

## PROTOTYPE – FACT SHEET

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**WORKING GROUP:** 2 – RENEWABLE ENERGIES  
**ORGANIZATION:** MANDULIS ENERGY

### TITLE:

**Renewable Energy to Power Agriculture & Rural Livelihood Enhancement (REPARLE)**

#### Mission statement

To deliver affordable, reliable and productive rural electrification that drives sustainable economic development.

Develop software-enabled biomass power projects in Uganda, to provide rural farming communities: i) clean energy; ii) agro-processing services; and iii) support to increase agricultural productivity.

We see renewable energy from agricultural waste (agri-waste), as an integrated solution to energy security, food security, climate resilience and poverty alleviation.

#### Briefly describe your prototype idea

Start with 8MW in off-grid (0.5MW across 16 sites) renewable energy projects, in 3 districts in Uganda (Gulu, Amuru, Nwoya). This is a highly scale-able business model for rural electrification, which we will expand across Uganda and other emerging markets.

At each power generation site, we provide affordable high quality agro-processing services to farmers, and also purchase sustainable biomass (agri-waste/ agro-processing byproducts) from both farmers and agro-processors, which is used as feedstock for the gasifiers.

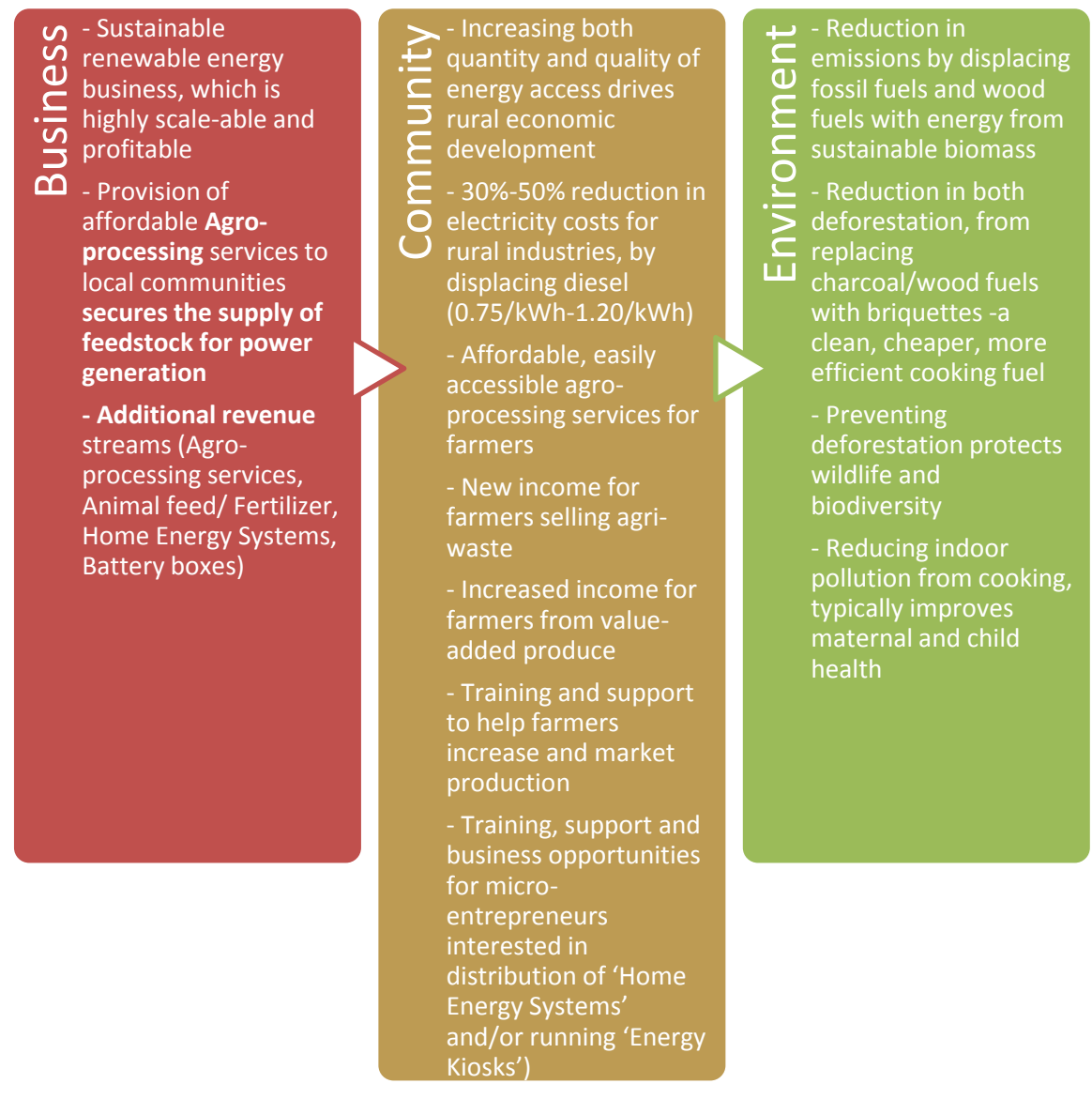
Gasification is a technology we use to produce clean energy (electricity and bio-char) from agricultural waste such as rice husks, maize husks/cobs, groundnut shells and coffee husks.

**Electricity** is distributed via a combination of micro-grids and battery boxes, both to i) 'large' consumers: rural industries (agro-processors, GSM towers, SMEs etc.); and ii) 'mid/small' consumers: rural communities (households, schools, hospitals and micro-businesses).

**Bio-char** is used to make briquettes (clean-burning solid fuel) to displace wood/charcoal, and sold wholesale through existing marketing channels, on long-term agreements, with industrial off-takers, as well as commercial off-takers (work with distributors that sell briquettes to households for clean cooking fuel).

**Agro-processing services** provided to farmers, is a key value driver, critical to ensuring feedstock security for power generation. Our innovative business model offers a comprehensive solution to energy access needs, and creates direct, incremental, synergistic sustainable impact opportunities that benefit our business, community and environment (*See Figure 1*).

**Figure 1:** Triple bottom-line business model that delivers strong, direct and quantifiable returns to our business, community and environment



## Target group

We target 3 types of customers:

### 1 – Farmers/ Rural Communities/ Rural Enterprises:

- Electricity
- Briquettes/cooking fuel
- Agro-processing services
- Energy efficient appliances (“Home Energy Systems”)

### 2 – Rural Industries (rice/maize mills, tea drying, coffee processors etc)

- Electricity
- Biochar/Briquettes

3 – Mandulis Energy’s 20MW grid biomass project in Gulu –that has a permit from Electricity Regulatory Authority, and will sell electricity to the government-owned Uganda Electricity Transmission Company (UETCL), on a 20-year, inflation-linked, USD-denominated power purchasing agreement.

## Potential partner(s) for implementation

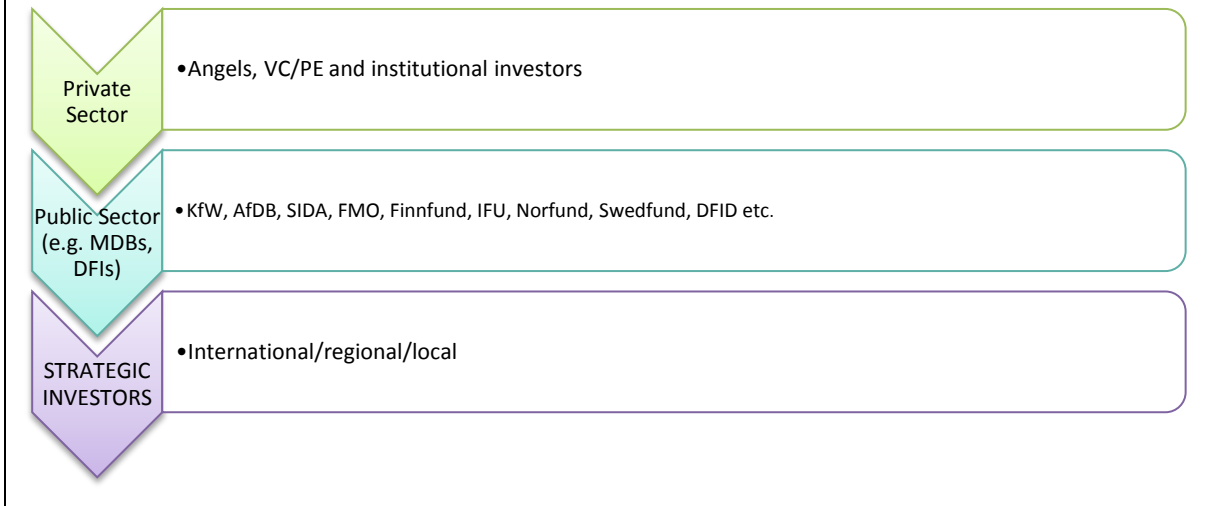
### PROJECT DEVELOPMENT & IMPLEMENTATION: PRIVATE SECTOR & NGO



### PROJECT DEVELOPMENT SUPPORT & RISK MITIGATION FROM PUBLIC SECTOR: GOVT, DFIs and MDBs



## SCALING UP & EXPANSION: PRIVATE & PUBLIC SECTOR INVESTMENT



## Key challenges and opportunities

A unique opportunity to provide a sustainable solution for energy access, while addressing major closely inter-linked challenges, including access to clean cooking fuel and affordable agro-processing.

### Electricity

- 80% of Uganda's 39 million people live in rural areas, and rural industries (agro-processing) contribute 37% of the country's GDP
- 95% of rural communities in Uganda are off-grid
- According to the Uganda Electricity Transmission Company Limited (UETCL), as of 2016 the grid has installed generation capacity of 850MW (predominantly hydropower) but a firm capacity of 496 MW that varies in accordance with prevailing hydrological conditions. With demand growing at 10% a year, these variances in output of the hydropower stations, leads to seasonal deficits of up to 150MW. This causes load shedding and unreliable grid power, which is insufficiently bridged with 100MW of standby HFO/diesel thermal power.
- CO2 Emissions in Uganda have increased 350% since 1990, and diesel/HFO contributed 70%

### Cooking Fuel

- 95% of Ugandan households use wood fuels (wood/charcoal) for cooking
  - \* Charcoal consumption per person, of 168kg a year
  - \* Demand rising 6% a year
- As a result, Uganda has lost 1/3 of forest cover since 1990, and at the current rate, could lose its entire forest cover by 2050

### Agro-processing

- Agro-processors spend \$0.75/kWh- \$1.20/kWh on diesel electricity
- As a result, farmers currently struggle to access affordable, quality, local agro-processing, and Agro-processors are unable to grow their businesses

### Opportunity

- Agri-waste already aggregated at agro-processing plants across Uganda can power 1650MW
- 80% of Uganda's 39 million, live in rural areas, and work in agriculture, contributing to 37% of GDP
- Food for local consumption and export, is produced by small scale farmers, with an average 1-5 acres
- Uganda is self-sufficient in food production and agriculture already accounts for 70% of export earnings, despite the inefficiencies, underlying the significant opportunity for affordable, reliable and productive rural energy access to drive disruptive economic transformation

### Traction – Key Milestones

- Pre-feasibility studies completed by Lahmeyer International GmbH
- Environmental & Social Impact Scoping Studies completed by ERM GmbH
- Feasibility permit approved by Uganda's Electricity Regulatory Authority
- Seeded by Angels a public sector investors (e.g. KfW/ UECCC)
- Partnership with French NGO ACTED, to support an existing network of 15,000 farmers (Gulu, Nwoya, Amuru) to produce feedstock
- Installed a pilot project in Olwiyo, an off-grid town in Nwoya District. An "Energy Hub" which is operational –and consists of a 32kW biomass power plant, agricultural processing, warehousing and briquetting.

### Next steps and Timeline

- \* 3-4Q' 2016: Raise financing, for **Phase I** (1x0.5MW) of rural electrification
- \* 4Q' 2016/ 1Q' 2017: Install, commission, and launch the phase I
- \* 2Q' 2017: Raise financing for **Phase II**, refine model, and start scaling-up
- \* 4Q' 2017: Total of 4 Energy Hubs operational
- \* 4Q' 2018: Total of 8 Energy hubs operational



\* 4Q' 2019: All 16 Energy hubs operational, run by a profitable and scale-able business that has created 15,000 farming jobs, delivered energy access to 120,000 people, saves over 700,000 tonnes/year of trees and averts over 2.5Million tonnes/year of CO2 emissions.

\* Each Energy Hub is self-sustainable, profitable, and has a payback period for total capex of less than 3 years.

\* Mandulis Energy is strongly positioned for **organic growth** within Uganda by re-investing profits. Our pipeline of projects expand our footprint across the country, and will deliver up to 320MW by 2030 (which is 10% of Uganda's (Nationally Determined Contribution) NDC targets committed to post COP21, of 3,200 MW of new renewable energy generation capacity by 2030). Therefore, **further external investment** will greatly catalyze growth and enable us to achieve our targets more rapidly.