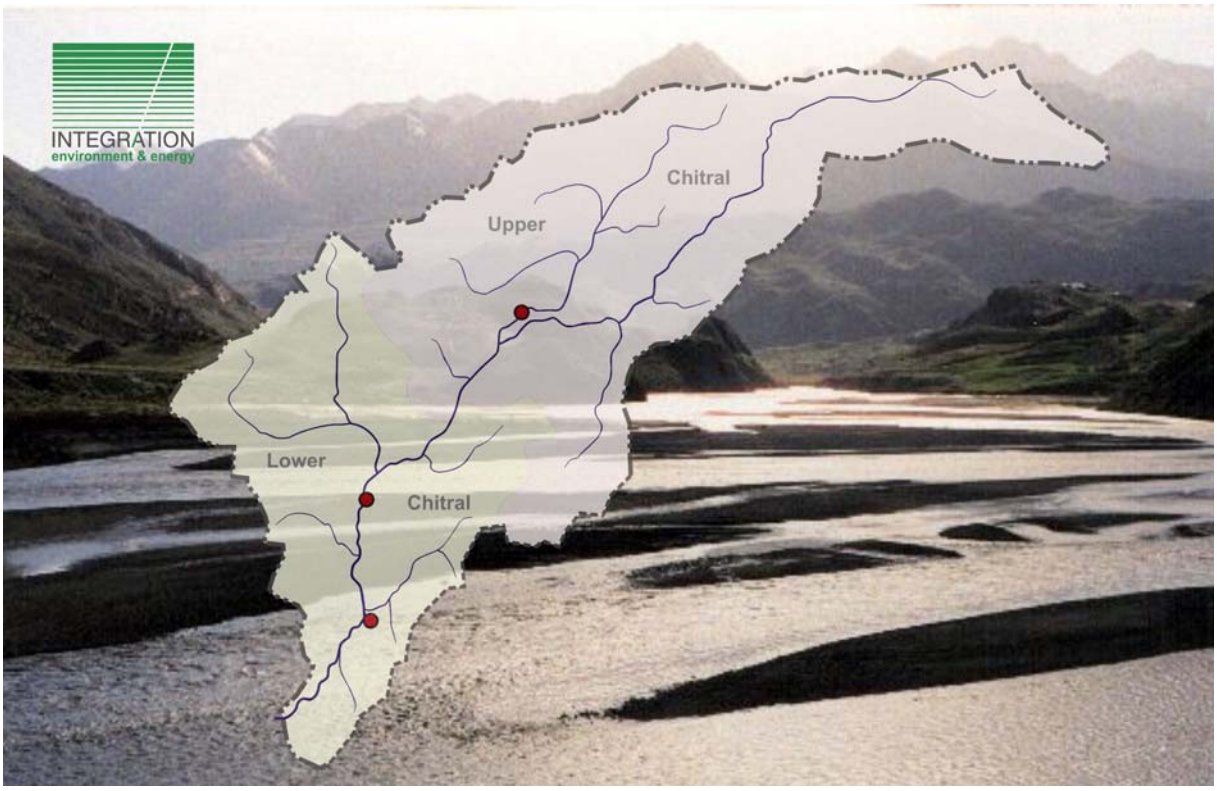
Productive Use of Energy in Chitral District, Pakistan



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Study Team:
Ulrich Frings
Irshad Khan
Christian Lempelius
Marlene Richter

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ABBREVIATIONS

AEDB	Alternative Energy Development Board
AJK	Azad Jamnu Kashmir
AKDN	Aga Khan Development Network
AKF	Aga Khan Foundation
AKSRP	Aga Khan Rural Support Programme
CADP	Chitral Area Development Project
CCS	Chitral Conservation Strategy
EU	European Union
FMFB	The First Micro Finance Bank
GEF	Global Environment Facility
GHG	Greenhouse Gas Emission
GTZ	Gesellschaft für Technische Zusammenarbeit mbH
HH	Household
HPP	Hydro Power Plant
IUCN	International Union for the Conservation of Nature
IPP	Independent Power Producer
KADO	Karimabad Development Organisation
KESC	Karachi Energy Supply Corporation
KWh	Kilowatt hour
LPG	Liquid Petroleum Gas
MACP	Mountain Areas Conservancy Project
MDG	Millennium Development Goal
MFI	Micro Finace Institute
MH	Microhydel
MHP	Micro Hydro Plant
MMA	Muttahida Majlis e Amal
NA	Northern Area
NGO	Non Governmental Organization
NWFP	North-West Frontier Province
PCAT	Pakistan Centre for Appropriate Technology
PCRET	Pakistan Centre for Renewable Energy Technology
PIA	Pakistan International Airlines
PMU	Project Management Unit
PURE	Productive Use of Renewable Energy
PV	Photovoltaic
Rs	Pakistani Rupee
SDA	Swiss Development Aid
SHP	Small Hydropower Plant
SHYDO	Sarhad Hydel Development Organization
SMEDA	Small and Medium Enterprise Development Authority
SRSP	Sarhad Rural Support Programme
SURE	Social Use of Renewable Energy
UC	Union Council
UNDP	United Nations Development Programme
VO	Village Organisation
WAPDA	Water and Power Development Authority
WO	Women's Organisation
WWF	World Wildlife Fund

Exchange Rate: 1 US$ = 60 Rs

0 EXECUTIVE SUMMARY

1 Framework Conditions

a Objectives and approach

1. The report aims to analyse the potentials for productive use of renewable energy in Chitral district. The results shall found the basis for the preparation of a PURE project. Productive use of renewable energy comprises the combination of energy supply with measures to initiate rural economic development for income generation and job creation. From about 43 initially selected sites, 5 have been finally selected as pilot sites: Izh-Ovirk, Bilphok/Shogore, Shagram, Bumburate, and Harchin-Raman. Each project site represents a single sub-project with its own results and impacts.

b Rural power supply

2. Rural electrification has always been a central objective for power sector reforms in Pakistan. But there is no firm Government policy for the development of decentralized power supply. From the 170,000 villages having no access to electricity, about 40,000 are planned to be connected to the national grid within the next decade. The remaining one have to be supplied by decentralised options of which only hydropower can provide sufficient capacity to initiate rural economic development

2 The Project

a Project objectives and goals

3. The project's overall goal is to contribute to poverty reduction and protection of natural resources in rural Pakistan. The project aims to overcome the institutional, organizational, technical and financial barriers which hamper the introduction of a sustainable decentralised electricity supply in rural areas for economic growth, income and job generation, and poverty reduction. It aims also to reduce the threat to natural resources and addresses two problem areas, rural poverty and protection of natural resources such as forests by providing alternative energy sources to the consumers. Beside, the project will contribute to the MDGs and to the reduction of greenhouse gas emissions (GHG) through the utilization of renewable energy sources. GHG reduction will be also achieved by replacing existing diesel engines and generators by electricity from MHP.

4. The project is based on an **innovative approach to rural electrification** (**"Quality Electricity Plus; QEP$^+$**) by using renewable energies. Rather than focusing on providing access to energy as project objective, the project aims to provide electricity as a basic tool to initiate value added productive chains in rural areas. Thus, access to modern reliable energy is the driven force behind a productive process that will generate income and improve living conditions for the rural population. The support of local entrepreneurs in developing, establishing and running a business is another key factor of success. The project will assess applicability of a variety of delivery mechanisms for productive uses and subsequently demonstrate the selected models.

5. The project will be based on strong participation of municipal governments as well as local communities to enhance synergies for the implementation and demonstration of technologies and production methods.

6. A comprehensive concept on **poverty reduction** through rural economic development will be elaborated and demonstrated at the proposed five pilot sites. The provision of electric power for productive use combined with assistance in start-up of small businesses, technical and business qualification and access to credits will address the village population directly. Protection of natural resources (in this case mainly wood) through the provision of alternative energy sources plays another important role.

b Barriers to be removed

7. Main barriers have been identified as

- I**nstitutional and policy barriers:** The rural decentralized power supply sector is not well structured. Supply strategies mainly concentrate on central supply options and "big solutions". There is a considerable lack of experience with alternative supply concepts and strategies for rural electrification. In addition, there is a lack of dialogue between potential energy developers and government. The existing policy framework is not sufficient to respond to the real needs of rural electrification. The project measures will support the elaboration of a decentralised rural power supply strategy for rural areas in Pakistan.
- **Technical barriers** include the lack of local manufacturing and repair capacities for micro and mini hydropower equipment, insufficient design and planning know how especially in the mini and micro hydro sector with respect to operational sustainability. Adequate measures including training seminars, initiating cooperation between national and foreign companies, and development of adopted standard design and technical lay-outs will support the development of a national market sector.
- **Operation and management barriers:** Management of decentralised power supply units requires certain structures, principles and knowledge which are currently not fully available in Pakistan. Careful and responsible operation is difficult in case operators are anyhow paid by the public, are earning very little money from their job and when nobody really takes care on their performance.
- **Information barriers:** Lack of awareness of and information about productive use potential, and the cost and benefits among potential users, vendors, and other stakeholders. Dissemination and replication are the main instruments to spread information among the stakeholders and throughout the country.

c Implementation agency

8. It is suggested to set-up a market-oriented "Agency for the promotion of productive use of renewable energy (**AforPURE)**" in Chitral town. Since the most viable source of renewable energy in Chitral district is hydropower, the focus is on the promotion of micro and small hydropower. **AforPURE** should be locally based and structured in a way that it can easy be copied to other areas. It will act independently, establish its own network, writes project proposals and looks for further national and international funding. The agency will only consist of 3 to 4 core professionals with

technical and socio-economic competence. They will cooperate and network closely with local social, technical, financial, grass root as well as government partners.

3 Project region

a Socio-cultural characteristics

9. The District of Chitral (NWF Province) in the northern part of Pakistan is one of the remotest and isolated regions in Pakistan inaccessible by road during winter months. Chitral's population stands at 369,000 at the end of 2004. Close to 90% of the population resides in 463 rural settlements, ranging in size from 20 to 3,573 inhabitants. Chitral town is the only urban settlement in the district, with 20,622 inhabitants.

10. The population of Chitral comprises a variety of ethnic groups with different production systems, know how, customs and languages. Next to the traditional power structure of clans and the relatives of the former king a second layer of different interests and power forms religion. In Chitral District the majority of the population belongs to the Sunni group of Islam. Mainly in the Central and Northern part of the district there are villages which adhere to the Ismaeli Shiite school. The Kalash indigenous people living in Rumbur, Bumburate and Birir valley adhere to their traditional belief if they are not converted to Islam.

11. In addition **various political parties**, strives for members and influence.

b Economic characteristics and main sources of income

12. Farming, livestock (sheep, goats) and remittances from unskilled migrant labour are the three major sources of livelihood. Main crops are maize, rice, barley and wheat. Farmers can harvest twice a year on about 50% of the cultivated land mainly in the south of the district. The area north of Booni belongs to the single cropping area. Besides cereals for subsistence households cultivate vegetables like potatoes, chillies and onions and fruit trees such as apricot, walnut and apples. Some unskilled labourers work in the Gulf States and in the urban areas of Pakistan. They contribute considerably to their family's living expenses. A small part of the population is employed locally in government schools, dispensaries, and some other government departments or as servicemen (Chitral scouts) at the Afghan boarder. 17% are governmental employees, and 10% are engaged in private services. Only 6% of the population is working in businesses. All in all only 24% of the population is working in a productive sector outside of agriculture.

13. Per capita income rose from 3.233 Rs in 1991 to about 11,090 Rs in 2001. which is low compared with other districts in the Northern Areas. This difference is also expressed by the low real growth rates of 0% in 1994 - 1997 and 3% in 1997 - 2001, reflecting less than half of the respective GDP growth rate.

c Economic growth potential

14. Chitral's mineral reserves have not been systematically explored, but are believed to be rich. The potentials in the handicraft sector include traditional handicrafts

as textiles (Patti) for which the region is well known and workshops for daily repairs and manufacturing of daily articles. Eco-Tourism has high potential as well (mountaineering, trekking, indigenous Kalash people). Irrigated agriculture and fruit plantation are potentials in the agricultural sector which can be exploited in the presence of water.

d Electricity demand

15. Today rural household's electricity demand and consumption is minimal in comparison with household's overall energy demand and consumption. Cooking and space heating account for over 95% of household energy demand in rural areas and 90% in urban areas. The decision which fuel to use depends on the heating and cooking habits of the households, on the availability and prices of fuel sources and on the general financial ability and willingness to pay for fuel. In the visited areas all households used electricity for lighting, but as well pine wood torches, kerosene lamps and seldom candles. In rare cases even liquid gas is used. The demand for electricity is indicated by the the distribution of present electric HH appliances. Better-off HHs bought various HH appliances hoping that their use would be possible. However due to insufficient capacity of existing supplies (if there is any) the use of appliances is limited. Nevertheless the purchase of these appliances and the utilisation of other energy sources such as diesel engines indicate a high potential demand for more and quality electricity.

e Selection criteria and results

16. The following socio-economic criteria were applied for the final site selection:

- **Number of households**. The number of HHs in the area planned to be supplied with electricity should be large enough to allow for some productive processing and service uses to safeguard maximum load factor of the envisaged capacity of the MHP. This criteria would also ensure the likely presence of a certain number of social and business services such as schools, hospital or health care centres, banks as existing or potential users of electricity. The minimum target was set at 400 HHs. In total about 4.000 HH were selected at five sites. The estimated population in these areas is about 35.200 persons.
- **Homogenous village situation.** All of the proposed villages are well organised and quite homogeneous. Households are open-minded. Together Ismaili and Sunni HHs already joined overall development activities in the respective villages.
- **Cash income**. Most of the households cannot survive on their agricultural income and need other cash income resources. Main cash income sources are government salary and pension pays (teachers, police and ex-servicemen). Seasonal migration out of Chiral and remittances are part of almost every rural HH income and constitute an important element to improved living standards. Due to established links for seasonal labour the majority of the HHs is able to be self-sufficient complementing income from subsistence farming with cash income generated off-farm
- **Gender awareness.** Women should benefit from project activities as much as their male colleagues. Productive electricity use and the use of household appliances increase the options for women to save labor and time. Gender awareness in the HHs helps to decide between different options and use the available potential.

- **Access to market**. The major markets are situated in Chitral or Booni in the North and Drosh/Ayun in the South. All villages visited are accessible from Chitral town by a four wheel drive car within 2 to 6 hours. Transport to and from the village is done by private local jeep taxis stationed in the village. However, in winter many times the valleys are not accessible by road.
- **Contribution to MPH construction.** As the communities will be the owners of the MHP, the population should contribute to the planning and construction process of the MHP by cash, material or labor. All villages proposed for a larger MHP installation were ready to contribute either in cash or in labor force.
- **Willingness and ability to pay for electricity**. In future all HHs are ready to use meters and pay according to their kWh consumption. The income situation of the HHs in the proposed areas allows for covering of all operational, future system repair and maintenance cost by mutually agreed tariffs. Up-scaling the electricity supply and installing meters will not negatively affect poor households.
- **Potential of productive energy use.** The whole concept is based on productive use of energy. The general growth potential of a village or selected area is determined by its agricultural, husbandry or horticultural surplus production, by value-adding processing opportunities, by its mineral resources, by its tourist attractions, by other potential business services and by the purchasing power of its own community. In most villages or proposed locations the general economic development potential is good. Villagers are aware of some electric equipment for productive use, but more technologies and value-added opportunities need to be introduced.

17. In each of the area a micro hydro power station with capacities of 200-300 kW will be constructed providing power for productive use. Capacity was designed according to productive need rather than to household needs in order to optimize plant factor (set as approximately 60%). Thus, the power stations are all economic feasible.

Economic analysis

Indicator	Izh -Ovirk	Bilphok-Shagore	Shagram	Raman – Harchin	Bumburate
Total Investment (US $)	724,710	693,420	558,740	688,520	660,240
Installed Capacity (kW)	300	300	200	300	300
Cost per kW installed capacity (US $)	2,416	2,311	2,764	2,295	2,201
Operational Cost/ year	49,083	47,205	39,124	46,911	45,214
Tariff (initial increase 4% p.a.; later 3% + 2%)	0.02	0.02	0.02	0.02	0.02
Cash Flow positive after: (years)	1	2	2	2	2
Full cost recovery after: (years)	4	6	4	4	4
Pay back period (years)	11	16	12	12	14
Surplus revenues (US $) after 25 years	956,799	266,444	594,044	715,253	523,604
Internal rate of return (%)	12	7	11	11	10
NPV (5%) in US $	440,294	110,629	268,013	324,995	231,841
NPV (10%) in US $	87,307	88,805	26,120	31,507	15,125

Total ranking of villages surveyed							
Rank	**1**	**2**	**3**	**4**	**5**		
Criteria/Villages	**Izh-Ovirk**	**Bilphok Shogore**	**Shagram**	**Bumburate**	**Raman/Harchin**	**Beyori valley**	**Birir valley**
• **Number of HHs**	**4**	**3**	**6**	**5**	**5**	3	1
• **Benefits balanced between relig. Goups**	**5**	**4**	**6**	**6**	**2**	5	5
• **Homogenous village situation**	**6**	**6**	**5**	**6**	**5**	2	5
• **Cash income sources**	**6**	**6**	**6**	**4**	**6**	4	2
• **Gender awareness**	**6**	**6**	**4**	**4**	**5**	2	3
• **Willingness to contribute to construction**	**6**	**6**	**5**	**5**	**5**	1	3
• **Willingness and potential to pay for electricity**	**6**	**6**	**5**	**4**	**5**	4	3
• **Management capacity for a MHP (Self help capacity)**	**6**	**6**	**4**	**3**	**4**	1	2
• **Present HH electricity demand**	**6**	**6**	**5**	**3**	**4**	2	2
• **Potential of productive energy use**	**6**	**6**	**6**	**4**	**4**	2	2
• **General growth potential**	**6**	**6**	**6**	**6**	**4**	2	2
• **Access to market**	**5**	**6**	**4**	**4**	**2**	4	2
Total score	**68**	**67**	**62**	**55**	**51**	32	31

Based on our rapid assessment the areas of Izh-Ovirk (1), Bilphok/Shogure (2), Shagram (3) and Bumburate (4) are likely potential sites for productive use of electricity. Due to its severe shortage of local fuel wood and expensive fuel wood "imports" from southern Chitral, Harchin/Raman (5) in the north would be an excellent site to introduce electric heater devices. The proposal for these pilot demonstration sites is in particular based on the consideration of a balanced cultural as well religious development approach and a successful implementation. Much more potential sites for further up-scaling do exist.

18. The hydropower station is definitely the least cost option when compared with other energy options in the area. In addition, supply of gas, kerosene and diesel can not be assured during at least 5 months in winter (closed roads). Necessary storage facilities require additional investments and running costs. Extension of grid is also not economic viable due to the large distances and comparably low demand. In addition, the current WAPDA tariffs exceed the local tariffs used in the analysis by 100%.

f Project costs

19. Project costs include

- technical design and supervision of construction
- investments for the power stations
- technical assistance for the establishing of the hydropower management
- technical assistance for support of activities in the framework of productive use of electricity including business and technical training, micro-credits, marketing and product development
- elaboration of strategies for dissemination of results.

Summary of Project cost (all figures in '1,000 US$)					
	Project area				
Cost item	**Izh-Ovirk**	**Bilphok-Shagor**	**Shagram**	**Raman Harchin**	**Bumburate**
Construction	520	500	400	492	475
Contingencies construction	130	125	100	123	119
Sub-Total construction	**650**	**625**	**500**	**615**	**594**
Planning, design, supervision	62	60	48	59	57
Contingencies planning	15	15	12	15	14
Sub-Total Planning	**77**	**75**	**60**	**74**	**71**
TA PURE	300	300	300	300	300
Total	**1,027**	**1,000**	**860**	**989**	**965**

20. The total project cost are about **4.841 Mio US$.**

4 Impacts and Benefits of the Project

a Social benefits

21. Access to electricity contributes to poverty alleviation and to sustainable human development. Electricity is essential for the provision of quality community services especially of educational and health services and of water supply. It has also tremendous positive impacts on rural households, particularly on children and women who bear the responsibility and hardship of main household work. Access to lighting, information and communication improves the living conditions of each household, reduces migration to the urban centres and improves the attractiveness of the community for well educated and professional service people like teachers, doctors, etc.

b Economic benefits

22. Access to electricity is one of the essential pre-conditions for improving the living conditions in rural areas through the creation of job and income opportunities; initiating local economic activities for a sustainable rural development; improving of health and education; substituting fuel wood by electricity to protect the forest resources and for poverty reduction. Skilled jobs are created through operation and management of power station, the demand for electric installations in houses and the repair of electric appliances and machinery. Services like tea houses, restaurants, video shops, workshops (i.e. machinery repair, welding, wood work, stone processing) also create jobs and improve the access to local services (which often results in additional cost savings due to saving of transport cost and time). Electricity can operate irrigation pumps to increase agriculture production, change from subsistence to cash crop production or add value by further processing. Apart from productive use, electricity substitutes other energy sources in households as wood, kerosene and candles usually at lower costs. After the first three years of operations total benefits at all five sites are in the range of US $ 475,000 – 560,000 added value through production or services, approx. 1,500 persons are (self) employed and have generated US $ 600 – 750,000 additional income.

Expected economic impacts at proposed sites after 3 years

Impact per Site	Annually Value-added	(Self)Employment	Annual Income
- At MHP	High level of maintenance	8 employees	US $ 5,000
Collection of fees	In the range of US $ 13,000 – 16,000 annually per site		
MHP Saving account			US $ 300
Indirect, through time saving at HH level, e.g.	Brumburet: US $ 20 – 30,000 Izh-Ovirk: US $ 30 – 35,000 Shogor-Bilohok	200 households 150 – 200 HHs	US$ 20 – 30,000 US$ 30 – 35,000
Mining (Shogore site) Others to follow	2 units / US $ 50 - 70,000 for cut slate slaps at site	Up to 50 employees	US $ 15,600
Improving productivity in agriculture & animal husbandry (wool carding and spinning)	Each site: US $ 10 – 15,000; All: US $ 50 – 75,000	Wool carding and spinning project Izh: 20 employees, 10 – 20 self-employed for modern chicken hatching (incubation)	US $ 50 – 75,000
Processing agricultural products (fruits, vegetable, kernels, wheat, maize)	Each site: US $ 25,000 – 50,000 All: US $ 125 – 250,000, depending on annually existing surplus production	Many households on self-employment basis involved	Direct or indirect All: US $ 125 – 250,000
Storing and chilling facilities (fruit, potatoes vegetable, onion)	Extending life span of products US $ 1 to 1,500 per chilling store for 3 tons (depends on store period and value of product)	2 – 3 per chilling house	US $ 1,000 net /chilling store
Skilled labor equipment for all trades(carpenter, tailor, welder, electrician, Car repair, saw miller)	Leads to increased productivity, time saving, improved quality: US $ 5,000 per site	No immediate or short-term additional employment, some in-migration from Chitral town	US $ 5,000 per site due to time saving and better quality
Business Services at each site:	US $ 10,000	Mainly families, self employment, small business: 5 – 10	At each site: US $ 10,000
Other services: washing, laundry, restaurants and guesthouses, etc.	US $ 20,000 at each site	Mainly families, self employment, small business: 5 – 10	US $ 20,000
TOTAL at each site (average)	US $ 95,000 – 115,000	300 persons ; mainly self-employed, family business	US $ 120 – 130,000, direct and indirect
Total at five sites*	**US $ 475,000 – 560,000**	**Approx. 1,500 persons**	**US $ 600 – 750,000**

- The employment and income effects at partners or suppliers are not included in these figures. Neither are included the acceleration of growth and spin-off effects in the villages due to increased demand from additional income generated (e.g. shop owners) within the villages. This will lead to further indirect value-added, employment and income generation.
- (see also List: Improvements of Productivity)

c Environmental benefits

23. The use of power generated by renewable energy contributes significantly to the sustainable management of natural resources, especially through substitution of fuel wood. It contributes also to a reduction of greenhouse gas emissions.

Greenhouse gas abatement by MHP (30 years projection)

Source	Izh-Ovirk	Shoghor	Shagram	Raman	Bumburate
MHP	6,652.8	6,652.8	4.435.2	6,652.8	6,652.8

Remark: refer to Annex 6; all figures in metric tons

24. The total figure amounts up to 31,046 tons of saved emissions of CO_2 during the lifetime of the power stations. This is equivalent of 310,460 US$ at a rate of 10 US$ per ton of CO_2.

Fuel wood saving due to electric heating stoves

Site	Number of HH	15%	Fuel wood saved (0.6 ton/HH)	Value at site (Rs 5,000/ton)
Raman - Harchin	800	120	72	360,000
Shagram	1,228	184	110	550,000
Bilphoke /Shagore	430	64	38	192,000
Izh-Ovirk	730	110	66	330,000
Total	**1161,228**	**478**	**286**	**1,432,000**

Remark: The site Bumburate valley in the south is still more privileged with good quality of fuel wood from near-by mountain trees and fruit tree branches. So this site is not yet considered for electric stone stoves.

d Design and manufacturing benefits

25. The new designs of optimized micro hydropower equipment as well as the higher demand for electro-mechanical equipment will contribute to the development of a national supply market. National design and planning bureaus will be qualified to transfer and adopt the design and planning principles to other sites and areas. The increasing demand of neighbouring countries having similar conditions and circumstances (e.g. Afghanistan) will further increase these market potentials.

A INTRODUCTION

26. The report aims to analyse the potentials for productive use of renewable energy in Chitral District, Pakistan. The results shall found the basis for the preparation of a PURE project. The field visits with respect to socio-economic aspects have been conducted during April and May, 2005. Pre-selection of sites was carried out in cooperation and close coordination with all decision makers and institutions involved in rural development in Chitral area. Out of 43 sites for which technical data were available (compare Annex 7) a total number of 7 areas comprising different number of villages have been proposed for further investigations. The detailed field survey has then been conducted in May 2005.

27. We wish to thank all people and institutions being involved in the discussions and field trips for their support and valuable inputs.

1 National Electricity sector

a Electric power supply

28. Pakistan's national grid supplies about 11 mill. consumers mainly in the central and southern part of the country. The total installed capacity is about 17.77 GW. In the northern and western parts of the country a considerable number of villages are either supplied by isolated small electric power grids (which often do not operate at an optimal level) or do not have access to electric power (about half of the population) at all. The latter count for about 170,000 villages.

Table A-1: Grid capacities

	Installed Capacity (MW)	Dependable/ Derated (MW)
Hydro	6,489	4,000 - 6,321
Thermal	12,452	10,953
of which IPPs	6,007	5,337
Nuclear	462	425
Total	**19,403**	**15,378 - 17,699**
Peak electricity demand in 2002:		12,929 MW

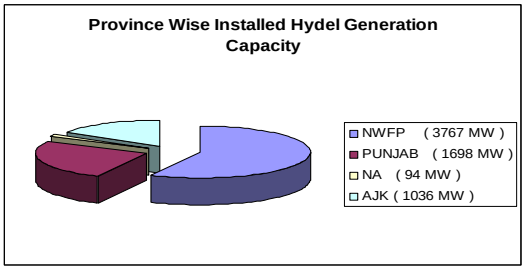
b Institutional settings

29. The power sector is formally in the process of unbundling[1]. In fact little has changed so far. KESC and WAPDA are still the main players in the field of generation, transmission and distribution[2]. Only in the field of power generation a few IPPs are engaged in the operation of thermal power plants.

[1] Currently best described as semi-privatized and semi-deregulated public service sector
[2] KESC operates the Karachi power supply utility, while WAPDA is responsible for the remaining national grid

Table A-2:	Generation capacities of national grid
WAPDA	11,178 MW
KESC	1,756 MW
IPP	6,007 MW

Figure A-1: Installed hydropower capacities



30. In the rural power supply sector little efforts have been undertaken by WAPDA to improve the situation. This is mainly due to the technical and management problems in ensuring quality and quantity of a grid supply in rural areas, the low profitability compared with urban supplies, the high costs for installation and operation, the recent problems in the current grid system with respect to quality and quantity and the reluctance of WAPDA to test alternative decentralized power supply options.

31. The efforts by the provincial governments to fill the gap in rural power supply on their own did not improve the situation very much. Lack of funds, identical supply concepts and little interest in these aspects are the main reasons. Thus, rural power supply is poor both in terms of quantity and quality.

c Rural power supply policies and plans

32. Verbally, rural electrification has always been a central objective for power sector reforms in Pakistan. Until 1995-1996 rural electrification grew at average rates between 9-11%, but has slowed down to less than 2% growth. Currently about 70,000 villages are electrified.

33. There is no firm Government policy for the development of decentralized power supply. From the 170,000 villages having no access to electricity, about 40,000 are planned to be connected to the national grid within the next decade. Provincial governments have started independently to develop micro/mini hydropower stations for rural electrification but ended up with high operation and maintenance costs, poor revenue generation and hence poor supply. Several of these projects are already abundant. Recently SHYDO has leased out some of the most problematic micro/mini hydropower stations. Another 400 households are going to be supplied by the ongoing AEDB PV program[3].

d Renewable energies

34. Pakistan is rich in renewable energy sources. Wind and solar dominate in the western and southern parts of the country whereas the mountainous northern and central regions have considerable hydropower resources. The total hydropower

[3] 100 solar systems per province, AEDB 01,2005

resources are assessed at being about 40 GW of which about 6.6 GW have been exploited so far.

e Experiences in micro hydropower

35. Mini and micro hydro for rural power supply are developed by provincial bodies (e.g. SHYDO) and NGOs like the Aga Khan Foundation. A similar approach is adopted in Upper Dir district (NWFP) by an EU funded project together with IUCN. In addition, PCRET (formerly PCAT) introduced some community based micro hydro stations (20-30 kW) in parts of NWFP in Swat, Dir, Chitral Kohistan, Mansehra and Abbottabad districts. The majority of the stations installed are very basic designed[4] and used for lighting only. Low capacities (ranging between 10 and 50 kW) do not allow productive use for income generation. Operation is mainly during evening hours.

36. Summarized, nearly 1,000 MW of micro, mini and small hydropower development opportunities (of which less than 1% are exploited so far) are available in the northern mountainous region of the country especially in NWFP, NA and AJK. Due to the lack of alternative power resources and the uneconomic high cost for grid extension, micro and mini hydropower is the most important power source for the northern areas of Pakistan. In addition, hydropower stations are the only economic and technical option for decentralized power supply targeting the improvement of rural life through productive use of electricity and thus contributing to poverty mitigation and income generation.

Technical aspects

37. Hydropower in general has a long tradition in Pakistan. With regard to design and planning of hydropower stations above a certain size (about 5 MW), sufficient engineering and technical know how is available in Pakistan itself, but not in rural areas. The same is valid for the construction field. Design of decentralized small units however require special skills and techniques to overcome a number of problems like

- Power stability and availability
- High per unit cost
- Low load factor
- Continuous operation throughout the year.

38. Mini and micro hydropower stations are due to their low capacity very sensitive towards non optimal design and require certain methods to overcome operational problems.

Management aspects

39. Hydropower stations require skilled operators and management staff. As opposed to individual house supplies (e.g. solar home systems, individual diesel generators), hydropower plants generate electricity centrally. Consumers are supplied through a small isolated grid. Thus, consumption has to be measured, read and billed by a central management unit. Management is one of the biggest obstacles to be found in both central grid and decentralized supply systems in rural areas. The far distances, low load factor and scattered settlement structures combined with almost non existent support structures like bank accounts, communication facilities and difficult control of illegal access to electricity makes the billing and revenue collection a tiring and time consuming task, resulting in very low rates of paid bills.

[4] with regard to civil structures, safety devices and efficiency of electro mechanic equipment

40. Local technical skills are often not sufficient to repair and even maintain the equipment in a proper way. Thus, equipment is not used to its optimal extent or is run without proper maintenance. In case of malfunction or break downs, replacements can not be done due to lack of funds resulting from too low tariffs.

Manufacturing capacity

41. Countrywide, there are only 2-3 micro scale local turbine manufacturers experienced mainly in small scale cross flow turbines and hydraulic governors (up to 100 kW). The only local generator manufacturer is Siemens (68 kVA to 700 kVA). Control and synchronization panels can be assembled locally by electronic and metal workshops. In addition, Chinese turbines and generators are widely used in the Microhydro sector.

2 Poverty

42. Despite the "right" method to be applied to measure poverty in Pakistan, there is a common understanding that poverty remained fairly stable during the 1990s, from 29.3% in 1993-1994 to 32.2% in 1998-99 (Table A.3).

Table A-3: Poverty during the 90s

Poverty Index	1992-93 HIES	1993-94 HIES	1996-97 HIES	198-99 HIES
Head-count ratio (*)	26.6	29.3	26.3	32.2
(+)	25.7	28.6	24.0	32.6
Poverty gap (*)	4.5	5.5	4.5	6.9
(+)	4.5	5.4	4.3	7.0
Severity of poverty (*)	1.2	1.5	1.2	2.2
(+)	1.2	1.5	1.2	2.2

Source: I-PRSP, page 8 table 2.1;
(*): assesses the poverty line by using a caloric basic approach
(+): according to WB Study, using the basic needs approach

43. Main aspects related to poverty are:

- Poverty is considerably higher in rural compared to urban areas. The respective figures measured are 36.3% for rural and 22.4% for urban areas
- Poverty is strongly related to a lack of basic needs especially education and cultivable land, whereby education is the most important factor that distinguishes the poor from the non-poor. The percentage of literate household heads is 27% in poor households while for non-poor households it is 52%
- One critical factor is the unemployment rate (Table A.4). Unemployment is highest among the extremely poor and lowest among the non-poor, showing the critical importance of employment generation for poverty alleviation. In addition most of the jobs of the poor are in the non-formal sector with low wages and high risks. Consequently, one of the core principles of Pakistan's poverty reduction strategy is to empower the people and create greater opportunities for increasing real income by improving access to productive assets.

Table A-4: Unemployment Rate

	Extremely Poor	Chronically Poor	Transitory Poor	Transitory Vulnerable	Transitory Non-Poor	Non-Poor	Total
Unemployment Rate	10.43	6.68	7.79	6.78	**7.06**	6.65	7.12
Urban	7.56	10.05	10.48	8.73	8.85	7.34	8.69
Rural	10.96	6.04	7.27	6.25	6.23	5.83	6.53

Source: PRSP, table 3.3

- Poverty varies across the provinces. Highest figures for urban as well for rural areas are shown NWFP (Table A.5).

Table A-5: Poverty by regions (1998-1999)

Provinces, Regions	Urban	Rural
Punjab	26.5	32.4
Sindh	19.0	29.2
NWFP	31.2	44.3
Balochistan	28.4	24.6
Azad Jammu and Kashmir (AJK)	14.5	16.5
Northern Areas	22.6	36.5
FATA		44.5

Source: PRSP, table 3.4

3 The role of energy supply in rural development and poverty reduction

a Barriers to rural development and poverty reduction

44. The two main aspects hampering people to pull themselves out of poverty are lack of jobs and education, whereby the latter limits the access of poor people to the former. Jobs in rural areas are to be found in agriculture, a sector which is no longer capable of absorbing the growing labour force. In addition, wages are usually low and working time is often limited to certain months only. Industries and enterprises are usually not very keen on doing business in rural areas due to

- Low quality of infrastructure (communication, electricity supply, roads)
- Lack of skilled personal
- Higher costs due to longer transport ways, etc.
- Difficult access to customers.

45. Thus, creation of rural jobs must be based on rural resources and initiated on a “small to big” approach. Economic activities are initiated through the production/processing of local goods and resources required at local and regional markets. Along with this, jobs can be found in small enterprises and workshops established. A local service sector will follow including small shops, tea houses, entertainment and trading. Finally, regional and even national markets can be approached.

46. Sustainable poverty alleviation requires the initiation of self-driven local economies creating job and income opportunities for the local population. Pre-conditions for this are access to:

- electricity to run machinery and equipment for local manufacturing and processing of local goods and to provide services
- technical skills to operate equipment and machinery adequately
- business skills to run a small business or enterprise on a profitable basis
- finance to buy equipment and machinery.

47. Thus, energy supply plays an important role in poverty alleviation. Beside the provision of power for productive use, locally generated energy also creates skilled job opportunities directly in the power supply system but also in workshops for electric appliances and for electrical house installations. And last but not least the revenues of the power supplies are circulating locally (and are not transferred to the provincial or national level) and contribute again to the local economy.

Figure A-2: Productive use of energy

48. A typical **impact chain** may be as follows: Small hydropower station provides electricity of sufficient quality and quantity for consumer and productive use. The electricity is used to process local products, to run small shops and other services. Accompanying measures provide business and technical skills, know how and start-up capital to start business activities. Thus, local markets are initiated providing job and income opportunities to the local population. The economic activities are self-driven and therefore sustainable. This finally, contributes to poverty mitigation in the project area.

b Electricity PLUS (QEP$^+$) for productive use

49. For the envisaged "MHP for Productive Use" promotion project a comprehensive rural electricity supply concept with three main elements is recommended. The development strategy "Electricity plus" (QEP$^+$) will address the village electrification from both ends: improving supply in terms of quality and quantity and stimulating demand in particular for productive use through demonstrations of new technologies, by shifting from fuel wood to electric heating and by replacing diesel through electric equipment.

50. Electricity alone does not reduce poverty as many experiences elsewhere have shown. The access to quality electricity has to be combined with other poverty alleviation and rural development strategies. **QEP+** is an overall strategy not only for basic rural electrification. In combination with other integrated development measures electricity plus can be the major element for productive income generating development and may as well contribute to poverty reduction in rural areas. **QEP+ credits** for poor farmers allows the purchase of processing machines in region where agricultural production can be processed. **QEP+ technologies** demonstrates new processing or time saving productive techniques, creates new income sources and increases the income of the poor, thus they are able to invest in labour saving electrical appliances. **QEP+ entrepreneurial or vocational training** creates new job opportunities for rural self-employment. As lack of electricity is not any longer the main reason for unutilised potential.

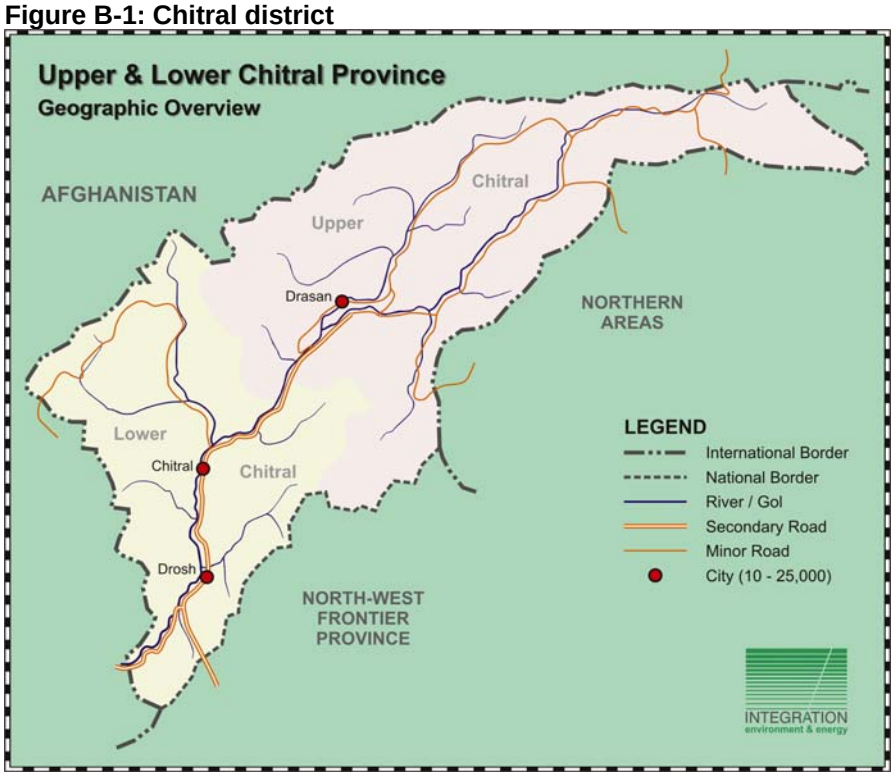
Figure A-3: Quality electricity plus

B PROJECT AREA

1 General Aspects

51. As project region the District of Chitral (NWF Province) in the northern part of Pakistan has been chosen. The district is one of the remotest and isolated regions in northern Pakistan.

Figure B-1: Chitral district



a Administrative structure

52. In 1969 the ancient Chitral state, governed by a royal family, merged as a district into the NWFP of Pakistan. The traditional “state” management concept of the former rulers was changed and the respective Government Ministries took over the responsibility of administrating the new district. Chitral District nowadays is divided into two Tehsils: Chitral and Mastuj. The divisions are divided in subdivisions (Union Councils). The Tehsils comprise several Union Councils which comprise several villages. All mentioned administrative units are headed by an elected Nazim each. The village council, headed by a village council nazim is the lowest administrative unit.

b Population

53. According to the 1998 census, Chitral’s population stands at 318,689 (162,082 males and 156,607 females). These statistics show that the population has increased at an average rate of 2.5% annually since the 1981 census. With this growth rate the number of population is estimated at being 369,000 at the end of 2004. Close to 90% of the population resides in 463 rural settlements, ranging in size from 20 to 3,573

inhabitants. Nearly 75% of these settlements are small, with a maximum population of 800. Chitral town is the only urban settlement in the district, with a population of 20,622.

54. The population of Chitral comprises a variety of ethnic groups with different production systems, know how, customs and languages. The majority of the people belong to the Khow ethnic group, their language is Khowar. The Khow strictly adhere to the Purdah system whereas the Kalash who are living mainly in the three valleys of Bumburate, Birir and Rumbur of Southern Chitral, do not observe Purdah. Other minorities like the Wahki in the upper area of Chitral near to the Afghan border, the Dameli in Southern Teshil of Drosh, the Gawari as well in the Southern valleys of Chitral have their own language, too. The majority of the population is Muslim and belongs to the Deobandi, a Sunnite school. Some villages adhere to the Ismaili group. The Kalash have their traditional believes.

Table B-1: Socio-economic indicators				
Table B-1.1: Population				
Average household size				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991	8	9	10	9
1997	10.1	9.6	9.7	10
2001	9.99	10.54	10.28	10.04
Male-female ratio				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991	113	114	113	120
1997	126	114	112	122
2001	112	110	107	108

55. The average household size grew during the last decade from 9 (1991) to about 10 in 2001; the male-female ratio of 110 is within the national average.

Table B-1.2: Education				
Adult literacy rates (%)				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991	24%	37%	44%	37%
1997	36%	46%	45%	37%
2001	42%	54%	55%	45%
People aged 10 and above who have had at least primary education.				
Male adult literacy rates				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1997	54%	63%	57%	52%
2001	61%	70%	70%	64%
People aged 10 and above who have had at least primary education.				
Female adult literacy rates				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1997	13%	26%	32%	18%
2001	21%	38%	39%	26%
People aged 10 and above who have had at least primary education.				

56. The adult illiteracy rates show a significantly high percentage of illiterate people (46% in 2001). The majority of the male population is able to read and write (70%) whereas only 38% of the female population attended a school.

c The power web: Clan, religion, royal inheritance and politics

57. The different existing **clans** are associated with geographic areas with clearly defined boundaries. However, belonging to a special clan is not a visible differentiating characteristic of the Chitrali Khow population. The Khow clans can be separated into two subgroups: the clans associated with the royal family and those clans who are lower in status. Solidarity between clan members and belongingness to the clan system still play a major role in identity building and political life.

58. Due to the shift of traditional power to Government and additional administrative changes during the last 50 years there exist very different power and interest layers in Chitrali society. The traditional power formerly represented by the Mehtar, the local king, is still remembered. In addition members of the royal family are known, respected and participate in political and business life. As a consequence in some ways a traditional power structure is underlying the modern administrative political system.

59. The second layer of different interests and power forms religion. In Chitral District the majority of the population belongs to the Sunni group of Islam. In addition we do have Ismaeli villages belonging to the Shiite school. The Kalash indigenous people living in Rumbur, Bumburate and Birir valley adhere to their traditional belief if they are not converted to Islam. In their area the Tablighi, one Sunni school, was doing preaching/missionary activities among the Kalash. There is a negligible small percentage of Christians and Hindus living in the urban area. The selected villages don't suffer from religious conflicts.

60. In addition various political parties strives for members and influence. Since September 11th a significant reaction of the population to the war in Afghanistan could be observed. During the last parliament elections in 2002 the three parliament seats from Chitral were won by a coalition between the Muttahida Majlis e Amal (MMA) and other parties, which belong to the fundamentalist wing of the Sunni religion. They were sending student fighters to Afghanistan to participate in the Afghan war and supported the Taliban. As the Taliban were mainly belonging to Pathan clans, there was a big solidarity of the Pathan community with their suffering brothers in Afghanistan. Several fundamentalist Mullahs, mobile Muslim preachers, were influencing mainly the illiterate population and preaching against Western behavior and values, even forbidding using electricity because the water flowing through a turbine is not pure anymore. They are the leaders of Islamic schools (madras's) and exerted a strong influence in the Sunni villages. Meanwhile however the situation has changed and it seems that the MMA is joining the mainstream of development. In these Southem areas of Chitral the Ismaili religious group is less welcomed and less accepted.

d Existing power supply

61. **Fuel wood** is the major source of energy for cooking and space heating in Chitral, particularly during the severe winter's months. About 100% of rural households and 94% of urban households are totally dependent on fuel wood. Beside, cow dung,

agricultural residues and other non-wood materials are used which could otherwise be utilized as manure to improve agricultural productivity.

62. Limited availability of commercial fuels, high fuel prices and low-income level of the people in the area are the major constraints in shifting from one source of energy to another.

63. The major fuel wood suppliers are the southern two valleys of lower Chitral (Shishi and Kalash valleys). Transporting fuel wood up to 100-120 km nearly doubles its costs. The high prices forces to spend a sizable amount of the family budget for purchasing fuel wood. This hampers the economic growth in real terms for the community, as whatever being earned and saved throughout the year is being spent to purchase fuel wood in winter

64. Main wood source are oak tree forests in the south and fruit trees. Both have adverse effects on either the household income or the environment.

65. The dry oak forests which grow between 1,200 and 1,800m above sea level, in the lower part of Chitral district are under severe biotic pressure and likely to become endangered within a decade. The forests, though the government property are being managed under a customary and traditional system by the local community, which mainly focuses on earning money from the sale of the oak wood, are exploited as much as possible. Since the resource is communal property the ownership is lacking, which ultimately leads to destruction of these precarious forest resources. Regeneration is absent at lower elevations, most likely as a result of persistent and uncontrolled grazing.

66. In 1995 a survey of 235 sampled households in the Chitral District indicated the following fuel wood consumption pattern at household level (see Table B-2).

Table B-2: Household Fuelwood Consumption Pattern

	Summer (March to September) in kg	Winter (November to April) in kg	Total fuel wood Consumption kg/year
Rural Area			
Per day/hh*	21	50	
Per month/hh*	645	1,520	
Per year/hh*	4,514	7,602	12,116
Urban Area			
Per day/hh*	19	35	
Per month/hh*	564	1,067	
Per year/hh*	3,948	5,335	9,283

Note: hh* stands for household; 235 sampled households

Source: Mukhtar Ahmad, Effects of Fuelwood Scarcity on the social-economic Conditions in District Chitral, Pakistan – A Research Paper submitted to the Faculty of Forestry, University of Toronto, January 2004, page 26 (Adopted from Ali, 1995)

67. During winter time households in rural areas need 875 kg more fuel wood per month (Urban areas: 503 kg due to availability of alternative energy sources like kerosene, electricity and gas) compared with the summer months.

68. In comparison, there are two major constraints in the rural areas, the non availability of commercial fuels and low income level, both creating obstruction in shifting local people from one source of energy to another. That fuel wood supply is in most cases not sufficient is indicated by the proportional relation between income and fuel consumption.

Table B-3: Fuel consumption of HH by income group

Items	Low*	Medium*	High*
No. of Households %	58.53	29.75	11.78
Average monthly per capita Income (Rs)	800	1,165	1,640
Average monthly fuel wood consumption in summer (7 months) kg	495	583	655
Average monthly fuel wood consumption in winter (5 months) kg	1,104	1,322	2,037
Average monthly kerosene consumption in summer (7 months) Gallons	1.67	2.35	3.30
Average monthly fuel wood consumption in winter (5 months)	2.47	3.90	4.19

* Income Groups (households) in 1995: Low' net monthly income < Rs.9600, 'Medium'net monthly income from Rs 9,600-18,000 and 'High' net monthly income >Rs 18,000.

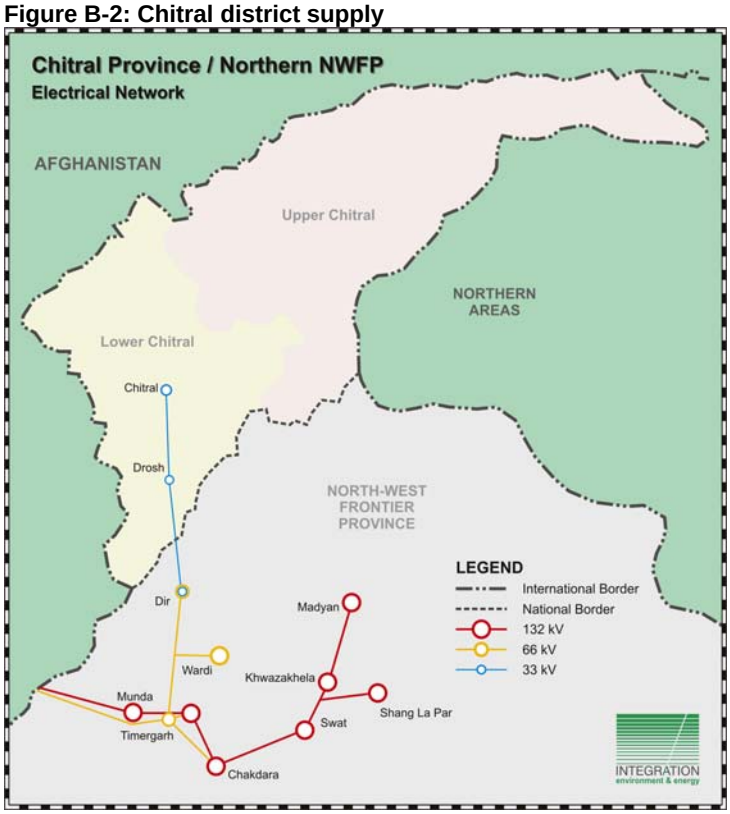
69. Presently (May 2005) rural households pay between Rs 4 (Shagram) and Rs. 6 (Raman) per kg commercial fuel wood from Chitral market including transport. Taking only the additional cost for wood fuel for heating in winter into account total costs varies from 2,436 Rs (low income HH) to 5,528 Rs for high income HH in Shagram and from 3,654 Rs to 8,920 Rs in Raman area respectively. Daily opportunity costs which could be spent for i.e. electric heating are ranging from 80 Rs (Shagram area, low income HH) up to 297 Rs (Raman area, high income HH).

70. Summarizing, the high cost and unsure supply during winter of fuel increases the pressure of the natural forest resources. At least in the northern part of Chitral district even the cost for fuel wood is so high, that electric heating becomes an economic and environmental alternative.

71. **Central electricity** supply is available in the district centre itself and in its vicinity. Main elements are:

- 2.8 MW hydropower station at Reshun about 60 km north of Chitral town
- 33 kV transmission line to Turkho, Mulkho and Mastuj valleys
- 1 MW hydropower station in Chitral town
- 300 kW Shishi hydropower station near Drosh in lower Chitral
- 100 kW Garam Chashma hydropower station
- 33 kV transmission line connecting Chitral town to the national grid via Lawari pass in Hindukush mountain ranges[5]
- In addition, a number of community and private based hydropower stations have been installed. However, many of them are not constantly operating or already out of order due to bad design or maloperation.
-

Figure B-2: Chitral district supply



72. There are no plans for grid extension to the Northern Areas nor any improvements for the existing 33 kV transmission line to Chitral foreseen in the WAPDA grid extension plan (until 2008).

Table B-4: Electricity supply in northern Pakistan

Districts	Supplied households (%)
Khaplu	68
Skardu	79
Gilgit	93
Ghizer	60
Astore	67
Chitral	77

73. About 77% of the households are supplied with electricity of mainly very basic quantity and quality. The remaining 83,000 people do not have access to electric power supply.

[5] The unreliable supply is due to the difficult terrain. The area connected to is on the WAPDA least priority list. The transmission line remains broken through out the winter months since the time it was commissioned in the mid 1990s.

e Accessibility

74. Chitral district suffers not only with access to power but also on zero access to the region during winter because the only road that connects Chitral to the rest of the country remains closed throughout the winter months. Access then depends on the PIA flights from Peshawar every day but sometimes even they remain suspended for up to a week due to bad weather.

f Main sources of income

75. Farming, livestock and remittances from unskilled migrant labour are the three major sources of livelihood. Maize, wheat and rice is farmed on small holdings mainly for subsistence. Some unskilled labourers work in the Gulf States and in the urban areas of Pakistan. They contribute considerably to their family's living expenses. A small part of the population is employed locally in government schools, dispensaries, and some other government departments.

76. Per capita income rose from 3.233 Rs in 1991 to about 11,090 Rs in 2001. which is low compared with similar districts in the Northern Areas. This difference is also expressed by the low real growth rates of 0% in 1994 - 1997 and 3% in1997 - 2001, reflecting less than half of the respective GDP growth rate.

Table B-5: Income				
Per capita income in nominal terms (Rs.)				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991	2,384	3,233	3,134	2,850
1994	4,540	5,746	6,355	3,717
1997	8,900	8,092	11,330	6,873
2001	13,796	11,090	16,801	11,053
Per capita income in real terms (Rs.)				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991	2,384	3,233	3,134	2,850
1994	3,407	4,312	4,769	2,790
1997	4,771	4,337	6,074	3,684
2001	6,078	4,886	7,402	4,870
Real growth rate				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991-94	14%	11%	17%	-1%
1994-97	13%	0%	9%	11%
1997-01	7%	3%	5%	8%

77. Settled farming communities exist still at altitudes of just above 3,000 metres. The marginal size of cultivable land is further diminishing as a result of fragmentation when it is sub-divided among the male children. Average size of landholding per household has been reduced from 0.6 ha in 1991 to 0.45 ha in 1997. Although the main activity of the people is farming, none of the crops is sufficient for local needs.

During winter time households buy additional wheat from Government stores, which have been constructed all over the area.

Tourism

78. Tourism was developed as an industry after Chitral state merged with Pakistan in 1969. Chitral's main tourist attractions are mountaineering and trekking, a pleasant summer climate and the unique culture of the Kalash people. With its rugged landscape and rich biodiversity, the area is also an ideal destination for ecotourism. However, picnic spots, trekking routes and other areas of cultural significance are yet to be identified and opened to visitors. At present, the absence of an all-weather road link with the rest of the country is the single most important constraint to the development of tourism. Meanwhile, local communities lack interest in developing this sector perhaps because its potential importance is not widely recognized. About 16,000 tourists visited Chitral annually, 2,000 of whom were foreign nationals. Since the September 2001 event the number of foreign visitors to the Chitral valley has declined dramatically.

Local resource-based enterprises

79. Even though there have been some recent attempts to create off- and on-farm employment by promoting local resource-based micro enterprise initiatives in sectors such as hand weaving, horticulture, husbandry and tourism, the impacts are very limited. Groups of spinners and weavers brought together under the AKRSP 's Shubinak House Project have played a significant role in promoting *shu* (also known as *patti*), the traditional woolen fabric of the area. These guilds produce woolen products and supply value-added clothing to the market.

80. "North-South Seeds" is the AKRSP's latest initiative, aimed at generating employment opportunities in areas with scarce natural resources. Managed as a seed company and earning a profit, the project aims to produce and market high-quality local varieties of vegetable seeds which are in great demand among vegetable growers in the area who are expanding operations at an annual rate of 4%. The enterprise employs the services of contract growers to produce raw seeds in accordance with stringent quality standards, a process which requires continuous training and supervision by AKRSP seed technologists.

Mining

81. Chitral's mineral reserves have not been systematically explored. Known deposits based on fragmentary surveys show antimony ore mined on a small scale (estimated at 8,617 t), good quality magnetite ore (estimated at 7.3 million t).There are large quantities of high quality marble and granite. Arsenic minerals such as orpiment and realgar occur in large deposits some 4,000 m above sea level in Terich valley. galena, pyrite and copper minerals such as chalkopyrite are reported as well as quartz veins containing lead-zinc ore and copper, antimony in large quantity, some soapstone and talc, gemstones such as aquamarine and topaz, dolomite, galene and pyrite.

Conclusion

82. High potentials in the rural economic sector are to be seen in agriculture. Considerable areas of land could be cultivated additionally with the presence of irrigation water.

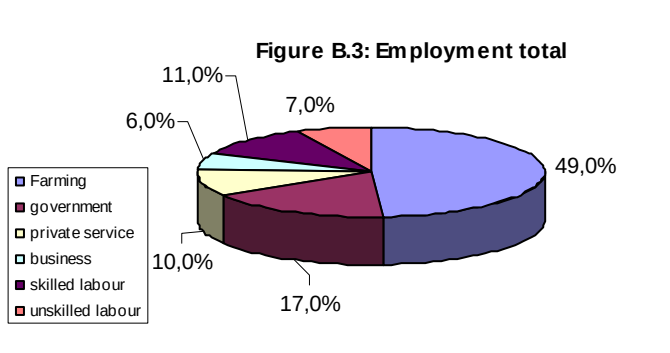
83. Mainly still unexploited are the stone and mineral deposits of the region. Chitral is rich in gem and semi precious stones as well as in minerals and stones used in the construction sector as limestone, marble, dolomite, granite and slate.

84. The potentials in the handicraft sector include traditional handicrafts as textiles for which the region is well known and workshops for daily repairs and manufacturing of daily articles.

Table B-6: Potentials for productive use of electric power	
Handicraft: • Chitrali patti • Woollen socks • Sweaters • Jackets • Agricultural machinery repair, • Metal workshop • Carpentry	**Services:** • Bakery • Tea house • Cinema/video • Restaurant • Hotel • Shop • Store
Agriculture: • Animal husbandry • Dairy products • Chicken farm • Irrigation • Agro processing (milling, cooking, conservation, drying)	**Stone and mineral processing:** • Marble, granites, slate, soap stones • Iron core • Serpentine • Mica • Gemstone, semi-precious stones polishing • Jade • Orpiment
Construction material: • Limestone crushing, milling • Dolomite crushing, milling	**Minerals:** • Antimony roasting • Lead

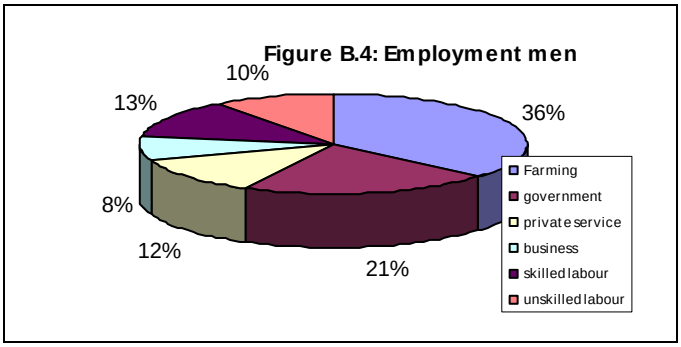
g Employment

85. Farming is still the most important employment sector. However, land resources are limited and household's portion is diminishing. Thus people are forced to look for jobs outside the agricultural sector.

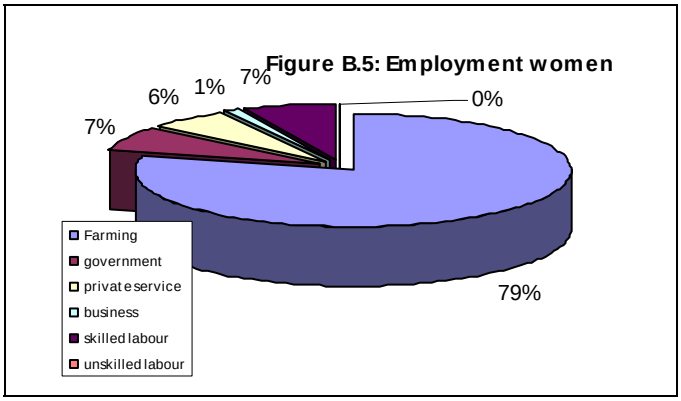


86. 17% are governmental employees, and 10% are engaged in private services. Only 6% of the population is working in businesses. All in all only 24% of the population is working in a productive sector outside of agriculture.

87. There are extreme differences in employment of women and men. The majority of the women are engaged in the agricultural sector (men only 36%), followed by governmental (7%) and private service (6%) jobs. Due to the purdan system women obviously have no access to business activities and are commonly not working as unskilled labour.



88. For men public (21%) and private services (12%) provide the majority of jobs outside the agriculture sector.



h Poverty

89. The overall poverty rates are decreasing from a very high level (68%) since 1991. However, in 2001 there are still 42% of the total district population counted as poor of whom 14% are even counted as poorest people. The figures are by far the highest in the northern regions of Pakistan.

Table B-7: Poverty				
Head Count Index				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991	76%	68%	62%	64%
1994	65%	51%	38%	72%
1997	43%	50%	35%	62%
2001	34%	42%	29%	38%
Poorest people (living below half of the poverty line)				
Years	**Baltistan**	**Chitral**	**Gilgit**	**Astore**
1991	44%	28%	30%	31%
1994	44%	20%	12%	33%
1997	14%	22%	9%	30%
2001	8%	14%	8%	12%

2 Development programs in Chitral district

Aga Khan Rural Support Programme

90. The Aga Khan Rural Support Programme (AKRSP) is an internationally recognized community-based development organisation that has been working in northern Pakistan in the field of integrated rural development. AKRSP's mission in Chitral is to alleviate poverty through promoting sustainable livelihoods of the mountain communities. Established by the Aga Khan Foundation in 1982 and presently funded by a consortium of international bilateral and multilateral donors AKRSP has, over the years, acted as a catalyst for integrated rural development. Organising local human, physical and financial resources AKRSP has enabled rural communities to bring about their own development in an equitable and sustainable manner.

The First Micro Finance Bank

91. The First Micro Finance Bank is the only Micro Finance Institution in Chitral District. It provides small loans to skilled poor individuals mainly by group loans for income generation. It is building financial assets through collective savings and access to group loans.

The AKRSP activities on micro hydro

92. AKRSP has installed over 180 micro hydropower (MHP) units (15-75 W) in Chitral District. Community organisations manage the MHP, operators are trained. Electricity is supplied for lighting, TV and other consumptive consumptions. The villagers contribute to the construction of the power plant and the channels by cash, material and labour inputs. The creation of village and women organisations supported by AKRSP has led to a broad participation of the concerned rural population. The activities of AKRSP have included, among several others, local communities coming together to construct and maintain basic infrastructure in their respective villages, initiating programmes to manage and protect their natural resources.

93. Programme rationales of AKRSP were since the beginning of the implementation of the MH:

- Decision making with the village representatives and the population
- Creation of different committees as a management committee and an audit committee.
- Ownership and management of the MH by the villages
- Decision of flat rate tariffs for the operation of bulbs and different electric appliances to cover the operational costs by the village
- Selection of an operator.

94. Besides the known impacts as there are improvement of living conditions for all HHs, time and labour saving mainly for women and information availability in the villages by radio and TV, this communal approach for basic electrification organised and united the households of several villages under one basic demand. The experience that joint village forces could led to better living conditions for all HHs is one of the most important results because all other initiatives and development actions could build on this first and valuable experience.

The Mountain Area Conservancy Project (MACP)[6]

95. The MACP, which is supported by UNDP/GEF aims at protecting the rich biological heritage of the Karakoram, Hindu Kush and Western Himalayan Mountain ranges, advancing a comprehensive package of interventions to address threats to biological diversity. The MACP is based on the premise that in the long run, conservation interventions are unlikely to mitigate threats to biological diversity unless communities are actively involved. The project has three principle thrusts: first, to empower, organize and boost the capacity of local communities to conserve biodiversity at an ecological landscape level; second, to enhance the relative values of wild resources (as a conservation incentive) by promoting their sustainable use; and third, to create a conducive policy, legislative and financial framework for community-based conservation. The focus, therefore, is on empowering local communities to manage ecosystems and wild resources, making them accountable for the quality of their stewardship. A representative sample of biomes will be protected through the creation of four Conservancies (Managed Resource Protected Areas). Within the Conservancies, activities will engender the in-situ conservation of habitats and species and promote sustainable uses of biological resources. MACP is working with local institutions and NGOs like IUCN, AKRSP and WWF.

3 Socio-economic aspects of selected sites

96. The project proposal includes a number of sites for demonstration of rural development by productive use of sustainable energy generated by mini hydropower stations. Each project site represents a single sub-project with its own results and impacts.

Figure B-6: Sub-project sites

97. About 43 sites had been initially identified with respect to availability of hydropower resources, technical and socio-economic aspects as well as natural resources and economic potentials and costs in Chitral district. The results are compiled in Annex 7.

[6] cited from: UNDP Project Implementation Review 2001

98. From these 7 sites have been selected during the first field survey for detailed investigations, namely:

- Bilphok/Shogore
- Birir
- Shagram Torkhow
- Harchin/Raman
- Beyori
- Izh-Ovirk
- Bumburate.

99. The final ranking of villages was based on the following criteria:

Technical criteria

- Enough water for power generation during the whole year
- Existing basic electrification

Social criteria

- Large number of HHs
- (religious, ethnic, clan composition)
- Homogenous village situation
- Living standard and cash income
- Gender awareness
- Self help potential
- Willingness to contribute the construction of the MH
- Willingness and possibility to pay
- Management capacity of the village for a MHP
- Increasing HH electricity demand

Economic criteria

- Potential of productive energy use
- General development potential
- Access to market.

a General socio-economic situation

100. In this chapter socio-economic aspects which are not included in the ranking criteria (compare chapter 4.b) are briefly summarized.

Energy source of households

101. In the visited areas all households used electricity for lighting[7], but as well pine wood torches, kerosene lamps and seldom candles. In rare cases HHs even used liquid gas.

102. Every HH owns a metal oven for cooking and heating. Additionally a clay oven is used for baking bread. In winter better-off HH use an additional kerosene heater (depending on the number of rooms) for the sleeping room, which is switched on shortly before going to bed. Poor HH who own a one-room house sleep in winter in this room which is heated.

103. **Wood** is the main energy source for cooking and space heating in Upper and Lower Chitral. Whereas in Lower Chitral forest resources are still abundant in Upper Chitral forest resources get scarce. In addition to wood dried dung is often used in

[7] In general 76% of HH in rural areas use kerosene oil for lighting, 23% use electricity, and 1% use other material.

Upper Chitral. Men and women presently are collecting dry fire wood from the forests free of charge.

104. It is well known, that the use of electricity could improve the health condition mainly for girls and women who are constantly exposed to smoke during cooking and heating inside the house in winter. However due to limited capacities of the power stations till now electricity is mainly used for lighting and TV.

105. In all visited areas a local resource based energy mix for heating and cooking still prevails. Gas and kerosene are complementing the use of fire wood. Only better-off HHs can substitute wood by kerosene heaters and time to time gas cooking. Dry wood in mountainous areas can still be harvested without permission, and is thus preferred to any other source of energy.

106. With the bigger size of the newly built rural houses (more rooms) separating the living and sleeping areas, the heating concept might change in future. Better off HH will use electric heaters. Another innovation to reduce energy consumption and to keep the house warm is a double window, sealed ceilings and doors for insulation. Energy costs are compiled in Table B-8.

Table B-8: Fuel Cost

	Unit	Unit price Rs	Price/kWh Rs
Fuel wood	40 kg	170 – 350	4-9
Electricity WAPDA tariff Basic tariff (*)	 1 kWh 1 kWh	 2-4 1	 2-4 1
Kerosene	1 l	40	4
Diesel	1 l	29	3
Candle	1	5	15/week
batteries	1	2 - 22	7/week

Electricity supply

107. Current electricity supply is compiled in Table B-9.

Table B-9: Electricity supply

Area	Number of HH	Electrified	Non-Elelctrified	Power source
Bilphok/Shogore	430	218	212	Bilphok 30 KW Shogore 50 KW
Birir	308	305	3	Norbiz Birir 25 KW
Shagram	1,228	586 (+100 Shydo)	542	Borzund 100 KW
Raman/Harchin	800	150	650	Raman 30 KW
Beyori	440	30	410	Beyori Mandeh 30 KW
Bumburate	800	730	30	2x Krakal 50 KW,
Izh-Ovirk	730	335	395	50 KW

108. Costs for electricity are paid either by bulb or by meter. Fees vary from 10-25 Rs per bulb and 1-2 Rs per kWh. Operational costs include wages, spare and wear parts and a replacement fund (some 100.000 Rs).

Table B-10: Micro hydropower station operation cost

Area	Operator Rs/month	Watchman/line man Rs/month	Channel supervisor Rs/month
Bilphok	?	?	?
Shogore	?	?	?
Shagram	1,800	1,500	1,150
Harchin	1,200	1,200	-
Raman	?	?	?
Beyori	?	?	?
Bumburate	?	?	?
Izh-Ovirk	1,500	1,500	-

Gender and electricity use

109. According to the gender division of labour women are responsible for different household tasks. Their energy and electricity needs are different from those of their husbands. Whereas men prefer to buy as a first appliance a TV and/or small electric tools like drills and soldering irons, women want household appliances to reduce their workload. The need for electricity and the use of electric appliances is in consequence related to the gender division of labour and the different daily working cycles of men and women. The electric appliances already bought in the visited HHs prove this statement.

110. In the visited areas HH already own a certain number of human energy and time saving electric appliances mainly for women. However, women normally can not use these household appliances during day time because they are occupied with field work or need to graze their cows. In addition, electricity is only supplied at night. At night however, the use of HH appliances is forbidden because electricity capacity is not enough. The present electricity supply system (besides from the capacity problems) is not helping women to reduce their workload by using electric appliances.

111. In addition women are interested to open a ladies shop requiring also electricity. In the Kalash villages women are keen on electric sewing machines to produce handicrafts for sale during the summer time.

Electric appliances

112. The distribution of present electric HH appliances is quite different in the visited villages. Better-off HHs bought various HH appliances hoping that their use would be possible. However due to insufficient capacity of the MH the use of the appliances was forbidden. Nevertheless the purchase of these appliances show the demand for more and quality electricity. Table B-11 shows some examples

Table B-11: Existing electric HH appliances

Name	Oven	Juicer	Iron	Heating rod	Fan	Refrigerator	Washing machine	Butter churner
Bilphok	1	10	5	Each HH	90	10	25	60
Shogore		35			35	0	40	95
Birir		-			-	-	-	25

Table B-12: Information appliances

Name	Radio	Dish antenna with stabilizer	Loudspeaker	Tape	Computer
Bilphok	Each HH (with battery)	14	14 (battery)	More 9	46
Shogore	Each HH (battery)	23	4 (battery)	130	30
Birir	-	2	-	?	-
Shagram	Each HH	15	?	Each HH	25
Raman	Each HH		?	Each HH	2
Harchin	Each HH	16 (??)	?	Each HH	15 (?)
Beyori	Each HH	0	?	Each HH	-
Bumburate/Kakal	Each HH	2	?	Each HH	-
Izh-Ovirk	Each HH	30	?	Each HH	?

113. There was a strong demand for using computers and people complained about the electricity supply only during night.

b Accessibility / Social Infrastructure

114. All villages visited are accessible from Chitral town by a four wheel drive car. Transport to and from the village is done by private local jeep taxis stationed in the village like in Shagram and Shogore. However, in winter time the valleys are not accessible by road. Shogore and Shagram have several government institutions and private organizations working in education and health care, whereas the other villages don't benefit from larger government representation and infrastructures.

115. Due to the existing gender segregation, higher education possibilities for girls are not only an indicator for increasing gender awareness but as well for the economic potential of the HHs. Only private schools offer education to girls in the area.

116. With the exception of Beyori Micro Finance groups exists in all visited villages. In Shagram there is a branch of the Habib Bank. Daily shops are located along the main road. Products are sold either to mobile Pathan dealers or on the Chitral, Booni or Drosh market. Public guesthouses and restaurants are only existing in Bumburate, catering for national and international tourists in summer time.

117. Only in Shogore, Shagram, Harchin and Bumburate representatives of local NGOs do exist. They are partly supported by AKRSP and like in Shagram organised by the Sunni community.

Table B-13: Infrastructure I

Name of area	Schools	Hospital	Post office	Bank	Mosque	Jamaat Khana	Jastakhan
Bilphok	3	-	1	no	4	10	0
Shogore	4	2	1	no	2	2	0
Birir	6	1[8]	0	no	9	0	6
Shagram	14	3	1	1	15	11	0
Raman/Harchin	18	1	?	?	?	?	0
Beyori	5	-	-	-	5	-	0
Bumburate	5	2	1?	no	several	-	1
Izh-Overk	8	2	1	1	3	7	0

Table B-14: Infrastructure II

Name of area	Restaurant	Guidepost	Shops	Micro Finance	Transport	Gov. store	Guesthouse	NGO Office
Bilphok	-	-	10	yes	Taxi	?	-	-
Shogore	-	-	20	yes	Taxi	1	1	3
Birir	2	1	25	yes	By foot	1	5	0
Shagram	-	-	50	yes	Taxi	4	-	4
Raman/Harchin	1	-	67	yes	Taxi	1	1	?
Beyori	-	-	10	no	Taxi	no	-	-
Bumburate	25[9]			yes	Taxi	1	25	1
Izh-Overk	-	-	41	yes	Taxi	1	1	2

c Community organisation and self help potential

118. Traditionally the so called “gram”, an organisation of several HH in a village took over various collective responsibilities of the village[10]. Other forms of self-help structures for grazing the livestock and protecting the forests and wildlife were existing, too. When the Pakistani Government took over responsibility in 1969, norms and regulations eroded and villagers did not feel as responsible for their environment as before. The merger led to a different attitude towards natural resources and as a consequence problems turned up which until today are not solved completely. Only nowadays NGOs revitalise part of these traditional structures by creating village and women organisations etc. in order to support the planning and implementing of development activities of the communities. Whenever a new programme or activity starts in the village (micro finance group for example) a respective VO is formed and trained. The VOs seldom comprise the whole population, but are important groups with the same interests for a given time. The establishment of these groups contributes to village organisation, planning of activities and a same vision. Several village organisations form a cluster and several clusters organise themselves into a Local Support Organisation (LSO) like Karimabad Development Organisation (KADO). The leaders of these different organisations are well trained, very often speak English and act as the representatives of the area. Elected Government village or union councillors are members of these village organisations, too.

[8] Dispensary
[9] seasonal summer opening
[10] Source:CCS, Indigenous Resource Management in Chitral

119. Most of the visited villages are well organised, self-help potential was visible and has been proven. Households are open-minded, Ismaili women even actively participate in meetings and discussions. In areas with a majority of Ismaili HHs Sunni HHs joined overall development activities. However Sunni women do rarely attend women's group meetings and were hardly visible outside their homes. In villages with a majority of Sunni HHs, Ismaili HH join development activities, however access to Sunni women is only possible for insiders. Only in Beyori there were no village or women organisations existing.

d Landownership

120. As a consequence of traditional landownership and land tenure systems three land tenure systems are existing in Chitral: Private property, common (village) property and state property. Private land property is normally inherited by the male members of a household. About 95% of HHs own their land in Chitral District. In the villages visited every HHs has his own piece of arable land. Due to the inheritance system of land, landholdings nowadays are very small accounting for in average 9 kanal[11] per HH (5-7 family members), that is 4,554 m² The average size of arable land of poor households is about 2-3 kanals, equal to 1,012 to 1,515 m².

121. Pastures are mostly owned by the villages. Every HH has grazing rights on communal land. In the Southern part of Chitral forest land as well is used by all households. There are no official restrictions in using forest land, but villages set up rules for the management of forests and pastures in order to protect their sustainable use. Private fruit and forest trees are planted on the fields belonging to each HH.

e Agriculture

122. Agricultural activities and yields depend on irrigation and soil condition. The agricultural season lasts from end of June till end of October. Southern Chitral up to Booni belongs to the double cropping area. The area north of Chitral belongs to the single cropping area. Wheat is the main staple food in the villages. In the North wheat is complemented by maize. In double cropping areas wheat is sown in November and harvest is in June/ July. In single cropping areas wheat is sown in September/October and harvested in July/August. Additional crops are barley and rice in double cropping areas. Maize is consumed by the households in the Northern part and serves as additional fodder for cows. In Kalash valleys maize is intercropped with cow beans in high up areas. Besides cereals for subsistence households cultivate vegetables like potatoes, chillies and onions for sale.

Table B-15: Yield

Area	Good soil: wheat/barley	Bad soil: wheat/barley
Double cropping area	700 kg/kanal	2-300 kg/kanal
Single cropping area	3-500 kg/kanal	

123. In single cropping areas HHs are self-sufficient for about 6-8 months depending on the quality of the land, in double cropping areas they could be self sufficient for 8-10

[11] 1 Kanal is 5,445 feet² is 506m²

months. Consequently every HH has to buy additional cereals preferably wheat. Due to the isolated situation in winter time the Pakistani Government built grain stores, situated in every bigger village. This stores provide cereals throughout the year. In winter 2004/2005 the price for wheat was 8 Rs/kg. Government is paying for the wheat transport from Punjab to Chitral.

124. Each farmer has additional fruit trees mainly apples and apricots and grows timber trees. However, fruit can be sold only at local markets due to the very difficult transport conditions.

125. Agricultural tools and machinery give an insight in the level of agricultural mechanization at village/HH level. Processing machines are either powered by diesel or a tractor. Threshing is done with a tractor, milling machines are powered by diesel generators. The service is mainly paid with grains or flower. Water mills are running in always every village.

Table B-16: Agricultural equipment

Name of area	Milling machine	Water-mill	Wood saw	Thresher	Diesel
Bilphok	1 Diesel	13	yes	Mobile service	3
Shogore	1 Diesel	4	yes	Mobile service	3
Birir	-	10	yes	?	0
Shagram	-	20	yes	8	9
Raman	7 Diesel	30	yes	5	4
Beyori	-	12	yes	Mobile service	1
Bumburate/Kakal	-	3	yes	?	2
Izh-Ovirk		11	yes	-	1

f Animal husbandry

126. Sheep and goat are the main livestock in Chitral. They are used for wool, hides and dairy products. Almost every HH owns 2-3 cows which are kept near the house for every day milk. Horses are raised for polo matches, ponies and donkeys do transport work. Yaks and horses are seldom even in the northern part of Chitral. Chicken became popular during the last years with the Kho HHs, but they are no option for the Kalash people who are not allowed by their belief to eat chicken.

127. During summer time livestock is grazed on pastures. For winter time fodder for livestock is collected or cropped (e.g. alfalfa). Due to the overall fodder scarcity the number of livestock is still small. Biofuel is scarce due to the low number of cows and it is mainly used in the northern Chitral for cooking and heating.

Table B-17: Number of livestock

Name of area	Cattle	Chicken	Yak	Horse	Sheep	Goat	Donkey
Bilphok	2-3/HH	6-7/ HH	-	-	1,500	1,500	-
Shogore	2-3/HH	1,000	-	-	20/HH	150	-
Avi Shogore	5/HH	700		-	1,400	150	-
Birir	1-2/HH	2-5/HH	-	1	200	5-10/HH	30
Shagram	2 HH				10-20/HH	>10	0
Raman	2/HH	10-20/HH	-	-	10-20 HH	10/HH	0
Beyori	12000	20/HH	-	-	2,000	840	-
Bumburate/Kakal	3-4/HH	-	0	0	3/HH	2,000	2
Izh-Ovirk	2/HH	5-10/HH	-	1	6,500	5-6,000	-

128. Due to fodder scarcity, lack of regular veterinary services and climate conditions livestock productivity is quite low.

g Poverty

129. Chitral belongs to the poorest districts in the Northern area. The annual average per capita income is Rs 9,543 at current factor cost and Rs 4,939 at 1991 constant factor cost[12]. In 1998 more than 36% of the households lived below the poverty line at Rs 6.165 per capita per year. "The Gini coefficient for the households sampled by AKRSP was 0.36 (on a scale of 0 to 1, indicating perfect equality (0) or perfect inequality (1). Thus poverty is distributed more evenly in Chitral, compared to the rest Pakistan with a Gini coefficient of 0.40[13]. Reasons for poverty are among others continuous natural resource degradation, difficult climatic situation, low education level and a very young population.

Table B-18: No of HH per classification

	Poor HH	Middle HH	Better-offHH
Bilphok centre	66	22	7
Shogore	Rest	45	25
Birir	The rest	10	3
Raman/Harchin	?	?	?
Beyori	150	150	120
Bumburate	?	?	?
Izh-Ovirk	?	?	?

130. The following table shows the self assessment of the resource persons in these areas as to the description of the better-off, middle income and poor HHs. When comparing the three sites, it is obvious that the discription of the different HH categories is quite similar[14]. The main resources to overcome poverty are: cultivable land, some livestock and permanent employment. HH which lack these facilities might not be in a position to increase their living standard.

131. Middle income HHs are self sufficient with a mix of subsistence and cash income resources. The majority of HHs in the visited villages belongs to this category. It is self understanding that poverty always has to be related to the social context of the whole village. In a poor village for example poor HHs could be poorer than poor HHs in a rich village.

132. Better-off HHs have overall resources to lead a decent life, they have more than enough.

[12] Source: CCS, (AKRSP, 1997)
[13] Cited from CCS, Chitral, An Integrated Development Vision, p. 9
[14] This is also valid fort he poorest of the poor households to which about 2 – 5 HH per village belong. They are among others exempted from paying fro electricity

Table B-19: HH Classification

Shogore (double cropping)		
Poor HHs	**Middle income HHs**	**Better-off HHs**
• Owns small low yielding pieces of land only • Survives on bread and tea • Lives in a traditional one room house • Fuel wood from collection all year round • Bad health • Children attend government school in Urdu • Are not mobile, they have to walk long distances • Have no permanent job • Sometimes HH members are disabled and widowed • Have more children • Have no voice in the community	• Has bread, vegetables like potatoes and tea • Has enough land for cultivation • Children attend private schools in English • Can afford a taxi	• Eats meat, eggs, fish, can buy soft drinks • Has more than enough land, can sell land • Has a newly constructed modern house • Good health, can see the doctor and buy medicine • Children can attend private schools in English • Own a car or can afford a taxi • Have a permanent government job
Beyori (double cropping)		
Poor HHs	**Middle income HHs**	**Better-off HHs**
• Has very little land and not enough wheat • Has only 100-200 forest trees and no fruit trees • Has no employment • Has to collect and sell wood to get cash income	• Have livestock (10 sheep) • Owns 1-2 cows • Have at least 1 kanal land • Have not so much forest • but have employment	• Have a lot of trees (1000) • Have enough sheep (2,000)and goats (10) • Have employment
Shagram (single cropping)		
Poor HHs	**Middle income HHs**	**Better-off HHs**
• Have no or very little land • Have no cow for every day milk • Don't eat meat • Don't have wheat • Have less cloth • Cannot send their children to school • Don't pay for electricity • Live in a traditional house	• Are self sufficient in every thing (food, clothes,) • Children go to Government school • Can hire a taxi for transport • Pay their electricity	• Have enough land, enough food, • Own a car • Send their children to a private school and have means to send them to university

Conclusion

133. From discussion and experience with poor families it can be deducted that basic electricity very often is a factor to make life more comfortable but is not decisive for the structural improvement of living conditions. To directly benefit from electricity impacts electric appliances must be available and affordable.

134. The analysis of electricity use combined with the analysis of human and natural resources of a village or a household gives an idea about potentials and possible linkages of electricity supply to other factors of development and poverty alleviation. With these insights interlinked bundles of development strategies have to be designed to improve the impact of electricity on household level and get synergetic effects. The focus and vision on potential economic impacts of electricity consumption for poor

households assume somehow that these households have already all assets to use electricity but they have not!

135. Electricity is obviously not the only factor necessary for rural growth and poverty alleviation. Its positive impacts on rural households in general and specially on poor households can be improved by a broader and holistic view and concept of rural development and its interrelations and linkages with electricity consumption. Access to quality electricity for productive purposes will improve the life of rural HHs substantially and more over structurally.

h Transportation means

136. Mobility is valued very high in isolated villages with bad road conditions. As there is no public transport available, private jeeps serve as group taxis. They are normally based in the center village and belong to a better-off HH. Poor HHs can only benefit from taxi transport if cash money is available. Tractors serve for ploughing, threshing and sometimes even power a milling machine. The number of tractors is still low.

Table B-20: Means of transport

Name of community	Bicycle	Motor bike	Car	Truck	Tractor	Jeep
Bilphok	12	5	6	-	-	-
Shogore	3	5	2	1	1	3
Birir	1	2	1	-	-	6
Shagram	15	9	-	-	8	18
Raman	1	1	-	-	4	11
Beyori	1	2	1	-	-	6
Bumburate	-	-	-	-	-	-
Izh-Ovirk	-	1	-	-	1	9

i Credit facilities in the project area

137. There are two possibilities to receive credits in Chitral Valley. The Habib Bank in Chitral town has several branches in the District where credits are available. In addition since 2002 there exists a First Micro Finance Bank (FMBF) in Chitral which has micro finance saving and credit groups in almost all of the visited villages with special loan products for poor HHs. Individual and group loans do exist for micro enterprises. FMBF offers a full range of financial products, such as deposits and loans but also transfer of funds. However a specific credit for electric devices and equipment is not yet designed but is under process.

j Living conditions

Housing

138. The normal traditional Chitrali house is built of stones and clay and has only one room. A courtyard surrounded by mud walls belongs to every house. A hole is left in the roof for the metal oven. Additionally to the metal oven, HHs use an open fire in summer to boil water and make chapatti. Besides the door and the hole in the roof the

house has no opening, so it is very dark inside even during daytime. One has hardly enough light to read or write, children have to do their home work under difficult conditions. The flat roof is covered by wood with a layer of mud, a plastic cover and a final layer of mud. The roof is used for drying of fruits and agricultural products.

139. Men and male children normally sleep on the right side of the room near the entrance, whereas women sleep on the left side. The room is used as storing facility as well.

140. The modern house in Chitral is normally built in an U-shape around a small courtyard with several rooms each with separate entrance. It is built of brick stones and is covered by metal sheets. Different rooms for different purposes change heating habits in winter, as the sleeping room has to be warmed up before going to bed.

141. Most of the villages have tap water either in the house or in front of the house.

142. The Kalash house is built from stones with layers of wood. The houses are situated on the hill side and built on small terraces. It has a roofed terrace in front of the room, where every day life takes place. Cooking is done there as well in summer. A holy place is situated in front of the door, where the household members offer blood after slaughtering. Solid wooden storehouses for grain and other products are situated outside the houses. The house type of Beyori village was similar to the Kalash houses.

Family structure

143. An extended family of three generations forms a household. The household comprises the families of the father and his sons, every household consists in average of about 9-10 members. The leader of the household is normally the oldest man of the family. Land is inherited by the male members of the HH. Marriages are arranged between the different families. The future couple does not meet each other before marriage. When being married women join the household of the husband.

144. Members of the royal clans are not supposed to marry ordinary women. Intermarriages between different clans are possible. Traditionally resources are pooled and income is spent on family matters. Sons and daughters have to care for their parents.

Gender roles

145. Religion shapes gender roles in the villages.

146. In Sunni villages mobility of women is quite restricted. Sunni women are not supposed to leave the house except for farming and grazing cows. They should not meet strangers. Consequently it was difficult to meet Sunni women for discussion. Ismaili and Kalash women don't observe the Purdah system and can move freely in their villages. Ismaili women are not hindered to attend schools and even get higher education and university degree. Nevertheless it is still difficult for them to get a job in rural areas.

147. In the Kalash community women are easily reachable, they work outside the house and have almost no restrictions in their mobility. Kalash women even don't use a scarf to cover their head. Men can move easily and are not supposed to observe purdah.

Gender division of labour

148. Gender roles define the division of household and farm labour. The gender division of labour defines the daily tasks of men, women and children in a household. This division gives mainly to women the responsibility for housework like cleaning and cooking. Women are responsible for the domestic education of the children and they care about old HH members. In Chitral they help to collect fuel wood and grass for feeding the animals. Women as well as their husbands are also fully involved in agricultural and livestock production. If livestock is kept near the house, women graze and water the cows. Men are the representatives of the household in public. Men do shopping and go to the market,men buy everything the household needs. Income generated by women is spent for the household itself. Women normally don't have money on hands as their husbands are responsible for purchasing everything. In the extended family all resources are shared with the defferent family members.

149. The gender division of labour is similar in Sunni and Ismaili HHs. The following table shows the gender roles.

Table B-21: Division of work

Women	Men
• All household work as cooking and cleaning, • Agricultural work as weeding, feeding and grazing the cows, sowing vegetables, harvesting, collecting fuel wood • Collect water	• Shopping • Ploughing, sow cereals, irrigation of fields, transport harvest, collecting fuel wood, • Brick making, house construction • Drive a car • Selling products at the market • Buy all daily articles for the family

4 Site ranking

150. In cooperation with local resources persons the consultants screened the villages referring to the following selection criteria. Initially seven villages were pre-selected for more comprehensive site visits. Those criteria were as well applied for the final ranking of proposed sites. Social, economic and management criteria were equally valued and are of equal importance. Each criteria was ranked between 1 and 6, 6 signifying the highest manifestation of the criteria and 1 the lowest. The description of the criteria follows below.

a Large Number of HHs

151. The number of HHs in the area planned to be supplied with electricity should be large enough to allow for some productive processing and service uses to safeguard maximum load factor of the envisaged capacity of the MHP. This criteria would also ensure the likely presence of a certain number of social and business services such as schools, hospital or health care centres, banks as existing or potential users of electricity. A minimum of 400 HHs was required.

Assessment:

152. The visited villages belong to different Union Councils. Household size in Chitral subdivision (teshil) is 7.6 persons whereas it is in Mastuj sub division 8.4. persons[15]. The estimated population in the area is about 35.200 persons.

Table B-22: Number of households

Name of area	Name of Union Councils (UC)	Number of HH	Electrified	Non electrified	Capacity of existing MH
Shogore – Bilphok	Chitrali UC2, Karimabad UC, Shogore UC	430	218	212	Bilphok 30 KW Shogore 50 KW
Birir	Ayun UC	308	305	3	Norbiz Birir 25 KW
Shagram	Shagram UC Khut UC	1228	586 (+100 Shydo)	542	Borzund 100 KW
Harchin – Raman	Laspure UC	800	150	650	Raman 30 KW
Beyori	Drosh 2 UC	440	30	410	Beyori Mandeh 30 KW
Bumburate	Ajun UC	800	730	70	2x Krakal 50 KW
Izh-Ovirk	Garam Chashma UC	730	335	435	50 KW

b Religious, ethnic and clan composition

153. The three major religious groups (Sunni, Ismaili, Kalash) should all benefit from the project in order not to create bad sentiments, prejudice or suspicion among the groups.

Assessment:

154. In Chitral District the majority of the population belongs to the Sunni group of Islam. Mainly in the Central and Northern part of the District we do have villages which adhere to the Ismaili school. The Kalash indigenous people in Bumburate and Birir valley adhere to their traditional belief.

155. There are three distinct ethnic groups living in the selected villages: the Khow, the Kalash and the Dangerik. The majority of the inhabitants belong to the Khow ethnic group. The main language in the visited villages is Khowar (also called Chitrali). Almost every men can speak Urdu, the language in Government schools. Some HHs know Pashtu and some village representatives even speak English.

156. The indigenous Kalash people speak their own language: Kalashwar. The Sunni inhabitants of Beyori which belong to the indigenous group of the Dangeriks immigrated from Chilas. Their language is the Palula, a dialect similar to the Shina language.

157. The whole population is hierarchically structured and organized in clans. The Kho clans associated with the royal family are the Katore, Riza, Sangal, Khushamat, Khushwakhul, Mohammad Baig and Raisai. Other clans like the Roshtai, Zondrai,

[15] Source: 1998 District Census Report of Chitral, Census Publication No 20, Population Census Organisation, Statistics Division, government of Pakistan, Islamabad may 1999, p. 35

Dashmanai etc rank lower in social status. People immediately ask about their clan to position themselves and their partner.

Table B-23: Number of households according to religious believe

Name of area	Sunni	Ismaili	Kalash
Bilphok	41	249	-
Shogure	45	85	-
Birir	168	-	140
Shagram	673	593	-
Raman/Harchin	4	796	-
Beyori	440[16]	-	-
Bumburate valley	200	-	600
Izh-Ovirk	215	505	-

c Homogenous village situation

158. Conflicts about landownership, water rights or strong political oppositions, religious tensions will hinder sustainable cooperation between villagers. As a consequence the village should be homogenous referring to the above aspects. Prevailing conflicts among villagers or involved villages in one selected area would endanger future sustainable MHP management. Living in social harmony with other religious groups is an important precondition for developing self help potential and village based actions.

Assessment:

159. Due to different interpretation of Lslam there are at least two “development concepts” prevailing in the area. Ismaili villages are open-minded towards development and due to their hard work and their continuously increasing education level have good economic resources. As a consequence Sunni HH participate in community activities and benefit from them in areas where a considerable number of the HH belong to the Ismaili sect. In some southem Sunni HHs development activities are not as easy.

160. All visited villages are quite homogenous. All three religious groups (Sunni, Ismaili, Kalash) live in harmony together. Only in Beyori village representatives were reluctant to contribute to a MHP.

Table B-24: Homogeneity of visited villages

Name of area	Homogenous
Bilphok	+++
Shogure	+++
Birir	+++
Shagram	++
Raman/Harchin	++
Beyori	+
Bumburate valley	+++
Izh-Ovirk	+++

[16] The inhabitants of Beyori belong to an indigenous group called Dangerik. Their language is Pulalu, a dialect to the Shina language.

d Living standard and cash income

161. Availability of cash income is a necessary precondition for paying the electricity consumption and investing in productive electrical appliances. Income resources and living standard of HHs have to be assessed.

Assessment:

162. Most of the households cannot survive on their agricultural income and need other cash income resources. Main cash income sources are government salary and pension pays (teachers, police and ex-servicemen). Seasonal migration out of Chiral and remittances are part of almost every rural HH income and constitute an important element to improved living standards. Seasonal migrants leave in October, after the grain harvest has been threshed, and fuel wood and fodder has been collected, returning in April or May in time for the sowing season. Men engage in construction work, are salesmen or watchmen. The monthly salaries amount from 4,000 to 6,000 Rs for seasonal work depending on the quality of work. The average saving of migrants is about 3,000 Rs per month.

163. The trend towards increasing off-farm employment outside Chitral District has changed the gender distribution of labour visibly. During the seasonal absence of the men, traditional male responsibilities, such as clearing snow from roof tops and livestock sheds, managing land and attending to social obligations, are assumed now by the women.

164. The following cash income sources could be identified. Other income derives from sales of horticultural and livestock products.

Table B-25: Cash income sources by village members

Name of area	Gov. employees & ex-servicemen	Private employees	Farmers	Migrants	Business men
Bilphok	?	?	all	100	>10
Shogore	30	45	all	70	>80
Birir	25	10	all	0	?
Shagram	150	50	all	12	25-50
Raman	93	8	all	60-70	41
Harchin	59	3	all	145	29
Beyori	30	-	all	30	11
Bumburate	>60	65	all	0	>80
Izh-Ovirk	61 - 66	12	all	121	>50

165. The Kalash, however do not engage in seasonal work during the winter. Some men tried to find some income possibilities in Drosh, but were not successful, waiting for more than a week and came home without money. The main income in the Kalash valley Bumburate results from tourism during the summer time. Mainly women sell necklaces, weaved products and colorful dresses. Women from all HH categories produce their hand made dresses and hair ornaments by themselves. The following table shows income possibilities in Bumburate.

Table B-26: HH income possibilities in Bumburate	
Activity	**Rs**
Tourist guide through the village	200 Rs/day (for about five months in summer)
Selling jewelry	20-30.000 Rs per summer
Selling liquor and wine (200 Rs/1l wine, 500 Rs/1 l liquor)	6,000 Rs per summer
Selling Kalash dresses (3,000 Rs each)	6,000-9,000 Rs per summer
Photos	100 Rs/each (except on festival days)

166. Due to established links for seasonal labour the majority of the HHs is able to be self-sufficient complementing income from subsistence farming with cash income generated off-farm.

167. The assessment of living standards (food, cloth, housing, health) are quite difficult. Living conditions are harsh due to the total isolation during winter time. A self-assessment of representatives from the different villages, the visited women groups or even single HHs had the following result.

Table B-27: Description of HH categories		
Poor HHs	**Middle income HHs**	**Better-off HHs**
100 RS/day casual labour like wood selling	20-30.000 Rs per year	40-60.000 Rs per year
• Have no or very little land • Have no cow for every day milk • Don't eat meat • Don't have wheat • Have less cloth • Cannot send their children to school • Live in a traditional house • Don't pay for electricity	• Are self sufficient in every thing (food, clothes, etc.) • Children go to Government school • Can hire a taxi for transport • Pay their electricity	• Have enough land, forest and fruit trees • Have enough food, • Own a car • Send their children to a private school and have even means to send them to university

168. Besides the very poor HHs (the number ranges between three to twelve HHs) all other HHs in the visited villages are able to afford electricity.

e Gender awareness

169. Women should benefit from project activities as much as their male colleagues. Gender roles, the influence of women in their HHs, their mobility and activities are quite different and vary from village to village. Therefore gender awareness is quite important for the project. Productive electricity use and the use of household appliances increase the options for women to save labour and time. Gender awareness in the HHs helps to decide between different options and use the available potential.

Assessment:

170. Gender awareness varies from village to village.

Table B-28: Gender awareness

Criteria	Bilphok/ Shogore	Birir	Shagram	Raman Hanchin	Beyori	Bumburate	Izh-Ovirk
Gender awareness	Yes	Partly	Partly	Yes	Less	Partly	Yes

f Willingness to contribute to the construction of MHP

171. As the communities will be the owners of the MHP, the households should be motivated to contribute to the planning and construction process of the MHP by cash, material or labor. Self help potential is necessary for a sustainable maintenance of the power plant.

Assessment:
172. Except in Beyori where the representatives of the villages rejected village contributions in cash or labour, all other villages were ready to contribute either in cash or in labour force.

173. The villages are used to communal work as they regularly have to repair their irrigation channels and their roads sometimes. Consequently most villages proved already their ability in the past to manage a MHP and supply electricity to their fellow villagers and clients.

Table B-29: Willingness to contribute to the construction

Criteria	Bilphok/ Shogore	Birir	Shagram	Raman Harchin	Beyori	Bumburate	Izh-Ovirk
Willingness to contribute to ,the construction	Yes, in cash or kind	Yes	Partly	Yes, in cash or kind	No, no time to contribute in labor force, no money either	Yes, in cash or kind	Yes, well organized village

g Willingness and ability to pay for electricity

174. Presently electricity consumption has to be paid either per kWh (meter) or as a flat rate. Permanent cash income is a precondition to increasing electricity demand and the ability to pay for this demand. If basic needs are not satisfied, HH will not pay or reduce their electricity consumption as much as possible.

Assessment:
175. All HHs are ready to use meters and will pay according to their kWh consumption if more quality electricity is ensured. The income situation of the HHs in the proposed areas allows for covering of all operational, future system repair and

maintenance cost by mutually agreed tariffs. Up-scaling the electricity supply and installing meters will not negatively affect poor households. These HHs are allowed to use one electric fluorescent tube of 40 W free of charge. The representatives of the proposed villages have all emphasized their willingness to pay according to cost estimates and agreed tariffs.

h Self-help potential

176. The self-help potential of a village is manifested in the quality of its organizational structure and determined by the level of intensity of the organizational structure, ongoing activities and past experiences.

Assessment:

177. In all visited villages (exception: Beyori) the inhabitants had created Village Organizations (VO) and Women Organizations (WO) according to different tasks, needs and activities. These VOs and WOs are supported by national and international donors.

178. Ismaili villages tend to be well organized, self-help potential is visible and has been proven by past performance. Households are open-minded, women actively participate in meetings and discussions. In areas with a majority of Ismaili HHs Sunni HHs joined VOs and WOs and participated in development activities like the Ismaeli HHs. To conclude, development activities and programmes have a far better chance to succeed in Ismaili and mixed villages than in 100% Sunni villages.

Table B-30: Village organisations

Name of area	Village organisations
Bilphok	Several VOs and WOs
Shogure	VOs, LSO
Birir	10 VOs, 1 WO
Shagram	22 VOs, 12 WOs, CCB, different social welfare organizations[17]
Raman	18 VOs and WOs, IUCN, WASIP,
Beyori	-
Bumboret	2 VOs, 1 WO
Izh-Ovirk	Several VOs and WOs

i Increasing HH electricity demand

179. The first step on the scale of electricity consumption is basic electrification for lighting and information. When scaling up the capacity of the MHP there should be a realistic growth in consumption.

Assessment:

180. The purchase of different existing electric HH appliances shows the growing demand of electricity. The distribution of present electric HH appliances is quite different in the visited villages. Better-off HHs bought various HH appliances hoping that their use would be possible. However due to insufficient capacity of the MH the use of the appliances was forbidden. Nevertheless the purchase of these appliances show the demand for more and quality electricity.

[17] Al Shabab Social Welfare Organisation, Washich Young Welfare Organisation, Islah Yaram Welfare Oganisation

Table B-31: Existing electric time and human energy saving household appliances in three village

Name	Oven	Juicer	Iron	Heating rod	Fan	Refrigerator	Washing machine	Butter churner
Bilphok	1	10	5	Each HH	90	10	25	60
Shogore	?	35	?	Each HH	35	0	40	95
Birir		-			-	-	-	25

181. Not only household appliances but as well information appliances are valued high by the HHs.

Table B-32: Information appliances

Name	Radio	Dish antenna with stabilizer	Loudspeaker	Tape	Computer
Bilphok	Each HH (with battery)	14	14 (battery)	More 9	46
Shogore	Each HH (battery)	23	4 (battery)	130	30
Birir	-	2	-	?	-
Shagram	Each HH	15	?	Each HH	25
Raman	Each HH	?	?	Each HH	2
Harchin	Each HH	16 (??)	?	Each HH	15
Beyori	Each HH	0	?	Each HH	-
Bumburate/Kakal	Each HH	2	?	Each HH	-
Izh-Ovirk	Each HH	30	?	Each HH	?

182. All better-off and middle income HH would at least purchase the a standard set of time and energy saving HH appliances.

j Potential of productive energy use

183. The whole concept is based on productive use of energy. Consequently, there should be sufficient demand in this sector.

Assessment:

184. Villagers are aware of some electric equipment for productive use (carpenter, electrician, welders, tailors, wood saw mills), but more technologies and value-added opportunities need to be introduced (wool shearing, carding, spinning, weaving, walnut oil extraction or apple juice pressing, heaters, fruit drying, conservation and packaging, chilling stores, marble and slate cutting, polishing, gems cutting, faceting, polishing, or other business service facilities such as photo shops, photocopying, Internet or PC training).

Table B-33: Productive use potential							
Criteria	**Bilphok/ Shogore**	**Birir**	**Shagram**	**Raman / Harchin**	**Beyori**	**Bumburate**	**Izh-Ovirk**
Productive use potential	+++ good	+ poor	+++ good	++ medium	+ poor	++ fair	+++ good

k General development potential

185. The general development potential of a village or area is determined by its agricultural, husbandry or horticultural surplus production, by value-adding processing opportunities, by its mineral resources, by its tourist attractions, by other potential business services and by the purchasing power of its own community.

Assessment:
186. In most villages or proposed locations the general economic development potential is good or needs additional efforts to be actively exploited.

Table B-34: General economic development potential							
Criteria	**Bilphok/ Shogore**	**Birir**	**Shagram**	**Raman / Harchin**	**Beyori**	**Bumburate**	**Izh-Ovirk**
General growth Potential	++ medium	+ poor	+++ good	++ medium	+ poor	+++ good	+++ good

l Access to market

187. New or processed value added products or services need a market within the area or in a reachable distance. The major markets are situated in Chitral or Booni in the North and Drosh/Ayun in the South. The main market for the tourist destination "Bumburate Kalash valley" or "Birir Kalash valley" might be even outside the Chitral district in Pakistan or abroad.

Assessment:

Table B-35: Access to market							
Criteria	**Bilphok/ Shogore**	**Birir**	**Shagram**	**Raman Harchin**	**Beyori**	**Bumburate**	**Izh-Ovirk**
Access to market	good	poor	medium	poor	medium	Medium	Good to medium

188. The following tables show the assessment according to the criteria and the total score the villages got. Summaries for each sites are compiled in Annex 1.

Table B-36: Summary of ranking results

Criteria/Villages	Izh-Ovirk	Bilphok / Shogore	Shagram	Bumburate	Raman/Harchin	Beyori valley	Birir valley
• Number of HHs	730	430	1228[18]	800	800	440	308
• Benefits balanced between relig. Goups	Ismaili: 505 Sunni: 215	Ismaili: 334 HH Sunni: 86 HH	Sunni: 673 Ismaili: 593[19]	Kalash: 600 Sunni: 200 ?	Ismaili: > 462 Sunni: 2	Sunni: 440	Sunni: 168 Kalash: 140
• Homogenous village situation	Yes, well organized area, little land conflicts	Yes, good cooperation between Ismaili and Sunni HH	Yes, majority of Sunni and Ismaili	Yes, Kalash and converted Sunni households	Yes, majority of Ismaili HH	As far as it appears political competition and conflict	Yes Sunni Cheikh, Kalash
• Cash income sources	75 employees 121 migrants 50 busin. men	170 seas. migrants, 80 employees 80 busin. men	200 employ. 25 bus.men	125 employ. 80 seasonal busin.men	150 employ. 200 migrants	?	Little cash income resources
• Gender awareness	Yes, active involvement of women	Yes, women participate in activities	Partly	Partly	Yes	Less, women live under purdah system	Partly
• Willingness to contribute	Willing to contribute in labour/ cash	Able to contribute labour/ cash	Able and willing to contribute	Potential, but no interest and planning	Potential to contribute labour and cash	no time to contribute in labour/cash	No valuable information

[18] The final number of HHs to be supplied will be decided later.
[19] In the whole area including unelectrified HH, too

Criteria/Villages	Izh-Ovirk	Bilphok Shogore	Shagram	Bumburate	Raman/Harchin	Beyori valley	Birir valley
• Willingness, potential to pay for electricity	High, meter, free for very poor HH	Already experience with payment according to meter	Regular payments according to cash availability	Discount in winter, no cash income	Regular payments according to cash availability	1 MH has a break down since 9 months without efforts to repair	Difficulties with regular payments due to seasonal cash income
• Management capacity for a MHP (self help capacity)	Good past performance, high capacity MH very well managed	Several VOs and WOs, good performance, good management capacity	VOs, but due to purdah only Ismaili WO, Existing normal problems	8 smaller MHP in the valley, most are not in good conditions	Several VOs and WOs, Existing normal problems	Experience with traditional jirga	No valuable information
• Present HH electricity demand	HH appliances Prod. equipment	HH appliances Prod. equipment	Increasing demand	Only high seasonal demand	Increasing demand, less appliances	No information	Stable demand
• Potential of productive energy use	Increase of productivity new technology applications	Increase of productivity new technology applications	Increase of productivity new technology applications	Increase of productivity in hotels and restaurants	Increase of productivity new services technology applications	Poor	Poor
• General develpment potential	Good, Re-opening of Afghan border, some tourism, hot springs	Good, horticulture surplus, mining potential, transit to Afghan border	Good, horticulture surplus technical & social services	Good, High tourism potential handicraft for tourists	Medium Transit road to Shandur pass/Gilgit minning restaurants	Poor	Poor
• Access to market	Good to medium Chitral	Good Chitral	Medium Booni, Chitral	Medium Chitral, Pakistan	Poor Mastuj, Booni	Medium Chitral, Drosh	Poor Drosh, outside Chitral district

Total score							
Rank	**1**	**2**	**3**	**4**	**5**		
Criteria/Villages	**Izh-Ovirk**	**Bilphok Shogore**	**Shagram**	**Bumburate**	**Raman/Harchin**	**Beyori valley**	**Birir valley**
• **Number of HHs**	**4**	**3**	**6**	**5**	**5**	3	1
• **Benefits balanced between relig. Goups**	**5**	**4**	**6**	**6**	**2**	5	5
• **Homogenous village situation**	**6**	**6**	**5**	**6**	**5**	2	5
• **Cash income sources**	**6**	**6**	**6**	**4**	**6**	4	2
• **Gender awareness**	**6**	**6**	**4**	**4**	**5**	2	3
• **Willingness to contribute to construction**	**6**	**6**	**5**	**5**	**5**	1	3
• **Willingness and potential to pay for electricity**	**6**	**6**	**5**	**4**	**5**	4	3
• **Management capacity for a MHP (Self help capacity)**	**6**	**6**	**4**	**3**	**4**	1	2
• **Present HH electricity demand**	**6**	**6**	**5**	**3**	**4**	2	2
• **Potential of productive energy use**	**6**	**6**	**6**	**4**	**4**	2	2
• **General development potential**	**6**	**6**	**6**	**6**	**4**	2	2
• **Access to market**	**5**	**6**	**4**	**4**	**2**	4	2
Total score	**68**	**67**	**62**	**55**	**51**	32	31

Based on our rapid assessment the areas of Izh-Ovirk (1), Bilphok/Shogure (2), Shagram (3) and Bumburate (4) are likely potential sites for productive use of electricity. Due to its severe shortage of local fuel wood and expensive fuel wood "imports" from southern Chitral, Harchin/Raman (5) in the north would be an excellent site to introduce electric heater devices. The proposal for these pilot demonstration sites is in particular based on the consideration of a balanced cultural as well religious development approach and a successful implementation. Much more potential sites for further up-scaling do exist.

C PROJECT OUTLINE

1 Problem statement

189. Despite the availability of environmental friendly natural resources, rural electrification rate is low and hampers the economic development of the rural areas of Pakistan. Main reasons are missing governmental policies, lack of funds, high rate of poverty and a lack of programs that can incorporate communities supplied with electricity into a market economy through productive use of energy.

a Barriers to be removed

190. Main barriers have been identified as follows.

- **Institutional and policy barriers:** The rural decentralized power supply sector is not well structured. Supply strategies mainly concentrate on central supply options and "big solutions". There is a considerable lack of experience with alternative supply concepts and strategies for rural electrification. In addition, there is a lack of dialogue between potential energy developers and government. The existing policy framework is not sufficient to respond to the real needs of rural electrification. The project measures will support the elaboration of a decentralised rural power supply strategy for rural areas in Pakistan[20].
- **Technical barriers:** The technical barriers include the lack of local manufacturing and repair capacities for micro and mini hydropower equipment, insufficient design and planning know how especially in the mini and micro hydro sector with respect to operational sustainability. Adequate measures including training seminars, initiating cooperation between national and foreign companies, and development of adopted standard design and technical lay-outs will support the development of a national market sector.
- **Operation and management barriers:** Operation and management of decentralised power supply units requires certain structures, principles and knowledge which are currently not fully available in Pakistan. Careful and responsible operation is difficult in case operators are anyhow paid by the public, are earning very little money from their job and when nobody really takes care on their performance.
- **Information barriers:** Lack of awareness of and information about productive use potential, and the cost and benefits among potential users, vendors, and other stakeholders. Dissemination and replication are the main instruments to spread information among the stakeholders and throughout the country.

[20] The concept will be based on hydropower but allows transfer to other regions and other energy sources as well.

2 Project objectives and methodology

a Project objectives

191. The project's overall goal is to contribute to poverty reduction and protection of natural resources in rural Pakistan. The project aims to overcome the institutional, organizational, technical and financial barriers which hamper the introduction of a sustainable decentralised electricity supply[21] in rural areas for economic growth, income and job generation, and poverty reduction. It aims also to reduce the threat to natural resources and addresses two problem areas, rural poverty and protection of natural resources such as forests by providing alternative energy sources to the consumers. It contributes to the MDGs, especially to

- No 1: eridicate extreme poverty and hunger
- No 7: ensure environmental sustainability
- No 8: develop a global partnership for development (develop and decent productive work for youth; make available the benefits of new technologies – especially information and communication technologies).

192. Beside, the project will contribute to the reduction of greenhouse gas emissions (GHG) through the utilization of renewable energy sources. GHG reduction will be also achieved by replacing existing diesel engines and generators by MHP.

193. In combination with other integrated development measures electricity plus can be the major element for productive income generating development and may as well contribute to poverty reduction in rural areas.

194. A contribution towards environmental sustainability is done by replacing fire wood by electricity.

195. The project strategy is to focus on areas and communities within rural Pakistan that have no access to sufficient electricity, but sufficient renewable energy resources for power generation at their disposal and which have untapped natural resources and other economic potentials which can be exploited economically. The tools and methodologies for removal of barriers are been developed and demonstrated at the pilot projects in Chitral district.

b Project methodology

196. It is foreseen to implement the pilot projects in Chitral district of NWFP province. Due to the geographic and climatic conditions hydropower is the only viable energy resource in this region. Therefore power supply systems for productive use will be based on mini hydropower stations in Chitral district. However, the concept can be easily adopted to other renewable energy sources which may prevail in other regions of the country. With the removal of the identified barriers the concept becomes replicable on a sustainable basis. Dissemination activities ensure the nationwide awareness of the concept.

197. The project is based on an innovative approach to rural electrification by using renewable energies. Rather than focusing on providing access to energy as project

[21] Based on renewable energy

objective, the project aims to provide electricity as a basic tool to initiate value added productive chains in rural areas. Thus, access to modern reliable energy is the driven force behind a productive process that will generate income and improve living conditions for the rural population.

198. Beside, other renewable energies as thermal solar may be included in case they could be used in a productive way[22].

199. The support of local entrepreneurs in developing, establishing and running a business is another key factor of success. The project will assess applicability of a variety of delivery mechanisms for productive uses and subsequently demonstrate the selected models.

200. The project will be based on strong participation of municipal governments as well as local communities to enhance synergies for the implementation and demonstration of technologies and production methods.

201. A comprehensive concept on

- Poverty reduction through rural economic development through the provision of electric power for productive use combined with assistance in start-up of small businesses, technical and business qualification and access to credits
- Protection of natural resources through the provision of alternative energy sources for households and productive purposes

will be elaborated and demonstrated at pilot sites.

202. Following the above strategy, the project consists of five components, to be implemented under an operational framework.

1. **Development of decentralised electric power supply schemes for productive use based on renewable energy:** Suitable designs for micro- and mini hydropower stations are elaborated and demonstrated at selected sites. Capacities are calculated according to productive demand. Operation and management structures and tariff systems are introduced taking into account the ability and willingness to pay for and the revenues required for a sound plant operation. Training and qualification of personel and a monitoring system contribute to the sustainable operation of the plant.
2. **Identification and development of productive uses of electric power generated through renewable energy:** Products and processes with economic potential are identified and productive chains analysed and developed. In addition, new products and production processes, additional value added will be made available by shifting the level of production from low value raw materials to higher value finished or semi-finished goods. The main activities comprise:
   - o **A capacity building programme** to support the adoption of electric power for productive use including
     - ➢ Developing capacities in the design of renewable energy based decentralised electric power schemes and of manufacturers of system parts hereto
     - ➢ Developing capacities for operation, maintenance and management of decentralised renewable energy based power generation
     - ➢ Developing the skills of users to install, operate and maintain the new equipment.

[22] thermal solar energy can be used for drying, water heating, space heating

- **Enhancing access to finance:** In cooperation with financial institutions the project develops and catalyzes the implementation of financing schemes for productive use. Various delivery models[23] are analysed with respect to their suitability for financing productive use of energy. Emphasis is laid on the utilization of regular micro credit facilities.

3. **Risk management:** In case of using hydropower as renewable energy resource, water shed management is essential to ensure its sustainable operation. Consequently, a capacity building component is included to strengthen local processes to improve watershed management and reduce vulnerability to climate change. Methodologies for risk reduction and management at the local level will be explored.
4. **Promotion of legal, institutional and regulatory framework to facilitate rural electrification for productive use:** Regulatory and policy instruments are developed to promote both decentralised rural energy supply by renewable energy resources and productive use of electricity. A rural electrification strategy and concept is elaborated comprising necessary regulatory and political frameworks, technical framework conditions and solutions, and cost and benefits. The concept also includes principles for a national productive use programme as a key component to rural development in Pakistan.
5. **Monitoring evaluation dissemination and replication: A monitoring and evaluation system is** established and implemented. Basic features are an output oriented monitoring & evaluation system to measure project performance, an impact monitoring system providing information on overall goal achievements and long-term impacts. Baseline data on energy generation and use are collected during project implementation and indicators will be developed for different levels of project activities. Indicators to measure project impact will make use of the programme-level indicators developed for the GEF Climate Change Focal Area[24]. At the project level indicators also need to describe the number of changes in employment opportunities, revenues and profits. At overall objective level the development of rural economy, poverty and natural protection are to be measured.

[23] e.g. vendor financing, fee for service gradually decreasing subsidies. Loan guarantees, leasing soft loan

[24] which include energy production and installed capacities, technology costs, business and supporting services development, financing availability and mechanisms, policy development, awareness and understanding of technologies, energy consumption, fuel-use patterns, and impacts on end-users

D IMPLEMENTATION ASPECTS

1 Implementation structure

a Project organization chart

203. The project is co-funded by GEF. Main implementation agencies are AEDB and GTZ at national level. At district level an implementation concept has to be identified/established which can be disseminated to other areas, too (compare chapter 2). The overall proposed implementation structure is presented in Figure D-1. Beside the core implementation units all relevant institutions organizations are involved at respective levels. As local implementation agency the **AforPURE** (Agency for productive use of renewable energy) will be either established or a already existing experienced local development organization is to be nominated.

b AforPURE

204. It is suggested to set-up a market-oriented "Agency for the promotion of productive use of renewable energy (**AforPURE)**" in Chitral town. Since the most viable source of renewable energy in Chitral district is hydropower, the focus is on the promotion of micro and small hydropower[25].

Core Competence	**Main Functions and Tasks**
- Civil Engineering & Micro Hydro Technology - Socio-Economic Assessment & Small Business Promotion - Office Management & Accounting	- Planning, Designing & Supervision of Implementation at selected sites (Supply side focus) - Assessment of Potential for local Management and productive Use (Demand side focus) - Sub-contracting and monitoring of work progress/performance of partners
All other tasks should be realized in cooperation with external Partners or service Providers: - Socio-economic and technical site surveys, - Involvement of village organisations in planning, construction, self-management; - Demonstrations of productive technologies using electricity or solar energy; - Business Development Services (BDS) such as information, training, consultancy, marketing support, or investment loans for productive use; - Monitoring of changes and impacts at intervention areas (value-added, employment, income).	
Required Attitudes of Professional Staff - Responsiveness to peoples' problems and high level of flexibility; - Proven networking capacity (external partners, village organisations, government offices, donors); - High work motivation and firm commitment to agreed "Management by Objectives".	

[25] The use of solar energy – particularly for drying and hot water in hospitals or health care centers and as source for space heating should be exploited as well.

Legal Frame

205. It is proposed to develop this office or agency with the "Project Implementing Partner" of the Pakistan Government into a self-managed unit either as:

1. A **private non-profit professional company** with shareholders of concerned government offices, NGOs and the involved private sector; or as
2. A **specialized regional NGO** - "**AforPURE**" managed by the core staff and supervised by the concerned partners.

206. Considering the present purchase power of the targeted rural communities **AforPURE** will remain "donor-driven" as long as there are no long-term, low service charge loans or even grant facilities available in the country.

207. **AforPURE** should be locally based and structured in a way that it can easyly be copied to other areas. It will act independently, establish its own network, write project proposals and look for further national and international funding. The activities of **AforPURE** comprise:

- **Awareness raising and dissemination of information:** The newly created **AforPURE** informs villages and private and Government institutions about productive use of electricity, income generating possibilities and employment opportunities. Experiences of the five selected pilot sites will be disseminated and application procedure explained.
- **Application/resolution of interested communities:** Villages and interested village organizations send their application to **AforPURE** indicating the main characteristics of the area (location of site, number of HHs, envisaged productive energy use, present capacity of MH, present savings in maintenance fund, present or past development activities etc.).
- **Screening of sites:** Technical site screening including cost estimation and capacity calculation is conducted by **AforPURE** own staff or by other technical departments. In case the site is technically feasible socio-economic screening and ranking follows in the next step including the following criteria:
  - Large number of HHs
  - Homogenous village situation
  - Self-help potential
  - Living standard and cash income
  - Gender awareness
  - Willingness to contribute to the construction and manage the MHP
  - Willingness and ability to pay for electricity
  - High electricity demand
  - Economic development potentials
  - Access to market
  - Operational cost recovery
- **Evaluation of technical and socio-economic fact finding:** Technical and socio-economic staff of **AforPURE** jointly take the final decision as to support the application of the villages.
- **Elaboration of project proposal by AforPURE for national/international funding: AforPURE** staff writes a project proposal and submits it to national and international agencies and donors for funding.
- **Capacity building for management staff of MHP: AforPURE** will be responsible for capacity building and training of future operators of the MHP and supervises the

savings for the maintenance fund of the concerned villages in order to secure a sustainable supply of electricity.

- **Awareness raising: AforPURE** is responsible for continuous awareness raising for the productive use of electricity in the villages.
- **Informal vocational/technical/business training:** Villagers might no know how to use certain productive machinery. **AforPURE** will provide technical and vocational skill training on demand. Assessment of business opportunities will be a training topic for interested HHs.
- **Result and impact monitoring of funded project:** Result and impact monitoring will be done by qualified staff of **AforPURE**. Monitoring results will be shared with the relevant governmental institutions, organizations and donor agencies. After a time period of one year the MHPs are officially handed over to the villages and **AforPURE** will further on only support the impact monitoring.
- **Evaluation of experiences after three years of operation:** In order to continuously improve the construction and management system of the MHP, **AforPURE** will organize every three years a workshop with operators and management staff of the MHP to share experiences and evaluate the operation. Lessons learnt will be incorporated into the ongoing screening and capacity building procedures of **AforPURE**.

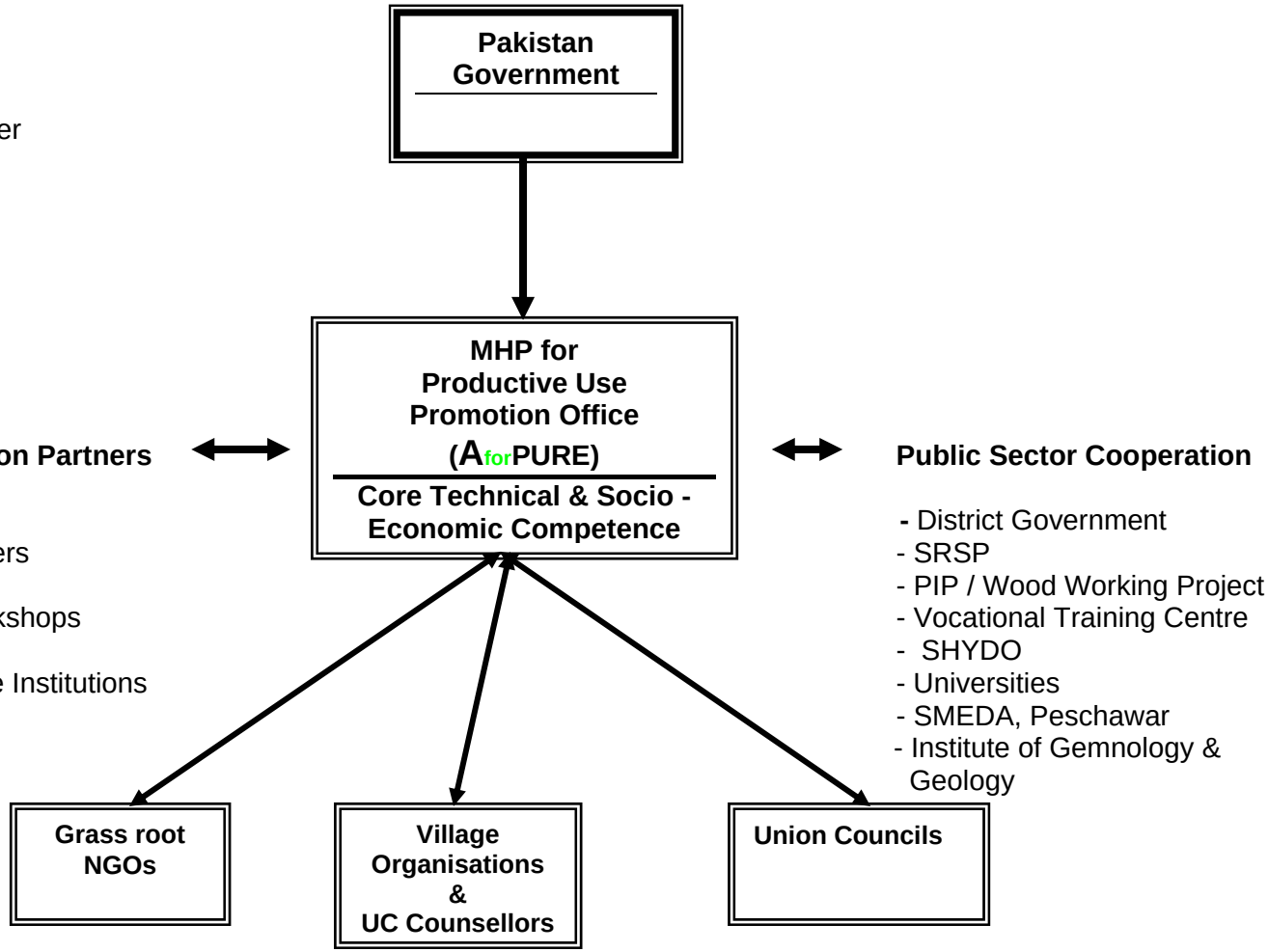
Figure D-1: Implementation organization chart

National Level
Consultative Partners
- AEDB
- Ministry of Environment
- Ministry of Water and Power
- AKDN
- Other NGOs

Provincial Level
Consultative Partner
- SHYDO, Peschawar

District & national Level:

Private Sector Cooperation Partners
Partners
- Turbine Manufacturers
- Generator Manufacturers
- Metal Workshops
- Generator Repair Workshops
- AKRSP, other NGOs
- Banks & Micro Finance Institutions



Public Sector Cooperation

- District Government
- SRSP
- PIP / Wood Working Project
- Vocational Training Centre
- SHYDO
- Universities
- SMEDA, Peschawar
- Institute of Gemnology & Geology

Village Level

2 Potential local partners in the "Electricity Plus (QEP+)" business approach

208. In the past, there has been no major initiative taken by any specialized agency solely focusing on the development of micro enterprises in the district. However, a few agencies and organisations do have good potential to cooperate on productive and commercial use of electricity from local MHP. Some of them have been visited and briefly assessed. The results are summarized in the following

a The Aga Khan Rural Support Program (AKRSP)

209. AKRSP is a multi-sectoral integrated rural development program. It started its activities in Chitral in 1983. Currently, it has an Enterprise Development Division (EDD), whose present main concern is the introduction of new business opportunities and marketing support in the district. The division makes a conscious effort to integrate several aspects of enterprise development into a package for its clients. These include organizing vocational and entrepreneurial training, facilitating credit, supplying market information, establishing market linkages, and encouraging the formation of marketing associations. AKRSP could facilitate the marketing of new products.

210. AKRSP has recently shifted its credit and savings section into an independent Micro Finance Institute which shares its equity with the IFC (60%). It provides commercial credit to individuals and groups for meeting their working capital requirements. The main feature of the program is its appropriate targeting of clients, which results in a significantly higher recovery rate than in traditional lending programs. The MFI has indicated its readiness to provide small investment loans (up to US $ 2,000) for equipment and machinery using electricity productively.

b Sharhat Rural Support Program (SRSP)

211. The SRSP is a government initiated NGO which partially follows on the recently been phased out CADP, a multi-sectoral rural development project similar to AKRSP. SRSP has limited staff and resources. Presently its main focus is the installation of local drinking water supply systems, construction of micro hydropower units and feeder roads in rural areas of Chitral. They indicated their readiness to cooperate with the project in all civil engineering related fields.

c Project for Horticulture Promotion (PHP)

212. Previously known as the Malakand Fruit & Vegetable Development Project (MFVDP), the PHP has been working in the district since 1988. PHP recognizes the importance of an integrated approach in developing micro-enterprises. Therefore, it provides assistance to the farming community during each step of the product cycle; from pre-production through post marketing. However, the scope of its activities is limited to horticulture promotion. PHP believes in and encourages collaboration with other agencies in order to promote horticulture in the province and provides technical guidance on horticulture promotion to several agencies in the district.

d The Bank of Khyber

213. In 1995, the Bank of Khyber (BOK) created a Micro-Enterprise Development Department (MEDD) to meet the working capital requirements of micro entrepreneurs. In some cases the department advanced development loans for either expanding existing enterprise or initiating new ones. The loan amount ranged from Rs. 50,000 to Rs. 4 million (US $ 1,000 – 80,000) with an interest rate of 18.5% per annum. In case of proper loan utilization and timely payment, the bank offered a 2% rebate to the borrower. The duration of the loan for working capital purposes was from six months to one year. However, the production loan was to be repaid within five years in six monthly installments. The bank started community loaning in 1997 when the MEDD was subsumed into a newly created department of Micro Business and Rural Development (MBRD). The objectives of the department have been broadened to encompass the rural development aspects as well as group lending. The terms and conditions for individual borrowing remain the same as they were during MEDD. However, the community loans are given at 1:10 ratio i.e. Rs. 10 against every one rupee saved by the community such as a village organization or an interest group. The maximum limit of the community loan is Rs. 250,000, to be repaid according to the nature of trade.

e Small Business Finance Corporation (SBFC)

214. SBFC has been operating in Chitral since December 1990 with the objective of encouraging self-employment among unemployed individuals of the district. SBFC processes loan applications of new businesses as well as existing ones provided their monthly income is below Rs. 10,000. The loan amount ranges from Rs. 10,000 to 500,000 at 16% annual interest with 1% rebate on timely payment. A loan is repayable in seven years on monthly installments. The loan recovery starts after a one-year grace period in which mark-up does not apply. As of June 1998, SBFC has entertained around 400 loan applications and disbursed about Rs. 80 million in the district, with an approximate 15% loan default.

f Agriculture Development Bank (ADB)

215. On January 16th, 1974 the first branch of the Agriculture Development Bank of Pakistan (ADBP) started functioning in Chitral. Chitral region is one of the 49 regions of the Agriculture Development Bank of Pakistan. The objective of the bank is promoting agriculture development by providing credit facilities to farmers. In the last three years, the Chitral region has disbursed agricultural loans amounting to Rs. 56.6 millions (1997), Rs. 23.3 millions (1996), and Rs. 18.7 millions (1995). The bank experience shows a significant default rate in Chitral owing to proper scrutiny of loan applications and avoiding over financing. The bank has three credit windows: short term, medium term, and long term. All of these credit windows require significant collaterals or substantial personal guarantees. The interest rate is 14% per annum with 3% rebate on timely payment. The purpose of short-term credit is to meet the credit requirement of farmers for a season or a crop. The loan amount ranges from between Rs. 5,000 to Rs. 25,000 and is repayable in six months. Medium-term credit is given from six months to five years. The loan amount is repayable in 10 six-monthly installments. The long- term loans are given for a five to ten year period for the purchase of tractors, machinery, or installation of tube wells. The loan is payable in 20 six-monthly installments. The borrowers of long-term loans should offer at least 5 acres of land and contribute a

minimum of 25% of the project. The bank's experience shows a poor recovery rate of this credit window.

g Wood Working Centre (WWC)

216. The Wood Working Centre (WWC) is a project of the NWFP Small Industrial Development Board, which started its work in the district in 1993. NWFP operates under the supervision of the Ministry of Industry and Production. The centre has a two-pronged objective: carpentry skill development; and meeting the furniture requirements of the district. The centre offers a two-year vocational course in carpentry. Currently (2005) only 6 trainees receiving a small scholarship are accepted. In comparison with the Government Vocational Institute the WWC is much better equipped and uses a wider range of wood material (e.g. partial and soft boards, marine plywood) as well as spray painting techniques.

h Government Commerce College

217. The college was established in Chitral in 1986 and since then only 85 students have been able to pass the B.com exam at their first attempt. The college provides formal training in accounting and business skills. The training is of intermediate level and the graduating students go down country to complete their masters' degree program. The college does not have any facility to arrange apprenticeships for the students to acquire practical experience in business management. However, the formal education system of the college does orient students towards a few aspects of enterprise management.

i Government Vocational Institute

218. The vocational institute started functioning in 1997. The institute offers a two-year course in two trades, electrician and auto mechanics. Currently, the third batch of 70 students is under training. It runs as well six-months courses in tailoring and carpentry skills. In the past it carried out additional short-term courses for village carpenters and electricians on request of AKRSP. Its training equipment is rather outdated and falls well behind the technical level in the Chitral town craft markets.

j Skill Development Centers (SDC)

219. There are two skill development centers in the district offering vocational training in various trades. The centers are run by the government's labor department. However, the current financial crunch has also affected the performance of the centers. These institutions only impart vocational training and do not provide entrepreneurial training. The centers were not visited by the mission.

3 Electricity for heating – a substitute to fuel wood

220. Today rural household's electricity demand and consumption is minimal in comparison to the household's overall energy demand and consumption. Cooking and space heating account for over 95% of household energy demand in rural areas and 90% in urban areas. The decision which fuel to use depends on the heating and cooking habits of the households, on the availability and prices of fuel sources (crop residues like maize stalks are only seasonally available, gas might be only available in the Chitral town) and on the general financial ability and willingness of a household to pay for. Better-off HH can afford Rs. 30 – 100 daily for fuel wood during winter times and consume much more fuel wood than poor households. Some do already now use other energy sources like gas, kerosene, electric heaters and cookers. To partially substitute fuel wood for heating and cooking is part of the comprehensive approach towards rural electrification[26].

> Cooking is consuming most of the HHs energy resources. Hot water is needed every day, specially during winter time. The use of wood as the main and scarce energy source could be complemented and partly substituted by solar vacuum collectors for water heating, too.

221. The rapid appraisal at all proposed sites leads to the conclusion that it is more economical to use electricity for space heating rather than buy fuel wood. During discussions in community meetings and as a result of the interviews it was confirmed that during the last very strong winter (November 2004 to March 2005) many people had to spent Rs 5,000 to 10,000 per household on fuel wood in addition to their own supply[27]. At least in the northern area of Izh-Ovirk, Shoghore, Shagram valley and Raman-Harchin expenditures of the well-off families exceed Rs 30 – 70 per day for purchase of fuel wood "imported" from the Chitral or southern markets during 5 to 6 winter months. At all four locations those better-off villagers have indicated their willingness to pay even more if electric heating would meet their needs. This is much more convenient (no further cutting, no cleaning of fireplace or stove, no smoke or smell) for both women and men.

222. Daily heating pattern during winter time at four households of government employees with cash income and some better-off shop keepers in Harchin and Raman indicate:

- 14h to 19 h: heating the main living room (kitchen, TV, work place of women and children);
- 19h – 22h: heating one or two more combined sleeping and living rooms if the household is shared by two or three families (e.g. brothers with wives and children or parents).

223. Similar pattern of space heating was confirmed at Izh, Shoghor and Shagram. Poorer families have normally only one main living room (approximately 20 m² and 50-60m³) with all functions.

[26] At all five project sites good fuel wood must be bought and paid costly at least during the five winter months.

[27] According to the AKRSP Farm Household Income and Expenditure Surveys „An Assessment of Socio-Economic Trends and Impacts in Northern Pakistan (1991, 1997), Gilgit February 2000, farm households in Chitral spent in average Rs 5,661 for Fuel Lighting in 1997. Due to price increases for fuel wood, candles, etc this amount has doubled to more then Rs 12,000 in 2004.

It is estimated that a heat saving natural stone stove with up to 2kW electric heating rod would be sufficient to heat the main room absorbing 16 kWh during 8 hours of heating. At Rs 1 per unit kWh daily cost of Rs 16 - 20 would be in reach of lower or medium income groups as well. Further investigation are needed into the minimum and maximum temperatures at those sites during winter time, appropriate stove design, suitable electric rod devices, capacity to save and shift heat (e.g. from after midnight charging to early afternoon), utilization of local stone material and stove building capacity, prices for in-room-construction, effective heat saving insulation of room or ceiling.

224. Electric heating as alternative to fuel wood should be seriously considered in the **QEP+** approach of the MHP project. It is estimated that one electric stone heat saving stove of 2 kW capacity could save up to 600 kg wood during five winter months. If only 15% of all households in the proposed single cropping areas would use such a stove effectively it would save substantial amounts of fuel wood.

Table D-1: Fuel wood saving due to electric heating stoves

Site	Number of HH	15%	Fuel wood saved (0.6 ton/HH)	Value at site (Rs 5,000/ton)
Raman-Harchin	800	120	72	360,000
Shagram	1,228	184	110	550,000
Bilphok/Shogore	430	64	38	192,000
Izh-Ovirk	730	110	66	330,000
Total	**31,88**	**478**	**286**	**1,432,000**

Remark: The site Bumburate valley in the south is still more privileged with good quality of fuel wood from near-by mountain trees and fruit tree branches. So this site is not yet considered for electric stone stoves.

225. There are no clear indications or evidence from other regions whether the declining demand for fuel wood would reduce sales prices in general or would lead to reduced fuel wood "collection" with a resulting softening of the deforestation process. The immediate benefits for the user of electric stoves would be mainly in the much more convenient and healthier heating system at same cost.

4 Aspects of a community based management concept for MHP

a Background

226. A government owned and operated power station will always have to struggle with conflicts in interests, low motivation of public paid workers, high bureaucratic rules and regulations (e.g. revenues have to be transferred to the central budget, from which (if so) expenses are transferred back), intransparency of cash flow and decision making. Central administration also reduces the local impact of electricity supply because locally collected money is not circulated locally but transferred to central level, services for the power station are provided through centralised channels which often do not consider locally available capacities and know how thus reducing again the economic benefits.

227. Revenues do not cover the cost for at least spare- and wear parts, basic maintenance works and operation. Sustainable operation cannot be achieved with insufficient revenues due to politically or socially motivated low tariffs, little interest in bill collection, tolerance of illegal power consumption, and low consumption rates. Thus

due to the limited load factor the tariffs are crucial to the overall performance and sustainability. Tariffs must

- be low enough to attract power consumption and to be afforded by the consumers
- be high enough to cover the daily expenses as well as necessary replacements and to ensure an attractive profit or salary for the operators to keep motivation to run the power station high
- support productive use to create income (which can be used for payment of electricity bill)
- level daily consumption distribution equally to reduce peak loads (leading to higher investment cost, brown outs, and disappointment of customers).
  In addition consumption has to be metered to allow correct billing according to consumption.

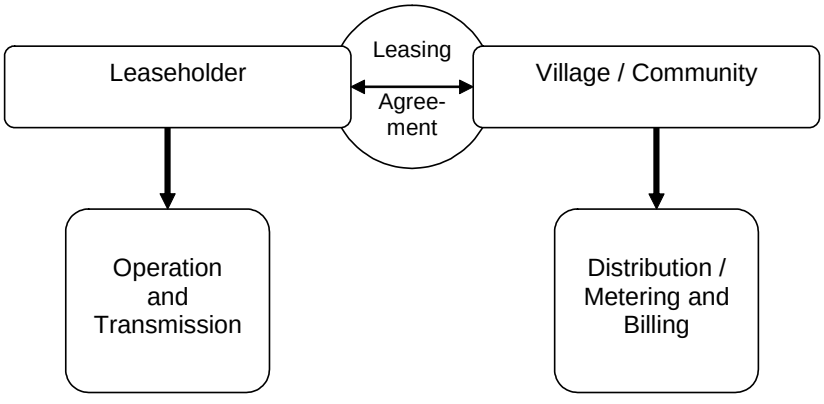
228. And last but not least sustainable operation cannot be achieved through unskilled and unqualified operation and management personnel. Operation and management staff are to be trained for their job. Training curricula have to be adopted to the Pakistani situation and suitable training institutes involved[28]. The training courses may be further used for other micro hydropower operators and other kinds of decentralised or isolated power generation units as well. Thus, it contributes to an overall improvement of the operation and management of those plants.

b Private based management concept

229. An optimised operation and management structure for a rural power station is at first organized locally. Responsibility and decision making is located as near as possible to the station and the beneficiaries themselves. Thus, line of command is short and local interests can be much better taken into consideration.

230. Secondly, operation and management should be private based. Thus, income is directly output oriented and can be controlled and influenced by the management itself. Bad performance will directly lead to lower profits whereas additional measures supporting power consumption will lead to higher profit rates.

Figure D-2: Organization of power supply: private based



231. Rights and duties are to be distributed in an appropriate way among the stakeholders. The leaseholder is responsible for power generation and transmission, whereas the community as owner of the station is responsible for distribution and billing. This includes respective sharing of losses. The community is responsible for the

[28] One is certainly the micro hydropower technical centre in Gilgit, which was established with Norwegian funds.

losses in the distribution system and thus for non-technical losses (it has also the means to enforce respective regulations and fines). Appropriate leasing management contracts are to be conducted among the parties involved.

232. Participation of HHs during the construction time increases the sense of ownership and should be asked from the villages. Except in Beyori where the representatives of the villages rejected the possibility of village contributions in cash and labour, all other villages were ready to contribute to an up-scaling of the electricity supply either in cash or in kind. The villages are used to communal work as they regularly have to repair their irrigation channels and their roads sometimes. Representatives referred to their present system of contribution where each member has to participate in labour work at least on week ends.

Sustainable management of MHP

233. Sustainable management includes a number of management and organizational conditions among which are the following:

- An elected "construction committee" should participate in the planning and designing process (ownership) and have a full insight in the purchase of equipment
- All HHs should either contribute in cash or in labour force according to their financial possibilities and time availability. The community should decide under which conditions a HH could be exempted from his contribution.
- The concerned villages including all electricity consumers should select an overall management committee overseeing all necessary activities concerning the MHP.
- The MHP is owned by the communities included in the supply system.
- The management committee selects
  - 1 president of the management committee
  - 1 secretary responsible for billing and book keeping
  - 1 secretary per village responsible for supervising the correct meter reading and collecting payments of bills
  - 1 external auditor for the book-keeping of every village and the auditing of the joint maintenance and repair fund at the MHP bank account.
- The existing monthly flat rate needs to be changed into a consumption-based kWh payment in all villages. Meters to monitor will be provided from the project.
- The president, secretary and the electricity fee collectors should propose an operational cost covering tariff(e.g. 1 Rs. per unit kWh) to the HHs
- Preferential treatment for poor HHs should also be discussed and decided by the villagers/management committee.
- In an annual information meeting the president of the management committee has to brief the villagers about the ongoing MHP technical performance, financial situation and book keeping. The auditor has to report about all financial transaction and provide a clearance certificate for the management committee.
- Bills are issued by the MHP management according to monthly meter readings[29]. A certain portion of the revenues are paid as leasing fee to the management unit which transfers the money to a bank account, solely to be used for major repairs and replacements. The remaining revenues (capital cost are deducted) belongs to the leaseholder who has to transmit 10% of hereof also to a bank account for purchasing spear and wear parts.

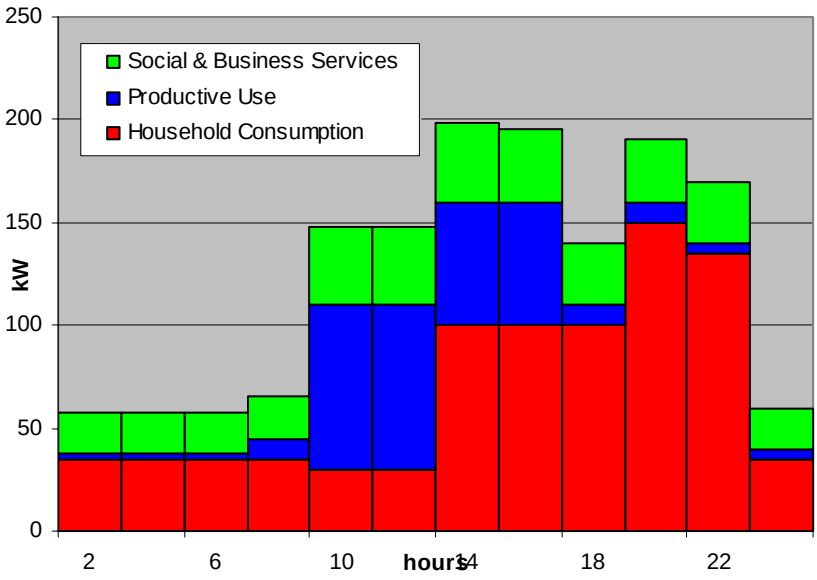
[29] The existing monthly flat rate needs to be changed into a consumption based kWh payment Monthly reading is essential to assure that cost for bills remain affordable within the monthly HH budget.

5 Technical Aspects

a Electricity demand

234. In general, energy is needed for almost all household tasks like lighting, cooking, heating and the use of appliances. Energy and electricity are necessary in agricultural production for irrigation and drainage, food processing and storage. Household businesses and sideline activities need electricity. Electricity is as necessary for basic water supply in the house as it is for entertainment and communication.

Figure D-3: Daily load distribution - winter; Shogore-Bilphok area



235. Electricity demand and electricity use is gendered and dependant on the existing gender division of labour. The purchase and present use of electric appliances and equipment depends on the living and income situation of rural households. The reasons for the purchase of electric appliances differ from village to village and according to each household's priority. Although access to basic electricity supply is granted, quality and stability of electricity supply further determine electricity demand in rural households. If the quality is not satisfactory and power cuts are frequent people cannot use electricity. When the power quality is not sufficient, households rarely buy sensitive electric appliances.

Table D-2: Standard electrical HH equipment

Time and energy saving appliances for women	Improving living conditions for HH
Washing machine	Television
Electric oven	Electric heater
Water heating rod	Computer
Iron	Fan
Juicer	Bread baker
Butter churner	Refrigerator
Sewing machine (Kalash)	Water boiler

236. The purchase of different existing electric HH appliances shows the growing demand of electricity. With increasing development options, further education possibilities and increasing cash income, HH are no more satisfied with a basic electricity supply only. They are striving for better living conditions and an increasing range of different use options. Better-off and middle income HH will purchase the following standard set of time and energy saving HH appliances.

237. For the economic analysis electricity demand had to be assessed. For this, all existing electric power consumers, their capacities and operation time and durations

have been collected and summarized in Annex 3. From these data a standard load curve (Figure D3) has been drafted. The results are compiled in Table D3.

Table D-3: Annual power demand (in MWh)

Consumer group	Izh -Ovirk	Bilphok-Shagore	Shagram	Raman – Harchin	Bumburate
Business and social services	91.96	250.00	137.52	105.18	76.32
Productive business	541.45	100	282.39	289.50	209.90
Households	588.44	400.00	468.52	663.21	611.09
Total	**1,221.85**	**750.00**	**888.43**	**1,057.89**	**897.31**

238. Station capacity is calculated at an average load factor of 60% to achieve economic feasibility. With growing demand load management measures are required during peak time.

b Technical Sites

239. Technical site profiles are compiled in Annex 2. Main technical data are presented below.

Izh-Ovirk MHP

Figure D-4: Intake location

240. The Izh-Ovirk Hydropower Project is located at a distance of about 50 km to the North-West of Chitral. The proposed HPP will draw the water from Beghust Gol, a right tributary of Lotkoh river through a gated weir.The 850 m long headrace channel will take the water to the powerhouse on the left bank of Beghust Gol, just upstream of its confluence with Lotkoh river. A 50 kW micro hydel station exists near to the proposed location. The existing micro hydel station will be replaced with an upgraded one due to insufficient flow during the winter months and its poor condition. Another 100 kW SHYDO MHP is located further downstream on the right bank of Lotkoh river. This powerstation is also poorly maintained and nearly half of population of the surrounding area has no access to electricity. The schematic sketch for the proposed project is attached.

Technical data of the proposed HPP	
Installed capacity:	300 kW
Altitude (Powerhouse):	2310 masl
Latitude:	35^0-59.20’
Longitude:	71^0-33.33’
Designed Discharge:	1.3 m3/sec

Gross head:	33 m	
Headrace Channel:	950 m	
Length of Transmission line (11 kV):	11 km	
Length of Distribution line (0.22 kV):	14 km	
Cost Estimates in US $		
Weir Intake + Sandtrap:		75,000.00
Headrace Channel:		65,000.00
Forebay:		29,250.00
Penstock:		26,500.00
Powerhouse (Civil works):		58,500.00
Electro-mechanical equipments & works		155,000.00
Transmission Line (11 kV):		59,400.00
Distribution Line (0.22 kV):		49,000.00
TOTAL DIRECT COST		**517,650.00**

Bilphok-Shoghore

Figure D-5: Existing headrace (40 kW)

241. The Bilphok-Shoghore Hydropower Project is located at a distance of about 15 km to the North-West of Chitral. The proposed HPP will draw the water from Lotkoh river through a gated weir. The 800 m long headrace channel will drop the water to the powerhouse on the left bank of Lotkoh river at a distance of about 2.5 km downstream of Shoghore village. A 40 kW micro hydro plant exists at the same location, which will be replaced by the construction of an upgraded new plant. In order to utilize the existing infrastructure, an increased discharge will be with drawn from the same river at the same location; however, the channel will require improvement to fit the new designed discharge. The Channel passes through some 200 m long sliding area, that will require slab on the top of the channel to avoid regular blockades. The existing micro hydro station is in poor condition without step up and step down transformers and long transmission and distribution cables. The schematic sketch for the proposed project is attached.

Technical data for the proposed HPP	
Installed capacity:	300 kW
Altitude (Powerhouse):	1668 masl
Latitude:	36^0-0.33'
Longitude:	71^0-47.73'
Designed Discharge:	2.3 m^3/sec
Gross head:	20 m
Headrace Channel:	800 m
Length of Transmission line (11 kV):	10.5 km
Length of Distribution line (0.22 kV):	12 km
Cost Estimates in US $	
Weir Intake + Sandtrap:	86,500.00
Headrace Channel:	45,500.00
Forebay:	26,350.00
Penstock:	15,500.00
Powerhouse (Civil works):	65,200.00
Electro-mechanical equipments & works:	160,250.00
Transmission Line (11 kV):	54,000.00
Distribution Line (0.22 kV):	42,000.00
TOTAL DIRECT COST	**495,300.00**

Shagram HPP

Figure D-6: 2*50 kW MHP

242. The village Shagram is located along Booni-Turkho road about 80 km to the north of Chitral town. The proposed hydropower station will draw the water from Bozund Gol through a gated weir intake to the powerhouse on the right bank. A 100 kW micro hydel station exists downstream of the proposed site, which is really in a very bad shape due high flow velocity in the headrace channel, which carry all the sediments, small stones to the turbines. The two crossflow units are not synchronized and operate independently. The proposed MHP is located upstream of the existing community owned 100 kW power station. The schematic sketch for the proposed MHP is attached.

Technical data of the Proposed HPP		
Installed Capacity:	200 kW	
Altitude (Powerhouse):	2390 masl	
Latitude:	36^0-28.86'	
Longitude:	72^0-25.79'	
Designed Discharge:	1.0 m^3/sec	
Gross head:	30 m	
Headrace Channel:	1200 m	
Length of Transmission line (11 kV):	9 km	
Length of Distribution line(0.22 kV):	11 km	
Cost Estimates in US $		
Weir Intake + Sandtrap:		58,000.00
Headrace Channel:		65,500.00
Forebay:		23,000.00
Penstock:		12,500.00
Powerhouse (Civil works):		38,000.00
Electro-mechanical equipments & works:		115,000.00
Transmission Line (11 kV) :		48,600.00
Distribution Line (0.22 kV):		38,500.00
TOTAL DIRECT COST		**399,100.00**

Bumburate

Figure D-7: Existing 50 kW MHP

243. The Bumburate valley is located in the South-West of Chitral town, at a distance of about 45 km. The proposed hydropower station will draw the water from Bumburate GoI through a gated weir intake to the powerhouse on its right bank. Two no. 50 kW community owned micro hydel stations exist near to the proposed location. The existing MHPs are in very poor condition and could hardly produce electricity, 30 % of its installed capacity. The area is very famous for tourism as mentioned in the village profile. The schematic sketch of the proposed MHP is attached.

Technical data of the proposed HPP		
Installed capacity:	300 kW	
Altitude (Powerhouse):	2170 masl	
Latitude:	35^0-41.07'	
Longitude:	71^0-39.852'	
Designed Discharge:	1.0 m^3/sec	
Gross head:	45 m	
Headrace Channel:	1200	
Length of Transmission line (11kV):	6.5 km	
Length of Distribution line (0.22 kV):	8 km	
Cost Estimates in US $		
Weir Intake + Sandtrap:		75,000.00
Headrace Channel:		68,500.00
Forebay:		27,000.00
Penstock:		28,000.00
Powerhouse (Civil works):		58,000.00
Electro-mechanical equipments & works:		152,000.00
Transmission Line (11 kV):		35,100.00
Distribution Line (0.22 kV):		28,000.00
TOTAL DIRECT COST		**471,600.00**

Harchin-Raman HPP

Figure D-8: Powerhouse and penstock location

244. The Harchin-Raman villages are located in the Laspure valley along Shandur road at a distance of about 100 km to the North-East of Chitral town. The proposed hydropower station will draw the water from Raman Gol through a gated weir intake to the powerhouse on its left bank. A 30 kW micro hydel station exists downstream of the proposed site, which was badly damaged last year during flood and then repaired by the community and remains in poor condition. About 75% of the surrounding population have no access to electricity. The schematic sketch of the proposed MHP is attached.

Technical data of the proposed HPP		
Installed capacity:	300 kW	
Altitude (Powerhouse):	2795 masl	
Latitude:	36^0-0.05.48'	
Longitude:	72^0-27.82'	
Designed Discharge:	0.75 m^3/sec	
Gross head:	60 m	
Headrace Channel:	1524	
Length of Transmission line (11 kV):	7 km	
Length of Distribution line(0.22 kV):	9 km	
Cost Estimates in US $		
Weir Intake + Sandtrap:		78,000.00
Headrace Channel:		68,500.00
Forebay:		35,000.00
Penstock:		38,000.00
Powerhouse (Civil works):		58,000.00
Electro-mechanical equipments & works:		145,000.00
Transmission Line (11 kV):		37,800.00
Distribution Line (0.22 kV):		31,500.00
TOTAL DIRECT COST		**491,800.00**

c Operational Staff

245. Operational staff is the same in each power station. Beside the manager, two operators, two linemen, two meter readers and one accountant run the power station. The staff plan and related unit costs are compiled in Table D-4.

Table D-4: Staff plan per MHP

Staff	No	unit	No of unit	Unit cost (Rs)	Total (Rs)
Chief operator, plant manager	1	Month	12	5,000	60,000
Operator	2	Month	24	3,500	85,000
Line men	2	Month	24	3,000	72,000
Meter reader	2	Month	24	3,000	72,000
Accountant	1	Month	12	1,500	18,000
Total	**8**		**96**		**307,000**

Remarks: accountant is part-time

6 Economic Aspects

246. The economic analysis is based on the technical design and unit costs taken from the national market. The detailed figures and data are compiled in Annex 4 and summarized in Table D-5. Calculations are based on the following assumptions:

- Currency: US$ only
- Exchange rate: 1 US$ = 60 Rs
- Inflation not included
- Tariff: 1 Rs (0.02 US$) per kWh
- 100% equity financed investment, therefore, no financing costs included
- Lifetime of all equipment: 25 years
- Average load factor: 60%
- System losses: 10%
- Non-technical losses: 0 %
- Maintenance and repair cost: 2% p.a. of initial investment
- Power demand compare chapter D-5

Table D-5: Summary of construction cost (in US$)

Items	Area				
	Bumburate	**Shagram**	**Izh-Ovirk**	**Bilphok-Shoghore**	**Raman-Harchin**
Civil works					
Weir intake and sandtrap	75.000	58.000	75.000	86.500	78.000
Headrace channel	68.500	65.500	65.000	45.500	68.500
Forebay	27.000	23.000	29.250	26.350	35.000
Penstock	28.000	12.500	26.500	15.500	38.000
Powerhouse	58.000	38.000	58.500	65.200	58.000
Electro-mechanical equipment					
Turbine,generator, electric	152.000	115.000	155.000	160.250	145.000
Other					
transmission line	35.100	48.600	59.400	54.000	37.800
Distribution line	28.000	38.500	49.000	42.000	31.500
Planning, supervision, Ffinal design	56.592	47.892	62.118	59.436	59.016
Contingencies	132.048	111.748	144.942	138.684	137.704
Total cost	**660.240**	**558.740**	**724.710**	**693.420**	**688.520**
Cost per kW installed capacity	**2.201**	**2.794**	**2.416**	**2.311**	**2.295**
Total investment	**660.240**	**558.740**	**724.710**	**693.420**	**688.520**
Operational cost per year:					
Item					
Staff costs	4.800	4.800	4.800	4.800	4.800
Chief Operator	1.000	1.000	1.000	1.000	1.000
Operator	1.400	1.400	1.400	1.400	1.400
Linesmen	1.200	1.200	1.200	1.200	1.200
Meter reader	1.200	1.200	1.200	1.200	1.200
Accountant	300	300	300	300	300
Maintenance, repair	13.205	11.175	14.494	13.868	13.770
Other operational cost	500	500	500	500	500
Total operational cost	**45.214**	**39.124**	**49.083**	**47.205**	**46.911**
Depreciation	26.410	22.350	28.988	27.737	27.541
Total capital cost	**26.410**	**22.350**	**28.988**	**27.737**	**27.541**

247. The results are compiled in Table D-6:

- **Investments** for the 300 kW plants differ slightly (+/- 5%) due to similar technical conditions at the construction sites.
- Since **operational costs** are directly related to total investments (variable costs are equal in all power stations) they are similar at all sites. Only at the Shagram 200 kW MHP site cost per kW installed capacity is close to 20% higher then the average of the four other sites.
- **Cash flow and pay back period** are very similar again. Since there are about 50% less electricity consumers in the Bilphok – Shogore area then in the other sites pay back period is 4 years longer and the IRR is only 7% - the lowest of all 5 proposed sites. But it is believed that all sites can accumulate sufficient surplus revenues to carry out a substantial overhaul after 25 years or even replace all vital parts of the respective MHP.

248. All five sites are economically viable but might not be able to pay back loans with service charges attached. The internal rates of return varying between 7% and 12% indicate that at least full costs coverage can be achieved. With respect to isolated systems of this capacity these results are very promising. Main reasons are:

- The comparable low investment cost per kW due to the village participation, the partly use of existing structures and optimised designs
- High consumption rates due to availability of cash and the high cost for fuel.

Table D-6: Economic analysis

Indicator	Izh -Ovirk	Bilphok-Shagore	Shogram	Raman – Harchin	Bumburate
Total Investment (US $)	724,710	693,420	558,740	688,520	660,240
Installed capacity (kW)	300	300	200	300	300
Cost per kW installed capacity (US $)	2,416	2,311	2,764	2,295	2,201
Operational cost/ year	49,083	47,205	39,124	46,911	45,214
Tariff (initial increase 4% p.a.; later 3% + 2%)	0.02	0.02	0.02	0.02	0.02
Cash flow positive after: (years)	1	2	2	2	2
Full cost recovery after: (years)	4	6	4	4	4
Pay back period (years)	11	16	12	12	14
Surplus revenues (US $) after 25 years	956,799	266,444	594,044	715,253	523,604
Internal rate of return (%)	12	7	11	11	10
NPV (5%) in US $	440,294	110,629	268,013	324,995	231,841
NPV (10%) in US $	87,307	88,805	26,120	31,507	15,125

249. The hydropower station is surely the least cost option when compared with other energy options (compare Table B-8; chapter B) in the area. In addition supply of gas, kerosene and diesel can not be assured during at least 5 months in winter (closed roads). Necessary storage facilities require additional investments and running costs.

250. Extention of grid is also not economic viable due to the large distances and comparably low demand. In addition, the current WAPDA tariffs exceed the local tariffs used in the analysis by 100%.

7 Project Costs

251. Project costs include

- Technical design and supervision of construction of micro hydropower plants, transmission and distribution lines
- Investments for civil works, electro-mechanic equipment, transmission and distribution systems
- Technical assistance for establishing of hydropower management
- Technical assistance for support of activities in the framework of productive use of electricity including business and technical training, micro-credits, marketing and product development. In addition strategies for dissemination of results have to be elaborated and implemented.

252. Construction costs have been calculated at current prices. Adjustments and transport costs have been applied where necessary by using local information. Contingencies have been added reflecting the uncertainty of the actual costs. The costs are summarized in Table D7.

Table D-7: Summary of Project cost (all figures in '1,000 US$)

	Project area				
Cost item	**Izh-Ovirk**	**Bilphok-Shagor**	**Shagram**	**Raman Harchin**	**Bumburate**
Construction	520	500	400	492	475
Contingencies construction	130	125	100	123	119
Sub-Total construction	**650**	**625**	**500**	**615**	**594**
Planning, design, supervision	62	60	48	59	57
Contingencies planning	15	15	12	15	14
Sub-Total Planning	**77**	**75**	**60**	**74**	**71**
TA PURE	300	300	300	300	300
Total	**1,027**	**1,000**	**860**	**989**	**965**

253. Total project costs amount to about **4.841 Mio US$.**

8 Impacts and benefits

254. Access to electricity is one of the essential pre-conditions for

- Improving the living conditions in rural areas through the creation of job and income opportunities
- Initiating local economic activities for a sustainable rural development
- Improving of health and education
- Substituting fuel wood by electricity to protect the forest resources and for
- Poverty reduction.

255. Benefits are to be expected in the following fields:

- **Social benefits:** Access to electricity contributes to poverty alleviation and to sustainable human development. Electricity is essential for the provision of quality community services especially of educational and health services and of water supply. It has also tremendous positive impacts on rural households, particularly on children and women who bear the responsibility and hardship of main household

work. Access to lighting, information and communication improves the living conditions of each household, reduces migration to the urban centres and improves the attractiveness of the community for well educated and professional service people like teachers, doctors[30], etc.

- **Economic benefits:** Access to electricity for productive use[31] is one of the pre-conditions for rural development, income and job creation to rural based economic activities. Skilled jobs are created through operation and management of power station, the demand for electric installations in houses and the repair of electric appliances and machinery. Services like tea houses, restaurants, video shops, workshops (i.e. machinery repair, welding, wood work, stone processing) also create jobs and improve the access to local services (which often results in additional cost savings due to saving of transport cost and time). Electricity can operate irrigation pumps to increase agriculture production or to change from subsistence to cash crop production. Apart from productive use, electricity substitutes other energy sources in households as wood, kerosene and candles usually at lower costs.
- **Environment benefits:** The use of power generated by renewable energy contributes significantly to the sustainable management of natural resources, especially through substitution of fuel wood. It contributes also to a reduction of greenhouse gas emissions.
- **Design and manufacturing benefits:** The new designs of optimized micro hydropower equipment as well as the higher demand for electro-mechanical equipment will contribute to the development of a national supply market. National design and planning bureaus will be qualified to transfer and adopt the design and planning principles to other sites and areas. The increasing demand of neighbouring countries having similar conditions and circumstances (e.g. Afghanistan) will further increase these market potentials.

a Growth potential and productive use of electricity[32]

256. The aim of the power supply is to provide enough electricity to secure three tasks:

(1) basic electricity for all households to use needed household appliances effectively,
(2) provide public and social services such as schools and health care centers with sufficient electricity to meet their requirements, and most important
(3) to enable the use of electricity for productive value-adding, employment and income generating activities.

257. The growth potential of those sites is determined by its natural resources and tourist attractions, its agricultural, horticultural or animal husbandry activities, and finally by the skill, experience and competence of its people to improve existing or start new on- or off-farm businesses. The growth potential is higher if access to markets is easy and the purchasing power of the villagers is enhanced by cash transfer from off-farm employment, remittance from migrants or pensions for ex-servicemen.

258. The main resources will be briefly assessed and compared for all proposed sites.

[30] Health and education services are also upgraded by using modern electrical equipment.
[31] capacities must be sufficient to run electric machinery and equipment; continuous operation must be possible
[32] For more details see the separate village profiles in Annex 1

Table D-8: Natural Resources

Activities (electricity use)	Izh-Ovirk	Shoghore	Shagram	Raman	Bumburate
Quarries & Mining (slate, marble, gems cutting, faceting, polishing)	potential	On-going	No activities	Surveys started	No activities
Hot springs (pumping, heating)	Yes, partly used	None	None	none	none
Forests & logging (saw mill, drying of timber)	Limited potential	Limited potential	Limited potential	Limited potential	Limited potential

259. In the mid to long-term mining has a very large potential since there is a great variety of minerals and ores in the Chitral mountains, but so far little has been properly surveyed and presently only in Shoghore Avi a slate quarry next to the main road is exploited. Large amounts of electricity could be used productively for compressors, cutting machines in the cases of slate and marble or faceting and polishing for gems and semi precious stones. In Raman several survey missions have assessed the potential, but no activities have started yet. The hot springs near Izh are used for guesthouses, but greater potential for heating purposes at adjacent villages needs further studies.

260. With the exception of southern Bumburate valley all other sites have no natural forest cover anymore. The reforestation efforts with poplar, willow, Robinia, Russian olive, etc. along rivers, roads, fields and around villages are remarkable, but in terms of logs or timber wood the supply is very limited. Most logs at the respective saw mills are "imported" from southern Chitral. At some places logs from poplar trees are sawn – mostly by hand - and used in local house building (windows, doors, ceiling, pillars), saw mills might take over partly with cheaper energy from electricity.

Table D-9: Agricultural and horticultural resources

Activities (electricity use)	Izh-Ovirk	Shoghore	Shagram	Raman	Bumburate
Threshing and winnowing (only near electricity poles or homes)	potential	potential	potential	potential	Potential
Wheat, barley, maize grinding (flour grinders or hammer mills)	High potential	High potential	High potential	High potential	Limited
Fruit drying and packaging (solar tunnel dryer with exhaust fan, sealing equipment)	High potential	High Potential, on-going	High Potential, on-going	Some potential	High Potential
Fruit (apples, mulberry, apricot) processing and juicing, bottling	High potential	High potential	High potential	Less surplus?	High Potential
Walnut kernel oil (extraction by spindle press, bottling)	Some potential	Some potential	No data	Little potential	High Potential
Mulberry leaves for silk worm rearing (spinning)		MOA Project			
Traditional herbs processing (drying, weighing, packaging)		KADO project			

261. All agricultural and horticultural products have a good potential to be processed by using electric energy. Nowadays threshing is mainly done by using tractor-driven threshers, but electric threshers could be a cheaper alternative. Fruit drying technology

is already known and used, but the process could be further improved. Fruit juicing and oil extraction are new technologies and its feasibility depends on volumes and market acceptability. The project should prepare further studies and demonstrate technologies for commercial applications.

Table D-10: Animal husbandry resources

Activities (electricity use)	Izh-Ovirk	Shoghore	Shagram	Raman	Bumburate
Sheep and goat shearing (electric shearing equipment)	High potential MAC Project	High potential	High potential	High potential	High potential
Raw wool processing (washing, carding, spinning, weaving)	High potential MAC Project	High potential	High potential	High potential	High potential
Chicken hatching (incubator, heating lamp)	Good potential	Good potential	Good potential	Good potential	Good potential
Silk worm rearing and spinning	MOA Project				

262. At all locations there are thousands of sheep, goats and a certain numbers of cattle. In the Garam Chashma UC (Izh-Ovirk) alone are more then 28,000 sheep, 32,000 goats and 9,000 cows. The further mechanization by using electric devices is very feasible and herdsmen are interested to be involved. MACP intends to set up a Collective Enterprise in Izh for wool processing and requests electricity from the envisaged UNDP project.

263. First trials with chicken rearing were not very successful, due to lack of professional competence and appropriate technology. Since almost every week more then 5,000 1-day-old or grown chicken are imported from Peshawar into the Chitral valley there is a growing market for local chicken hatching.

Table D-11: Skilled trades and modern business potential

Activities (electricity use)	Izh-Ovirk	Shoghore	Shagram	Raman	Bumburate
Carpenters (saw, drill, rooter, planner, universal machine)	High potential	High potential	High potential	High potential	Some potential
Tailors (sewing, over lock, iron)	High potential	High potential	High potential	High potential	High potential
Welders , car repair (welding, air compressor, color spraying, power tools)	Some potential	High potential	High potential	High potential	Some potential
Electricians (soldering, testing, repair tools for TV, PC, DVD, Video, radio)	High potential	High potential	High potential	High potential	Some potential
Photo laboratory & shop	Some potential	Some potential	Some potential	Some potential	Some potential
Photo copying services	some potential	some potential	potential	potential	potential
PC Training, Internet Services	High potential	High potential	High potential	?	No telecommunication
Laundry / wash saloon	High potential	potential	High potential	High potential	High potential
Groceries and shops (ice box, refrigerator, heating, light)	All places	All places	All places	All places	All places

264. In all proposed areas traditional crafts and skilled trades are still alive and most craftsmen are ready to invest in equipment if electricity supply at favorable prices is ensured. Some carpenters are even migrating temporarily for work to Chitral town due to lack of electricity and low quality manual equipment.

265. Where electricity and telecommunication is available there is high potential for modern business services, PC equipment and related services are in high demand. Most shop keepers wish to up-grade their services and use electricity for heating instead of inconvenient kerosene heaters. Since the number of shops at all locations is very large, they will request a growing portion of the electricity available.

Table D-12: Tourist development potential

Activities (electricity use)	Izh-Ovirk	Shoghore	Shagram	Raman	Bumburate
Home industry (Patti cloth, cap & dress making, beads chains, carving, stitching) by women	Some potential	?	Some potential	?	high potential
Goat hair carpet weaving by women (carding, spinning)	Good potential	Some potential	Good potential	Some potential	Good potential
Hotels in Guesthouses (fan, light, refrigerator, deep freezer	Some potential	Some potential	Some potential	Good potential	Good potential
Restaurants(ice box, refrigerator, heating, light)	Some potential	Some potential	Some potential	Good potential	Good potential
Natural resources, hot springs, trekking tours	Good potential	Good potential	Good potential	Good potential	Good potential

266. The Chitral district has a large and still unexploited tourist potential: very friendly people of different cultures and traditions, an impressive snow covered mountain panorama, beautiful fruit trees carrying valleys, and narrow roads along water falls and small rivers lead to remote traditional terrace houses, rare wildlife and flora, historic places and castles, handicrafts and the famous polo games at an altitude of 4,000 m.

267. After the Afghan crisis and the 9/11 event, tourist arrivals are gradually recovering and domestic as well as international tourists are coming again for trekking, mountaineering, visits to Kalash festivals or just for holidays and resting during the hot and rainy monsoon summer months in southern parts of Pakistan. The tourist infrastructure is not yet well developed, but with the Lowari rail tunnel in a few years to come (construction contract has been signed) there is need for local tourist development plans now. Each area needs facilities such as guest houses, restaurants, telecommunication, WebPages for reservation, trained guides, etc.

268. Electricity would be very important for the further growth of home industry of Kalash women and would facilitate their evening work in many ways (shearing and processing of wool, sewing and stitching, wood carving, and other souvenir products). In other areas as well spinning and weaving is part of women's daily life and the tourists could be a new market for their products.

Table D-13: Social and business service potential

Activities (electricity use)	Izh-Ovirk	Shoghore	Shagram	Raman	Bumburate
Hospitals and health care centers (med. Equipment, light, heating, fans, refrigerator, etc.)	high potential	high potential	high potential	Some potential	Some potential
Schools (science laboratory, PC training, light, heating)	high potential	high potential	high potential	high potential	Some potential
Bank & Micro Finance Institute (PC, Telecommunication, light)	high potential (Garam Chashma)	high potential	high potential	high potential	No tele-communi-cation
Post Office & Telecommunication	Good	good	Good	good	None

269. Most social and business services at all sites are strongly depending on electricity which is presently provided by diesel generator sets. Electricity from MHP will substitute those devices. In places such as Shoghore with many schools, a large hospital and dormitory, a bank and a women vocational training center electricity will be used substantially by social and business services. Health and education are basic elements in any long-term effort for economic growth and social change. In this sense electricity for those purposes is used productively as well.

Table D-14: Electricity resources for heating potential

Activities (electricity use)	Izh-Ovirk	Shoghor	Shagram	Raman	Bumburate
Substitute firewood for heating and cooking (energy saving stone stoves, cooker)	high potential & demand	high potential & demand	High potential & demand	high potential & demand	Some potential

270. Table D15 summarizes the socio-economic potentials.

Table D-15: Improvement in productivity, value-added and additional employment due to „Electricity plus (QEP$^+$)“
(all proposed technologies do have income and employment implications)

Proposed electric equipment & technology (ideas from resource persons, villagers and mission)	**Izh-Ovirk**	**Shagram**	**Bumburat e**	**Harchin -Raman**	**Shoghore-Bilphok**
Quarries and mining					
- cutting slate, soap stones				**X**	**X**
- cutting and polishing marble					**X**
- cutting, faceting and polishing semi-precious stone					**X**
Improving of productivity in agriculture & animal husbandry					
- sheep and goat shearing equipment	**X**	**X**	**X**		**X**
- carding and spinning	**X**				
- water lifting for “drip” irrigation /pumping to water reservoirs					
Processing of agricultural products					
- improved fruit (apricot, apple) drying and packaging technology	**X**	**X**			**X**
- fruit juicing and packaging (NEW)					
- walnut kernels oil extraction (NEW) and	**X**	**X**			**X**
- wheat & maize milling or grinding		**X**	**X**		**X**
Storing and chilling facilities					
- fruit, vegetable, onion, potatoes	**X**	**X**	**X**		
Skilled labor equipment	**All**	**All**	**All**	**All**	**All**
- wood saw mill (replacement of Diesel engine)					
- carpenters equipment (lathe, drill, planner, rooters, univ. machine, grinder, vertical saw)					
- welders equipment					
- Car/jeep repair equipment (air compressor, spray, power tools,)					
- Tailoring equipment (sewing, over lock, stitching)			**X**		
Business services					
- Computer centre (PC training, access to Internet, e-mail service)	**X**	**X**			**X**
- Photo copy service	**X**	**X**			**X**
- Photo shop & developing / printing service	**X**	**X**			**X**
- Banking and MF	**X**	**X**			**X**
- Tele-Communication Services	**X**	**X**			**X**
- Web page design and internet marketing			**X**		
Other Services using electricity productively for income generation					
- washing & laundry services	**X**		**X**	**X**	
- restaurants and guesthouses (refrigerator, fan, light, Satellite TV)	**X**	**X**	**X**	**X**	

b Socio-economic impacts and benefits – a scenario

271. After the successful installation of new or rehabilitated micro-hydropower plants the following benefits are expected within the first thee years.

At MHP sites:

- The professional self-management of the MHP will be ensured by further on-the-job training and counseling of all employees and the supervising management committee. At each site there are at least eight new jobs for skilled personel created in conjunction with the power plant (1 chief and 2 assistant operator, 2 line supervisors, 2 meter readers and fee collectors, 1 accountant).
- Funds are established for repair, replacements and maintenance works

At household and women level:

- It is expected that electricity consumption at household level will increase by 30 – 50% during the first two years after new installation is completed. These new equipment will reduce the workload for women (washing machine, iron, water rod, cooking, heating) and save time to be used for other productive and income generating activities such as spinning, weaving, tailoring, stitching and production of souvenir items for tourists. The consumptive use of electricity has indirect, but immediate impacts on value-added, self-employment and income at most households.
- About 200 Kalash women in Bumborate valley will use electric sewing machines productively to produce articles to be sold to tourists. In Shagram area also a large number of women is involved in producing school dresses and process raw wool for Patti weaving, etc. They as well will use electricity productively.
- In Izh (Gram Chashma area) there exist detailed plans by MACP to set up a raw wool processing center requesting 25 kW electricity capacity (washing, drying, carding, spinning, packaging) for more then 35 tons of wool annually, adding value in the range of US $ 100,000 - 120,000, employing 20 – 30 persons seasonally and creating additional direct income to both the herdsmen and the employees. Since this project replaces partially traditional homework of women, it is hoped that women will mainly be employed at the project. Similar approaches are likely to happen in Shagram and Bumburate (mainly goat wool).

Mining, Agro-Processing and Business Development at all sites:

- It is expected that at least one additional slate quarz (Shogore) will start operation. In mid-term a home industry processing semi-precious stones or gems by cutting and faceting tools will be established. Similar experiences do exist in Northern Thailand or Sri Lanka.
- Improvement and diversification of existing agricultural processing to produce dried fruit, jams, juices or extract eatable oil from walnut or apricot kernels are very potential at most sites.
- Almost all craftsmen and skilled trades person interviewed (carpenters, electrician, welders, tailors, saw and wheat flour mills) have agreed to invest immediately in mechanical tools if sufficient electricity at affordable prices would be available. There might be only limited employment effects from this shift in technology using electricity productively during the first years, but some carpenters (Bilphok) indicated that they would move back from Chitral to their villages.

- Chicken-hatching using electric uncubation and heating facilities will open at least at 3 sites.They will provide additional employment for 3-5persons and adding value to local produced corn.
- New modern businesses will come up at all sites as soon as electricity or other facilities such as telecommunication are available (photocopying, photo service, Internet and PC training, Web page design and marketing, PC accounting).
- Domestic and international tourism will pick-up again this year. Many opportunities such as restaurants, guesthouses and related services using electricity could be realized within the coming three years. The recent Kalash Spring Festival in Bumboret received a very high attention (May 2005) and has generated much additional income for the villagers.

272. By applying the "Electricity Plus" approach an approximate quantification of impacts of those opportunities and developments in the first three years indicates substantial growth potential (Table D-16).

Table D-16: Expected impacts at proposed sites after 3 years

Impact per Site	Annually Value-added	(Self) Employment	Annual Income
- At MHP Collection of fees	High level of maintenance In the range of US $ 13,000 – 16,000 annually per site	8 employees	US $ 5,000
MHP Saving account			US $ 300
Indirect, through time saving at HH level, e.g.	Brumburet: US $ 20 – 30,000 Izh-Ovirk: US $ 30 – 35,000 Shogore-Bilphok	200 households 150 – 200 HHs	US$ 20 – 30,000 US$ 30 – 35,000
Mining (site) Others to follow	2 units / US $ 50 - 70,000 for cut slate slaps at site	Up to 50 employees	US $ 15,600
Improving productivity in agriculture & animal husbandry (wool carding and spinning)	Each site: US $ 10 – 15,000; All: US $ 50 – 75,000	Wool carding and spinning project Izh: 20 employees, 10 – 20 self-employed for modern chicken hatching (incubation)	US $ 50 – 75,000
Processing agricultural products (fruits, vegetable, kernels, wheat, maize)	Each site: US $ 25,000 – 50,000 All: US $ 125 – 250,000, depending on annually existing surplus production	Many households on self-employment basis involved	Direct or indirect All: US $ 125 – 250,000
Storing and chilling facilities (fruit, potatoes vegetable, onion)	Extending life span of products US $ 1 to 1,500 per chilling store for 3 tons (depends on store period and value of product)	2 – 3 per chilling house	US $ 1,000 net /chilling store
Skilled labor equipment for all trades(carpenter, tailor, welder, electrician, Car repair, saw miller)	Leads to increased productivity, time saving, improved quality: US $ 5,000 per site	No immediate or short-term additional employment, some in-migration from Chitral town	US $ 5,000 per site due to time saving and better quality
Business Services at each site:	US $ 10,000	Mainly families, self employment, small business: 5 – 10	At each site: US $ 10,000
Other services: washing, laundry, restaurants and guesthouses, etc.	US $ 20,000 at each site	Mainly families, self employment, small business: 5 – 10	US $ 20,000
TOTAL at each site (average)	US $ 95,000 – 115,000	300 persons ; mainly self-employed, family business	US $ 120 – 130,000, direct and indirect
Total at five sites*	**US $ 475,000 – 560,000**	**Approx. 1,500 persons**	**US $ 600 – 750,000**

- The employment and income effects at partners or suppliers are not included in these figures. Neither are included the acceleration of growth and spin-off effects in the villages due to increased demand from additional income generated (e.g. shop owners) within the villages. This will lead to further indirect value-added, employment and income generation.
- (see also List: Improvements of Productivity)

c Greenhouse gas mitigation

273. The use of renewable energy contributes also to the reduction of greenhouse gases through substitution of fossil fuel resources like diesel and kerosene. Kerosene is mainly used in households for lighting and cooking whereas diesel is used for productive processes in workshops and small industries. Table D17 compiles the existing diesel engines and their approximately annual operation time. The avoided volume of greenhouse gas due to the operation of the MHP is compiled in Annex 6 and summarized in Table D18.

Table D-17: Diesel engines in operation**

Site	Number of Diesel	HP / kW	Hours / year
Izh – Ovirk*	1 Diesel at saw mill	22 / 16.5	200
	1 Kerosene generator set	06 / 4.5	150
Bilphok - Shogore	1 Diesel at saw mill	22 / 16.5	300 - 450
	1 Diesel at MFI / Bank	16 / 12.0	2,400
	1 Diesel at AK Hospital	60 / 45.0	3,600 – 4,200
	2 Diesel at slate quarry	30 / 22.5	720 x 2 = 1.440
	1 Wheat flour mill	10 / 7.5	500
Shagram	1 Diesel Generator for Compressor / Elect.	10 / 7.5 10 / 7.5	70 – 80 500 - 600
	1 Diesel Generator for Welding	16 / 12.0	1,500
	1 Diesel Generator at hospital	22 / 16.5	450
	1 Diesel at saw mill (+ carding machine)		
	5 more not visited, 8 tractors		
Raman - Harchin	1 Diesel Generator for Compressor	10 / 7.5	75
	1 Diesel engine for saw mill	22 / 16.5	300
	1 Diesel Generator at health care centre	10 / 7.5	300
	1 Diesel engine for wheat grinder /flour mill	10 / 7.5	500
Bumburate	1 Diesel Generator (PTDC)	/ 12	2000
	1 Stand-by Diesel Generator (PTDC)	/ 25	150
	1 Kerosene Generator (Galaxi)	/ 9	5-600
	6 – 8 dto. At other hotels		

* There are a number of kerosene generators in the bazaar, the police station and a guesthouse. Capacity and level of charge is unknown

** These list is incomplete because not all Diesel are known or could be visited. Most of the tractors are also operating frequently during harvest season as threshers which could be replaced in some cases by electric engines.

Table D-18: Greenhouse gas abatement by MHP (30 years projection)

Source	Izh-Ovirk	Shoghore	Shagram	Raman	Bumburate
MHP	6,652.8	6,652.8	4.435.2	6,652.8	6,652.8

Remark: refer to Annex 6; all figures in metric tons

274. The total figure amounts up to 31,046 tons of saved emissions of CO_2 during the lifetime of the power stations. This is equivalent of 310,460 US$ at a rate of 10 US$ per ton of CO_2.

E ANNEXES

Annex 1

Village Profiles

Village Profile Izh-Ovirk

Estimated population		5548
Number of HHs		730
	Electrified HH	335
	Non electrified HH	395
Religious composition	Sunni	215
	Ismaili	505
Accessibility	One hour more on mostly good roads further up of Shogore, 2 hours from Chitral town	
Infrastructure	Schools	8
	Hospital	2
	Post office	1
	Bank	1
	Mosque	3
	Jamaat Khana	7
	Shop	41
	Restaurant	0
	Transport	9 Jeeps
	Tractor with equipment	1
	Gov. store	1
	Guesthouse	1 (2 rooms)
	NGO	2
	Tele-communication system	25 lines
Cash income sources	Seasonal migrants	121
	Gov. /private employees	75
	business men	50
	Diesel generator	5 – 10
Self help potential		Several VOs and WOs, very good performance
Existing electric appliances	Mixer, Juicer	9
	Fan	10
	Refrigerator	3
	Washing machine	15
	Butter churner	All
	Iron	All
	Geyser, Electric rods	1
	Satellite Dish, TV	30
Energy use	Lighting	Electricity
	Heating	Wood, kerosene
	Cooking	Wood, gas
Present E demand		For heating , cooking, water boiling, washing
Productive potential	Substituting water mills	11
	Substituting Diesel	5 -10
	Agricultural products processing, Incubator	UNDP/MACProject on wool processing
	Wool processing	
	Tourism Development	
	Technical business services	

Village Profile Bilphok/Shogore

Estimated population		3270
Number of HHs		430
	Electrified HH	218
	Non electrified HH	212
Religious composition	Sunni	86
	Ismaili	334
Infrastructure	Schools	7
	Hospital	2
	Post office	2
	Bank	0
	Mosque	6
	Jamaat Khana	12
	Shop	30
	Transport by jeep	3
	Gov. store	1
	Guesthouse	1
	NGO	3
Cash income sources	Seasonal migrants	170
	Gov. /private employees	80
	Business men	80
Self help potential		Several VOs and WOs, good performance
Exisiting electric appliances	Juicer	45
	Fan	125
	Refrigerator	10
	Washing machine	65
	Butter churner	155
	Iron	5
	Electric rods	>350
	Computer	76 (?)
	Diesel	7
	Tractor	1
Energy use	Lighting	Electricity, gas, kerosene
	Heating	Wood, kerosene
	Cooking	Wood, Kerosene, gas
Electricity demand	HHs	Heating, cooking, washing
	Public services	Ventilation, cooling
Productive potential	Substitute watermills	17
	Diesel generator	7
	Quarries and mining	1 -3 marble and slate sites
	Tourism, trekking	3 guesthouses/ hotel
	Skilled trades	25 - 30
	Business services	10 - 15

Village Profile Shagram

Estimated population		10,316
Number of HHs		1,228
	Electrified HH	586 (+100 Shydo)
	Non electrified HH	542
Religious composition	Sunni	673
	Ismaili	593
Accessibility	Very poor during winter months, 2 hours from Bunji (34 km), 4 hours from Chitral under normal conditions; road improvements are on-going for first 8 km	
Infrastructure	Schools	14
	Hospital	3
	Post office	1
	Bank(Habib)	1
	Mosque	15
	Jamaat Khana	18
	Shop	50
	Restaurant	-
	Transport(Jeeps)	25
	Tractors with equipment	8
	Gov. store	4
	Private Guesthouse	7
	NGO	4
Cash income sources	Seasonal migrants	12
	Gov. /private employees	200
	Business men	25
	Diesel generator	9
Self help potential		22 VOs, 12 WOs, CCB, different social welfare organisations
Existing electric appliances	Juicer	20-30% of HH
	Refrigerator	4
	Butter churner	20-30% of HH
	Iron	Most HH
	Electric rods	some
	Computer	25
	Satellit Dishes/TV	15
	Mixer	1- 2% of HH
Energy use	Lighting	Electricity kerosene
	Heating	Wood
	Cooking	Wood
Present E demand	For heating , cooking, water boiling, washing	Ventilation
Productive potential	Substitution of watermill	20
	Substitution of Diesel	9
	Skilled trades	30 - 40
	Guesthouses for tourists	8 -10
	Processing of agric. products	Large quantities
	Schools, hospital	PC centers, health equip.

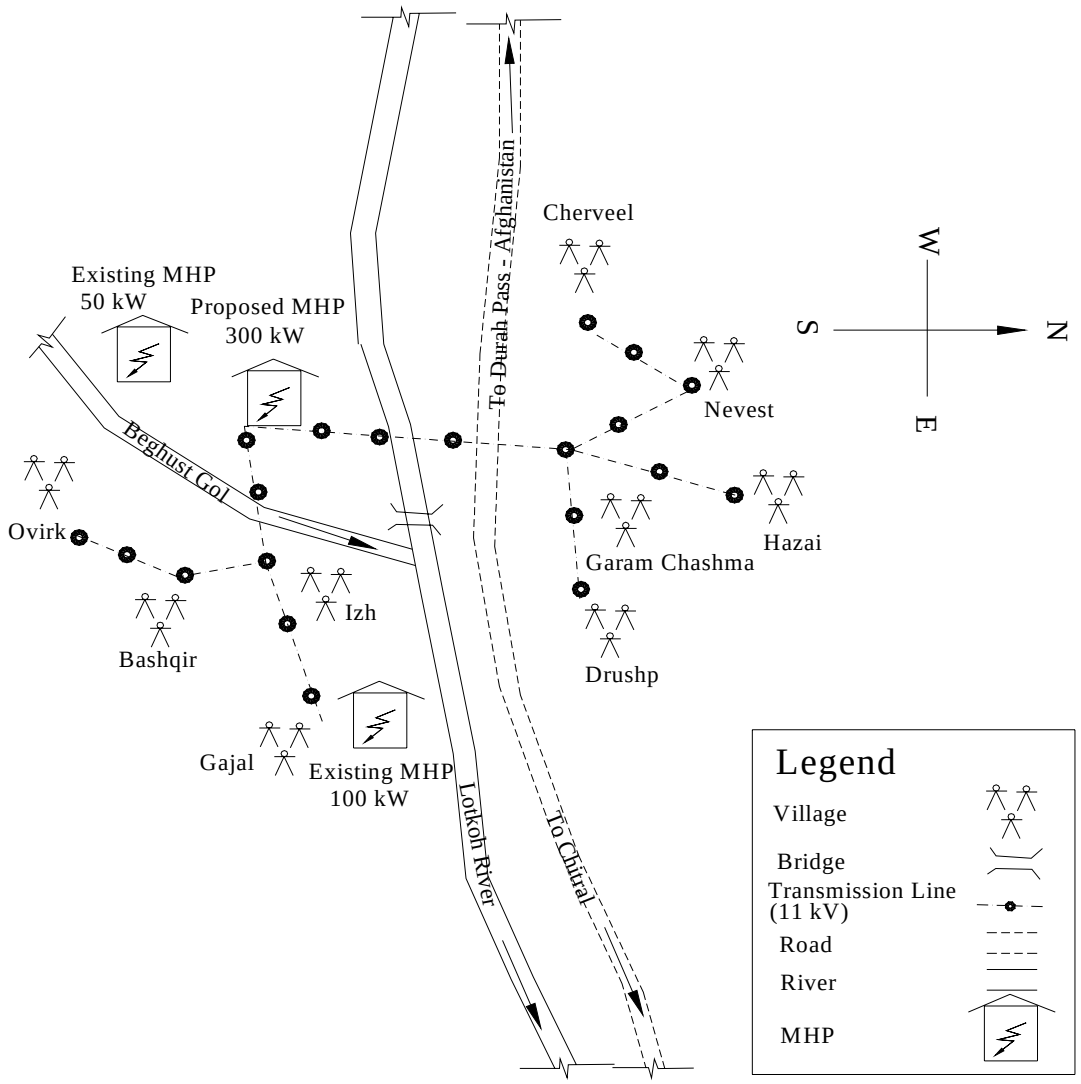
Village Profile Harchin - Raman

Estimated population		3900
Number of HHs		800
	Electrified HH	150
	Non electrified HH	650
Religious composition	Sunni	4
	Ismaili	796
Accessibility	5 -6 hours drive from Chitral on off-roads, road to Gilgit via Shandur pass (3,800 m)	
Infrastructure	Schools	18
	Hospital	1
	Post office	1
	Bank	?
	Mosque	11
	Jamaat Khana	12
	Shop	67
	Restaurant	1
	Transport by Jeep	11
	Government store	1
	Guesthouse	1
	NGO	?
Cash income sources	Seasonal migrants	80
	Gov. /private employees	125
	Business men	30-40
Self help potential		18 VOs and WOs, IUCN, WASIP,
Existing electric appliances	Juicer	?
	Fan	10
	Refrigerator	5
	Washing machine	21
	Butter churner	220
	Satellite Dish/TV	26
	Iron	Many
	Electric rods	>150
	Heater	20
	Computer	17
Productive Equipment	Tractor with equipment	9
	Wood saw mill (Diesel)	1
	Welding, compressor	1
	Carpenters hand tools	18
Energy use	Lighting	Electricity, Gas
	Heating	Dung, wood
	Cooking	Dung, wood
Present E demand	For heating ,	cooking, water boiling, washing, energy and time saving appliances
Productive potential	Replace of watermills	25
	Substitution of Diesels	10
	Tourism, Poultry farming Quarring & mining	Incubator
Increase in productivity	Flour mills,welding, carpenters, tailoring	

Annex 2

Technical Lay-Out of Power Supply

Schematic Sketch of Izh-Ovirk MHP



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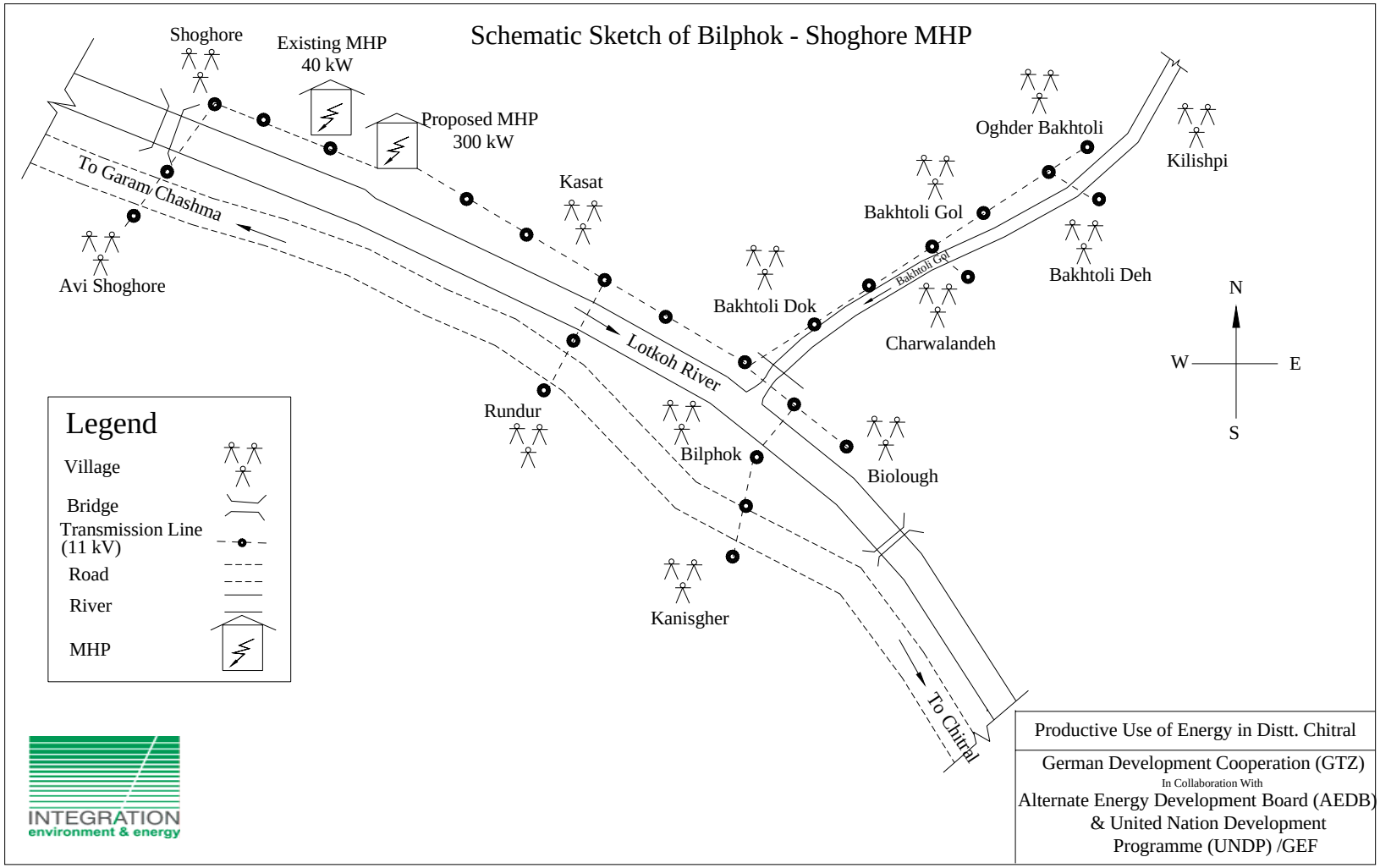
Schematic Sketch of Bilphok - Shoghore MHP
Shoghore
Existing MHP
40 kW
Proposed MHP
300 kW
To Garam Chashma
Avi Shoghore
Kasat
Lotkoh River
Rundur
Bilphok
Kanisgher
Bakhtoli Dok
Bakhtoli Gol
Bakhtoli Cgt
Oghder Bakhtoli
Kilishpi
Bakhtoli Deh
Charwalandeh
Biolough
To Chitral
N
W
E
S
Legend
Village
Bridge
Transmission Line
(11 kV)
Road
River
MHP
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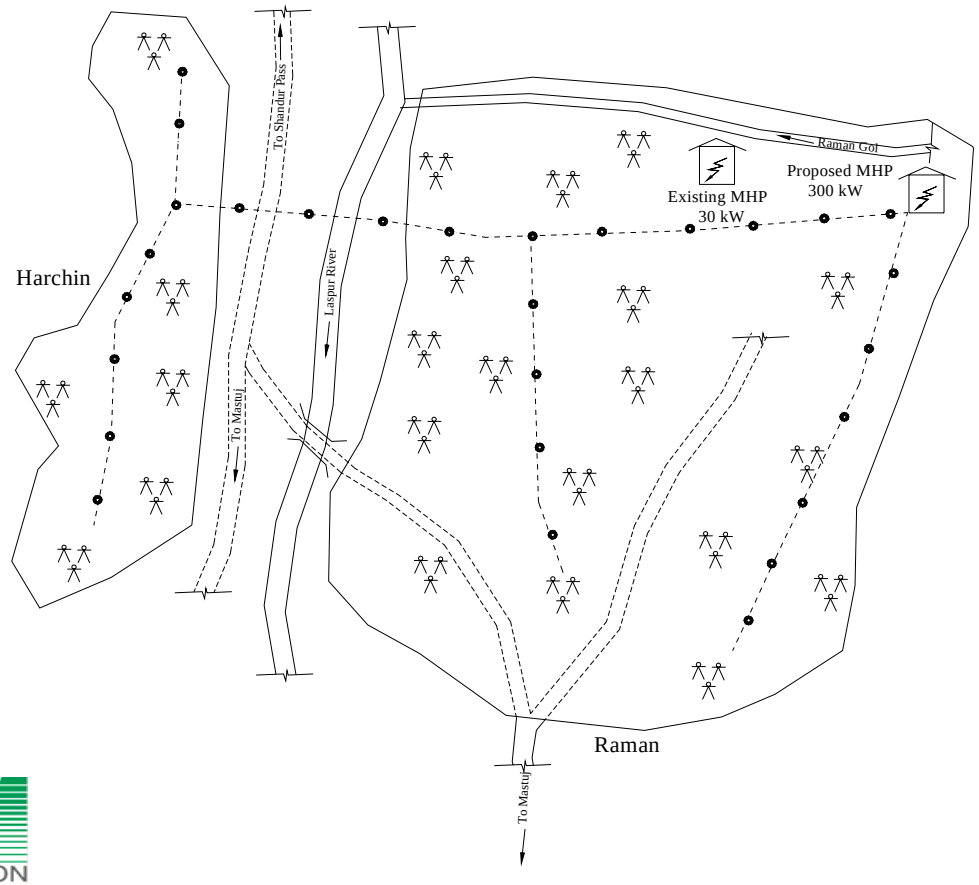
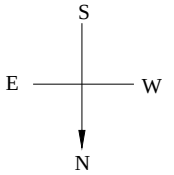
Schematic Sketch of Harchin-Raman MHP





Legend

- Village
- Bridge
- Transmission Line (11 kV)
- Road
- River
- MHP

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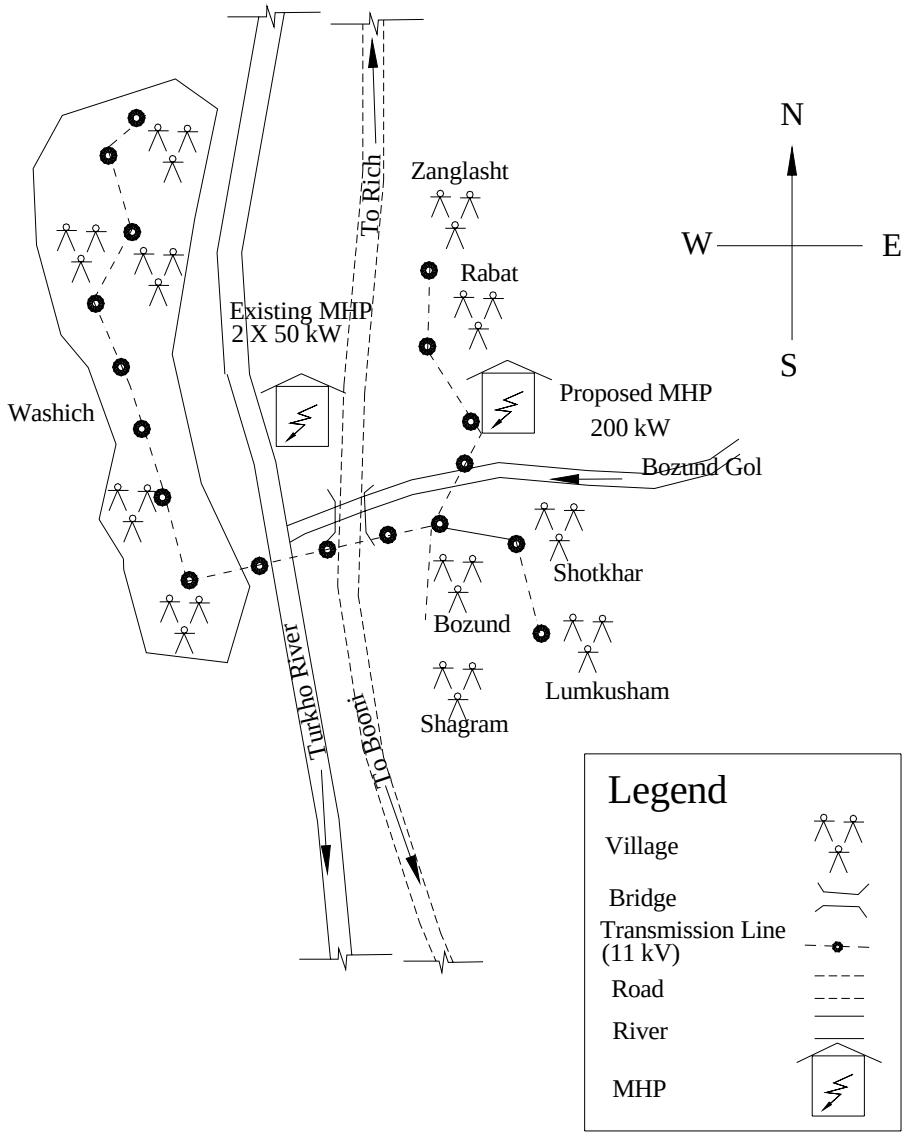
Schematic Sketch of Shagram MHP



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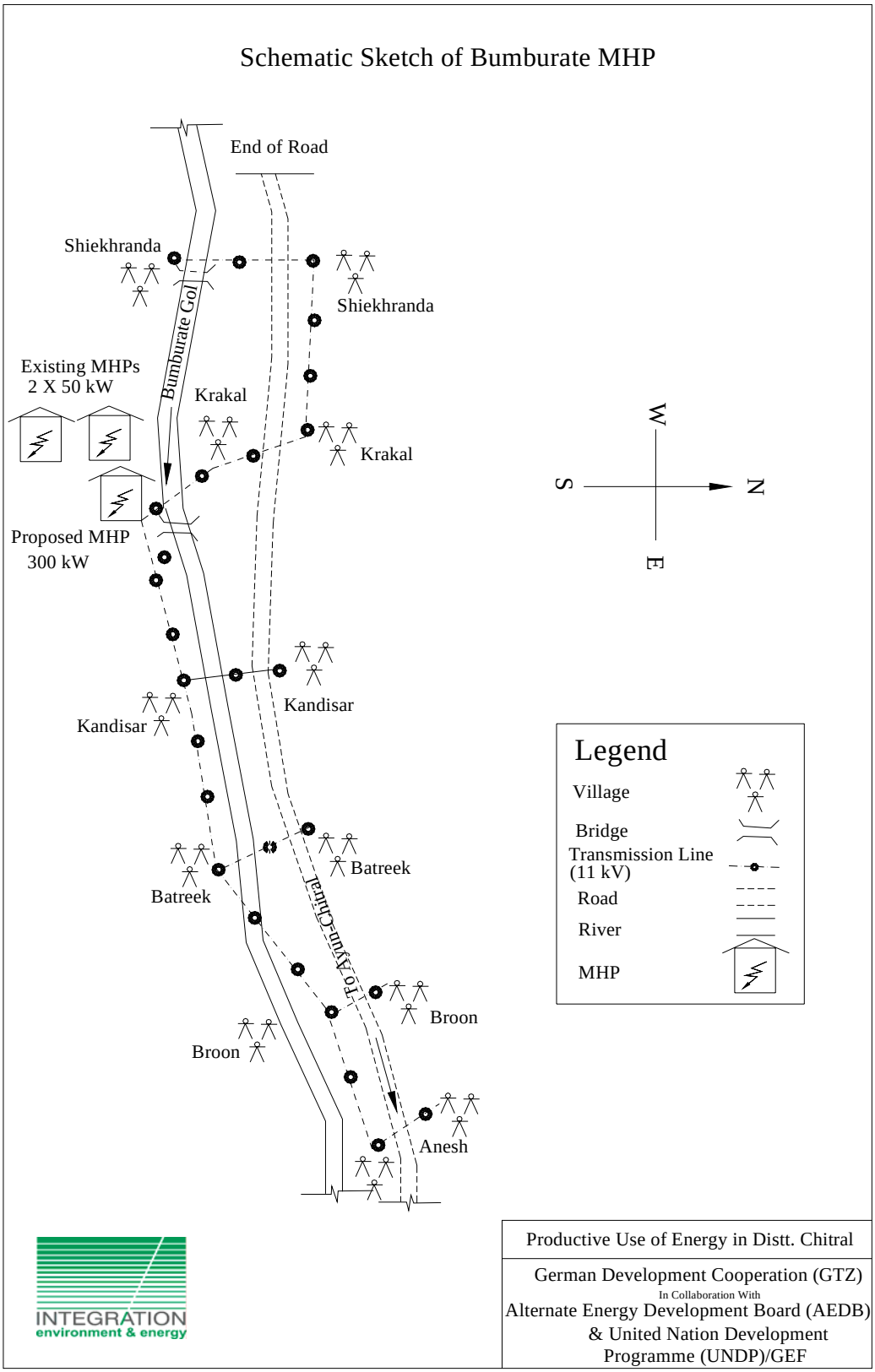
Schematic Sketch of Bumburate MHP
End of Road
Shiekhranda
Shiekhranda
Bumburate Gol
Existing MHPs
2 X 50 kW
Krakal
Krakal
Proposed MHP
300 kW
W
S
N
E
Kandisar
Kandisar
Batreek
Batreek
Po Ayun Chaual
Broon
Broon
Anesh
Legend
Village
Bridge
Transmission Line
(11 kV)
Road
River
MHP
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Annex 3

Power Demand

Electricity Demand: (kW x h daily)

Business and Social Services at proposed sites:

Business & Social Services	Izh-Ovirk	Shagram	Bumborate	Harchin-Raman	Shogore-Bilphok
Micro Finance Institution /Bank	-	5kW x 8h	-	1kW x 8h (saving bank/PO)	5 kW x 8 h
Hospital Diesel Generator or Health Care Center	2 x3 kw x 8h	10kWx12h	2 x 1kW x 8h	3kWx 8h	15 – 25 kW x 24 h (15kW x 24h)
Vetenary Hospital	2kW x 8h	2kW x 8h	-	-	2kW x 8h
Schools (light, PC)	6 x 3 kW x 6h	6 x 3 kW x 6h	6x2kwx6h	14 x 2kW x 8h	
Gov. Wheat Store (light)	-	4x 200Wx10h	2 x 200W x 10h	1x200W x 10h	
Female Vocation Training Center (light)	-	-	-	-	
Police Office & Dormitory (light,radio communication)	3kw x 12 h	3kw x 12 h	3kW x 12 h	3kw x 12 h	
Drinking water pump with piped water lines	Gravity	Gravity	Gravity	Gravity	
NGO offices /Cultural center	2 kW x 8 h	3kWx8h	CC: 6kW x 10h	2kWx12h	
Others (road lights, Post office, Mosques, Jamat Khanas)	6 kw x 12 h	6kWx10h (5 NGO offices)	Hotel & Festival areas:6 kW x 10h	4kW x12h	
Total annual Electricity Demand from Business and Social Services	91,960	137,520	76,320	105,180	250,000kW

Existing and potential productive Businesses

Electric equipment	Izh-Ovirk	Shagram	Bumborate	Harchin-Raman	Shogore-Bilphok
Saw mill 22 HP Diesel engine (to be converted)	70 kW start up 3 h run	70 kW start up 3 h run	- 1 only in Phachlawandeh)	70 kW sart-up 3 h (mobile)	
Slate cutting machine + 15 HP Diesel engine	Potential	-	-	Potential	
Slate /marble cutting machine (additional)	Potential	-	-	Potential	
Welding & grinding equipment (new)	3 x 3kw x 3 h	3 x 3kw x 3 h	2 x 3kWx3h	2 x 3kWx3h	
Carpenter equipment (new)	3 x 3 kW x 4h	3 x 3 kW x 4h	3 x 3 kW x 4h	3 x 3 kW x 4h	
Compressor for tyres; painting (new)	1 x 2 kW x 1h	1 x 2 kW x 1h	1 x 2 kW x 1h	1 x 2 kW x 1h	
Tailoring equipment (iron, sewing,overlock, light, etc.)	6 x 2 kW x 4h	6 x 2 kW x 4h	30 women in HH x 1kW x 3h 3 T x 2kW x 4h	6 x 2 kW x 4h	
Electrician, TV, Radio repair	2 x 500W x 6h	2 x 500W x 6h	1 x 500 W x 6h	2 x 500W x 6h	
Wheat flour mill	2 x 2kW x 3h	2 x 2kW x 3h	2 x 2kW x 3h	2 x 2kW x 3h	
Shearing equipment (new) 3 sets	1x 3kWx 4h 3 x 10 days/year	1x 3kWx 4h 3 x 10 days/year	-	-	
Carding equipment(new)	1x 2kW x 4h seasonal	1x 2kW x 4h seasonal	-	-	
Exhaust Fan for solar fruit drying equipment (new)	Testing 3 units x	Testing	?	-	
Walnut kernals press (new)	-	-	1x3kW x 2h (testing, season)	-	
Grocery & other shops (Tape, light, refrigerator)	41 x 1 kW x 8 h	50x1kWx6h	50 x 1kw x 3h	92 x 1kWx8h	
Sales to outsite shops	100x1kWx4h (Garam Chashma)				
Restaurants (light, heater TV Dish, refrigerator, cooker) new	-	-	In Hotels & guesthouses	1kW x 8h	
Hotel/Guesthouse(light, TV Dish, refrigerator, cooker, heater) new	3kW x 12 h	7x3kWx6h	60-70 kW during 4 summer months x 10h	5 x 1kW x 10h	
Chilling store for 3-5 tons vegetable and fruits (new), ventilation, cooling, light	3 months/year 5kW x 24 h	3 months/year 5kW x 24 h	-	3 months/year 5kW x 24 h	

Others (battery charger, petrol pump, PC Centers, Telecommunication, Dry cleaner/ washing saloon)	5 kW x 12 h	5 kW x 12h	3 kW x 8h	3kW x 12h	
NEW: Water lifting for drip irrigation (fruit trees, vegetables inter croping)	5kW pump x 12h (seasonal, 3 -4 months)	-	-	-	
Total existing & potential productive business using electricity in the first year	541,450	282,390	209,900	289,500	100,000

Private Households Total Annual Electricity Demand

Electric appliances	Izh-Ovirk	Shagram (partly SHYDO)	Bumborate	Harchin-Raman	Shogore-Bilphok
Light /HH (3 - 5 bulbs or phos. tube lamps)	730 x 120W x 10h	500x120x10h	800x120Wx10h	800x120Wx10h	
Refrigerator	30 x 300W x 12h	30 x 300W x 12h	80x300Wx12h	80x300Wx12h	
Fan	-	-	-	-	
Washing Machine	50 x 400W x 1h	50 x 400W x 1h	50x400x1h	50x400x1h	
Iron	100 x 400W x 1h	100 x 400W x 1h	200x400Wx1h	200x400Wx1h	
Juicer (mixer)	-	-			
Butter Churner	730 x 180W x 1h	730 x 180W x 1h	800x180Wx1h	800x180Wx1h	
PrivateTV Dish Ant.& Stabl.	30 x 500W x 4h	30 x 500W x 4h	30x500Wx4h	30x500Wx4h	
Electric heater	100 x 1kW x 8h	100 x 1kW x 8h	50 x 1kWx8h	50 x 1kWx8h	
Water heating rod	70 x 1kW x 1/2h	70 x 1kW x 1/2h	60x1kWx 1/2h	60x1kWx 1/2h	
Tape recorder/Radio	730 x 150W x 1h	730 x 150W x 1h	800x150Wx1h	800x150Wx1h	
Personal Computers/ Printers	15 x 300 W x 2h	15 x 300 W x 2h	?	20 x 300W x 2h	
Electric cooker	70 x 500W x 2h	70 x 500W x 2h	30x500Wx2h	50x500Wx2h	
Total private household annual electricity demand	588,440	468,520	611,090	663,208	400,000
Grand Total	1,221,850	888,430	897,310	1,057,888	750,000

Annex 4

Economic analysis

300 kW MHP at Izh-Ovirk site

Izh - Ovirk	no. units	US$
Civil works		
Weir Intake and Sandtrap	1	75,000
Headrace Channel	1	65,000
Forebay	1	29,250
Penstock	1	26,500
Powerhouse	1	58,500
Electro-mechanical equipment		
Turbine, Generator, Electric	1	155,000
Others		
Transmission line	1	59,400
Distribution line	1	49,000
Planning, Supervision, Final Design	12%	62,118
Contingencies	25%	144,942
Total Cost		**724,710**
Cost per kW installed capacity	**300**	**2,416**
Total Investment		**724,710**
Operational Cost per year:		
Item	No	**Izh-Ovirk**
Staff costs		4,800
Chief Operator	1	1,000
Operator	2	1,400
Linesmen	2	1,200
Meter Reader	2	1,200
Accountant	1	300
Maintenance, repairs	2%	14,494
Other operational cost		500
Depreciation	4%	28,988
Total operational cost		**49,083**

Assumptions:

- Currency: US$ only
- Exchange rate: 1 US$ = 60 Rs
- inflation not included
- tariff: 1 Rs (0.02 US$) per kWh
- 100% equity financed investment, therefore, no financing costs included
- Lifetime of all equipment: 25 years
- Average load factor: 60%
- System losses: 10%
- Non-technical losses: 0 %
- Maintenance and repair cost: 2% p.a. of initial investment
- Power demand compare chapter D-5

Tarif:
The unit price for 1 kWh is Rs 1 or US$ 0.02 and will increase by 4% annually during the first 11 years of operation, then increase only by 3% annually until the 20th year of operation.

Results and Cash Flow

Year	Result	Cash-Flow	Cash-Flow
	US$/year	US$/year	US$ cum.
-1	-2,000	-362,355	-362,355
0	-2,000	-364,355	-726,710
1	-28,409	580	-726,130
2	-16,755	12,233	-713,897
3	-3,113	25,875	-688,022
4	12,861	41,849	-646,173
5	21,550	50,538	-595,635

In the case of Izh-Ovrik already after the first year of full power generation the cash revenue covers the cash expenditures for operation and maintenance. This is due to the larger population and expected higher electricity consumption at this site compared with Bilphok – Shogore. From the fourth year of operation the annual results are positiv and all operational cost including 4% depreciation p.a. on total initial investment can be recovered by cash revenues from fee collection.

If the MHP would have been financed by a 0 % interest (service charge) loan the management of the plant could now – after a grace period of only 5 years start to pay back the loan over a period of 12 years. Within the remaining 10 years of the plant's life span US$ 956,799 could be accumulated which could be used for additional rural development activities.

Key financial figures

Internal Rate of Return:		**12%**
Net Present Value at:	5%	**$440,294**
Net Present Value at:	10%	**$87,307**

300 kW MPH at Bilphok – Shagore Site

Bilphok – Shoghore	**no. units**	**US$**
Civil works		
Weir Intake and Sandtrap	1	86,500
Headrace Channel	1	45,500
Forebay	1	26,350
Penstock	1	15,500
Powerhouse	1	65,200
Electro-mechanical equipment		
Turbine, Generator, Electric	1	160,250
Others		
Transmission line	1	54,000
Distribution line	1	42,000
Planning, Supervision, Final Design	12%	59,436
Contingencies	25%	138,684
Total Cost		**693,420**
Cost per kW installed capacity	**300**	**2,311**
Total Investment		**693,420**
Operational Cost per year: Item	No	**Bilphok – Shogore**
Staff costs		4,800
Chief Operator	1	1,000
Operator	2	1,400
Linesmen	2	1,200
Meter Reader	2	1,200
Accountant	1	300
Maintenance, repairs	2%	13,868
Other operational cost		500
Depreciation	4%	27,737
Total operational cost		47,205

Assumptions:

- Currency: US$ only
- Exchange rate: 1 US$ = 60 Rs
- inflation not included
- tariff: 1 Rs (0.02 US$) per kWh
- 100% equity financed investment, therefore, no financing costs included
- Lifetime of all equipment: 25 years
- Average load factor: 60%
- System losses: 10%
- Non-technical losses: 0 %
- Maintenance and repair cost: 2% p.a. of initial investment
- Power demand compare chapter D-5

Tarif:

The unit price for 1 kWh is Rs 1 or US$ 0.02 and will increase by 4% annually during the first 11 years of operation, then increase only by 3% annually until the 20th year of operation.

Results and Cash Flow

Year	Result	Cash-Flow	Cash-Flow
	US$/year	US$/year	US$ cum.
-1	-2,000	-348,710	-348,710
0	-2,000	-358,710	-707,420
1	-32,710	-4,973	-712,393
2	-24,616	3,121	-709,272
3	-15,172	12,565	-696,707
4	-4,100	23,637	-673,070
5	1,879	29,616	-643,454

Already after the second year of full power generation the cash revenue covers the cash expenditures for operation and maintenance. From the fifth year of operation the results are positiv and all operational cost including 4% depreciation p.a. on total initial investment can be recovered by cash revenues from fee collection.

If the MHP would have been financed by a 0 % interest (service charge) loan the management of the plant could now – after a grace period of 6 years start to pay back the loan over a period of 16 years. Within the remaining 9 years of the plant's life span US$ 266,000 could be accumulated which could be used for additional rural development activities.

Key financial figures (based on assumptions)

Internal Rate of Return:		**7%**
Net Present Value at:	5%	**$110,629**
Net Present Value at:	10%	**-$88,805**

200 kW MHP at Shagram Site

Shagram	no. units	US$
Civil works		
Weir Intake and Sandtrap	1	58,000
Headrace Channel	1	65,500
Forebay	1	23,000
Penstock	1	12,500
Powerhouse	1	38,000
Electro-mechanical equipment		
Turbine, Generator, Electric	1	115,000
Others		
Transmission line	1	48,600
Distribution line	1	38,500
Planning, Supervision, Final Design	12%	47,892
Contingencies	25%	111,748
Total Cost		**558,740**
Cost per kW installed capacity	**200**	**2,794**
Total Investment		**558,740**
Operational Cost per year:		
Item	No	**Shagram**
Staff costs		4,800
Chief Operator	1	1,000
Operator	2	1,400
Linesmen	2	1,200
Meter Reader	2	1,200
Accountant	1	300
Maintenance, repairs	2%	11,175
Other operational cost		500
Depreciation	4%	22,350
Total operational cost		**39,124**

Assumptions:

- Currency: US$ only
- Exchange rate: 1 US$ = 60 Rs
- inflation not included
- tariff: 1 Rs (0.02 US$) per kWh
- 100% equity financed investment, therefore, no financing costs included
- Lifetime of all equipment: 25 years
- Average load factor: 60%
- System losses: 10%
- Non-technical losses: 0 %
- Maintenance and repair cost: 2% p.a. of initial investment
- Power demand compare chapter D-5

Tarif:

The unit price for 1 kWh is Rs 1 or US$ 0.02 and will increase by 4% annually during the first 11 years of operation, then increase only by 3% annually until the 20th year of operation.

Results and Cash Flow (see full details in annex xy)

Year	Result	Cash-Flow	Cash-Flow
	US$/year	US$/year	US$ cum.
-1		-279,370	-279,370
0	-5,000	-284,370	-563,740
1	-24,011	-1,662	-565,402
2	-15,526	6,824	-558,578
3	-5,630	16,720	-541,858
4	5,964	28,314	-513,544
5	12,245	34,595	-478,949

Already after the first year of full power generation the cash revenue covers the cash expenditures for operation and maintenance. This is due to the smaller MHP (200 kW) and the resulting lower investments and a relative high level of electricity consumption. From the fourth year of operation the annual results are positiv and all operational cost including 4% depreciation p.a. on total initial investment can be recovered by cash revenues from fee collection.

If the MHP would have been financed by a 0 % interest (service charge) loan the management of the plant could now – after a grace period of only 5 years start to pay back the loan over a period of 12 years. Within the remaining 10 years of the plant's life span US$ 594,044 could be accumulated which could be used for additional rural development activities.

Key financial figures (based on assumptions)

Internal Rate of Return:		**11%**
Net Present Value at:	5%	**$268,013**
Net Present Value at:	10%	**$26,120**

Economic Analysis of the 300 kW MHP at Bumburate valley site

Bumburate	no. units	US$
Civil works		
Weir Intake and Sandtrap	1	75,000
Headrace Channel	1	68,500
Forebay	1	27,000
Penstock	1	28,000
Powerhouse	1	58,000
Electro-mechanical equipment		
Turbine, Generator, Electric	1	152,000
Others		
Transmission line	1	35,100
Distribution line	1	28,000
Planning, Supervision, Final Design	12%	56,592
Contingencies	25%	132,048
Total Cost		**660,240**
Cost per kW installed capacity	**300**	**2,201**
Total Investment		**660,240**
Operational Cost per year:		
Item	No	**Bumburate**
Staff costs		4,800
Chief Operator	1	1,000
Operator	2	1,400
Linesmen	2	1,200
Meter Reader	2	1,200
Accountant	1	300
Maintenance, repairs	2%	13,205
Other operational cost		500
Depreciation	4%	26,410
Total operational cost		**45,214**

Assumptions:

- Currency: US$ only
- Exchange rate: 1 US$ = 60 Rs
- inflation not included
- tariff: 1 Rs (0.02 US$) per kWh
- 100% equity financed investment, therefore, no financing costs included
- Lifetime of all equipment: 25 years
- Average load factor: 60%
- System losses: 10%
- Non-technical losses: 0 %
- Maintenance and repair cost: 2% p.a. of initial investment
- Power demand compare chapter D-5

Tarif:

The unit price for 1 kWh is Rs 1 or US$ 0.02 and will increase by 4% annually during the first 11 years of operation, then increase only by 3% annually until the 20th year of operation.

Results and Cash Flow

Year	Result	Cash-Flow	Cash-Flow
	US$/year	US$/year	US$ cum.
-1		-330,120	-330,120
0	-5,000	-335,120	-665,240
1	-29,934	-3,525	-668,765
2	-20,377	6,033	-662,732
3	-9,958	16,452	-646,280
4	2,249	28,659	-617,621
5	8,860	35,270	-582,351

Already after the second year of full power generation the cash revenue covers the cash expenditures for operation and maintenance. This is due to the high number of electric users (hotels, guesthouses) during summer an the number of heaters to be installed. From the fourth year of operation the annual results are positiv and all operational cost including 4% depreciation p.a. on total initial investment can be recovered by cash revenues from fee collection.

If the MHP would have been financed by a 0 % interest (service charge) loan the management of the plant could now – after a grace period of only 6 years start to pay back the loan over a period of 14 years. Within the remaining 8 years of the plant's life span US$ 523,604 could be accumulated which could be used for additional rural development activities.

Key financial figures (based on assumptions)

Internal Rate of Return:		**10%**
Net Present Value at:	5%	**$231,841**
Net Present Value at:	10%	**-$15,125**

300 kW MHP at Raman – Harchin Site

Raman - Harchin	no. units	US$
Civil works		
Weir Intake and Sandtrap	1	78,000
Headrace Channel	1	68,500
Forebay	1	35,000
Penstock	1	38,000
Powerhouse	1	58,000
Electro-mechanical equipment		
Turbine, Generator, Electric	1	145,000
Others		
Transmission line	1	37,800
Distribution line	1	31,500
Planning, Supervision, Final Design	12%	59,016
Contingencies	25%	137,704
Total Cost		**688,520**
Cost per kW installed capacity	**300**	**2,295**
Total Investment		**688,520**
Operational Cost per year: Item	No	**Raman – Harchin**
Staff costs		4,800
Chief Operator	1	1,000
Operator	2	1,400
Linesmen	2	1,200
Meter Reader	2	1,200
Accountant	1	300
Maintenance, repairs	2%	13,770
Other operational cost		500
Depreciation	4%	27,541
Total operational cost		**46,911**

Assumptions:

- Currency: US$ only
- Exchange rate: 1 US$ = 60 Rs
- inflation not included
- tariff: 1 Rs (0.02 US$) per kWh
- 100% equity financed investment, therefore, no financing costs included
- Lifetime of all equipment: 25 years
- Average load factor: 60%
- System losses: 10%
- Non-technical losses: 0 %
- Maintenance and repair cost: 2% p.a. of initial investment
- Power demand compare chapter D-5

Tarif:

The unit price for 1 kWh is Rs 1 or US$ 0.02 and will increase by 4% annually during the first 11 years of operation, then increase only by 3% annually until the 20th year of operation.

Results and Cash Flow

Year	Result	Cash-Flow	Cash-Flow
	US$/year	US$/year	US$ cum.
-1	- 2,000	-344,260	-344,260
0	-2,000	-346,260	-690,520
1	-28,942	-1,401	-691,921
2	-18,794	8,747	-683,174
3	-6,964	20,577	-662,597
4	6,894	34,435	-628,162
5	14,415	41,956	-586,206

Already in the second year of full power generation the cash revenue covers the cash expenditures for operation and maintenance of Raman power station. This is due to the high number of electric heaters to be installed in this most expensive area for "imported" fuel wood and with the high demand for household electricity (new connections). From the fourth year of operation the annual results are positiv and all operational cost including 4% depreciation p.a. on total initial investment can be recovered by cash revenues from fee collection.

If the MHP would have been financed by a 0 % interest (service charge) loan the management of the plant could now – after a grace period of only 6 years start to pay back the loan over a period of 12 years. Within the remaining 10 years of the plant's life span US$ 715,253 could be accumulated which could be used for additional rural development activities.

Key financial figures (based on assumptions)

Internal Rate of Return:		**11%**
Net Present Value at:	5%	**$324,995**
Net Present Value at:	10%	**$31,507**

Annex 5

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Annex 6

Technical sites Chitral district

Annex 6.1: Summary Sheets

Table : Socio-Economic Aspects

No.	Community	No. of households	No. Of population	No. of schools	No. of hospitals	Other Public Infrastructure	Main Source of Income	Average household income /year (Rs)
1	Bilphok	350	3.675	9	Nil	Nil	Livestock & Agriculture, Govt. service	20.000
2	Beori Lower Chitral	350	3.675	1	Nil	Nil	Livestock & Agriculture	30.000
3	Kiyar	155	1.628	1	Nil	Nil	As above	10.000
4	Susoom	400	4.200	4	1	P.O, large storage facility, road passable with 4WD, wooden bridges.	As above	25.000
5	Rozbis Birir Gole	250	2.625	2	1	Resthouse, large storage facility, road passable with 4WD.	As above	28.000
6	Begusht	350	3.675	2	1	Large storage facility, P.O., road passable with 4WD.	As above	30.000
7	Birzeen	300	3.150	2	Nil	Large storage facility, road passable with 4WD, P.O.	As above	40.000
8	Parabaik	350	3.675	3	1	Large storage facility, road passable with truck, P.O.	As above	40.000
9	Momi	180	1.890	2	Nil	Large storage facility, road passable with 4WD.	As above	25.000
10	Rabat Arkari	300	3.150	2	Nil	Road passable with 4WD.	As above	20.000
11	Shole Arkari	400	4.200	6	2	Road passable with 4WD, large storage facility, P.O.	As above	15.000
12	Shoghore	350	3.675	5	2	Bank, large storage facility, police chowki, P.O., metal road.	Livestock & Agriculture, Govt. service	25.000
13	Gajal	340	3.570	7	3	Thana, large storage facility, PO, road passable with truck, Govt. offices.	Livestock & Agriculture, Govt. service	40.000
14	Madaklasht	400	4.200	4	2	P.O, road passable with 4WD.	Livestock & Agriculture, Govt. service	50.000
15	Breshgram	310	3.255	5	0	Exchange, PO, large storage facility, road passable with 4WD.	Livestock & Agriculture, Govt. service	25.000
16	Baleem (DORDABAHM GOLE)	400	4.200	2	Nil	Bridge, water supply, road passable with truck.	Livestock & Agriculture, Govt. service	30.000
17	Raman	420	4.410	5	2	Thana, large storage facility, PO, road passable with 4WD.	Livestock & Agriculture, Govt. service	28.000
18	Khush Raow Gole	450	4.725	5	2	Large storage facility	Agri/Livestock	2.000
19	Power	400	4.200	4	1	Large storage facility, PO, Scoutpost, road passable with 4WD.	Livestock & Agriculture, Govt. service	25.000
20	Gazin	300	3.150	6	1	PO, large storage facility, Bridge, road passable with 4WD.	Livestock & Agriculture, Govt. service	20.000
22	Ghoru	320	3.360	5	Nil	Bridge, PO, large storage facility, road passable with 4WD.	Livestock & Agriculture, Govt. service	15.000
23	Shagram	450	4.725	8	2	Thana, Tehsil Offices, road passable with 4WD, P.O.	Livestock & Agriculture, Govt. service	30.000
24	Tairech Gole	430	4.515	3	Nil	Large storage facility, road passable with 4WD, bridges.	Agriculture/Livestock	35.000
25	Rau Gole (Ruwa)	280	2.940	1	Nil	Road passable with 4WD	Livestock & Agriculture, Govt. service	10.000
26	Khot Bala	500	5.250	3	1	Large storage facility, road passable with 4WD.	Agriculture/Livestock	40.000
27	Tairech Bala (Chakosh) Gole	400	4.200	5	1	Large storage facility, PO, road passable with 4WD.	Livestock & Agriculture, Govt. service	20.000
28	Sunich	120	1.260	2	Nil	Road passable with 4WD	As above	25.000
29	Besti Shenjure Koch	250	2.625	2	1	Large storage facility, road passable with 4WD	As above	20.000
30	Oveer Gole	320	3.360	2	Nil	Large storage facility, P.O., road passable with 4WD.	Livestock & Agriculture, Govt. service	25.000
31	Gobore Bakh	250	2.625	2	1	Large storage facility, P.O., road passable with 4WD.	Livestock & Agriculture, Govt. service	30.000
32	Izh Garamchashma	450	4.725	6	2	Govt Offices, large storage facility, P.O., road passable with truck	As above	45.000
33	Golain Istore	250	2.625	3	1	Large storage facility, road passable with 4WD.	Agriculture/Livestock	15.000
35	Chakosh Gole (Rech)	350	3.675	8	2	Large storage facility, PO, road passable with 4WD.	As above	30.000
36	Bhoroghol (Dharkot Gole)	215	2.258	1	Nil	Large storage facility, no road passable with 4WD.	As above	40.000
37	Bumburait Gole Kalash	250	2.625	10	1	Rest houses, PTDC, large storage facility, road passable with 4WD.	Livestock & Agriculture, tourism	40.000
38	Rumbure Gole Kalash	350	3.675	3	1	Offices/Hotels/Shops, road passable with 4WD.	Livestock & Agriculture, tourism	50.000
39	Joghore Gole	150	1.575	1	Nil	Road passable with 4WD.	Agriculture/Livestock	25.000
40	Meerdin	150	1.575	2	Nil	Large storage facility, road passable with 4WD.	As above	35.000
41	Jinjerate Koh	350	3.675	2	Nil	Road passable with 4WD.	Agriculture/Livestock	25.000
42	Dominal Nisar	150	1.575	2	Nil	Road passable with truck, P.O.	Agriculture/Livestock	2.500
43	Ashrate	350	3.675	4	2	PTCL offices, road passable with 4WD, bridges, etc.	As above	50.000
	Total	**13.090**	**98.175**					
	Priority Status:	High	Medium	Low	population: 10.5 per household			

Table: Technical Aspects

No.	Community	Net discharge (m^3/s)	Net head (m)	Type of turbine	Length of penstock (m)	Length of channel (m)	Length of transmission line (km)	Length of distribution line (km)	Total power (kW)
1	Bilphok	1,20	17	X-Flow	37	1.204	15	25	150
2	Beori Lower Chitral	1,13	98	As above	137	1.524	12	20	300
3	Kiyar	0,60	23	As above	53	762	5	3	103
4	Susoom	1,00	86	As above	137	808	8	10	200
5	Rozbis Birir Gole	0,70	29	As above	64	610	10	15	150
6	Begusht	1,13	64	As above	122	817	11	13	300
7	Birzeen	1,60	25	As above	152	975	15	20	300
8	Parabaik	1,60	24	Cross Flow	140	869	12	30	300
9	Momi	1,00	20	As above	76	701	1	11	150
10	Rabat Arkari	1,80	21	As above	131	1.524	25	16	300
11	Shole Arkari	2,00	27	As above	122	671	36	30	400
12	Shoghore	1,27	25	As above	119	1.006	19	14	250
13	Gajal	1,60	34	As above	137	1.006	13	34	400
14	Madaklasht	1,40	29	As above	128	914	9	14	300
15	Breshgram	0,80	16	As above	64	762	10	15	100
16	Baleem (Dordabahm Gole)	2,50	16	As above	122	1.067	15	36	300
17	Raman	1,00	76	As above	107	1.311	20	35	300
18	Khush Raow Gole	0,28	168	Pelton wheel	290	762	15	30	200
19	Power	2,00	137	Pelton wheel	290	808	14	12	300
20	Gazin	1,80	26	Cross Flow	76	762	18	25	300
22	Ghoru	1,80	14	As above	61	1.006	15	20	200
23	Shagram	1,00	27	As above	64	1.067	28	45	200
24	Tairech Gole	0,80	26	As above	125	610	15	30	300
25	Rau Gole (Ruwa)	0,28	152	Pelton wheel	244	122	5	2	250
26	Khot Bala	1,00	20	As above	40	457	8	11	400
27	Tairech Bala (Chakosh) Gole	1,00	26	As above	146	1.006	15	25	400
28	Sunich	0,40	122	As above	183	244	6	5	200
29	Besti Shenjure Koch	0,65	91	As above	137	762	10	12	300
30	Oveer Gole	1,30	29	As above	152	610	12	20	300
31	Gobore Bakh	1,10	26	As above	122	762	10	13	200
32	Izh Garamchashma	1,60	37	As above	67	579	12	20	250
33	Golain Istore	1,50	25	As above	76	762	9	14	300
35	Chakosh Gole (Rech)	0,40	198	Pelton wheel	290	472	11	15	550
36	Bhoroghol (Dharkot Gole)	2,27	46	Cross Flow	107	1.067	14	15	300
37	Bumburait Gole Kalash	1,47	55	Cross Flow	76	762	11	15	300
38	RumbureGoleKalash	1,70	64	Cross Flow	107	1.158	8	10	300
39	Joghore Gole	1,19	88	As above	137	975	12	12	150
40	Meerdin	1,70	55	Cross Flow	91	899	9	10	500
41	Jinjerate Koh	0,37	46	As above	85	863	12	15	150
42	Dominal Nisar	0,31	91	As above	149	1.073	16	13	200
43	Ashrate	1,81	64	As above	107	914	11	20	300
	Priority Status:	High	Medium	Low					

Table: Economic Potentials & Natural Resources

No.	Community	Arable land not in use (ha.)	Animal Husbandry	Minerals	Stones	Others	Traditional handicrafts	productive use of electricity (irrigation at each site possible)
1	Bilphok	526	Potential for animal husbandry, dairy products, chick supply.	Antimony	Marble/granite and different precious stones, limestone, dolomite	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill	Chitrali Patti, woollen socks, sweaters and jackets.	antimony roasting, limestone crushing, marble processing.
2	Beori Lower Chitral	607	As above	semi-precious stones	serpentinite	As above	As above	Handcraft processing unit
3	Kiyar	809	As above	Gemstone, moon stone	coloured stones	As above	As above	Gemstone cutting and polishing unit
4	Susoom	1.012	As above	As above	As above	As above	As above	As above
5	Rozbis Birir Gole	1.052	As above	Nil	Marble	As above	As above	Marble Processing unit
6	Begusht	607	As above	Gemstone	granite, slate	As above	As above	Gemstone cutting and polishing unit.
7	Birzeen	809	As above	Gemstone	Nil	As above	As above	As above
8	Parabaik	1.012	As above	As above	As above	As above	As above	As above
9	Momi	486	As above	As above	As above	As above	As above	As above
10	Rabat Arkari	324	As above	Not reported	Not reported	As above	As above	Nil
11	Shole Arkari	405	As above	As above	construction stones	As above	As above	Stone cutting unit
12	Shoghore	1.012	As above	Not reported	Marble, granite, slate	As above	As above	Marble processing and polishing unit.
13	Gajal	1.214	As above	Gemstone		As above	As above	Gem cutting and polishing unit
14	Madaklasht	1.416	As above	Soap stone	coloured stones	As above	As above	Soap stone crushing and grinding unit
15	Breshgram	202	As above	Nil	slate	As above	As above	Slate processing unit
16	Baleem (Dordabahm Gole)	1.619	As above	Iron, Antimony	Nil	As above	As above	Antimony roasting unit, iron ore processing unit
17	Raman	1.821	As above	As above	As above	As above	As above	As above
18	Khush Raow Gole	486	As above	Serpentine, Berite, gemstone	Marble	As above	As above	Handicraft processing unit

19	Power	202	As above	As above	As above	As above	As above	As above
20	Gazin	809	As above	As above	As above	As above	As above	As above
22	Ghoru	81	As above	As above	As above	As above	As above	As above
23	Shagram	486	As above	Anitmony	Nil	As above	As above	Antimony roasting unit
24	Tairech Gole	607	As above	Jade/Serpentine	Orpiment	As above	As above	Depend upon the mineral potential
25	Rau Gole (Ruwa)	2.024	As above	Granite, Tungstun	Marble, granite, slate	As above	As above	Crushing and polishing plant
26	Khot Bala	809	As above	Antimony, Orpiment	As above	As above	As above	Antimony roasting plant
27	Tairech Bala (Chakosh) Gole	607	As above	Jade, Serpentine, Orpiment	As above	As above	As above	Depends on mineral potential
28	Sunich	243	As above	Not surveyed	Not surveyed		As above	Nil
29	Besti Shenjure Koch	202	As above	Lead	coloured stones	As above	As above	Depends on mineral potential
30	Oveer Gole	324	As above		Granite, slate	As above	As above	Depends on mineral potential
31	Gobore Bakh	364	As above	Mica, Gemstone	As above	As above	As above	Gem cutting and polishing unit
32	Izh Garamchashma	405	As above	Nil	As above	As above	As above	As above
33	Golain Istore	202	As above	Soap stone	coloured stones	As above	As above	Soap stone crushing and grinding unit
35	Chakosh Gole (Rech)	486	As above	Nil	As above	As above	As above	Stone crushing and polishing unit
36	Bhoroghol(Dharkot Gole)	607	As above	Serpentine,Berite, Gemstone	Gemstone	As above	As above	Marble processing and gem cutting and polishing unit
37	Bumburait Gole Kalash	578	As above	Gemstone	Marble	As above	As above	As above
38	RumbureGoleKalash	405	As above	Nil	As above	As above	As above	Marble Processing unit
39	Joghore Gole	809	As above	Gemstone	Slate	As above	As above	Marble/slate processing unit
40	Meerdin	405	As above	Not surveyed	Not surveyed	As above	As above	Nil
41	Jinjerate Koh	202	As above	As above	As above	As above	As above	As above
42	Dominal Nisar	243	As above	Iron Ore	Nil	As above	As above	Iron ore processing unit
43	Ashrate	486	As above	Not surveyed	Not surveyed	As above	As above	Nil
	Priority Status:	High	Medium	Low				

Table: Cost Aspects

Table : Cost estimations

				Power station		Transmission line			Distribution line				Total cost			
No.	Community	Total Power (kW)	No. of population	Cost per kW ($US/kW)	Total cost ($US)	Length (km)	Cost ($US/km)	Cost ($US)	Length (km)	Cost ($US/km)	Cost ($US)	Technical Assistance ($US)	Total cost ($US)	80% share of total cost (US$)	Cost per kW ($US/kW)	Cost per capita ($US/cap)
1	Bilphok	150	3.675	1.200	180.000	15,0	5.400	81.000	25,0	3.500	87.500	69.700	418.200	334.560	2.788	114
2	Beori Lower Chitral	300	3.675	1.050	315.000	12,0	5.400	64.800	20,0	2.500	50.000	85.960	515.760	412.608	1.719	140
3	Kiyar	103	1.628	1.150	118.450	5,0	5.400	27.000	3,0	3.500	10.500	31.190	187.140	149.712	1.817	115
4	Susoom	200	4.200	1.350	270.000	7,9	5.400	42.466	10,5	3.500	36.593	69.812	418.870	335.096	2.094	100
5	Rozbis Birir Gole	150	2.625	1.050	157.500	10,0	5.400	54.000	15,0	3.500	52.500	52.800	316.800	253.440	2.112	121
6	Begusht	300	3.675	1.550	465.000	11,4	5.400	61.722	13,0	3.500	45.500	114.444	686.666	549.333	2.289	187
7	Birzeen	300	3.150	1.600	480.000	15,0	5.400	81.000	20,0	3.500	70.000	126.200	757.200	605.760	2.524	240
8	Parabaik	300	3.675	1.650	495.000	12,4	5.400	67.068	30,0	3.500	105.000	133.414	800.482	640.385	2.668	218
9	Momi	150	1.890	1.250	187.500	0,8	5.400	4.115	10,9	3.500	37.979	45.919	275.512	220.410	1.837	146
10	Rabat Arkari	300	3.150	1.450	435.000	25,0	5.400	135.000	16,0	3.500	56.000	125.200	751.200	600.960	2.504	238
11	Shole Arkari	400	4.200	1.625	650.000	36,0	5.400	194.400	30,0	3.500	105.000	189.880	1.139.280	911.424	2.848	271
12	Shoghore	250	3.675	1.350	337.500	19,1	5.400	102.870	13,6	3.500	47.474	97.569	585.413	468.330	2.342	159
13	Gajal	400	3.570	1.450	580.000	13,0	5.400	70.200	34,0	3.500	119.000	153.840	923.040	738.432	2.308	259
14	Madaklasht	300	4.200	1.750	525.000	9,1	5.400	49.378	13,7	3.500	48.006	124.477	746.860	597.488	2.490	178
15	Breshgram	100	3.255	1.150	115.000	10,0	5.400	54.000	15,0	3.500	52.500	44.300	265.800	212.640	2.658	82
16	Baleem (Dordabahm Gole)	300	4.200	1.650	495.000	15,0	5.400	81.000	36,0	3.500	126.000	140.400	842.400	673.920	2.808	201

17	Raman	300	4.410	1.800	540.000	20,0	5.400	108.000	35,1	3.500	122.682	154.136	924.818	739.855	3.083	210
18	Khush Raow Gole	200	4.725	1.700	340.000	15,0	5.400	81.000	30,0	3.500	105.000	105.200	631.200	504.960	3.156	134
19	Power	300	4.200	2.150	645.000	13,7	5.400	74.088	11,9	3.500	41.500	152.118	912.705	730.164	3.042	217
20	Gazin	300	3.150	2.170	651.000	18,0	5.400	97.200	25,0	3.500	87.500	167.140	1.002.840	802.272	3.343	318
22	Ghoru	200	3.360	2.050	410.000	15,0	5.400	81.000	20,0	3.500	70.000	112.200	673.200	538.560	3.366	200
23	Shagram	200	4.725	2.500	500.000	28,0	6.800	190.400	45,0	3.500	157.500	169.580	1.017.480	813.984	5.087	215
24	Tairech Gole	300	4.515	1.800	540.000	15,0	5.400	81.000	30,0	3.500	105.000	145.200	871.200	696.960	2.904	193
25	Rau Gole (Ruwa)	250	2.940	1.000	250.000	4,6	5.400	24.689	2,1	3.500	7.469	56.432	338.589	270.871	1.354	115
26	Khot Bala	400	5.250	980	392.000	8,0	5.400	43.200	10,5	3.500	36.890	94.418	566.508	453.206	1.416	108
27	Tairech Bala (Chakosh) Gole	400	4.200	2.400	960.000	15,0	5.400	81.000	25,0	3.500	87.500	225.700	1.354.200	1.083.360	3.386	322
28	Sunich	200	1.260	1.050	210.000	6,0	5.400	32.400	5,1	3.500	17.924	52.065	312.388	249.911	1.562	248
29	Besti Shenjure Koch	300	2.625	1.150	345.000	9,8	5.400	52.672	11,6	3.500	40.432	87.621	525.724	420.579	1.752	200
30	Oveer Gole	300	3.360	1.450	435.000	12,0	5.400	64.800	20,0	3.500	70.000	113.960	683.760	547.008	2.279	204
31	Gobore Bakh	200	2.625	1.560	312.000	10,2	5.400	55.139	12,6	3.500	44.272	82.282	493.693	394.954	2.468	188
32	Izh Garamchashma	250	4.725	1.350	337.500	12,2	5.400	65.837	20,0	3.500	70.000	94.667	568.004	454.403	2.272	120
33	Golain Istore	300	2.625	1.400	420.000	9,4	5.400	50.760	13,8	3.500	48.286	103.809	622.855	498.284	2.076	237
35	Chakosh Gole (Rech)	550	3.675	1.000	550.000	10,7	5.400	57.607	14,8	3.500	51.772	131.876	791.255	633.004	1.439	215
36	Bhoroghol (Dharkot Gole)	300	2.258	3.000	900.000	13,7	5.400	74.066	15,2	3.500	53.340	205.481	1.232.888	986.310	4.110	546
37	Bumburait Gole Kalash	300	2.625	1.050	315.000	11,4	5.400	61.722	14,6	3.500	51.205	85.585	513.512	410.810	1.712	196
38	RumbureGoleKalash	300	3.675	1.150	345.000	7,6	5.400	41.148	9,6	3.500	33.600	83.950	503.698	402.958	1.679	137
39	Joghore Gole	150	1.575	1.000	150.000	12,2	6.982	85.125	12,2	3.500	42.672	83.339	361.136	288.908	2.408	229
40	Meerdin	500	1.575	1.250	625.000	8,5	5.400	46.084	10,2	3.500	35.739	141.364	848.187	678.549	1.696	539

41	Jinjerate Koh	150	3.675	1.550	232.500	11,8	5.400	63.450	14,9	3.500	52.220	69.634	417.804	334.243	2.785	114
42	Dominal Nisar	200	1.575	1.050	210.000	15,6	5.400	84.127	13,0	3.500	45.339	67.893	407.359	325.887	2.037	259
43	Ashrate	300	3.675	1.050	315.000	11,4	5.400	61.441	19,8	3.500	69.342	89.157	534.940	427.952	1.783	146
	Priority Status:	High	Medium	Low	Exchange rate used $US 1 = 55 Rs											

population: 10.5 per household

transmission, distribution lines; refer to Annex 2

technical assistance (TA): 20% of total construction cost

80% share of total cost: 20% are provided through local participation

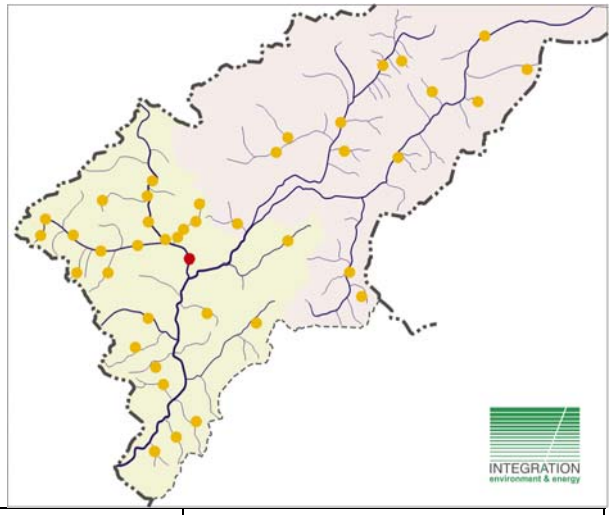
Annex 6

Technical sites Chitral district

Annex 6.2: Site profiles

Bilphok (S.No 1)

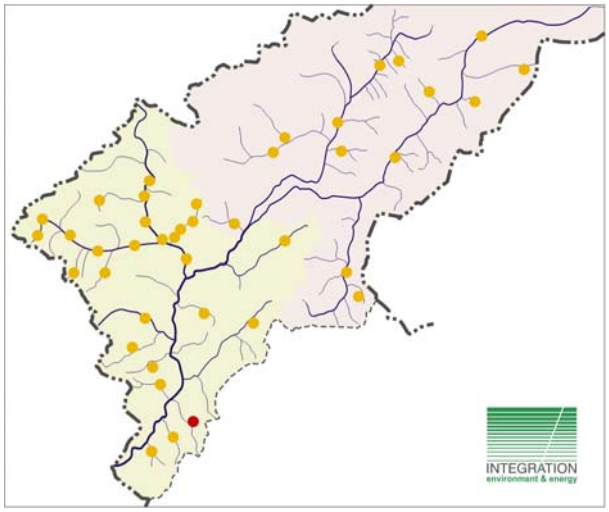
Population	3.675
No. of households	350
Total power	150 kW
Per kW cost	US $1.200
Priority Status	High



Technical data	Net discharge	1,20 m³/s
	Net Head	17 m
	Type of Turbine	X-flow
	Length of Penstock	37 m
	Length of Channel	1204 m
	Length of Transmission line	15 km
	Length of Distribution line	25 km
Infrastructure	Area	Lower
	No. of Schools	9
	No. of Hospitals	Nil
	Other Public Infrastructure	Nil
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	20.000
Economic activities	Arable Land Not In Use	526 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Antimony
	Stones	Marble/granite and different precious stones, limestone
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	antimony roasting, limestone crushing, marble processing.
	Unskilled people / day	250
	Skilled people / day	120

Beori Lower Chitral (S.No 2)

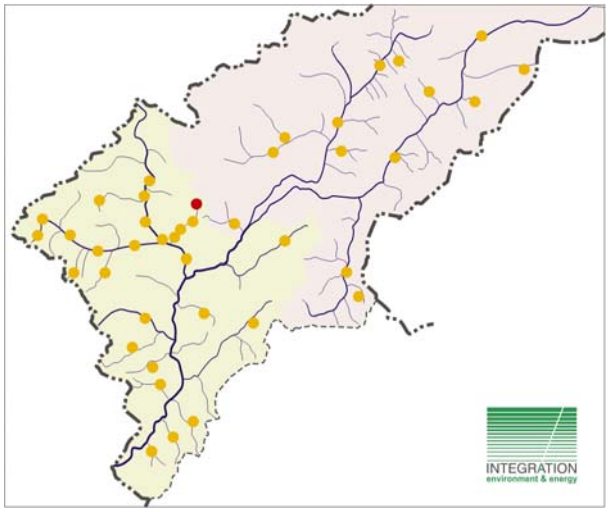
Population	3.675
No. of households	350
Total power	300 kW
Per kW cost	US $ 1.050
Priority Status	Medium



Technical data	Net discharge	1,13 m³/s
	Net Head	98 m
	Type of Turbine	X-flow
	Length of Penstock	137 m
	Length of Channel	1.524 m
	Length of Transmission line	12 km
	Length of Distribution line	20 km
Infrastructure	Area	Lower
	No. of Schools	1
	No. of Hospitals	Nil
	Other Public Infrastructure	Nil
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	30.000
Economic activities	Arable Land Not In Use	607 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Serpentine and semi-precious stones
	Stones	Not reported
	Others	Tourism, hotels, irrigation channels, tailoring, cottage industry, saw mill.
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Handicraft processing unit
	Unskilled people / day	250
	Skilled people / day	120

Kiyar (S.No 3)

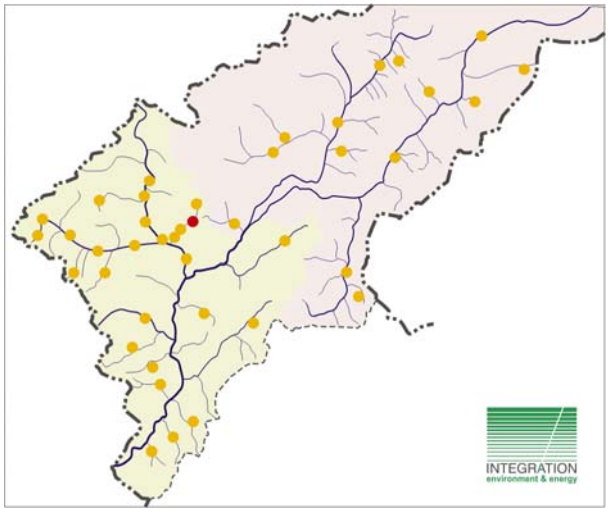
Population	1.628
No. of households	155
Total power	103 kW
Per kW cost	US $ 1.150
Priority Status	High



Technical data	Net discharge	0,60 m³/s
	Net Head	23 m
	Type of Turbine	X-flow
	Length of Penstock	53 m
	Length of Channel	762 m
	Length of Transmission line	5 km
	Length of Distribution line	3 km
Infrastructure	Area	Lower
	No. of Schools	1
	No. of Hospitals	Nil
	Other Public Infrastructure	Nil
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	10.000
Economic activities	Arable Land Not In Use	809 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone, moon stone
	Stones	Coloured stones
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gemstone cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

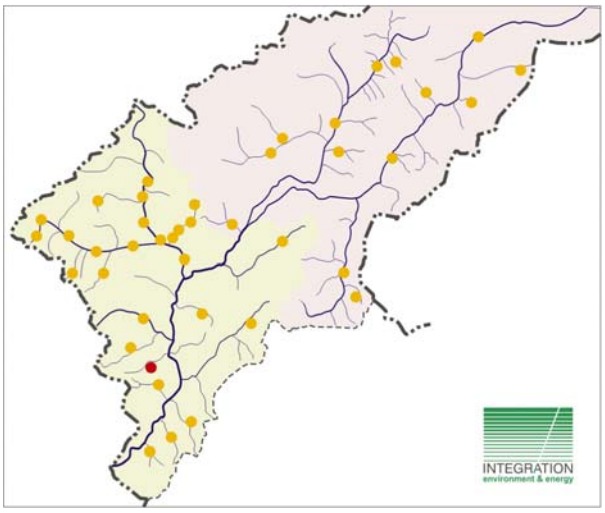
Susoom (S.No 4)

Population	4.200
No. of households	400
Total power	200 kW
Per kW cost	US $ 1.350
Priority Status	High



Technical data	Net discharge	1,00 m³/s
	Net Head	86 m
	Type of Turbine	X-flow
	Length of Penstock	137 m
	Length of Channel	808 m
	Length of Transmission line	8 km
	Length of Distribution line	10 km
Infrastructure	Area	Lower
	No. of Schools	4
	No. of Hospitals	1
	Other Public Infrastructure	P.O., large storage facility, road passable with 4WD, wooden bridges
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	1.012 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone, moon stone
	Stones	Coloured stones
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gemstone cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Rozbis Birir Gole (S.No 5)

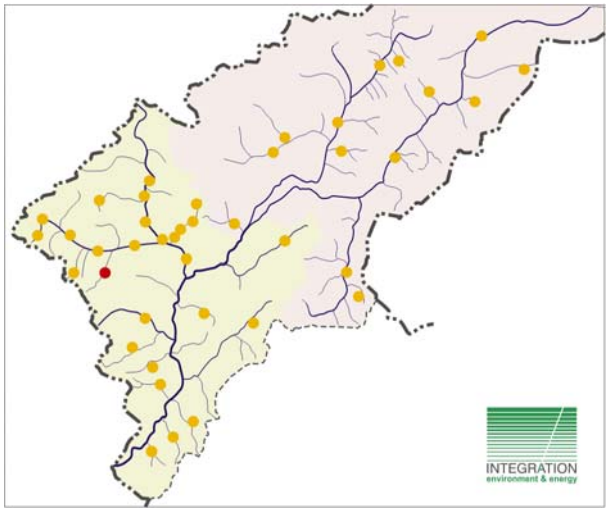


Population	2.625
No. of households	250
Total power	150 kW
Per kW cost	US $ 1.050
Priority Status	High

Technical data	Net discharge	0,70 m³/s
	Net Head	28,8 m
	Type of Turbine	X-flow
	Length of Penstock	64 m
	Length of Channel	610 m
	Length of Transmission line	10 km
	Length of Distribution line	15 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	1
	Other Public Infrastructure	Resthouse, large storage facility, road passable with 4WD
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	28.000
Economic activities	Arable Land Not In Use	1052 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Nil
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Marble processing unit
	Unskilled people / day	250
	Skilled people / day	120

Begusht (S.No 6)

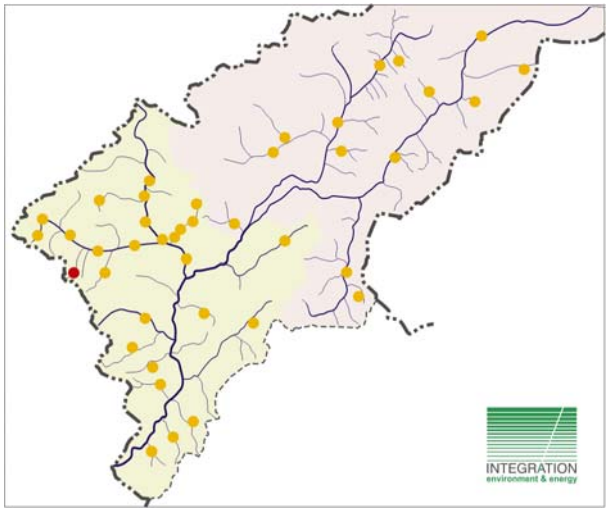
Population	3.675
No. of households	350
Total power	300 kW
Per kW cost	US $ 1.550
Priority Status	High



Technical data	Net discharge	1,13 m³/s
	Net Head	64 m
	Type of Turbine	X-flow
	Length of Penstock	122 m
	Length of Channel	817 m
	Length of Transmission line	11 km
	Length of Distribution line	13 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, P.O., road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	30.000
Economic activities	Arable Land Not In Use	607 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone
	Stones	Granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gemstone cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Birzeen (S.No 7)

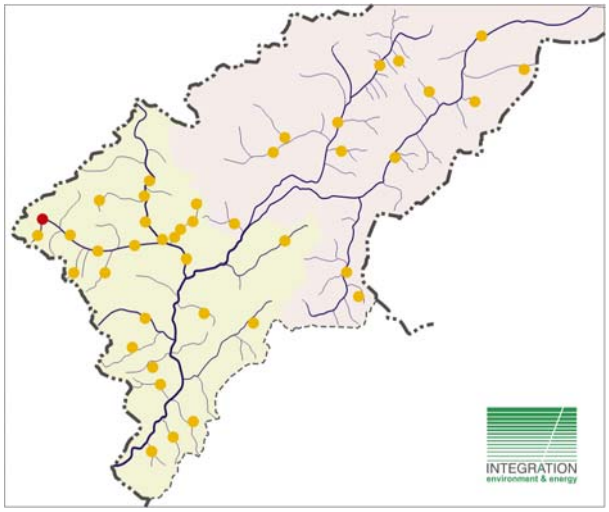
Population	3.150
No. of households	300
Total power	300 kW
Per kW cost	US $ 1.600
Priority Status	High



Technical data	Net discharge	1,60 m³/s
	Net Head	25,0 m
	Type of Turbine	X-flow
	Length of Penstock	152 m
	Length of Channel	975 m
	Length of Transmission line	15 km
	Length of Distribution line	20 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Large storage facility, road passable with 4WD
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	40.000
Economic activities	Arable Land Not In Use	809 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone
	Stones	Nil
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gemstone cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	150

Parabaik (S.No 8)

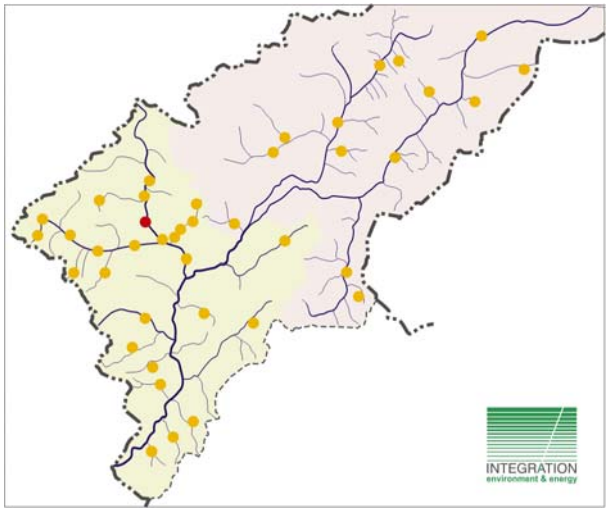
Population	3.675
No. of households	350
Total power	300 kW
Per kW cost	US $ 1.650
Priority Status	High



Technical data	Net discharge	1,60 m³/s
	Net Head	24 m
	Type of Turbine	Cross flow
	Length of Penstock	140 m
	Length of Channel	869 m
	Length of Transmission line	12 km
	Length of Distribution line	30 km
Infrastructure	Area	Lower
	No. of Schools	3
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, road passable with truck, P.O.
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	40.000
Economic activities	Arable Land Not In Use	1012 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone
	Stones	Nil
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gemstone cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Momi (S.No 9)

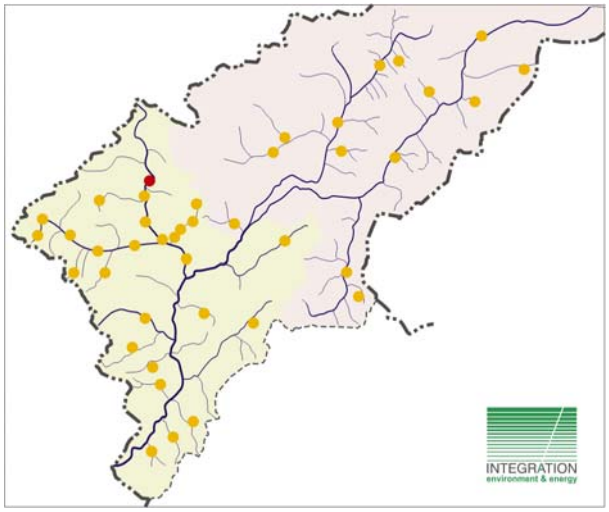
Population	1.890
No. of households	180
Total power	150 kW
Per kW cost	US $ 1.250
Priority Status	High



Technical data	Net discharge	1,00 m³/s
	Net Head	20 m
	Type of Turbine	Cross flow
	Length of Penstock	76 m
	Length of Channel	701 m
	Length of Transmission line	1 km
	Length of Distribution line	11 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Large storage facility, road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	486 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone
	Stones	Nil
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gemstone cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

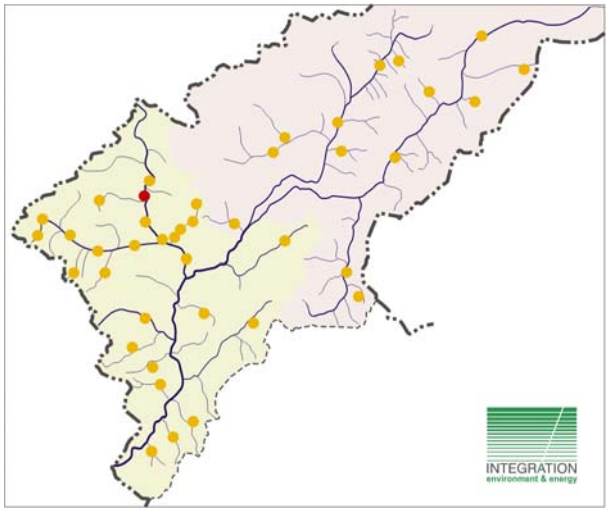
Rabat Arkari (S.No 10)

Population	3.150
No. of households	300
Total power	300 kW
Per kW cost	US $ 1.450
Priority Status	High



Technical data	Net discharge	1,80 m³/s
	Net Head	21 m
	Type of Turbine	Cross flow
	Length of Penstock	131 m
	Length of Channel	1.524m
	Length of Transmission line	25 km
	Length of Distribution line	16 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Road passsable with 4WD.
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	20.000
Economic activities	Arable Land Not In Use	324 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Not reported
	Stones	Not reported
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Nil
	Unskilled people / day	250
	Skilled people / day	120

Shole Arkari (S.No 11)

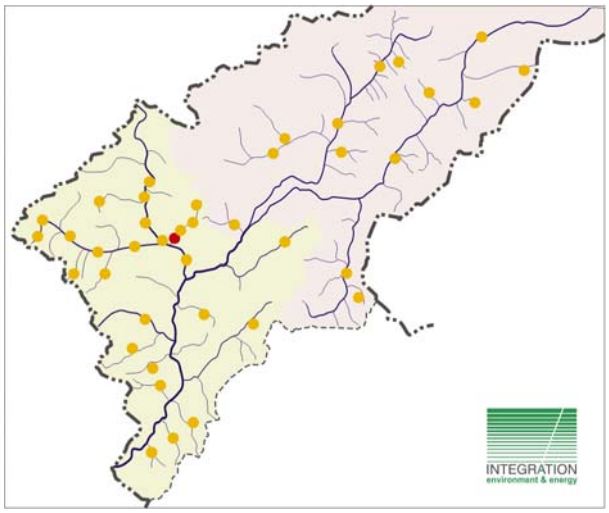


Population	4.200
No. of households	400
Total power	kW
Per kW cost	US $ 1.625
Priority Status	High

Technical data	Net discharge	2,00 m³/s
	Net Head	27 m
	Type of Turbine	Cross flow
	Length of Penstock	122 m
	Length of Channel	671 m
	Length of Transmission line	36 km
	Length of Distribution line	30 km
Infrastructure	Area	Lower
	No. of Schools	6
	No. of Hospitals	2
	Other Public Infrastructure	Road passable with 4WD, large storage facility, P.O.
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	15.000
Economic activities	Arable Land Not In Use	405 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Not reported
	Stones	Construction stones
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Stone cutting unit
	Unskilled people / day	250
	Skilled people / day	120

Shoghore (S.No 12)

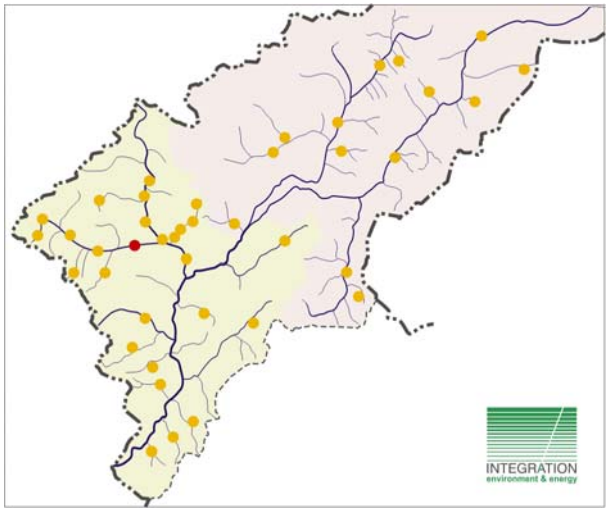
Population	3.675
No. of households	350
Total power	250 kW
Per kW cost	US $ 1.350
Priority Status	High



Technical data	Net discharge	1,27 m³/s
	Net Head	25 m
	Type of Turbine	Cross flow
	Length of Penstock	119 m
	Length of Channel	1.006 m
	Length of Transmission line	19 km
	Length of Distribution line	14 km
Infrastructure	Area	Lower
	No. of Schools	5
	No. of Hospitals	2
	Other Public Infrastructure	Bank, large storage facility, police chowki, P.O., metal road
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	1.012 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Not reported
	Stones	Marble, granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Marble processing and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Gajal (S.No 13)

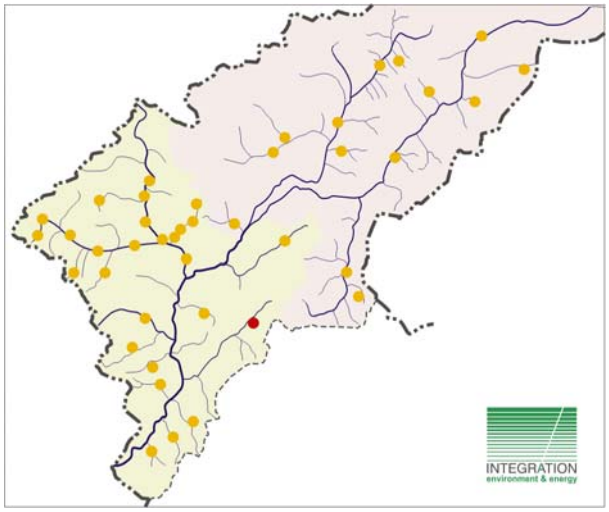
Population	3.570
No. of households	340
Total power	400 kW
Per kW cost	US $ 1.450
Priority Status	High



Technical data	Net discharge	1,60 m³/s
	Net Head	34 m
	Type of Turbine	Cross flow
	Length of Penstock	137 m
	Length of Channel	1.006 m
	Length of Transmission line	13 km
	Length of Distribution line	34 km
Infrastructure	Area	Lower
	No. of Schools	7
	No. of Hospitals	3
	Other Public Infrastructure	Thana, large storage facility, P.O., road passable with truck, Govt. offices.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	40.000
Economic activities	Arable Land Not In Use	1.214 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone
	Stones	Not reported
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gem cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Madaklasht (S.No 14)

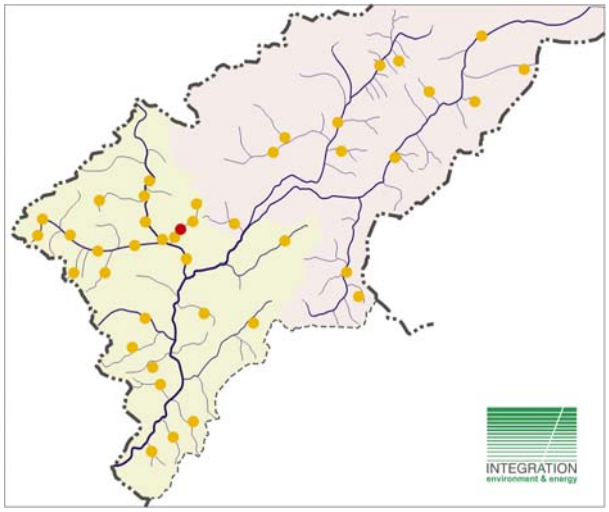
Population	4.200
No. of households	400
Total power	300 kW
Per kW cost	US $ 1.750
Priority Status	Medium



Technical data	Net discharge	1,40 m³/s
	Net Head	29 m
	Type of Turbine	Cross flow
	Length of Penstock	128 m
	Length of Channel	914 m
	Length of Transmission line	9 km
	Length of Distribution line	14 km
Infrastructure	Area	Lower
	No. of Schools	4
	No. of Hospitals	2
	Other Public Infrastructure	P.O., road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	50.000
Economic activities	Arable Land Not In Use	1.416 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Soap stone
	Stones	Coloured stones
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Soap stone crushing and grinding unit
	Unskilled people / day	250
	Skilled people / day	120

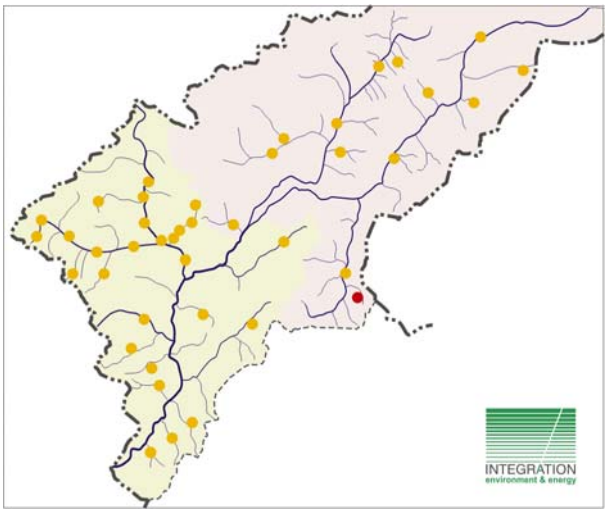
Breshgram (S.No 15)

Population	3.255
No. of households	310
Total power	100 kW
Per kW cost	US $ 1.150
Priority Status	High



Technical data	Net discharge	0,80 m³/s
	Net Head	16 m
	Type of Turbine	Cross flow
	Length of Penstock	64 m
	Length of Channel	762 m
	Length of Transmission line	10 km
	Length of Distribution line	15 km
Infrastructure	Area	Lower
	No. of Schools	5
	No. of Hospitals	Nil
	Other Public Infrastructure	Exchange, large storage facility, P.O., road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	20.000
Economic activities	Arable Land Not In Use	202 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Nil
	Stones	Slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Slate processing unit
	Unskilled people / day	250
	Skilled people / day	120

Baleem (Dordabahm Gole) (S.No 16)

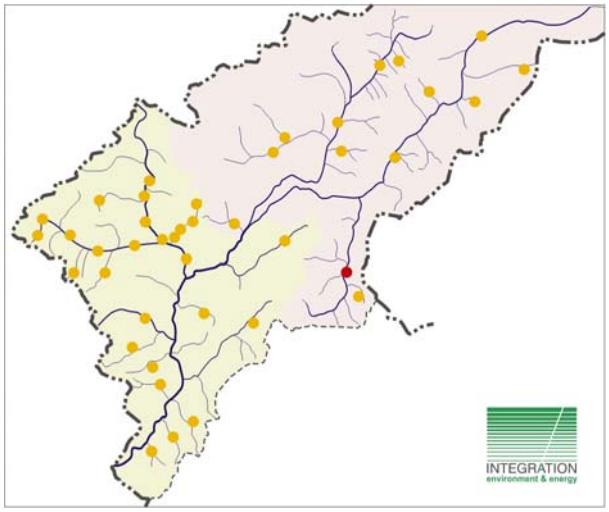


Population	4.200
No. of households	400
Total power	300 kW
Per kW cost	US $ 1.650
Priority Status	Medium

Technical data	Net discharge	2,50 m³/s
	Net Head	16 m
	Type of Turbine	Cross flow
	Length of Penstock	122 m
	Length of Channel	1.067 m
	Length of Transmission line	15 km
	Length of Distribution line	36 km
Infrastructure	Area	Upper
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Bridge, water supply, road passable with truck.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	30.000
Economic activities	Arable Land Not In Use	1.619 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Iron, antimony
	Stones	Nil
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Antinomy roasting unit, iron ore processing unit
	Unskilled people / day	250
	Skilled people / day	120

Raman (S.No 17)

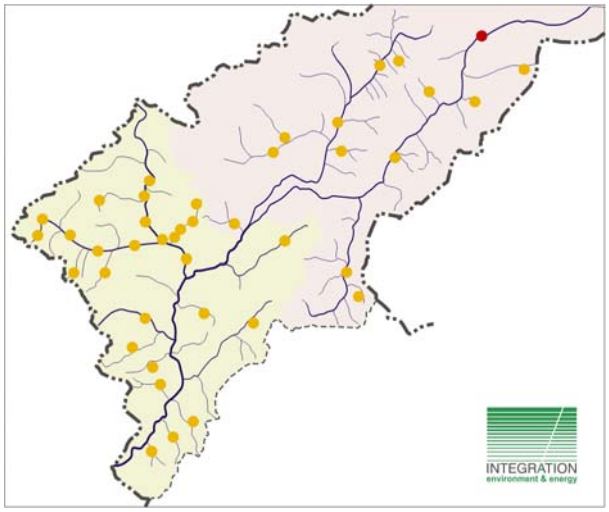
Population	4.410
No. of households	420
Total power	300 kW
Per kW cost	US $ 1.800
Priority Status	High



Technical data	Net discharge	1,00 m³/s
	Net Head	76 m
	Type of Turbine	Cross flow
	Length of Penstock	107 m
	Length of Channel	1.311 m
	Length of Transmission line	20 km
	Length of Distribution line	35 km
Infrastructure	Area	Upper
	No. of Schools	5
	No. of Hospitals	2
	Other Public Infrastructure	Thana, large storage facility, P.O., road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	28.000
Economic activities	Arable Land Not In Use	1.821 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Iron, antimony
	Stones	Nil
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Antinomy roasting unit, iron ore processing unit
	Unskilled people / day	250
	Skilled people / day	120

Kush Raow Gole (S.No 18)

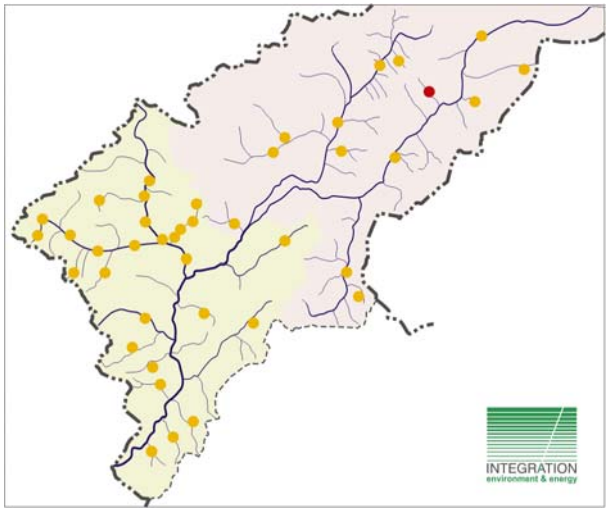
Population	4.725
No. of households	450
Total power	200 kW
Per kW cost	US $ 1.700
Priority Status	High



Technical data	Net discharge	0,28 m³/s
	Net Head	168 m
	Type of Turbine	Pelton Wheel
	Length of Penstock	290 m
	Length of Channel	762 m
	Length of Transmission line	15 km
	Length of Distribution line	30 km
Infrastructure	Area	Upper
	No. of Schools	5
	No. of Hospitals	2
	Other Public Infrastructure	Large storage facility
	Main Source Of Income	Agriculture / Livestock
	Other Products	None
	Av. Household income per year	2.000
Economic activities	Arable Land Not In Use	486 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Serpentine, berite, gemstone
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Handicraft Processing Unit
	Unskilled people / day	300
	Skilled people / day	150

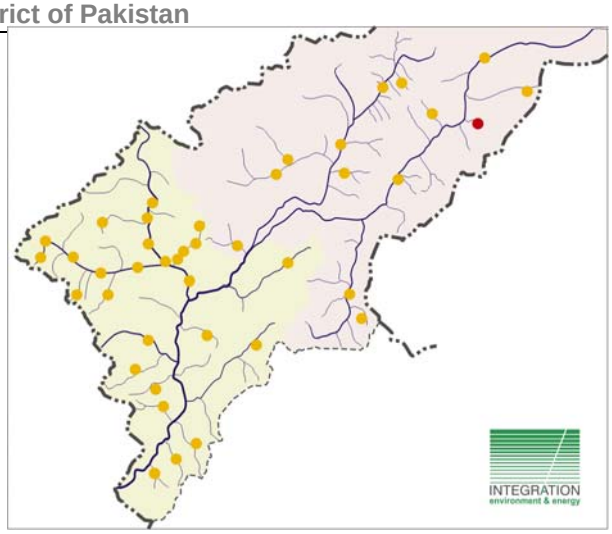
Power (S.No 19)

Population	4.200
No. of households	400
Total power	300 kW
Per kW cost	US $ 2.150
Priority Status	High



Technical data	Net discharge	2,00 m³/s
	Net Head	137 m
	Type of Turbine	Pelton Wheel
	Length of Penstock	290 m
	Length of Channel	808 m
	Length of Transmission line	14 km
	Length of Distribution line	12 km
Infrastructure	Area	Upper
	No. of Schools	4
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, P.O., Scoutpost, road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	202 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Serpentine, berite, gemstone
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Handicraft processing unit
	Unskilled people / day	300
	Skilled people / day	150

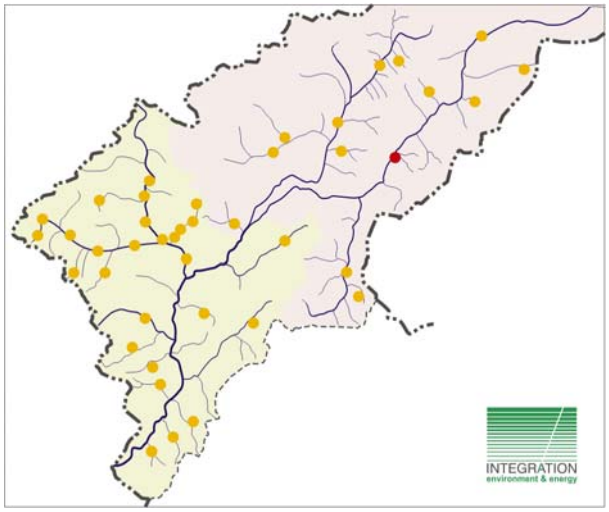
Gazin (S.No 20)



Population	3.150
No. of households	300
Total power	300 kW
Per kW cost	US $ 2.170
Priority Status	High

Technical data	Net discharge	1,80 m³/s
	Net Head	26 m
	Type of Turbine	Cross flow
	Length of Penstock	76 m
	Length of Channel	762 m
	Length of Transmission line	18 km
	Length of Distribution line	25 km
Infrastructure	Area	Upper
	No. of Schools	6
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, P.O., bridge, road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	20.000
Economic activities	Arable Land Not In Use	809 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Serpentine, berite, gemstone
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Handicraft processing unit
	Unskilled people / day	300
	Skilled people / day	150

Ghoru (S.No 22)

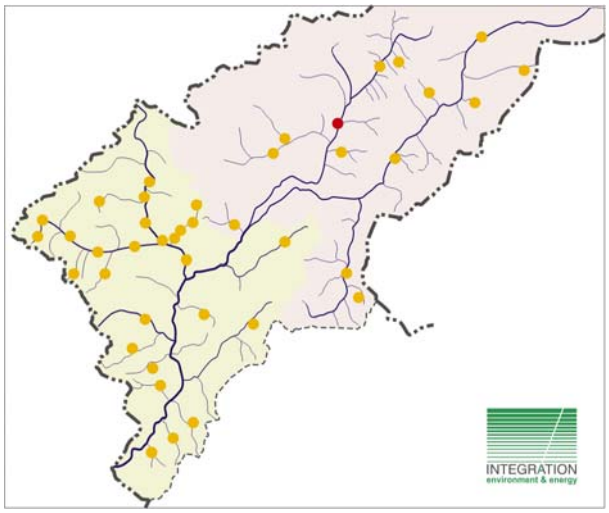


Population	3.360
No. of households	320
Total power	200 kW
Per kW cost	US $ 2.050
Priority Status	Low

Technical data	Net discharge	1,80 m³/s
	Net Head	14 m
	Type of Turbine	Cross flow
	Length of Penstock	61 m
	Length of Channel	1.006 m
	Length of Transmission line	15 km
	Length of Distribution line	20 km
Infrastructure	Area	Upper
	No. of Schools	5
	No. of Hospitals	Nil
	Other Public Infrastructure	Bridge, P.O., large storage facility, road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	15.000
Economic activities	Arable Land Not In Use	81 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Serpentine, berite, gemstone
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Handicraft processing unit
	Unskilled people / day	300
	Skilled people / day	150

Shagram (S.No 23)

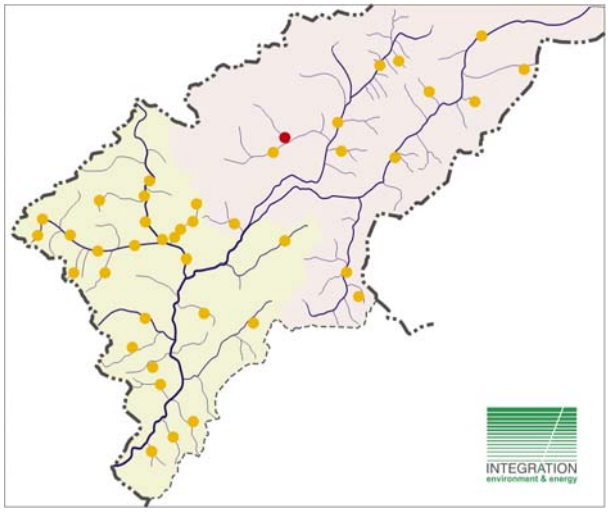
Population	4.725
No. of households	450
Total power	200 kW
Per kW cost	US $ 2.500
Priority Status	Medium



Technical data	Net discharge	1,00 m³/s
	Net Head	27 m
	Type of Turbine	Cross flow
	Length of Penstock	64 m
	Length of Channel	1.067 m
	Length of Transmission line	28 km
	Length of Distribution line	45 km
Infrastructure	Area	Upper
	No. of Schools	8
	No. of Hospitals	2
	Other Public Infrastructure	Thana, Tehsil offices, road passable with 4WD, P.O.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	30.000
Economic activities	Arable Land Not In Use	486 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Antimony
	Stones	Nil
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Antimony roasting unit
	Unskilled people / day	250
	Skilled people / day	150

Tairech Gole (S.No 24)

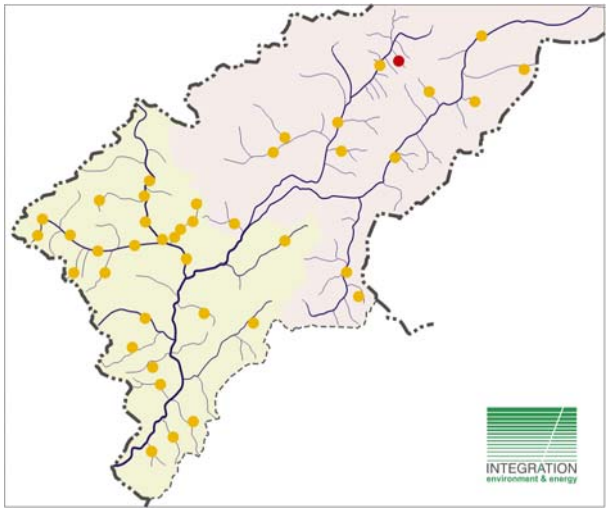
Population	4.515
No. of households	430
Total power	300 kW
Per kW cost	US $ 1.800
Priority Status	High



Technical data	Net discharge	0,80 m³/s
	Net Head	26 m
	Type of Turbine	Cross flow
	Length of Penstock	125 m
	Length of Channel	610 m
	Length of Transmission line	15 km
	Length of Distribution line	30 km
Infrastructure	Area	Upper
	No. of Schools	3
	No. of Hospitals	Nil
	Other Public Infrastructure	Large storage facility, road passable with 4WD, bridges
	Main Source Of Income	agriculture, livestock
	Other Products	None
	Av. Household income per year	35.000
Economic activities	Arable Land Not In Use	607 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Jade, serpentine
	Stones	Orpiment
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Depends upon the minerals
	Unskilled people / day	250
	Skilled people / day	120

Rau Gole (Ruwa) (S.No 25)

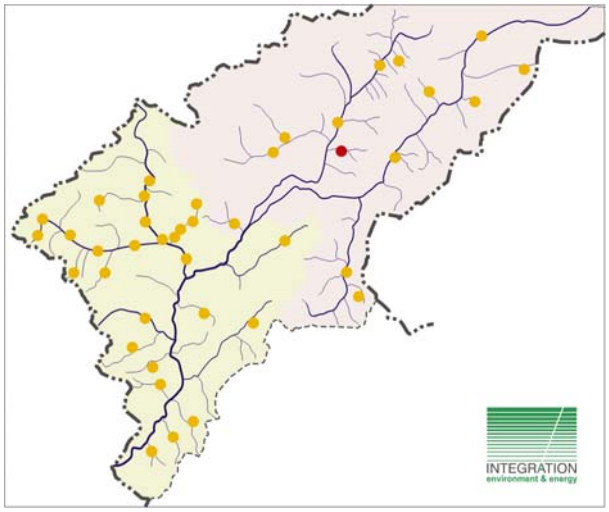
Population	2.940
No. of households	280
Total power	250 kW
Per kW cost	US $ 1.000
Priority Status	Medium



Technical data	Net discharge	0,28 m³/s
	Net Head	152 m
	Type of Turbine	Pelton wheel
	Length of Penstock	244 m
	Length of Channel	122 m
	Length of Transmission line	5 km
	Length of Distribution line	2 km
Infrastructure	Area	Upper
	No. of Schools	1
	No. of Hospitals	Nil
	Other Public Infrastructure	Road passable with 4WD
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	10.000
Economic activities	Arable Land Not In Use	2.024 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Granite, tungsten
	Stones	Marble, granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Crushing and polishing plant
	Unskilled people / day	250
	Skilled people / day	120

Khot Bala (S.No 26)

Population	5.250
No. of households	500
Total power	400 kW
Per kW cost	US $ 980
Priority Status	Medium

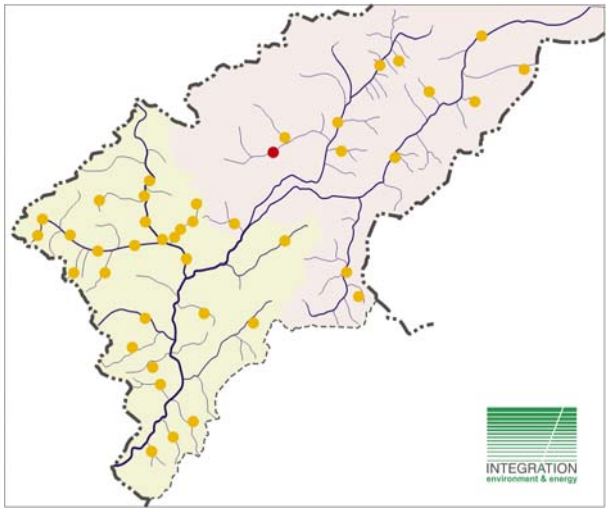


Technical data	Net discharge	1,00 m³/s
	Net Head	20 m
	Type of Turbine	Pelton wheel
	Length of Penstock	40 m
	Length of Channel	257 m
	Length of Transmission line	8 km
	Length of Distribution line	11 km
Infrastructure	Area	Upper
	No. of Schools	3
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, road passsable with 4WD.
	Main Source Of Income	Agriculture / Livestock
	Other Products	None
	Av. Household income per year	40.000
Economic activities	Arable Land Not In Use	809 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Antimony, orpiment
	Stones	Marble, granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Antimony roasting plant
	Unskilled people / day	250
	Skilled people / day	120

Tairech Bala (S.No 27)

(Chakosh) Gole

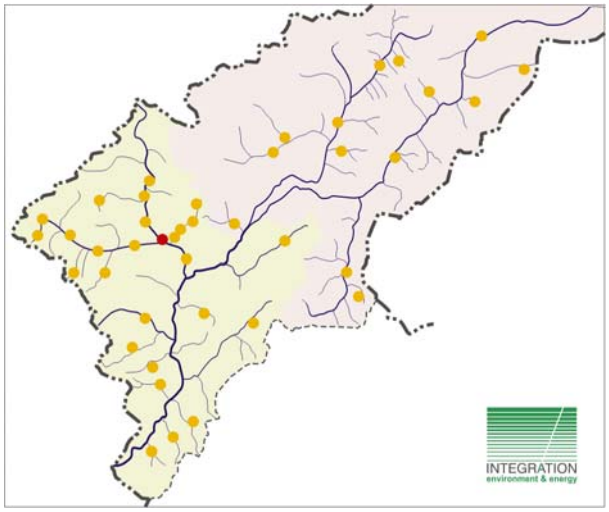
Population	4.200
No. of households	400
Total power	400 kW
Per kW cost	US $2.400
Priority Status	High



Technical data	Net discharge	1,00 m³/s
	Net Head	26 m
	Type of Turbine	Pelton wheel
	Length of Penstock	146 m
	Length of Channel	1006 m
	Length of Transmission line	15 km
	Length of Distribution line	25 km
Infrastructure	Area	Upper
	No. of Schools	5
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, P.O., road passable with 4WD.
	Main Source Of Income	Livestock & agriculture
	Other Products	None
	Av. Household income per year	20.000
Economic activities	Arable Land Not In Use	607 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Jade, Serpentine, orpiment
	Stones	Marble, granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Depends on mineral potential
	Unskilled people / day	250
	Skilled people / day	150

Sunich (S.No 28)

Population	1.260
No. of households	120
Total power	200 kW
Per kW cost	US $ 1.050
Priority Status	High

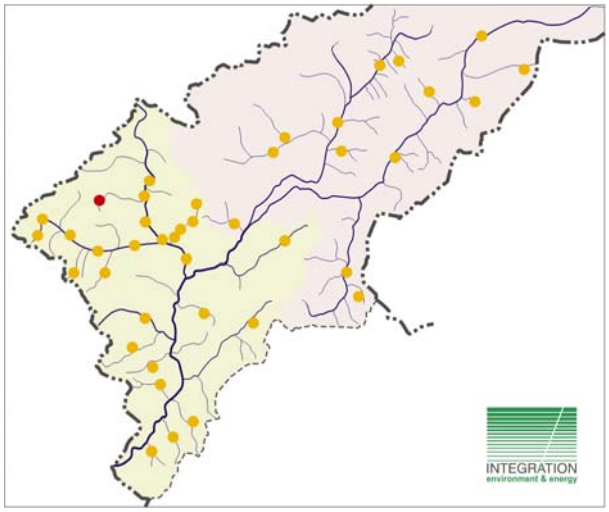


Technical data	Net discharge	0,40 m³/s
	Net Head	122 m
	Type of Turbine	Pelton wheel
	Length of Penstock	183 m
	Length of Channel	244 m
	Length of Transmission line	6 km
	Length of Distribution line	5 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Road passable with 4WD
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	243 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Not surveyed
	Stones	Not surveyed
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Nil
	Unskilled people / day	250
	Skilled people / day	120

Best Shenjure Koch (S.No 29)

(Chakosh) Gole

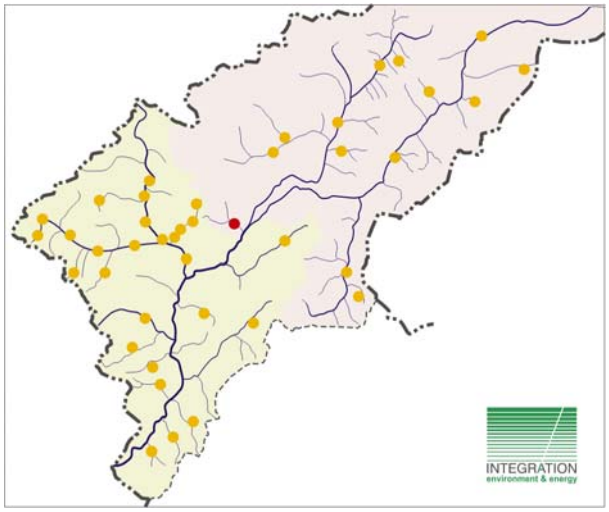
Population	2.625
No. of households	250
Total power	300 kW
Per kW cost	US $ 1.150
Priority Status	High



Technical data	Net discharge	0,65 m³/s
	Net Head	91 m
	Type of Turbine	Pelton wheel
	Length of Penstock	137 m
	Length of Channel	762 m
	Length of Transmission line	10 km
	Length of Distribution line	12 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, road passable with 4WD
	Main Source Of Income	Livestock and agriculture
	Other Products	None
	Av. Household income per year	20.000
Economic activities	Arable Land Not In Use	202 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Lead
	Stones	Coloured stones
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Depends on the mineral potential.
	Unskilled people / day	250
	Skilled people / day	120

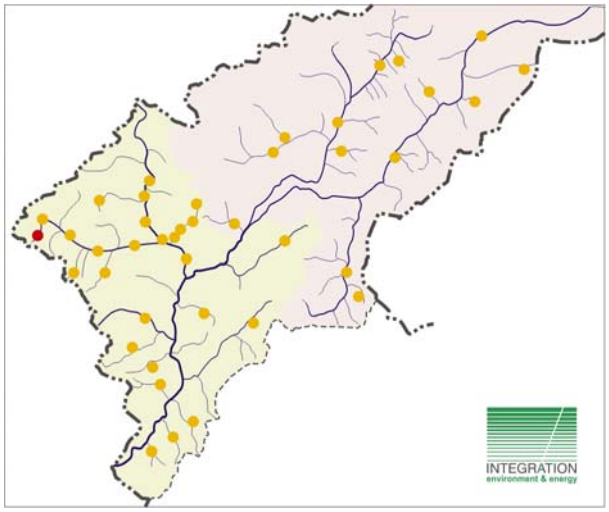
Oveer Gole (S.No 30)

Population	3.360
No. of households	320
Total power	300 kW
Per kW cost	US $ 1.450
Priority Status	Medium



Technical data	Net discharge	1,30 m³/s
	Net Head	29 m
	Type of Turbine	Pelton wheel
	Length of Penstock	152 m
	Length of Channel	610 m
	Length of Transmission line	12 km
	Length of Distribution line	20 km
Infrastructure	Area	Upper
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Large storage facility, PO
	Main Source Of Income	Agriculture and livestock
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	324 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Nil
	Stones	Granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Depends on mineral potential.
	Unskilled people / day	250
	Skilled people / day	120

Gobore Bakh (S.No 31)

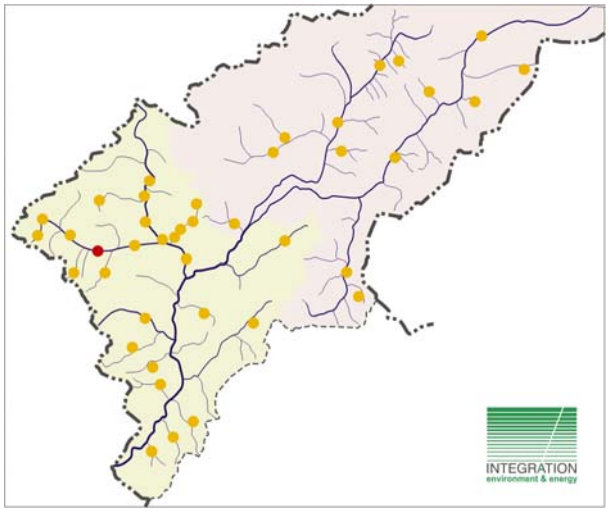


Population	2.625
No. of households	250
Total power	200 kW
Per kW cost	US $ 1.560
Priority Status	High

Technical data	Net discharge	1,10 m³/s
	Net Head	26 m
	Type of Turbine	Pelton wheel
	Length of Penstock	122 m
	Length of Channel	762 m
	Length of Transmission line	10 km
	Length of Distribution line	13 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, P.O., road passable with 4WD.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	30.000
Economic activities	Arable Land Not In Use	364 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Mica, gemstone
	Stones	Granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gem cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Izh Garamchashma (S.No 32)

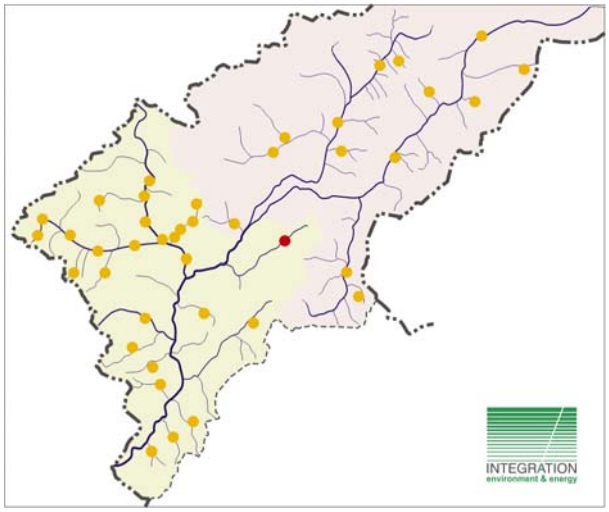
Population	4.725
No. of households	450
Total power	250 kW
Per kW cost	US $ 1.350
Priority Status	High



Technical data	Net discharge	1,60 m³/s
	Net Head	37 m
	Type of Turbine	Pelton wheel
	Length of Penstock	67 m
	Length of Channel	579 m
	Length of Transmission line	12 km
	Length of Distribution line	20 km
Infrastructure	Area	Lower
	No. of Schools	6
	No. of Hospitals	2
	Other Public Infrastructure	Govt. offices, large storage facility, P.O., road passable with truck.
	Main Source Of Income	Livestock & Agriculture, Govt. service
	Other Products	None
	Av. Household income per year	45.000
Economic activities	Arable Land Not In Use	405 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Nil
	Stones	Granite, slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Gem cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Golain Istore (S.No 33)

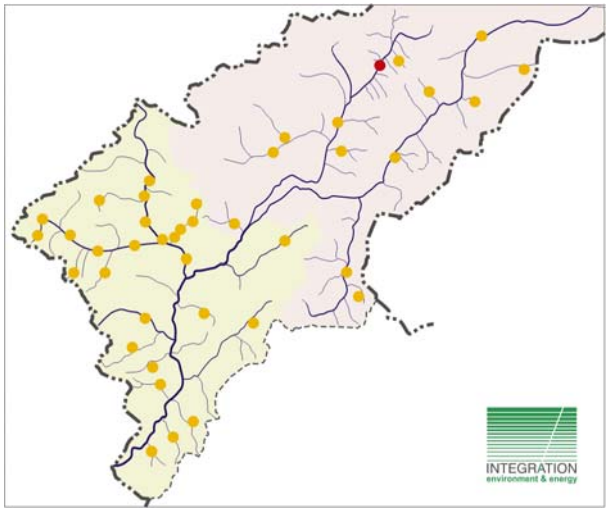
Population	2.625
No. of households	250
Total power	300 kW
Per kW cost	US $ 1.400
Priority Status	High



Technical data	Net discharge	1,50 m³/s
	Net Head	25 m
	Type of Turbine	Pelton wheel
	Length of Penstock	76 m
	Length of Channel	762 m
	Length of Transmission line	9 km
	Length of Distribution line	14 km
Infrastructure	Area	Lower
	No. of Schools	3
	No. of Hospitals	1
	Other Public Infrastructure	Large storage facility, road passable with 4WD.
	Main Source Of Income	Agriculture / Livestock
	Other Products	None
	Av. Household income per year	15.000
Economic activities	Arable Land Not In Use	202 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Soap stone
	Stones	Coloured stones
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Soap stone crushing and grinding unit
	Unskilled people / day	250
	Skilled people / day	120

Chakosh Gole (Rech) (S.No 35)

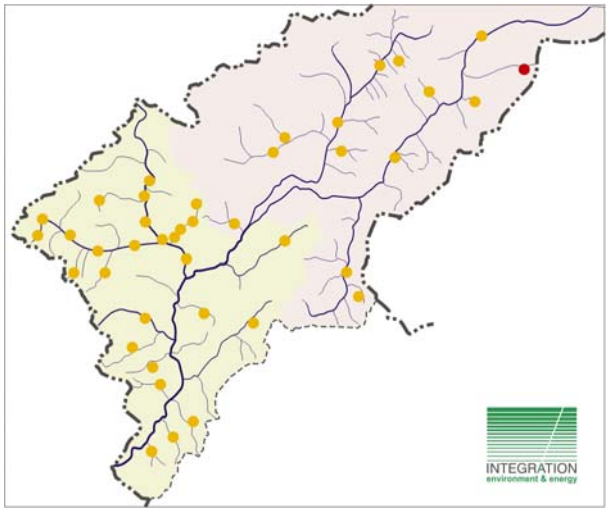
Population	3.675
No. of households	350
Total power	550 kW
Per kW cost	US $ 1.000
Priority Status	Medium



Technical data	Net discharge	0,40 m³/s
	Net Head	198 m
	Type of Turbine	Pelton Wheel
	Length of Penstock	290 m
	Length of Channel	472 m
	Length of Transmission line	11 km
	Length of Distribution line	15 km
Infrastructure	Area	Upper
	No. of Schools	8
	No. of Hospitals	2
	Other Public Infrastructure	Large storage facility, PO, road passable with 4WD
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	30.000
Economic activities	Arable Land Not In Use	486 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Nil
	Stones	Coloured stones
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Stone crushing and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Bhoroghol (S.No 36)

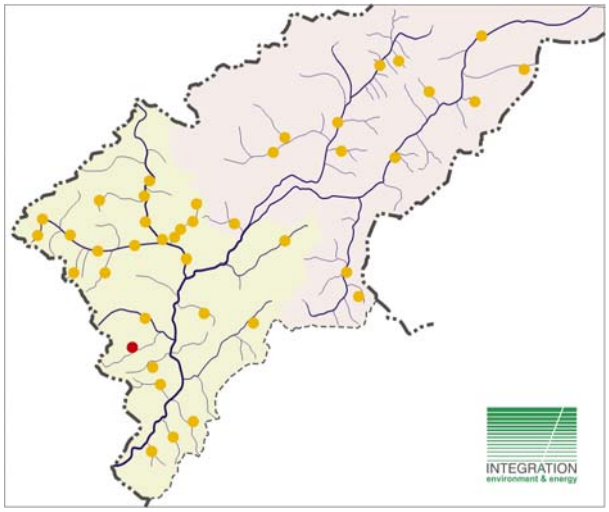
Population	2.258
No. of households	215
Total power	300 kW
Per kW cost	US $ 3.000
Priority Status	High



Technical data	Net discharge	2,27 m³/s
	Net Head	46 m
	Type of Turbine	Cross flow
	Length of Penstock	107 m
	Length of Channel	1067 m
	Length of Transmission line	14 km
	Length of Distribution line	15 km
Infrastructure	Area	Upper
	No. of Schools	1
	No. of Hospitals	Nil
	Other Public Infrastructure	Large storage facility, no road passable with 4WD
	Main Source Of Income	Livestock & Agriculture
	Other Products	None
	Av. Household income per year	40.000
Economic activities	Arable Land Not In Use	607 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Serpentine, berite, gemstone
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Marble processing and gem cutting and polishing unit
	Unskilled people / day	300
	Skilled people / day	150

Bumbureit Gole Kalash (S.No 37)

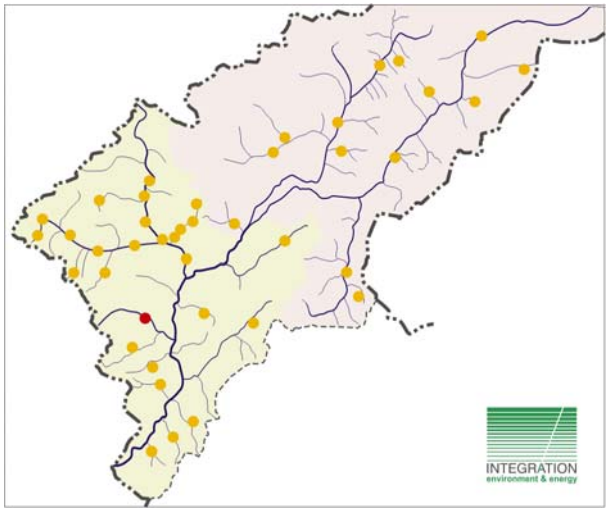
Population	2.625
No. of households	250
Total power	300 kW
Per kW cost	US $ 1.050
Priority Status	High



Technical data	Net discharge	1,47 m³/s
	Net Head	55 m
	Type of Turbine	Cross flow
	Length of Penstock	76 m
	Length of Channel	762 m
	Length of Transmission line	11 km
	Length of Distribution line	15 km
Infrastructure	Area	Lower
	No. of Schools	10
	No. of Hospitals	1
	Other Public Infrastructure	Resthouses, PTDC, large storage facility, road passable with 4WD
	Main Source Of Income	Livestock and agriculture
	Other Products	None
	Av. Household income per year	40.000
Economic activities	Arable Land Not In Use	578 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Marble processing and gem cutting and polishing unit
	Unskilled people / day	250
	Skilled people / day	120

Rumbure Gole Kalash (S.No 38)

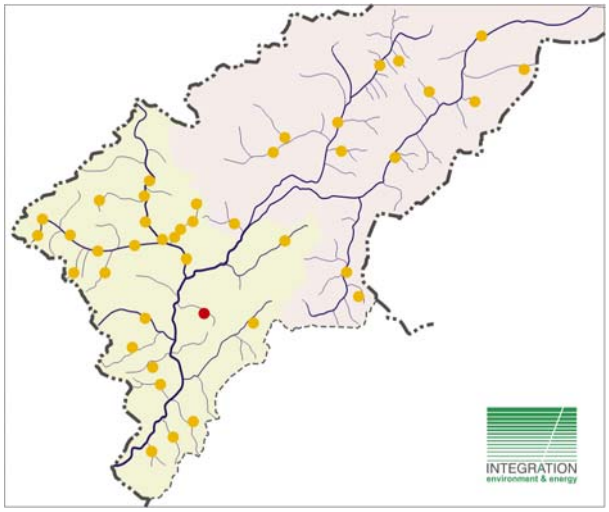
Population	3.675
No. of households	350
Total power	300 kW
Per kW cost	US $ 1.150
Priority Status	High



Technical data	Net discharge	1,70 m³/s
	Net Head	64 m
	Type of Turbine	Cross flow
	Length of Penstock	107 m
	Length of Channel	1158 m
	Length of Transmission line	8 km
	Length of Distribution line	10 km
Infrastructure	Area	Lower
	No. of Schools	3
	No. of Hospitals	1
	Other Public Infrastructure	Offices, hotels, shops, road passable with 4WD
	Main Source Of Income	Tourism
	Other Products	None
	Av. Household income per year	50.000
Economic activities	Arable Land Not In Use	405 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Nil
	Stones	Marble
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Marble processing unit.
	Unskilled people / day	250
	Skilled people / day	120

Joghore Gole (S.No 39)

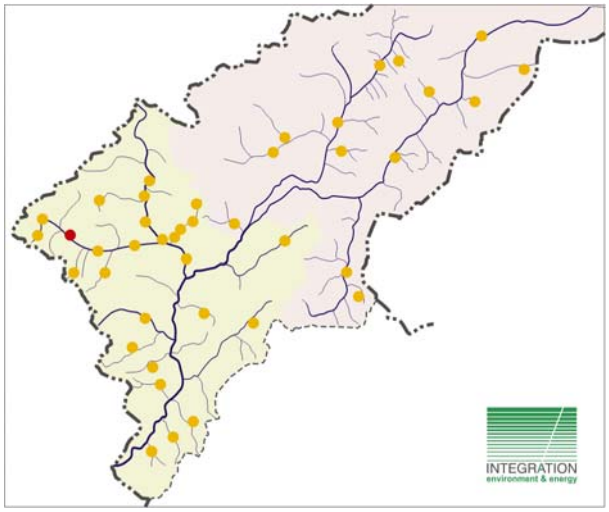
Population	1.575
No. of households	150
Total power	150 kW
Per kW cost	US $ 1.000
Priority Status	High



Technical data	Net discharge	1,19 m³/s
	Net Head	88 m
	Type of Turbine	Cross flow
	Length of Penstock	137 m
	Length of Channel	975 m
	Length of Transmission line	12 km
	Length of Distribution line	12 km
Infrastructure	Area	Lower
	No. of Schools	1
	No. of Hospitals	Nil
	Other Public Infrastructure	Road passable with 4WD
	Main Source Of Income	Agriculture / Livestock
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	809 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Gemstone
	Stones	Slate
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Marble/slate processing unit
	Unskilled people / day	250
	Skilled people / day	120

Meerdin (S.No 40)

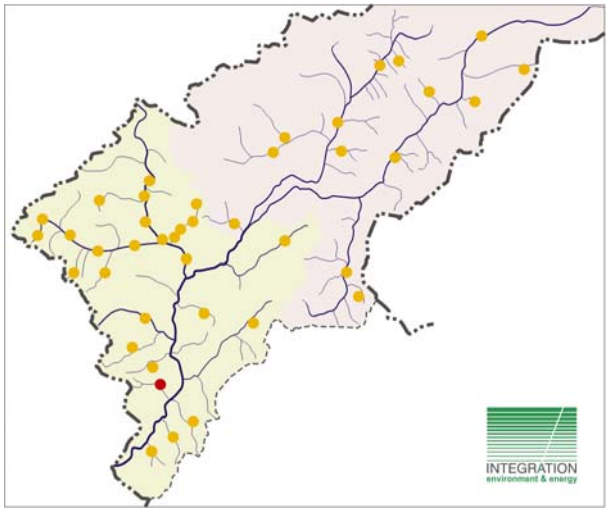
Population	1.575
No. of households	150
Total power	500 kW
Per kW cost	US $ 1.250
Priority Status	Medium



Technical data	Net discharge	1,70 m³/s
	Net Head	55 m
	Type of Turbine	Cross flow
	Length of Penstock	91 m
	Length of Channel	899 m
	Length of Transmission line	9 km
	Length of Distribution line	10 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Large storage facility, road passable with 4WD.
	Main Source Of Income	Agriculture / Livestock
	Other Products	None
	Av. Household income per year	35.000
Economic activities	Arable Land Not In Use	405 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Not surveyed
	Stones	Not surveyed
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Nil
	Unskilled people / day	250
	Skilled people / day	120

Jinjerate Koh (S.No 41)

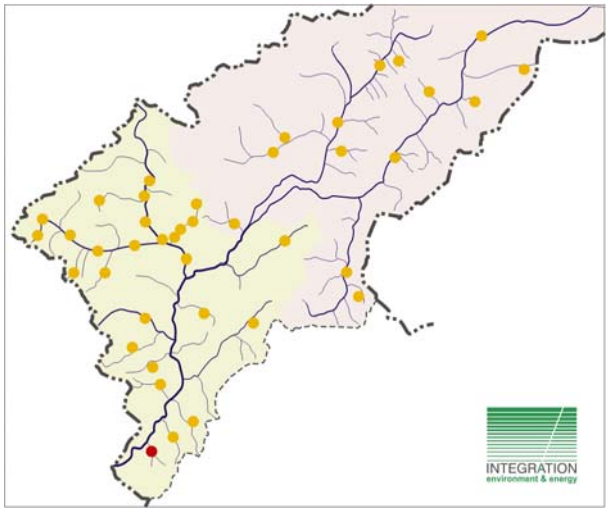
Population	3.675
No. of households	350
Total power	150 kW
Per kW cost	US $ 1.550
Priority Status	Low



Technical data	Net discharge	0,37 m³/s
	Net Head	46 m
	Type of Turbine	Cross flow
	Length of Penstock	85 m
	Length of Channel	863 m
	Length of Transmission line	12 km
	Length of Distribution line	15 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Road passable with 4WD.
	Main Source Of Income	Agriculture / Livestock
	Other Products	None
	Av. Household income per year	25.000
Economic activities	Arable Land Not In Use	202 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Not surveyed
	Stones	Not surveyed
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Nil
	Unskilled people / day	250
	Skilled people / day	120

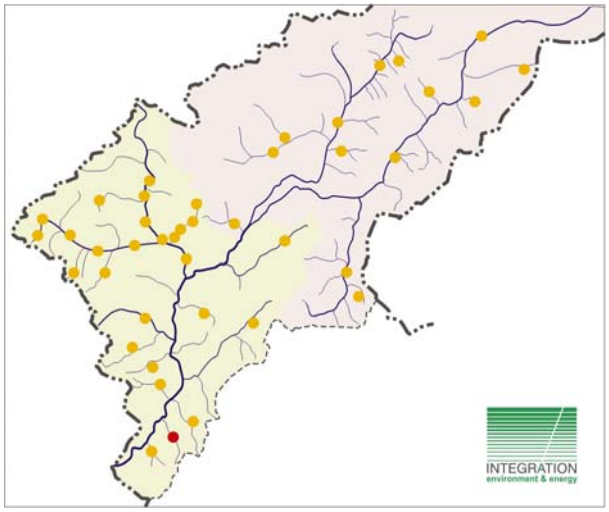
Dominal Nisar (S.No 42)

Population	1.575
No. of households	150
Total power	200 kW
Per kW cost	US $ 1.050
Priority Status	Low



Technical data	Net discharge	0,31 m³/s
	Net Head	91 m
	Type of Turbine	Cross flow
	Length of Penstock	149 m
	Length of Channel	1073 m
	Length of Transmission line	16 km
	Length of Distribution line	13 km
Infrastructure	Area	Lower
	No. of Schools	2
	No. of Hospitals	Nil
	Other Public Infrastructure	Road passable with truck, PO
	Main Source Of Income	Agriculture and livestock
	Other Products	None
	Av. Household income per year	2500
Economic activities	Arable Land Not In Use	243 ha.
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Iron ore
	Stones	Nil
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Iron ore processing unit.
	Unskilled people / day	250
	Skilled people / day	120

Ashrate (S.No 43)



Population	3.675
No. of households	350
Total power	300 kW
Per kW cost	US $ 1.050
Priority Status	Low

Technical data	Net discharge	1,81 m³/s
	Net Head	64 m
	Type of Turbine	Cross flow
	Length of Penstock	107 m
	Length of Channel	914 m
	Length of Transmission line	11 km
	Length of Distribution line	20 km
Infrastructure	Area	Lower
	No. of Schools	4
	No. of Hospitals	2
	Other Public Infrastructure	PTCL offices, road passable with 4WD, bridges, etc.
	Main Source Of Income	Agriculture / Livestock
	Other Products	None
	Av. Household income per year	50.000
Economic activities	Arable Land Not In Use	486 ha
	Animal Husbandry	Potential for animal husbandry, dairy products, chick supply.
	Minerals	Not surveyed
	Stones	Not surveyed
	Others	Tourism, hotelling, irrigation, heating, cooking, washing, tailoring, cottage industry, flour mill, saw mill
	Traditional Handicrafts	Chitrali Patti, woollen socks, sweaters and jackets.
	How these products / resources could be exploited if electricity would be available?	Nil
	Unskilled people / day	200
	Skilled people / day	100