

“EDM – Past, Present and Future”

Presented by:

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Presentation Outline

1. The Electricity Development Outlook Over Last decade
2. Electrification Overview Of The Mozambique Grid
3. Transmission Grid Expansion
4. Demand Growth
5. Present Situation
6. Supply Vs Demand Balance
7. Challenges With Supply Quality
8. Opportunities on the Energy Sector
9. Regional Context – Power Balance
10. Cost Of Electricity From The New Ipp's
11. Long-term Transmission Projects
12. The Current & Future Challenges
13. Long-term Generation and Transmission Projects
14. Conclusions



ELECTRICITY DEVELOPMENT OUTLOOK IN THE PAST

Focus

- Extend the **access to electricity** to the population
- Emphasis on **Rural electrification**
- Replace **insustainable diesel generation** by “cheap energy from **Cahora Bassa**” for economic development in Provincial Capitals

Funding

- Predominantly under **Concessional Scheme** and **Grants** to promote **Social development**

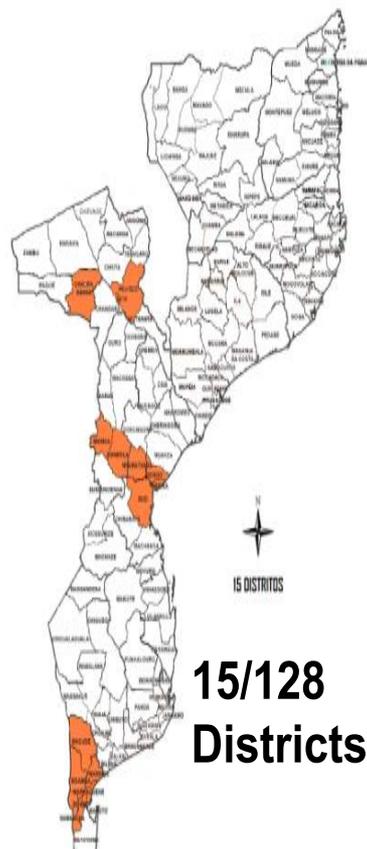
Clients / market

- Mainly Households, **Regulated** (low) tariffs
- Surplus capacity of transmission infrastructure
- **Large Capacity available from Cahora Bassa Hydro Power**

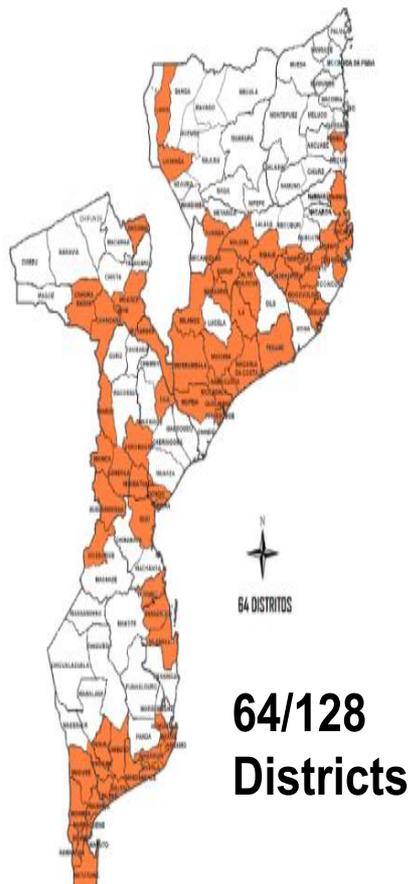


ELECTRIFICATION OVERVIEW OF THE MOZAMBIQUE GRID

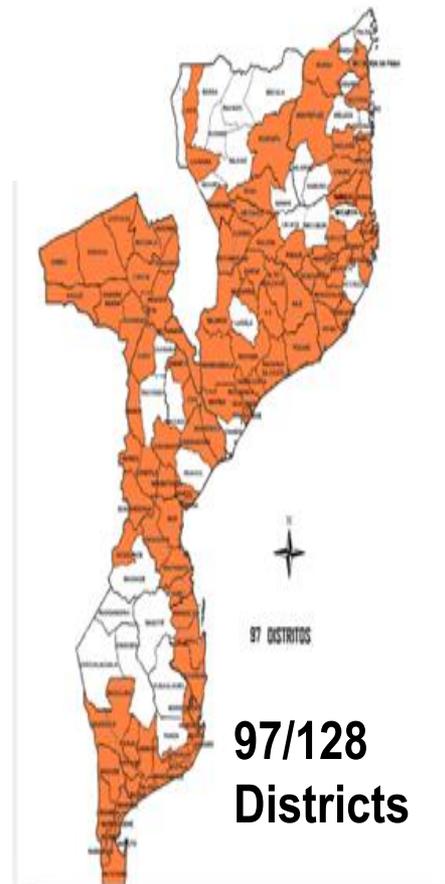
1977 - 1990



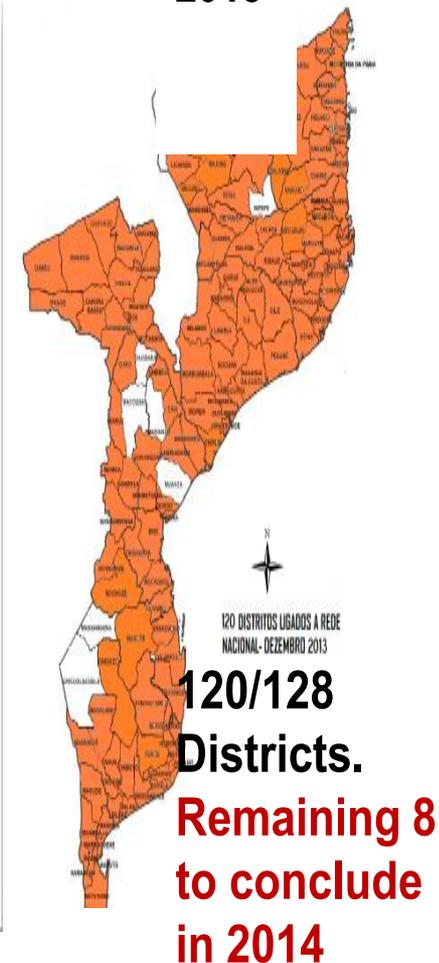
2007



2010



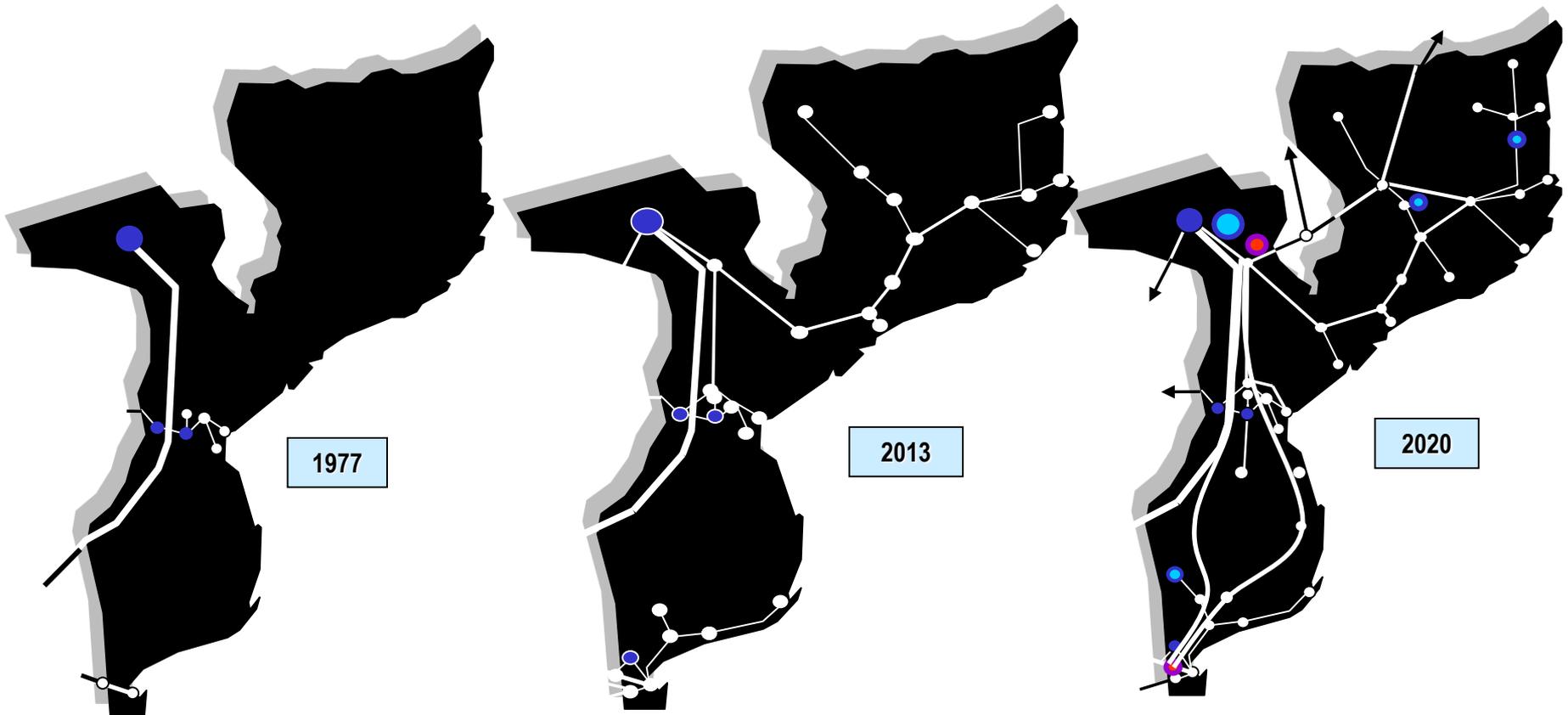
2013



Network designed for rural electrification program



TRANSMISSION GRID EXPANSION



1977

2013

2020

Only three provincial capital were connected to the National Grid

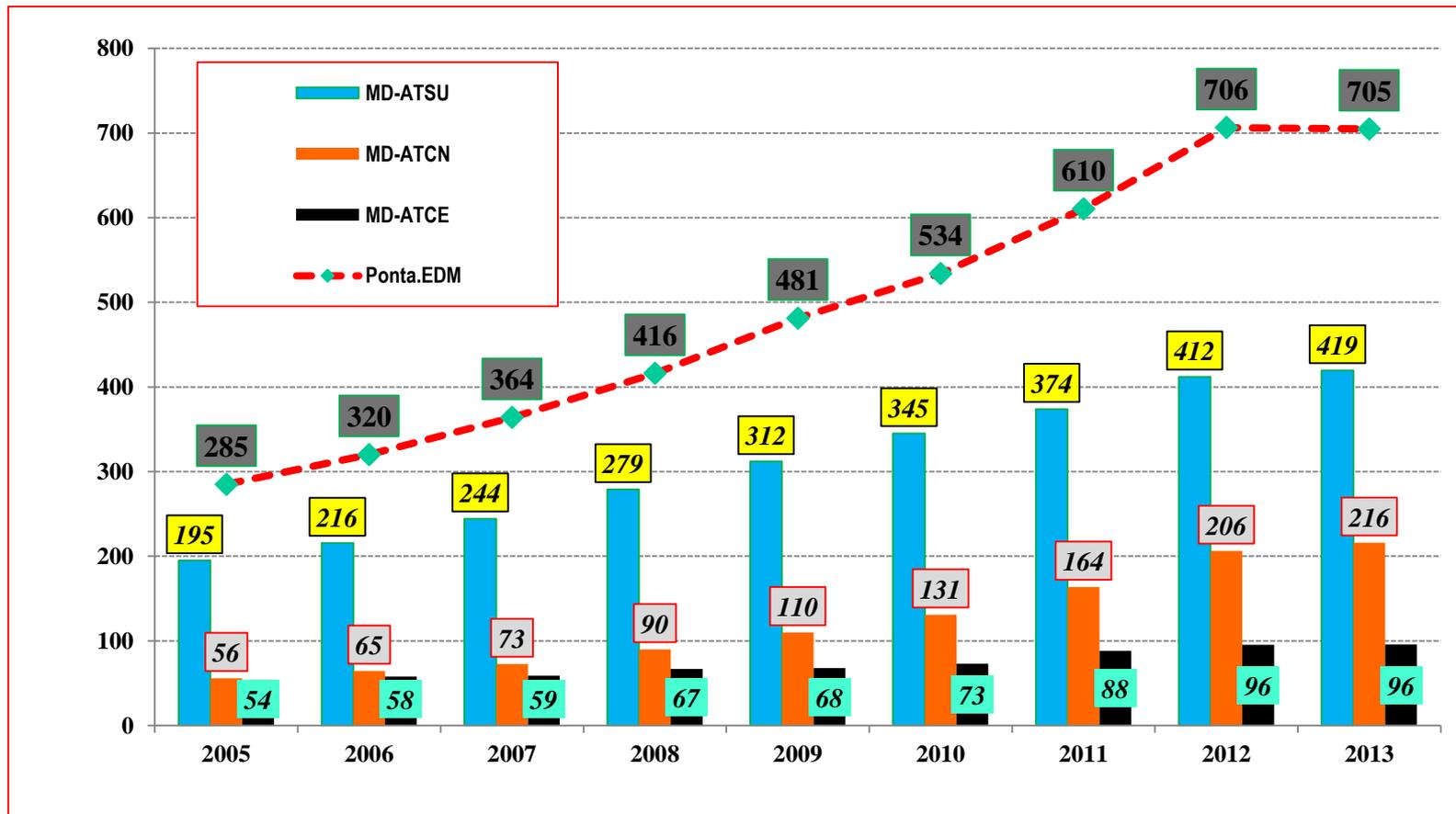
Radial network with NO Redundancy connecting ALL Provincial capitals SOURCE of power basically Cahora Bassa,

New power stations and new lines to be built as part of National Grid



DEMAND GROWTH

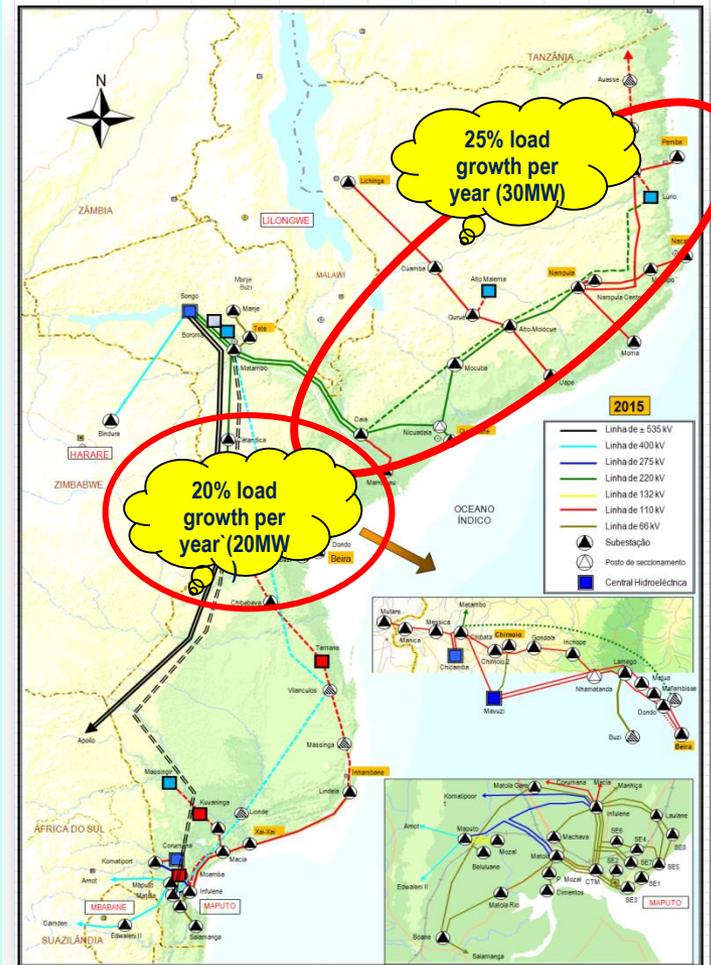
Transmission Sub-systems	Peak Load	Load Factor
Linha Centro-Norte & Tete	216	0.64
Sistema Centro *(Mav.Chi.Chib.)	96	0.66
Sistema Sul	419	0.61
Total EDM (Integrada)	705	0.68



PRESENT SITUATION

Central and Northern Regions

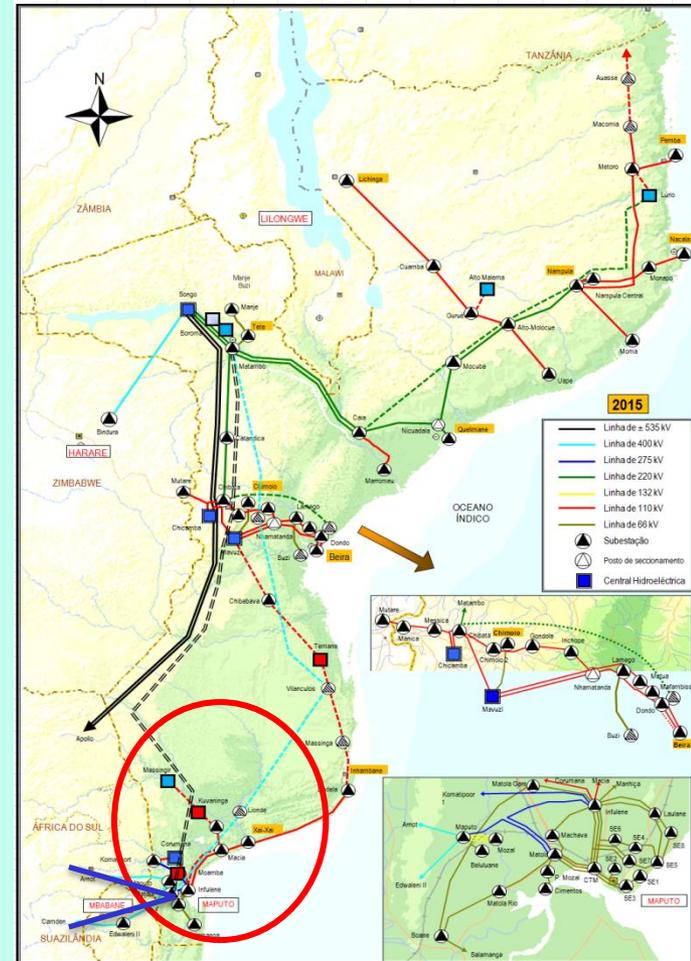
- Existing transmission capacity is exhausted and requires intensive investment program;
- Limited capacity on the 110 kV network to the Beira Corridor (20% growth/year, 20MW);
- Rehabilitation of Mavuzi and Chicamba power stations is critical for better contribution on the quality of supply;
- The demand has overreached the transmission capacity of the 220 kV Songo – Nampula network (25%/yaer, 30 MW) with negative impact on the quality of supply;
- Nacala has become an important load centre and the existing grid is by far unable to meet the current demand



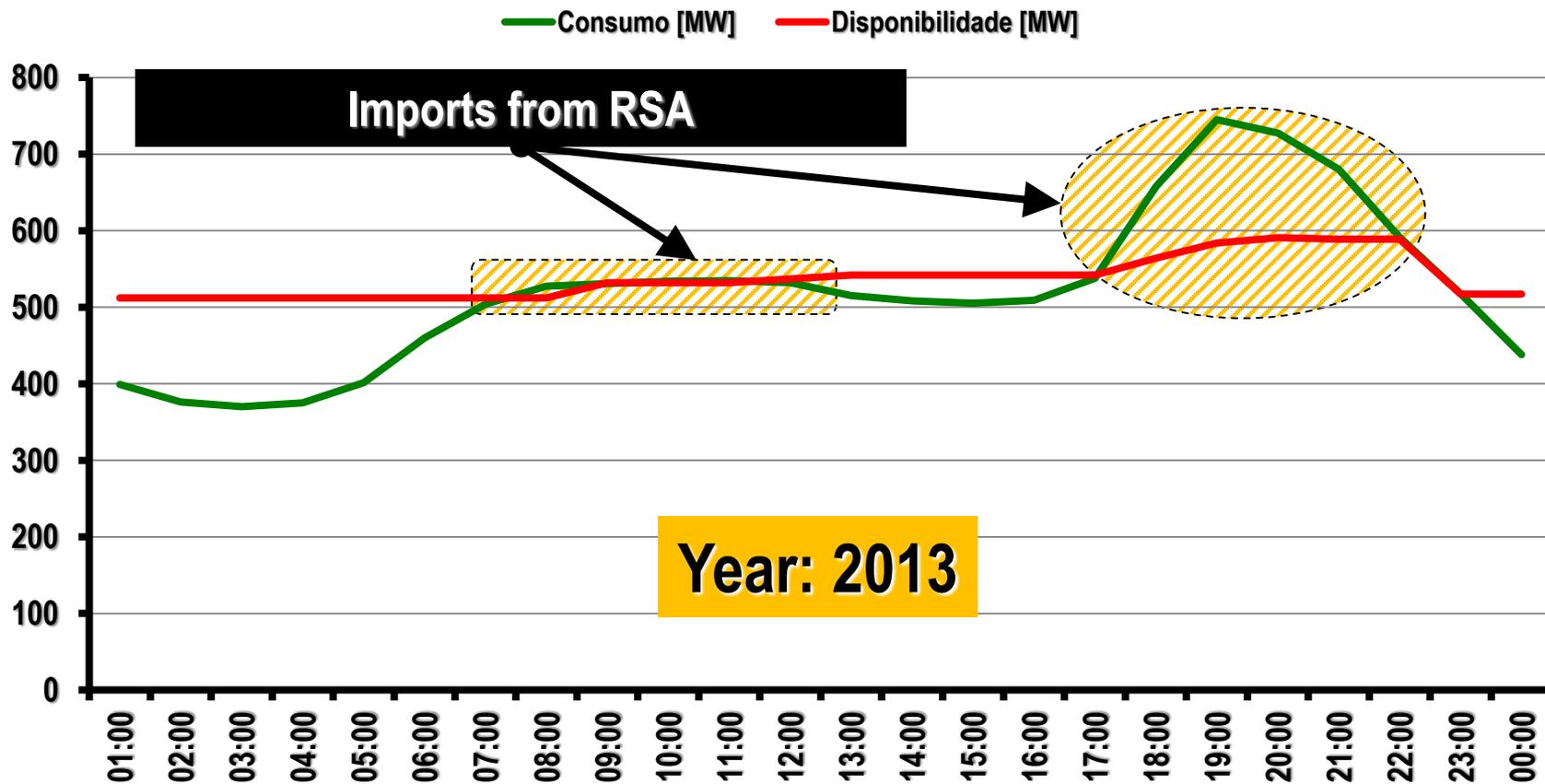
PRESENT SITUATION

Southern Region

- Supply to the southern region dependant on third parties: HCB (HVDC line Songo –Apollo), ESKOM and MOTRACO 400kV networks
- Due to contractual requirements only 300 MW can be transferred via Eskom (HVDC) and the peak load is 450 MW;
- To meet the peaking requirements, over 150 MW are imported at emergency rates in a daily basis (25-30cUSD/kWh);
- Overloaded Motraco network due to EDM load growth, (about 60 MW/year – 15%) imposes 400kV transmission upgrade;
- The 66 kV transmission system in Maputo has reached its limit and reinforcement is required to meet the new outgoing developments



SUPPLY VS DEMAND BALANCE



Shortage of generation leading to import at emergency rates (over 150 MW daily @25-30cUSD/kWh)



Challenges with supply quality

Power Quality Issues

- Improvement of the quality of supply and the following areas have been identified as the most important:
 1. Considerable part of the grid is aged (over 30 years), being the Central Region the most aged (average 40 years);
 2. At least 300 km of underground cables in Maputo distribution network need to be replaced to cope with the new buildings under construction
 3. The transmission grid is operating on the edge of its limit, resulting in power oscillations and increased breakdowns;
 4. Most of the electrification projects are based on long (150 – 200 km) medium voltages lines with limited transfer capability and low performance, therefore these lines have to be replaced by transmission lines

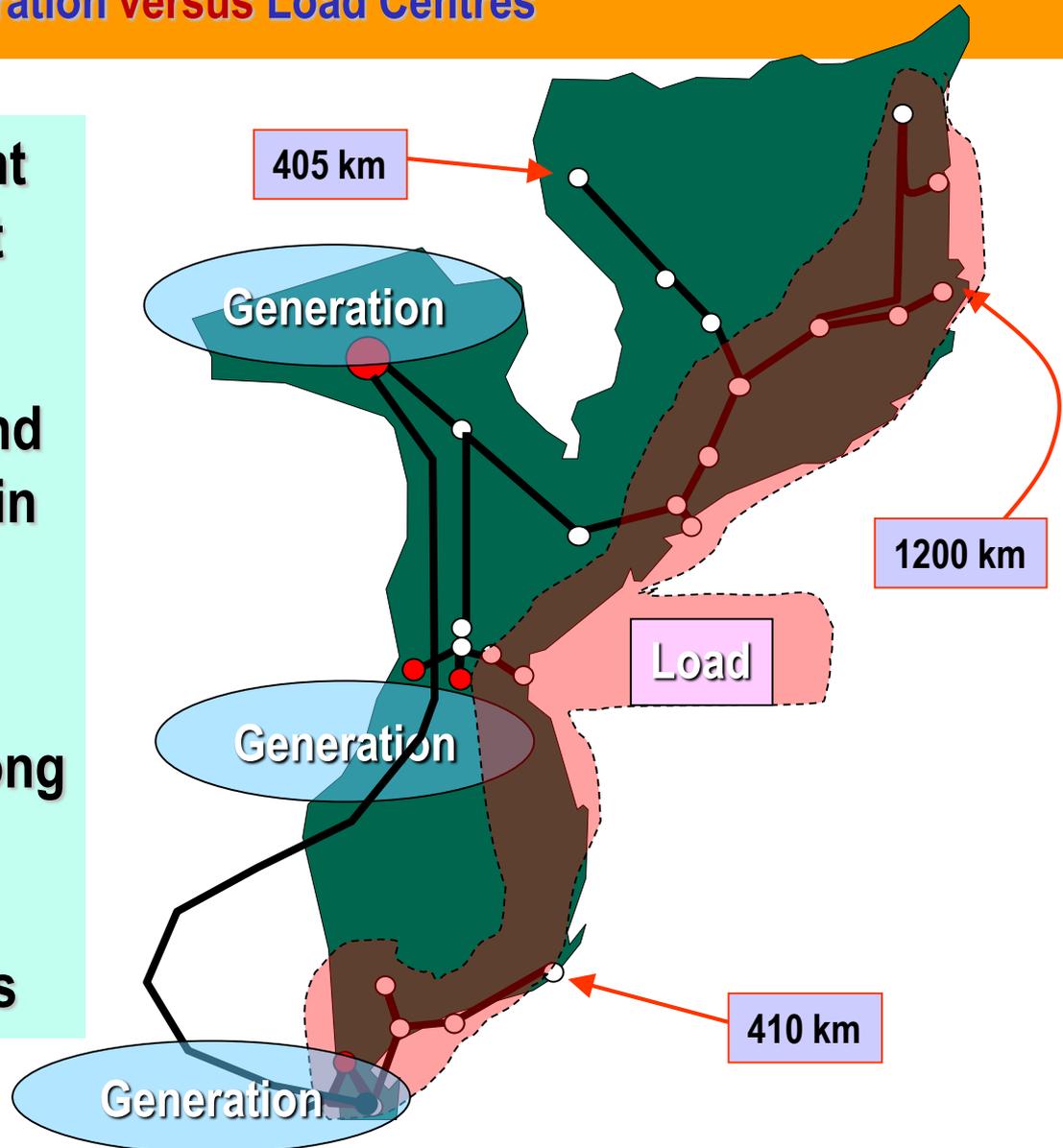
EDM must embark on an aggressive investment program to cope with the fast growing demand that requires higher stability and continuity of supply



Quality of Supply

Generation versus Load Centres

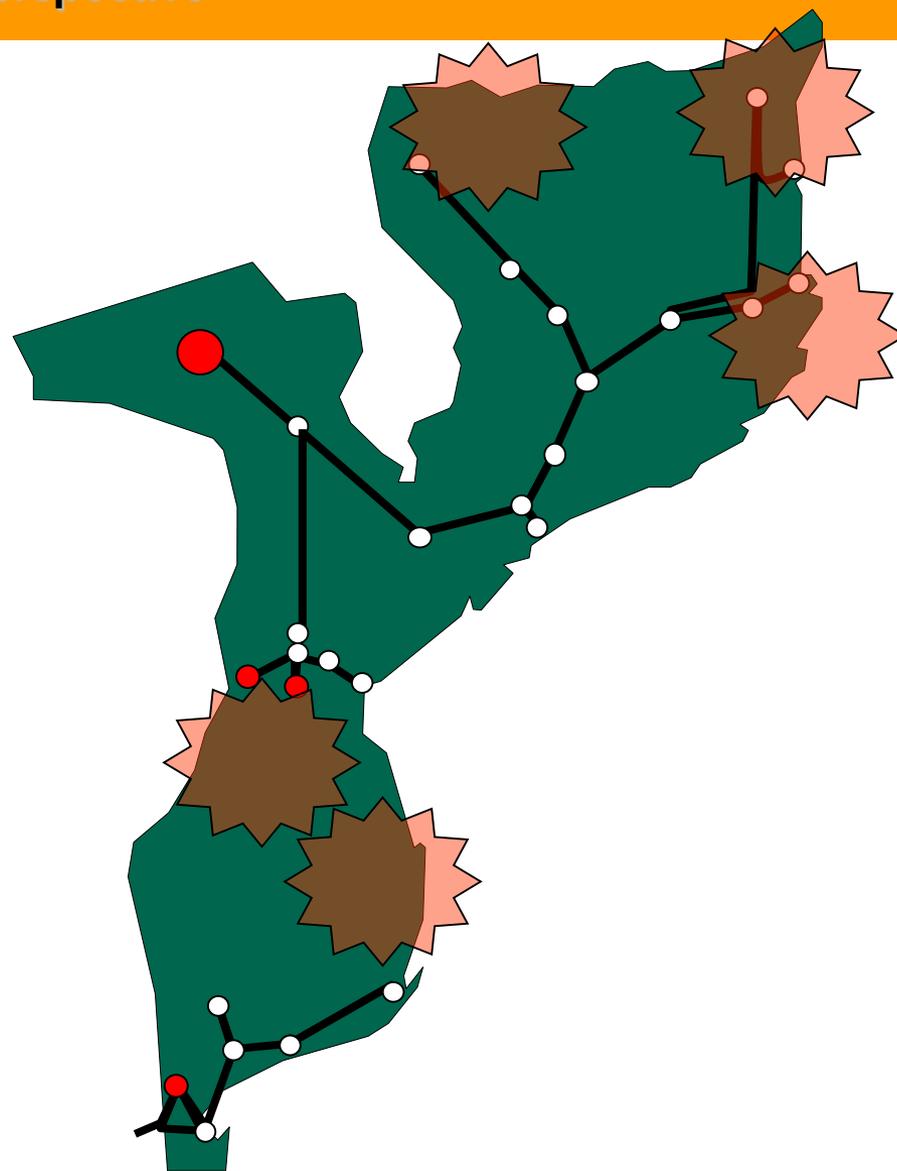
- Cahora Bassa power plant is the main source (about 92%);
- New generation (hydro and thermal) is concentrated in Tete province;
- Load centres located far away from generation (long transmission lines) pose challenges on voltage control and energy losses



Challenges with supply quality in Mozambique

Future perspective

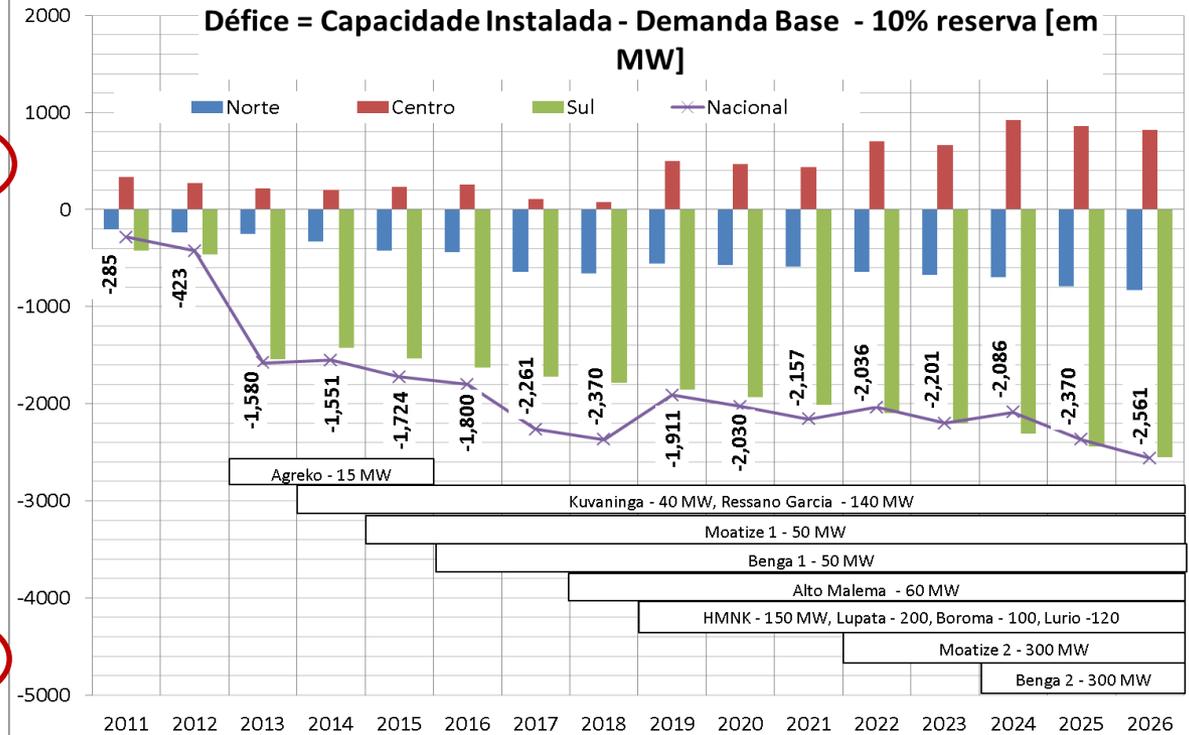
- **Diversification of the generation matrix by using the existing natural resources;**
- **Part of natural gas shall be used for power generation in order to improve the quality of supply**
- **Coal and Gas must be part of the solution by the possibility to locate power plants close to the load centres**



Opportunities on the Energy Sector

Demand Vs Generation Requirements

Projeccao da demanda MW				
Ano	Norte	Centro	Sul	Nacional
2011	182	217	1,394	1,793
2012	211	276	1,432	1,919
2013	230	330	1,475	2,035
2014	296	342	1,534	2,172
2015	384	358	1,619	2,361
2016	397	379	1,699	2,475
2017	587	518	1,790	2,895
2018	652	549	1,847	3,048
2019	667	574	1,908	3,149
2020	683	598	1,976	3,257
2021	700	626	2,047	3,373
2022	750	657	2,128	3,535
2023	773	693	2,219	3,685
2024	798	733	2,323	3,854
2025	885	788	2,439	4,112
2026	920	827	2,539	4,286



Emerging private investment on power business (Aggreko, Kuvaninga, Moatize, Benga, ...)

- The EDM power off-take on the planned generation is insufficient to cover the projected load
- There is an opportunity to an increased Public Private Partnership to generate power from Gas, Coal and other sources to support industrialization and export of surplus power to SAPP

REGIONAL CONTEXT – POWER BALANCE

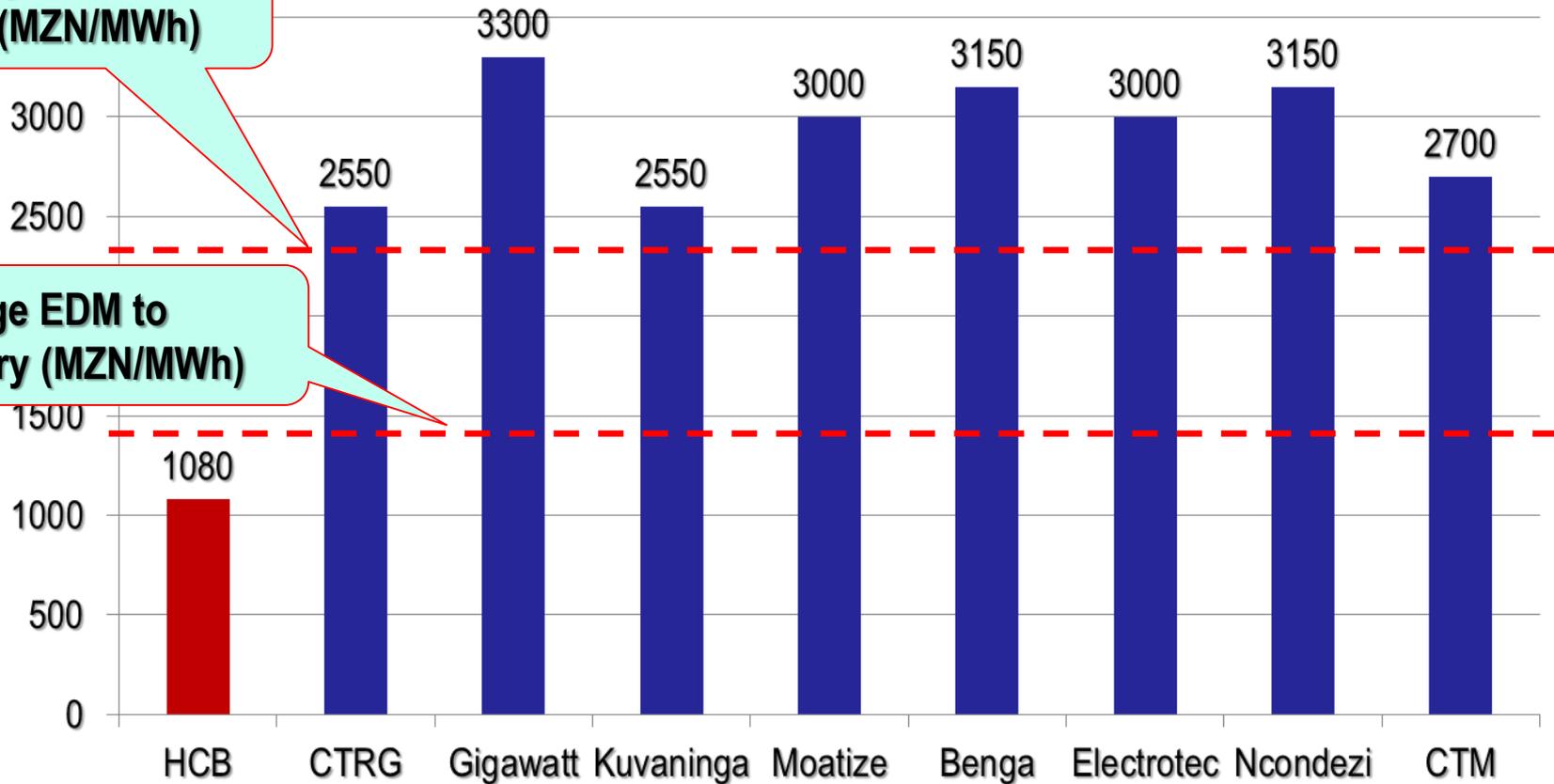
No.	Country	Utility	Installed Capacity [MW] As at Jul 2013	Available Capacity [MW] Jul 2013	Suppressed Demand & Forecast Demand	Capacity Shortfall including reserves, MW	Calculated Reserve Margin, %
1	Angola	ENE	1,793	1,480	1426		
2	Botswana	BPC	352	322	604		
3	DRC	SNEL	2,442	1,268	1398		
4	Lesotho	LEC	72	72	138		
5	Malawi	ESCOM	287	287	412		
6	Mozambique	EDM /HCB	2308	2,279	636		
7	Namibia	NamPower	501	392	635		
8	South Africa	Eskom	44,170	41,074	42416		
9	Swaziland	SEC	70	70	255		
10	Tanzania	TANESCO	1380	1,143	1444		
11	Zambia	ZESCO / CEC/LHPC	1,870	1,845	2287		
#REF!	Zimbabwe	ZESA	2,045	1,600	2267		
TOTAL SAPP			57,290	51,832	53,918	(7,670)	-4.0%
Total Interconnected SAPP			53,830	48,922	50,636	(6,939)	-3.5%



COST OF ELECTRICITY FROM THE NEW IPP'S

Average EDM retail price (MZN/MWh)

Average EDM to industry (MZN/MWh)



COST OF ELECTRICITY FROM THE NEW IPP'S

- In the next three years the energy cost from the new IPP's will **increase 100%** and the **revenues** are expected to increase **around 45%**, posing high risk of **Electricity Industry collapse**
- The cost of the new PPA's require retail tariff adjustment or other mitigation measures for financial sustainability of the power sector;
- The new PPA's will require corporate and Government guarantees/incentives



THE CURRENT & FUTURE CHALLENGES

Focus / Infraestrutura

- Ensure **medium and long term** energy needs
- Access to natural resources for power generation
- Ensure a diversified and **Balanced Generation Mix** (Hydro, Thermal, Renewable)
- Promote private initiative
- Quality of Supply and Grid Extension

Clients / market

- Establishment of **medium and large scale Industry**
- **Overloaded and Ageing** Transmission and Distribution Networks
- **Déficit of power** against **Fast Growing Demand**

Funding

- **Financial viability** on the investments (Project Finance)
- Continued need for Grants, Concessional funding and Soft loans
- Need for Cost reflective Tariff or Cost recovery mechanism
- Corporate and **Government Guarantees**

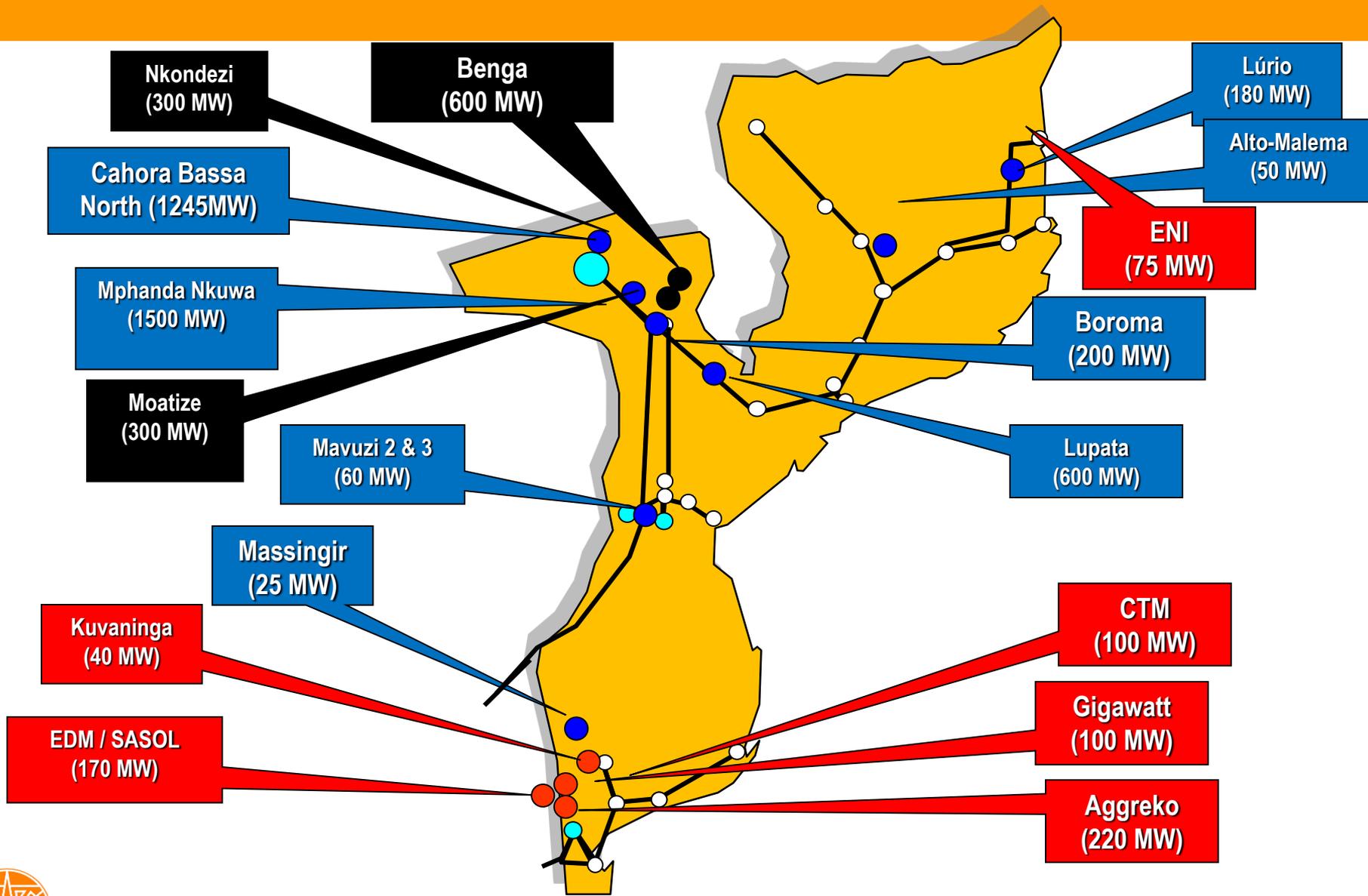


LONG-TERM TRANSMISSION PROJECTS

- The Electricity Master Plan provides a wider range of priority projects, however, here are some:
- The Mozambique Backbone (STE) shall play a relevant position on the long-term solution **(2bUSD)**
- Transmission lines upgrades in Southern Region and substation reinforcement in Central and Northern Regions **(175MUSD)**
- Chibata – Dondo 220 kV line **(55MUSD)**
- Maputo Tx & Dx Network Upgrade and Reinforcement **(250MUSD)**
- Supply to Beluluane Industrial Park **(60MUSD)**
- The second Caia – Nampula transmission line with preference for a 400 kV line **(620MUSD)**
- Reinforcement of the Dx network in Nacala including a substation in Namailo **(60 MUSD)**
- Upgrade of Chimoio Dx network **(30MUSD)**
- Upgrade of Beira Tx & Dx networks **(60 MUSD)**



GENERATION PROJECTS – SHORT AND LONG TERM



Challenges of the Energy Sector in Mozambique

Conclusions

1. Generation, transmission and distribution infrastructure are unable to cope with current and future demand and are an important constraint to the economic and social development;
2. The existing natural resources (coal, hydro, gas and renewables) can play a determinant role on the power balance at cost effective rates;
3. Diversification of the generation **matrix** and **location** will positively influence the quality and security of supply;
4. The improvement of quality of supply requires a massive investment on the generation, transmission and distribution grid (**over 2bUSD in the next 5-10 years**);
5. **The financing cannot be raised on utility balance sheet and requires government support**
6. The cost of the new PPA's require retail tariff adjustment or other mitigation measures for financial sustainability of the power sector (cost reflective tariff);
7. **The new PPA's require corporate and Government guarantees/incentives**
8. Improvement of maintenance of the existing infrastructure will complement the actions for better quality of supply;
9. Training of the staff is a key complement .



Challenges of the Energy Sector in Mozambique

Financial support

Commitment on continued support on the electricity sector in Mozambique in particular to:

- ✓ **Mozambique Transmission Backbone**
- ✓ **The 2nd Caia – Nampula transmission line**
- ✓ **Strategic Generation and Transmission projects as defined in the Electricity Master Plan under review**
- ✓ **Capacity building**
- ✓ **Security/guarantee arrangements for new PPA's**

