



## Energy-Forum 2017

Friday, 1st December 2017; Technology Centre  
Gostritzer Straße 63; 01217 Dresden; Germany

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# TANZANIA ENERGY SECTOR AS THE KEY DRIVER TO ONGOING INDUSTRIALIZATION

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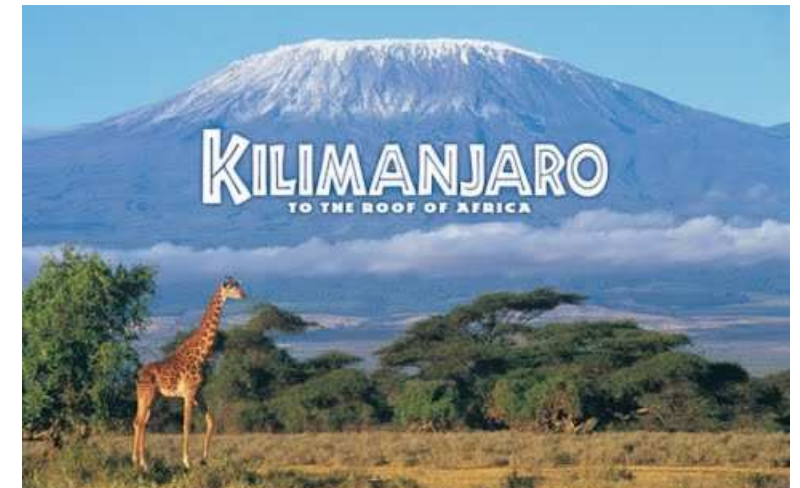
# 1. INTRODUCTION

## 1.1 Tanzania country statistics

- Land: 885,800 sq. Km
- Population: 50.144 million
- GDP growth rate: 7.3

## 1.2. Natural resources/tourism attractions

- 16 National Parks
- 38 Game Reserves
- 43 Game Controlled Areas
- wildlife protected area network covers 233,300 Sq. Km (28%) of the total Tanzania's land surface area.



# 1.3. Tanzania: Abundant energy resources

SNO	RESOURCES	PROVEN POTENTIAL	LEVEL OF EXPLOITATION
1	Hydropower	Large Hydro 4,700 MW	561 MW
		Mini & small hydro > 310MW	4.7 MW
2	Natural gas	15.697x10 <sup>9</sup> m <sup>3</sup>	714 MW
			(0.78x10 <sup>9</sup> m <sup>3</sup> )
3	Petroleum	Active petroleum system exist along deep sea and Lake	None
4	Coal	304x10 <sup>6</sup> tons	<150,000 t/annum
5	Biomass	150 million tones/annum	38 MW
6	Wind	* 0.9 - 4.8 ms <sup>-1</sup> abundant	> 129 windmills for water pumping
		* 5.0 - 12 ms <sup>-1</sup> in isolated locations	< 1MWe installations
7	Solar	High insolation (4.5 – 6.5 kWh/m <sup>2</sup> )	PV < 10 MWp installations
8	Geothermal	650 MW	None
9	Nuclear	Annual production of 3.7 mil. pounds of uranium with mine lifetime of 12 years (Pre-feasibility)	None
10	Tidal , wave & OTEC	Not assessed	None



## 2. *STRATEGIC DRIVER TO TANZANIA ENERGY SECTOR*

Industrialization motive by the 5<sup>th</sup> government through the Tanzania Development Vision 2025

- Envisions developing Tanzania into a middle income economy through industrialization
- Raise GDP per capita from USD 640 to USD at least USD 3,000;
  - Industrial sector to contribute 15% of GDP, from current 9.9% contribution
  - Industrial sector to employ 40% of labour force

# .... / STRATEGIC DRIVER TO TANZANIA ENERGY SECTOR

- Increase electricity generation capacity from existing level (1,511.55 MW) to at least 10,000 MW by 2025; and
- Increase electricity connection level to at least 50% by 2025



# 3. Electricity Supply Industry Reform Strategy

## 3.1 Key features of the proposed reform

- Unbundling the vertically integrated utility into four supply chain segments
  - Generation
  - Transmission
  - Distribution
  - Retail
- Creating an institutional framework conducive to private sector participation as a means to attract investment in the sector

## 3.2 Reforms Roadmap

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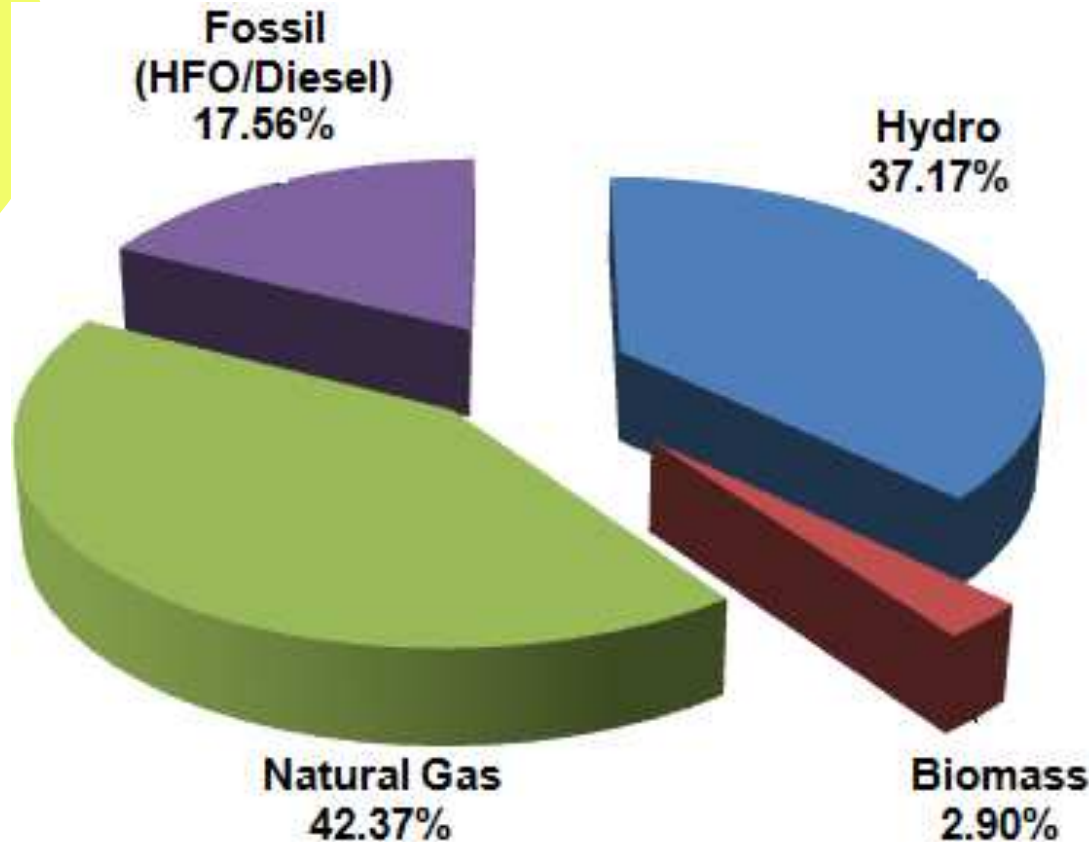
Reforms will be implemented in four phases clustered into four time frames. Described below:

- **Immediate Term (2014-2015):** Turning around TANESCO as per the Internal Reforms Programme
- **Short Term (2015-2018):** Unbundling of generation from the Transmission and Distribution Segments
- **Medium Term(2018-2021):** Unbundling Distribution from Transmission segment
- **Long Term (2021-2025):** Horizontal Unbundling of distribution



# 4. Power Generation

## 4.1 Generation mix



- Total installed capacity is 1.512 GW
  - Hydro 561.84 MW
  - Biomass 43.80 MW
  - Natural gas 640.50 MW
  - Fossils 265.41 MW
- TANESCO owned power plants
  - Grid connected
  - Isolated plants
- Independent Power Producers (IPPs)

## 4.2 TANESCO Owned Plants

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### 4.2.1 Grid connected plants – Hydro (Total Inst. 561.8 MW)

- i. Kidatu 204 MW (year 1975, 1980)
- ii. Kihansi 180 MW (year 2000)
- iii. Mtera 80 MW (year 1988)
- iv. Pangani 68 MW (year 1995)
- v. Hale 21 MW (year 1964)
- vi. Nyumba ya Mungu 8 MW (year 1969)
- vii. Uwemba 0.84 MW (year 1991)

## 4.2.2 Grid connected plants – Gas (Total Inst. 640.50 MW)

i.	Import from Songas	189.00 MW
ii.	Ubungo I gas plant	102.00 MW
iii.	Ubungo II gas plant	129.00 MW
iv.	Tegeta gas plant	45.00 MW
v.	Somanga Fungu	7.50 MW
vi.	Mtwara	18.00 MW
vii.	Kinyerezi I	150.00 MW

## 4.2.3 Grid connected plants – HFO & IDO (Total Inst. 173.44 MW)

- i. Import from IPTL-HFO 103.00
- ii. Zuzu IDO plant 7.44
- iii. Nyakato HFO plant 63.00



## 4.2.4 Off grid plants – HGO/GO/DIESEL (Total Inst. 91.97 MW)

18 nos. Isolated regional plants, 91.97  
MW



# 5. Transmission System

## 5.1 Existing TANESCO Transmission System map



## 5.2 Transmission System data

Voltage Level (kV)	Transmission Lines		Power Transformers	
	Length, km (4,866.85)	No of sections (50)	Quantity (83)	Capacity, MVA (2,189)
220	2,732.36	20	34	1295
132	1,555.79	23	36	812
66	578.7	7	13	82
<b>Compensation Equipment</b>				
Capacitors			100 MVar	
Reactors			300 MVar	
SVC			± 60 MVar	
Number of Grid Substations (Transmission): 45				
Number of 33/11kV Substations: 67				

## 5.3 Distribution System

- Total distribution network (MV lines) is 26,597 km
  - 33 kV lines = 20,882 km
  - 11 kV lines = 5,715 km
- Low voltage (400 and 230V) lines = 48,789 km



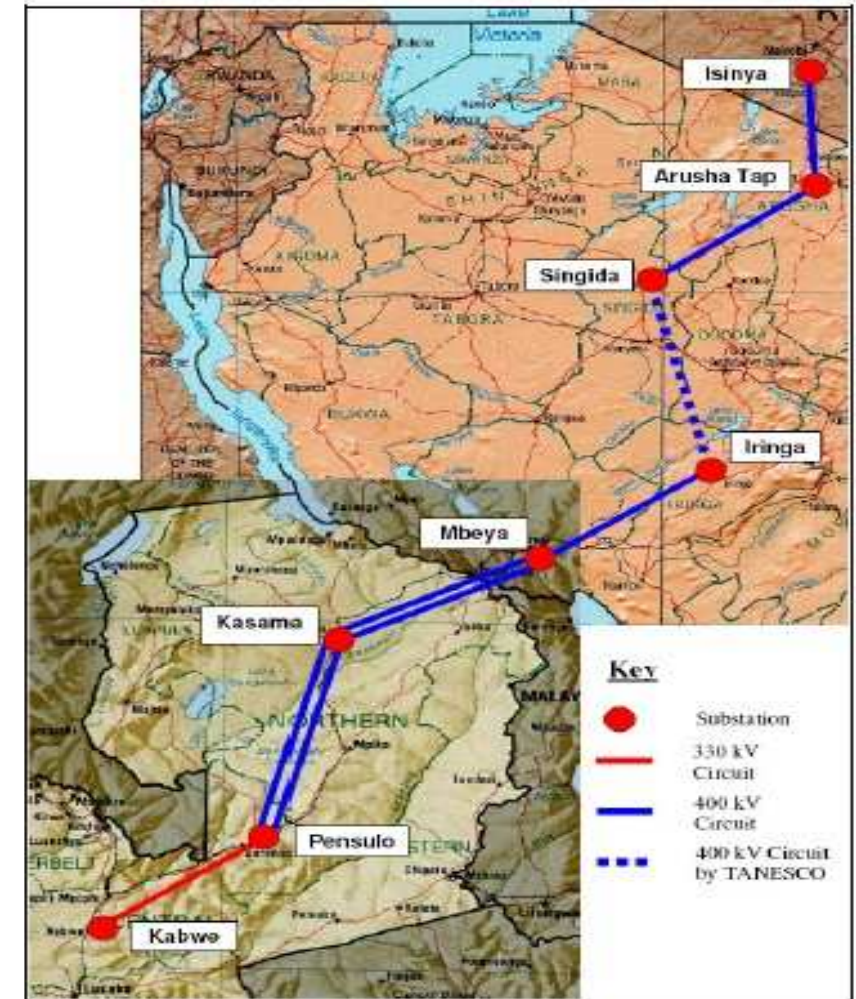
## 6. Short and Medium Term Electrification Projects

- The projects are implemented so as to address:
  - Power shortage
  - Power reliability
- These projects consist of generation (IPP, PPPs and TANESCO owned) and Transmission and Distribution.
- The estimated costs for all planned short and medium term projects is over 3 billion U. S. \$.



# 6.1 Ongoing transmission line projects

1	North east grid - NEG
	Kinyerezi - Arusha
2	North west grid (NWG):
	220kV Bulynhulu-Geita
	220kV Geita-Nyakanazi
	400kV Nyakanazi-Kigoma-Sumbawanga-Mbeya
3	Zambia - Tanzania - Kenya (ZTK) interconnector
	Inter governments agreement done
	Financing secured
4	Backbone transmission investment project (BTIP):
	Lot I (400kV Iringa-Dodoma line)
	Lot II (400kV Dodoma-Singida line )
	lot III (Singida-Shinyanga line)
	Lot IV (Iringa - Dodoma - Singida - Shinyanga)



## 6.2 Proposed generation projects (at different levels)

### 1 Solar power

- i University of Dodoma, 55 MW

### 2 Hydropower

- i Stiegler's gorge, 2.1 GW
- ii Masigira, 70 MW

### 3 Natural gas

- i Mkuranga PPP, 250 - 350 MW
- ii Kinyerezi III, 600 MW
- iii Kilwa energy power, 320 MW
- iv Kinyerezi IV, 378 MW
- v Kamal steel, 200 MW

### 4 Wind power

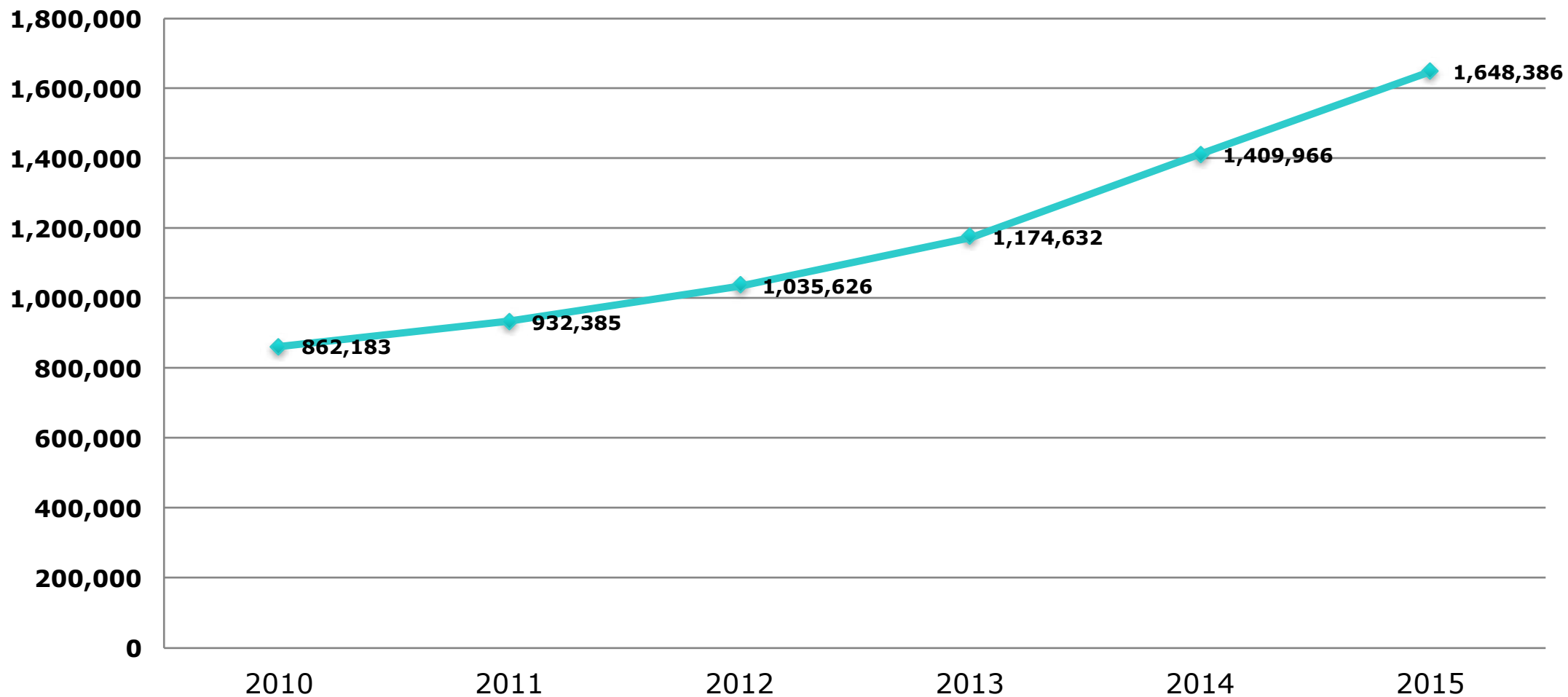
- i Geo wind (Singida), 50 MW
- ii Singida wind power, 100 MW
- iii Sino Tan Wind (Makambako), 100 MW
- iv Wind lab (Makambako),

### 5 Coal power

- i Mbeya (Kibo Mining), 300 MW
- ii Rukwa (Edenville), 300 MW
- iii Mchuchuma, 600 MW
- iv Ngaka Mbinga (TANCOAL), 200 MW

# 7. Major Achievements

## 7.1 Increase in New Connections



## 7.2 Access to Electricity

### Population accessibility to grid electricity:

- Overall: 67.5%
  - Rural: 49.3%
  - Urban: 97.3%

### Regions with 80 percent and above:

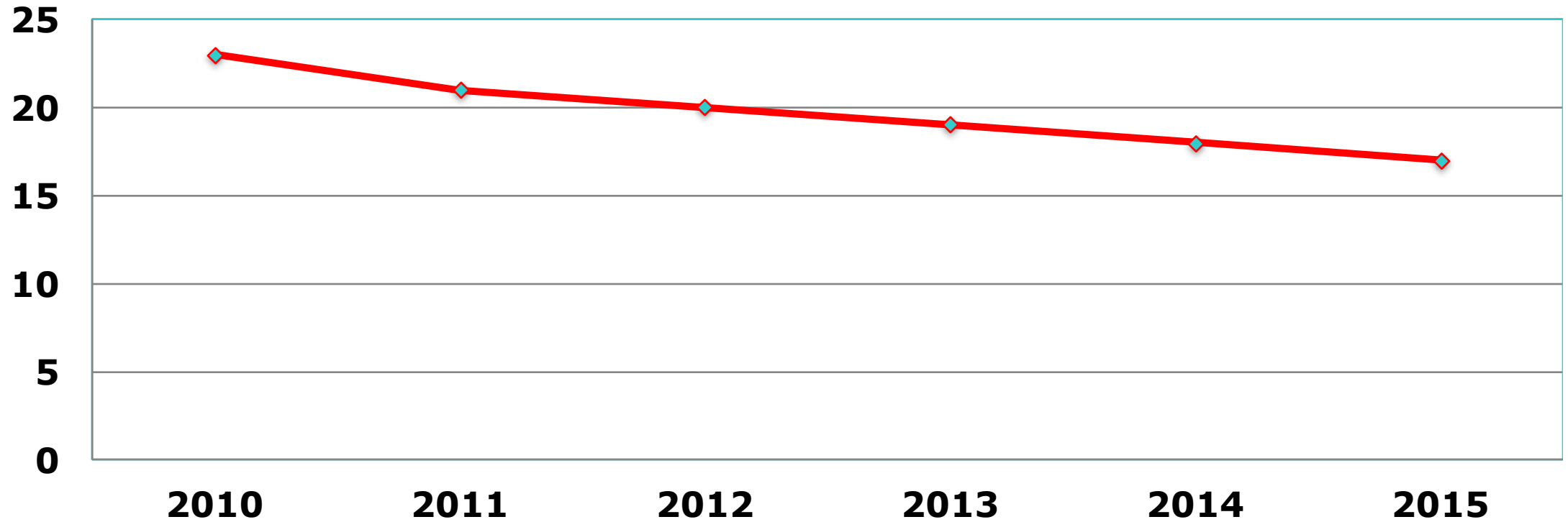
- Dar es Salaam (100%); Kilimanjaro (91.7%); Mbeya (86%); Coast (80.4%) and Arusha (80%).

### Grid or Solar electrification for households:

- Rukwa (15.4%); Shinyanga (23.4%)
- Songwe (24.5%); Kigoma (27.8%)
- Mtwara (29.2%)

# 7.3 Reduction of corporate system losses

**System Losses, %**



# 8. Electrification Challenges and mitigation

1	Rapid growth of demand	Execution of ongoing and new projects on generation (Natural Gas, Coal and Renewables), Transmission and Distribution.
2	Frequent poor hydrology	Improve generation mix (Renewables, Natural Gas, Coal etc.).
3	High cost of thermal generation	Improve generation mix and supporting small power purchase agreements (SPPA) for renewables
		Converting plants to natural gas (IPTL)
4	High energy losses from aging transmission and distribution system.	Execution of ongoing and new projects on generation, transmission and distribution.
5	Increasing prices of running and maintenance spare parts	Entering Service Contracts with OEM for timely delivery of Plants O&M services
6	Non technical losses	AMR meters for low and medium power users
		Enhancement of inspection
7	Outstanding electricity debts	Rolling out postpaid meters in favour of prepaid ones (LUKU/AMR)

## 9. ROLE OF ENERGY EFFICIENCY

Increased energy access can be achieved through sustainable utilization and adopting energy efficiency (management) practices, which:

- Reduce energy demand and costs
- Reduce carbon emissions and the environmental damage
- Reduce risk – the more energy consumed, the greater the risk that energy price increases or supply shortages could negatively affect development goals

# 9.1 Energy Efficiency Status

HOUSEHOLD	TRANSPORT	BUILDING	INDUSTRY
<ul style="list-style-type: none"> <li>• Rate of adoption of energy efficient stoves still low</li> </ul>	<ul style="list-style-type: none"> <li>• About 50% of vehicles imported in used condition</li> <li>• Increasing congestion</li> <li>• Inadequate maintenance</li> <li>• Inadequate road infrastructure</li> <li>• Inadequate mass transit modes</li> <li>• Fuel switching negligible</li> </ul>	<ul style="list-style-type: none"> <li>• Inappropriate envelopes</li> <li>• Inefficient appliances</li> <li>• Negative behaviours</li> <li>• Low adoption of energy efficient technologies</li> </ul>	<ul style="list-style-type: none"> <li>• Rampant use of standard motors</li> <li>• Inefficient equipment/processes</li> <li>• Electrical demand not managed</li> <li>• Negative behaviours</li> </ul>



## 9.2. Energy Efficiency Challenges

### Absence of legal, regulatory and administrative instruments:

- Standards and labeling
- Building codes
- Energy management systems
- Monitoring, reporting and verification (MRV)
- Energy management guidelines
- ECE legislation
- Communication and awareness raising strategy

## **Inadequate Capacity**

- Inadequate institutional capacity in regulation/guidelines, systems and tools for measurement, monitoring and verification of energy efficiency targets
- Inadequate capacities in establishing, archiving and benchmarking database for energy efficiency initiatives
- Absence of energy auditors profession development framework

# ASANTE, Thank you!

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