Microgrid and Productive Use

by

SMART HYDRO POWER GmbH
Smart Hydro Power GmbH

Shareholder:
- Kolmsee family 36%
- eCapital (VC fund) 35%
- KfW (German development bank) 12%
- HTGF (private/public) 12%
- Private investors 5%

Smart Hydro Power designs, builds and commercializes kinetic hydropower plants from 1 kW to 100 kW and packages systems for rural electrification.
SMART HYDRO POWER offers Energy Solutions for most remote Areas

PERU

INDIA

NIGERIA

South- Africa

INDONESIA

Colombia
Lessons Learnt from Rural Micro-Grids

1. Hybrid generation minimizes need for storage and allows flexible load management

2. Load management is key for stability and costs (LCOE)

3. Productive use increases sustainability and participation
Hybrid Rural Electrification Plant

Standard module with turbine, PV, batteries and energy management system
Hydro-kinetic as Baseload Source

SMART Freestream 5 kW

SMART Monofloat 5 kW

Capacity Curve (power to velocity)
Customized Turbine Solutions
SMART Micro-Grid Controller with integrated Load Management

Off-grid Inverter
Possible as 230 / 110 V single phase or 400 V three phase, 4 kW modules up to 50 kW as synchronized systems

Integrated Load Management and Remote Control
Steering for up to eight circuits which can be managed independently or as interdependent network

Hybrid Grid-tie Inverter
AC coupled system to minimize battery load cycles. Two independent MPPT

Rectifier / Dump load Controller
Rectifying chaotic AC from wind / water turbine to DC
Peaks in micro-grids affect the performance in three ways: (1) the grid becomes more unstable, (2) higher demand on reactive load, (3) reactive load and excess energy drive costs per kWh (LCOE).

Introducing deferrable loads.
Productive Use as deferrable Load

- Most electromotors (pumps, mills, mixer) can be used in a variable manner (slow / fast) varying capacity
- Many machines run independent from labour and its outcome can be stored: water pump, ice machine
- Other machines do allow interruptions: drier, fridge, ice production
Hybrid Cellular Micro Grids with Deferrable Load

Households clustered to cells and a deferrable load connected on 220V / 400V level with hybrid PV-hydro power plant.
Marisol (Peru): No Productive Use: Learning from Mistakes
Bellavista (Peru): Community House

Bellavista - Napo
Jiri Jiri (Colombia): Electric Boat and Community House

Jiri Jiri - Putumayo
Bhamane (India): Rice Mill
Conclusions

✓ In many areas of the world hybrid solutions are more advantageous (= more stable + LCOE) than single source plants.

✓ Productive use is technically efficient (deferrable load) and allows the appropriation of the technology which makes projects long term sustainable.

✓ Rural micro grids – as all micro grids – need an advanced grid operations by load management

✓ Side Comment: Productive use require meters. In a way these meters are the technical representation of a growing differentiation within the rural society – this includes economical and social inequality.
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