative stress test of risks exacerbated or opportunities enhanced by climate change factors
4. Modify to an economically acceptable design to improve resilience
5. Create, monitor, report and evaluate disaster risk management plan

…especially climate change….

Farmers' yields will fall
Climate change is likely to reduce yields of major cereal crops across Africa. In **Namibia**, for example, climate impacts on agriculture could reduce annual GDP by between 1% and 6%. **Nigeria** and **Kenya** could be similarly impacted.

Extreme weather will increase
Global warming changes the frequency, intensity, extent and duration of weather and climate extremes. These include more pronounced droughts, floods, heat stress and tropical cyclones. **Morocco**, **Ethiopia** and **Nigeria** are particularly vulnerable to such weather.

Disease and malnutrition
Extreme events such as flooding can combine with longer-term changes such as warmer temperatures to spread infectious diseases, shift malaria regions and exacerbate malnutrition. Among others, **Mozambique**, **DRC** and **Ghana** will be affected.

Water resources may dwindle
Changes in rainfall could reduce water availability in some regions. As many as 90 million people would be at risk if rainfall drops to the point at which groundwater resources become non-renewable. This will be a problem particularly for **Zambia** and **Namibia**.

Impacts on energy generation
Energy production that depends on hydropower will be most affected. Rainfall changes may increase capacity to generate in East Africa but decrease it in West and Southern Africa. **Angola** and **Côte d'Ivoire** will be negatively affected.

Rising sea levels threaten cities
Most of Africa's biggest cities are on the coast, including Accra, Dar es Salaam, Lagos and Maputo. Millions of people could be at risk from flooding in **Mozambique**, **Ghana** and **Gabon**.

Fisheries under threat
Rising ocean temperatures and ocean acidification are radically altering aquatic ecosystems. This jeopardizes the sustainability of fisheries and aquaculture, and the livelihoods of the communities that depend on fisheries, such as those in **Gabon**, **Namibia** and **South Africa**.

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Impact examples	Mitigation examples
• Increased evaporation • Increased demand for available water • Increased sedimentation • Loss of reservoir storage • Increased flood handling capacity • Increased spills	**Structural** • Modify or replace service spillway • Develop alternative spillway **Operational** • Reduce forebay level seasonally • Increase storage for flood management • Design and implement enhanced flow forecasting systems • Reduce diversion flows • Implement changes to upstream operations in the cascade system **Government action** • Establish early warning system • Add redundancies to reduce risk • Protect or remove vulnerable areas

Source: AfDB

…to benefit from the upside of investment!

Socio-economic benefits include:

- Energy storage and peak hour generation
- Employment opportunities through increased access to reliable energy as well as support infrastructure e.g., testing facilities, grid connections
- R&D investment in nascent technologies and commercialization
- A holistic implementation of water and energy solutions, strengthening resilience and adaptation services through appropriate water management
- Locally developed supply chains

Original artwork by Brigitte Winchester, Hatch

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