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Feasibility study and business plan for manufacturing a 3 kW-electrical solar Stirling engine and *dish, for off-grid electrical power supply units*

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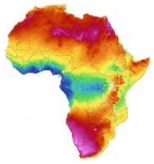

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Presentation Outline

- Background
- Stirling Dish Technology
- Research Problems
- Research Design
- Marketing Research
- Manufacturing Plan
- Economical Analysis of a Residential 3 kW Stirling Dish
- Conclusion

Background

- In 2009 Africa had 587 million people without access to electricity
- Rural areas 80 % of this number (International Energy Agency)

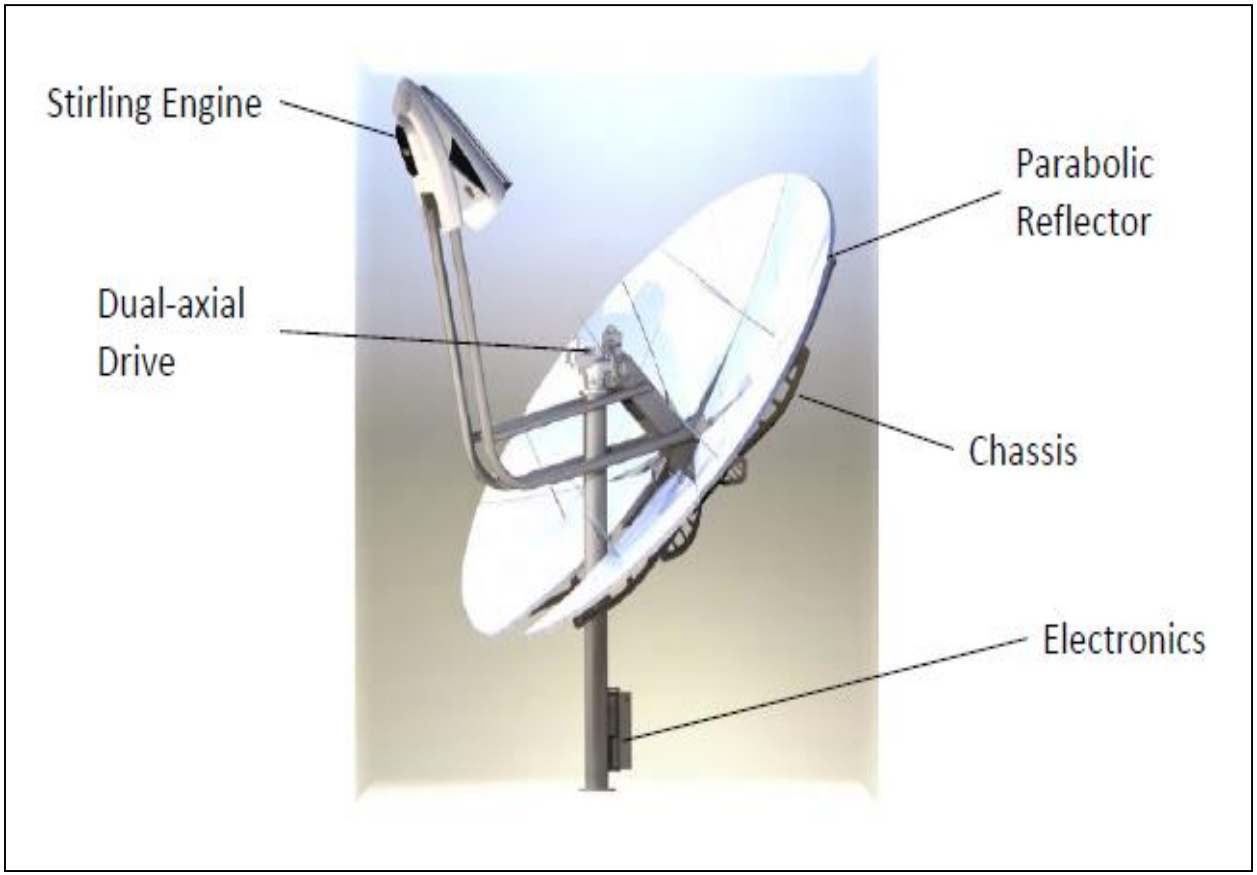
- Table 1. Electricity Access in 2009 (International Energy Agency)

	Population without electricity million	Electrification rate %	Rural electrification rate %
Africa	587	41.8	25
-North Africa	2	99.0	98.4
-Sub-Saharan Africa	585	30.5	14.2
Developing countries	1,314	74.7	63.2
World	1,267	81.5	68

Background

- Rural areas are scattered and isolated
- Have a low population density which makes it expensive to extend electricity grids to rural areas
- One technology Africa can look into : Stirling dish

Stirling Dish System



Research Problems

- Market potential in Africa has not been assessed
  - Market size
  - Risks in off-grid rural markets
- Profitable business venture

Research Design

Market Research

- Customers: needs, attitudes and buying habits
- Conducted a survey in a rural community without access to electricity

- Objectives of the survey:

- Determining the market interest of the solar Stirling dish amongst the people
- Formulating an overview of the energy situation in rural communities
- Determining a realistic price for the solar Stirling dish
- Identifying the needs of the customers that could be incorporated in the designs of the Stirling engine and the concentrator

Manufacturing Plan

- Plant location : Johannesburg
- Plant layout (physical arrangement) - U-shaped production line
- Space requirement : 4000 m^2

- Costs analysis:
  - **Material costs** : raw materials
  - **Manufacturing costs** : machining
  - **Production costs** :labour and electricity

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Manufacturing Plan

- <u>Results:</u>
- Manufacturing costs of one Stirling dish
- Selling price : R 90 000.00

- Number of days needed to complete one unit
  - Concentrator- 1/2 day
  - Stirling engine- 5/6 days
- Number of workers required

Economical Analysis of a Residential 3 kW Stirling Dish

- Deployment of the Stirling dish in rural areas is not necessary compete with other technologies but to provide electricity
- This type of purchasing plan is suitable for a homeowner with a low income

- <u>Assumptions used in the analysis:</u>

- Loan = selling price of Stirling dish with 10 % down payment
- Period : 30 years
- Discount rate : 10 %
- Inflation rate : 3 %

Economical Analysis of a Residential 3 kW Stirling Dish

ITEM	VALUE
Levelised Cost of Energy	1.38 R/kWh
Life line areas	2.11 R/kWh
Discounted payback period	10.74 years

Conclusion

- Viable market exist in Africa
  - 24 % households have a total monthly income R 4000- 10 000 or more per month
- Manufacturing of this technology is possible in Africa
- Purchasing plan that can make product more affordable to homeowners

Acknowledgements:

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Supporting information

Cost of one power supply 3 kW	R 90 000.00
Manufacturing cost of concentrator	R 447.28
Manufacturing cost of engine	R 2 997.95
Manufacturing overheard 10 %	R 3 789.75
Material cost of concentrator	R 40 190.63
Material cost of engine	R 15 258.47
Material cost overheard 10%	R 60 994.01
Total costs	R 64 783.76
Profit	30%

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Supporting information

- Machining: welding, drilling, milling, turning and broaching
- Concentrator = 2 workers
- Stirling dish = 25 workers
- PMT (annual interest rate, years and amount)

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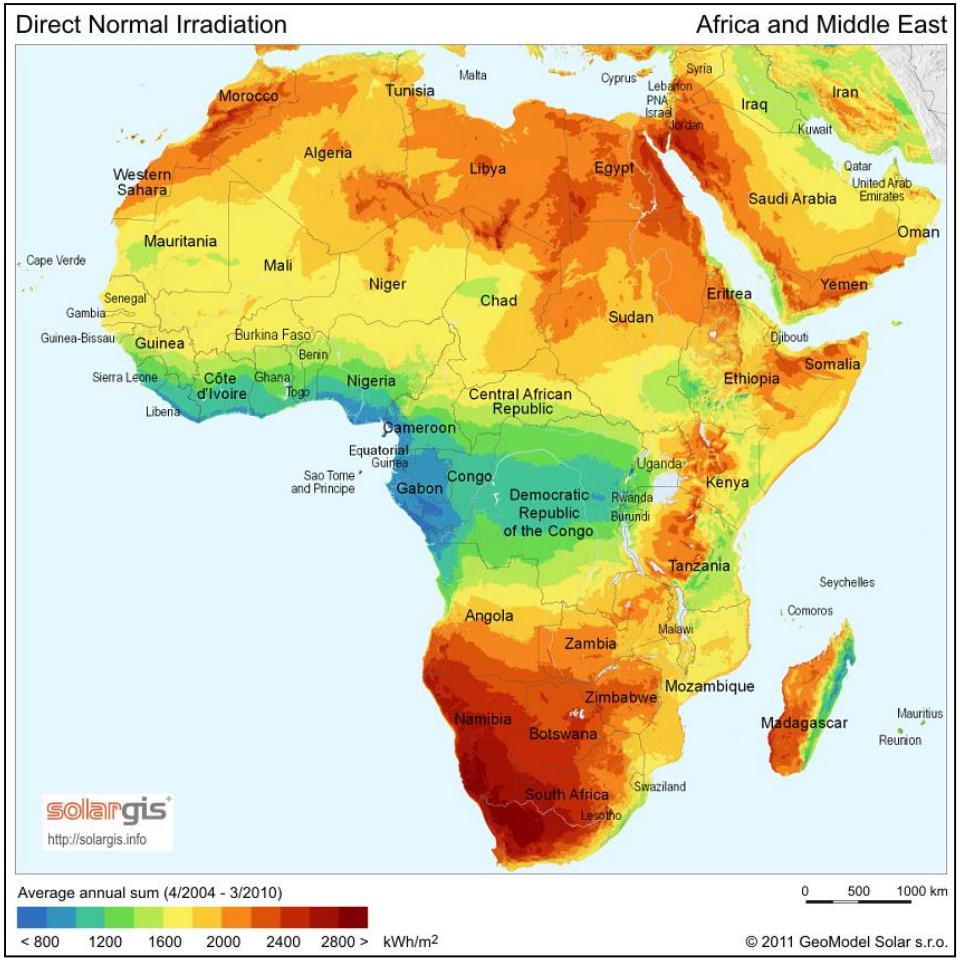
Supporting information

ITEM	VALUE
Net Present Value	R 14 058.44
Internal Rate of Return	17.53 %
Levelised Cost of Energy	1.38 R/kWh
Life line areas	2.11 R/kWh
Discounted payback period	10.74 years

Supporting information



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