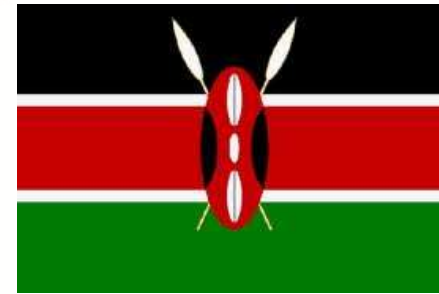


MINI-GRID ELECTRIFICATION SYSTEMS IN KENYA



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Preface

“...Please pass my heartfelt apologies to the organisers of this Extremely important event which I feel concerned for not been able to attend at the last minute.

Advise them that I had some very crucial official matters to attend to regarding finalizing of electrification of all public facilities...”

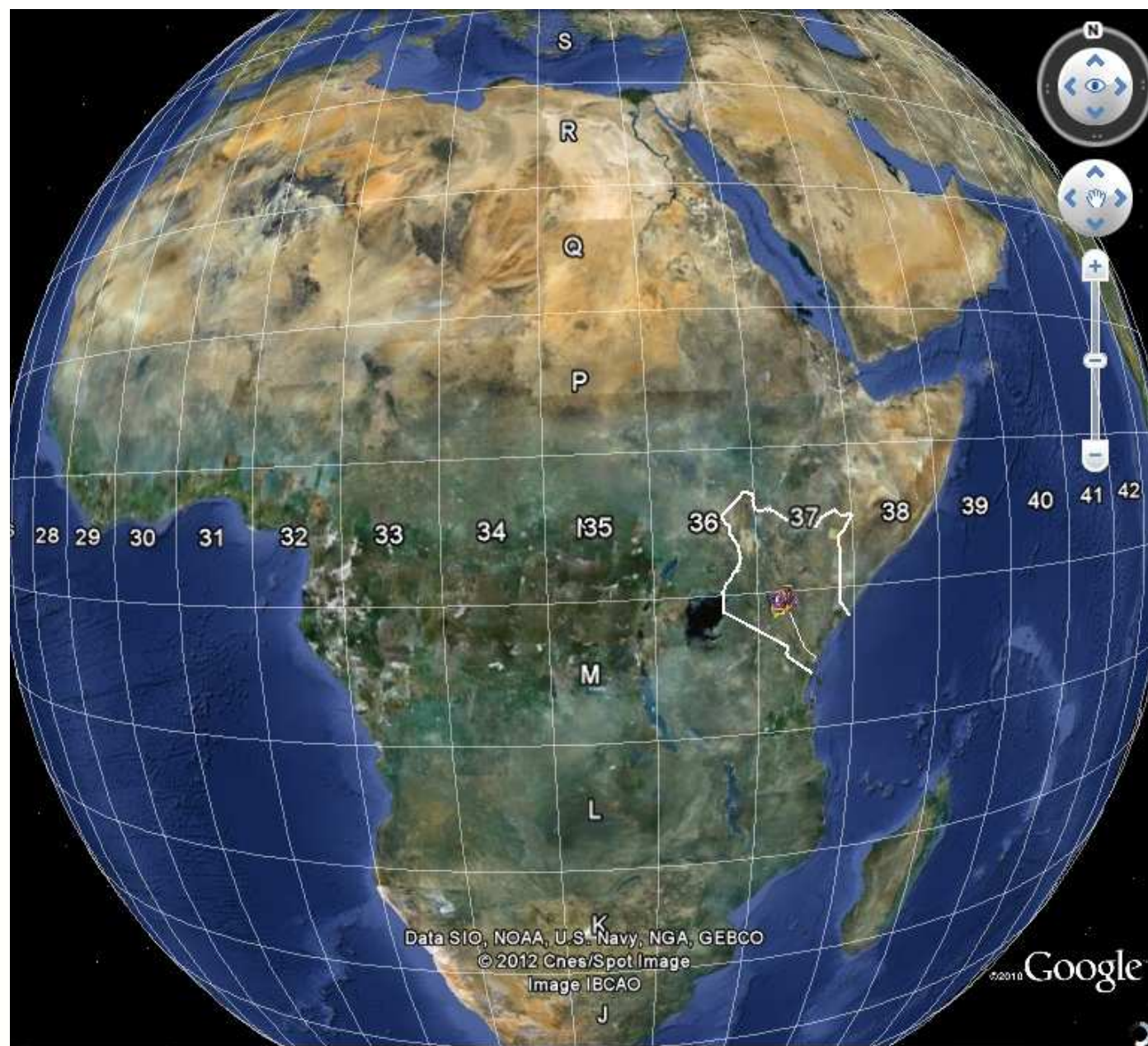
Zachary Ayieko
CEO, REA KENYA

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1. Kenya- an overview
2. History of Rural Electrification in Kenya
3. Kenya- Current Electrification
4. Targets for Rural Electrification
5. Mini Grids and Renewables in Kenya
6. Challenges
7. Prospects for Future Growth

1. Kenya- an overview

KENYA - LOCATION



KENYA'S NEW CONSTITUTION

- ❑ Kenya's gained independence in 1963 as a Republic. The New Constitution promulgated in 2010 has drastically and substantially changed the governance structure in Kenya by the creation of 2 levels of Government and 47 Counties
- ❑ Introduced devolution and enhanced individual rights
- ❑ Established New institutions as part of the changes in line with the objectives and targets of Vision 2030



ENERGY POLICY AND LEGISLATION

- ❑ Alignment of the energy sector policy and legislation with Vision 2030 and the Constitution is underway.
- ❑ Vision 2030 recognizes energy as one of the Vision and as such an appropriate policy, legal, regulatory and institutional framework review is under way, a Draft Energy Bill is under preparation.
- ❑ REA is also reviewing its Strategic Plan, to align it to the Draft Energy Bill and Draft National Energy Policy

REA UNDER THE NEW CONSTITUTION

According to the Draft Bill, REA will remain a national organization whose functions will include:

- ✓ Planning for nationwide network expansion and to cross subsidize unviable areas
- ✓ Ensure a fair distribution of resources
- ✓ Ensure that the Rural Electrification Program Fund is utilized to reach the marginalized areas
- ✓ Innovate on Renewable energy sources

REA UNDER THE NEW CONSTITUTION - CONT'D

Under the draft bill it is proposed that the Rural Electrification Authority shall transform into the National Electrification and Renewable Energy Authority (NERA) to become the lead agency for development of all other renewable energy resources excluding geothermal and large hydros

NERA shall be the one stop shop for information and guidance to investors on renewable energy projects.

2. History of Rural Electrification in Kenya

HISTORY OF RURAL ELECTRIFICATION IN KENYA

- The former Rural Electrification Fund (1973), The Rural Electrification Authority (2007) was established to realize Government target of providing electricity to the majority of Kenyans, as there was need to create a special agency to extended electricity to as many rural areas
- The primary mandate of the Authority is to accelerate the pace of rural electrification in the country.
- Under Vision 2030, the Government aims turning Kenya into a middle income country by 2030. In order to power the vision, REA aims for universal connectivity by 2020

MANDATE OF THE RURAL ELECTRIFICATION AUTHORITY

- Increase access to electricity by expanding the National grid in the rural areas
- Increase access by installing off-grid stations and developing mini-grid
- Promote the development of Renewable Energy
- Universal connectivity by 2020
- Equalization for 47 new counties

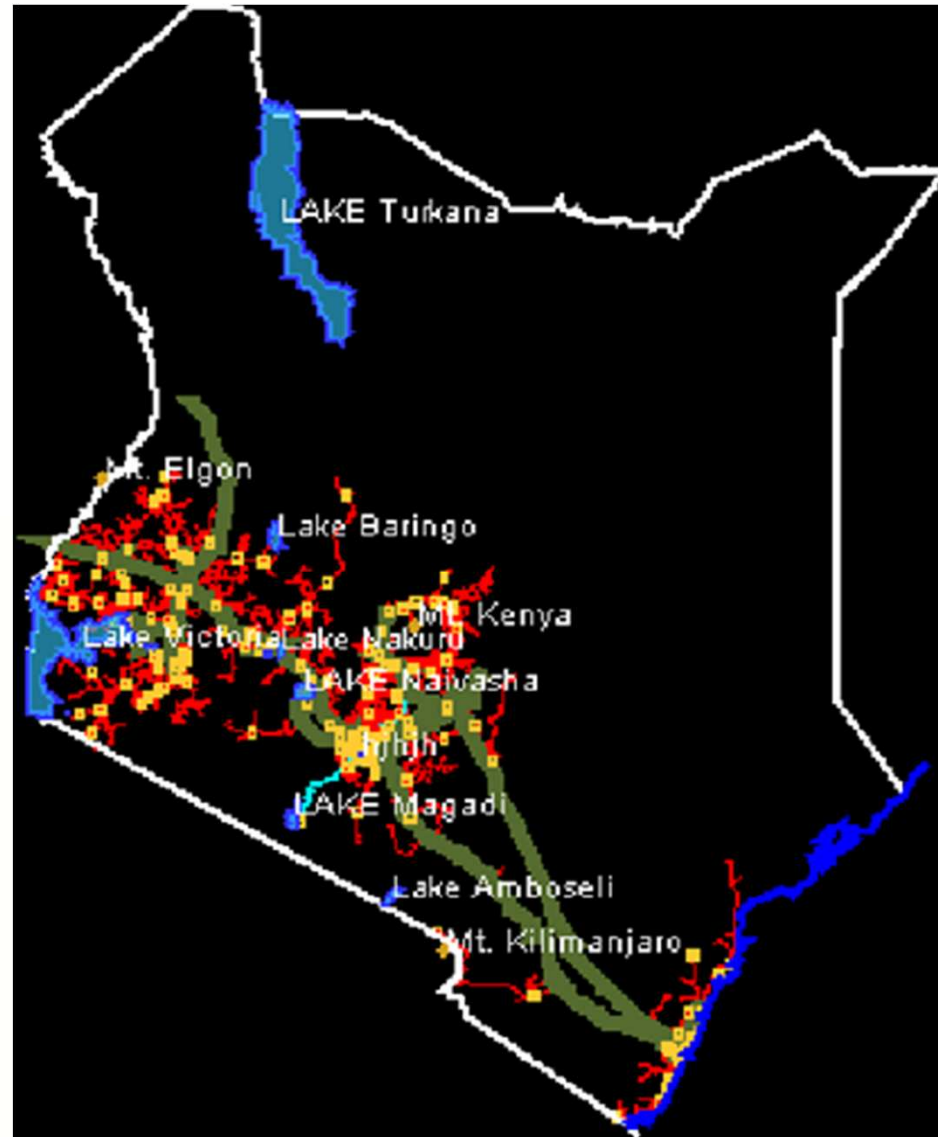
3. Current Electrification in Kenya

CURRENT ELECTRIFICATION

Major economic activities in Kenya take place along the “Railway belt” from Mombasa in the Coast to Kisumu in the West.

- Railway line runs from the Mombasa – Nairobi – Nakuru – Eldoret – Malaba – and Kisumu
- Urban settlements follow same route
- Roads follows the same route
- Oil Pipeline follow the same route
- So powerline follow the same route
- Major towns in Northern/Eastern Kenya depend on mini grids

KENYA- MAIN ELECTRICITY GRID



4. Targets for Rural Electrification in Kenya



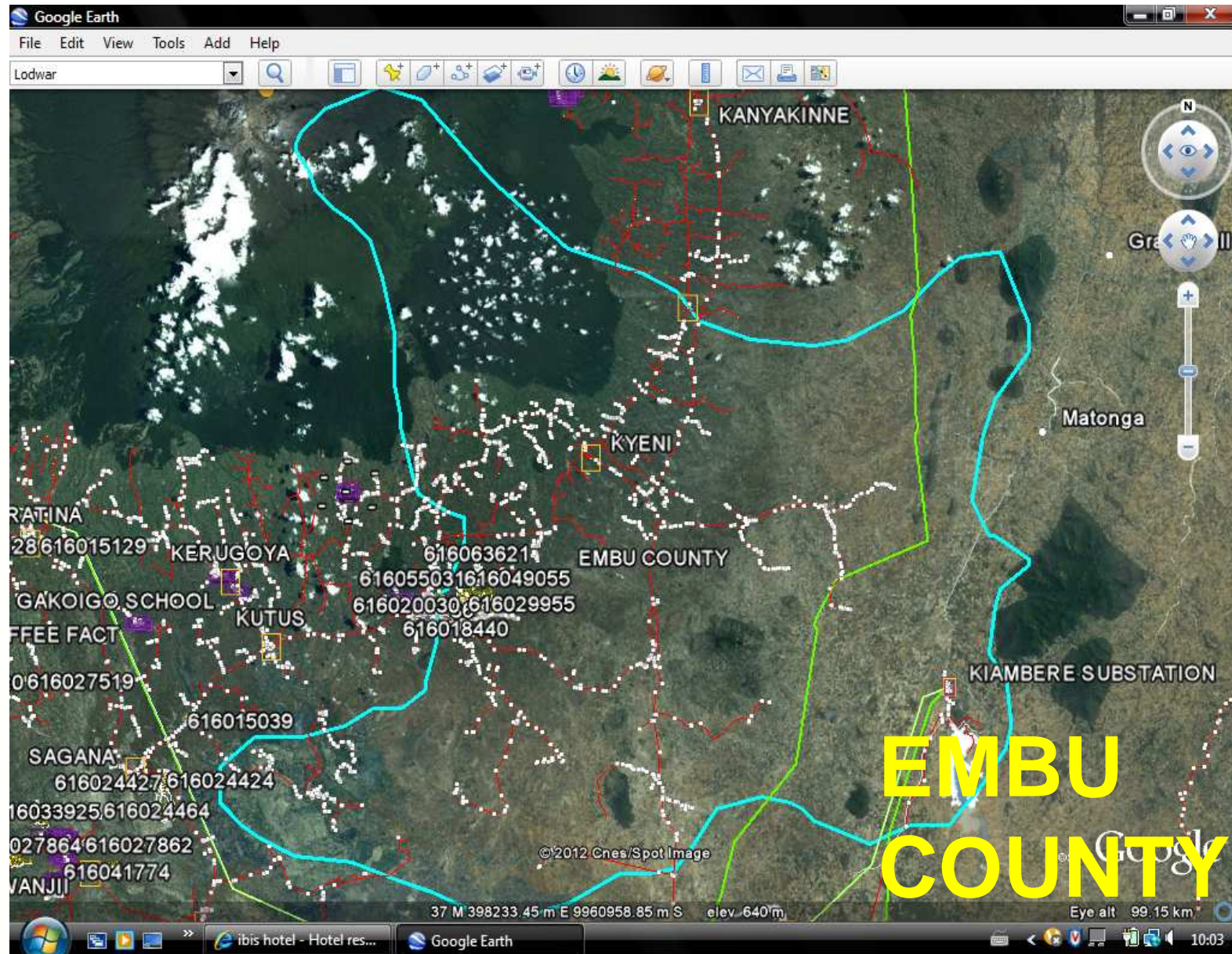
Status of Public Facilities

FACILITY	ELECTRIFIED	NOT ELECTRIFIED	TOTAL
Trading Centre	9,667	3,447	13,114
Public Secondary Schools	8,108	-	8,108
Health Centres	3,346	940	4,286
Total	21,121	4,387	25,508
% Cover	83%	17%	100%

TARGETS FOR RURAL ELECTRIFICATION

- The target for rural electrification is to provide electricity to all public facilities including trading centres, secondary schools, primary schools, health centres, community water works and one million households by June 2014.
- At present, a total of 21,121 public facilities have been electrified leaving a balance of 4,387 to be electrified in the by June 2013.
- After connection of public facilities, we aim at mass connection of individual homes. We are considering methods of resource mobilization
- GIS mapping to quantify the task is underway

GIS MAPPING FOR RESOURCE ESTIMATION



5. Kenya- Mini Grid and Renewable Systems

KENYA: MINI-GRID SYSTEMS



KENYA'S ELECTRICITY GENERATION CAPACITY

- The Installed capacity for electricity generation is 1521MW consisting as follows:

Resource	Installed Capacity (MW)	%
Hydro	762	50.1
Thermal	530	34.9
Geothermal	198	13.0
Co-generation	26	1.7
Wind	5	0.3
Solar	(minor)	-
Total	1521	100

MINI-GRID SYSTEMS IN KENYA

- In order to serve the rest of the country where there is no grid, there are currently 18 operational micro grids operated by Kenya Power with a total installed capacity of 19MW
- 7 of these have operated for more than 30 years
- 11 have been developed in the last six years
- 11 more are currently being developed
by the Rural Electrification Authority

INSTITUTIONAL ARRANGEMENT

- The current arrangement is that the Mini-grids are developed by REA and are handed over to Kenya Power (KP) for operation
- Funds for the development of the Mini-grid are from GoK or from Development partners through the Government.
- Kenya Power operates the system, retails electricity and collects 5% levy for REA

RATIONALE FOR MINI GRID SYSTEMS

Mini grids are established where grid power line extensions are not economically viable due to

- Distance from grid
- Demand
- Economic activities



MINI-GRID STATIONS

- All the Off-grid stations have diesel generators



TARIFF SYSTEM IN KENYA

- The tariff system in Kenya is such that it is uniform irrespective of whether one is on the national grid or the off-grid system
- Based on consumption of energy.
- The fuel used for generation is a pass through cost to all consumers around the country dependent on energy consumption.
- There is cross-subsidy.



RENEWABLE ENERGY

In the areas where the off-grid system are being put up there is abundance of renewable energy

- Solar
- Wind
- Mini Hydro-REA has 2 sites

(Ministry of Energy is undertaking Feasibility Study to develop the National Small Hydro Atlas and to develop least 10 sites through Public Private Partnership)

RENEWABLE ENERGY (Cont)

- In order to off-set fuel consumption, Renewable energy is being introduced into the off-grid systems.
- The following stations already have renewable energy:

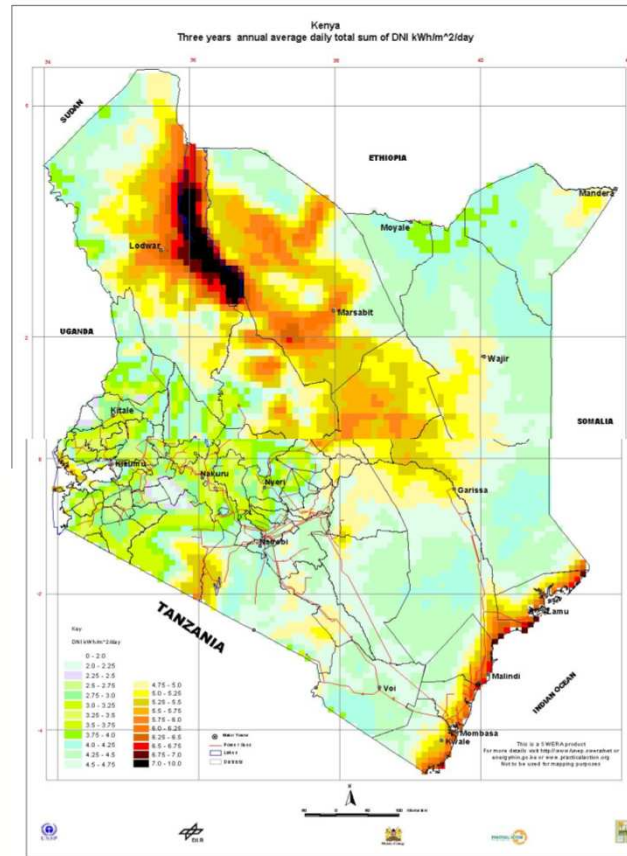


RENEWABLE ENERGY (Cont)

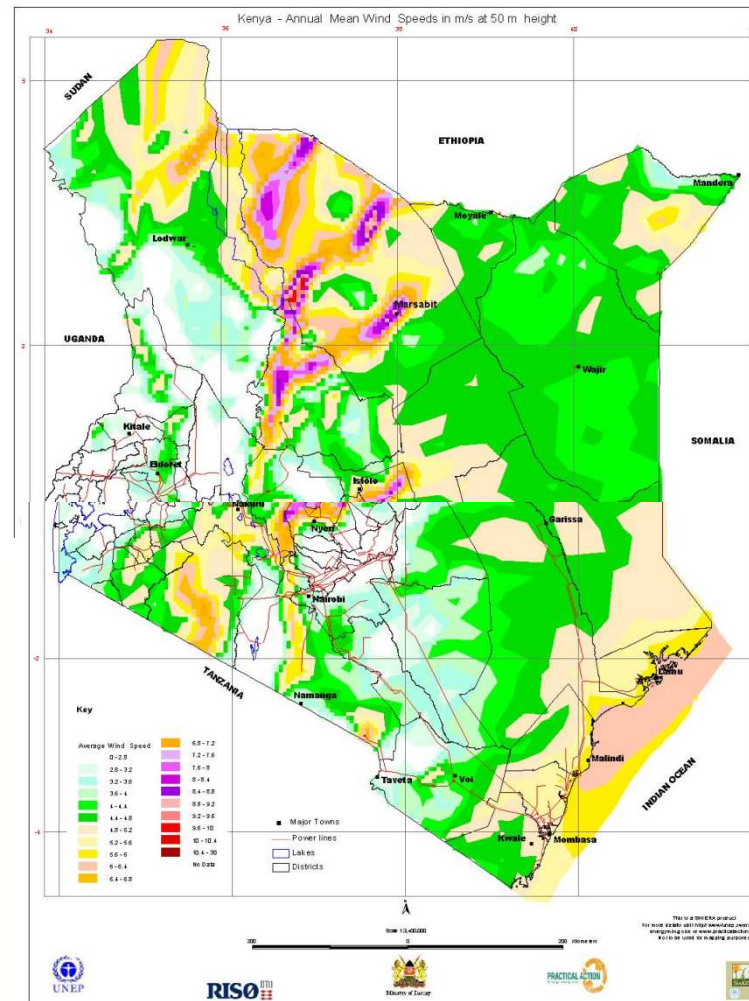
Station	Diesel (KW) Installed	Solar (KW)	Wind (KW)
Lodwar	1440	60	-
Merti	128	10	-
Habaswein	360	30	50
Mandera	1600	300	-
Hola	800	60	-
Marsabit	2406	-	500
El Wak	360	50	-



KENYA SOLAR MAP



KENYA WIND MAP



OFF-GRID RENEWABLE ENERGY PROJECTS (Cont)



OFF-GRID RENEWABLE ENERGY PROJECTS (Cont)



OFF-GRID RENEWABLE ENERGY PROJECTS (Cont)



OFF-GRID RENEWABLE ENERGY PROJECTS



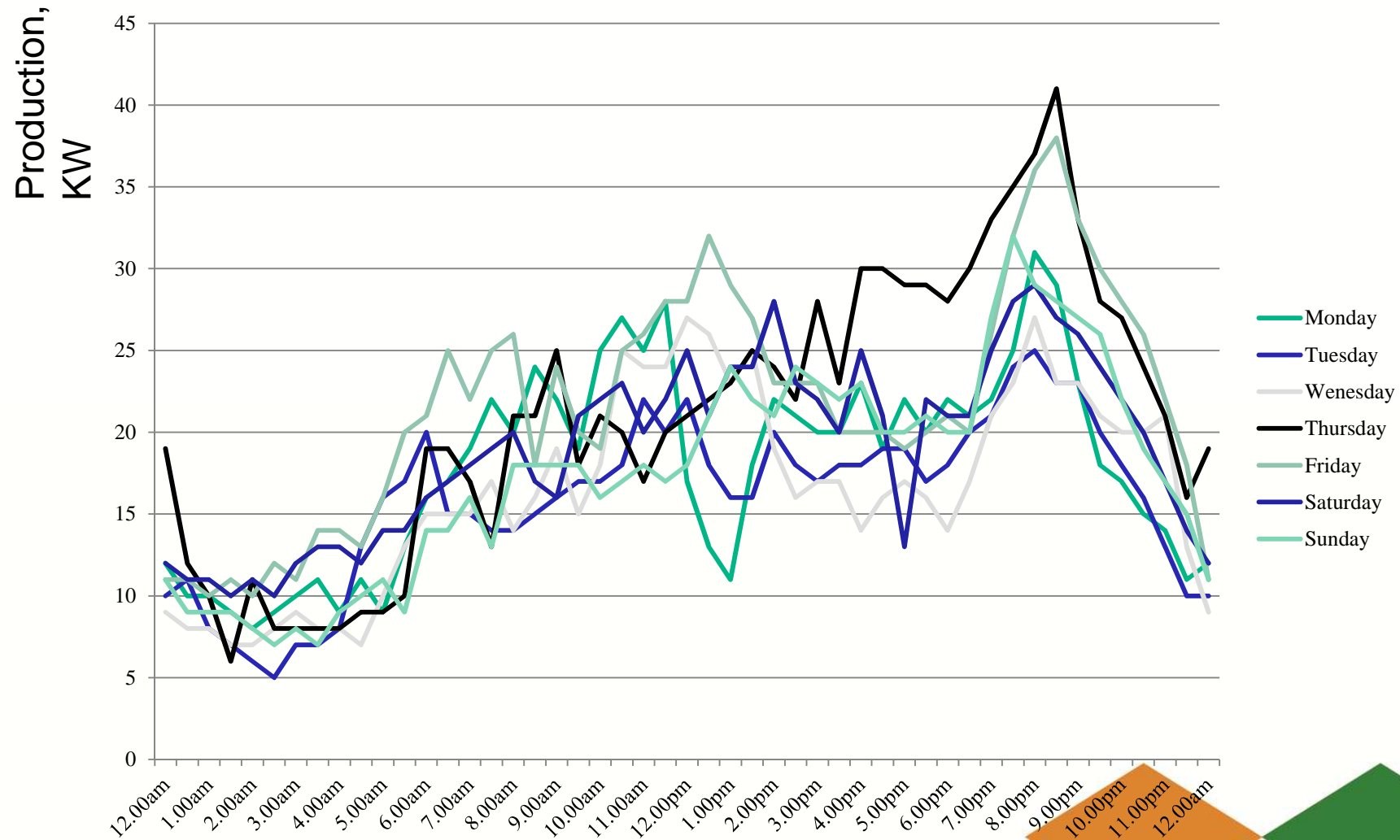
OFF-GRID RENEWABLE ENERGY PROJECTS (Cont)



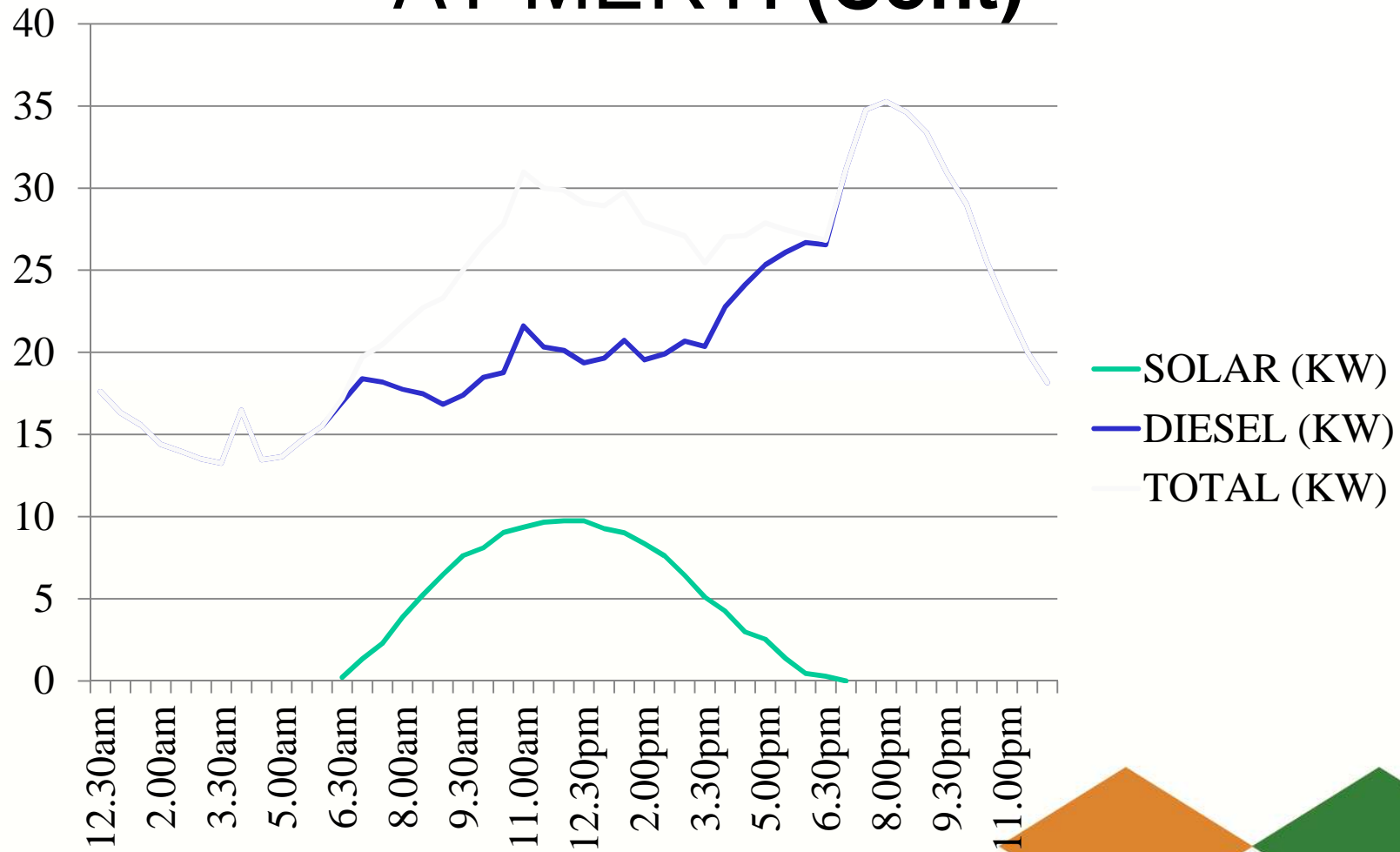
OFF-GRID RENEWABLE ENERGY PROJECTS (Cont)



EXAMPLE SOLAR PERFORMANCE AT MERTI



EXAMPLE SOLAR PERFORMANCE AT MERTI (Cont)



ENVIRONMENTAL AND FINANCIAL BENEFITS FOR MERTI SOLAR AND MARSABIT WIND PLANTS

NO.	DESCRIPTION	Merti Solar	Marsabit Wind
1	Installed Capacity (kW)	10	500
2	Annual Estimated Production (kWh)	24,893.00	553,340.00
3	Fuel Price (Ksh/l)	111.57	123.05
4	Specific Fuel Consumption (l/kWh)	0.34	0.32
5	Annual Savings in Fuel Costs (Ksh)	944,286.08	21,788,315.84
6	Savings in Fuel Costs per kW installed (ksh/kW)	94,428.61	43,576.63
7	Avoided Carbon Dioxide (kg)	22,248.83	442,672.00

COST BENEFIT ANALYSIS

Description	Merti Solar	Marsabit Wind
Rated capacity for the plant (kW)	10.00	500.00
Estimated maximum output per year using current daily average (kWh)	24,893.00	553,340.00
Fuel price delivered to site (Kshs/l)	111.57	123.05
Actual specific fuel consumption (l/kWh)	0.34	0.32
Actual generation cost based on fuel only (Ksh)	37.93	39.38
Maintenance cost (Ksh/kWh)	1.290	1.290
Total generation cost - fuel and maintenance (Ksh/kWh)	39.224	40.666
Annual saving on fuel and maintenance (Ksh)	976,406.083	22,502,302.937
Capital cost for the plant (Ksh)	10,716,655	174,263,281
Annuity on Capital Cost for 25 years at the rate of IRR	976,455.45	22,502,699.93
Internal Rate of Return (IRR)	7.68%	12.18%

COST BENEFIT ANALYSIS FOR OTHER SOLAR SITES

NO	STATION	CAPACITY (KW)	IRR (%)
1	Merti	10	7.68%
2	Habaswein	30	18.63%
3	Hola	60	13.40%
4	Elwak	50	19.16%
5	Lodwar	60	19.20%



FUTURE PLANS FOR MINI GRIDS

- The Country intends to put up 60MW of Solar in Garissa to be implemented by KenGen and the Ministry of Energy
- REA intends to put up at least 250MW in 2013-2018 from renewable energy resources into the grid and to retrofit all the existing off-grid stations to have renewable energy components



FUTURE PLANS FOR MINI GRIDS CONT'D

Note:

- Other agencies have renewable power sources e.g. Kenya Power (Wind) and Geothermal on Grid
- REA also has Biogas projects in 3 rural schools

FUTURE PLANS (Cont)

- All new off-grid stations coming up will have renewable energy components.
- With the assistance of Development partners, REA intends to develop off-grid systems that will be primarily renewable with diesel backup.



6. Challenges

CHALLENGES

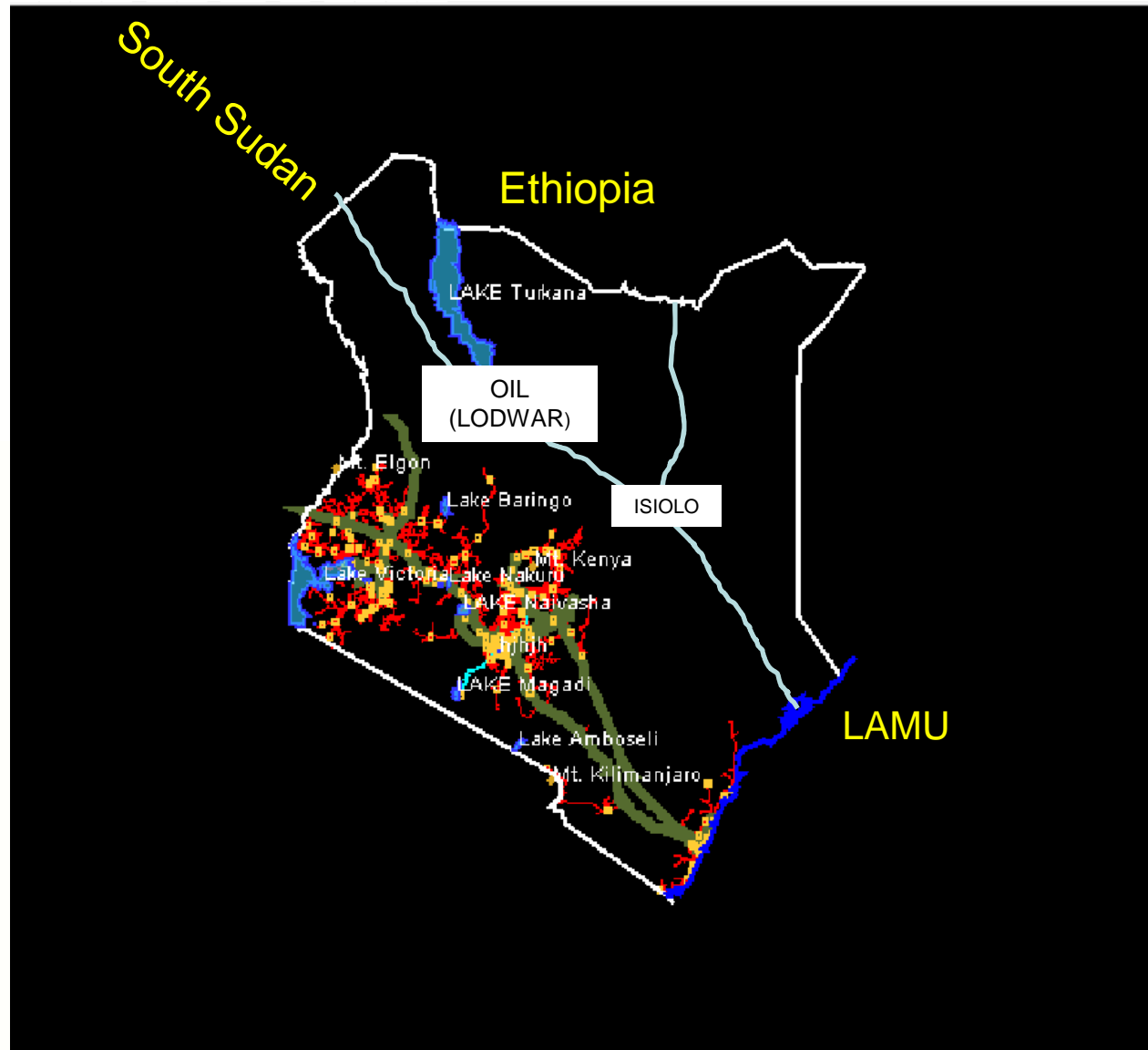
- Inadequate Resources and Project Finance
- High maintenance and operational costs
- High initial capital investment
- Low customer base in North/East
- Difficult fuel transportation logistics
- Existing institutional transfer formalities

7. Prospects for Future Growth

PROSPECTS FOR FUTURE GROWTH

- The 47 devolved governments are expected to provide development in rural areas
- Regional integration under Comesa Region is opening up new areas e.g. Lamu Port- South Sudan-Ethiopia Transport Corridor
- Faster development is also expected in mini grid areas due to the discovery of oil in the Region

KENYA- 47 COUNTIES, OIL, AND LAPSSET PROJECT





***Thank you...from
the land of the
Big Five***

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