Ministry of Energy
Republic of Sierra Leone

ENERGY SECTOR STRATEGY 2014-2017

September 2014

VISION – To Increase Generation to 1000MW by 2017

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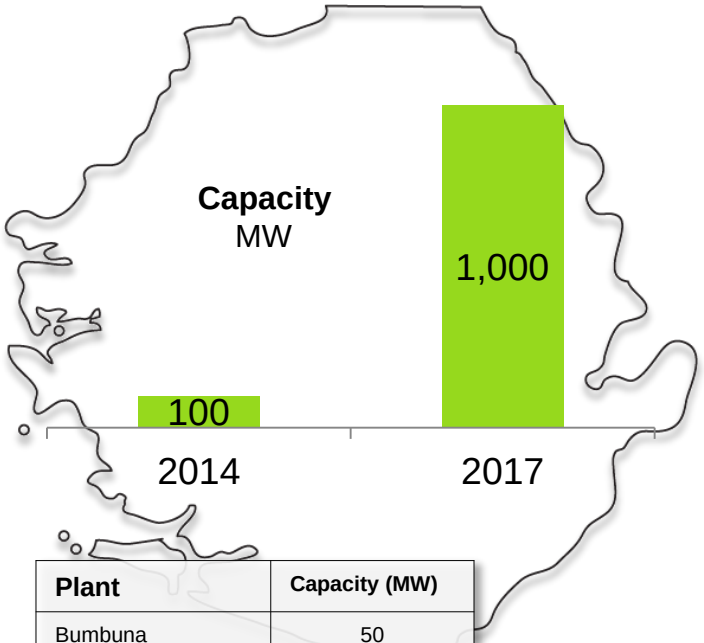
VISION – Increase Generation to1000 MW by 2017



Plant	Capacity (MW)
Bumbuna	50
BKPS	10.8
Kingtom HFO	10
Blackhall Rd HFO	16.5
Makeni DFO	3.3
Lungi	6
Kono	2
Lunsar	1
Total	**100MW**

Achieving this requires

Demand

- Required to attract the private sector and make the investment financially sustainable

Generation Investment

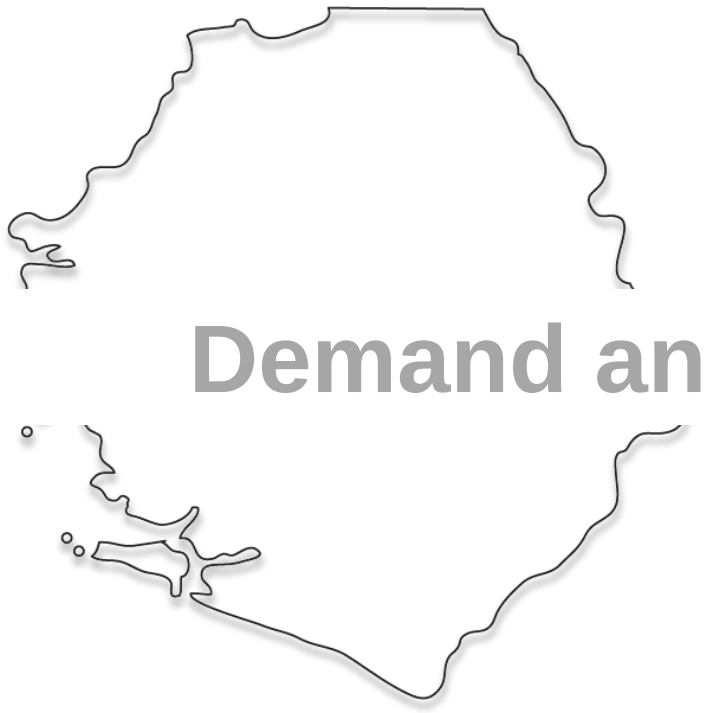
- Well defined projects to attract the private sector
- An Energy mix that will result in a tariff consumers can afford

Network Investment

- Rehabilitation works to improve quality of service for existing customers
- Extending access through T&D investment

Institutional Capacity Building

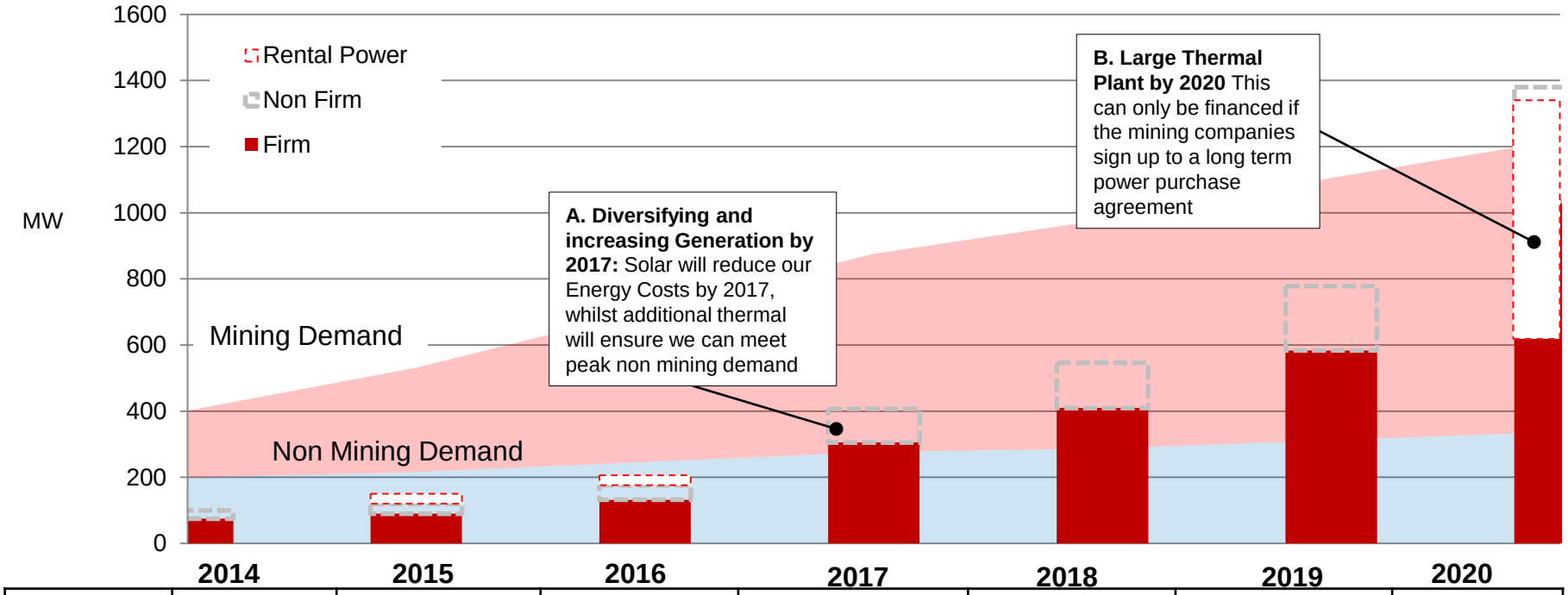
- Training of staff and reorganization of the Ministry and Power Sector to support growth



Demand and Generation

Demand Forecast : Current Interventions

Projected demand, additions and generation shortfall: 2014 – 2020

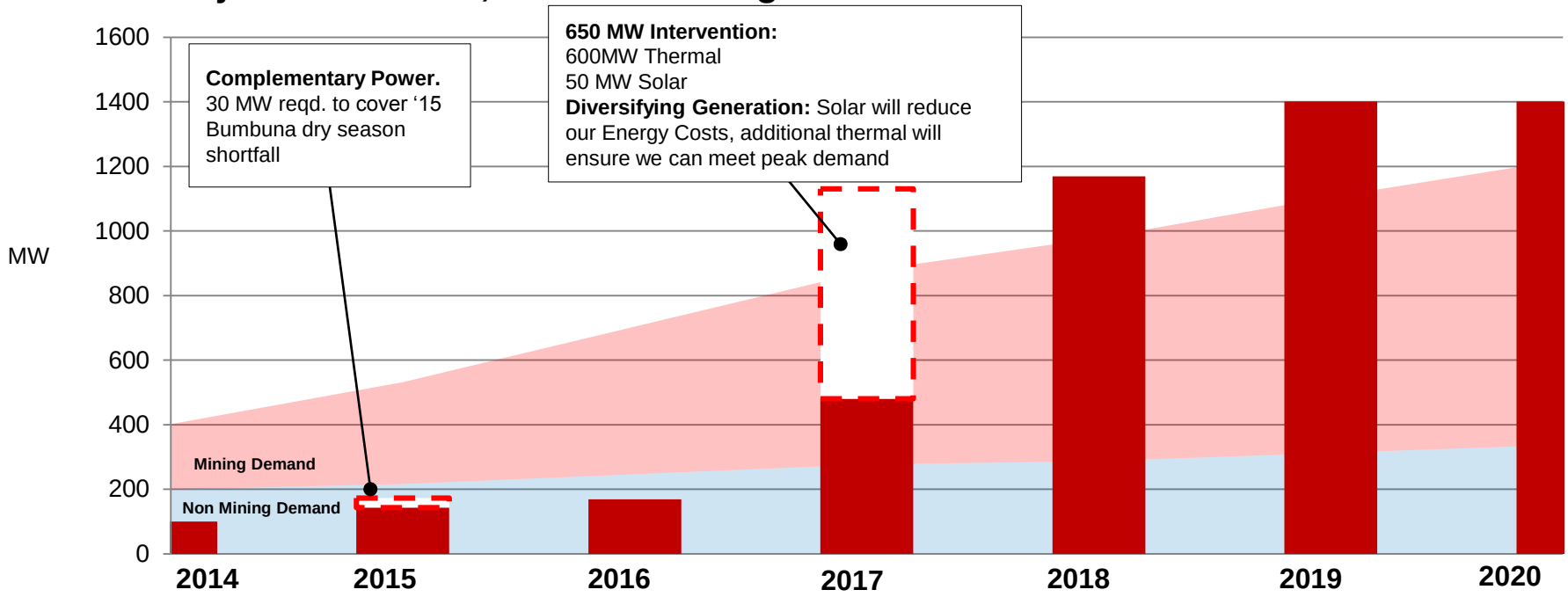


	2014	2015	2016	2017	2018	2019	2020
Installed	**100 MW**	**120 MW**	**176 MW**	**407 MW**	**546 MW**	**778 MW**	**1380 MW**
Total Addition		**20 MW**	**56 MW**	**231 MW**	**139 MW**	**232 MW**	
Generation Additions (In the pipeline)		Bankasoka – 2 MW (Hydro) Charlotte– 2 MW (Hydro) Kono – 4 MW Addax – 12 MW	CEC – 50 MW (HFO) Solar Park – 6 MW	CEC– 39 MW (HFO) Betmai– 25 MW (Hydro) Moyamba– 12 MW (Hydro) Bumbuna II – 132 MW WAPP – 23 MW	CEC – 39 MW (HFO) Mange– 100MW (Hydro)	Bekongor III– 160MW (Hydro) Bumbuna II– 72 MW (Hydro)	
Shortfall	**900MW**	**880MW**	**824 MW**	**593 MW**	**454 MW**	**222 MW**	**-**

Source: PPA Energy Demand Forecast 2014

Demand Forecast: Proposed Interventions

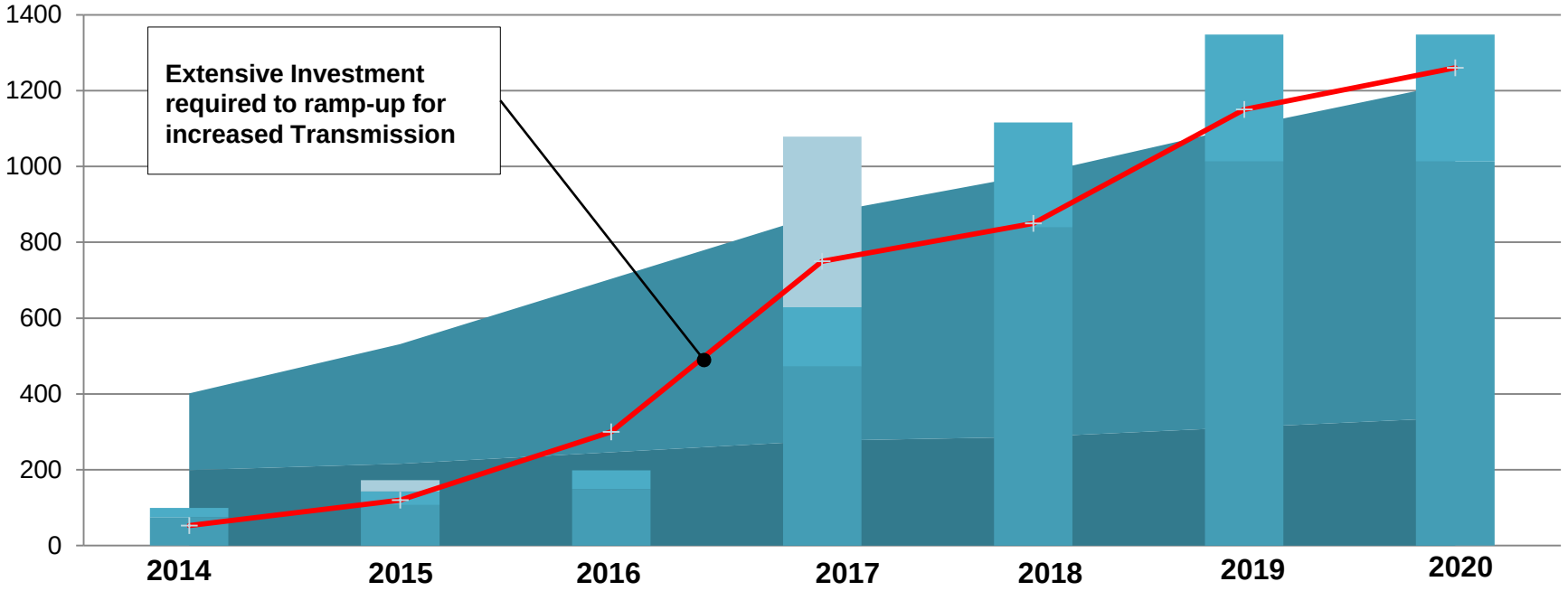
Projected demand, additions and generation shortfall: 2014 – 2020



Installed	100 MW	173 MW (30 MW rental)	199 MW (-30MW Rental)	1080 MW	1119 MW	1351 MW	1351 MW
Total Addition		**73 MW**	**56 MW**	**881 MW**	**139 MW**	**232 MW**	
Generation Additions (In the pipeline)		Bankasoka– 2 MW Charlotte – 2 MW Kono – 4 MW Addax – 12 MW **Provincial HQ towns – 23MW** **Thermal – 30MW**	CEC (HFO) – 50 MW Solar Park – 6 MW	CEC (HFO) – 39 MW Betmai – 25 MW Moyamba – 12 MW Bumbuna II – 132 MW WAPP – 23 MW **Thermal 1 :600 MW** **Solar – 50MW**	CEC (HFO) – 39 MW Mange – 100MW	Bekongor III (Hydro) – 160MW Bumbuna II (Hydro) – 72 MW	
Intervention Cost				**Power: $2Bn** **T&D: $80M**	-	-	-

Planned Transmission: Proposed Interventions

Projected Transmission & Distribution Expansion



Installed Capacity	**63 MW**	**120 MW** (30 MW rental)	**300 MW** (-30MW Rental)	**750 MW**	**850 MW**	**1150 MW**	**1260 MW**
Total Addition		**57 MW**	**180 MW**	**450 MW**	**100 MW**	**300 MW**	**110 MW**
Areas of Expansion		**Western Area**	**Western Area/ Northern Province**	**Northern and Eastern Province**	**Eastern and Southern Province**	**All Areas**	**All Areas**
Intervention Cost		**50 KM $16.0m**	**300 KM $120m**	**600KM $240m**	**200 KM $80m**	**400 KM $160m**	**100 KM $40m**

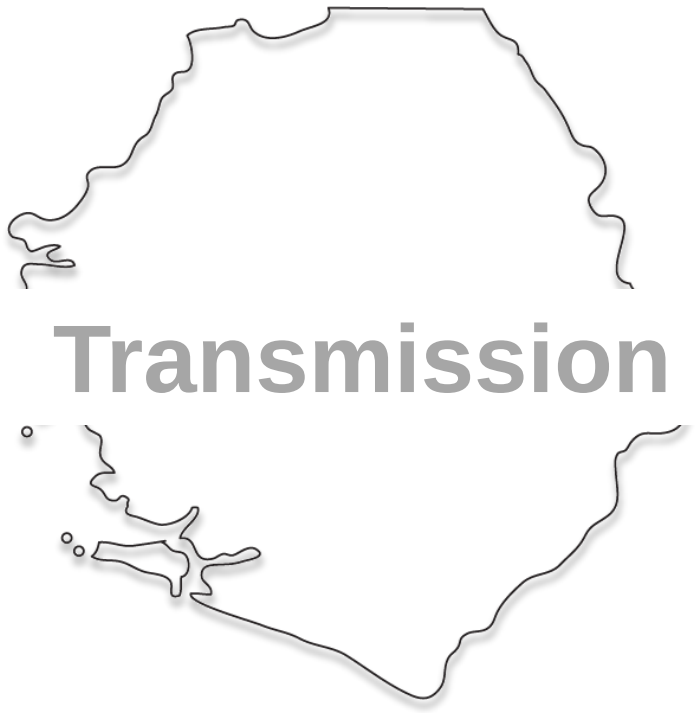
Mining and Industrial Consumers: Demand Forecast

Table: Current Capacity and forecast demand

		2013 Estimate	By 2020 (Base Case)
	Location	Firm Capacity [MW]	Firm Capacity [MW]
Mining Companies			
African Minerals	Tonkolili	20	174
Sierra Rutile	Moyamba	23	37
London Mining	Marampa	15	40
Sierra Minerals	Moyamba	4	3
Koidu Holdings	Kono	6	18
Marampa Iron Ore	Marampa		121
Amara Mining	Baomahu		10
China Kingho)	Pujehun	8	8
	SUBTOTAL	76	411
Other Large Self-Generating Industrial Companies			
China Kingho	Sewa River	0	70
Leocem	Freetown	7	8
Dangote	Freetown	0	4
Samshi Afrika	Port Loko	0	30
	SUBTOTAL	7	112
	TOTAL	83	523

Notes:

- Capacities and projected demands were obtained during a Mining companies round table hosted by GoSL in 2012
- These figures account for projected demand of existing mines. The demand forecast anticipates additional mining interests will be developed



Transmission and Distribution

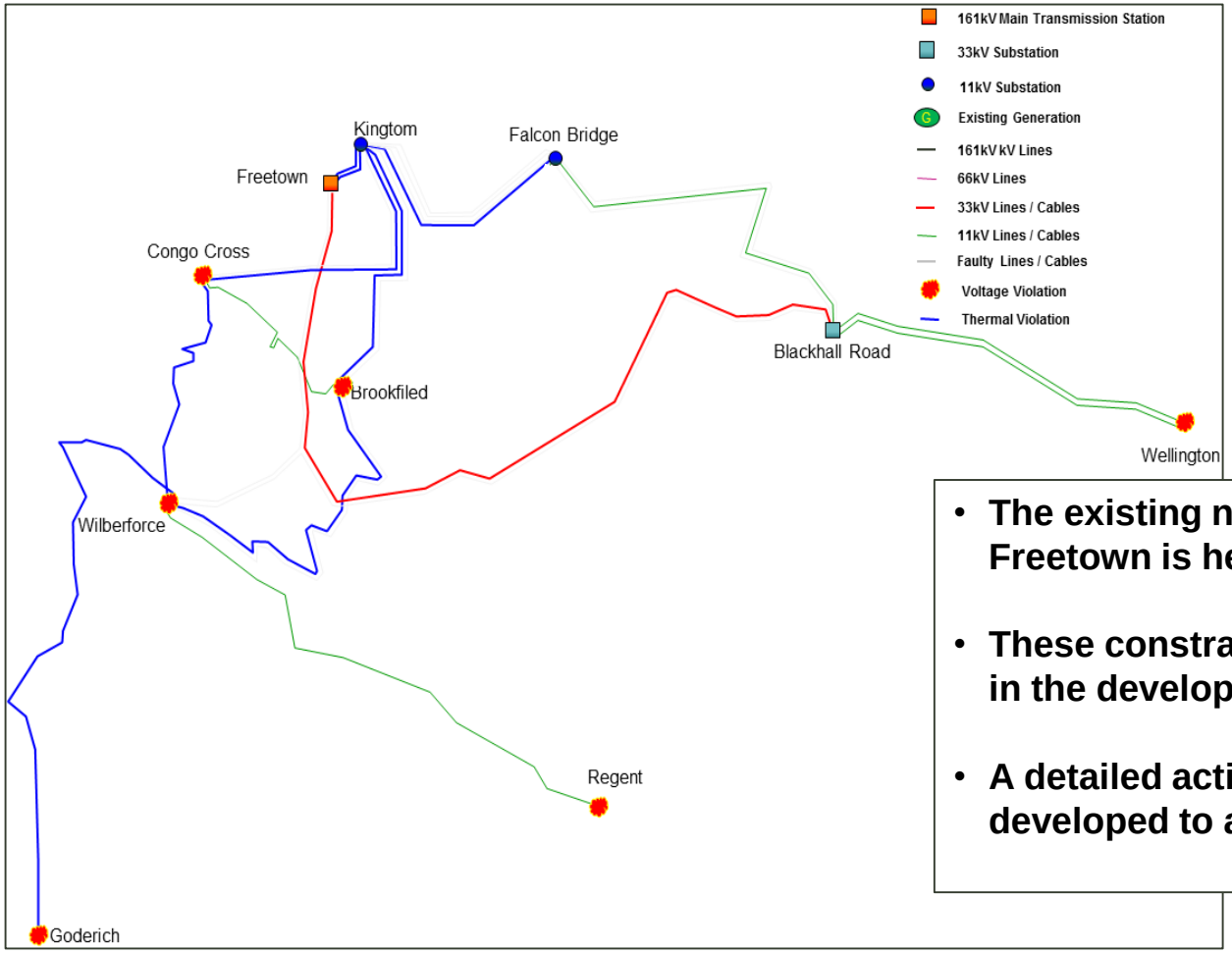
Transmission & Distribution – Currently funded Interventions

GoSL and a number of other partners are already engaged in this work

Funding	Project Description	Area Covered
GoSL **$10M USD**	Develop National Grid and integrate Mining Companies	Nationwide
	Emergency Grid works in the Western Area	Interventions in the Western Area
	Establish & Upgrade 11kv distribution networks to dark spot and problem areas Maintenance works	Western Area
JICA **$3.8M USD**	Rehabilitation of T&D network in the Western Area	Goderich substation and extension of 11kv network to Wilberforce
DFID **$16M USD**	Energy Access Programme (EAP) • Rehabilitation of T&D • Solar rollout to 14 villages • Roadmap for renewable technologies in rural areas	Rehabilitation: Kingtom, Wilberforce, Black Hall Road & Wellington Solar & Renewable Energy rollout : Nationwide
World Bank **$40M USD**	Energy Sector Utility Reform Project (ESURP) • EDSA Management Contract • Network improvements • Project implementation & generation studies	Network improvements restricted to urban areas
IDB **$10.7M USD**	Low and medium voltage network in Western Area	Western Area
ECOWAS **$21M USD**	• T&D in Western Area • Revolving fund for fuel • Meters	Western Area
WAPP (AfDB, WB, EU) **331.51M UA**	• 525 Km energy network interconnecting Cote d'Ivoire, Liberia, Sierra Leone and Guinea • Energy Access to 115 communities within 5 km of the line • 4,700 Prepaid Meters provided to 115 communities	7 Districts across SE to North of Sierra Leone (Pujehun, Kenema, Kono, Tonkolili, Bombali, Koinadugu, Kambia), 5 substations (Bekongor, Yiben, Bumbuna, Kamakwie, Kenema) and 115 Communities (within 5 km of the line)

Transmission & Distribution - Western Area Current Status

Existing Grid – Can evacuate approx. 45 MW

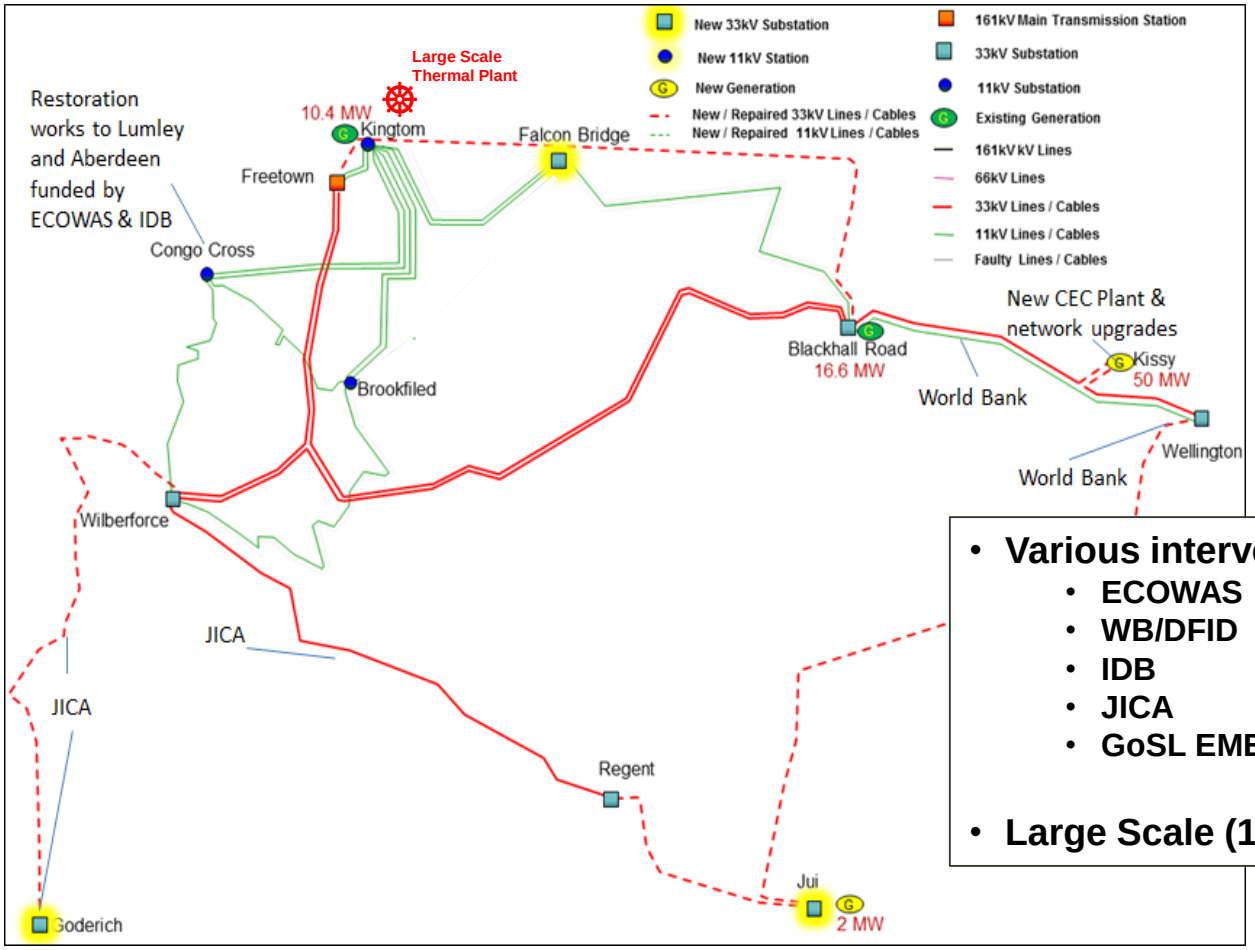


Constraints indicated in Blue

- **The existing network in and around Freetown is heavily constrained**
- **These constraints are the limiting factor in the development of the power sector**
- **A detailed action plan has been developed to address these constraints**

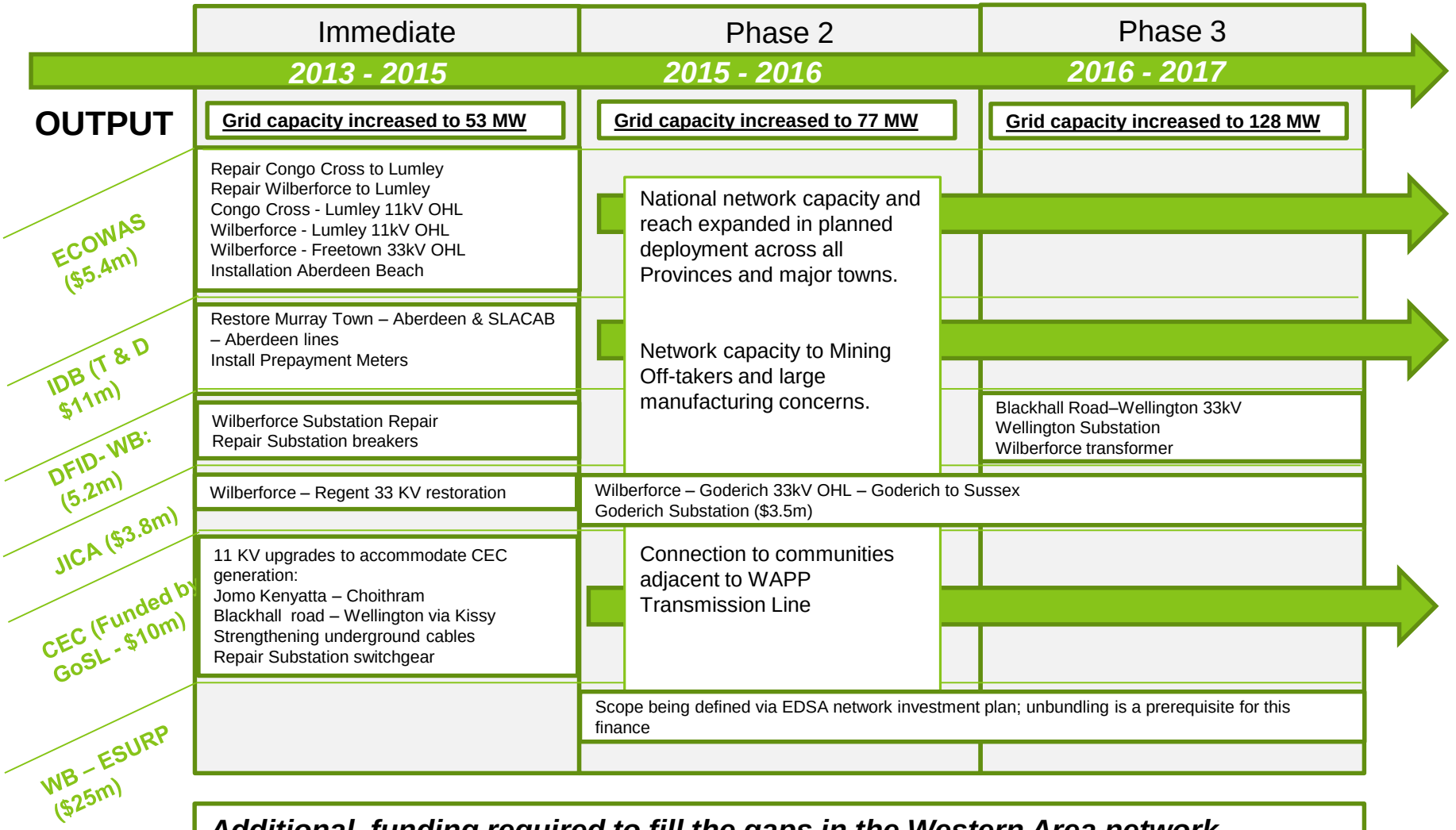
Transmission & Distribution - Western Area Interventions

Upgraded Grid – Can evacuate 128 MW



- **Various interventions funded by:**
  - **ECOWAS**
  - **WB/DFID**
  - **IDB**
  - **JICA**
  - **GoSL EMERGENCY GRID WORKS**
- **Large Scale (128MW) Plant by CEC**

Network Rehabilitation and New Capacity Roadmap:

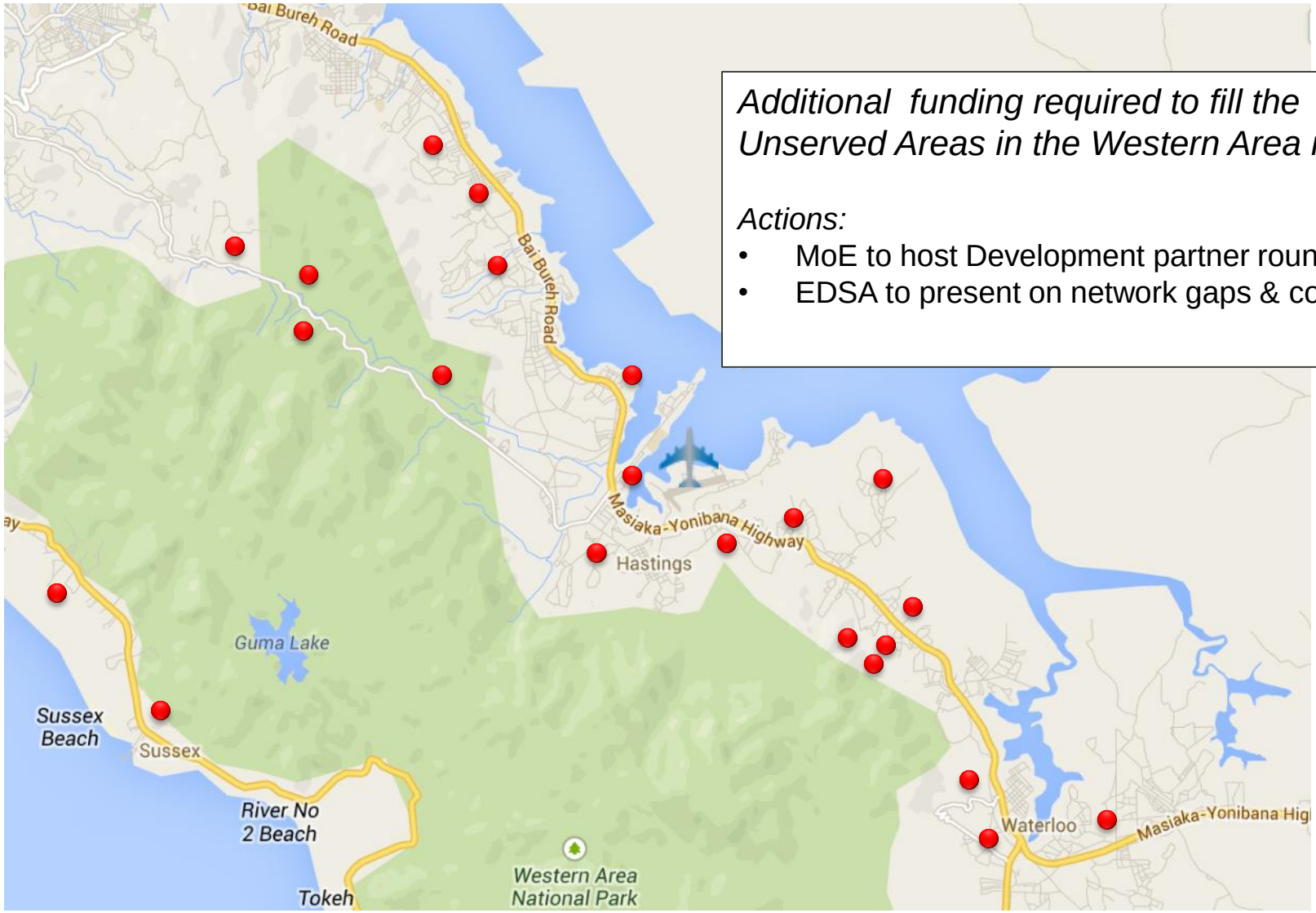


Additional funding required to fill the gaps in the Western Area network

Actions:

- MoE to host Development partner round table.
- EDSA to present on network gaps & costs

Transmission & Distribution - Western Area Interventions

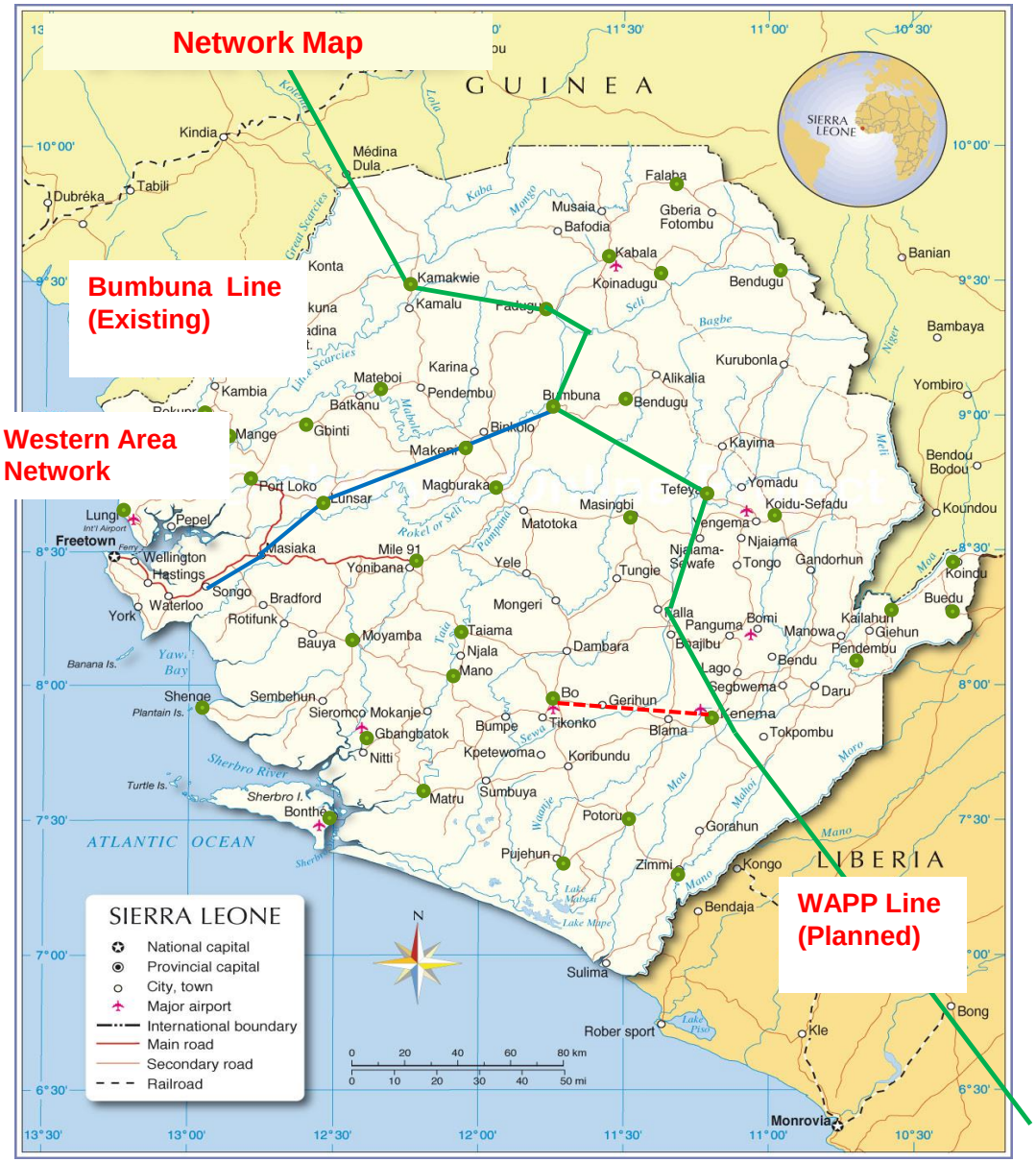


Additional funding required to fill the Unserved Areas in the Western Area network

Actions:

- MoE to host Development partner round table.
- EDSA to present on network gaps & costs

Transmission & Distribution – Current Nationwide Interventions



A. Planned - The development of the Sierra Leone portion of the WAPP (indicated in GREEN)

B. Existing - The 161 KV line linking Bumbuna I to Freetown (indicated in BLUE)

C. Existing and Planned -The Western Area Network (indicated in RED)

D. Existing Thermal Plants and Mini Grids
   A. Bo/Kenema
   B. Makeni
   C. Lungi Plant
   D. Lunsar
   E. Koidu/Kono

Transmission & Distribution – Proposed Interventions

Mission:

Creating a power system that will enhance greater access to electricity and other energy related activities in the urban and rural communities. Implementation and management is at the Provincial Level

Achieving this requires

Rehabilitation

- Rehabilitating and upgrading the existing network to increase both the reliability of the network and the amount of power the network can transmit

Network and access expansion

- The transmission and distribution network needs expansion to connect new generation and increase access

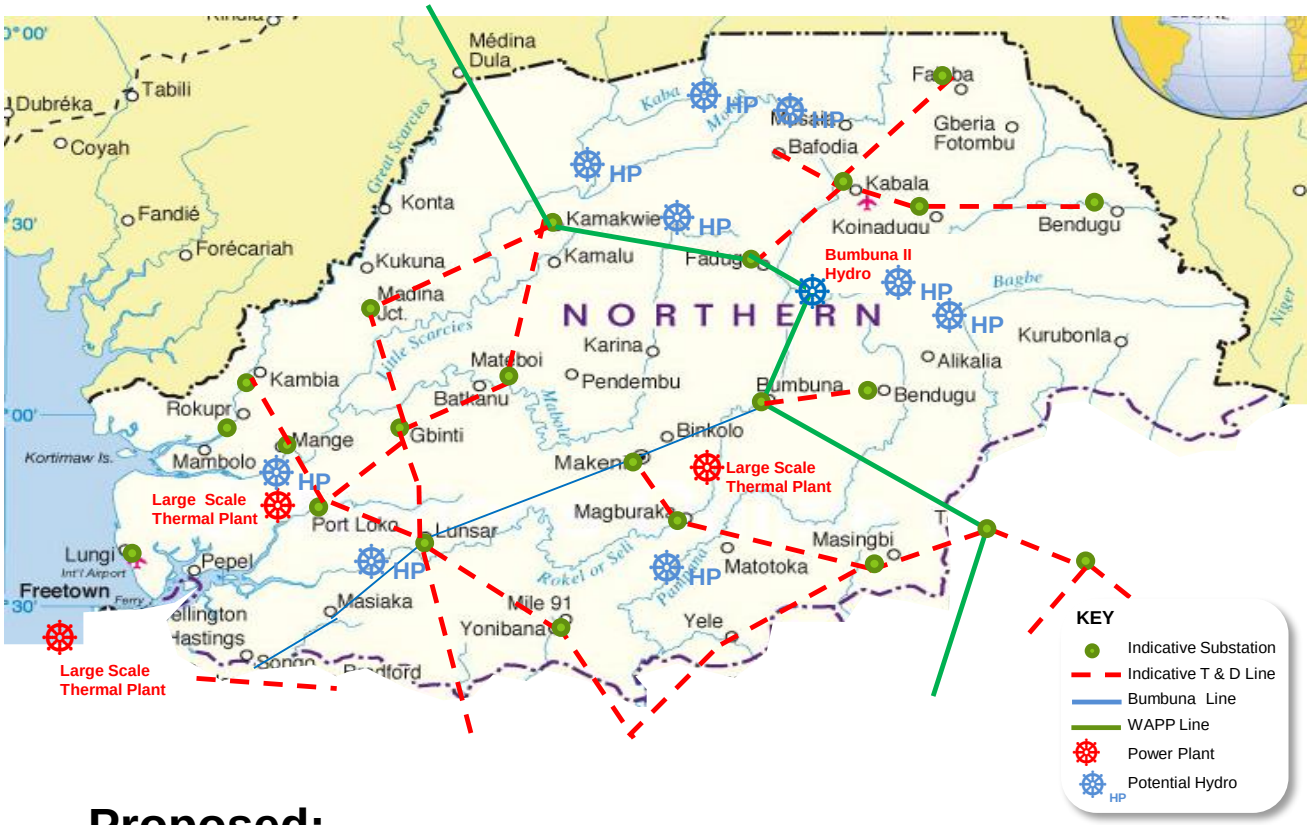
Transmission & Distribution – Proposed Interventions

Location	Size (KV)	Distance (Km)	Cost ($)
Mamamah T&D Network	11	14.4	77,043
Mamamah T&D Network	0.4	44	235,410
Bumbuna - Mamamah Transmission Line	225	188	63,920,000
Mamamah - Wellington Transmission Line	225	45	15,300,000
Lunsar Substation	161	2	15,000,000
Lunsar – Portloko Transmission Line	115	34	181,908
Port Loko – Lungi Transmission Line	115	70	1,571,667
Lungi-Pepel Transmission Line	33	60	321,014
Lunsar City - T&D	11	20.4	109,145
Lunsar Citry - T&D	0.04	62	331,715
Port Loko City - T&D	11	15.6	83,464
Port Loko City – T&D	0.04	42	224,710
Lungi City – T&D	11	56.4	301,753
Lungi City – T&D	0.04	132	706,231
Makeni Substation Transmission Line	161	3	67,357
Makeni-Magburaka Transmission Line	33	30	160,507
Makeni City – T&D	11	39.6	211,869
Makeni City – T&D	0.04	128	684,830
SubTotal		986.4	99,488,625

Location	Size (KV)	Distance (Km)	Cost ($)
Magburaka Substation			
Magburaka City – T&D	11	13.8	73,833
Magburaka City T&D	0.04	28	149,807
Moyamba Substation Transmission Line	225	66	22,440,000
Moyamba - Pujenhun Transmission Line	225	169	57,460,000
Moyamba City – T&D	11	7.8	41,732
Moyamba City - T&D	0.04	18	96,304
Pujehun Substation			15,000,000
Pujehun City - T&D	11	6	32,101
Masiaka City - T&D	11	7	37,452
Masiaka City - T&D	0.04	18	96,304
Kabala Substation	11	8.4	44,942
Makeni – Kabala Transmission Line	115	120	2,694,286
Kabala City	0.04	16	85,604
SubTotal		478	98,252,365
Total Transmission Distance		1464.4	197,740,990

Source: Analysis by NPA & MoE

Transmission & Distribution – Northern Province



Current Status:

Limited T &D Lines clustered around Thermal Plants at Lunsar

Connection to Bumbuna Line at :

- Makeni
- Magburaka
- Binkolo
- Port Loko
- Masiaka and
- Lunsar

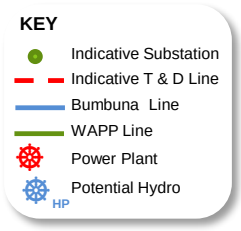
Proposed:

- Expanded T &D Network with a mix of power generation alternatives and Micro-grid installations.
- Bumbuna II installation and Large Scale Thermal Plants to serve Mining and Non-Mining Activity

WAPP Connection

Towns within 5KM of WAPP Line

Transmission & Distribution – Eastern Province



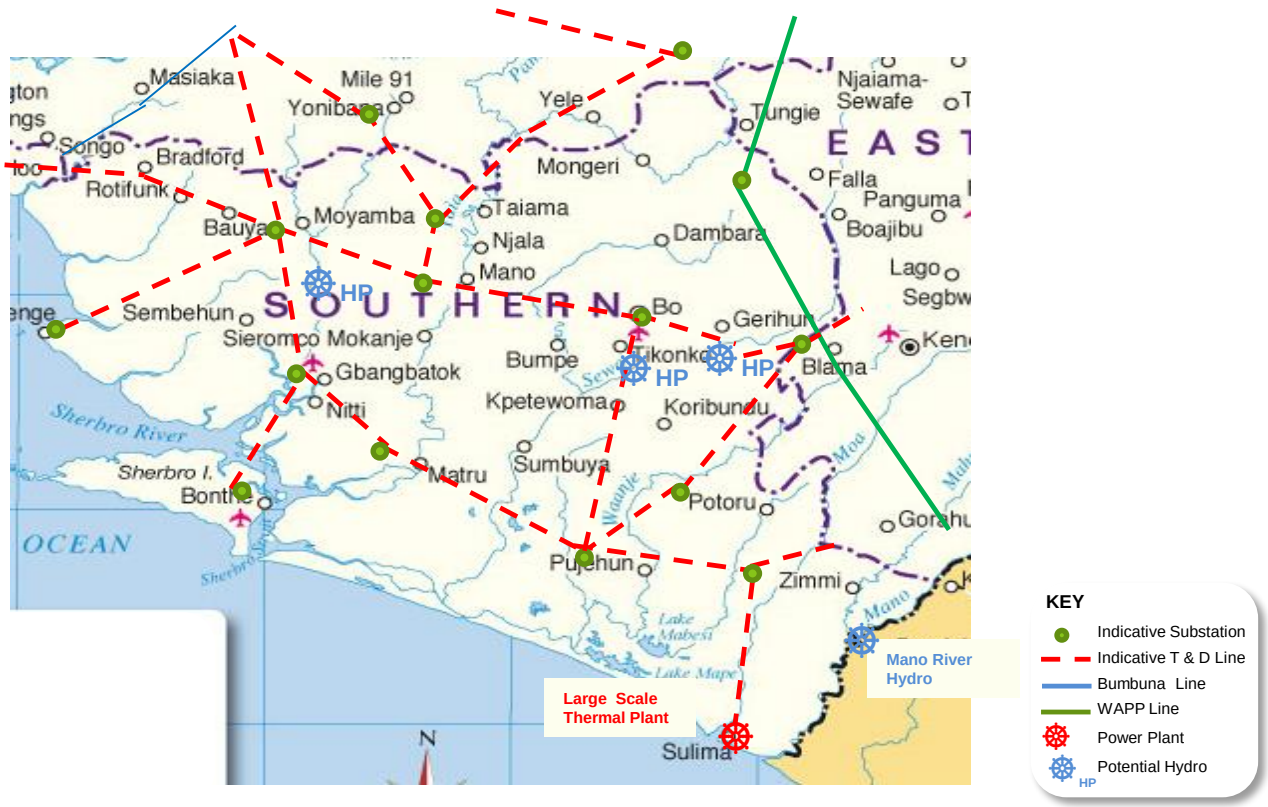
Current Status:
Limited T &D Lines clustered around Thermal Plants at Koidu and Kenema

Connection to Bumbuna
NA

Proposed:
Expanded T &D Network with a mix of power generation alternatives and Micro-grid installations. Large Scale Thermal Plant for Base Load Supplement

WAPP Connection
Towns within 5KM of WAPP Line

Transmission & Distribution – Southern Province



Current Status:
Limited T &D Lines clusterd around Thermal Plants at Bo

Connection to Bumbuna
NA

Proposed:
Expanded T &D Network with a mix of power generation alternatives and Micro-grid installations
Large Scale Thermal Plants at Mano River (Hydro) and Coast (Gas)

WAPP Connection
Towns within 5KM of WAPP Line

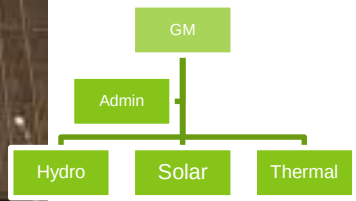
Institutions

Institutional Capacity Building– Policy/Management Implementation

The Ministry

Policy and Direction

- Undertake a full audit of the Ministry's functions and capacities and propose changes
- Provide legal, planning and investment management technical assistance in conjunction with hiring local counterparts to develop
- Establish training curriculum and run courses on technical topics, planning, economics & project management



EDSA and EGTC

Management and Operations

- Unbundling of NPA
- Creation of an independent regulatory commission

EDSA

EGTC

Resource Development

- Establish engineering training schools and workshops for EDSA & EGTC engineers
- Establish project management capability in both utility companies though assignment of experts for 2-3 years to locals and delivery of relevant software
- Management Information Systems (MIS): Deliver MIS to support: planning and investment, corporate functions, asset and works management

Investment Requirements

Generation Investment

Support	Costs
Feasibility studies & transaction advisory for small scale hydro (possible feed in tariff)	$100k - $2m
Support auditing existing hydro studies and proposing a way forward	$0.25m
Study fuel contracting and storage	$0.3m
Support	**Costs**
Costs for large thermal, hydro & solar projects	Up to $2.5B
TOTAL	**Approx. $2.5B**

Network Rehabilitation

Support	Costs
Audit existing network and scope of on-going works to identify gaps and "Quick wins"	$0.5m
Audit of metering & revenue collection and establishment of enhanced revenue protection policy	$0.5m
Establish workshop	$1m
Support	**Costs**
Up to $100m of network reinforcements required in line with Master-plan	$100m
TOTAL	**Approx. $100m**

Access Provision & Network Extension

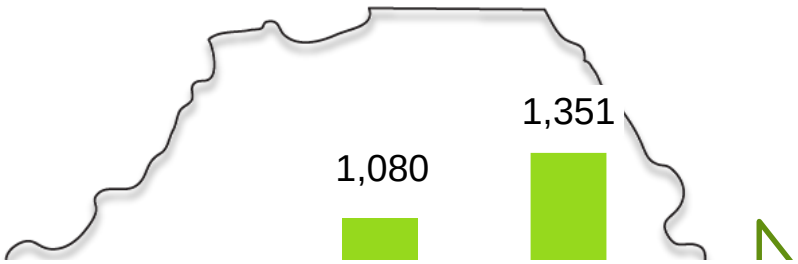
Support	Costs
Develop Energy access master-plan and prospectus	$2m
Develop investable models for isolated grid solutions	$0.25m
Support	**Costs**
Finance and support in risk mitigation for the development of isolated grids	$5m
Energy Access	$200m
Transmission and Network Expansion	$200m
TOTAL	**Up to $380m**

Capacity Building and Institutional Strengthening

EDSA | EGTC | Ministry of Energy | Commission | Bumbuna I

$20 – 30m

Summary And Conclusion

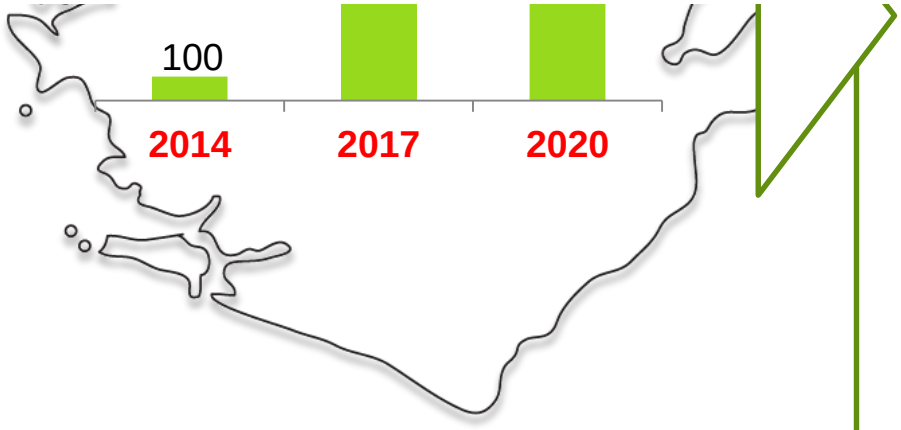


1000 MW by 2017/18 with:

Generation Investment

- All pipeline projects are executed
- Investment is made in 2 or 3 Large scale power plants and other renewable energy source projects
- **Commitment of mining companies as off takers with long term power purchase agreement**

1000 MW can be achieved by 2017/2018



- Through planning and investment - create a power system to enhance access to electricity and other energy related activities throughout the country
- Rehabilitate existing infrastructure to improve quality and reliability of service for customers
- **Financed with mining companies long term power purchase agreement**

Institutional Capacity Building

- We transform the Ministry and the Power Authorities to manage the growth
- Train and retain staff and provide services to support growth

THANK YOU