SWITCH ENERGY ALLIANCE CASE COMPETITION 2023



SWITCH ENERGY ALLIANCE

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EXECUTIVE SUMMARY

Problem Overviev	 Electricity access still challenging in Kenya; limited supply infrastructure in Bangladesh. Energy supply is unreliable in Kenya and Bangladesh especially at peak hours. Inefficient and environmentally unfriendly cooking methods.
Electrification Solution	 Integration of Battery Energy Storage systems with geothermal plants in Kenya. Grid intensification plan to power homes at 600m to 2km around grid systems. Distribution of Solar Home System to 1.34 million households. Solar Community Grid Box systems to power 212 communities and 2000+ public facilities.
Clean Cooking Solution	 Comprehensive reform of the LPG supply chain for urban areas. Introduction of Mukuru cook stoves in rural regions. Introduce flexible payment system to encourage adoption of clean cooking option.
Financing	 The total budget for the projects is about \$2.4 billion Project financing would depend on loans, grant, and counterpart funds Feasible re-payment plan was developed to ensure efficient debt servicing
Impact	 Solution will power 3 million homes in Kenya and provide clean cooking to 8 million homes. Carbon abatement of up to 2.5 million tonnes per year. Projected revenue portfolio of \$5billions for Kenyan government by 2033. Actionable insights from Kenya can be deployed to Bangladesh.













BASIC HUMAN AND DEMOGRAPHIC INDICATORS - KENYA

Capital Nairobi, 47 counties

Area 569,140 square kilometres

Population 48 million. Expected to reach 65 million by 2030 **Rural population:** 73.8%

Religion 83.5% Christian, 10.9% Muslim, 1.8% other, 1.6% none

Language

English and Swahili are official languages with numerous indigenous languages

GDP: US \$70 billion GDP per capita: US \$1,750 6

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Population below poverty: 36% HDI Ranking: 152

Average Monthly Rural Family Income US \$135.14

Main Economic Sectors(% contribution to GDP) 55% Services, 22% Agriculture and 17% Industry

Labour Force by Occupation 54% Agriculture, 39% Services and 7% Industry

Source: Kenya Bureau of Statistics (2023)

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BASIC HUMAN AND DEMOGRAPHIC INDICATORS - BANGLADESH

Capital Dhaka, 7 Provinces

Area 147, 570 square kilometres

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Population 173 million **Rural population:** 60.29%

Religion 80% Muslim, 12% Hindu, 2% others

> Language Bengali and Chakma

GDP: US \$483.3 billion **GDP per capita**: US \$2,820

Population below poverty: 20.5% HDI Ranking: 129

Average Monthly Rural Family Income US \$294

Main Economic Sectors (% contribution to GDP) 40% Services, 38% Agriculture and 22% Industry

> **Labour Force by Occupation** 54% Agriculture, 39% Services and 7% Industry

Source: Hussain and Tinker, Encyclopedia Britannica (2023)

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ENERGY SITUATION ASSESSMENT





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ENERGY SITUATION ASSESSMENT

BANGLADESH



Source: Energy Scenario of Bangladesh 2021-22, Bangladesh Energy and Mineral Resources Division, 2023

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OVERALL ASSESSMENT & OPTION ANALYSIS



KENYA ENERGY ISSUE ANALYSIS



Source: International Trade Administration (2022)

KENYA ENERGY ISSUE ANALYSIS



Source: Kenya Least Cost Power Development Plan (2021)

ISSUE ANALYSIS: COOKING FUEL SITUATION



from Household Air

Pollution in Kenya

report cooking-related

accidents annually

53% of Household Air

Pollution related deaths

 Urban
 20.5%
 79.5%

 Rural
 0
 Tier 3 (> 5% HH exp)
 Tier 5 (< 5% HH exp)</td>

 Source: World Bank, 2020
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LightUP KENYA!

Generation Capacity

To increase electricity capacity to 5,000 MW by 2033

Electricity Access

To provide at least 95% Energy access by 2033.

Clean Cooking

Provide clean cooking solution to 95% of Kenyans by 2033.

FEASIBILITY CRITERIA Financial feasibility

Technical feasibility



LIGHTUP KENYA SOLUTION MODEL



NB: The above model was adapted and modified from the Kenya National Electrification Strategy Report (2018)





ON-GRID SOLUTIONS



ON-GRID SOLUTIONS: SYSTEM EXPANSION



Figure: Screening analysis of potential energy sources in Kenya showing associated energy costs at different Utilization Factors
Source: Kenya Least Cost Power Development Plan (2021))

Our Proposal: 450MW GEOTHERMAL PLANT + GRID-SCALE BATTERY ENERGY STORAGE SYSTEMS

Geothermal plants typically have high-capacity factors but decline marginally over time.

BESS integration with Geothermal plants can increase the capacity factor of Geothermal Systems due to increased peak demand arising from BESS Geothermal plants serve as base load plants and are relatively cheaper

Only 0.9 GW of the 10 GW geothermal potential in Kenya has been exploited



IMPLEMENTATION PLAN



Sources: U.S Energy Information Administration, 2023. BESS Capacity: LKS Energy, 2018 No. of households: PowerAfrica Report, 2021

ON-GRID SOLUTIONS: INTENSIFICATION



Equipment Procurement and Logistics	Local Manufacturing and Sourcing	Workforce and Skill Development	Finance
Acquiring the necessary electrical infrastructure components, such as transformers, cables, conductors, switchgear, and insulators.	Engaging local manufacturing and sourcing of equipment and materials to stimulate the domestic economy and reduce supply chain risks.	Engaging local skilled and vocational workforce that can manage the supply chain, install, operate, and maintain the electrical infrastructure is paramount.	Focus on cost-efficient procurements through streamlined supply chain, while maintaining balance between quality and affordability.



OFF-GRID SOLUTION



OFF-GRID SOLUTION



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SOLAR ENERGY POTENTIAL OF KENYA



1.34 million connections through Solar Home Units by 2030



Lack of education and Nomadic

lifestyle of residents

Kenya Off-grid Solar Project is Kenya's electrification project to provide electricity areas not served by the national grid

CONSIDERATIONS



Off-grid areas have difficult terrain with very sparse population

Family Annual Electricity Needs (kWh)
- ····································

Two 50W Fans 4hrs/day	150
Two Light bulbs 8hrs/day	60
Phone and radio charging	20
Small 150W fridge	400
Others	70
Total Daily Total Average daily sunlight hrs Solar Panel Wattage	700 2 6 467 Watts 300W solar Panel X 2

NB: Estimations are based on report of Kenya Energy and Petroleum Regulatory Authority (2023)

IMPLEMENTATION PLAN



SOLAR COMMUNITY MODEL



2024	2025	2026	2027	2028-2032	2033
Planning	Pilot Project	Scale up	Expansion	Accelerated Deployment	Sustained Expansion
 Feasibility Study Establish Partnerships Permits and Approvals 	 Deploy first mini-grid Pilot testing Train locals and raise awareness 	 Deploy 5 mini-grids to priority communities Intensify community engagement 	 Deploy 15 mini-grids Evaluate performance of mini-grids 	 Deploy 32 minigrid/year Establish local supply chain for replacement and maintenance. 	 Evaluate impact of mini- grid Deploy more mini-grids
No. of micr Capac	ro-grid(s) 1 city 25 KW	5 250 KW	15 0.5 MW	160 7.5 MW	31 1.5 KW

Total Micro-grid Boxes: 212 | Total Energy : ~10 MW | Excess energy is fed into Transmission systems to power home clusters

SOLAR COMMUNITY POTENTIAL PARTNER



Grid-in-box configurations and Features

	Minimum	Maxiumum
Container-Mounted Solar (PV)	4 kW	25.2 kW
Battery Storage (LiFePO4)	7.4 kWh	148 kWh
Inverter	6.8 kW	27.2 kW
Voltage	120/240 V	120/208 V
Phase Type	Single-phase	Three-phase
Generator (Optional)	8.5 kW	50 kW

BOXPOWER

Scalable and replicable microgrid designs
Off-grid and grid-tied functionality
Installs in a few hours, minimal foundation requirements
Pre-wired outlets for plug-and-play use
Proven effectiveness in extreme weather conditions
Fully automated with remote monitoring and control





Source: BoxPower, 2023



CLEAN COOKING SOLUTION



SOLUTION STRATEGY FOR COOKING FUEL



SOLUTION STRATEGY FOR COOKING - URBAN

Comparative Analysis of Cooking Fuel Alternatives

	OPTION	BIOETHANOL STOVE	ELECTRIC STOVE	LPG STOVE	ELECTROMAGNETIC INDUCTION STOVE
	TYPE OF FUEL	BIOETHANOL	ELECTRICITY	LPG	ELECTRICITY
	Cost and Acquisition	 High cost of technology Moderate cost of fuel Limited market intelligence 	 High cost of technology High cost of fuel Limited market intelligence 	 High cost of technology High cost of fuel Comprehensive market intelligence 	 High cost of technology High cost of fuel Limited market intelligence
	Availability	 Limited supply options for both stove and fuel Limited distribution options Limited/lack of awareness 	 Limited supply options for both stove and fuel Limited distribution options Limited/lack of awareness 	 Moderate supply options for both stove and fuel Moderate distribution options Moderate awareness 	 Limited supply options for both stove and fuel Limited distribution options Limited/lack of awareness
	Health hazards	- Risk of indoor air pollution due to incomplete combustion	- Generate electromagnetic fields but within safety limits	- Possible combustion emissions but still safe	- Generate electromagnetic fields but within safety limits
Adapted from Kenya Cooking Sector Study, Ministry of Energy (2019)			Accelerate LPG stove and fuel adoption through review of supply.		
				This remains the least cost and most accessible cooking fuel option in Kenva.	

SOLUTION STRATEGY FOR URBAN COOKING



Adapted from World Bank Group 2018, Dalberg-GLPGP 2013 and Dubey et. Al., 2019

SOLUTION STRATEGY FOR RURAL COOKING

IMPROVE ADOPTION OF MUKURU CLEAN STOVE



Proposed regions for Mukuru clean stove fabrication plants



Source: MapsKenya, 2022

Willingness-to-Pay Analysis

With an instalmental payment offer of 6 to 12 months, the willingness to pay for improved cookstoves (lower tier cookstove priced at KSh 380 (US\$3.80) rose from 63%.7 to 72.0.



ACTION PLAN

URBAN LPG ACCESS ACCELERATOR

RURAL CLEAN STOVE SOLUTION





FINANCIAL PLAN



FINANCIAL PLAN

Table: Cost estimations for Battery Energy Storage System

Item	Cost (\$)
Lithium-ion Phosphate batteries \$342/KWh	2500000
Battery Housing and infrastructure	700000
Site Surverys and Engineers	2000000
Site Preparation and Installation Cost	1000000
Training and Capacity Building	1000000
Operations and Maintenance (5 years)	500000
Contingency	4500000
Total Cost of Single BESS Unit	54500000
Grand Total for 5 BESS Units	272,500,000

Estimations are based on the Kenyan Least Cost Power Development Plan (2021-2030)

Table: Cost estimations for 450MW Geothermal Plant

Item	Cost (\$)
Site civil works	7200000
Equipment	13410000
Well drilling	266400000
Steam gathering system	142200000
Consultancy services	59400000
Environmental & social (E&S) management	1000000
Contingency (10% of total cost)	54400000
Grand Total for Geothermal Plant	544,010,000

All estimations are based on the Menengai Geothermal Development Plan (supported by AfDB)

Table: Cost estimations for Grid Intensification

Year	Cost (\$)
Year 2024-2028	607100000
Year 2029-2033	87880000
Total	694980000

All estimations are based on the 2018 Kenya National Electrification Strategy. Full cost breakdown and cost consideration for grid intensification available on Appendix 2

Total Cost for On-Grid Solution: 1, 511, 490, 000

FINANCIAL PLAN

Table: Cost estimations for Off-grid Programs

Off-Grid Solar Program	Cost (\$)
SOLAR HOME UNITS	448,900,000
SOLAR COMMUNITY SYSTEM	9,849,520
Setup and Operational Costs	48,236,000
Grand Total for Solar Program	506,985,520

All estimations are based on the 2018 Kenya National Electrification Strategy Full cost breakdown and cost consideration for off-grid solar programs available on Appendix 3

LPG ACCESS ACCELERATOR	Cost (\$)
Construction of an LPG Import terminal at Mombasa	12900000
Construction of storage facilities at Nairobi and Mombasa	126000000
Installation of mini depots in inner urban Kenya	460000
Subsidization of 4.5 million 6kg-cylinders (60%)	99360000
Blockchain tracking of the 4.5 million 6kg-cylinders	4844250
Miscellaneous	200000
Total for LPG ACCESS ACCELERATOR	359864250

Table:	Cost	estimations	for	Clean	Cooking	Solutions
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MUKURU CLEAN STOVES ADOPTION	Cost (\$)
Establishment of 9 clean stoves fabrication plants	900000
Training of workers	900000
Training of distributors	90000
Subsidization of the clean stoves (65%)	22750000
Miscellaneous	100000
Total for Mukuru Clean Stoves Adoption	32840000
Behaviour change and communication strategy for clean cooking	12000000
GRAND TOTAL for Mukuru Clean Stove	44840000

FINANCIAL ROLL OUT

Electrification and Clean Cooking Annual Cost Financing Breakdown (in \$ '000)

Investment Costs in 000's USD	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Grid intensification I & II	42440	121600	125700	131520	185840	166400	17120	17560	18040	18520	694980
450 MW Geothermal Plant	27000	44000	610000	82250	106720	92561	61000	40300	21000	8178	544010
Battery Energy Storage System	9500	21220	37200	75500	27260	37170	21000	37250	4700	1700	272500
Solar Home	4341	11041	11041	37841	37841	37841	88091	88091	88091	88091	492312
Solar Community	482	528	714	1179	1969	1969	1969	1969	1969	1922	14673
LPG Access Accelerator	-	-	100000	100000	55460	20880	20880	20880	20880	20880	359864
Mukuru Clean Stove	-	-	4500	4500	990	4570	4570	4570	4570	4570	32840
Clean cooking Awareness	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	12000
Grand Total	84963	199590	341355	433990	417280	212832	215831	211821	160451	145062	2423179

Cumulative Investment Plan (2024-2033)



Percentage Investment By Project



CASH FLOW AND FINANCIAL MODEL



Finance Program	Remark	% Fund	Value	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	(RE)INVESTMENT AND DEBT SERVICING			
Loans and Grants	Negotiated with global finance organizations e.g. World Bank	50	\$750,000,000	GRAM PLAN	Initial Investment (to fund first 5 years: 2023 - 2028)	\$1,500,000, 000		
Energy Bonds	To encourage public-private partnership	10	\$150,000,000	PRO	Revenue by 2029	\$1, 070, 232, 716		
Counterpart Funding	Multilateral partnership with diplomatic allies of Kenya to aid in funding energy projects	15	\$225,000,000	DING]	At 60% annual revenue re-investment from 2029 (after break-even point), the project can fund itself.			
Government Contribution	Designed to foster community participation in funding energy cluster	25	\$375,000,000	FUN RI	20% of annual revenue from 2029 can be used in de servicing for 5 – 10 years.			



SOLUTION TRANSFER PLAN



SOLUTION TRANSFER PLAN



several times a day.

ON-GRID SOLUTION

BATTERY ENERGY STORAGE SYSTEM INTEGRATION WITH GEOTHERMAL SYSTEMS			GRID INTENSIFICATION				
GEOGRAPHIC FEASIBILITY No geothermal plants exists in Bangladesh, and it is NOT economically viable to set one up, considering the low geothermal gradient in Bangladesh.			Bangladesh has already reached 99% energy access rate. So, grid intensification may not be an immediate need for Bangladesh.	NEED?			
ALTERNATIVE PLAN Integration of Battery Energy Storage System with existing Natural Gas plants which account for 47% of Bangladeshi's energy mix.			Digitization of grid through implementation of SMART GRID system.	ALTERNATIVE PLAN			
POTENTIAL IMPACT	Reduction in transmission losses by 50%. 10% increase in capacity factor of gas plants. Increase peak demand. Improve grid reliability.		2-way communication between utilities and customers. Reduce frequency and duration of power outages. Improve power system stability and performance.	POTENTIAL IMPACT			

Power Plants in Bangladesh





More spending should be directed at Battery Energy Storage integration over grid intensification since Bangladesh already has a 98% electrification rate.

OFF-GRID SOLAR SOLUTION



Plan

ay-as-You-Use

(Source: World Bank, 2023)

Solar Unit Cost: \$450 Current energy spending per family: 6% of monthly income

> <u>Payment Plan</u> Initial Payment: \$30, Free Installation! Monthly Payment: \$12 for 3 years

CLEAN COOKING SOLUTION

Major Drawbacks
• Socio-cultural perceptions

• Lack of awareness

Affordability

Bangladesh has the lowest access to clean cooking fuels and technologies in SE Asia

77% of the population lack access to clean cooking

92% of rural households rely on solid fuels such as wood, coal and animal dung for cooking and heating



LPG FEASIBILITY



With exception of Dhaka, LPG and PNG coverage in Bangladesh provinces are under 30%

LPG demand has grown by 60% but with serious supply shortfall

80% of Bangladesh LPG industry is largely import-oriented

Serious infrastructure constraints for import, storage, supply and distribution of LPG

At current non-subsidized price of USD 36/12.5 kg, LPG not affordable for low to mid income rural dwellers

PROPOSED PLAN

Battery-supported Electric Cooking (e-Cooking)

• Overcapacity of national grid has serious adverse economic impact. eCooking addresses this problem by increasing electricity consumption while providing clean cooking access.

• Full deployment over ten years is feasible since Bangladesh has 99% energy access.

LPG VALUE CHAIN RESTRUCTURING

The government should develop new high-capacity import terminals near deep seaports.
Construct provincial bulk storage facilities and invest in country-wide LPG Pipelines

ACTION PLAN

- Accelerated Distribution of electric stoves
- Flexible payment plan for electric stoves
- Subsidies and vouchers for LPG Cylinders and improved cook stoves.



Source: Bangladesh eCooking Market Assessment, 2022

IMPACT: Potentially reach 77% of population still cooking with polluting fuels.

Source: PWC Energy Report, 2020.

SOLUTION TRANSFER ACTION PLAN





BEYOND 2033 AND IMPACT ASSESSMENT



BEYOND 2033: 2050 IN-VIEW





Team EnerGreen has allocated \$300 million to finance the 'Beyond 2033' Plan in Kenya. This will finance the Green Hydrogen Plan, establishment of Green Banks and framework to facilitate carbon trading.

IMPACT ASSESSMENT



QUANTITATIVE IMPACT ASSESSMENT

Annual Electrification Rate



3 million Homes connected, guaranteeing 95% energy access to Kenyans

Projected Kenyan Energy Mix by 2033



gender inequality gaps.



 78% share of renewable energy sources, which is higher than the global average of 29%.

- CO2 emission avoidance of 2.5 million tonnes per year, equivalent to removing 500,000 cars from the road.
- Stimulate investment and innovation in the renewable energy sector
 - Potentially create 300,000 jobs

- Empower 8 million homes
 Decrease the amount of to
 Reduction in respiratory-relife expectancy.
 - Empower 8 million homes with clean cooking stoves and cylinders
 - Decrease the amount of toxic emissions generated from cooking
 - Reduction in respiratory-related health conditions, and improved life expectancy.
 - Climate and environmental protection

• Potentially increase Kenya's HDI value by 0.02 points, equivalent to \$100 increase in gross national income per capita.

Improved social equity through reduction in energy poverty and



• Potentially accommodate 30% women in job creation drive.



• Investment opportunity for small, medium-scale businesses.

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& Well-Being

Team Ene Green



Ogonna Emenaha



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Scan the barcode to get more information on the EnerGreen LightUP Kenya Project



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APPENDIX

Appendix 1: Option Analysis Criteria

Accessibility:

- 1: Limited or poor access to energy resources and services.
- 2: Moderate access with notable challenges.
- 3: Reasonable access with some issues.
- 4: Excellent access with minimal barriers.

Environmental Impact:

- 1: High negative environmental impact, unsustainable practices.
- 2: Significant negative environmental impact.
- 3: Moderate environmental impact with concerns.
- 4: Minimal to no negative environmental impact, highly sustainable.

Quality of Energy Services:

- 1: Very poor quality with frequent disruptions.
- 2: Low quality with significant service issues.
- 3: Average quality with room for improvement.
- 4: Good quality with minor service disruptions.

Reliability:

- 1: Highly unreliable with constant blackouts and disruptions.
- 2: Unreliable with frequent interruptions.
- 3: Moderately reliable with occasional disruptions.
- 4: Highly reliable with minimal to no disruptions.

Affordability:

- 1: Extremely expensive and unaffordable for most of the population.
- 2: Costly with affordability issues.
- 3: Moderately affordable with some challenges.
- 4: Very affordable and accessible to the majority.

Safety:Total1: Extremely unsafe with frequent accidents and hazards.2: Unsafe with significant safety concerns.3: Moderately safe but with some safety issues.4: Very safe with minimal safety issues.

Security:

- 1: Extremely insecure with frequent theft, vandalism, or attacks.
- 2: Insecure with significant security issues.
- 3: Moderately secure but with some security concerns.
- 4: Very secure with minimal security issues.

Potential for Roadblocks:

- 1: High potential for significant roadblocks and challenges.
- 2: Potential for major roadblocks.
- 3: Moderate potential for roadblocks and obstacles.
- 4: Low potential for any significant roadblocks.

Total Rating

1 - 8 Least Favourable

9 - 16 Less Favourable

17 - 24 Moderately Favourable

> 25 - 32 Most Favourable

NB: This analytical criteria was developed by Team EnerGreen for the 2023 Switch Case Competition

Appendix 2: Grid Intensification Budget

GRID INTENSIFICATION PROGRAM BASED ON ESTIMATIONS OF KENYA ELECTRIFICATION STRATEGY 2018 (in million \$)											
	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	TOTAL
Grid Intensification I	23.9	141	340.3	294.8	442.4	33.5	34.5	35.4	36.3	37.3	177
Grid Intensification II	82.2	340.4	154.6	34	22.2	8.1	8.3	8.5	8.8	9	42.7
Total Cost (Purely based on estimations of Kenya Electri. Strategy)	106.1	481.4	494.9	328.8	464.6	41.6	42.8	43.9	45.1	46.3	219.7
Final Cost (Only 40% of original estimations above since we are also											
building Battery storage systems)	42.44	192.56	197.96	131.52	185.84	16.64	17.12	17.56	18.04	18.52	87.88
Adjusted Cost	42.44	121.6	125.7	131.52	185.84	16.64	17.12	17.56	18.04	18.52	87.88

GRAND TOTAL (GRID INTENSIFICATION)	2024-2028	607100000
	2029-2033	87880000
	Total	694980000



Appendix 3: Off-Grid Solar Solution Cost Structure

SOLAR HOME SOLUTION COST						
Item	Cost in Kenya Shillings	Cost in \$				
Solar Panel	24,331	165				
Inverter	7,373	50				
Battery	14,746	100				
Instalation Cost	2,949	20				
Total Unit Cost	49,399	335				
Cost for 1.34 Million Homes 44890000						

SOLAR COMMUNITY SYSTEM							
Community Power Need							
	Energy need in						
Facility	Kwh	No. Units	Cost in \$				
School (Assuming a classroom uses half of household comsumption)	300	10 classrooms	3000				
Community Clinic	1314	I clinic	1314				
Streetlight	60.2	10 Streetlights	602				
Other public utilities (offices/boreholes			1084				
Total Electricity Need per community center			6000				
Grid-in-Box System to meet community demand							
NB: 18 units of 350 W solar panels needed = $17 \times 350 = 6300$							
Item	Price	Unit					
Solar Panels (18 units of 350 watts of solar panels)	\$2/wattage	18 Units	12600				
Inverter (\$0.5 x 350 units x 18)	\$0.5		3150				
Battery			5000				
Charge Controller (\$0.2 per wattage)	\$0.2		1260				
Wiring and Installation (\$1.5 per watt)	\$6300		9450				
Salaries (5 workers for 2 months per site)	\$3000	5 workers	15000				
Total cost of grid-in-box per community			46460				
Total cost for 212 communities	46460	212	9,849,520				

TOTAL COST OFF-GRID SOLUTION							
Solar Program							
	No. of Units	Cost per Unit in \$	Total Cost in \$				
SOLAR HOME UNITS	1340000	335	448,900,000				
SOLAR COMMUNITY SYSTEM	121	46460	9,849,520				
Other Costs	Unit	Unit cost					
Site surveys and engineers (for microgrids)	200 Engineers	1000	5000000				
Training of local workers, distributors, marketers		50000	500000				
LightUp Kenya Payment Apps		30,000	100,000				
Distribution Network (Setup cost for solar shops)	250 Point-of-sales	4000	1000000				
Community Engagements	212 Communities	3000	636000				
Operations and Maintainace (Remote monitoring, Data Analyis etc)			1000000				
Logistics and Transportation			1000000				
Feasibility studies	212 sites	2000	1000000				
Contingency			20000000				
GRAND TOTAL			506,985,520				



"Trust EnerGreen to revolutionize the energy sector with our disruptive innovations and solution models"