CHALLENGES IN SCALING OF MICRO-UTILITIES
OPERATION, LEGAL FRAMEWORKS AND FINANCING

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DIPL.-ING. NICO PETERSCHMIDT
MANAGING DIRECTOR INENSUS GMBH
AGENDA

01 Definition of Micro-Utilities
02 Walking down the economies of scale curve
03 Transaction costs in Micro-Utilities
04 Financing along the Micro-Utility development timeline
05 Conclusions and recommendations
DEFINITION OF MICRO-UTILITIES

Micro-Utilities:

- are often SMEs with limited financial resources
- Have besides financial interest intrinsic motivation to electrify rural areas
- Need innovative approaches to be successful
- Typically supply electricity to less than 5000 customers and generate revenues of below 1 M€
### EXAMPLES FOR EXISTING MINI-/ MICRO-UTILITIES

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Unique selling proposition</th>
<th>Development Stage</th>
<th>Financing and ownership structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Power Source Group</td>
<td>Model adjusted to the framework in the Philippines, Community Energizer Platform™</td>
<td>Large pilot villages connected, preparing for replication in smaller sites</td>
<td>American founders with new local investors/shareholders</td>
</tr>
<tr>
<td>Husk Power Systems</td>
<td>Franchising approach for gasification plants adjusted to Indian conditions, entering into Africa</td>
<td>80 plants supplying electricity to 300 villages established</td>
<td>Mainly impact investors like Shell Foundation, Acumen Fund, LGT Philanthropy, Bamboo Finance etc.</td>
</tr>
<tr>
<td>INENSUS West Africa</td>
<td>PPP model adjusted to Senegalese framework, risk management model of MicroPowerEconomy, solar and small wind technology</td>
<td>Pilot village connected in 2010, replication in 30 more villages initiated</td>
<td>Joint Venture between the INENSUS GmbH and CSI MATFORCE; Mezzanine from FMO for scale-up</td>
</tr>
<tr>
<td>Wireless Energy</td>
<td>New demand side management approaches, adjusted to conditions in Chile</td>
<td>publicly funded projects, private investments planned</td>
<td>unknown</td>
</tr>
<tr>
<td>MFC Nyetaa</td>
<td>Adjusted to conditions in Mali</td>
<td>Currently preparing for seven village connections</td>
<td>Owner and Mali Folkecenter, further investors unknown</td>
</tr>
<tr>
<td>Sunlabob</td>
<td>PPP model for micro-hydro systems as in Laos</td>
<td>Pilot system installed in 2005</td>
<td>Equity from the owner, Triodos bank and FMO 2007</td>
</tr>
<tr>
<td>Energy for Africa</td>
<td>Village holds shares of the micro-utility just as the professional company.</td>
<td>Pilot system installed in Senegal</td>
<td>A medium size German utility is major shareholder</td>
</tr>
</tbody>
</table>
WALKING DOWN THE ECONOMIES OF SCALE CURVE

Foto: A Micro-Utility connects new customers
CHALLENGES IN SCALING OF MICRO-UTILITIES
OPERATION, LEGAL FRAMEWORK AND FINANCING

SMALLER GRIDS – DIFFERENT CHALLENGES

<table>
<thead>
<tr>
<th>Sales per site (logarithmic axis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000 kWh/year</td>
</tr>
<tr>
<td>100,000 kWh/year</td>
</tr>
<tr>
<td>1,000,000 kWh/year</td>
</tr>
<tr>
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<tr>
<td>1,000,000,000 kWh/year</td>
</tr>
</tbody>
</table>

Economies of scale effects

- Mini-Utility sector
- Micro-utility sector
- Inofficial sector
- Husk Power Systems
- INENSUS
- Power Source Group
- Cooperatives and small utilities
- National and large/medium private utilities in main-grids

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MANAGING DIRECTOR INENSUS GMBH
SMALLER GRIDS - DIFFERENT CHALLENGES

Decreased economies of scale effects means increased challenges in:

1. Technical system stability due to higher concurrency

2. Prevention of conflicts arising due to intransparent community decision making structures

3. Revenue stabilization due to less divers income sources of customers

4. Increasing operation and transaction costs per kWh produced requires new management approaches
COST OF ELECTRICITY PER kWh – EXAMPLE INENSUS WEST AFRICA

Targeted margin
Transaction and head office
Operation and Maintenance
Diesel Fuel
Depreciation and Interest

→ 36% of tariff are transaction and head office costs

Source: INENSUS West Africa data indicative
THE TRANSACTION COST LEVER

High transaction cost lead to high electricity prices resulting in:

1. Electricity price elasticity challenge
2. Conflicts with Regulatory Authorities
3. Conflicts with willingness / ability to pay
TRANSACTION COSTS IN MICRO-UTILITIES

Foto: Wind-Solar-Diesel hybrid power system with battery storage for village power supply designed and operated by INENSUS West Africa
CHALLENGES IN SCALING OF MICRO-UTILITIES
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TRANSACTION COSTS

1. Implementation period defined by Public Partner vs. duration to acquire permissions
2. No coverage of foreign exchange risk
3. Low tariffs vs. costs for acquisition of permissions; cost of permission acquisition must often be neglected in tariff calculation according to regulatory authorities
4. Equity needs to be spent when available vs. permissions need unpredictable duration
5. Expensive CDM application procedure cannot be covered by grants
6. CDM only applicable with large scale projects in PoA approach
7. Implementation period defined by Public Partners vs. due diligence duration of banks
8. Taxation scheme in dev. countries often not transparent to SMEs
9. Low total amount of capital required and low tariffs vs. high effort to acquire a loan
10. Long and expensive due diligence processes
11. MFIs often expect high immediate benefits from cooperation with micro-utilities and are not prepared to invest into new markets without donor support

Micro-Utility (SME)

Int. Public Partners / Donors

Nation. authorities/ministries

Nation. fiscal policy

Foreign investment guarantors

CDM / UNFCCC

Banks

Equity investors

MFIs

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FINANCING ALONG THE MICRO-UTILITY DEVELOPMENT TIMELINE

Foto: Happy electricity customers of a Micro-Utility

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### Financing Along the Micro-Utility Development Timeline

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of adj. model</td>
<td>Select village</td>
<td>Political framework and financing</td>
<td>Model implementation &amp; installation</td>
<td>Operation, Maintenance Monitoring Due Diligence for replication</td>
</tr>
<tr>
<td>PPP money or subsidies for pilot phase</td>
<td>PPP money or subsidies for scale-up</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Cashflow:

- **Core equity 1:** 20 k€ ... 100 k€
- **Core equity 2:** 30 k€ ... 150 k€
- **Core equity 3:** 100 k€ ... 500 k€
- **Core equity 4:** 30 k€ ... 150 k€
- **Core equity 5:** 20 k€ ... 50 k€
- **Core equity 6:** 300 k€ ... 10 M€

- Equity from impact investors, loans from development banks, etc.
- 0.5 M€ ... 10 M€

#### Breakeven

- Financing gap

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**Dipl.-Ing. Nico Peterschmidt**

Managing Director INENSUS GMBH
CONCLUSIONS AND RECOMMENDATIONS

Foto: Before the Micro-Utility takes over
CONCLUSIONS AND RECOMMENDATIONS

Transaction costs and related long project preparation durations are the main barriers for Micro-Utility scale-up.

Two approaches could overcome the transaction cost challenge:

1. BOTTOM-UP: Financing instruments could be set up supporting the company foundation and scale-up preparation phase where most of the transaction costs occur. The financing instruments should be a mixture of grants and early stage long term investments, preferably equity. Long term loans should be available in local currency for reasonable interest to reduce the foreign exchange risk of the micro-utility.

2. TOP-DOWN: Transaction costs can be reduced by coordinating constraints of support instruments, financing instruments and the legal framework of the respective country. Country specific private sector electrification programs involving a number of financing and support instruments adjusted to each other might be established. A mixture of both approaches might solve the problem. IRENA, UN Foundation, etc. could play a central role in the coordination process.
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CONTACT

INENSUS GmbH
Am Stollen 19D
38640 Goslar
Germany

www.inensus.com
Tel +49 (5321) 38271 0
Fax +49 (5321) 38271 99

INENSUS West Africa S.A.R.L.
10, Avenue Faidherbe, B.P. 397
Dakar
Sénégal

DIPL.-ING. NICO PETERSCHMIDT
MANAGING DIRECTOR INENSUS GMBH