Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Energising Development (EnDev) Indonesia

Productive use of energy (PUE) for Micro-hydro power (MHP) in Indonesia

Pilot Project Findings

Project Overview

- Applied research on cost-benefit assessment of PUE initiatives through promotion of off-the-shelf electrical appliances in 9 MHP-electrified villages, facilitated through 2 NGOs

PUE Pilot Project (August - December 2012)		
Province	West Sumatra	South and West Sulawesi
NGO	ProWater	OWT
Number of villages	6	3
Total number of HH	401	210
Number of businesses	38	15
Number of appliances	63	49
Value of appliances	EUR 5,630	EUR 3,640
Average appliance cost	EUR 92/appliance	EUR 74/appliance
Average appliance power	587W	461W
Smallest appliance	10W egg incubator	100W sewing machine
Largest appliance	1,500W rice huller	900W circular wood saw 900W coffee grinder

Project Assumptions

- PUE will **strengthen** the sustainability of community-based **MHPs** by expanding the revenue potential (increased electricity sales) and improving overall MHP cost effectiveness (optimisation of capacity factor)
- PUE appliances will **improve** production and **income** and reduce work load and overall expenditure of rural businesses
- Numerous small-scale, **off-the-shelf appliances** spread across several businesses are more cost effective and less technically vulnerable than single specialised/customised large appliance.

- **Study conducted in 53 rural businesses, using 112 electrical appliances, in 9 villages in Indonesia (Sulawesi and Sumatera) over 5 month period**

- **Project Examples and Anecdotal Feed-back**

- By using desk light, they can work in the evenings after household chores
- In West Sulawesi, 3 tailor groups increased their monthly profit by 30% - 40%
- By having embroidery and lockstitch machines in-house, they do not need to travel to town for such service

Tailor group in Paninggiran Bawah, West Sumatra. Working on clothes using manual sewing machines may take around 3 weeks. Through an electric sewing machine, the production time is reduced to 3 days. However, for some artwork and finishing, the villagers still prefer to use the manual appliance.

- In Tawalian Timur and Salumokanan, monthly profit increased by 20% for basic repairs
- Tandung, the profit increase was 40% due to modifications and enhancements

Motorbike modification in Tandung, West Sulawesi. Normal motorbike ride to Masamba takes up to 4 days. By improvising the motorbike suspension, the distance can be covered in 2 days. Such modification was usually done in Masamba, 30-40km from the village. The workshop also does spray painting work.

- Carpenters use the widest variety of electrical appliances, all readily available at hardware retailers.
- The use of electrical appliances speeds-up the jobs; for instance to make one cupboard normally takes six days, by using these appliances only takes three days.
- The carpenter at Sungai Keruh, Sumatera, made an average monthly profit of over Euro 1,900.

- Bread making is a popular side-job and done by housewives to supplement household income.
- In Sulawesi, monthly profit increased by 20%. This equals an average additional profit of almost EUR 10 per month. At a total cost for the appliances (blender and mixer) of Euro 50 this implies a payback period of 6 months. The benefit of time saving is not considered.

- A blacksmith mostly produces and maintains agriculture utensil such as hoe, axe, scoop, machete, sickle, scythe
- A metal grinder and blower are the most common appliances, costing a total of Euro 108.
- The blacksmiths in Sulawesi increased monthly profit by almost Euro 20 (30%)

- Most of community sell dry coffee cherries without grinding at a price of about Euro 0.60/kg. One kilogram of coffee cherries yields about 0.7 kg of ground coffee. This ground coffee sells at about Euro 2/kg.
- An electric off-the-shelf coffee grinder costs about Euro 100, and has a production rate of about 36 kg/hour.

Petrol-operated rice huller in Agam District, West Sumatra. These mobile units (about 5kW) have provide rice hulling services to communities for a long time, at sufficient quantity and quality to remain a popular option.

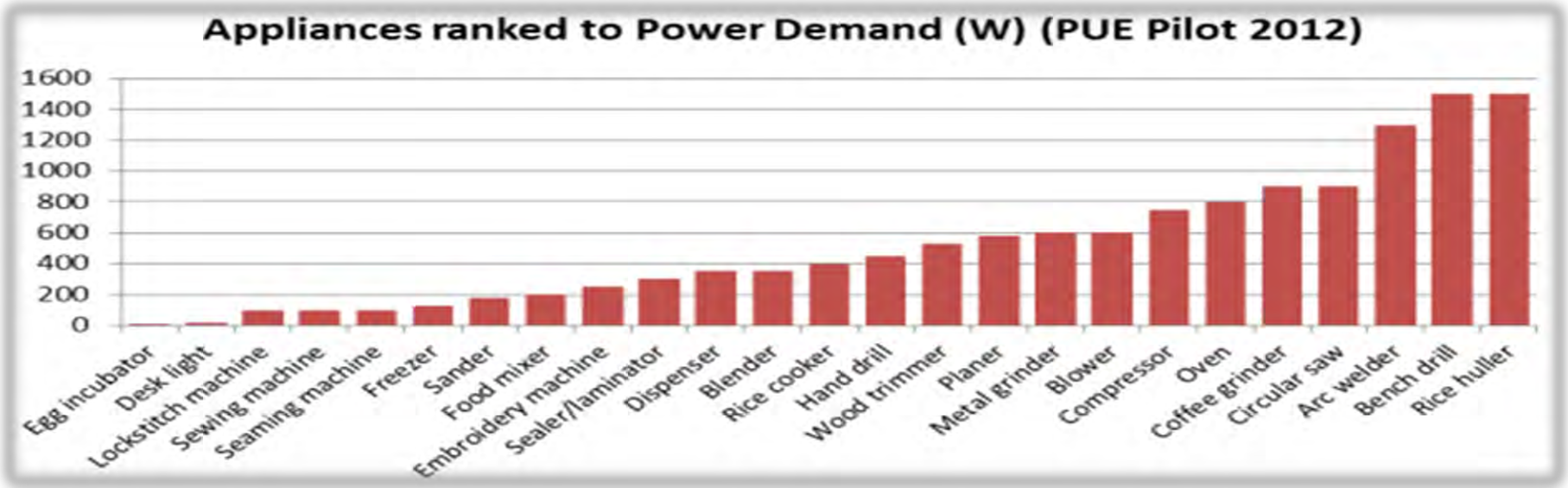
Trouble appliances:

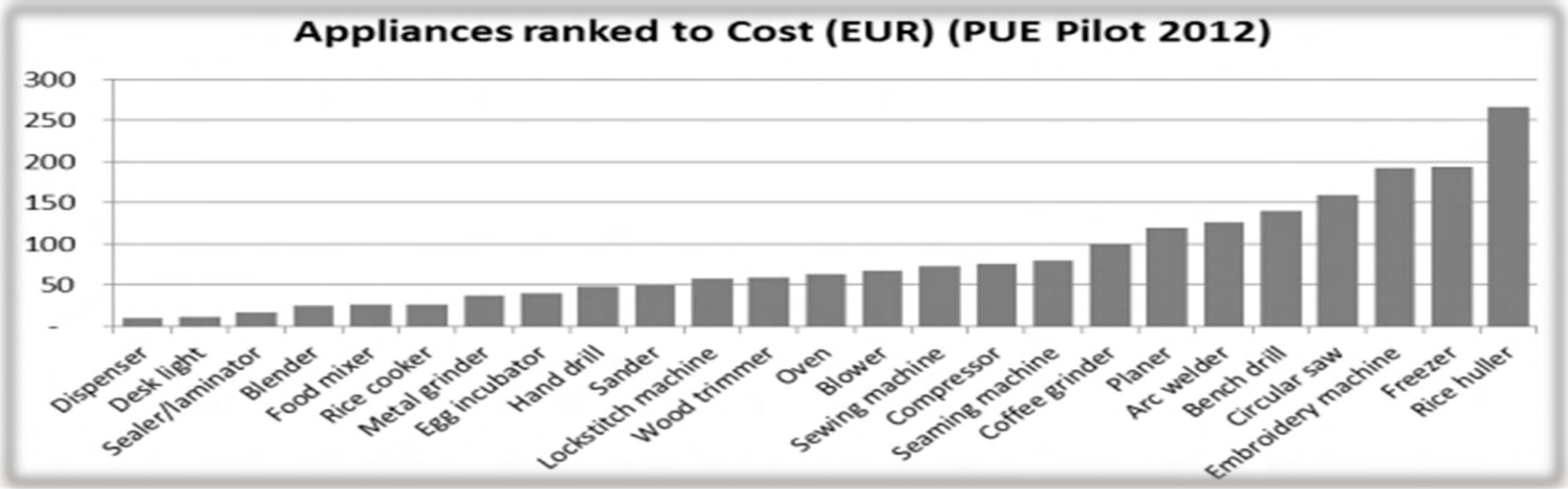
Egg hatchery (10W, Euro 40)

- Too low power to hatch the eggs.
- Vulnerable to power supply disruptions (due to incubation interruption)
- The business made a loss.
- At the moment the community (assisted by ProWater) is trying to modify the equipment.

Rice huller (1.5 kW, Euro 266)

- Low quality of rice and low output rate, compared to the petrol-fuelled rice huller.
- Power demand required installation at power house, which was inconvenient for community.


Appliances ranked to Power Demand (W) (PUE Pilot 2012)
1600
1400
1200
1000
800
600
400
200
0
Egg incubator
Desk light
Lockstitch machine
Sewing machine
Seaming machine
Freezer
Sander
Food mixer
Embroidery machine
Sealer/laminator
Dispenser
Blender
Rice cooker
Hand drill
Wood trimmer
Planer
Metal grinder
Blower
Compressor
Oven
Coffee grinder
Circular saw
Arc welder
Bench drill
Rice huller


Appliances ranked to Cost (EUR) (PUE Pilot 2012)
300
250
200
150
100
50
-
Dispenser
Desk light
Sealer/laminator
Blender
Food mixer
Rice cooker
Metal grinder
Egg incubator
Hand drill
Sander
Lockstitch machine
Wood trimmer
Oven
Blower
Sewing machine
Compressor
Seaming machine
Coffee grinder
Planer
Arc welder
Bench drill
Circular saw
Embroidery machine
Freezer
Rice huller

- **Conclusions**

Conclusion: Appliance performance

Business	Electrical appliances
Blacksmith	Metal grinder, blower
Bread-making	Blender, mixer, sealer/laminator
Carpentry	Hand drill, sander, planer, trimmer, circular saw, metal grinder, compressor
Coffee grinding	Coffee grinder
Egg hatchery	**Egg incubator**
Rice milling	**Rice huller**
Tailor	Sewing machine, embroidery machine, lockstitch machine, seaming machine desk light
Warung (Kiosk)	Oven, freezer, water dispenser, blender, rice cooker, food mixer
Workshop	Compressor, bench drill, arc welder, metal grinder

- **Only specialised appliances (10W egg hatchery and 1.5 kW rice huller) failed**
- **Average cost of appliance Euro 83**
- **Average power demand 533 Watts**

Conclusion: Business performance

- 72% of businesses made a profit
- Group-operated businesses increased monthly profit by 20% to 40% compared to baseline (3-month prior profit)
- Businesses that relied on specialised equipment made a loss
- Individual-operated businesses performance varied considerably according to entrepreneur skill, market access and business size
- Community-operated businesses made a loss (was considered “community service”)

Conclusion – MHP performance

Description	Sumatra						Sulawesi		
	Lembah Derita	IMPP	Paninjauan	Paninggiran Bawah	Wonorejo	Sungai Keruh	Salumokanan	Tawalian Timur	Tandung
Income collected from households (EUR/month)	76	40	200	60	320	480	120	48	52
Income collected from PUE (EUR/month)	No special tariff for PUE applied. The business owners pay only the household tariff.						20	14	14
Total expenses for salary and maintenance (EUR/month)	36	21	182	46	92	300	88	25	36
Number of connections	22	42	99	28	139	70	90	51	70
Difference (%) pre- and post-PUE in MHP profit	0%	0%	0%	0%	0%	0%	+63%	+60%	+88%
Increased MHP operating time (hours/day)	0	0	0	0	+4	0	+8	+8	+8

- **In Sulawesi the average 5 businesses per village, increased profit for MHP operation by at least 60% (increased total turn-over by 17%- 29%)**

http://endev-indonesia.or.id