MICRO HYDRO EXPERIENCE IN NEPAL
BARPAK RURAL ELECTRIFICATION

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BACKGROUND NEPAL

- Economic hydroelectric potential of about 40,000 MW, only about 700 MW used (54 MW of this suitable for plants < 1 MW)
- Extension of national grid expensive, time consuming and difficult.

- Micro, mini hydro projects very appropriate for mountainous rural areas.
- Simple and inexpensive technology with locally manageable resources.

- In addition: rich in solar resource (annual average insolation 5 kWh/m^2/d), high wind energy potential in high Himalayan plateaus, biogas highly feasible below 1000 m.

BARPAK RURAL ELECTRIFICATION

	New extended MHP system		Old MHP system
Plant capacity	130 kW		50 kW
Design flow	90 l/s		100 l/s
Gross head	193 m		96 m
No of connections	1,186 households		564 households
Transmission line	12 km LT line 2.8 km MT line (11 KV)		6.4 km LT line 1.8 km MT line
Total Project cost	USD 158,000 (including old structural components)		58,022 USD
AEPC subsidy	48 % (USD 74,100)		20 % (11,600 USD)
Loan	40 % from relatives		60 % (34,810 USD) Agricultural Development Bank, Nepal
Equity	12 %		20 % (11,600 USD)

INITIATION

- 1989 dynamo water mill
- government level announcement on subsidies for alternative energy sources
- 1991 electrification of Barpak village through a 50 kW hydro plant owned and operated by a private developer (Barpak Rural Electrification Pvt. Ltd.); 60% loan, 20 % subsidy, 20 % equity
- Bir Bahadur Ghale from Barpak initiated project and founded company
- Operation on participatory basis (public hearings, mass meetings etc.)

50 KW MHP (1991-2004)

- Flat tariff system: 1watt = 0.012-0.018 USD/month.
- Lighting load: Morning (2-3 hours), Evening (4-6 hours).
- generated power at day time used for 5.5 kW agro processing mill (monthly revenue at that time: ~270 USD from MHP and ~350 USD from mill)
- *Economic status of project was weak as the maximum load factor was only 20-25% (despite the mill; mill was only productive use at that time).*

50 KW MHP (1991-2004) LESSONS LEARNED

- Flat tariff system (per W) to be change, metering system needed with payment per kWh
- Economic status of the MHP project can be improved with productive use → already ~ 27% of revenue from 5.5 kW mill
- BUT: need for more productive use!

  → identification and assessment of various cottage industries, meaning existing indigenous businesses to be "modernised" to use electric appliances, e.g. carpentry, black smith

  → result see next slide

50 KW MHP (1991-2004) END USES (AFTER AWARENESS RAISING AND TRAINING)

End uses	Production	Used power	No. of direct employment	Operating time
Two Mills	Agro processing	5 kW, 5 kW	2,2	6AM- 5 PM
Furniture Mill	Furniture for local villager	7 kW	7	9AM- 5PM
Bakery oven	Bread, dough-nut , Biscuits	6 kW	2	12PM-5AM Post mid-night
Nepali handmade paper	Export quality, handmade paper	10 kW	35	Post mid night
Metal work	Make metal, doors and windows	6 kW	2	9AM -5PM
Video parlour	Films show	-	4	Night 8PM-11PM
Rope way	Goods Transportation	10 kW	6	9AM-5PM

OLD MHP: NEPALI HAND MADE PAPER, CARPENTRY , GOODS TRANSPORT ROPEWAY

130 KW MHP (2004-) TARIFF SYSTEM

Purpose	Type of Supply	Minimum Charge in USD/month (2017: 100 NRs = 1 USD)	Rate above minimum (USD/ kWh)	Operating time
Domestic	1 phase, up to 5A	25 units = 1.5 USD	0.07	24 hour
Commercial industries/ Dedicated lines	3 phase, up to 25 kVA		0.1-0.12	24 hours
Day time cottage industries	3 phase, up to 10 kW	30 USD	0.08-0.1	7 am – 6pm
Off hours cottage industries	3 phase, up to 20 kW	10 USD	0.03	11 pm – 5 am

lines for industries which require 24 hour service are called **"dedicated lines".** The type of supply is in kVA as transformers are used to supply 11kV to them.

130 KW MHP (2004-2017) PRODUCTIVE END USES (AFTER EXTENSION OF MHP)

SN	Type of End Uses	No. x	Max. load (kW) of number x of appliances	Products	Direct employment
1	Agro processing mills	5	20 kW	Rice husking, Grinding	10
2	Oil Expeller mills	2	12 kW	Oil expelling	3
3	High vision hall	1	1.2 kW	Entertainment	2
4	Cyber café	1	0.8 kW	Internet surfing	3
5	Photo studio	1	0.8 kW	Photo printing	2
6	Metal work shop	2	12 kW	Metal work	5
7	Stone cutting mill	3	15 kW	Stone works	6

130 KW MHP (2004-2017) PRODUCTIVE END USES (AFTER EXTENSION OF MHP)

SN	Type of End Uses	No. x	Max. load (kW) of number x of appliances	Products	Direct employment
8	Bakery (off hours)	1	12 kW	Bread, Cookies, etc.	3
9	Mobile Tower	3	12-20 kW	Back up for Tower	3
10	Feed mill	1	4.5 kW	Feeds	2
11	Furniture mill	2	13 kW	Furniture	14
12	Cable TV	1	1.2 kW	Entertainment	3
13	Electronic repairing center	3	1.2 kW	Electronics parts repair	3
	Total	26	**105.7 kW**		58

STONE CUTTER MILL /METAL WORK SHOP

WIRE LESS INTERNET SYSTEM & MOBILE TOWER)

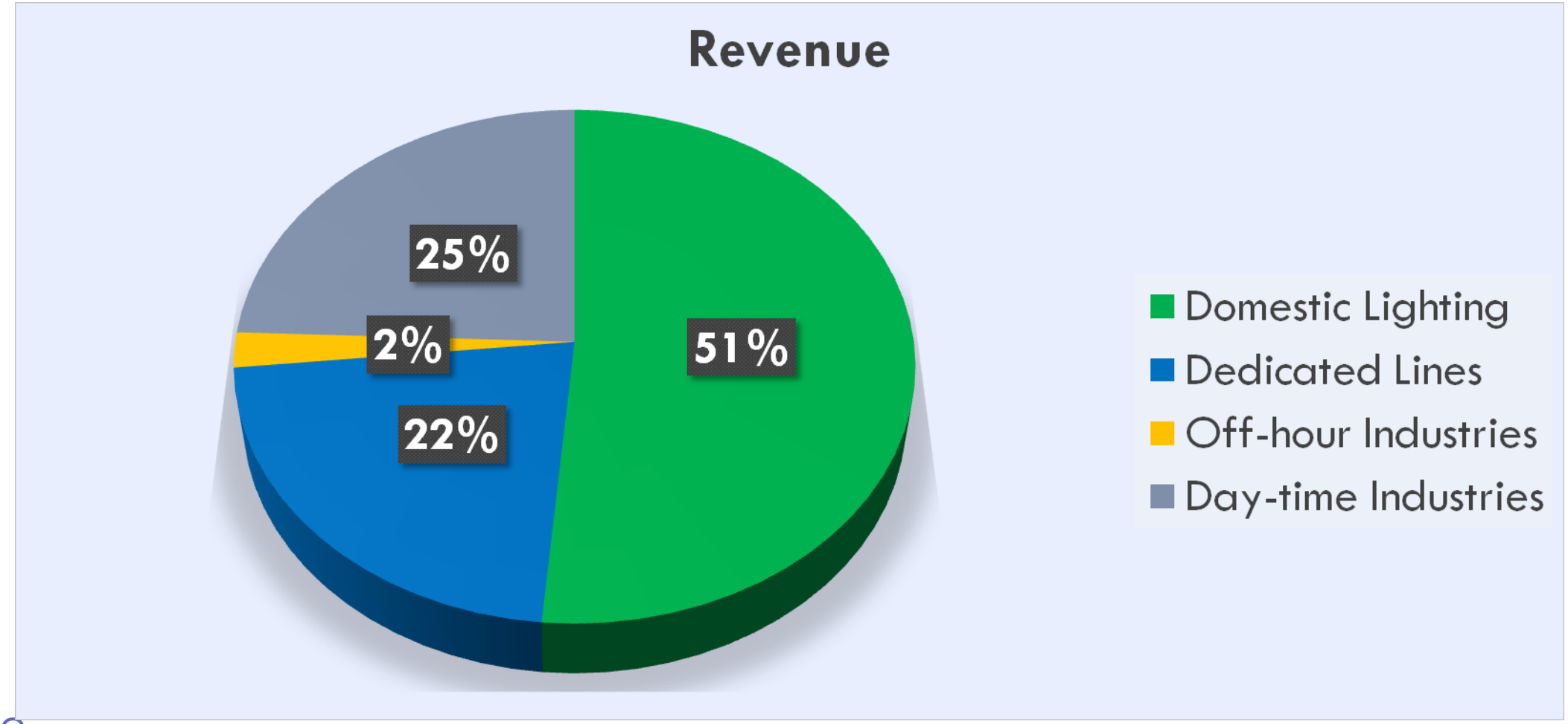
BAKERY

METAL WORKS

CARPENTRY

PHOTO STUDIO/COMMUNICATIONS

130 KW MHP (2004-2017) REVENUE



PRESENT ENERGY SCENARIO IN BARPAK

- Today about 400 households (from 1,180) use electricity for **cooking** and other **household activities.**
- 2015 April Earthquake with epicenter in Barpak → increasing energy demand due to **reconstruction** and **development activities.**
- Now additional energy 500kW required to fulfill energy demand which is increasing by 10-12 % per year (head at this site can be increased + additional flow available; but not enough for 500 kW).
- **Regulation of energy tariff** needed to better **balance** load between peak and off-peak hours

SUMMARY ON HOW PEU WAS DEVELOPED

1. Mill establish to meet local demand (essential for population)
2. Awareness raising on PEU: promote skilled locals and introduce new technologies + access to finance for entrepreneurs to buy appliances (loans from Agricultural Development Bank and local micro finance institutions → "modernisation" of existing local industry which used other forms of energy (bakery, metal workshop etc.)
3. Introduce fair and transparent tariff system ; utilize excess energy during minimum load hours by introducing Dynamic Tariff System with seasonal tariff managed by smart meters.
4. From 2. and 3. generate more revenues for the MHP and more employment in the village
5. Expand MHP capacity as consumption grows, or even better, design the MHP from the very beginning also for all developing PEU!

CONCLUSION

MHP can not only meet lighting requirements but also substantially **improve livelihoods**

Study possibilities of **PEU already during feasibility** to ensure correct design

Employment & income generation, information and communication flow, enterprise development, etc. are the interlinked areas MHP can support.

Future focus on a) soft loan facilities and b) facilitation of small and medium enterprise development, both to maximize load factor of MHP

Private sector needs to invest and develop initiatives while government maintains stringent assessments and regulations (for fast and easy access to subsidies).

Loans and subsidies **for MHP as well as for PEU** should be accessible to **privates, cooperatives and other interested stakeholders**

THANK YOU

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