HIGHLIGHTS OF THE ENERGY SECTOR IN ZAMBIA

2nd GENERAL ASSEMBLY

African Association for Rural Electrification

13th Annual Meeting CLUB-ER

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TAJ PAMODZI HOTEL / LUSAKA - ZAMBIA

"Sustainable Rural Electrification Projects: Tariffs for Mini Grids"

PRESENTATION BY

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Outline of Presentation

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6. Opportunities for Renewable Energy development
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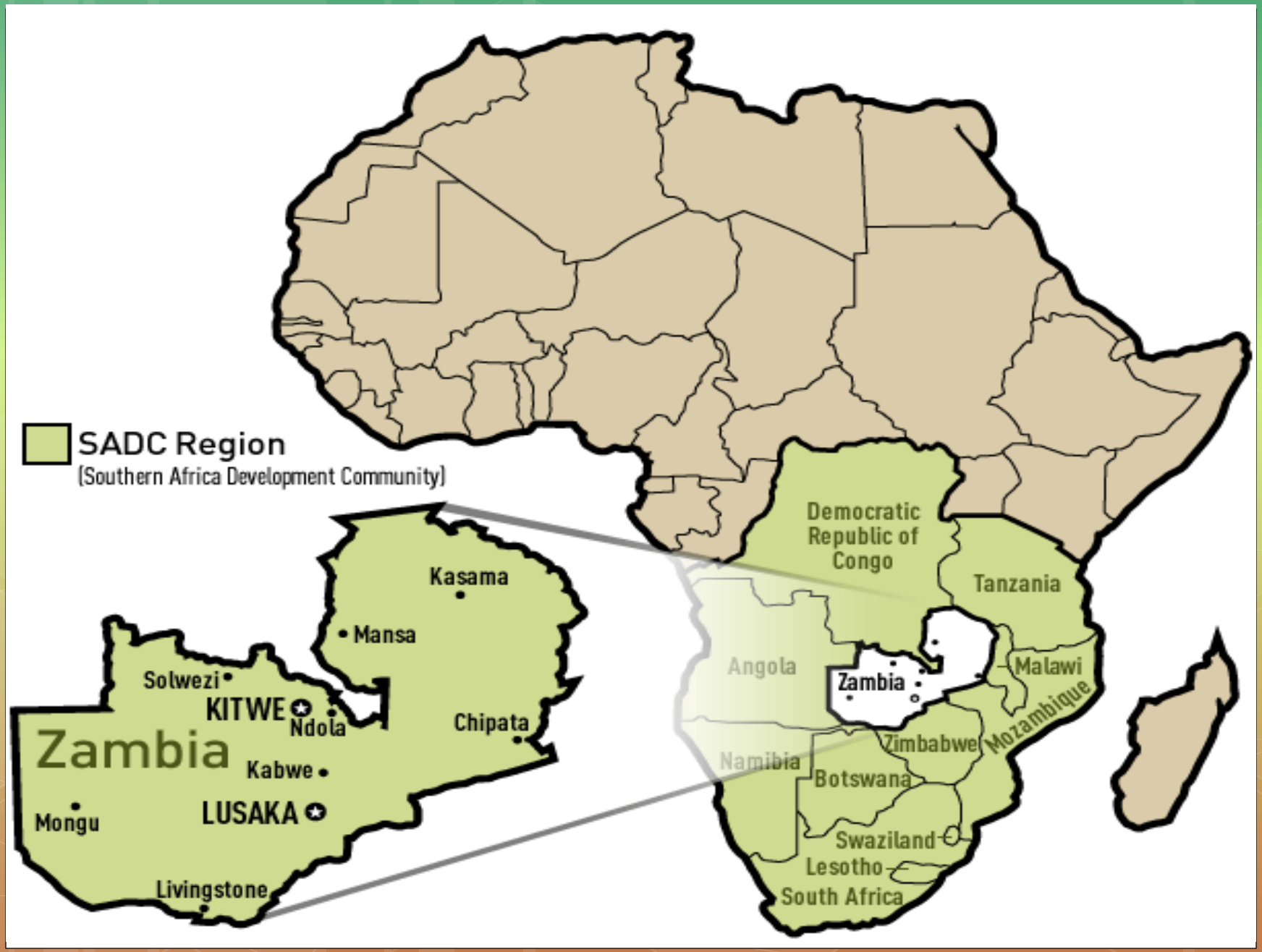
1. Introduction

- Zambia is a landlocked country in South Central Africa, and shares its borders with 8 countries: Angola, Botswana, Democratic Republic of the Congo (DRC), Malawi, Mozambique, Namibia, Tanzania and Zimbabwe.

- Zambia's Geographic area is 752,614 square kilometres and is subdivided into ten provinces, with a total population close to 15.5 million.

- In 2016, Gross Domestic Product (GDP) was US$19.7 billion, equating to a per capita income of around US$1,181.


SADC Region
(Southern Africa Development Community)
Democratic Republic of Congo
Tanzania
Kasama
Mansa
Angola
Zambia
Malawi
Solwezi
KITWE
Ndola
Chipata
Mozambique
Zimbabwe
Zambia
Namibia
Botswana
Kabwe
Mongu
LUSAKA
Swaziland
Lesotho
South Africa
Livingstone

1. Introduction Cont'd

- The national electricity access rate, is at 31.2% , Urban access at 67.7% and about 4.4 percent in rural areas have access to electricity and 7.4 percent of households in rural areas have access to lighting energy through solar Photovoltaic (PV) Systems (CSO 2015 LCMS Report).

- The electricity supply industry in Zambia is dominated by the state-owned company ZESCO Ltd which owns and operates over 90% of the generation, transmission and distribution.

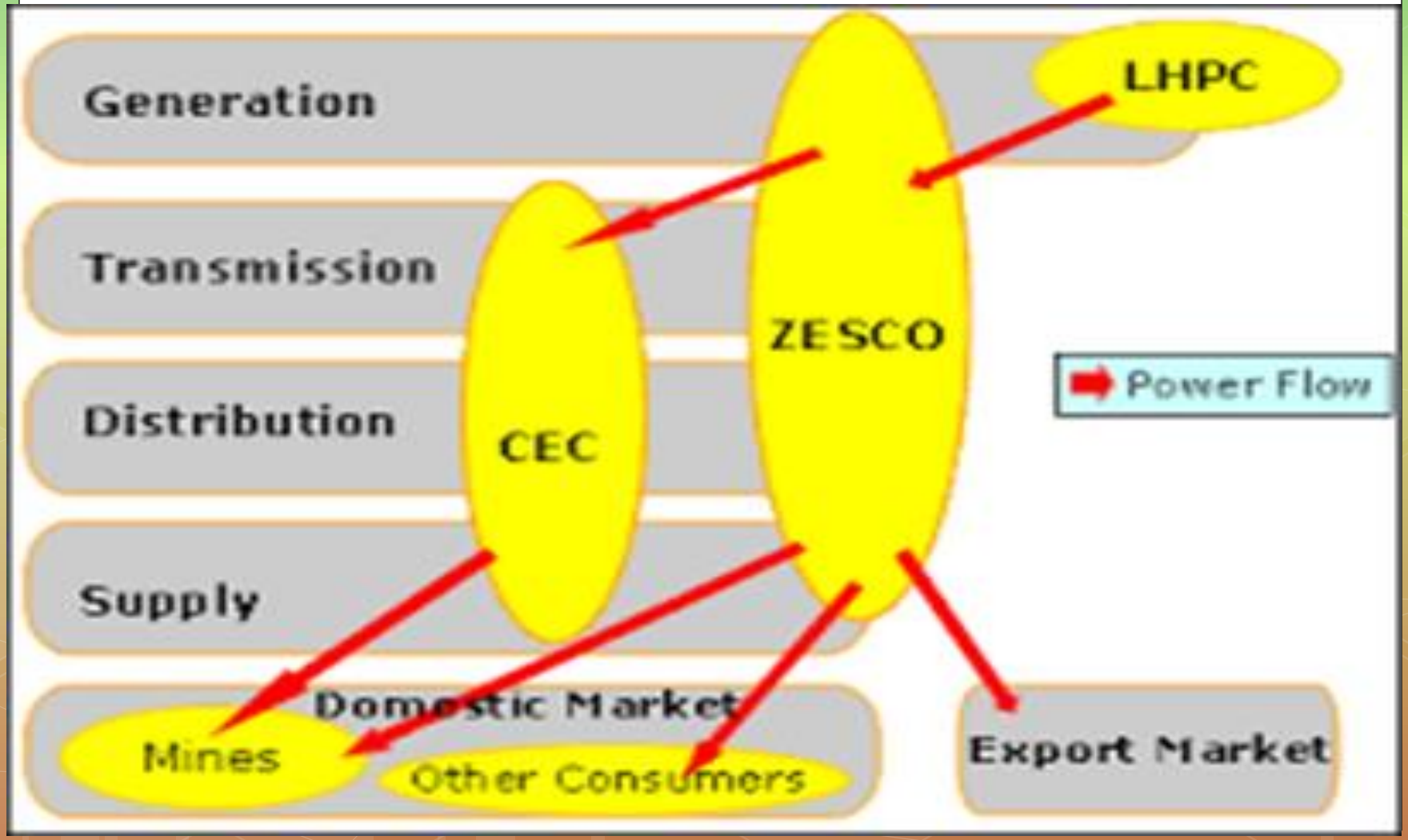
- Hydro generation dominates the Electricity Supply Industry (ESI) in Zambia which accounts for about 85% translating into 2,363MW of the total installed capacity as at 2016 (large power stations contribution is 2,268MW while small power stations accounts for 95.5MW)

- The balance of 15% was from diesel [92MW], Coal [300MW], Heavy Fuels Oils (HFO) [50MW], and Solar Photovoltaic (PV) generation plants [0.06MW].

1. Intro Cont'd-Installed Generation Capacity

No.	Power Station	Owner	Installed Capacity (MW)
1.	Kafue Gorge	ZESCO Ltd	990
2.	Kariba North Bank	ZESCO Ltd	1,050
3.	Itezhi-Tezhi	ZESCO Ltd	120
4.	Victoria Falls	ZESCO Ltd	108
5.	Lunzua	ZESCO Ltd	14.8
6.	Lusiwasi	ZESCO Ltd	12
7.	Chishimba Falls	ZESCO Ltd	6
8.	Musonda Falls	ZESCO Ltd	5
9.	Shiwang'andu	ZESCO Ltd	1
10.	Lunsemfwa	Lunsemfwa Hydro Power Ltd	31
11.	Mulungushi	Lunsemfwa Hydro Power Ltd	25
12.	Zengamina	Charles Rea	0.7
13.	Gas Turbine (Standby)	CEC	80
14.	Heavy Fuel Oil (HFO)	Ndola Energy	50
15.	Maamba Coal	Maamba Collieries Ltd	300
	TOTAL		2,793.5 MW

1. Introduction Cont'd



1. Introduction Cont'd

INSTITUTIONAL FRAMEWORK

- Ministry of Energy (Department of Energy) – Oversees Energy Sector in Zambia and provides policy guidance;
- Energy Regulation Board (ERB) - responsible for licensing, tariff setting, and quality of supply and service standards for all segments of the energy sector (including fuel and electricity);
- Office for Promoting Private Power Investment (OPPPI) - Mandated to promote private sector participation in power generation and transmission projects in Zambia;
- Rural Electrification Authority - Mandated to provide electricity infrastructure to all rural areas for increased access, improved productivity and quality of life;

1. Introduction Cont'd

- **INSTITUTIONAL FRAMEWORK**
- ZESCO Ltd-National power utility company responsible for generation, transmission and distribution of electricity in Zambia;
- Copperbelt Energy Corporation (CEC)- Private power company that buys power from ZESCO and supplies mainly the mines
- Lunsemfwa Hydropower Company-IPP that owns Lunsemfwa and Mulungushi Hydropower Stations;
- Maamba Collieries Limited-IPP that owns Maamba Thermal Coal Plant and is contributing 300MW to the national grid.

2. Renewable Energy Potential in Zambia

Hydropower	• Installed capacity 2,318MW • Potential- more than 6000MW • 29 small/mini hydro sites mainly in Northern & Luapula, (4 MW) and North Western provinces (13 MW)
Biomass-	• 2.15 million tonnes, which translates to 498MW • Current capacity - 20MW by Zambia Sugar Company • 1MW project under development by CEC • Biofuels Industry
Geothermal	• 80 hot springs • Kalahari undertaking some explorations • 2MW project underway
Wind	• average speed of 2.5 m/s • Wind Resource Mapping on-going
Solar	• average solar insolation of 5.5 kWh/m2/day • 60kw mini-grid operational, 30MW project underway

3. The Rural Electrification Authority (REA)

- REA is a statutory body created through an Act of Parliament – Rural Electrification Act No. 20 of 2003.
- REA's overall mandate is to spearhead creation of electricity infrastructure in rural areas with a target of 51% of the rural households electrified by 2030.
- 1,217 Rural Growth Centres (RGCs) to be electrified by 2030 with resource of US$50million per year.
- REA commenced implementation of rural electrification projects in 2006.
- The Rural Electrification Master Plan (REMP) is the principal source of rural projects

4. What is a mini-grid?

- A mini-grid is an electricity distribution network operating typically below 11 kV, providing electricity to a localized community and derives electricity from a diverse range of small local generators using renewable energy technologies with or without its own storage;
- Mini-grids are certainly one of the key enablers to increase the access to electricity in rural Zambia;
- At a systemic scale, off-grid electrification makes economic sense in lot of remote areas compared to grid extension;
- At a local scale, the need for affordable, reliable and clean energy access is urgent to ensure the socio-economic development of communities;

5. Renewable Energy Projects by REA

- Renewable Energy projects under implementation and existing by REA:
- **Existing**
  - 60kWp Mpanta isolated solar mini grid located in Samfya District of Luapula Province.
- **Under Implementation**
  - 200kWp Chunga isolated solar mini grid located in the Kafue National Park, in Mumbwa District of Central Province.
  - 300kWp Lunga isolated solar mini grid located on Kasomalunga island in Lunga District of Luapula Province.
  - 640kW Kasanjiku Mini Hydro located in Mwinilunga District of North Western Province.

6. Opportunities for Renewable Energy Development

- REA intends to continue promoting Renewable Energy by developing the Renewable Energy Framework which will provide targets and opportunities.

- **Private sector participation** – work closely with the private sector in developing RE projects in rural areas. REA has the following opportunities for private sector participation:

  - **Provision of available sites for development** – The REMP has a provision of identified ***29 mini hydro potential sites*** and REA could work with the private sector by providing them with information on rural electrification projects sites.

7.Opportunities for Renewable Energy Development Cont'd

- **Capital subsidies –** REA has a provision in supporting the private sector by offering 'smart subsidies' for rural electrification projects in line with the RE Act

- **Project feasibility studies -** REA could partner with the private sector to finance feasibility studies for projects.

- **Labour for projects** – REA could work with the private sector by engaging them as contractors to provide labour for construction of rural electrification projects.

- **Management and Operation** of the electricity infrastructure – REA could partner with the private sector to sustainably manage and operate constructed power plants through a Public Private Partnership (PPP) Model.

8. Challenges in the Development of Renewable Energy

- Non cost reflective tariff in the region has led to reduced private sector participation in exploring the renewable technologies
- High upfront costs, especially for feasibility studies and project development
- Most equipment is imported, with no or limited local options for manufacturing
- Research, development, and production of renewable energy infrastructure occur outside the region and there are no localisation strategies in place

9. Challenges to the Development of Renewable Energy Cont'd

- Renewable energy development heavily depends on cooperating partners' subsidies at present. There are inadequate local financing Institutions at national and regional level to promote renewable energy technologies

- Lack of mandatory standards, robust regional grid code to handle technical issues to do with renewable energy production and integration to the grid

- There are inadequate skills in project management and national institutions for implementing renewable projects. These include project preparation, management and harmonization with national and regional plans

10. Lessons learnt by REA in promoting Renewable Energy Technologies

- High cost of developing mini-grids – REA is able to provide a capital subsidy in line with the Rural Electrification Act No. 20 of 2003.
- Due to the high cost and specialised knowledge required there is need to partner with institutions involved in RE technologies for purposes of building capacity in renewable energy
- There is need to have anchor loads capable of paying a cost reflective tariff to meet the costs of operation and maintenance of mini-grids
- Private sector is more interested in on-grid renewable energy projects

11. Lessons learnt by REA in promoting Renewable Energy Technologies

- There is need for efficient collection system for monthly electricity bills e.g. prepaid billing system;
- Connection Fee can bring about an initial commitment;
- The community can be innovative and become efficient by engaging in productive uses of electricity;
- Private sector are not keen in operating isolated mini-grids because of low income levels resulting in low levels of fees collected which can not allow them to operate sustainably.

12. Conclusion

- Achieving universal modern energy access will require transformations in how countries conceptualize and finance energy systems.
- Rural Electrification Rate in Zambia is very low hence REA has huge task of electrifying all rural areas of Zambia.
- Lending institutions should open up to fund the development of small mini grids.
- Work with other sectors to encourage beneficiaries of mini grid energy to engage in productive activities so as to boost their income levels.

12. Conclusion Cont'd

- There are a lot of opportunities in the electricity subsector, particularly in underserved rural areas.
- Private sector participation is crucial and is therefore encouraged to take advantage of available opportunities and projects to partner with REA.
- Further, Government through the relevant institutions is creating an enabling environment which will result in an increased number of the private sector in the implementation of Renewable energy in rural areas.

60kW MPANTA SOLAR MINI GRID PLANT

60kW MPANTA SOLAR MINI GRID PLANT

200kW CHUNGA SOLAR MINI GRID PROJECT

The sales and administration block

The three bedroomed staff house

200kW CHUNGA SOLAR MINI GRID PROJECT- TARGETED BENEFICIARIES

640kW KASANJIKU MINI HYDRO POWER PLANT

640kW KASANJIKU MINI HYDRO POWER PLANT- SITE ESTABLISHMENT (SITE OFFICE AND SITE CAMP)

640kW KASANJIKU MINI HYDRO POWER PLANT- OFFICE BLOCK AND WORKSHOP SUBSTRUCTURE WORKS (MULTI-FACILITY BUILDING)

640kW KASANJIKU MINI HYDRO POWER PLANT- POWER CANAL EXCAVATION IN PROGRESS

640kW KASANJIKU MINI HYDRO POWER PLANT- EXCAVATION COMPLETED FOR THE PENSTOCK AREA

640kW KASANJIKU MINI HYDRO POWER PLANT- EXCAVATION FOR THE SURFACE POWER HOUSE COMPLETED

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