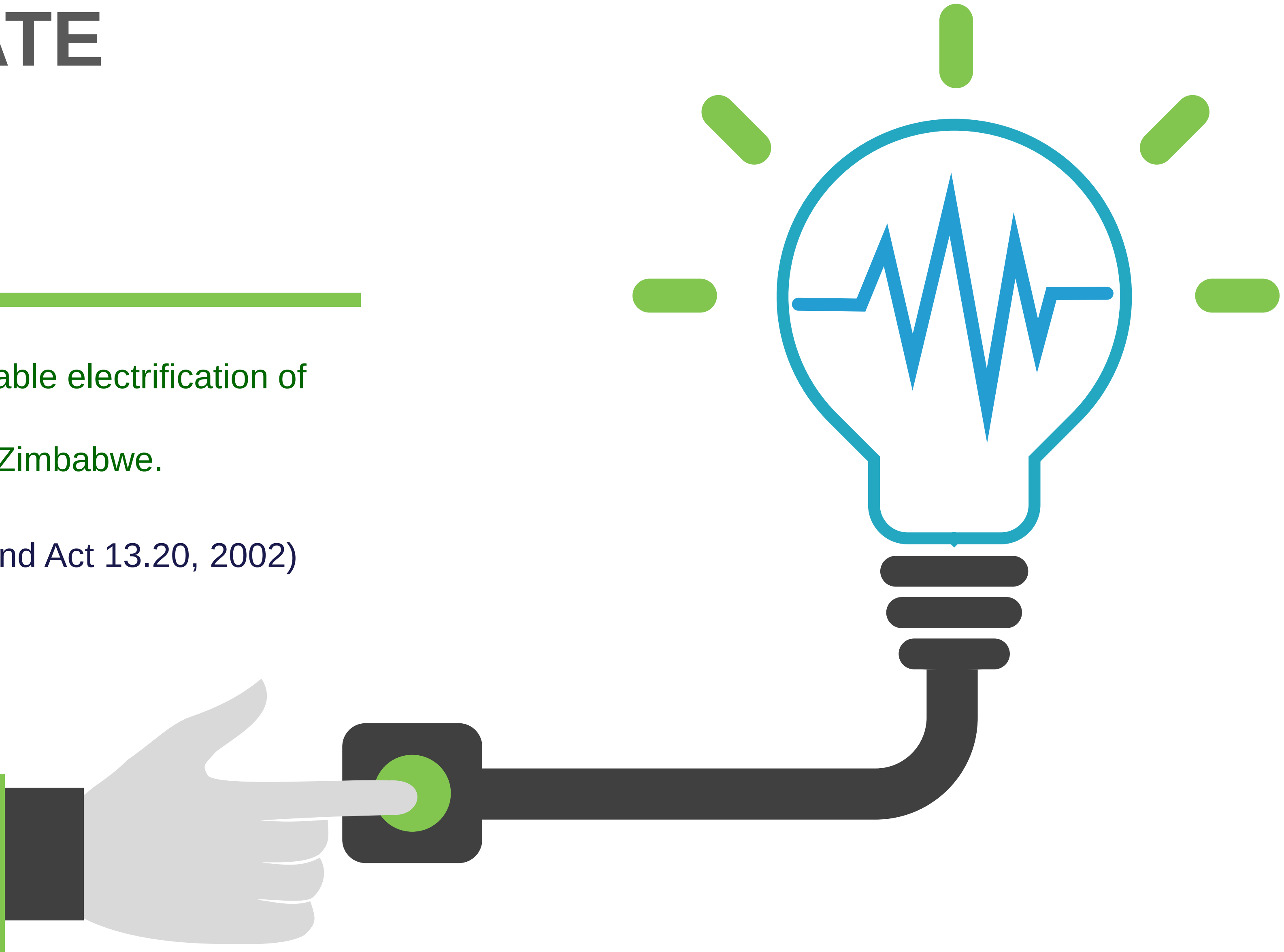
PRESENTER
Cliff Nhandara
Planning & Technology
Director (REF)

# REF MANDATE

To facilitate rapid and equitable electrification of rural areas in Zimbabwe.

(Rural Electrification Fund Act 13.20, 2002)



Universal access to modern energy services by the rural communities of Zimbabwe by 2030

# Mandate-Key functions

**01** **Long-term energy planning**

**02** **Rural Energy Projects implementation**

**03** **Fund management**

- To undertake long term grid and off grid planning(Rural)

- To facilitate provision of sustainable modern energy infrastructure in rural areas of Zimbabwe.
- To undertake research, development and adaptation of new energy technologies

- To manage the Rural Electrification Fund

# FUNDING SOURCES

No.1

**6% ELECTRICITY LEVY**
. By far the biggest source

No.2

**FISCAL ALLOCATIONS**
Variable contribution.

No.3

**ZERA SURPLUS**
Modest contribution

2020

No. 4

**CREDIT/LOAN FACILITIES**

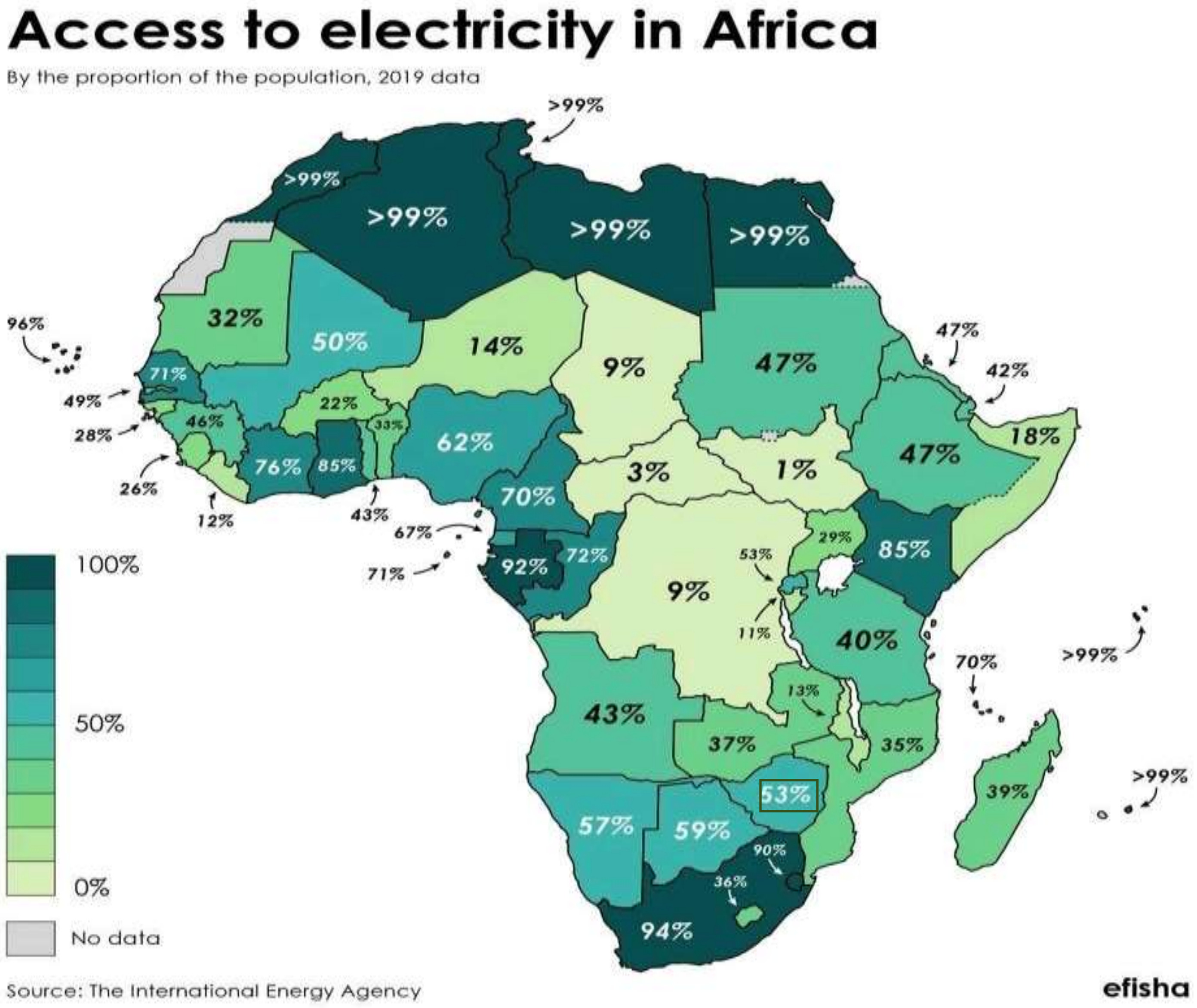
Accessed 44m from CATIC in 2008

No.5

**GRANTS**
These have come as co-funding from development agencies such as UNDP for mini-grids

No.6

**DONATIONS**
Solar equipment from Italy and China.




# Zimbabwe level of electrification 62%

ZIM CENSUS 2022

# Solar Mini Grid Programme

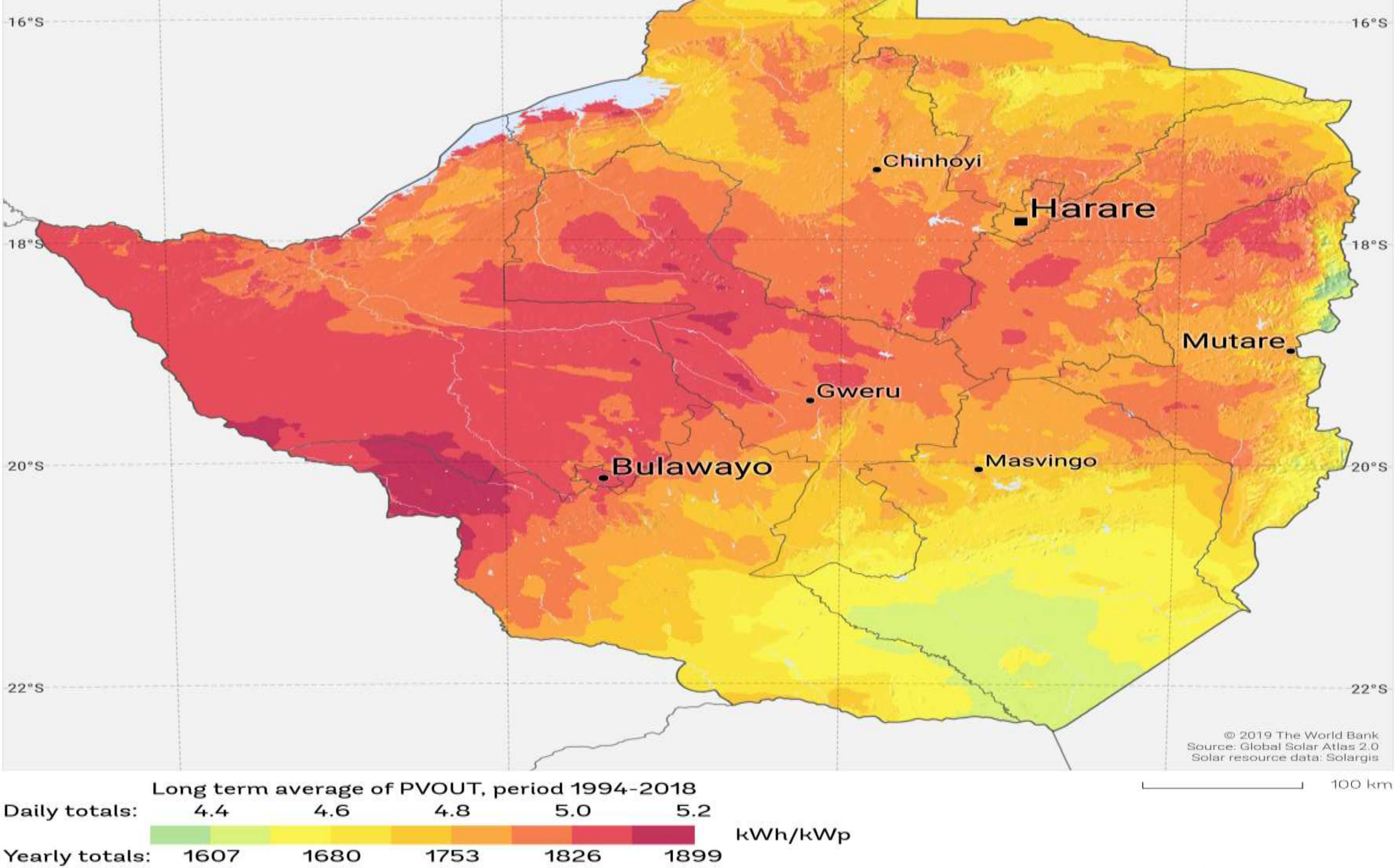
## Mid-range solar mini-grids

Typically 60kW-200kW in size supplying rural settlements- villages, institutions, business centers,Rural cottage industries

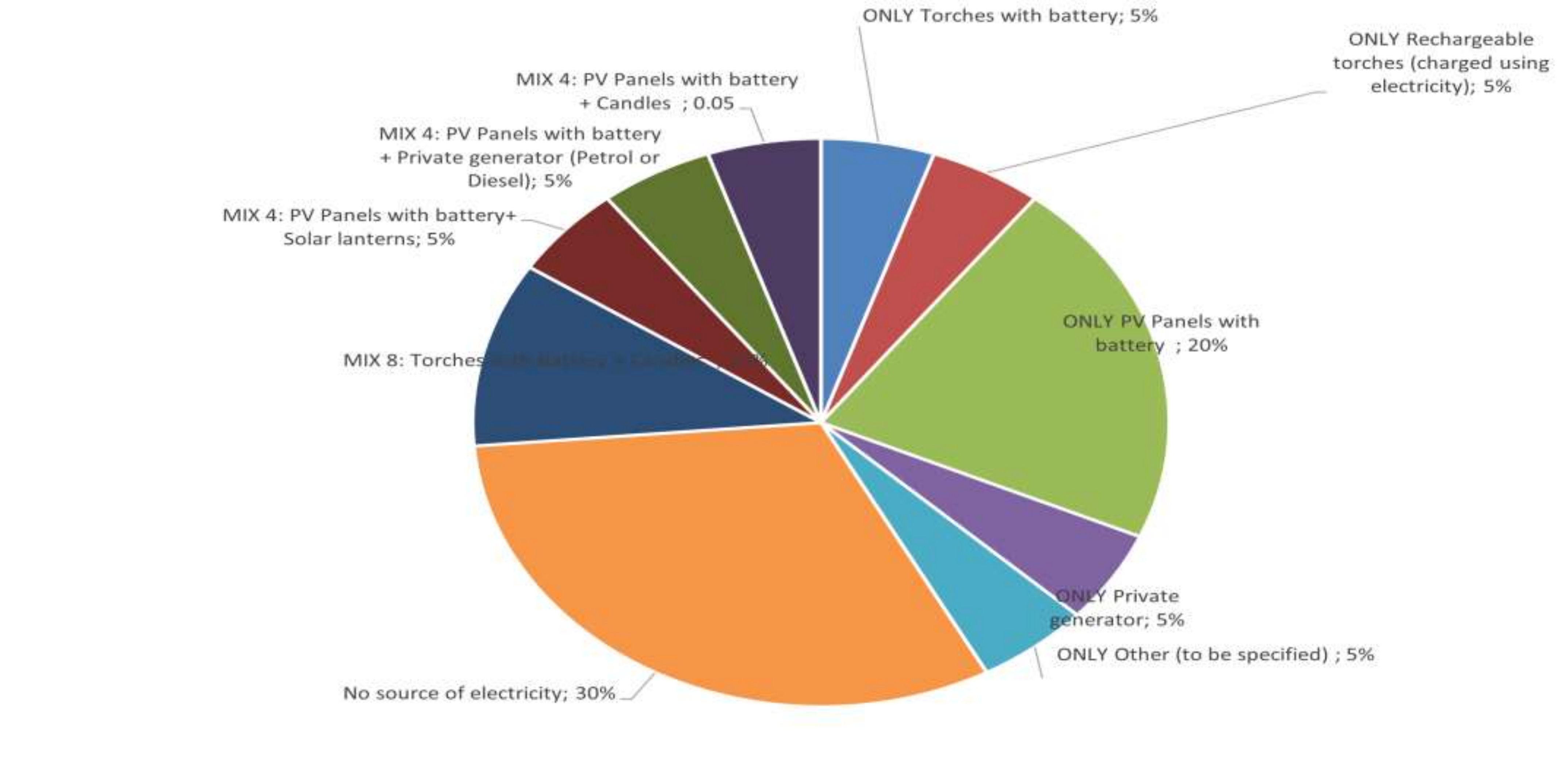
### Business model

REF finances (Viability Gap Funding) , constructs and jointly operates and maintain with the benefitting Communities.

Development agencies like UNDP are joining hands with REF and private Investors to provide such systems with productive use.


16°S
18°S
20°S
22°S
Chinhoyi
Harare
Mutare
Gweru
Bulawayo
Masvingo
© 2019 The World Bank
Source: Global Solar Atlas 2.0
Solar resource data: Solargis
100 km
Long term average of PVOUT, period 1994-2018
Daily totals: 4.4 4.6 4.8 5.0 5.2
kWh/kWp
Yearly totals: 1607 1680 1753 1826 1899

- Current Energy source mix



## Contribution towards Sustainable Development Goals (SDGs)

The proposed 60-200 kW solar mini-grids project aligns with several Sustainable Development Goals (SDGs). In particular, it aligns with SDG 1 (No Poverty) and SDG 5 (Gender Equality) by providing reliable electricity access that enhances the quality of life and empowers women through increased economic opportunities.

The public-private partnership model, involving the UNDP, supports SDG 17 (Partnerships for the Goals), facilitating collaboration among various stakeholders in implementing sustainable energy solutions. Additionally, the “green village” concept promotes SDG 11 (Sustainable Cities and Communities) by fostering decentralised energy systems that enhance local resilience.

The projects are expected to generate employment opportunities, thus contributing to SDG 8 (Decent Work and Economic Growth), while also addressing SDG 10 (Reduced Inequalities) by improving electricity access in underserved areas. Together, these elements underscore the project's potential to drive significant social and economic benefits in rural communities.

# SENSITIVITY ANALYSIS

To seek financial viability, alternative financial structures have been explored.

a) 50% scenario
b) 70% scenario
c) Min. Viability scenario: starting from the initial CAPEX, the subsidy level is the minimum value that meets all the following thresholds for the financial viability indicators: IRR > 10%, NPV > 0 and payback time < 15 years. The subsidy is calculated including the full CAPEX. The optimum scenario is not based on tax and duties exemption but explores the minimum subsidy required to meet financial parameters. Thus, the required subsidy can be used to cover tax and duties exemption in case of need.

# Project 1 Profile

| | | | |
|---|---|---|---|
| Energy Needs Assessment | | | |
| **Annual Energy Demand (2023)** | 131 MWh | | |
| **Peak Power Demand (2027)** | 80 kW | | |
| **Annual Energy Demand (2027)** | 236 MWh | | |
| Technical Features | | | |
| **PV Technology** | Monocrystalline | | |
| **BESS Technology** | Li-Ion storage chemistry | | |
| **PV Generation Capacity** | 180 kWp | | |
| **BESS daily usage** | 328 kWh | | |
| **BESS installed Capacity** | 544 kWh | | |
| **Distribution Network Typology** | 3ph LV Overhead line 230/400 Volts | | |
| **Distribution Network Length** | 3.76 km | | |
| **Connections** | 614 | | |
| **Penetration Rate** | HHs 86 %, SBs 100 %, IN 100 % | | |
| Economic Analysis: 50%, 70%, Min. Viability scenarios | | | |
| | **50% scenario** | **70% scenario** | **Min. Viability scenario** |
| **Capex** | 952,793 | | |
| **Equity to invest** | 50 % | 30 % | 49 % |
| **Subsidy level** | 50 % | 70 % | 61 % |
| **IRR** | 9.2% | 15.5% | 12.1 |
| | **50% scenario** | **70% scenario** | **Min. Viability scenario** |
| **Pay Back Time** | 11 years | 8 years | 9 years |
| **NPV** | -92,047 USD | 78,094 USD | 1,531 USD |
| **LCOE** | 0.187 USD/kWh | 0.144 USD/kWh | 0.163 USD/kWh |
| **Cost per connection** | 776 USD/conn | 466 USD/conn | 605 USD/conn |

# Project 2 Profile

## Technical Features

| | |
|---|---|
| **PV Technology** | Monocrystalline |
| **BESS Technology** | Li-Ion storage chemistry |
| **PV Generation Capacity** | 180 kWp |
| **BESS daily usage** | 218 kWh |
| **BESS installed Capacity** | 547 kWh |
| **Distribution Network Typology** | 3ph LV Overhead line 230/400 Volts |
| **Distribution Network Length** | 6.76 km |
| **Connections** | 238 |
| **Penetration Rate** | HHs 86 %, SBs 100 %, AL 100 % |

## Economic Analysis: 50%, 70%, Min. Viability scenarios

| | **50% scenario** | **70% scenario** | **Min. Viability scenari** |
|---|---|---|---|
| **Capex** | 943,132 USD | | |
| **Equity to invest** | 50 % | 30 % | 51 % |
| **Subsidy level** | 50 % | 70 % | 49 % |
| **IRR** | 12.3 % | 19.6 % | 12.1 % |
| | **50% scenario** | **70% scenario** | **Min. Viability scenari** |
| **Pay Back Time** | 9 years | 6 years | 9 years |
| **NPV** | 11,697 USD | 180,114 USD | 3,276 USD |
| **LCOE** | 0.183 USD/kWh | 0.141 USD/kWh | 0.185 USD/kWh |
| **Cost per connection** | 1,981 USD/conn | 1,189 USD/conn | 2,021 USD/conn |

# Project 3 Profile

| Technical Features | |
|---|---|
| **PV Technology** | Monocrystalline |
| **BESS Technology** | Li-Ion storage chemistry |
| **PV Generation Capacity** | 70 kWp |
| **BESS daily usage** | 80 kWh |
| **BESS installed Capacity** | 211 kWh |
| **Distribution Network Typology** | 3ph LV Overhead line 230/400 Volts |
| **Distribution Network Length** | 1.60 km |
| **Connections** | 73 |
| **Penetration Rate** | HHs 86 %, SBs 100 %, AL 100 % |

Economic Analysis: 50%, 70%, Min. Viability scenarios

| | **50% scenario** | **70% scenario** | **Min. Viability scena** |
|---|---|---|---|
| **Capex** | | 430,322 USD | |
| **Equity to invest** | 50 % | 30 % | 53 % |
| **Subsidy level** | 50 % | 70 % | 47 % |
| **IRR** | 12.9 % | 21.0 % | 12.1 % |
| | **50% scenario** | **70% scenario** | **Min. Viability scena** |
| **Pay Back Time** | 9 years | 6 years | 9 years |
| **NPV** | 12,609 USD | 89,452 USD | 1,083 USD |
| **LCOE** | 0.267 USD/kWh | 0.218 USD/kWh | 0.275 USD/kWh |
| **Cost per connection** | 2,947 USD/conn | 1,768 USD/conn | 3,124 USD/conn |

# Project 4 Profile

## Technical Features

| | |
|---|---|
| **PV Technology** | Monocrystalline |
| **BESS Technology** | Li-Ion storage chemistry |
| **PV Generation Capacity** | 100 kWp |
| **BESS daily usage** | 105 kWh |
| **BESS installed Capacity** | 293 kWh |
| **Distribution Network Typology** | 3ph LV Overhead line 230/400 Volts |
| **Distribution Network Length** | 1.68 km |
| **Connections** | 73 |
| **Penetration Rate** | HHs 92 %, SBs 100 %, AL 100 % |

## Economic Analysis: 50%, 70%, Min. Viability scenarios

| | **50% scenario** | **70% scenario** | **Min. Viability scenario** |
|---|---|---|---|
| **Capex** | | 539,337 USD | |
| **Equity to invest** | 50 % | 20 % | 57 % |
| **Subsidy level** | 50 % | 80 % | 43 % |
| **IRR** | 13.9 % | 22.4 % | 12.1 % |
| | **50% scenario** | **70% scenario** | **Min. Viability scenario** |
| **Pay Back Time** | 8 years | 5 years | 9 years |
| **NPV** | 36,300 USD | 132,610 USD | 2,592 USD |
| **LCOE** | 0.228 USD/kWh | 0.182 USD/kWh | 0.244 USD/kWh |
| **Cost per connection** | 3,694 USD/conn | 2,216 USD/conn | 4,211 USD/conn |

# Project 5 Profile

| Technical Features | |
|---|---|
| PV Technology | Monocrystalline |
| BESS Technology | Li-Ion storage chemistry |
| PV Generation Capacity | 200 kWp |
| BESS daily usage | 306 kWh |
| BESS installed Capacity | 593 kWh |
| Distribution Network Typology | 3ph LV Overhead line 230/400 Volts |
| Distribution Network Length | 4.08 km |
| Connections | 352 |
| Penetration Rate | HHs 86 %, SBs 100 %, AL 100 % |

Economic Analysis: 50%, 70%, Min. Viability scenarios

| | 50% scenario | 70% scenario | Min. Viability scenario |
|---|---|---|---|
| Capex | 952,609 USD | | |
| Equity to invest | 50 % | 30 % | 53 % |
| Subsidy level | 50 % | 70 % | 47 % |
| IRR | 12.8 % | 20.7 % | 12.1 % |
| | 50% scenario | 70% scenario | Min. Viability scenario |
| Pay Back Time | 9 years | 6 years | 9 years |
| NPV | 27,773 USD | 197,882 USD | 2,257 USD |
| LCOE | 0.176 USD/kWh | 0.137 USD/kWh | 0.182 USD/kWh |
| Cost per connection | 1,353 USD/conn | 818 USD/conn | 1,434 USD/conn |

# COSTS

| NUMBER OF SITES | TOTAL CAPACITY | TOTAL BENEFICIARIES | TOTAL COSTS |
|---|---|---|---|
| 100 | 6MW | 500 000 + | US$20M |

# Project Finance Structure

| Capex | % |
|---|---|
| Design | 1.0 |
| Generation system | 17.1 |
| Battery Storage | 20.3 |
| Plant facilities | 3.4 |
| Distribution planning | 0.7 |
| Distribution Network | 6.7 |
| Last-mile connections | 14.1 |
| Spare parts | 1.0 |
| Commissioning | 0.9 |
| Labor, Logistics and taxes | 34.7 |
| Total Capex | 100.0 |

# Planned implementation

| | 26Q1 | ’26 Q2 | ’26 Q3 | ’25 Q3 |
|---|---|---|---|---|
| **Activity A** | Environmental and social Impact Assessment (ESIA)<br><br>(EMP) | Financial Support | Distribution Line construction | Plant Construction |
| **Activity B** | | Equipment Design | Water supply Provisions | Service connections |
| **Activity C** | | Equipment Specification | Land preparation/Plant civil works preparations | Pre-Commissioning |
| **Activity D** | | Procurement | | Commissioning |

*Capability to deliver*

# Projects Implementation
# 7 Project Completed
# 3 Currently In Progress

# Summary of set-up and operate costs 120MW/yr Solar Assembly Plant

| Item | Value ($) | Percent of total capital cost |
|---|---|---|
| Production line machinery | 1,095,000.00 | 14.52% |
| Hybrid solar-grid-battery power plant | 2,211,040.00 | 29.31% |
| Factory and Warehouse Buildings | 1,800,000.00 | 23.86% |
| Working capital: Raw materials | 2,128,227.99 | 28.21% |
| Working capital: HR | 109,500.00 | 1.45% |
| Working capital: Transport | 200,000.00 | 2.65% |
| **Total Capital Cost** | **7,543,767.99** | **100%** |

Initial Investment: ~USD 7.2 million (CAPEX + Working Capital)

Debt-Equity Ratio: 70:30 (with concessional loans and equity contributions)

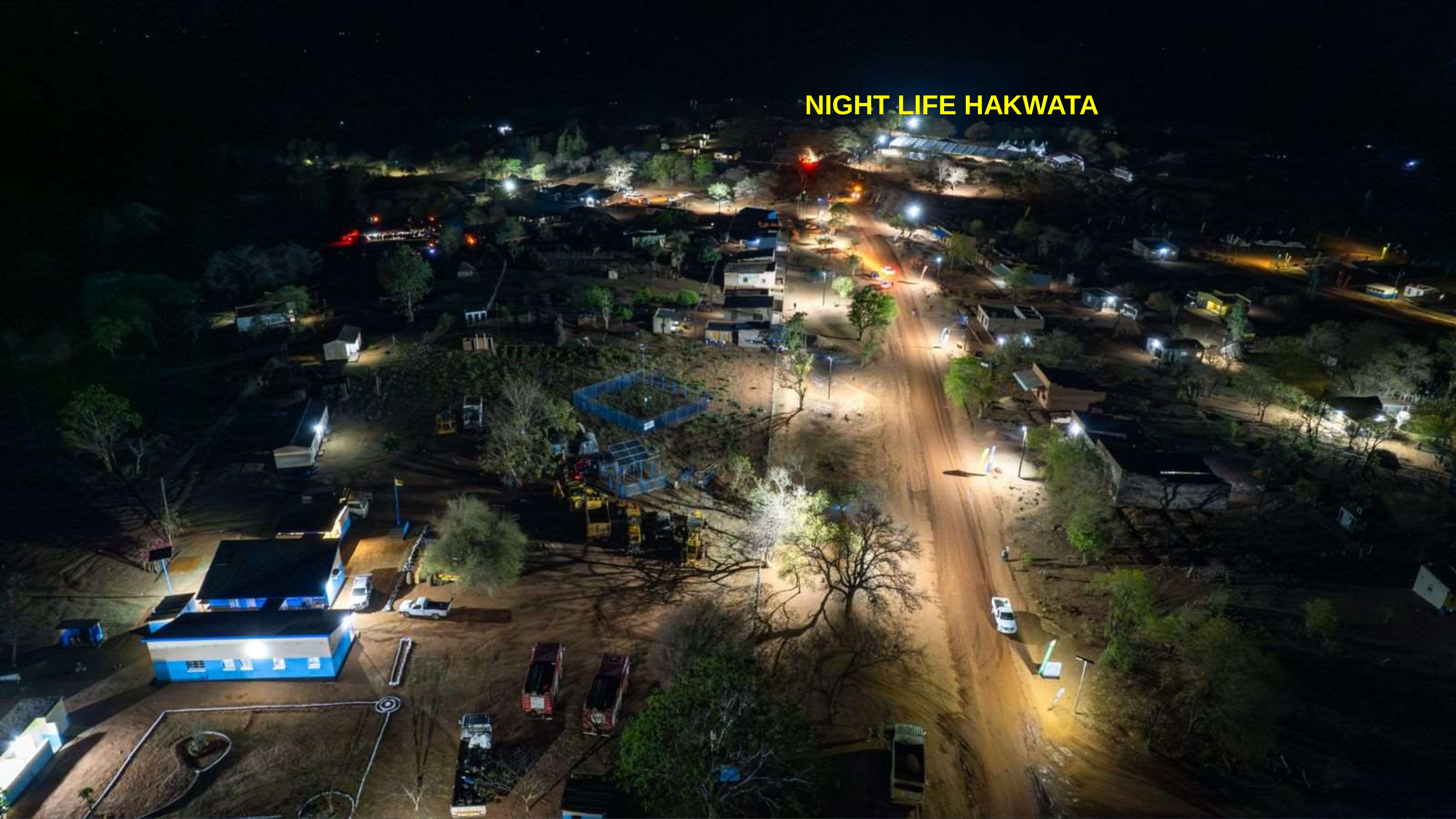
IRR: Above benchmark rates across scenarios

Payback Period: Within 5–7 years

NPV: Positive across sensitivity-tested assumptions

# RECENTLY COMMISIONED 200KW HAKWATA

# NIGHT LIFE HAKWATA




# TRANSFORMATIVE USE OF RENEWABLE ENERGY



# We are looking for:-

**01**

**Climate finance**

Climate funds/Grants with the help of accredited entities

**02**

**Partnership**

we are looking  for a partnership with investors.

**03**

**Equipment arrangements**

We are also looking for short-term Loan arrangements to secure project materials mainly Imported Solar Equipment.

# Thank You

APRA
Accelerated Partnership for Renewables in Africa

IRENA
International Renewable Energy Agency