

EASTERN AFRICA POWER POOL



BUILDING THE WIRES, CAPACITY, AND HARMONIZATION FOR TRUE REGIONAL INTEGRATION

**By ENG. JASPER ODUOR
EAPP EXECUTIVE SECRETARY**

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Outline

- 1. The Pool:** Profile, Activities & Achievements
- 2. The Region:** Supply situation & Resources:
- 3. True Regional Integration:** The 3 Imperatives
- 4. Prospects for the Region**
- 5. The way forward**

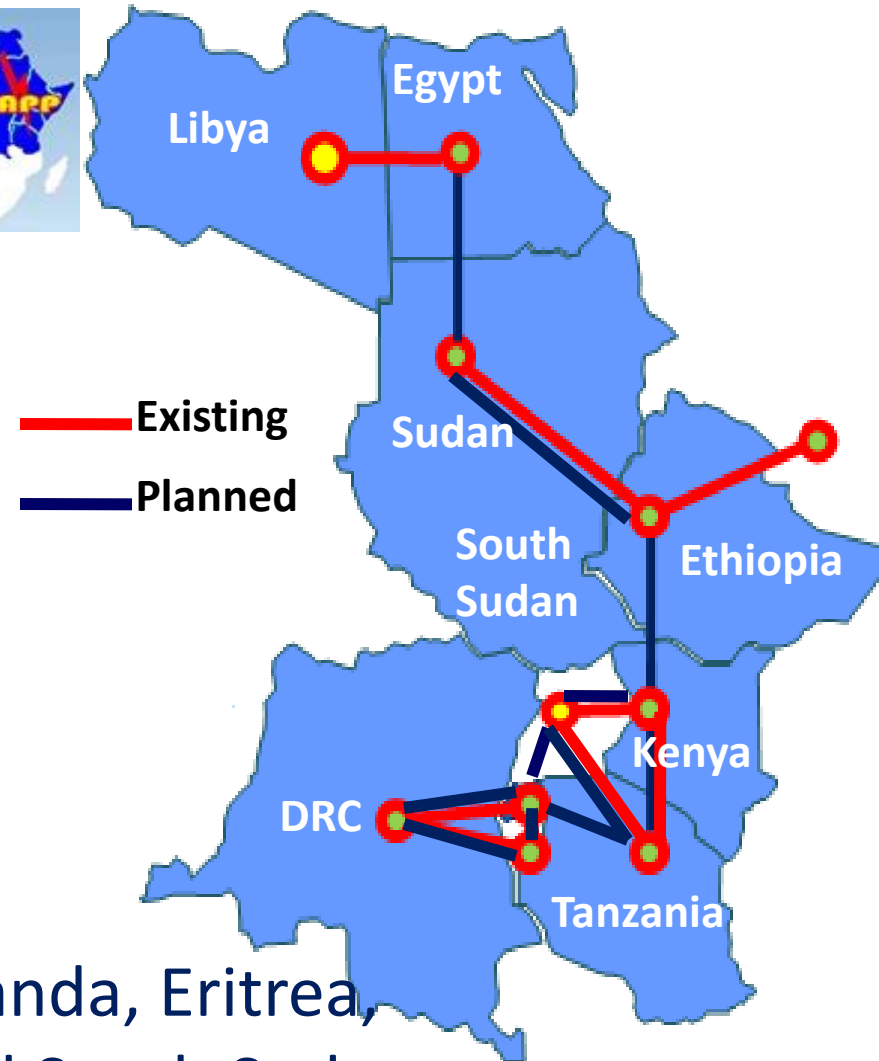
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The Power Pool

- Established in 2005
- 9 countries & 12 utilities

Burundi	REGIDESO/SINELAC
DRC	SNEL/SINELAC
Egypt	EEHC
Ethiopia	EEPCo
Kenya	KPLC, KENGEN, KETRACO
Libya	GECOL
Rwanda	RECO/SINELAC
Sudan	MED
Tanzania	TANESCO



Potential Members: Djibouti, Uganda, Eritrea,
Somalia, and South Sudan

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EAPP Objectives

- 1. Secure power supply for the regions countries**
- 2. Optimize the use of energy resources**
- 3. Coordinate system planning, development & operation**
- 4. Increase power supply in the region**
- 5. Reduce electricity cost by interconnection & power trade**
- 6. Provide efficient coordination in power production, transmission & trade**
- 7. Create a conducive environment for investment**
- 8. Facilitate the development of competitive electricity market**

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Current Activities:

Institutional Development (ID)

- Market & Governance design, Training, Templates, Rules, etc

Harmonization with Regional Grid Code (Powering Progress)

RMP & RGC prepared & approved. Gap Analysis between RGC and national technical standards in progress.

Coordination & Collaboration:

- Critical for implementation of RMP and Market Road Map



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EAPP Achievements

- Drafted a Governance structure
- Market design & Road Map to 2025.
- Approved Regional Master Plan & Grid Code
- Market Rules under review
- Recruited RMOC and RRC key staff
- Capacity Building for utilities and staff
- Harmonization of technical standards began
- Excellent relations with partners

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The Region: Supply Resources

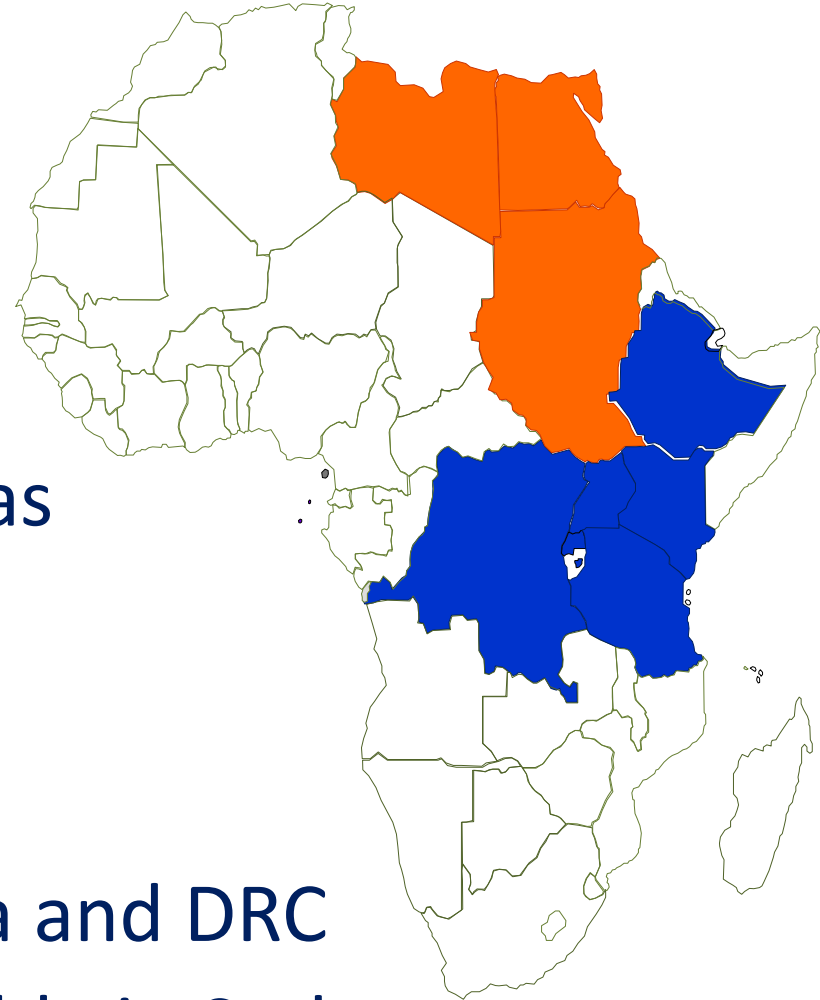


Largely oil and Gas



Hydro, Geothermal, Gas

- Wind & Solar in all parts
- Biomass in most parts
- Oil also available in Uganda and DRC
- Hydro potential also available in Sudan

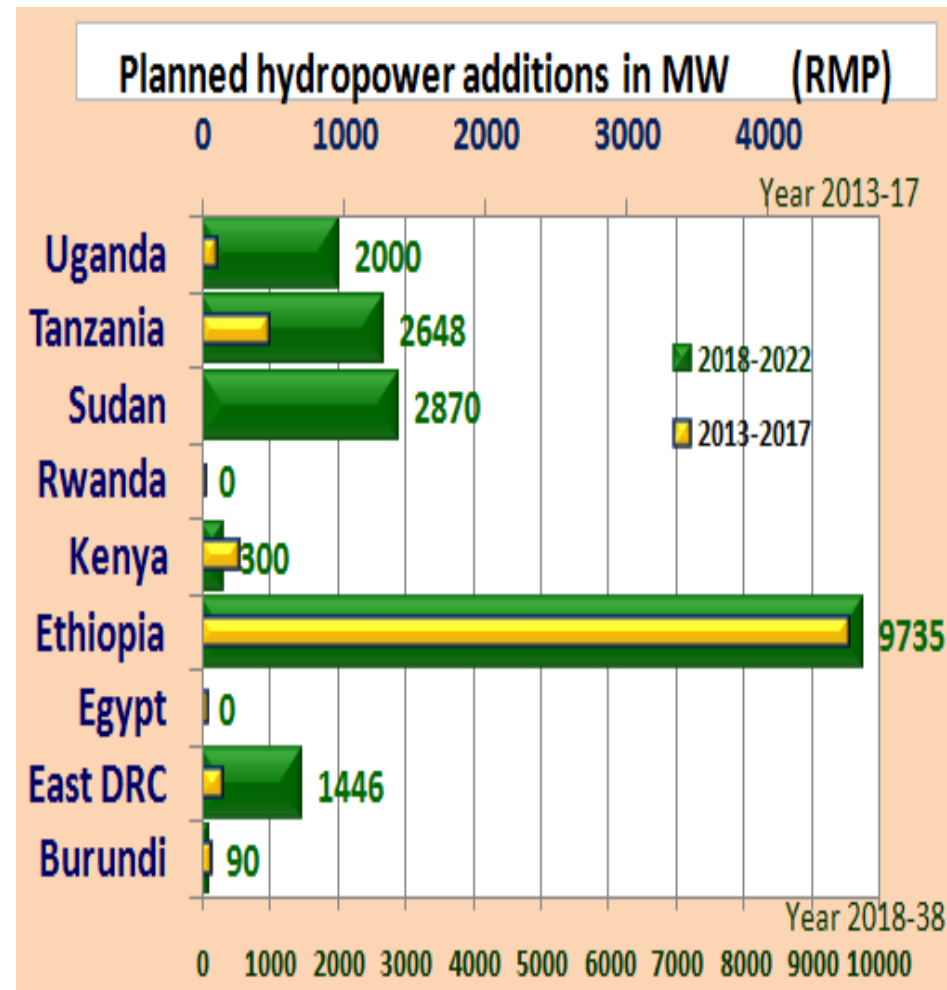


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Hydropower

- Good potential in central and south of region.
- 2012 Regional average energy 167,778 GWh
- Regional firm capacity is 78% of average
- DRC potential 100 GW; Ethiopia's 45 GW.



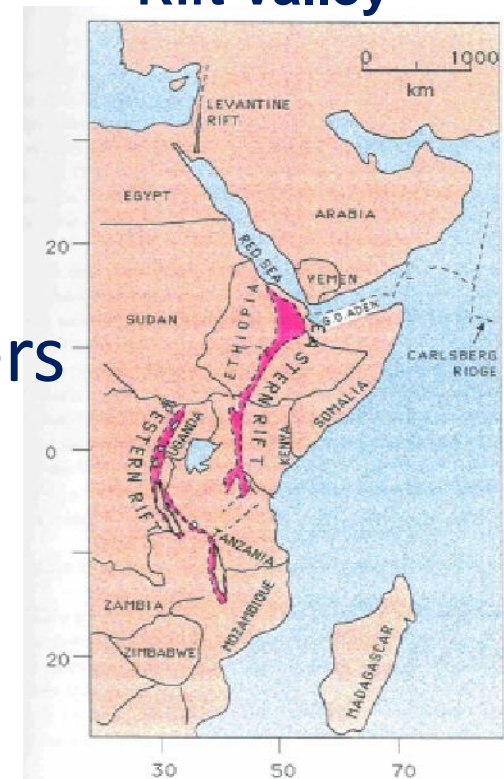
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Geothermal Resources

- Available in most countries of Region
- Studies going on by many members
- Potential not well developed
- Kenya most active country. GDC. Highest installed capacity.

Great East African Rift Valley



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Biomass

- Traditional use dominant
- Big co-generation potential

Wind

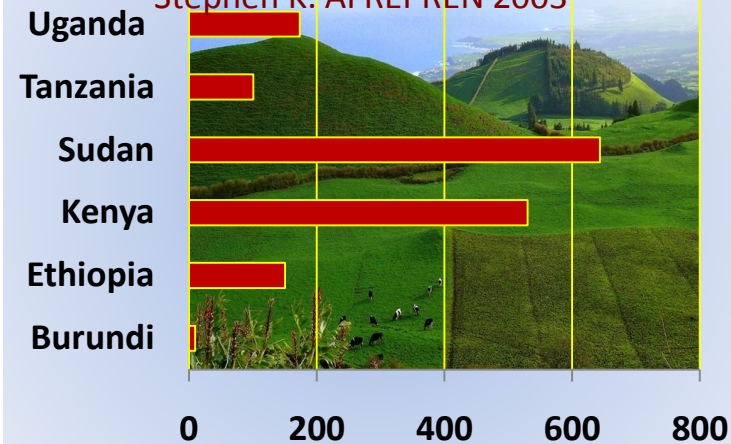
- Potential believed available
- Installations in Egypt, Ethiopia, Kenya

Solar

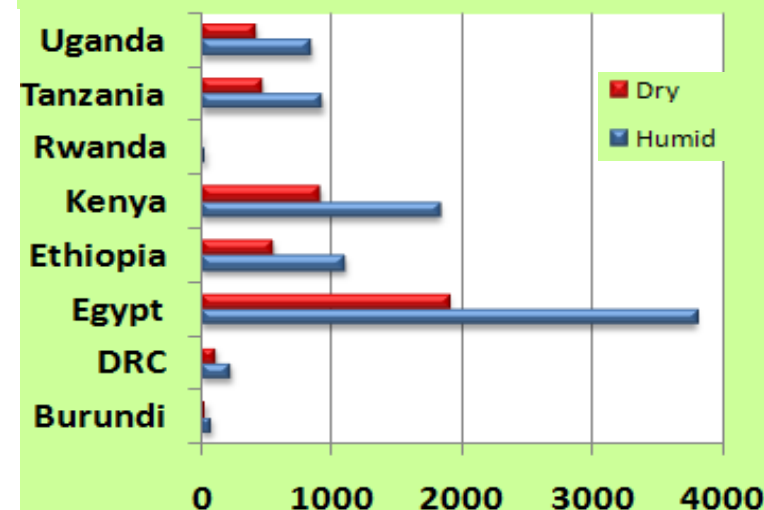
- High potential in the region
- Mainly off-grid application
- Unaffordable to the poor

Co-generation potential GWh.

Stephen K. AFREPREN 2003



Bagasse potential, X10³Tonnes (WEC 2010)



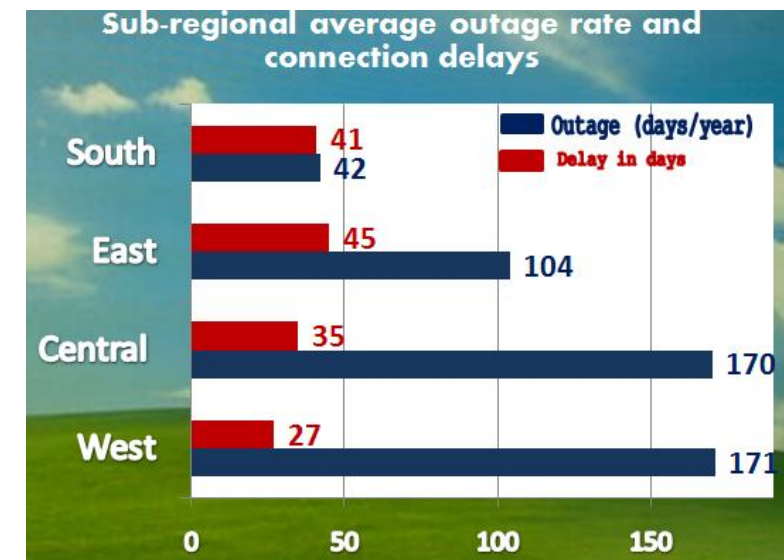
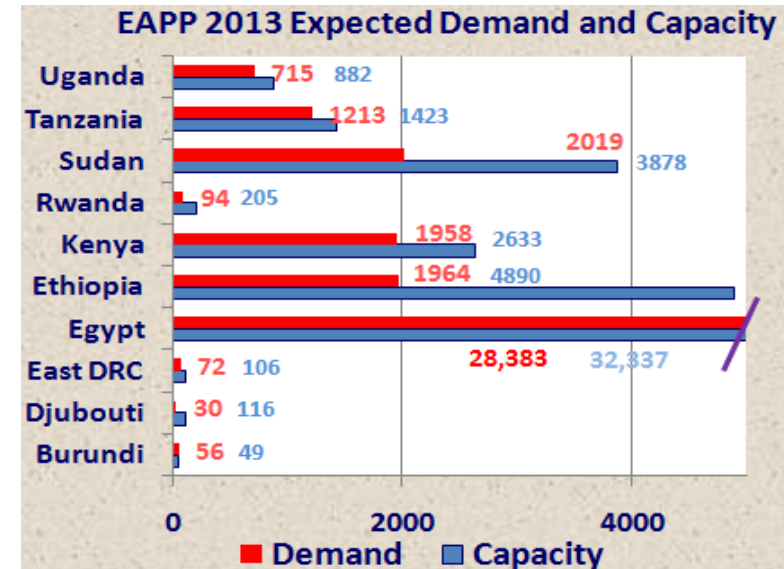
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Supply Situation

- Regional demand growth rate is 7%. Twice GDP growth rate
- Draught, power shortage and emergency supply over last decade
- Low system reliability *
- Average power loss in the region 23%*

*2009 World Bank Report



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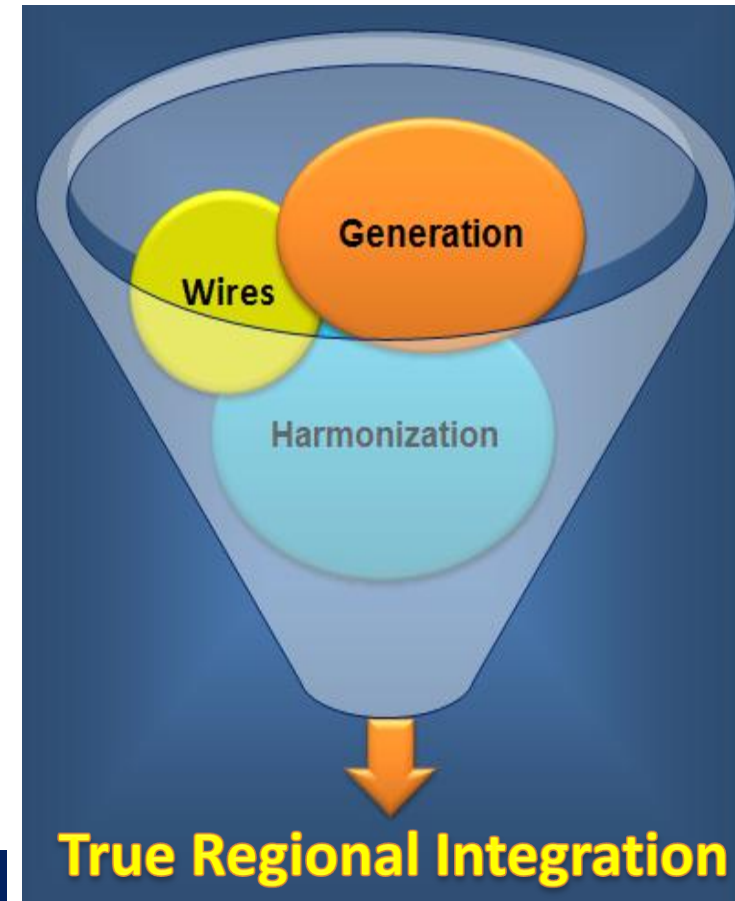


True Regional Integration: The Three Imperatives

- Wires
- Capacity (Generation), &
- Harmonization

Vital elements for true regional integration

(Harmonization of Technical, Legal Policy & Regulatory provisions that affect regional power trade.)





Why these imperatives

Wires

- Access to cheaper energy and ancillary services impossible without interconnection
- Benefits from complementary load-profiles coordinated maintenance, & energy banking require interconnection
- Domestic lines need reinforcement; Spare capacity is required to wheel large volumes.



Why these imperatives *contd.*

Wires

- 2nd Stage of EAPP Regional Market (DAM and BM) anticipates trading between any two countries. Interconnection has to be in place.
- Interconnections with many countries help avoid overdependence on single countries or resources.
- Multiple connections help reduce wheeling charges when non-adjacent members trade



Why these imperatives? *Contd*

Generation Capacity

- Surplus capacity is essential. Sharing capacity is at the heart of power trade.
- Surplus capacity improves reliability, affordability, & access. Ancillary services for voltage support and emergency supply need surplus capacity.
- Hydro is main primary source in central and south of region. Higher reserve & better generation mix (geothermal, wind, etc) essential to survive draught.



Why these imperatives? *Contd..*

Harmonization

- Necessary for technical compatibility and legality
- Legal institutional, regulatory, & policy provisions of regional countries assessed (*Mercados D1*)
- No member country restricts cross-border trade. But explicit provisions are needed in most countries' legal, regulatory and policy frameworks.
- Regional Grid code approved by SC. Pilot Project in progress to identify gap between grid code and national standards. (USAID finance)

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What has EAPP done to achieve the Imperatives?

	EC Project	Master Plan	Powering Progress
Capacity	Simulated power trade & established attractiveness. Established impact of trade on generation mix	Updated demand forecast Identified regional generation expansion plan	
Wires	Identified network is weak for wheeling;	Identified interconnection projects & benefits	Pilot gap analysis in progress
Harmonization	Identified legal, policy, regulatory, and institutional gaps. Prepared action plan to address issues.	Prepared Grid Code Defined planning criteria	Will prepare Standard PPA; Harmonization of technical standards

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Prospects for the Region

Wires

- Feasible Interconnection projects identified. (RMP)
- Ongoing projects in good progress:
 - Rwanda-DRC-Burundi
 - Kenya-Uganda, and
 - Kenya-Tanzania
- Concrete pledges for Ethio-Kenya interconnector

Expected Interconnectors (RMP)			
Connecting	Voltage (KV)	Capacity (MW)	Date
Tanzania-Kenya	400	1520	2015
Ethiopia-Kenya	DC 500	2000	2016
Ethiopia-Sudan	500	2X1600	2016
Egypt-Sudan	DC 600	2000	2016
Rusumo HPP Transmission system			2015

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Prospects *Contd..*

Capacity

- Regional generation projects identified (RMP)
- Encouraging attention to wind, and geothermal; helps improve generation mix
- Power market attractiveness proved. Investment in capacity improves reliability

Expected Power Plants (RMP)				
Country	Plant Name	Type	Capacity MW	Date
East DRC	Ruzizi III	Hydro	145	2024
	Ruzizi III	Hydro	287	2027
Ethiopia	Mandaya	Hydro	2000	2031
	Gibe III	Hydro	1870	2013
	Gibe IV	Hydro	1468	2016
	Karadobi	Hydro	1600	2036
Rwanda	Kivu I	Gas	100	2013
	Kivull	Gas	200	2033
Tanzania	Stieglers (I,II,III)	Hydro	1200	2020-26
Uganda	Karuma	Hydro	700	2016
	Ayago	Hydro	550	2023
	Murchison Falls	Hydro	750	2032

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Prospects *Contd..*

- RMP predicts surplus capacity.
- Surplus comes mostly from hydro and geothermal
- Regional availability of hydro predicted 78%

Countries with surplus capacity; Average 2013-2038

Country	Load GWh	Surplus GWh	Surplus %
Ethiopia	28,386	12,577	44%
Uganda	7,768	2,636	34%
Tanzania	18,455	5,059	27%
Burundi, Rwanda, and DRC	3,369	840	25%
Kenya	39,975	6,003	15%
Sudan	46,707	7,824	17%

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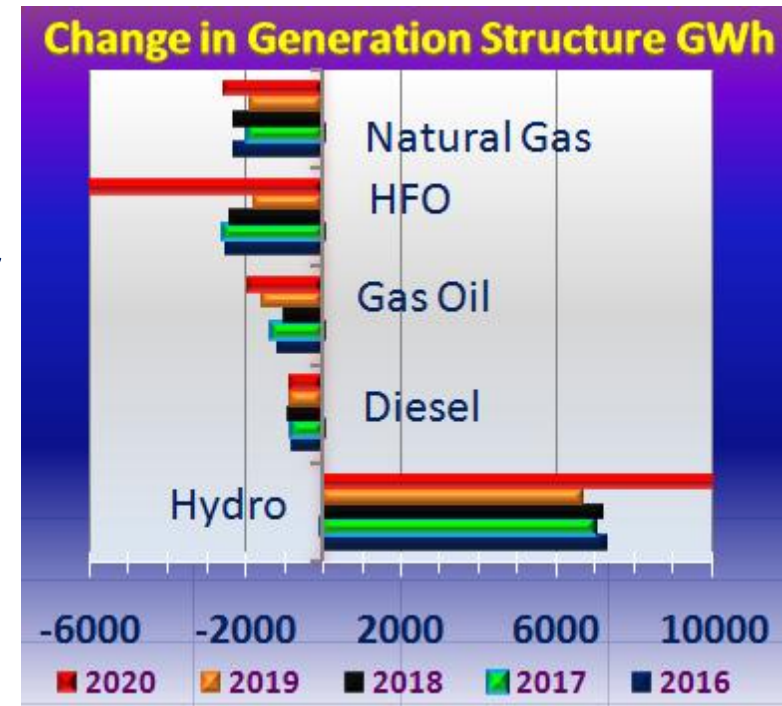
Prospects Contd...

Thermal production will decrease;
Hydro will increase due to power
trade. (*Mercados simulation*)

By 2020:

- Kenya produces 30,715 GWh geothermal, & 1134 GWh wind.
- Egypt 8802 GWh wind, & 2635 GWh solar
- Ethiopia will produce 843 GWh from wind.
- Regional hydro production will increase by 12,620 GWh

Mercados simulation result



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Prospects *Contd...*

Harmonization

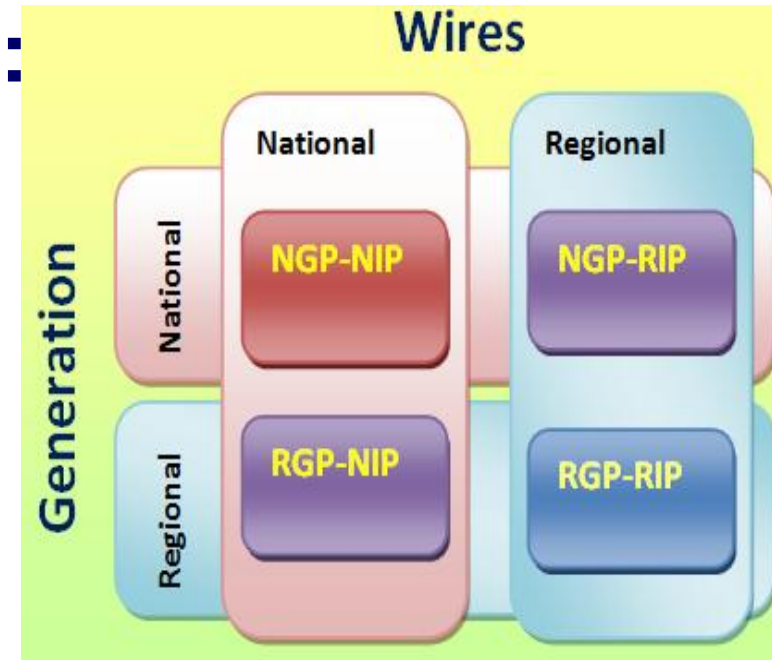
- Regional Grid Cod (RGC) will harmonize system operation and planning.
- Gap analysis between RGC and operations practices in Ethiopian and Kenya started. Results expected to provide benchmarking data & help scale-up project.
- Standard PPAs prepared to harmonize bilateral exchanges.
- Market rules & RRC instrumental for harmonization

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Building the wires & capacity: What are the options?

- RMP explored four scenarios.
 - NGP-RIP and RGP-RIP found to be more attractive.
- RGP-RIP gives highest benefit: 1.2 Billion USD. annually.
 - NGP-RIP most realistic Scenario. Region saves 969 million USD annually.
 - Scenarios feasible even if cost doubles.

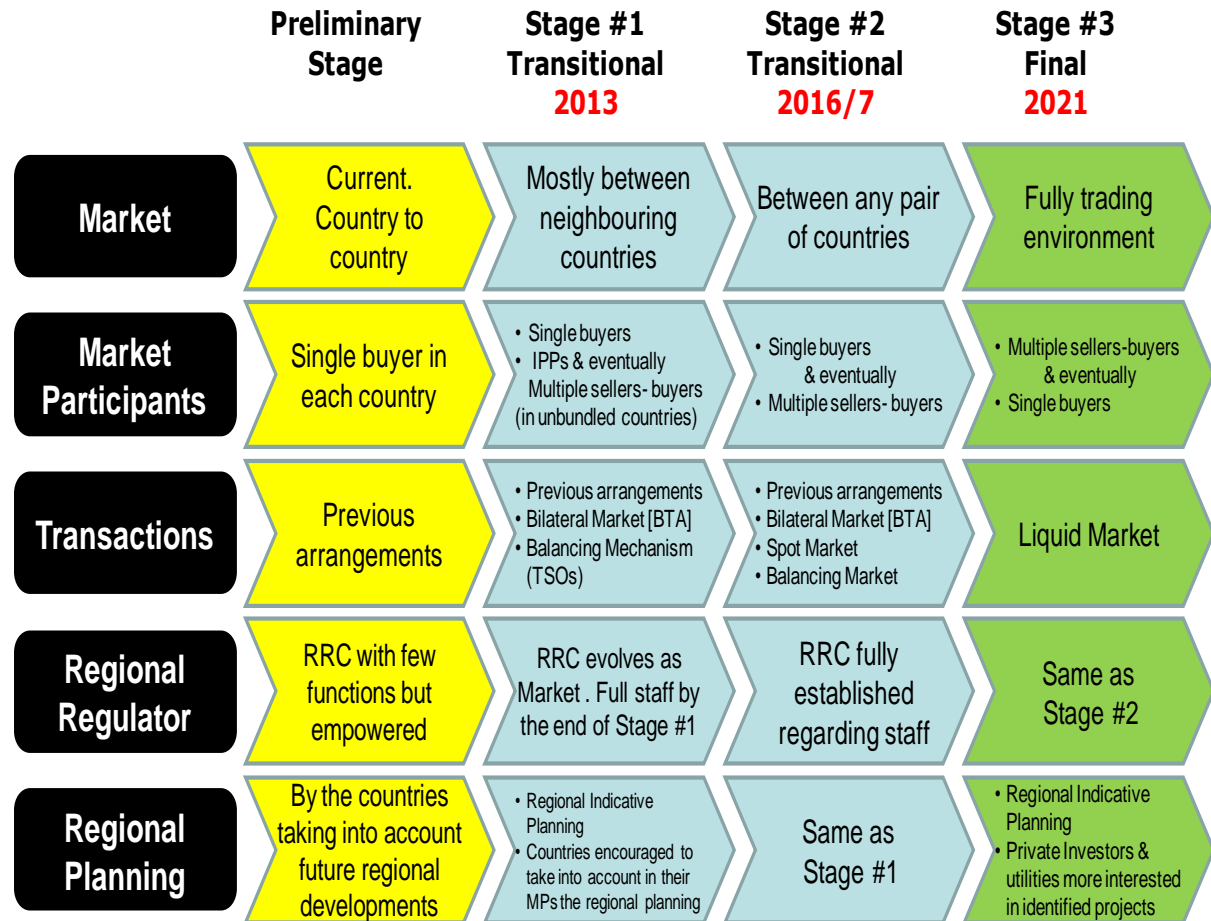


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The Market Road Map

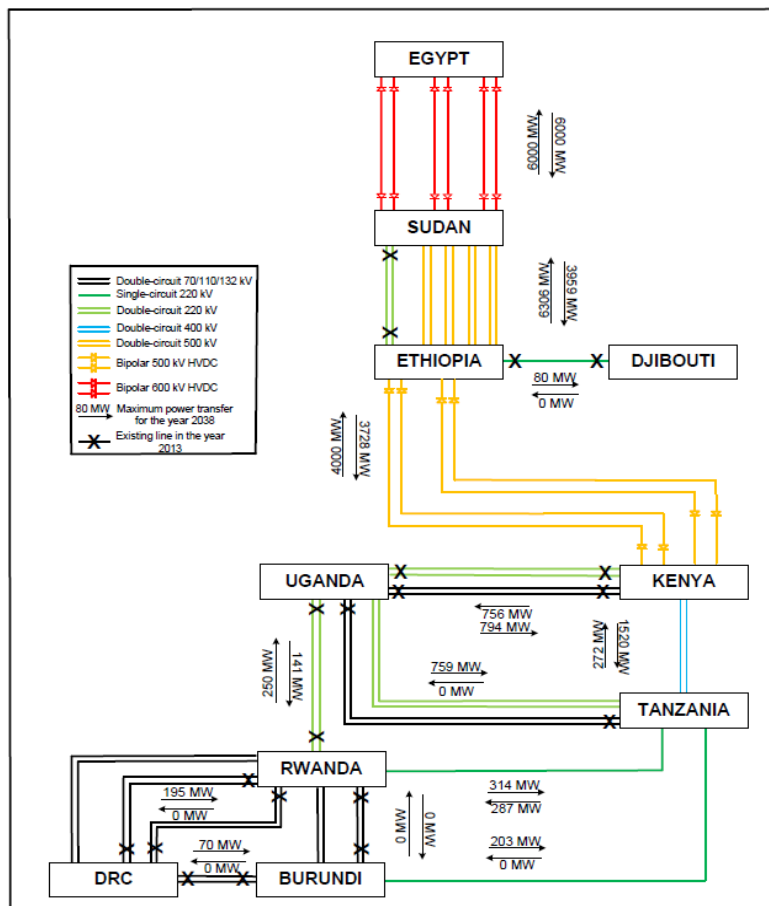
- Full fledged power market in four stages.
- Preliminary stage more bilateral



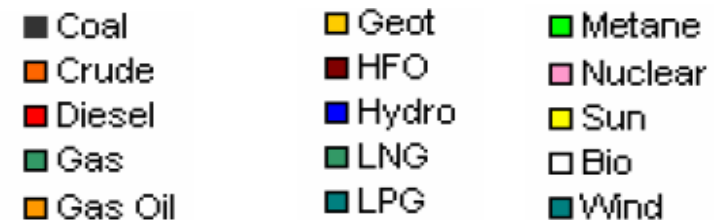
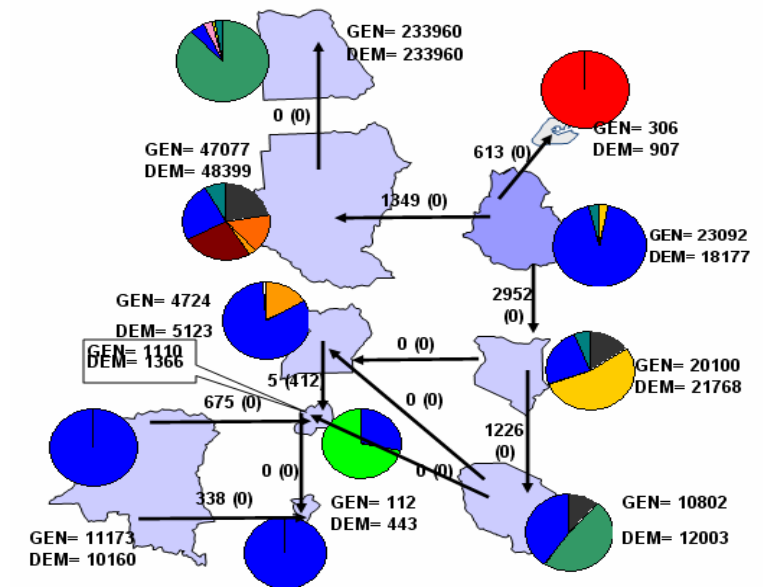
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Interconnections & Forecast Trade: 2038



Generation Mix After Interconnections: 2019





The Way Forward Capacity

- Capacity additions needed to meet RMP reliability criteria: (probability of a 2% deficit in any month less than 5%)
- Region is prone to draught. Geothermal & wind needed to improve generation mix.
- Higher reserve preferable in hydro dominated areas to withstand draught.
- PPP & donors needed for financing



The Way Forward *Contd..*

The Wires

- Region rich in resources. Economic use of resources require interconnection.
- Implementation of ongoing interconnectors shall be expedited to realize market as per plan.
- Membership of all regional countries & utilities needed to strengthen EAPP.
- Support from development partners appreciated.



The Way Forward *Contd...*

Harmonization

- Address institutional, policy, legal & regulatory issues identified in EAPP assessment study
- Active participation of all members essential to operationalize RRC
- Members shall identify and address gaps in their technical standards to meet RGC requirements
- Equip, staff, & train operations and planning units.
- Political support to EAPP's vision important

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THANK YOU

eapp@eappool.org

<http://www.eappool.org>

