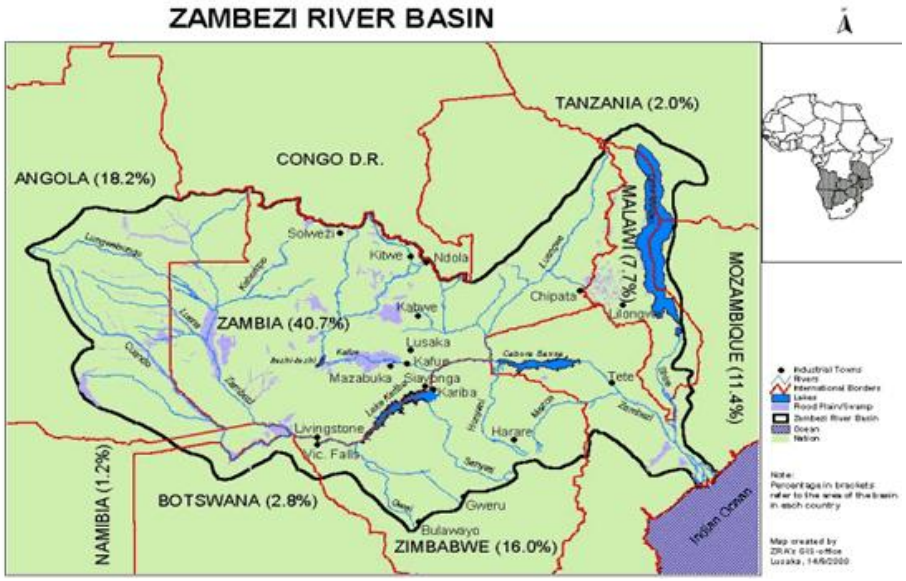
Climate vulnerability of renewable energy: hydropower in southern Africa

COP22 Side Event

November 2016

Outline

- Policy issue, project approach
- Our approach: study design and team
- Quantifying vulnerability: study results
- Climate and energy policy implications
- Next steps



Policy issue and project approach

- How could the climate change impacts on hydropower affect an entire regional electricity system?

  => integrated climate-development-energy analysis

Approach

Electricity model (LEAP) for Southern African Power Pool and river basin model for water allocation (WEAP) for Zambezi River Basin (with Brian Joyce, SEI)

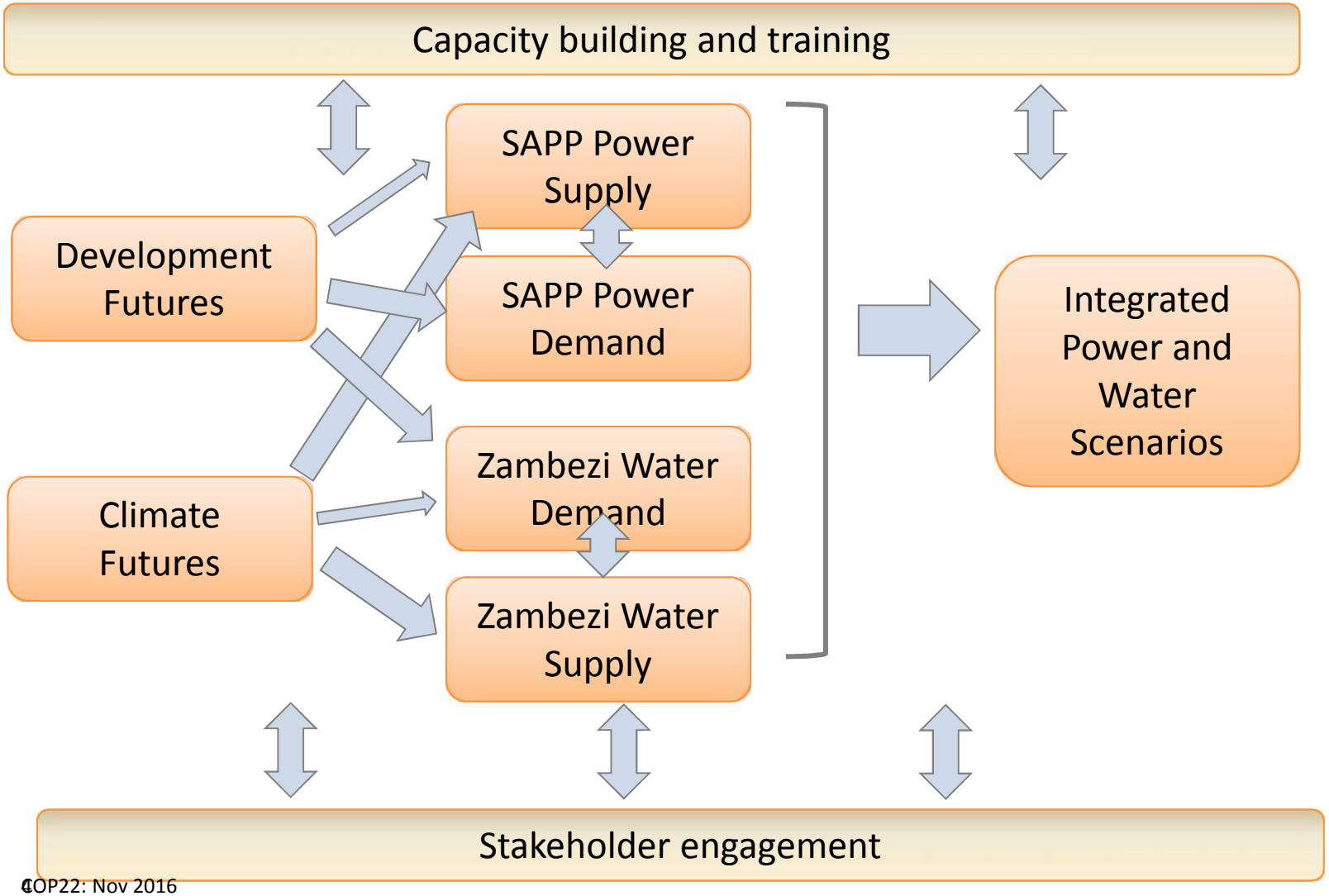
www.energycommunity.org

www.weap21.org

Funding:

CDKN (2012-14) and World Bank Cooperation in International Waters in Africa (CIWA) (2014-16)

Our approach: integrated analysis supported by training and engagement



Scenario approach: uncertainties in future climate and development

		Climate futures		History
		"Drying" marker scenario (e.g. drying in many sub-basins)	"Wetting" marker scenario (e.g. wetting in many sub-basins)	Historical climate
Development futures	BAU (e.g. moderate economic growth)	"BAU Dry"	"BAU Wet"	"BAU baseline climate"
	Grand Deal (e.g. transforma-tional growth)	"GD Dry"	"GD Wet"	"GD baseline climate"

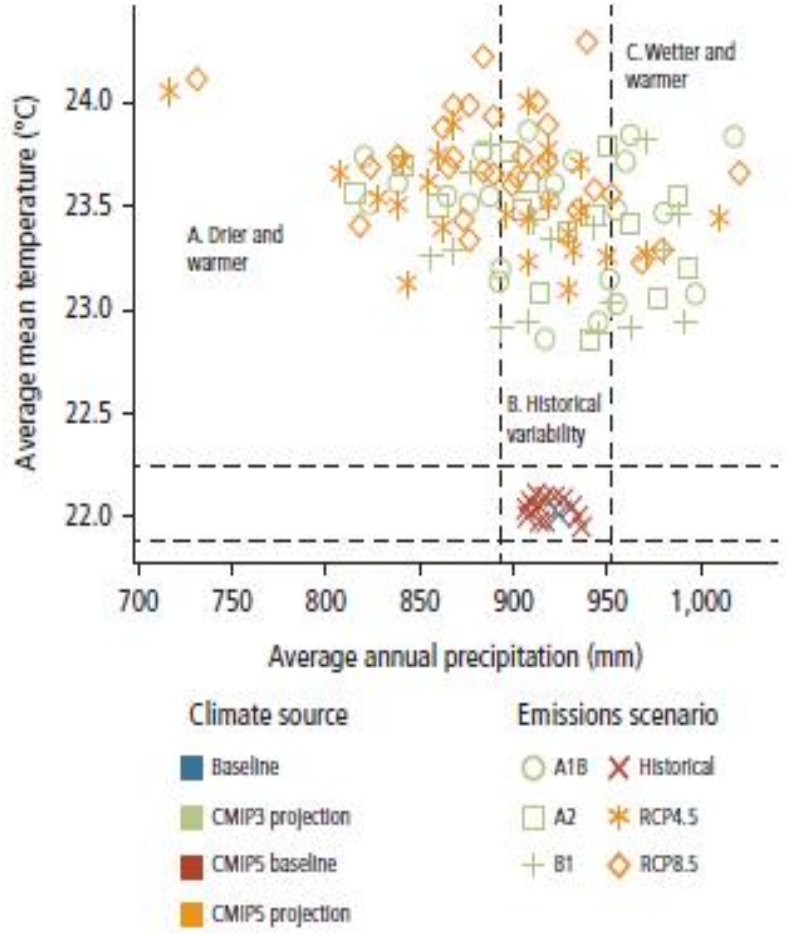
Modelled future scenarios

Modelled baseline

Remember these names, esp BAU & GD!

All Zambezi climate futures are warmer, and more are drier

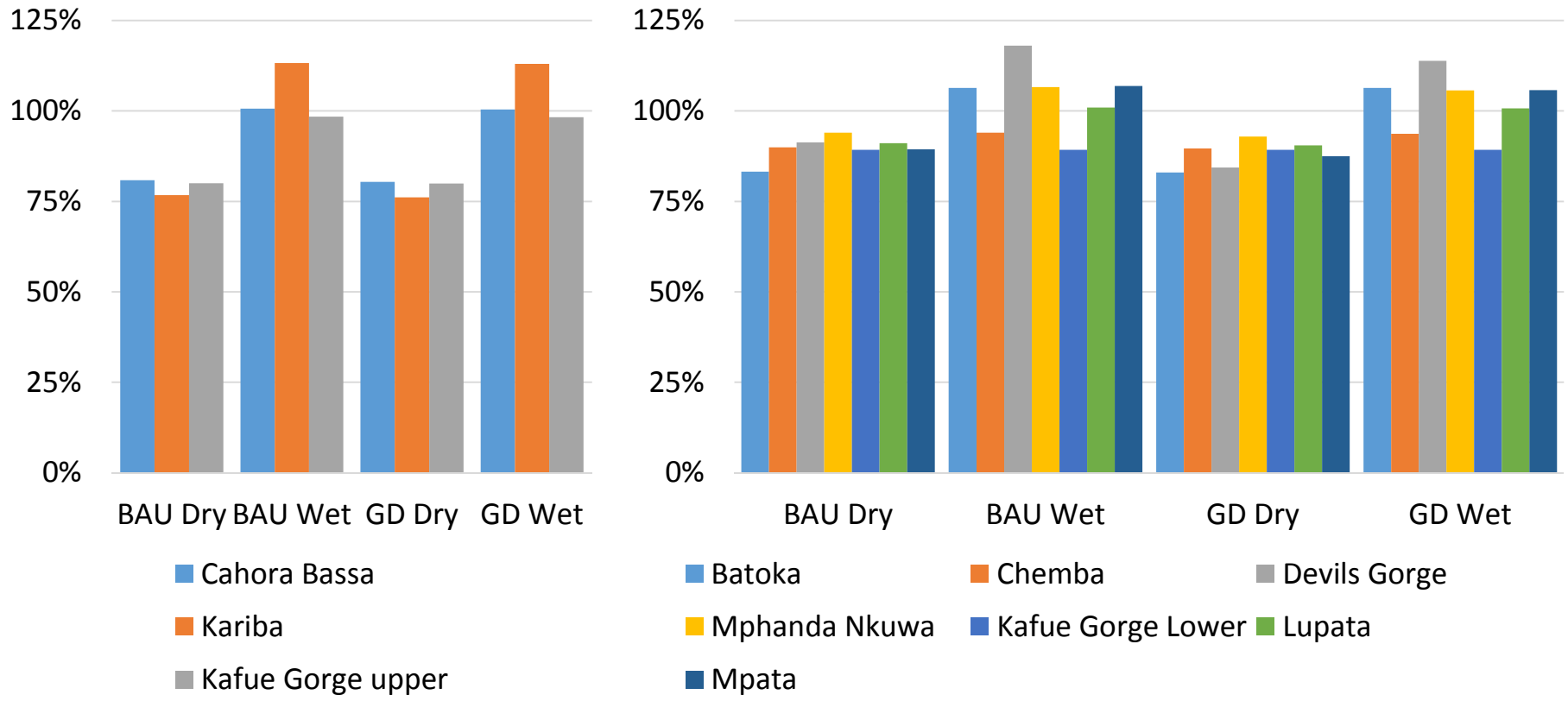
Precipitation and mean temperature in modelled climate futures: Zambezi River Bain



Source: Cervingi et al (2015) Enhancing the Climate Resilience of Africa's Infrastructure: The Power and Water Sectors. World Bank

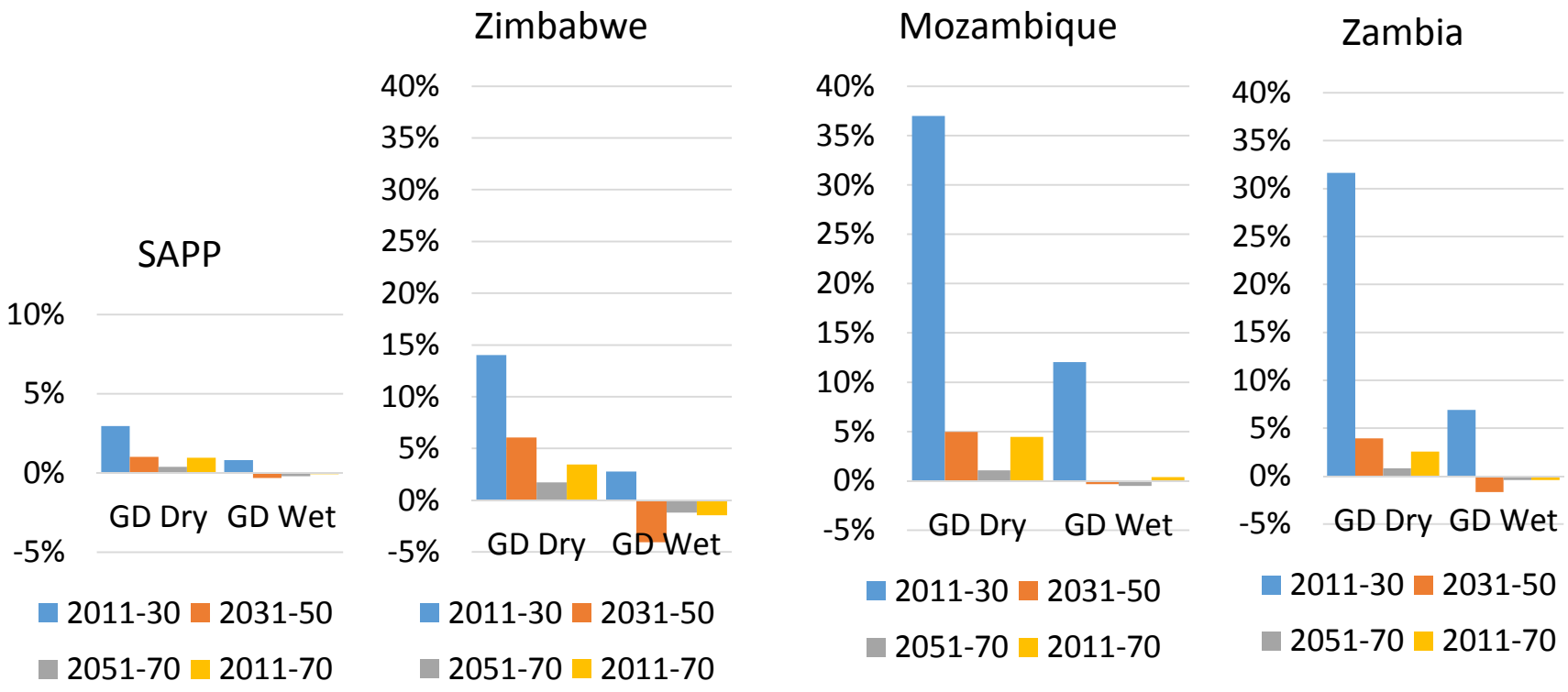
Hydropower plants vulnerable to drying - with limited benefit from wetting

Hydropower generation from dry and wet climates for major existing plants, 2011-70 (% baseline generation)

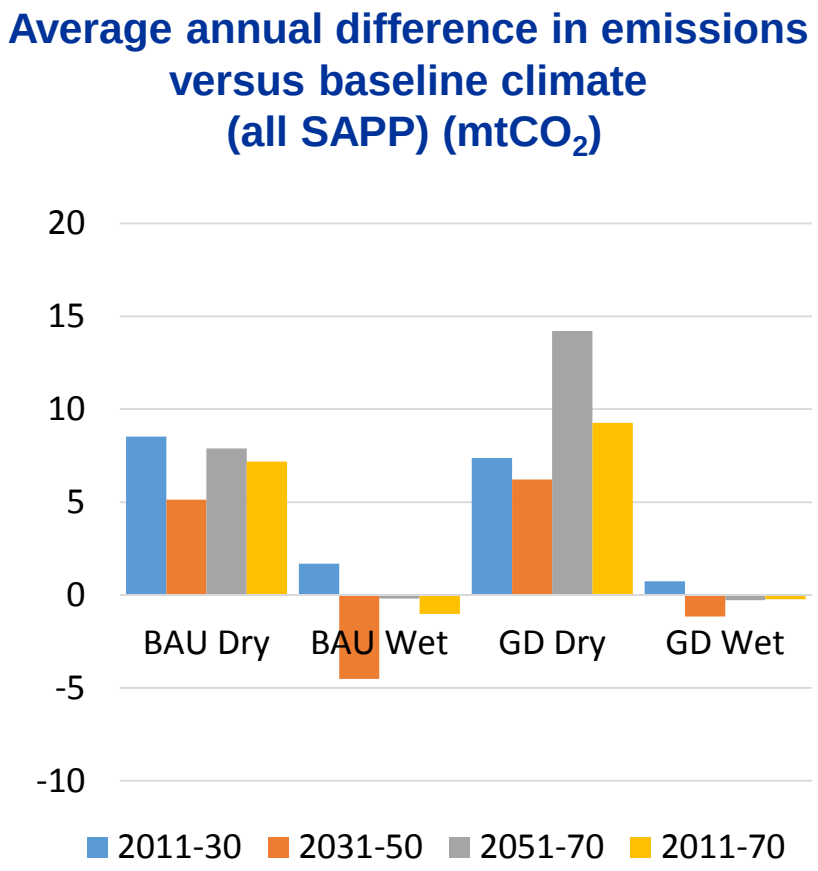


Hydro-rich countries most vulnerable to drying

Change in generation costs relative to baseline climate (% total generation cost)



Regional CO_2 emissions could increase more than a large coal plant due to lack of water



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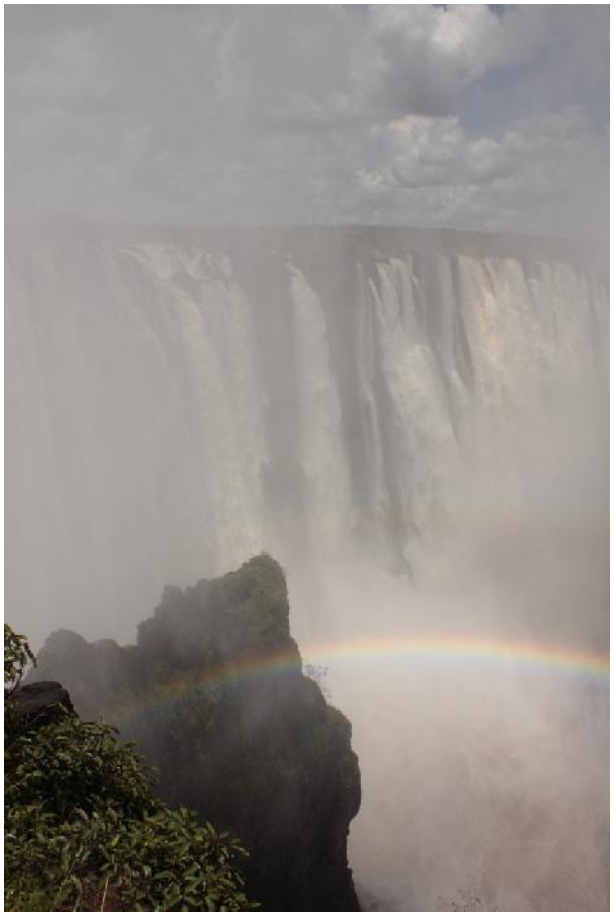
Energy and economic policy implications

- Less hydropower = less export revenue, budget shortfalls & economic losses
- Need strong cooperative governance arrangements to manage increasingly scarce shared water resources
  - Build on PIDA, WB support for transformation energy projects
- Need to integrate climate change and upstream development into national and regional electricity planning
  - Not just policy, but capacity building and relevant tools

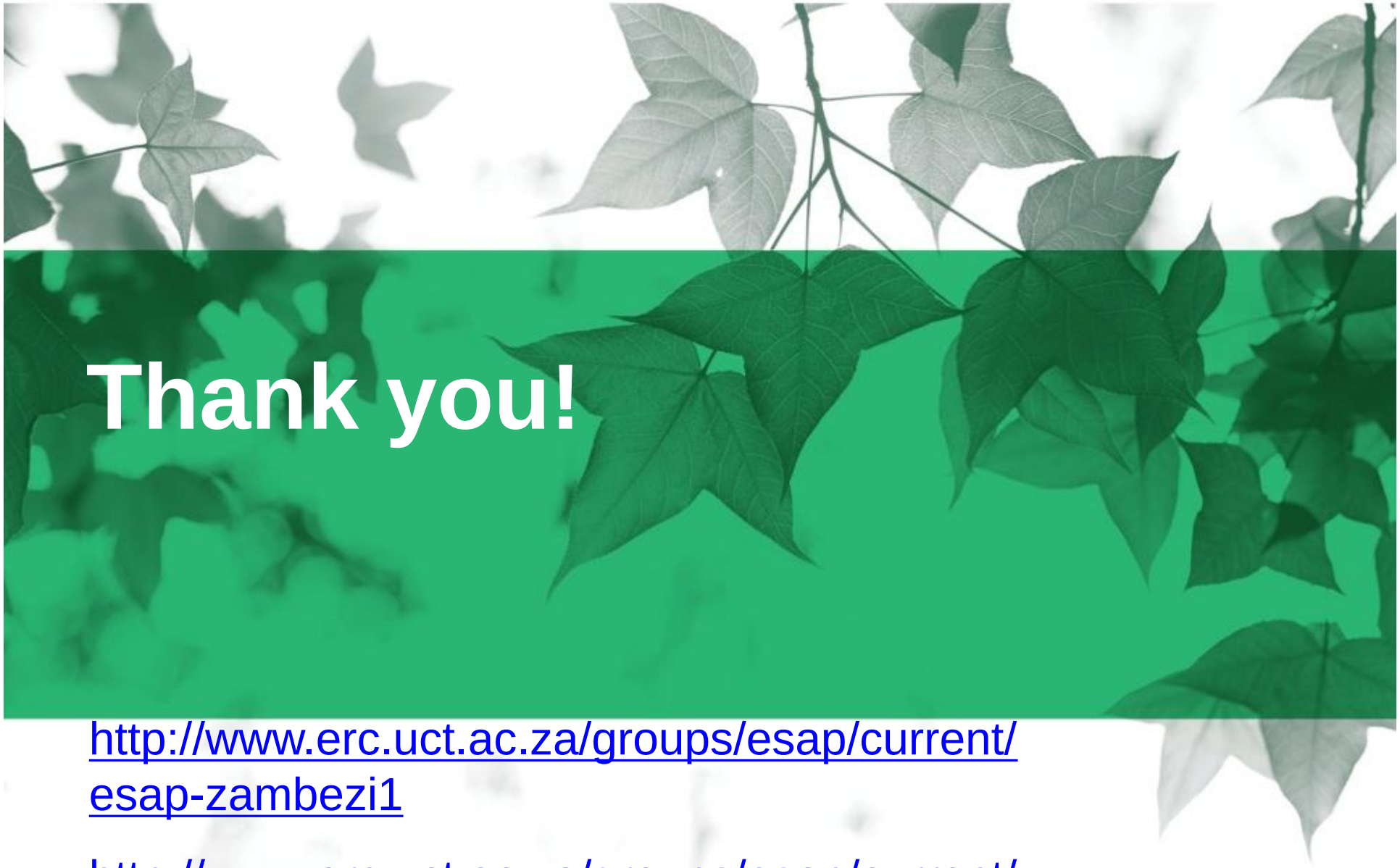


Climate policy implications

- Most SAPP countries have quantitative commitments for mitigation in their INDCs
  - Mozambique and Malawi have only committed to actions, not quantitative reductions or limitations
- For Zambia and Zimbabwe, the impacts of climate change could potentially make it *more* difficult to meet their mitigation commitments
- INDC/NDC requests for international support are therefore critical, because they will need *financing*, *capacity building* and *technology transfer* to achieve mitigation goals within the context of an uncertain climate

Next steps

- Seeking funding to support SAPP with additional analysis and capacity building
  - Incorporating more regional river basins (e.g. Congo)
  - Matching renewable energy supply to regional demand
  - Impact of inter-basin transfers
  - Economic trade-off between irrigation and hydropower
  - Training and customized tools for all of the above
- Apply integrated approach in other power pools and shared river basins with vulnerability to climate change



http://www.erc.uct.ac.za/groups/esap/current/esap-zambezi1

http://www.erc.uct.ac.za/groups/esap/current/esap-zambezi