
Decentralised Micro Hydro Technology Solutions for Transforming Rural Communities – Cases from Malawi, Mozambique and Zimbabwe

Chandirekera Sarah Mutubuki-Makuyana
Practical Action Southern Africa

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**Project implementers' presentation
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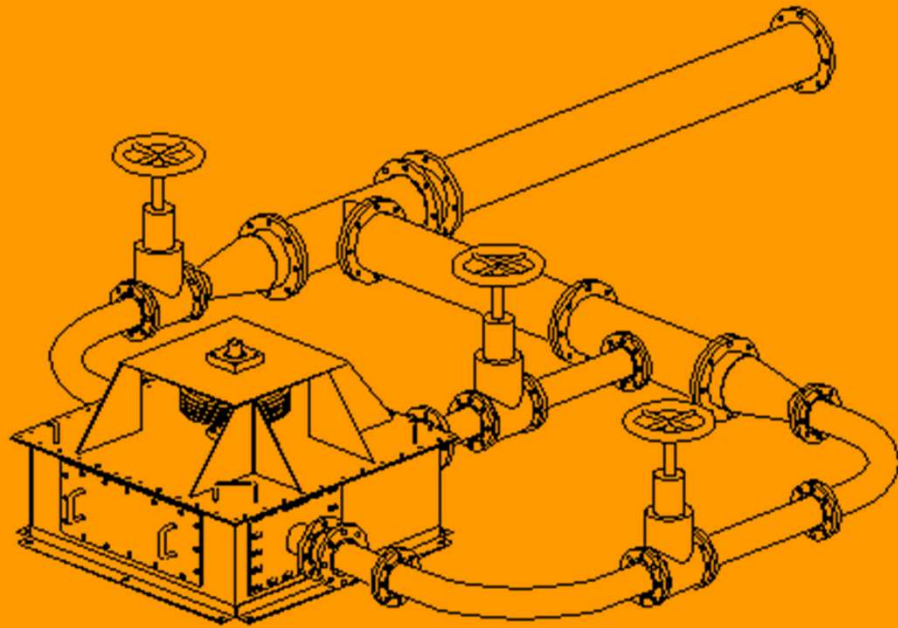


Practical Action

- Formerly ITDG (Intermediate Technology Development Group)
- Based on the book “Small is Beautiful” by Schumacher
- A technology based International NGO with head offices in Rugby, UK
- Seven country and regional offices – UK, Nepal, Bangladesh, Sri Lanka, Kenya, Sudan and Peru
- Zimbabwe office based in Harare operates in Malawi Mozambique, Zambia and Zimbabwe



Catalysing modern energy service delivery to marginal communities in Southern Africa



REGIONAL HYDRO PROJECT



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Project Background

- ACP EU Energy Facility Funded Project (2007 – 2012)
- Co-Financed by Practical Action, States of Jersey, Tridos, Conlog and other Individuals
- Project Budget Euro 2,2 million
- Location: Mulanje Mountain Malawi; Manica Province – Mozambique; Manicaland Province – Zimbabwe.



Project Background continued

- Project Partners: Mulanje Mountain Conservation Trust; Kwayedza Simukai Manica



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Project Objectives

- To adopt, adapt and apply community based management models in the establishment and running of microhydro power systems (MHS) in Malawi, Mozambique and Zimbabwe
- Reach out to 45,000 men and women with modern energy



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Assumptions/Hypothesis

- wider uptake and delivery of modern energy in the region hampered by:
- Human Capacity (Decision making to end use)
- Good cases of MHS and resource assessment tools
- Financial Support (not worth supporting?)
- Community and Institutional Awareness (Concept still alien)



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Approach

- **Site Identification**
 - desk study
 - Stakeholder consultations (RDCs, DAs, Chiefs, Communities)
- **Participatory Prefeasibility studies**
 - Technical
 - Socio – economic
 - Business
- **Decision – To invest or not to invest**
- **Detailed Feasibility Studies**
 - Technical, Socio – economic, business
 - Energy Planning – participatory CBP process



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Approach conti.

- **System Designs**
 - desk designs – Technical designs (civil work designs, turbine designs, transmission and distribution designs). Business designs (ownership and management structures, tariff structure, financing structure for initial, O & M costs and system growth, demand / load forecasting, viability ratios including IRR)
 - Stakeholder consultations and participation (RDCs, DAs, Chiefs, Communities)
- **Procurement Process**
- **Community Based Construction process**
- **Capacity Building Trainings**
 - Technical trainings
 - business management trainings
 - Energy Management trainings



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Approach conti.

- Handover
- Monitoring and Advisory Services
 - Technical trainings
 - business management trainings
 - Energy Management trainings



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Gender Mainstreaming in in MHSs

- Gender Goals and Action Plans (WPEEEE Model)
- Gender Mainstreaming in Visibility Products
- Gender Action Plans
- From housewives to shareholders



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Planned/actual production, price of energy provided

Name of Scheme	Design Capacity (kW)	New / Rehab	Cost of Scheme (Euro)	Beneficiaries	Tariff (HH; Bus; Social)
Chipendeke (zw)	25	New	181,990	3930 (RHC,2011)	USD0.10 ; 0.32; 0.10
Dazi (zw)	20	New	93,101	928	
Nyafaru (zw)	20	Rehab	41,945	5618 (RHC, 2007)	
Ndiriri (mz)	27	New	41,515	645	
Nerufundo (mz)	24	Rehab	12,941	1400 (est)	
Bondo (mw)	88	New	480,000 (est)	10877	
Nyamwanga (zw)	30	New	100,487 (est)	3797	
Ngarura (zw)	16	New	35,962 (est)	5423 (clinic)	
Hlabiso (zw)	30	New	144,000 (est)	3846 (est)	
Chitunga (mz)	30	New	100,487 (est)	2502	
Chua (mz)	27	Rehab	15,000 (est)	3564	
Chihururu (mz)	27	Rehab	15,000 (est)	1050	
Nguarai (mz)	27	Rehab	15,000 (est)	1420	



Operation and maintenance

- Operation and maintenance is done by community members who are trained by Practical Action and other stakeholders (Rural Electrification agencies and power utility companies)
- All schemes are community owned



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Sustainability and how will it be ensured,

- Technical Sustainability
- Technical Trainings of community members – Sengasenga video and book
- Linkages with local fabricators
- Community to community linkages
- Linkages with power utility companies and rural electrification agencies and other stakeholders
- Financial-affordability and replacement – The Tariff Calculator



Challenges

- Cost overruns – contract rider approved
- Some costs crucial for the sustainability of the schemes had not been included in the budgets at the start of the project (Community Energy Centre, Prepayment Systems, Connections to Business Centres)
- Establishing a Decentralised Energy Fund where companies and individuals can contribute towards sustainability of schemes and new



Achievements to date

- Additional generating power of 204 kW against a target of 320kW installed from micro hydro systems which contributes to the share of renewable energy in the three countries (target to be reached by 2012).
- One tool and business models for viability of micro hydro systems tested and operational (The Tariff Calculator).
- Rural electrification agencies buy-in into MH technology – REA modified mandate to extending small decentralised grids from national grid
- Four completed micro-hydro energy systems are generating and supplying efficient and reliable energy services to the rural populations(Chipendeke (zw); Ndiriri (mz); Dazi (zw); Nyafaru (zw); Bondo (mw); Nerufundo (mz))
- Five schemes (Chitunga, Ngarura, Hlabiso, Nyamwanga, Chihururu, Nguarai, Chua)
- 3 online inventories of the market potential of micro hydro systems in the three countries at various levels of completion



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Lessons

- BOQs critical to avoid cost overruns
- Gender mainstreaming critical
- Financing from private sector and financial and business models demonstrating viability and sustainability
- Imparting technical capacity to partners needs for the lead agency to be hands on
- Community mobilisation and buy in necessary for sustainability of schemes
- Involvement of other technical stakeholders crucial



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Business Model Concepts

- Ownership and Management model – community based (company, cooperative, individual, trust)
- Pricing – three tier pricing structure – social services (schools, rural health centres); HHs; commercial end-use activities
- A self subsidizing tariff structure which ensures viability of schemes
- Engineering the ability of households to pay
 - Prepayment Billing System – compliments of Conlog Systems, SA
 - payment in the form of recurring commodities (agricultural produce). Linkages with commercial entities that utilise commodities as raw materials
 - Consumer structured Tariffs (e.g. Seasonally).



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Economic Model Concepts

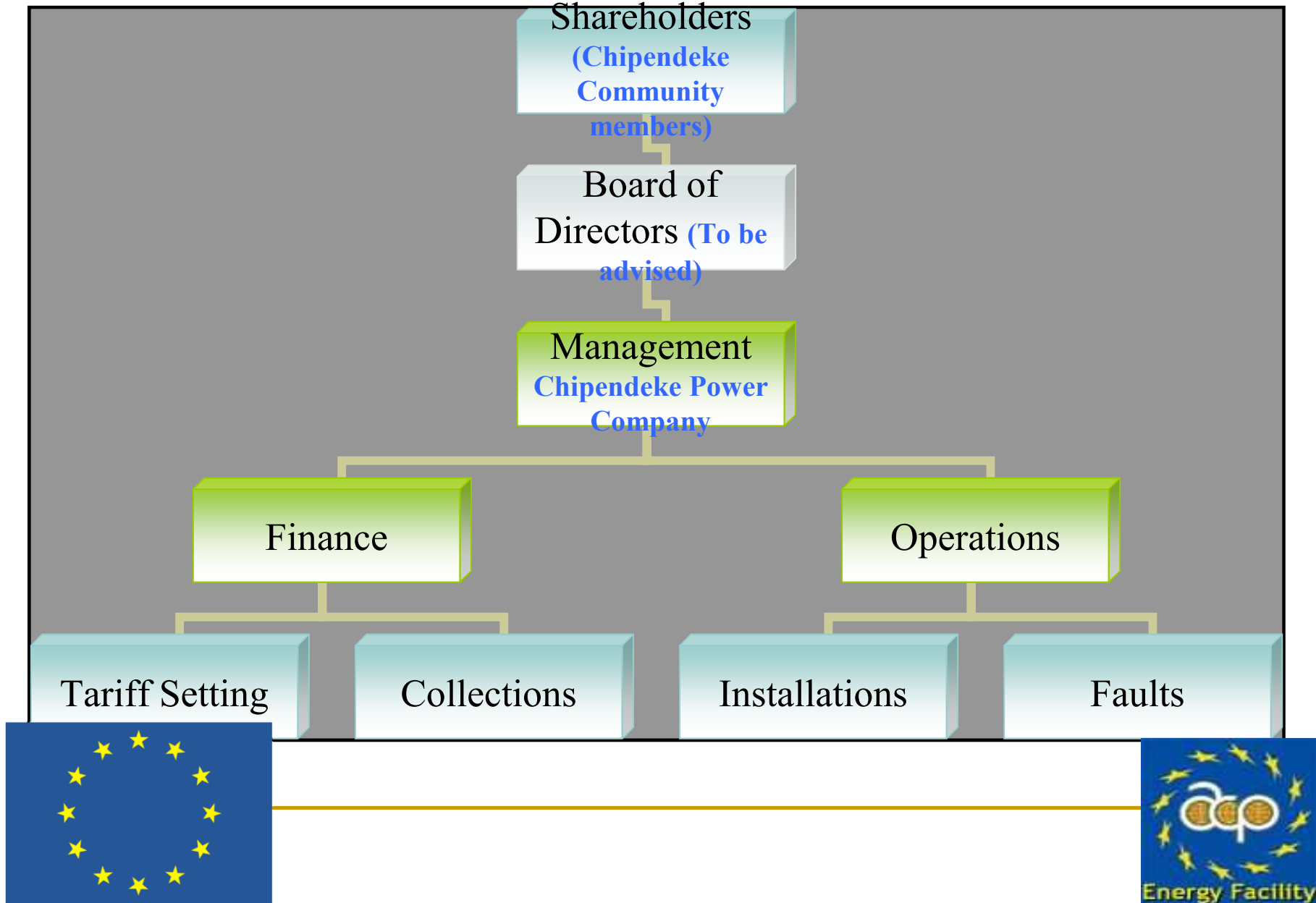
- Expected Benefits to beneficiaries
- Investors – dividends; shareholding with share certificates and directorship status
- Households – access to electricity for lighting, entertainment
- Commercial entities – increased productivity and incomes
- Community – jobs, opportunities for investments (micro retail industry – grocery shops; micro production industry – milling and agro processing, welding, tailoring; private services – saloons, barber shops)



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Example of Ownership and Management Model - Chipendeke MHS



Certificate of Ownership

This certifies that
Zacharia Dinhira, ID. No. **75-034949 B 75**, **Josephine Murepa**, ID No. **75-008368 J 75** and **Ennia Dinhira**, ID No. **75-034976 F 75**, residing in Village **2A** in ward 22 of Mutare Rural District, having jointly contributed 14 days to the construction of Chipendeke Micro Hydro Scheme, are part owners jointly holding **0.4%** stake.



SIGNED

Ernest Mupunga
Regional Director, Practical Action

Xavier Marchel
Ambassador—EU Delegation Zimbabwe

Chipendeke MHS in Zimbabwe – A Community Company that generates and sells electricity to surrounding community.

- Installed power capacity 25 kW
- Cost - Euro 68,000.00
- Beneficiaries – 1,323 people through 1 grinding mill, a rural health centre, 1 school, agro-processing businesses and direct connections to surrounding households.



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Community participation at Chipendeke, Mutare.



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2010/07/1



Power House and power lines at Chipendeke, Mutare.



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Turbine at Chipendeke, Mutare.



Some owners of Chipendeke MHS, Mutare.



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Prepaid Meters at Chipendeke, Mutare.

Ndiriri MHS in Mozambique - Reha

an existing mechanically powered grinding mill provides electricity to surrounding isolated community.



N DIRIRE BUSSINESS CENTRE 2010

- Installed Capacity - 27 kW
- Beneficiaries - 162 people through direct household connections, 1 grinding milling service, and 7 shops.
- Cost - Euro 20,000.00



2011/01/02





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Hydro mechanically powered grinding mill at Ndiriri, Manica.

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Street Lights at Ndiriri, Manica.

Chitunga MHS in Mozambique — Demonstrates the use of decentralised micro hydro power for community energy centre.

- Expected Capacity - 33 kW
- Expected cost - +/- Euro 105,000.00
- Expected beneficiaries — 1300 people through 1 grinding milling service, 15 bancas, a rural health centre, 1 school, government offices, 1 agro-processing business and direct connections to households at the centre.



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Forebay and second desilting Tank at Chitunga, Manica.

Nerufundo MHS in Mozambique improves efficiency of a hydro mechanically powered grinding mill from 8 minutes per bucket to 2.3 minutes per bucket.

- Expected Capacity 15 kW
- Expected cost - Euro 15,000.00
- Expected beneficiaries – 1 grinding mill, and surrounding 300 households.



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Dazi MHS in Zimbabwe

Demonstrates a sustainable market driven model and supply chain for batteries charged by a micro hydro power scheme to increase RE electricity outreach to rural communities.

- Installed capacity - 20 kW
- Cost of scheme - Euro 40,000.00
- Expected beneficiaries – 92 people through grind milling services, direct household connections, and battery charging facilities



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Energy Fa

Dazi MHS in Zimbabwe also demonstrates a high head and low flow scheme.

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Power House at Dazi, Nyanga.



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Power lines at Dazi, Nyanga.

Nyamwanga MHS in Zimbabwe - Demonstrates geographical terrain cases where the direct penstock approach is applicable.

- Expected 30 kW
- Expected cost - +/- Euro 115.000.00
- Expected beneficiaries – 3 797 people through 1 grinding mill, 2 shops, a community energy centre, 1 school and teachers houses, honey processing centre, and agro-processing businesses.



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Hlabiso MHS in Zimbabwe Demonstrates use of decentralised micro hydro power for cable transportation in rural mountainous areas.

- Expected capacity - 30 kW
- Expected cost - +/- Euro 140,000.00
- Expected beneficiaries – 500 primary school children, agro businesses and surrounding 240 households.



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Energy Facil

Nyafaru MHS in Zimbabwe is a study case of sustainability issues of an institution run decentralised micro hydro system.

- Installed capacity - 20 kW
- Cost - Euro 20,000.00
- Beneficiaries – 720 primary and secondary school children, teachers houses, 1 rural health centre and nurse's house; battery charging facility for surrounding households.





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