

Decentralized Rural Energy Development in Nepal

Challenges, Opportunities and Strategic Options

Proceedings of two days
National Conference held in Kathmandu, Nepal
22-23 January, 2009

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Association of District Development Committees of
Nepal

Decentralized Rural Energy Development in Nepal

**Proceedings of two days
National Conference held in Kathmandu, Nepal**

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Rishi Raj Lumsali
Chairperson

Association of District Development Committees of Nepal (ADDCN) is the representative organization of all 75 District Development Committees (DDCs) of Nepal. It works in two output areas especially advocacy and lobby in favor of strengthening local democracy and decentralization process in Nepal and provide timely services to the member DDCs in capacity development areas. Besides this, it also works in the area of promoting rural energy and environment through member DDCs in local level. In this connection, ADDCN in collaboration with Ministry of Local Development, Ministry of Water Resource, Ministry of Science and Technology, Water and Energy Commission Secretariat and FNCCI jointly organized "National Conference on Rural Energy Development in Nepal" on 22-23 January 2009 in Kathmandu.

I believe that this program was successfully completed with the financial support from AEPC, Nepal Electricity Authority, REDP/ UNDP, SNV Nepal, Renewal Energy Project, Rural and Alternative Energy Pvt.Ltd. and Federation of Nepal Chambers of Commerce and Industry (FNCCI). Therefore I would like to take this opportunity to thank to all the supporters of the program.

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I also would like to thank Prof. Dr. Jaganath Shrestha for his keynote speech. Moreover, we also express our gratitude to Mr. Sanjaya Dhungel of WECS, Er. Gyanendra Lal Pradhan of FNCCI, Mr. Bir Bahadur Lama, Mr. Mangal Das Manandhar of AEPC, Dr. Jagadish Chandra Pokharel, former VC of NPC who

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Lastly, let me allow expressing my cordial thanks to all for their constructive and meaningful participation and support to make this seminar grand success.

Thank you.



Rishi Raj Lumsali
Chairperson, ADDCN
February 2010

ACCRONYMS

| | | |
|-------|---|--|
| ADDCN | = | Association of District Development Committees of Nepal |
| AEPC | = | Alternative Energy Promotion Center |
| CA | = | Constitutional Assembly |
| CDM | = | Clean Development Mechanism |
| DDC | = | District Development Committee |
| FNCCI | = | Federation of Nepalese Chambers of Commerce and Industry |
| HH | = | House Hold |
| IOE | = | Institute of Engineering |
| LG | = | Local Government |
| MSW | = | Municipal Solid Waste |
| MuAN | = | Municipal Association of Nepal |
| MW | = | Mega Watt |
| NAVIN | = | National Association of VDCs in Nepal |
| NEA | = | Nepal Electricity Authority |
| NGO | = | Non Government Organization |
| NPC | = | National Planning Commission |
| PPP | = | Public Private Partnership |
| REDP | = | Rural Energy Development Programme |
| REP | = | Renewable Energy Project |
| RETs | = | Renewable Energy Technologies |
| SWAp | = | Sector Wide Approach |
| TU | = | Tribhuvan University |
| TYIP | = | Three Year Intern Plan |
| VAT | = | Value Added Tax |
| VDC | = | Village Development Committee |
| WECS | = | Water and Energy Commission Secretariat |
| WWF | = | World Wildlife Fund |

Background

The National Conference on Rural Energy Development in Nepal was organized at a time when the national grid had power outages for 16 hours daily; and secondly it was organized by the members and association of the District Development Committees of Nepal. These two points makes the conference very significant, timely and offers now opportunities.

Nepal has demonstrated again and again the possibilities for developing rural energy potentials with affordable and locally appropriate technologies. The public is generally frustrated with the pace of change in the sector given the fact that energy development across Nepal has been uneven. Areas like the Khumbu have good energy supply while large projects supply energy Kathmandu taking up all the resources the country has. People are tired of waiting for planners and investors in Kathmandu to come up with solutions to meet the energy needs of the people. It is in this context that the 2 day conference was organized.

Currently most Nepalese live a subsistent lifestyle and biomass (forest and agricultural) residue and livestock waste make up most of the energy sources used by the people. Low life expectancy, poor living environments, drudgery, respiratory problems, lack of communication and entertainment mediums have become indicators of Nepal's under-development. As we begin the new millennium, 40% Nepalese have access to electric power and this makes up less than one percent of our total demand.

The 40% is the national figure and if we separate the rural out, only 7% of the populations have access to electric power. Furthermore, this power is expensive and extremely unreliable (16 hours power outage per day in the spring of 2009).

Despite the natural gift of abundant water and good gradient along the slopes of the Himalaya, about 600 MW of potential has been generated so far.

This scenario can be attributed to several factors. They are

1. Over dependence on centrally planned projects that compete for scarce resources.
2. Over reliance on foreign aid to pay for and build large projects and the long gestation time to develop them and seek needed funding
3. The inability of the average Nepali to pay for expensive power generated
4. Poor management of the sector including the national grid.

It is quite obvious that future energy development needs of Nepal will have to include some large energy projects. However, in order to meet the daily

needs of millions of people whose quality of life needs to improve at a rapid pace, there are numerous other possibilities at the local levels i.e. municipal, village and district levels.

Energy Conference Goals

The two day conference in Kathmandu was organized to look at the key issue of how Nepal can achieve the target of rural energy development through decentralized governance in Nepal.

Given that the government has declared the Nepali fiscal year (2009-2010) as “Alternate Energy Year”; it is critical to ensure that decentralization to local governments be a key point of the strategy for success.

In the three year interim plan of Nepal, the following targets are laid out:

- to provide renewable energy to an additional 1500 villages
- to produce 11,500 k.w. energy from micro hydro in 50 districts of the 75
- to install 90,000 solar panels in 73 districts
- distribute 140,000 solar tukis all over the country
- install 50 solar pumping units
- develop micro irrigation systems in 30 districts
- install 810 solar energy plants in 30 districts
- install 1500 solar dryers and cookers in 40 districts
- build 100,000 biogas plants in 70 districts
- install 4000 improved water mills in 40 districts

Such commitments on paper are not new and are often met only with foreign aided projects.

This time it can be different. Local governments at the district, village and municipal levels can and have to play a central role in meeting the energy demands of rural Nepal. Local governments have proven that they can

- Build partnership with communities, private sector, NGOs, and various other actors.
- Disseminate information and technologies
- Take on more responsibility to meet the needs of people in line with decentralization and devolution
- Increase investments at the local level and ensure equity at the local level

Further local governments have a better proven record of delivery in rural energy development projects in 72 districts of the country. It is a great opportunity to decentralize the task of meeting Nepal’s energy needs by making local governments a partner in progress. The full potential of local governments have to be mobilized for this course.

Conference Content

1. Exhibition

As the participants arrived at the venue (Staff College, Jawalakhel) there was an exhibition of rural and decentralized energy systems. The exhibited energy solutions included biogas, solar tuki, solar home systems, improved cook stoves, solar water pumps etc. This was a good way to start the conference as it allowed the participants to discuss energy options with people managing the stalls. (see annex).

2. Opening Ceremony

The inaugural program was chaired by Mr. Rishiraj Lumsali, chairperson of ADDCN and the guest of honor was the Minister for Local Development. Welcome remarks were presented by Mr. Madhav Prasad Poudel, coordinator of the conference. The representatives of the various political parties were present and spoke about their commitments to the objectives of the conference. Donors and the private sector were also represented.

3. Energy Award

Prior to the conference, Natural Resource Energy and Environment unit (NaREE) of ADDCN had solicited applications from the 75 districts to submit their applications detailing their investment in the energy sector based on a set of criteria. The decision was to award the best three districts based on the District Energy Index. The panel of judges decided to make this year's award to the districts that scored the highest based on a set criteria. (See annex 2)

4. Keynote Speaker

In order to set the tone for the entire conference and to give a general overview of the state of the rural energy sector, Professor Dr. Jaganath Shrestha, IOE TU made a keynote presentation. Dr. Shrestha took the participants through a short history, the available technologies, past experience and future potentials.

5. Technical Sessions/Paper Presentations

There were a total of five technical papers presented during the conference. The papers' titles presenters, chairpersons of the sessions and the commentators are followed as below

Each presentation was followed by comments, questions and answers and discussion. The discussions and the main issues raised and discussed were recorded for this report.

6. Lalitpur Declaration

All the participants of the conference showed solidarity and commitment to the cause of rural energy development by signing the Lalitpur Declaration. It captures the main issues discussed and agreed by the participants. See the detail of declaration in annex 1.

7. Closing Ceremony

The chief guest for the closing ceremony was the Minister for water resources Mr. Bishnu Paudel. Other speakers included donors and the private sector.

Proceedings of the Technical Sessions

The technical sessions were held with the help of paper presenters, chairperson for each session, commentators and a Question & Answer session. The following are the broad areas of general agreement to move the agenda of rural and decentralized energy generation, management and distribution. The entire conversation was held in the context of daily 16 hours of power outage nationally and the fact that the government's policy announcement on dealing with the situation refused to even mention local governments and the vital role they can and should play. Historically the concept of local government has been debated and central policy makers are only willing to recognize them as local units of the Ministry of Local Development and the key power being with the person appointed by the ministry. The energy supply situation is not going to change if we continue to make it the sole function of the central government. Energy generation, management and distribution needs to be a local government function.

It is in this context that the discussions and learning of the two day conference on rural energy development in Nepal has been documented for future reference and action. The insights and possible strategies moving ahead have been organized as per the themes of the various technical sessions held. The technical sessions were facilitated by Mr. Anil Chitrakar.

Technical Session

Following the opening ceremony of the conference, the technical session was conducted as follows.

1. Role of Central Government

The first paper was presented and discussion

Energy Promotion Strategy of Government of Nepal

Presented by : Mr. Sanjay Dhungel, WECS

Session chaired by : Mr. Shanker Nath Koirala, Secretary, MoWR

Commentators : Mr. Som Nath Pudel, Mr. Krishna Prasad Sapkota, CA Member

The conference recognized and solicited a clearly defined role for the central government in ensuring energy security for present and future energy needs of the people. These inputs are also based on the lessons learnt from the past.

- The first part is that energy is not just an end in itself but a means to a greater end for the Nepali people. Sufficient, reliable and affordable energy will ensure a inclusive and peaceful Nepal.
- Energy is currently a political agenda and it needs to move out and become a purely economic agenda.
- There is need to make a direct link between the energy sector and academic institutions where a lot of knowledge is housed. This relation has to be nurtured.
- The urban – rural divide is growing day by day and energy consumption levels is one indicator which will show progress being made to narrow the gap.
- There are big losses in the system with many institutions and persons not paying for the energy they use. This has to end if energy prices are to be managed.
- There is a need to streamline the laws, rules and regulations for generating energy development and management and authority devolved to local governments.
- Local people can share the cost and also share the benefits just as they have done in the forestry sector. Energy sector must become an integral part of the responsibility of local government.
- The human resources that are needed and the investments required for this should be a central function.
- There is also need to link energy planning with environmental planning. Right now one is seen to be against the other.
- Donor coordination and international and national level resources mobilization should be a central function but needs to be complimented

locally.

- Despite the 16 hours of power outage per day, there was no indication that the central government is serious about developing the energy sector.
- There are numerous technological solutions at the center e.g. waste to energy, which needs to be promoted at the local level.
- Nepal is always trying to manage various CRISIS – what we need is a national energy development strategy with a clearly defined role for local government.
- Employment and creation of jobs can also be attained through development of the energy sector.

2. Private Sector Involvement

Role of private Sector and Effective Implementation of Public Private Partnership Policy in Energy Sector,

Presented by : Er. Gyanendra Lal Pradhan, FNCCI

Session chaired by : Mr. Kishor Thapa, Secretary, Water and Energy Commission secretariat

Commentators : Mr. Purusottam Man Shrestha, PPPUE,
Mr. Lal Kumar K.C. Member of ADDCN

The conference recognized the role of the private sector can and will play in the development and management of energy resources at the local level. The following are the key issues related to the private sector:

- Private sector is demanding an enabling environment to do business. Business also needs energy to employ and also self employ in any commercial venture or industry. They want reliable energy for this.
- The private sector can help mobilize capital at the local level across the country. This is in itself an untapped resource.
- The local governments can create a business and investment climate where there is peace and security, work environment and a return on investment.
- The private sector is in a better position to access science and technology, financial resources, can better perform management functions like metering power use, etc.
- The local government can play a critical role in mobilizing local support for private initiated energy projects.
- The local governments are already good at a multi stake holder approach in development and partnership with the private sector is key.
- Local governments can provide incentives and also secure investments for the private sector.

3. Choices of Decentralized Energy Technologies

Present status, challenges and future prospect of micro-hydro and hydropower development in Nepal

Presented by : Mr. Bir Bahadur Ghale
Session chaired by : Mr. Kush Kumar Joshi, Chairperson of FNCCI
Commentator : Mr. Shanta Bahadur Pun

The conference heard a detailed presentation based on the adoption of small hydro power and related technologies in Bardiya, Gorkha. This led to a very positive discussion about a strategy to adopt these solutions at the local level. The participants also expressed gratitude to the fact that this presentation by Bir Bahadur Ghale was based on real experience. The following were the key issues raised and discussed.

- Decentralized energy technologies and their application is the best way to create rural jobs and enterprises
- These technologies make local people less dependent on central resources
- Local energy enterprises have proved that they can mobilize local capital.
- The load factor (for 24 hours) is low in general across Nepal; but there are enough model villages that have high load factors and hence the profitability.
- People should also be aware that the various technologies such as micro mini and small hydro are very site specific.
- If energy is used as a means in all its forms, local industries and enterprises can have good impact on poverty reduction.
- Currently there is a huge disparity in interest rates; for example to buy a car in Kathmandu and to generate power in rural Nepal. The desired interest rate is suggested at 6% vs. the present 18%. If the project itself could be collateral, the better.
- We also need to train and create more energy entrepreneurs in rural Nepal.
- The royalty generated by local energy projects should go to the VDC or DDC, but not to the center.
- National policy should enable selling power to the grid at a good price as well.
- Insurance is a new concept and needs to happen for these decentralized projects.
- If a settlement is too scattered, solar may be a better option than hydro.
- In the manufacturing and assembling of technologies such as hydro, biogas and solar, Nepal has proved it is the best in the region and has a comparative advantage and export potential.
- The ability to identify social and ecological impacts and mitigate the negative is essential
- There is need to constantly lobby for better policies from the government.

4. Management of Renewable Energy Resources

Present situation and future strategy of Government of Nepal in promoting renewable energy

Presented by : Mr. Mangal Das Maharjan, Deputy Executive Director AEPC

Session chaired by : Mr. Umesh Mainali, Secretary of MoEST

Commentators : Dr. Govind Nepal, Mr. Jeevan Bahadur Shahi, member of ADDCN

Very often energy development has taken place without looking, at how the basic resources may be managed for long term sustainability.

The following issues made up a good discussion

- Water is seasonal resources in most parts of Nepal. Regulated flow regimes, upstream watershed management and storage for example are key to design.
- Solar is more prevalent all over the country and is reliable source throughout the year!
- Land wind maps are currently not good enough to design projects.
- 72 districts of the 75 have energy and environment units that can be made capable to map and design energy projects.
- Nepal has already proved to be a center for excellence for the entire SA Region for small hydro and biogas energy development.
- Energy resources are being researched all over the world and the information and technological knowhow needs to be synchronized at the global, national and local levels.
- It is also important to promote the right end use technologies such as lights and cookers.
- Currently we are subsidizing the use of a few energy resources, it may be good to start understanding the real cost and educating people about it.
- Wind resources need to be promoted for irrigation and water lifting.
- While biogas is good when people have livestock, it was pointed out that less and less people are in the villages with livestock and hence could be a future challenge.
- In the context of local governments receiving block grants, there is need to look at capacity building for energy development.
- The resources mobilized by cooperatives also needs to be diverted for energy sector.
- Baglung district could be a demonstration area to show how small hydro plants can all be linked by a 'grid'.

5. Role of Local Government

Role of local government in promotion of energy sector in Nepal

Presented by : Dr. Jagdish Chandra Pokharel, Immediate VP of NPC

Session chaired : Mr. Punya Prasad Neupane, Secretary of Ministry of Local Development

Commentators : Dr. Dwarika Nath Dhungel, former Secretary, GoN, Krishna Prasad Jaishi, Spokesperson of ADDCN

The key issue for the conference was the role for local government in rural energy development in the context of 16 hours of power outage each day and also the fact that the central government did not even recognize a role for them in meeting the ever increasing demand for energy nationally. The role of local government is looked upon positively given a good track record on other sectors in the past.

The following are the key issue that were raised and discussed.

- Laws, rules and regulations on energy must be clear about the role for local governments. Energy planning must be integrated. The 'year of energy' should be a good year to announce this. Rural energy should also receive as much as 50% subsidy.
- Reliance for energy from the center must end. We need local energy independence. Benefits from carbon trading should be passed on to the local level.
- Locally generated energy can be sold to the national grid helping national demand, not the way it is currently.
- The system of issuing license from the center needs to end and should favor local projects.
- Action needs to be catalyzed at the local level. Policy making is important but does not lead to action without support.
- Competition will also be good to get to targets more quickly and efficiently.
- Local governments can mobilize resources available at the local level and create the needed local support for energy projects.
- Central policy must translate into local action. It is here that things happen.
- Due to Nepal's topography cost is high and local governments need to diversify the use and management of resources.
- Coordination is better at local level.
- Energy from waste is possible at local level.
- Local entrepreneurs can be tapped for energy development.

Short term actions for implementation

1. The district energy index has been initiated and an award for the best performing district has been established. This needs to be made an annual event and the prizes made more. There are seventy five districts each with a unique set of energy mix that can be harnessed. The establishment of a competition would clearly enhance the will do step up and do more. The system will also become more accountable to the people as the public, through media will learn of how other districts are making progress. These indexes can be modified over time to make them timely and more public oriented.
2. An energy promotion division has to be established and resourced at DDC and strengthened to implement the Lalitpur Declaration. The hosting of the conference is a very good beginning. The work now needs to be done to take commitments into action. The position of the local governments in terms of their ability to implement projects is a key asset and needs to be invested in. Kathmandu is often too far away to get things done.
3. To initiate district level energy plans and identify projects for implementation. There are many “low hanging fruits” that are worthy of a closer look and subsequent investment. It is a real challenge when so many people and organizations offer to invest such as at the meeting of the nonresident Nepalis where a simple list of profiles of local energy projects can and should be floated. The commercial banks are looking for “deprived sector” lending opportunities. Poverty Alleviation Funds and self employment funds can help bring people together to start a small energy company.

Presented Technical Papers

Energy for Development in the Perspective of Nepal

Key Note Speech

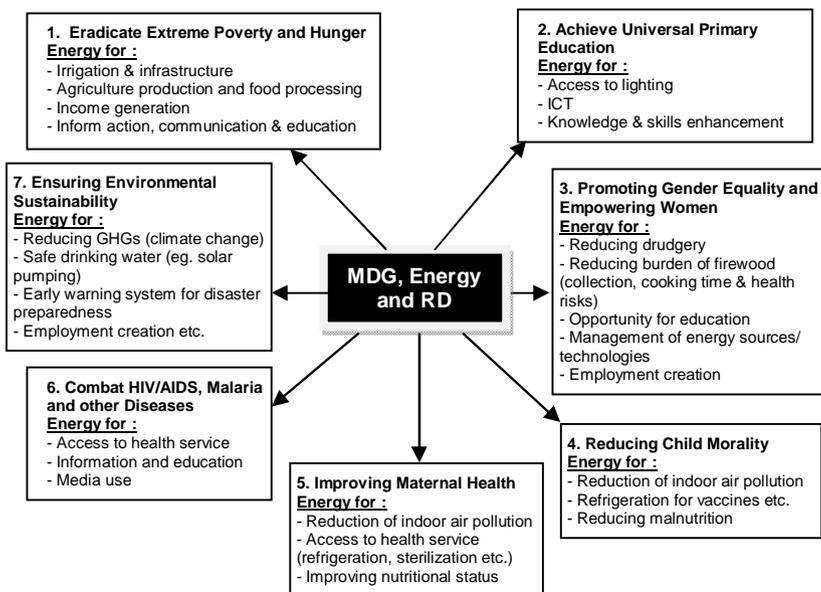
Prof. Dr. Jagan Nath Shrestha
IOE, TU

- Population is now 1000 times greater than 10,000 years ago
- Over the past 30 years it has doubled and will be double in next 40 to 50 years
- More people, more energy need and pressure on fossil fuel will continue to increase which is not sustainable and hence the more important it is for us to have access to and make use of environmentally friendly energy resources

Impact of Climate Change

- There is no difference for the Earth's atmosphere whether GHGs are coming from developed or developing countries
- No matter how strong, one country cannot win the battle against climate change acting alone
- **Collective action is not an option but an absolute necessity**

Millennium Development Goals, Energy and Rural Development in Nepalese Context



A Tree living for 50 Years

Generates - Rs. 8.5 laks worth of Oxygen

Rs. 10 laks worth of soil Fertilizer

Rs. 10 laks worth of Soil Erosion Control

Rs. 17 laks worth of Air Pollution Control

Rs. 8.5 laks worth of shelter for

Birds and Animals besides

Fruits and Vegetable

One well grown tree can retain 2 tons of water which trickles down to form a stream of potable water

So When a Tree is Cut the net loss is worth more than

Rs. 51 laks.

[Source: - Mucosol]

Natural Energy Resource Base of Nepal

- About 6,000 rivers, with a total length of about 45,000 km with an annual discharge of 200 billion cubic meters of water are available in the country
- The commercial potential of hydro-power in Nepal are said to be about 83,000 MW and 42,000 MW respectively.
- So far only about 603 MW have been connected to peak load system, which constitute about 1.88% of total energy supply
- Forests supply nearly 78 % of the total energy requirement of the country, and also provide 50% of fodder for livestock purpose.
- On average Nepal has 6.8 sunshine hours per day, i.e. 2,482 sunshine hours per year with the intensity of solar insolation ranging from 3.9 to 5.1 kWh/m²/day. (National average is about 4.7 kWh/m²/day.)
- Though significant wind potential is noted to be available in mountainous region (Mustang district, Khumbu region, Palpa, Ramechhap, Karnali Chisapani, Jumla) no proper wind mapping of Nepal has been done so far.

Three Year Interim Plan(2007/08 to 2009/10) (2064/065 to 2066/067)

- Living standard of rural people will be improved through the application of appropriate Alternative/Renewable Energy Technology
- Living standard of people will be increased through R&D, improvement and application of Science and Technology
- CDM related projects will be developed.
- Efforts will be made to minimize air, water and noise pollution

Building Integrated PV Electric System

- Electrification from solar PV modules through Building Integrated PV Electric System (BIPVES)
- Electricity generated by PV modules shall be supplied to the building using

- 220, 2V DC, 468 Ah Batteries and 15kVA Inverter
- BIPVES system will generate about 27kWh per day

Recent Government policy related to PV Application in Urban areas

- GoN/MOF has decided to provide tax and VAT exemption for photovoltaic technology to be used in urban areas to reduce the impact of ever increasing load shedding hours. (Decision taken on 2064/11/19 (March 02, 2008) at secretary level)
- But GoN is still silent on BIPVES grid connection policy

Cost of 1 kWp BIPVES

- 1 kWp PV Array(25 years warranty) Rs. 3.75 Lakhs
- Grid Connector Rs. 0.75 Lakh
- Support Structure Rs. 0.25 Lakh
- Installation Cost Rs. 0.25 Lakh*
- Total Cost around NRs. 5 Lakhs
- Certificate of Green Energy Producer (Feed in tariff cost in USA and Germany) and as high as 65% subsidy in USA
- Cost per month NRs. 1666 for 150 units (NRs. $(500,000/(25*12))=$ NRs 10/unit at fixed price for 25 years but cost of electricity will increase for sure in future
- * May vary from place to place

Solar Thermal Technology

- With National average sunshine hours of 6.8/day and solar insolation intensity of about 4.7 kWh/m²/day, there is a huge potential for solar thermal devices such as Solar Water Heaters (SWH), Solar Dryers (SD), Solar Cookers (SC).
- Presently SWH have been fully commercialized with total installation of more than 100,000 panels in 80,000 households. This shows quite significant improvement in SWH installations in last 7 years.
- SD and SC are still in the phase of dissemination and commercialization.

Important socio-economic benefits of biogas plants

- Reduction of the workload of mainly women and girls by about 3 hours/day/household. The saved time is used for education, income generation activities and leisure.
- Annual savings of:
 - Fuel wood used for cooking to the extent of 282,024 (@2 tons/plant) (at 90% operability)
 - Agriculture waste to the extent of 49,354 tons (@0.35 ton/plant).
 - Dung cakes to the extent of 84,607 tons (@0.60 ton/plant).
- Annual saving on kerosene of 3.5 million liters (@25 liters/plant).
- Annual reduction of GHG emissions to the extent of 987,084 tons CO₂ – equivalent (@7 tons/plant).

- Annual production of 246,771 tons – dry weight (@1.75 tons/plant) bio slurry and bio compost
- Proper usages of bio-slurry and bio-compost in 125,344household (at 80% hhs usage).
- Improved agriculture yields and reduced use of chemical fertilizer.
- Improvement of rural sanitations by connecting 98,708 toilets in 70% plants
- Reduction of indoor pollution due to kitchen smoke in 141,012 households.
- Reduced incidence of illness and expenses on health.
- Generation of direct and indirect employment to some 11,000 persons by Dec. 2005.
- **Annual total thermal power output 443 MW (at 3.14 kW/plant/day at 90% operability).**
- **550 MW electric power stations are needed to generate 443 MW thermal energy at 80% electric stove efficiency.**

Barriers to Large- Scale Dissemination of RETs

| RETs | Barriers |
|-------------------------------|--|
| Micro-and Mini-Hydro | <ul style="list-style-type: none"> • Inadequate work on developing strategy • Not availability of basic field data • Insufficient end-uses other than lighting • Technical and operational problems |
| Improved Cooking Stoves (ICS) | <ul style="list-style-type: none"> • Incompatibility of existing models with the traditional life- style • Lack of information dissemination • Inadequate attention in applied research and development |
| Bio-gas | <ul style="list-style-type: none"> • Less access by ultra-poor and disadvantaged people • Issues of low temperature in high Mountains • Low dung availability from small farms • Exclusion of women in decision making |
| Solar Photovoltaic | <ul style="list-style-type: none"> • High initial investment • Lack of repair and maintenance facility at local level |
| Solar Thermal System | <ul style="list-style-type: none"> • Technology not yet suitable for the mountain region • No standardization |
| Bio-mass Gasifies | <ul style="list-style-type: none"> • Un-economical due to subsidized electricity and diesel • Inadequate applied research and development |
| Wind Energy system | <ul style="list-style-type: none"> • Non- availability of wind monitoring and mapping data for many places • Inadequate applied research and development |

| | |
|--------------------------------------|--|
| Other RETs like Biofuel and Hydrogen | <ul style="list-style-type: none"> • Lack of trained personnel • Poor resource assessment • Insufficient field demonstration and dissemination • Lack of market support • Non-existence of financial incentives • Social inertia |
|--------------------------------------|--|

Methane Emission

- Municipal solid waste (MSW) landfill sites: one of the largest human-generated source of methane emission
- Solid Waste Management is a problem for most municipalities because of lack of proper land fill sites

Way out:

- Use waste where it is produced.
- Reduce methane generation from the landfill sites by dumping lesser amount of biodegradable materials.

Means/Technology:

- Biogas technology that utilizes kitchen/vegetable waste, grass and other biodegradable wastes to generate biogas
- Institutional of CH₄ Compression Plant

Energy From Waste at Mirable Resort, Dhulikhel Municipality

1. Volume of plant : 10m³
2. Volume of gas holder : 1.2m³
3. Initial feeding date : 15 February 2008 (2064/11/4)
4. Feeding materials (Batch feeding) :
Biodegradable garden waste : 400 kg
Kitchen waste : 500 kg
Cow dung : 400 kg
1. Daily feeding : 3 to 10 kg kitchen waste per day
2. Stable gas generation started on : 15 March 2008 (264/12/2)
3. Availability of gas : At least 5 hours (total gas generated approx., 5x400liters/day)
4. **Pressure on 1st July 2008: 10.5 kPa (5.5 kPa one full stove; 3.5kpa two full stove burning)**
5. Application : Preparing meals for 55 2employees (3 times/day) (except rice cooking)
6. Total volume of gas generated/month = 2m³/dayx30 days = 60m³
7. Equivalent energy generated/month = 60m³x21 MJ/m³ = 1260 MJ
8. Equivalent weight of LPG gas generated/ month = 1260MJ/49 MJ/kg = 25.71kg

9. **Equivalent no. of LPG cylinder replaced = $25.71\text{kg}/14.2\text{kg}/\text{cylinder} = 1.81\text{cylinders}$ (As per hotel manager, at least 2 LPG cylinders are saved per month).**
10. **Equivalent CO₂e saved from being emitted to atmosphere per month = $25.71\text{kg} \times 3.5\text{kg}/\text{kg} = 90\text{kg}$**
11. **Equivalent CO₂e saved from being emitted to atmosphere within 25 years = 270 Tonnes**

Main Output of Water Resources Strategy (January 2002/2059)

- Install 820 MW including 70 MW for export by 2007
- Install 2230 MW including 400 MW for export by 2017
- Install 22,000 MW (60% of all households (about 7 million houses) will be provided with electricity) including 15,000 MW for export by 2027

Main output of National Water Plan (2005/2062)

- 700 MW is developed for domestic use, 100kWh/capita (35% hh supplied by INPS) by 2007
- 2100 MW is developed for domestic use, 160 kWh/capita (55%hh supplied by INPS) by 2017
- 4000 MW is developed for domestic use, 400 kWh/capita (75% hh supplied by INPS) and significant amount of electricity export to earn national revenue by 2027

Key Issues

- How to change existing Top Down Approach in energy planning ?
- How to involve stakeholders to bring powerful changes ?
- How to ensure effective coordination ?
- What should be done to replace slowly the use of traditional energy resources by hydropower that is compatible with the people's consuming capacity ?
- How to reduce the dependency on imported fossil fuels through the application of indigenous energy resources ?
- How to utilize Kyoto Protocol to meet the additional cost of providing energy production ?

SUPPORT AND TRUST UNIVERSITIES OF NEPAL

- Involve them in GoN R&D Activities (e.g.Krishna Vir)
- Involve them in solving national engineering related problems
- Involve them in GoN consultancy works (under the leadership of senior faculty members)
- Ask them what they can do for New Nepal besides their BAU
- Formulate UAC (university action committee) under the leadership of NPC/GoN

Energy Promotion Strategy of Government of Nepal

Er. Sanjaya Dhungel, WECS

Mr. Sanjay Dhulgel, Senior Divisional Engineer of WECS had made presentation on behalf of WECS, The Session of the Presentation is mentioned below.

1. 87.67% Nepalese still rely on traditional sources of energy
2. Nepalese consume 14 GJ energy as compared to 26 GJ as Asian average.
3. Nepalese consume a mere 69 KWH of energy compared to 617 KWH for Asia.
4. WECS has a clearly stated vision for ending poverty in Nepal by developing local energy resources that will meet people's needs, be reliable and regular in supply.
5. The goals are to use biomass on a sustainable basis, hydro has to move to a majority position, fossil fuel dependency has to be reduced, price of energy must be affordable, alternate energy sources to be developed, and end use should be efficient.
6. There are a number of policy issues that need to be addressed for proper development of the energy sector.
 - we need the right energy mix
 - cost of production needs to be a key factor in selecting sites
 - need to link with poverty alleviation goals
 - energy and economic growth linkages must be established
 - long run marginal cost must be considered
 - keep in mind purchasing power of client
 - local governments role has not been properly utilized
7. A national energy strategy needs to be launched with the following in mind
 - develop new bio fuels
 - make it easy for hybrid vehicles
 - make use of electricity for cooking needs
 - improve efficiency
 - improve information and communications
 - increase capacity of the grid
 - prevent pilferage
 - Manage better end use
 - Involve the private sector

Explore clean development mechanisms for new funds

Role of Private Sector and Effective Implementation of Public Private Partnership Policy in Energy Sector

Er. Gyanendra Lal Pradhan, FNCCI

Objective of Public Private Partnership is to ensure that all individuals and communities involved and affected by development gain maximum sustainable benefits.

In hydropower, this can be achieved.

- Nepal's abundant water resources and geophysical features provide ample opportunities for hydropower generation in Nepal (More than 6,000 rivers and rivulets all over the country specially in rural remote locations.)
- The poor—the target group can benefit from this because the socio-economic benefits from a hydropower project to the rural populace is extensive.

Rivers -National Resource

- Rivers being a national resource should not benefit only a limited group – development even if achieved can never be sustainable.
- Rivers, in addition to being national resources are also renewable in nature. To derive optimal benefits by the people, government's role is key.

Few Examples

In Nigeria, Industries owned and controlled by few only; no sound and equitable distribution of economic benefits; profits and benefits in few pockets only.

- Even, Gulf countries' profits and benefits not equitably shared with directly affected people.
- Sustainable Development

Public Private Partnership by sharing its ownership effectively contains this skewed distribution.

Life of Hydropower Plants

Hydropower Plants licensed by Government –

- 35 years for domestic projects
- 30 years for export projects

Construction period: 3-5 years

Therefore, License Holders can operate and reap benefits for 30-32 years for domestic projects and 25 -27 years for export projects.

After the expiry of the license term, 100% of the hydropower generation project is transferred to the Nepal Government free of cost.

Status of Hydropower Projects (as of 2009)

| Projects in Operation and PPA Conducted Projects | |
|---|-----------|
| Total No. of Projects in operation | 16 |
| Total installed capacity of the projects in operation | 156.34 MW |

| PPA Conducted Projects | |
|---|---------|
| Total No. of Projects in operation | 26 |
| Total installed capacity of the projects in operation | 81.4 MW |

| PPA Applied Projects | |
|--|--------|
| Total No. of Projects applied for PPA | 81 |
| Total installed capacity of all projects applied for PPA | 550 MW |

How will I benefit?

Government

- Ownership and Integration
- National Assets-Asset formation and retention in the country
- Free equity for the national power system in project companies
- Energy Tax, Royalties etc which goes for development purposes in villages
- Return of the Government's project development expenses etc
- Self sufficiency in energy sector
- Infrastructure for growth such as rural electrification, rural roads etc

How will I benefit?

Investors

- Financial Returns
- Project Success

They bring in:

- Private capital
- Private management efficiency
- New & better technology
- Local Public
 - Employment Generation (Economic upliftment)

- Local development (infrastructure development)-like rural electrification, rural road and trail bridge construction activities, water supply schemes and facilities etc
- Skills development (job related learning opportunities)-like bar bending, mason, gabion works, carpentry, welding, electrician etc
- Empowerment through Ownership (shares to the community based companies with local shareholders)

The *General Public* benefits by getting continuous and quality power; getting opportunity to trade shares in a transparent company, thus allowing the scattered capital resources in the market to invest in infrastructure and development.

Through PPP, a wide sector can benefit with target group-the poor population benefiting the most.

| Stakeholders & their expectations from Hydropower | | |
|--|--|--|
| Customers | Financers | Local Community |
| <ul style="list-style-type: none"> • Continuous supply of power • Quality Power • Low tariff | <ul style="list-style-type: none"> • Loan Security • Short gestation periods | <ul style="list-style-type: none"> • Preferential treatment • Infrastructure development • Employment & poverty elimination |
| Government | Private Investor | Employees |
| <ul style="list-style-type: none"> • Customer's & Community's interests • Self sufficiency in energy sector • Infrastructure for growth | <ul style="list-style-type: none"> • Manage expectations of other stakeholders • Success of projects • Moderate Financial returns | <ul style="list-style-type: none"> • High compensation & benefits • Career growth |
| High expectations across all stakeholders | | |

Government's resources not adequate even for investments in development of basic infrastructure, leave alone hydropower development which is essentially a very capital intensive affair.

Hydropower being commercially viable, capital can be mobilized from the Private Sector. *Private Sector can be entrusted the sole responsibility to meet the energy needs of the country.*

If the Government can play the role of a FACILITATOR through investment-friendly policies and framework, sufficient financial investment can be mobilized from the private sector though there is also a need to draw the international investors at the same time.

A Proposed Model

In small hydropower projects less than 25 MW project, economic benefits can be shared as:

- 2% shares to be distributed to the two categories
 - Category 1: (those who cannot afford to buy- like low wage workers)
 - Category 2: (those who may afford- like Officers)
- 3% shares to the Villagers
- 10% shares to the General Public
- 85% shares to Promotor Groups

PPP is a must if Nepal wants to take the Hydropower sector (which is the future in energy sector) as the Ace sector for sustained economic growth in the long run. What is needed from the government is :

- *Conducive investment friendly environment including security*
- *Favourable and progressive policies including incentives*
- *Ability to retain investor's confidence*

Two types of security is paramount in hydropower-one against armed threats and another social threat to plant and its operations. *There has to be a feeling of ownership amongst the community members/local populace for the investments made at the project sites. This can only happen if they participate and share the benefits. For this PPP is a must.*

Present Situation and Future Strategy of Government of Nepal in Promoting Renewable Energy

Mr. Mangal Das Maharjan
Deputy Executive Director, AEPC

Presentation Outline

- Nepal's Energy Situation
- Government Policies in RE Sector
- AEPC: introduction, objectives & approach
- AEPC Programmes/Projects and Progress
- Collaboration and Cooperation
- AEPC's key outcomes/achievements
- Milestones and Way Forward
- Details on Funding Gap

Policy Trend

- Importance of Alternative Energy Technologies was recognized during the 7th plan period (1985-1990)
- The development of the Energy Sector given special priority during the 8th plan (1992-1997); Objective was to reduce the growing gap between urban and rural areas.
- Establishment of AEPC in 1996
- Large scale promotion of RETs for poverty reduction and livelihood enhancement in 9th (1997-2002) and 10th (2002-2007) plan period

Government's Policy and Strategy

- Rural Energy Policy, 2006
 - RE integrated for socio-economic development (enterprise and human development)
 - RETs promotion through decentralized approach; capacity building of local government bodies (DEES/U)
 - Establishment of Rural Energy Fund (different level)
 - Grid-Connection of RET
 - Renewable (Rural) Energy Subsidy Arrangement, 2008 (Earlier versions 2000 & 2006)
 - Ensure access of rural households to RETs

Introduction of AEPC

- AEPC - established in November 3, 1996
- **National Executing Agency** – Renewable energy (RE) programmes and projects
- **Government Institution under MoEST**- semi autonomous status; Board represented by public sector, private sector & subject expert
- **Mandate:** policy and plan formulation, resource mobilization, technical support, M & E, quality assurance and coordination

Introduction to AEPC

Objective

- The overall objective of AEPC is to popularize and promote the use of Renewable Energy Technology (RET) and Energy Efficiency
 - to raise living standards of the Nepalese people,
 - reduce the negative environmental impacts, and
 - to develop commercially viable alternative energy technologies in the country

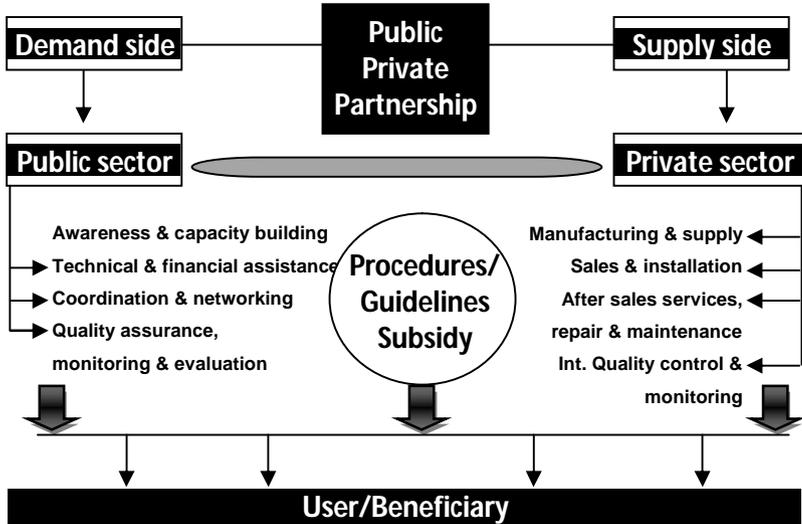
Six Broad Objectives:

- Preparation of short, medium, and long term policies and plans
- Implementation of programs for development of RETs and Energy efficiency
- Standardization, quality assurance, and monitoring
- Providing technical Service and support to rural people
- Facilitating financial assistance
- Strengthening of partners' (i.e. civil society, local agencies and private sector) capacity

Approach:

- Demand driven
- Involvement of communities, local bodies (VDCs, DDCs) and NGO's
- Public private partnership (PPP)
- Support in terms of capacity building, standardization, quality assurance, monitoring, information dissemination and channeling financial incentives

Programme Implementation Modality



Four Partners of RE Sector

The Government of Nepal (GoN):

- Renewable energy policies and institutional development
- Standards, Guidelines & Quality Assurance (QA)
- Monitoring activities
- Support R and D activities
- Facilitate Financial support

External Development Partners

- Technical assistance
- Financial assistance

Private Sector

- Service delivery
- Promotion and marketing of products
- Innovation of technologies and applications
- Providing loans and insurance

Civil Society

- Promotion
- Ownership and management of facilities.
- Participatory implementation
- Monitoring

AEPC 's Major Programmes and Projects

| Name | Date started | Phase | Planned Date of Ending | External Development Partners | Technology |
|---|--------------|-------|------------------------|-------------------------------|---------------------------|
| Energy Sector Assistance Programme | 2007 | II | 2012 | Denmark Norway | Hydro Biomass Solar |
| Biogas Support Program (BSP) | 2002 | IV | 2009 | SNV, KfW, DGIS | Biogas |
| Rural Energy Development Programme (REDP) | 2007 | III | 2009 | WB, UNDP | Hydro |
| Renewable Energy Project (REP) | 2004 | | 2010 | EU | Solar |
| Improved Water Mills Programme (IWMP) | 2003 | | 2008 | DGIS | Water Mills |
| Wind Technology | 2008 | | | UNEP! Denmark! UNDP! | Wind |
| Biofuels | 2008 | | | SNV! | |
| Energy Efficiency | 2008 | | | | |

Details on Funding GAPS

| Name | Date started | Planned Date of Ending | Total Budget for Implementation (M US\$) | Funding Secured (M US\$) | Funding GAP (M US\$) | Remarks |
|-----------------|--------------|------------------------|--|--------------------------|----------------------|--------------------|
| ESAP/REF | 2007 | 2012 | 78 | 53 | 25 | |
| BSP | 2002 | 2009 | 21 | 21 | 16 | Gap for next phase |
| REDP | 2007 | 2009 | 27 | 11 | 16 | |
| REP | 2004 | 2010 | 26 | 21 | 5 | |
| IWMP | 2003 | 2008 | 1.6 | 1.6 | 4 | Gap for next phase |
| Wind Technology | 2008 | | 3 | 0.0 | 3 | New Program |
| Total | | | | | 69 | |

Progress till Poush 2065 (Dec 2008)

| SN | RE Type | Unit | Progress | Number of HHs benefited |
|----------------------------|------------------------|--------|----------------|-------------------------|
| Access to Electricity | | | 7 % Population | |
| 1. | Biogas Plants | Number | 196,000+ | 1,96,000+ |
| 2. | Micro hydropower | kW | 10,581 | 1,05,805 |
| 3. | Solar Home System | Number | 160,543 | 1,60,543 |
| 4. | Solar Tuki | Number | 59,120 | 59,120 |
| 5. | Solar Cooker/Dryer | Number | 2,500 | 2,500 |
| 6. | Improved Cook Stoves | Number | 295,396 | 2,95,396 |
| 7. | Improved Water Mill | Number | 4,909 | 1,47,270 |
| 8. | ISPS (182) & PVPS (57) | Number | 239 | 38,680 |
| Total HHs benefited | | | | 10,05,314 |

GoN's Target of RETs for 3-Yrs Interim Plan

| S.N. | RE Type | Unit | Target | Remarks |
|-----------------------|-------------------------|--------|-------------------|-----------------------|
| Access to Electricity | | | 10% of Population | |
| 1. | Biogas Plants | Number | 100,000 | 73 districts |
| 2. | Micro hydropower | KW | 15,000 | 54 districts |
| 3. | Solar Home System | Number | 75,000 | 73 districts |
| 4. | SSHS (Solar Tuki) | Number | 140,000 | 75 districts |
| 5. | Solar Cooker/Dryer | Number | 1,500 | 40 districts |
| 6. | PVPS (200) & ISPS | Number | 1,131 | 24 districts |
| 7. | Improved Water Mill | Number | 3,000 | 40 districts |
| 8. | Wind Energy | KW | 100 | & wind mapping contd. |
| 9. | Improved Cooking Stoves | Number | 300,000 | |

Collaboration and Cooperation

German Development Service (DED):

- Technical support to build the capacity of biogas companies
- Assisting District Energy and Environment Units in planning, monitoring and promotion strategy at local level
- **RisØ Laboratory, Denmark:**
- Wind Mapping activities, Training AEPC staffs
- **German Technical Cooperation (GTZ) and CIM/GTZ:**
- Technical Support, Support on CDM and RET financing
- **World Wildlife Fund (WWF)/ Nepal**
- Biogas promotion
- **USAID SARI/E**
- Regional centre of Excellency on micro Hydro Technology.
- **RVWRMP/GoN+FINNIDA**
- MHP and integrated Community Development
- Asian Institute of Technology
- Winrock International
- Tribhuvan University
- Kathmandu University
- Federation of Community Forestry Users' Nepal (FECOFUN)
- Poverty Alleviation Fund (PAF)
- National Dairy Association
- National Cooperative Federation (NCFN)
- Agriculture Development Bank Limited
- Practical Action Nepal (former ITDG)
- NTNC/ACAP
- NSTB/CTEVT

AEPC's Key Outcomes

- About 7 % of population use RETs
- Addition of 500 jobs every year; about 8,000 people are working in RETs
- Reduction of Fuel wood by 51% per HH (265Kg/month/HH)
- Preservation of natural resources : more than 25% reduction in fuel wood consumption by almost 300,000 households
- Saving of family expenses by reduction of 50 to 100 liters of kerosene per year and significant amount of Diesel
- Involvement of more than 350 Small and Medium Scale Enterprises
- Economic activity increased; in some cases almost 50% growth in HH income
- Saving in medical expenses due to improved health
- Optimum utilization of local resources and skills, and lots of opportunities to export Nepali products and skills
- Strong pro-poor strategy for access to renewable solutions
- Reduced drudgery especially for women

- Gender and social inclusion in all activities
- Promotion of information and communication networks to remote locations
- Environmental benefits by conserving forest and other sources of energy
- Tapping opportunities of carbon trading
- Working through Private and Public Partnership (PPP)

Milestones

- Set up Energy and Environment Unit in 72 districts to coordinate RET activities
- Celebrating 2008/2009 (Nepalese fiscal year 2065/66) as an Alternative Energy Year
- Implementer/Coordinator for Rukum Ujyalo Program
- Allocation by the government NRs. 50 million for bio-fuels promotion
- Generation of 20 MW of power by wind technology through PPP
- Initiating Energy Efficiency activities

Way Forward

- Integration of RETs with the other development activities
- Huge potential to scale up with climate funding (CDM)
- Promote the SWAp or Joint Financing concept
- A comprehensive policy for the sector and proven implementation modality
- A successful PPP with a triangular interplay of govt., private sector and civil society for mutual accountability
- Promote Innovative financing mechanism, micro credit
- South-south cooperation
- Establishing Centre of Excellence for micro hydro and Biogas!

Present Status, Challenges and Future Prospect of Micro-hydro & Hydropower Development in Nepal

Mr. Bir Bahadur Ghale
Federation of Micro-hydro Entrepreneurship in Nepal

1. Development of small and micro hydro began in the 1960s.
2. Government has promoted the technology through subsidy from Agricultural Development Bank
3. By 2005 small hydro plants of 120 KW capacity were operational and day time end use was high making them profitable.
4. It is estimated that about 0.7 million households use some form of alternate energy resources today.
5. Generally speaking 90% of small and micro hydro is community owned while only 10% are private.
6. While the advantages of hydro plants are well understood, there are a number of challenges as well as opportunities these offer.
7. There is need to understand the post operation challenges in managing these plants as well.
8. The cost of hydro plants can vary from 1.5 million rupees per KW near road heads to 2.4 million rupees per KW at 5 to 7 days walking distance.
9. There is need and opportunity to bring in private banks to develop small hydro.
10. Design and planning for these projects needs to be a meticulous and detailed process.
11. There is also a need to understand the best practices in setting the tariff. Revenue streams need to be monitored and may vary seasonally.
12. Low interest rates, job creation goals, the capacity to build up to 1 MW plants, service centers at district headquarters, all can make the development of small hydro a reality. We need to work to iron out the processes for speed and efficiency.

The Role of Local Government in Promotion of Energy Sector in Nepal:

Dr. Jagdish Chandra Pokharel
Former Vice-President of NPC

Introduction

Energy is the backbone for national development and social well being of a nation. There is a constant evolution in the structure and approach to energy development in Nepal. It uses two prong approaches for energy development. The first approach is to develop relatively large size projects and increase the total power available in the country. It also focuses on export and import of power through national system. It uses the national transmission network for power transfer. It uses its own distribution system nationwide. The second approach develops smaller independent units serving single or a small number of households locally. The main purpose of this system is to address domestic consumption need. Micro-hydro, solar, biofuel, wind energy system belong to this category.

The first type of approach is guided by economic rules. This system is necessary to support for industrialization and urban economic activities. Ministry of Water Resources, Nepal Electricity Authority, Department of Electricity Development and their local level offices support this approach. The second type of approach is guided by the social needs and values. Alternative energy promotion center, biogas promotion center, some private firms, some programs and their local level organizations support the second type of system.

Nepal's policy encourages participation of state, private sectors, civil society and cooperatives for energy development. The state's role is increasingly developing into facilitator, regulator, controller and creator of appropriate environment for non-state actors to play active role in energy development. Recently, the energy situation in the country is deteriorating. The national system of energy development has not been able to cope with the increasing demand. This situation has contributed to more than fifteen hours darkness (load shading) every day. The urban and industrial area is most affected by this energy shortage. The situation has become politically, socially and economically challenging for the nation. It has become

necessary to understand why the system has failed and what can be done to improve the situation immediately and in the long run.

The government has formulated a three year interim plan (TYIP), energy strategy, water resources development plan and strategy and alternative energy development plan to address the immediate and long term need for energy development. In this paper, I use the TYIP to get insights into the problem. The initial findings suggests that there is a need to further enlarge the space for local governments, private sectors, civil society, community based organization and cooperatives to play more meaningful role in energy development. The finding also suggests a need to bring in the energy issues in federalism discourse currently taking place in the country. This paper is a quick and broad overview of the problem. It should lead to other bigger studies and deeper analysis.

1. The National Level Plan

Assessment of Situation

Of the total population, 48.5 percent was expected to have access to electricity services by the end of the Tenth Plan. Prior to the Tenth Plan, electricity was available to 58 municipalities and 1600 VDCs in the country. A total of 2,100 VDCs were expected to have access to electricity services, at least partially, by the end of the Tenth Plan. Electricity supply has been expanded to cover 59 Districts in the country. In the Community Rural Electrification Program, initiated during the Tenth Plan period, people's participation in the expansion of electricity supply has been encouraging. The per capita electricity consumption has increased to 76 KWH. The peak electricity demand of 426 MW towards the end of Ninth Plan increased to 648 MW towards the end of Tenth Plan period.

Water resources being the main source of energy in Nepal, its planning has occupied an important space in developing strategy for energy development. The National Water Plan and Water Resources Strategy were formulated during the Tenth Plan period. The achievement of the tenth plan was much lower than targeted. (See the following table for details). In hydropower sector only 40 MW were added during this period and that all of this has been done under the initiative of the private sector.

Table 1: Targets and Achievements in the Tenth Plan Period and Existing Status

| Sector | Unit | Target | State of Progress | State as of F.Y.2063/64 |
|---|---------|--------|-------------------|-------------------------|
| Installed Capacity- | Km. | 315 | 40 | 556 |
| Hydropower | MW | 430 | 47 | 2669 |
| Transmission Line (132 and 66 KV) | M.V.A. | 426 | 332 | 1,089 |
| High Capacity Sub-Stations (132 and 66 KV Capacity) | Km | 865 | 123 | 2485 |
| Transmission Line (33 KV) | M.V.A. | 101 | 112 | 245 |
| 33/11 KV Capacity Sub-Station | Km. | 14,917 | 8,672 | 49,930 |
| Distribution Line (11 KV and 400/230 Volts) | Number | 2,600 | 2100 | 2100 |
| VDCs with Access to Electricity | 000 | 706 | 417 | 1,280 |
| Number of Consumers | Percent | 10 | 8.5 | 48.5 |
| Beneficiary Population | | | | |

Problems and Issues

The following problems and issues were identified while formulating the TYIP;

- The number of project implemented by the private sectors was much lower than the number of purchase agreement made with the Nepal Electricity Authority (NEA).
- Tendency to acquire license for hydropower development and not to develop the project. Thus leading to high level of speculation and selling of licenses.
- Constant decrease in the public sector investment has caused inadequate development of hydropower.
- Lack of public and private sector investments in the development of the transmission and distribution system.
- Weak implementation of the Electricity Act, 1992 and the Hydropower Development Policy, 2001.
- Continuously decreasing trend in collecting electricity bills.
- Increase in the backlog bills to be paid by the government agencies and municipalities.

Main Challenges

According to the TYIP, the power sector faces the following challenges and opportunities.

- To ensure supply to meet the ever increasing demand for electricity.
- To make coordinated efforts for the development of hydropower and alternative energy sources in order to provide electricity in the rural areas.
- To control the leakage of electricity.
- To rationalize the electricity tariff on time.

Targets

The TYIP sets the following targets for the Plan period.

- Completion of the construction of ongoing hydropower projects adding 105 MW.
- Initiating the construction of new hydropower projects shall be taken up for additional 2,115 MW.
- Additional 10 percent of the population to be covered through the national grid.
- Expansion of electricity services to cover additional 500 VDCs in the national grid, covering a total of 2,600VDCs by the end of the Plan.
- Per capita electricity consumption to be increased from 76 KWH to 100 KWH.

Key Assumptions

The Plan made the following assumptions while preparing the plan.

- Private sector participation will increase.
- Cooperation and coordination with other Ministries will become effective
- Market for electricity export will be available.
- Required capital will be available.
- Consumer's capacity for electricity consumption will increase.
- Electricity bills due will be collected regularly.

Policies

The TYIP also outlined the following working policies.

- The existing legislative provisions and laws will be updated and modified.
- Nepal Electricity Regulation Commission will be set up to undertake electricity generation, transmission and distribution for easy regular, better managed and transparent business in power sector.
- The public institutions will be restructured to ensure a competitive environment in the power sector.

- The mechanism for electricity tariff rate will be updated and made transparent.
- The transmission and distribution works will pay greater attention environment conservation. Arrangements will be made for approval to Environmental Impact Assessment coming from the same agency, which approves and grants permission for hydropower development, transmission and distribution by making the single door system effective.
- Increased participation of the community and local institutions and attracting domestic and foreign investments will be assured.
- Emphasis will be given towards mobilization of the domestic capital market for investment in the electricity sector. Domestic investors will be encouraged to make investments in the development of hydropower plants of designated capacities.
- Priority will be given to the utilize labor, skill, resources and facilities available in Nepal in the implementation of hydropower projects.
- Promotion activities, for promoting foreign investment in the electricity sector, will be undertaken.
- Nepal's transmission line will be connected with the SAARC countries for the development of a regional power grid, bilateral arrangements shall be made with the countries concerned.
- Efforts will be made towards formulating the needed legislations and laws for this purpose.
- Export of electricity will be encouraged.
- The provisions of the Water Resources Strategy and the National Water Plan, 2005, will be implemented progressively. The river basin approach will be applied on the basis for the development and management of water resources.
- The public and private sectors will promote the development of electricity, solely or jointly to address the demand for electricity development.
- Private sector will be encouraged to undertake the implementation of hydropower development on the BOOT (Build, Own, Operate and Transfer) principle through competitive bidding.
- The utilization of existing hydropower generation capacity will be maximized to meet the domestic electricity demand. In order to achieve this, run-of-the-river and reservoir backed projects shall be developed.
- Efforts will be made to undertake large reservoir based and multipurpose projects. The downstream benefits resulting from large reservoir based multipurpose projects will be utilized to maximize benefits to the country.
- Hydropower development will be undertaken as an alternative to thermal power projects contributing to environment conservation.
- The tendency of acquiring license for the development of small hydropower plants and distribution system, but not undertaking actual development and distribution, will be discouraged.

- Existing transmission system will be strengthened and efforts will be made to link the micro and small hydropower plants with the national grid.
- New transmission lines and sub-stations will be developed to ensure effective transmission of electricity generated in the power projects through the national transmission system and to ensure effective distribution from the national grid for the agriculture, industry and tourism sectors and for distribution to the rural areas and cities.
- Electricity export and import between India and Nepal will be undertaken under bilateral exchange by strengthening the existing cross-country transmission line and developing new transmission lines.
- Rural electrification will be a priority under the existing policy of achieving social justice through the expansion of electricity services to the rural areas.
- Electrification in the remote rural areas will be promoted through the development of small and micro-hydropower projects at the local level.
- Besides promoting people's participation, a Rural Electrification Board will be instituted and arrangement for a separate fund shall be made to help support this initiative.
- Policy for supplying electricity at cheaper rates in the agricultural and production sector will be adopted.
- Leakage of electricity will be controlled. Besides utilizing needed technical measures, additional legal provisions will be developed based on the needs. Emphasis will be given to mobilize people's support to help achieve control on electricity leakage.
- Consumers will be protected by ensuring quality, dependable and easily accessible electricity services.
- Consumers will be motivated for demand management to help promote energy conservation, and electricity tariff structure will be adjusted based on the supply, contributing to the maximization of consumption.

Electricity Generation and Supply

Regarding new generation of power, the Plan makes the following commitments.

- Hydropower projects with a total capacity of 105 MW shall be developed under the public and private sectors within the Three Year Interim Plan to meet the domestic electricity demand. For this, the public sector will contribute 85 MW and the private sector will contribute 20 MW. In the Plan period, Middle Marshyangdi Hydropower Plant of 70 MW capacity and Kulekhani-III Hydropower Plant of 20 MW capacity will contribute to the public sector share in hydropower development.
- The private sector contribution of 20 MW will primarily come from small and micro hydropower schemes. In order to develop the generation

capacity to 5,000 MW over 10 years, within the Three Years Interim Plan period construction of hydropower plants of a total of 2,085 MW capacity will be initiated.

- The Plan also identified some projects for implementation. Important projects with a share in contribution to this capacity will be 30 MW from Chamelia Hydropower Project, 402 MW from Arun-III, 300 MW from Upper Karnali, 309 MW from Upper Tamakoshi (Rolwaling), 60 MW from Upper Trishuli-III (A), 40 MW from Upper Trishuli-III (B) and 27 MW from Rahughat Hydropower Project. Of these projects construction of some will be undertaken under public sector investment while others will be under joint investment of the public and private sectors. Some of the projects will be undertaken exclusively under private sector funding with foreign investment.
- Among the reservoir based hydropower projects under study, construction of Upper Seti (122 MW), which is considered suitable to the existing power system, will be initiated under the public sector. Similarly, under private sector funding, construction of schemes with a total capacity of 45 MW will be initiated.

Transmission System

The Plan sets the following targets for transmission system expansion.

- Construct a total of 174.5 km long transmission line of varied kilowatt capacities for export and import of electricity between India and Nepal.
- Of the three proposed important cross-border transmissions of 400 KV, construction of Dhalkebar-Bhittamod (30 km) transmission line the target was to complete within the Interim Plan period. The construction of other two transmission lines, Butwal- Sunauli (25 km) and Duhabi-Jogbani (15 km), will be initiated. Construction of Hetauda-Bardghat transmission line of a capacity of 220 KV will be completed.
- While undertaking the construction of transmission lines, construction of new sub-stations and expanding the capacity of existing sub-stations of different capacities will also be taken up. Within the Interim Plan period, expansion of a total of 377 M.V.A. in the capacity of transmission sub-stations will be achieved.

Distribution, Expansion and Electrification

The Plan also sets targets and identifies projects for distribution, expansion and electrification. Since the electricity services have expanded to cover most urban areas but still deficient in the rural areas, efforts will be made in the Three Year Interim Plan period to expand electricity connections, to cover larger parts of the rural areas. This will involve the construction of

transmission and distribution lines of 651 km of 33 KV capacity, 3,163 km of 11 KV capacity, 5,978 km of 400/230 Volts and construction of 33/11 KV distribution sub-stations of a total of 113 M.V.A. capacity will be completed during the Plan period. This will help expand electricity services to an additional 500 VDCs providing electricity to a total of 450,000 households. The national electricity transmission grid will be expanded to an additional 10 Districts during the Plan period.

Under the Community Rural Electrification Program, transmission and distribution lines of 130 km of 33 KV, 1,154 km of 11 KV and 2,345 km of 400/220 volts will be completed. This is expected to help expand electricity services to an additional 135,000 households. Since the rural electrification program contributes to poverty alleviation, emphasis was given to expanding this program to the areas of the *Dalits*, *Adibasi Janjatis*, marginal and disadvantaged communities. Alongside of this, participation of *Dalits*, *Adibasi Janjatis*, persons with disability, *Madhesis*, Muslims, freed *Kamaiyas*, senior citizens, women, disadvantaged and marginal communities, shall be encouraged in the Rural Electrification Program.

Special Initiative to Address Load Shading

In order to address the continuing deficiency in electricity supply (load shading) the TYIP suggests the following;

- In the first year of the Plan, i.e. F.Y. 2007/08, 40 to 50 MW of electricity will be imported from India
- In the second year of the Plan, i.e. F.Y. 2008/09, 70 MW will be added to the national grid with the completion of Middle Marshyangdi Hydropower Project. In later years the duration of load shading will progressively reduced with the electricity imported from India.
- After the completion of the Interim Plan period, the hydropower projects initiated during the period of the Interim Plan shall start reaching completion beginning from F.Y. 2010/11 and in the F.Y. 2013/14 approximately 600 MW of electricity will be added to the national grid. After 2013/14, it is expected that load shading in Nepal will not exist, with the domestic production of electricity. Besides these initiatives, control on leakage of electricity and electricity demand management programs shall be undertaken on a regular basis.

Estimated Budget

The Plan estimated a budget of Rs. 32,400 million to be spent through Nepal Electricity Authority, Department of Electricity Development and Water and Energy Commission Secretariat, during the Plan period.

Implementation Arrangement

Currently the programs in the national level electricity development sector are taken through the Ministry of Water Resources, including, Water and Energy Commission, Department of Electricity Development (DED) and Nepal Electricity Authority (NEA). The NEA implements the programs of electricity generation, transmission and distribution. In some of these programs the private sector is also involved. The promotion of the private sector in electricity development is carried out through the DOED. The following institutional arrangements are proposed in the Plan.

- A High-level Electricity Sector Regulatory Commission (ESRC), with special powers, and the current Electricity Tariff Setting Commission, will be placed under this commission. DOED will function as the secretariat of the commission.
- ESRC will undertake monitoring and supervision of security arrangements for the electricity system, supply regularity of supply and the quality of distribution. Further, it will make periodic reviews of the norms of fixing rates for the purchase and sale of electricity.
- The DED and Water and Energy Commissions will take up survey, studies and promotion activities.
- The NEA will be responsible for undertaking electricity generation, transmission and distribution.
- A separate division shall be established for these tasks in the Ministry of Water Resources to undertake effective monitoring of larger hydropower projects and establish policy level and execution level coordination with the national and international stakeholders.
- The implementation of the programs will be undertaken in coordination with the local institutions, political entities and groups and individuals. This will help to ensure that the implementation of programs are unaffected by the situations at the local level.

Arrangements for Monitoring and Evaluation

The Plan makes the following arrangements for Monitoring and Evaluation.

- Effective arrangements shall be made for the regular monitoring and evaluation of the programs from the central as well as regional levels.

- Training of human resources engaged in monitoring and evaluation will be used as a means to motivate them, to undertake monitoring and evaluation effectively.
- In order to undertake monitoring and evaluation tasks effectively, information sources shall be modified and improved based on the impact of the project, and progress made and physical and economic indicators. For the effective monitoring and evaluation of progress, quarterly review of progress and on-site supervision, shall be undertaken at different levels on a regular basis.
- Arrangements shall be made to undertake the monitoring of implementation process along with the monitoring of physical progress.
- After the completion of the project ex-post evaluation, an impact assessment will be carried out and the lessons learnt shall be incorporated in the formulation of future projects. Emphasis will be made on base line data collection to accomplish this.

2. Local Level System Approach

Assessment of Situation

Rural sector occupies important place in Nepal's economy. However, expected growth in the rural sector could not be achieved to expectations with the implementation of the development programs in the past. Therefore, the TYIP give special attention to development initiatives for the rural sector.

Assessment of the total national energy consumption over past five years shows that the share of traditional energy to this consumption has been 86 percent while the share of commercial energy sources have been only 14 percent. Of the total energy needs in the country, 77 percent of the need is contributed by fuel wood, agricultural residues and dunk cake contribute 9 percent of the needs and remaining 14 percent of the needs are met from imported petroleum, coal and electricity.

The per capita energy consumption in Nepal has been 343 kg of oil equivalent. Though rural sector accounts 86 percent of the energy demand of the country, this is met largely from bio-energy sources.

To date, only 5.1 percent of the population in the rural area has been served with alternative energy sources. Renewable energy from biological sources and imported kerosene continue to dominate in the energy used in the rural areas.

The Plan recognizes linking the rural areas to the national electricity grid for increasing access to electrical energy would demand huge time and budgetary investments. However, environment friendly alternative energy sources can be developed at costs affordable by majority of the population and that this can contribute tremendously to rural economy and rural development. Also, development and promotion of alternative energy sources in the rural areas would help in effectively managing the energy sector of the country and enhancing the quality of rural life through environmental balance, reducing the time spent in fuel wood collection, creating additional employment opportunities, health improvement and increasing the access of children to education.

The potential for alternative energy development potential in the country suggest micro- hydropower can be developed to generate 50 Megawatts, 1132.7 Megawatts can be generated from solar energy (considering 5% of the area potentially suitable @ 4-5 kw/sq.m/day) and 1.9 million biogas plants can be developed. The potential for wind energy development is yet to be established as collection of relevant data is still in progress. Promotion of improved cook stoves can reduce the fuel wood consumption by 10-30 percent, thus creating possibilities for additional energy with the current fuel wood supply.

In the Tenth Plan period, alternative (rural) energy subsidy policy and subsidy implementation work plan were developed and brought to implementation within the framework of objectives and policies set for alternative energy sector. For the development of alternative energy together with rural electrification supported from large hydropower projects, Rural Energy Policy had also been approved.

Of the stated target to serve 5 percent of the population with the electricity and supply electricity to 1000 VDCs during the Plan period, additional 3 percent of the population could be covered and that the supply of electricity could be expanded to 1770 VDCs. Within the Tenth Plan period, 6 percent of the rural population had access to electricity with the development of alternative energy sources.

Of the target set to producing energy equivalent of 44 Megawatts by developing 200,000 *Gobargas* plants in 65 districts in Tenth Plan period, development of 81,138 plants (40.6%) could be completed in 63 districts in the first four years of the Plan, capable of producing 17.85 Megawatts of energy.

Similarly, of the target set for the distribution of 52,000 units of solar electrical system in 52 districts, installation of 62,835 units (120%), capable of generating 1.88 Megawatts, could be completed in 72 districts. In micro-hydropower development, while the target has been generating of 10 Megawatts in 47 districts, 4 Megawatts (3956.79 kw) of additional (40%) electrical power generation capacity can be developed with the coverage in 52 Districts.

Of the target of installation of 2,700 units of solar dryer/cooker in 20 Districts, the actual achievement has been installation of 1,258 units of solar dryer/cooker in 46 Districts. Similarly, of the target of developing 100 units of solar water supply and micro irrigation schemes in 15 districts during the plan period, 13 solar water supply and micro irrigation schemes are in operation in seven districts. Of the target set to installing 4000 improved water mills, total of 2,837 improved water mills could be installed in 29 districts.

On wind energy side the target was to generate 20 kw of energy and completion of wind energy mapping in 20 districts of which generation of 2.9 kw of electrical energy and wind energy mapping in 5 districts were completed.

During the 10th Plan period, the target was to complete construction of 250,000 units of improved cook stove in the rural areas of which construction of 212,852 units (85.14%) of cook stoves could be completed. The promotion of alternative energy sources contributes directly to reducing the emission levels of carbon, methane and other gases in the atmosphere that reduces the green house gas emission levels. This has created the possibilities for Nepal to start carbon trading in global market under Clean Development Mechanism (CDM).

Issues and Problems

Though alternative energy sector has witnessed significant progress, the problems currently facing this sector are: lower rate of dissemination and expansion of alternative energy technologies in the remote areas due to lower economy, awareness level and conflicts.

Due to lower level of technology dissemination in these areas, this has not been able to minimize environmental degradation resulting from continued deforestation. Similarly, adequate technical manpower in this sector has

been lacking and the persistent conflict in the past continued to affect the transportation of equipments and accessories for the promotion of alternative energy technology.

Challenges

The challenges facing the alternative energy sector include: i) the grants available from the donor agencies covering only a fraction of the cost of installation of alternative energy technologies and lack of arrangements for easily accessible credit for majority of population, ii) developing the possibilities for the connection of small and micro-hydropower plants to the national grid in future in case of expansion of the national grids, iii) increased utilization of micro- hydropower for productive uses besides its use in meeting the household consumption, and iv) integration of alternative energy in the development plan of local institutions and capacity building of local institutions to undertake selection, promotion, coordination and monitoring and evaluation of alternative energy promotion programs.

The plan also identifies the following opportunities that can be beneficially exploited:

- Government of Nepal and donor countries have considered alternative energy as priority sector for development and promotion
- Alternative energy has implicit potential to contribute in strengthening rural economy through promotion of trade and industry and employment promotion at local level.
- Alternative energy can be promoted to help low income, marginal and disadvantaged and contribute to rehabilitation of the households displaced by conflict by providing them electricity and cooking fuel.
- Alternative energy is environment friendly energy source and the possibilities of reducing green house gas emission levels with the promotion of alternative energy, and the savings in the carbon emission levels; thereof has created possibilities of carbon trading in the global market.
- Increasing private sector participation in the alternative energy promotion and the increasing competition in the service provision has helped enhancing the accessibility of technology to the consumers, reducing the cost, improving the quality of technology and accelerating the services.

Alternative Energy Promotion

The Plan envisions doing the following for alternative energy promotion:

- Contribute to rural development, enhance rural economy and quality of rural life, increase the employment opportunities and contribute to the sustainability of environment.

- Reduce the dependence on the external sources of energy with the development and promotion of alternative energy technologies, their commercialization potential and promote as means of mainstream energy supply.
- Reduce the dependence on the conventional energy sources due to far reaching environmental consequences and progressively replace them with the modern energy alternatives that are affordable.
- Promote of alternative energy as integral program of Clean Development Mechanism (CDM) due to its established potential in reducing greenhouse gas emission in the atmosphere and therefore promote it as mean for generating financial resources in long terms through carbon trading.
- Contribute to the broader national goal of achieving social inclusion and gender mainstreaming through increased participation of population of all class, caste and gender in the development, promotion and utilization of alternative energy sources.

Targets

The alternative system sets the following targets.

- Increase access of additional 5 percent of the population in 1500 VDCs to electricity during the Plan period.
- Promote of small and micro-hydropower schemes in 54 Districts, capable of generating 11,500 kilowatts (11.5 Megawatt)
- Install of 90,000 units of solar electrical systems in 73 Districts to provide electricity at the household level.
- Distribute of 140,000 units of solar lantern in 75 Districts.
- Develop and commissioning of 50 solar drinking water supply and micro irrigation schemes in 30 Districts.
- Install of 810 institutional solar electrical systems in 30 Districts.
- Install of 1,500 units of solar dryer/cooker in 40 Districts.
- Development of 100,000 units of biogas plants in 70 Districts.
- Improvement and installation of 4,000 units of water mills in 40 Districts.
- Map the wind energy in the Districts considered feasible for wind energy generation and actual generation of 50 kw of wind energy.
- Develop of 300,000 units of improved cook stove and installation of other bio-energy technologies in the mid and high hilly regions.
- Establish of Energy and Environment Cell/Unit under Local Agencies/DDCs in all the 75 Districts to undertake such activities as, planning, coordination and monitoring and evaluation for alternative energy promotion.

Policies

Following key working policies have been outlined in the Plan.

(a) Promotion and Expansion

- In order to make the development program of small and micro-hydropower effective, and to support in effective operation, repair and maintenance of completed hydropower project, Regional Service Centers shall be established besides expanding the Rural Energy Development Branch. Strategies shall be developed and implemented to promote end use diversification in order to make the installation of micro-hydropower projects economically and financially viable.
- Capacity development programs for utilization of available bio- energy resources in the rural areas, such as, fuel wood and agricultural wastes, shall be undertaken. This would help minimizing the negative environmental consequences resulting from the use of bio-energy sources.
- Promotion of solar energy helps meeting the energy demand effectively. Therefore, in the rural areas not likely to be connected by national electricity grid in near future and in those areas where micro-hydropower development is infeasible, solar energy systems shall be promoted.
- Promotion of solar pumping system shall be undertaken for micro irrigation development in the hilly and mountainous areas, where feasible, for small scale vegetable production. This program would complement Agricultural Perspective Plan.

(b) Energy for Livelihood Improvement

- The dependence on imported energy sources shall be progressively reduced with the development of alternative energy sources.
- Efforts shall be made towards promotion of bio-energy technologies, such as, gasifiers, briquettes, bio-fuel, etc., and awareness building programs, for the utilization of these technologies shall be undertaken.

(c) Promotion of Community and Private Sector

- Alternative energy development, distribution and utilization shall be made sustainable by promoting formation of user groups through social mobilization and their active participation in policy making, construction and operation of alternative energy schemes.
- Arrangements shall be made for the purchase agreement of electricity from those small and micro-hydropower schemes providing electricity prior to the expansion of national grid.
- Economic activities and trade and industrial activities, based on alternative energy sources, shall be promoted.

- Participation of local level institutions in the development of alternative energy sources shall be promoted under existing decentralization framework and energy policy.

(d) Alternative Energy Sources based Information Technology

- In the remote areas, not connected to national electricity grid, electricity available from alternative energy sources will be used in promoting information technology to increase the accessibilities of these areas to information, communication and for the development of educational opportunities. Similarly, educational institutions shall be mobilized to train manpower needed for the energy promotion.

(e) Rural Energy Fund

- Needed modifications in the subsidy policy and subsidy implantation work plan in order to increase access of rural population to alternative energy technologies and to maximize the benefits thereof
- Financial support shall be provided through Central Rural Energy Fund to ensure sustainability in alternative energy development. This fund will be used in providing support for collective collateral, revolving fund and easy loan, in order to increase the accessibility of poor, marginal, disadvantaged and ethnic groups to alternative energy technologies. This fund will also be used in ensuring credit guarantee on credit advanced that would encourage financial institutions to advance credit in alternative energy sector.
- Needed legislation will be developed for the institutionalization and continuity of Alternative Energy Promotion Center for effective contributions alternative energy technology development and rural development. Institutional and human resources development of the center shall be undertaken for effective planning and programming and successful program implementation, monitoring and evaluation, regular reviews and public hearing.

(f) Research and Development

- In order to ensure sustainable energy supply, which is basic need of the rural population, and to contribute to the development of rural economy, priority will be given to research, development, technology transfer, and technology dissemination programs in the energy sector.
- Participation of educational institutions, private sector and non-governmental organizations will be promoted to undertake research and development and promotion of alternative energy technologies, including ways and means to reducing the cost of development.

- For quality assurance of alternative energy technologies, the capacity of Alternative Energy Testing Center will be enhanced to undertake quality testing and quality control of alternative energy technologies.
- Financial support shall be made available for research and technology development in the areas of alternative energy technologies.

The Programs

The Plan has introduced the following programs to achieve its target.

Bio-Energy Program

The Plan continues and introduces the following programs to achieve its goal. Considering increasing popularity of the biogas plants due to its benefits to the rural households in terms of availability of clean cooking fuel and digested slurry, which has established beneficial effects in enhancing agricultural productivity and in environmental conservation, biogas development program will be expanded. During the plan period total of 100,000 biogas plants have been proposed to be developed, including 99,950 family size biogas plants and 50 community/institutional plants. Additional financial support will be provided in order to increase the accessibility of poor and disadvantaged households to biogas technology and development of small size plants shall be given priority besides undertaking research for the development of appropriate plants for upper mountainous regions and ways and means of reducing the cost of plant development.

Similarly, total of 300,000 improved cook stove and other bio-energy systems are proposed to be developed during the plan period in order to improve energy efficiency of conventional fuel, such as fuel wood, improvement in the health and sanitation of the households and reduction of work drudgery on women and children. Research and studies shall be undertaken on bio-fuel production during the plan period. Similarly, feasibility study and promotional activities on such energy production technologies, as, gasifier, briquettes and bio-fuel, shall be undertaken.

Solar Energy Program

Considering the usefulness of solar energy technologies in the areas not connected to national electricity grid and also where feasibility of micro-hydropower development is low, total of 90,000 household size solar electricity system have been proposed to be installed during the plan period

for electricity supply in the rural areas. Similarly, total of 50 solar pumping units have been proposed to be installed during the plan period considering the usefulness of solar pumping units in providing clean drinking water supply in the rural areas. For lighting in the poor households, installation of 140,000 units of solar lantern has been proposed. Considering the usefulness of solar dryers/cookers and water heaters and considering the possibility of meeting the increasing energy demands in the rural areas with the promotion of solar energy technologies, installation of 1500 units of solar dryers/cookers has been targeted.

Installation of 810 solar electricity systems shall be undertaken in the remote rural areas to provide electricity for lighting and operation of computers in government/community schools, for lighting and operation of refrigerator in health centers and for community services with the operation of photocopy machines and facsimile local level. Research and studies shall be undertaken focused to the ways and means of reducing the cost of solar electrical systems and training programs shall be organized to train skilled manpower to undertake repair and maintenance.

Small and Micro-Hydropower Program

Total of 11,500 kilowatts of electrical power has been proposed to be developed through small and micro-hydropower plants from smaller streams in the rural areas during the Plan period. Besides providing electricity for households' uses, promotion of electricity use in the productive activities, such as, development of small-scale trade and industry, contributing directly to employment promotion and supporting rural economy have been proposed. Similarly, installation of 4,000 improved water mills has been proposed during the Plan period.

Wind Energy Program

For wind energy development, besides developing generation capacity for 50 kilowatt of electricity in different parts of the country, activities pertaining to wind mapping and collection of relevant data on wind energy harnessing have been targeted during the plan period. Similarly, in the Districts where wind mapping and collection of wind data have been completed, micro wind turbines have been proposed to be installed for electricity generation.

Estimated Budget

The expenditure towards program implementation for alternative energy

promotion in the Three Years Development Plan has been estimated to be Rs. 4957.0 million at constant prices of F.Y. 2006/07.

Implementation Arrangement

The following implementation arrangements have been made in the Plan.

Information Dissemination System

For information dissemination on alternative energy technologies, the existing resource center under Alternative Energy Development Center will be strengthened and expanded to function as central level resource center and pertinent information shall be disseminated through this center. Similarly, management information system (MIS) shall be developed and strengthened for information and database management. At the District level, Energy and Environment Development Cell/Unit shall be established in coordination with the local level institutions and support shall be provided to expand these units to local level resource center. Information and knowledge dissemination on alternative energy shall also be undertaken through Renewable Energy Service

Centers established at different locations and through local level non-governmental organizations and private sector.

Organizational Structure

Improvement and changes in the existing implementation framework shall be carried out for effective development and expansion of alternative energy development. To achieve this, the Alternative Energy Development Center at the central level will be undertaking such tasks as formulation of policies on alternative/rural energy, research and studies, subsidy implementation, technical supporting, selection of companies/institutions engaged in undertaking installation of energy technologies, coordination with the donor institutions and monitoring and evaluation. Similarly, private sector will be undertaking tasks related to production and installation after sale services and technology transfer needed for the promotion of alternative energy technologies.

Non-governmental organizations shall be engaged in social mobilization, awareness building and information dissemination. The local level institutions shall be undertaking policy formulation, monitoring and evaluation, coordination and resource mobilization at the local level. For development and expansion of alternative energy and for the mobilization and facilitation of credit and subsidy for this purpose, Central Rural Energy

Fund at the central level and District Energy Fund at the District level shall be established. Alongside this regional level service centers will be established in different parts of the country depending upon the needs and in coordination with the local institutions in order to make the development of small and micro-hydropower projects economically viable and operationally sustainable.

Arrangements for Monitoring and Evaluation

The monitoring and evaluation of alternative energy development programs shall be undertaken by the Alternative Energy Promotion Center at the central level and by the local institutions at the local level. On site monitoring and evaluation will be strengthened by institutionalizing geographic and management information system at all levels. The monitoring and evaluation will be undertaken based on result based indicators. The number and capacity of energy technologies, improvement in the economical status, improvement in the status of health and education, employment promotion, operation of energy technology and access to electricity shall be used as indicators in the course of monitoring and evaluation.

Conclusion

Energy, especially, electric source of energy has drawn intensive attention and debates among policy makers, experts, politicians and locals in Nepal. The long hours of darkness (load shedding) in areas receiving power through the national grid of the NEA has forced the government to announce Energy Emergency. Though rural area is also affected, directly and indirectly by this, the urban area which has limited choice to conventional energy sources feels the crunch more.

The rural area which makes technically speaking over 84% of the country's total population has mixed affect on the lack of electricity as a source of energy. As 90% of the rural people still depend o other sources such as biofuel, renewable and others – feel that the long hours of darkness in so called urban areas has made the decision makers and influential people realize intensity of the hardship the rural people have been always facing. They feel that this will help promote other sources of energy beside fossil fuel and electricity. They also think that this problem is an “eye opener” and “awakener” for the policy makers.

The urban people however, feel that this is more than urban – rural issue and that it is a national issue that has created problem for everyone in the

nation directly or indirectly. They suggest that the lack of power has affected industries both big and small, agriculture and non agriculture and production as well as service industry. Therefore, the problem should be looked at non-sectorally and as a national problem which has or will eventually affect everyone.

Both the arguments have certainly made some positive contribution to the whole issue of energy development discourse. The crisis has forced the policy makers to look for other options to conventional energy sources. This has made the henceforth “unfeasible” options feasible; made people more attentive to make adjustments to their energy consumption behavior. The technology has received greater acceptance; people have also shifted to renewable and less consumptive approaches such as CFL lamps, solar powered batteries, even biogas and biomass source of electricity for lightening. This has to some extent has alerted people and general consumer which has certainly contributed to check much greater crisis. However industries that depend on fossil fuel and electricity fill the real impact of the load shedding. This has broader implication on the national economy of the country by implication to the price of consumer goods and employment.

There is no doubt that the whole national system is affected by this energy situation. It is therefore important and useful to examine the whole issue from a systemic prospective. This will only help to come up with appropriate solution to the problem. Such approach will help identify the role and space for policy making and action for all important actors affecting the system. This will also help set the direction for immediate and long term actions. The interface of the system that governs the energy sector and the system that governs the nation will also help clarify the confusions about the responsibilities of different actors and take a positive outlook of the emerging situation.

This paper defines system as a collection of institutional units governed by rules and regulations. By energy system I imply a subsystem that generates, transmits and distributes power as well as the subsystem that receives and consumes power, such as community, households and individuals. By government system I mean the institutions such as Ministry of Water Resources, Department of Electricity Development, Nepal Electricity Authority, Ministry of Environment, Science and Technology, Alternative Energy Promotion Center and others. The system also includes private

sector organizations, such as Federation of Nepal Chamber of Commerce and Industries (FNCCI), CNI, IPPN, and other agencies.

This paper groups the national governance system under three major categories – State, Market/private sector and civil society/cooperatives. The roles and responsibilities of the actors belonging to each category are discussed with elaboration on the role and responsibilities of the Local level government systems.

Effectiveness of a System

Theoretically speaking, for a system to deliver effectively in should include the following qualities;

- **Functional-** Every structure (units) should be functional in order to make the system work.
- **Coordination-** It requires coordination among systems – big system and small system
- **Collective efforts** – system can be active when every units/structure put their collective efforts.
- **Active** – No wire is active unless they are plugged in. So every unit should be provided authority and made active.
- **Responsibility-** Units should be responsible to carry out given or assigned tasks
- **Accountability** – Units should be accountable towards the system

The system should also have clarity of vision, objective identification of problem and issues, clear understanding of challenges and risks, ability to identify opportunity and exploit them, appropriate and adequately funded programs to materialize the intended objective, implementation capacity and a strong monitoring and evaluation mechanism.

The national power system of Nepal seems to be too complex and lacking some of the required qualities and strength to deliver the intended output during this transitional period. It has delivered less than expected mainly because of its own internal problem as well as external factors. The small and local systems are less complex and less affected by the external factors. Therefore, they are capable of delivering the output even in the difficult situation. These finding have implication for policy and program during this transitional stage before the restructuring of the state.

Specifically, the following causes can be attributed to the ineffectiveness of the power development system in Nepal.

1. **Jhola ma Khola** (Rivers and the Bag): One of the reasons for the system to fail deliver is the licensing and enforcement mechanism. The licensing agency, DOED, issues licenses to the promoter but it is weak in monitoring and enforcement for implementing the project. The promoter often times does not implement the project on designated time. It is not easy for the DOED to cancel the license and award it to other promoter. A recent data shows the following.
 - a. Less than 1 mw - 140 projects
 - b. 1-2 mw – 74 projects
 - c. 3-10 mw – 112 projects
 - d. 10 – 100 mw – 11 projects
 - e. more than 100 mw – 65 projects licenses were issued

Most of these projects are yet to be initiated. Many licenses have financial or technical capacity to get them implemented. Most of them are looking for buyers and speculating. This phenomenon, Jhola ma Khola has largely contributed to the absence of projects in line.

2. **Conflict**: The government attributes the current situation to the decade long Maoist led conflict in the country. They substantiate their arguments with a large number of projects of different sizes which were ready to be executed but did not materialize due to the conflict. According to NEA, the conflict-affected projects can be categorized into two groups. Projects destroyed by the Maoists and whose reconstruction process has not started yet and projects that the Maoist did not allow to be implemented during the conflict
3. **Natural causes**: The government also provides the following reasons for not being able to meet the current demand for electricity.
 - a. The Kosi river changed its course and destroyed the transmission tower and a significant length of transmission lines which was used to import power from India to meet the peak demand for electricity.
 - b. The low level of rainfall and declining flow in the run of the river projects reduced the electricity generation.

4. **Costly production:** Nepal Electricity Authority did not want to run the multi fuel plants because of their high per unit cost. It argued that, it will not be able to sell the power to meet its cost of production without government subsidy.
5. **Centralized Planning:** The local government organizations assert that the current situation is a result of highly centralized planning, biased policies and urban centered development paradigm.
6. **Monitization of power:** The power has been calculated in term of money and tradable commodity whole planning for their development. This has ignored certain social and economic benefits, consequently giving lower priority to rural energy development.

General Recommendation

Based on our analysis of energy development system and policies as reflected in the three year interim plan, the following recommendations are made;

- The system should be more decentralized.
- Subsystems that can function independently but that can be integrated when required with the larger (National) system should be promoted.
- The energy sector perspective and the lessons should be brought into the discourse of national debate on federalization of the country.
- The two prong approach taken by the national plan to develop energy should continue.
- The alternate energy promotion and development should be given special priority during the transitional stage.
- The conventional source of energy (Hydropower development) should be given priority for national economic development.
- The institutional structure should be developed such that they support each other.
- The policy, plan and programs should be developed in such a way that the small and the big system complement each other.
- All the major actors and stake holders should be engaged in the development of power sector.

The Role of Local Governments

The local government can help the national government in energy development by addressing some of the issues raised in the Plan. They can do following;

- Help implement government policies at the local level
- Mobilize local resources including remittance to finance the projects
- Collect revenues
- Resolve conflict and facilitate timely implementation of projects
- Mobilize people around issues of national concern
- Effectively monitor project implementation
- Ensure local level distributive justice
- Build local level capacity
- Develop joint partnership with private sector, cooperative and local community

To provide local government to play effective role in the above areas there should be changes in the policies, rules and regulations governing the energy development.

Specific Recommendations for Decentralized Energy Development

The LSGA framework and interim constitution provide some space and role for local governments to play in energy development. However, based on the experiences of the local bodies specifically the District Development Committees, the following recommendation are made to increase their role.

1. Make District Government Chief (the Chair of DDC) chair of the District Water Resources Committees in place of present provision of Chief District Officer (CDO).
2. Redefine the Micro Hydro Project to include up to 1 MW schemes.
3. The District Water Resource Committee Issue licenses for up to 1 MW projects by giving priority to the producer of the same district.
4. The Central Energy Grant be provided through District Development Fund (DDF).
5. The government help develop local level grid to transmit and sell surplus power of the micro hydro power plants to the national system.
6. Make provision for the PPA at the local level with the consent of NEA, DDC and FNCCI.
7. Make provision for 100% central government matching to the local governments annual contribution to the local energy development fund.
8. Make the NEA's customer directives in coordination with the DDC's Energy Unit.
9. The share of the bonus of Carbon Centers from Community Forestry be utilized for energy development through District Government.

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Lalitpur Declaration

Endorsed by National Conference on Rural Energy Development, 2009

Lalitpur Declaration adopted by National Conference on Rural Energy Development

The National Energy Conference jointly organized by Association of District Development Committees of Nepal (ADDCN) and Federation of Nepalese Chambers of Commerce and Industry (FNCCI) on January 22-23, 2009 had passed the following Lalitpur Declaration-2009 (2065). Distinguished personalities, including the then Minister for Water Resource Bishnu Poudel, Minister for Local Development Ramchandra Jha, Secretary at Ministry of Water Resource Shanker Prasad Koirala, Secretary at Ministry of Local Development Punya Prasad Neupane, Secretary at Water and Energy Commission Kishor Thapa, representatives of FNCCI put their signature and endorsed the Declaration. The Declaration is as follow.

Keeping in mind the responsibility of constituting a common forum to reduce the energy crisis prevailing in the country and ensure sustainable development of overall energy sector and its reliable supply, we the participants of National Rural Energy Conference held during January 22-23, 2009 (organizers-Association of District Development Committees of Nepal, Ministry of Local Development, Ministry of Environment, Science and Technology, Alternative Energy Promotion Center, Ministry of Water Resource, Water and Power Commission, Federation of Nepalese Chambers of Commerce and Industry and partner organizations and participating Constituent Assembly (CA) members, Local Development Officers, including representatives of cooperatives, civil society, Non Governmental Organization, journalists and other stakeholders) have adopted Lalitpur Declaration with common commitment of all sides concerned for its implementation by agreeing upon the following points for energy development in Nepal.

- We put emphasis on the policy of domestic supply of energy and pledge for its implementation by mobilizing and utilizing Nepali capital, technology and market at optimum level to free Nepal from current energy crisis.
- The conference has firm belief that a congenial environment to end energy crisis should be created by flowing investment in this sector on the joint venture of private sector, community, cooperative, local and national governments in line with the policy of Public Private Partnership (PPP).
- The conference reaches an understanding to specify provision at policy level to provide license for small and micro hydropower production up to five mega watt under the guidance of local government, make agreement for energy purchase and sale and undertake exchange on lease and fixing of electricity charge through a common mechanism representing local Electricity Authority and District Chamber of Commerce and Industry and consensus.
- We are committed to set up a viable network by explicitly delegating the responsibilities of works and ensuring the resources for the energy development.
- The conference agrees upon an idea to develop a system in a bid to gradually reduce energy supply in unproductive sector by creating an environment where energy could be excessively utilized in productive sector.
- The conference stresses to specify provision of exempting customs duty and Value Added Tax (VAT) on the import of materials, equipments and machinery things necessary for energy production in case of energy entrepreneurs and investors and also underlines that this type of taxes should also be exempted on the manufacturing goods for the purpose of energy production.
- The conference urges the government to pay attention on formulating policy so that financial institutions would provide loan on subsidized interest rate.
- We are agreed to ensure ownership and judicious benefit sharing among people nearby embankment area, stakeholders, local, sub-national and national governments accordingly while utilizing and fixing the rights on energy resources.

- The conference underlines to reduce dependency on traditional energy by exploring and developing environment friendly energy like Ethanol, bio-diesel, ensuring maximum utilization of biogas and Briquette, promoting solar, wind and mercury/heat energy, developing and expanding community forestry area and developing and promoting watershed area. We are also pledged to invest bonus/benefits received from the sale of carbon replaced with the production of environment friendly energy in the area for further energy production. The conference also calls on the government to come up with user friendly policy of exempting tax and customs duty in order to increase the use of electric vehicles.
- The conference believes that the responsibility of mainstreaming all types of energies produced at local level to local, regional and national power grid and puts emphasis on creating appropriate law friendly environment and its effective implementation.
- For the sustainable development of energy sector, the conference calls on the central government to specify provision to add cent per cent grant in the budget allocated by the local government under District Energy Fund. Accommodating an arrangement that carbon trade fund, royalty, development grant share, donor agency grant amount would be accumulated in the District Energy Fund; we are agreed to make an arrangement to implement projects on the partnership between the Fund and private sector under Public Private Partnership (PPP) policy.
- The conference demands the set-up of effective mechanism at distinct level by acquiring or purchasing land necessary for energy development and providing landowner with project share and compensation as per the prevailing relative market price on the effort of local government
- The conference appeals the authority concerned to formulate and enforce special policy that ensures regular dialogue among local people, government and private sector and addresses security issues in order to accomplish hydropower projects on time and mitigate risks created during project implementation.
- The conference also stresses to formulate laws and policies in consistent with the spirit of this Declaration by immediately scrapping or amending the incompatible Acts and Rules.

Evaluation Format

(Indicator)

| S.N. | Indicators | No. | Max No. | Remarks |
|------|--|---------------------------------------|---------|---------|
| 1 | No. of Micro Hydro Scheme installed | 1 - 3 = 7 | 15 | |
| | | 4 - 6 = 10 | | |
| | | Above 6 = 15 | | |
| 2 | Installed Capacity in (KW) | 10 - 20 = 7 | 15 | |
| | | 21 - 40 = 10 | | |
| | | Above 41kw = 15 | | |
| 3 | No of Toilet Attached Biogas (TAB) | 1 - 10 = 5 | 20 | |
| | | 11 - 20 = 10 | | |
| | | 21 - 30 = 15 | | |
| | | Above 30 = 20 | | |
| 4 | No. of Solar home System Installed | 1 - 4 = 2 | 10 | |
| | | 5 - 10 = 4 | | |
| | | 11 - 15 = 6 | | |
| | | Above 15 = 10 | | |
| 5 | No. of Peltric Set Installed | 1 - 4 = 2 | 8 | |
| | | 5 - 10 = 4 | | |
| | | 11 - 15 = 6 | | |
| | | Above 15 = 8 | | |
| 6 | Beneficiary Households <u>Targeted Groups</u> | Upto 100 = 2 | 5 | |
| 7 | | 101 - 300 = 3 | | |
| 8 | | 301 - 500 = 4 | | |
| 9 | | a.Dalits b.Ethnic Above 500 = 5 | | |
| 10 | c. Others | | | |
| 6 | Percentage of dalit & ethnic | 10-20 = 2 | 5 | |
| 7 | | 20 - 40 = 3 | | |
| 8 | | 40 - 60 = 4 | | |
| 9 | | Above 60 = 5 | | |
| 10 | | Sub Total | 78 | |

| S.N. | Indicators | No. | Max No. | Remarks |
|------|---|------------------|------------|---------|
| 1 | No. of Technical Staff related to energy sector | up to 2 = 1 | 3 | |
| | | 2 - 4 = 2 | | |
| | | Above 4 = 3 | | |
| 2 | No. of support staff related to energy sector | 3 -6 = 1 | 3 | |
| | | 7 -10 = 2 | | |
| | | Above 10 = 3 | | |
| 3 | Allocated budget of DDC in Energy Sector | 2-5 % = 1 | 4 | |
| | | 5 - 10% = 2 | | |
| | | 11 - 20%= 3 | | |
| 4 | Actual Expenditure in Energy Sector | Above 20 % =4 | 10 | |
| | | 50- 70% = 5 | | |
| | | 70 - 90%= 7.5 | | |
| 5 | Audit Report (two years) | Above 90 % = 10 | 2 | |
| | | 2 | | |
| | | Sub Total | 22 | |
| | | Total | 100 | |

Participated Districts

| | | | |
|----------|------------------------|-------------|---------------|
| 1 | Kavrepalanchowk | 84.5 | First |
| 2 | Panchthar | 82.5 | Second |
| 3 | Tanahu | 82 | Third |
| 4 | Dhading | 79 | |
| 5 | Nuwakot | 72 | |
| 6 | Dolakha | 68 | |
| 7 | Baglung | 66 | |
| 8 | Tehrathum | 66 | |
| 9 | Achham | 66 | |
| 10 | Dadeldhura | 60 | |
| 11 | Nawalparasi | 55 | |
| 12 | Mustang | 53 | |
| 13 | Makawanpur | 51.5 | |
| 14 | Magdi | 49 | |
| 15 | Jumla | 48 | |
| 16 | Syanja | 46 | |
| 17 | Rukum | 42 | |
| 18 | Bardia | 41 | |
| 19 | Banke | 41 | |
| 20 | Okhaldhunga | 39 | |
| 21 | Rupandehi | 37 | |
| 22 | Jhapa | 36 | |
| 23 | Sunsari | 33 | |
| 24 | Baitadi | 31 | |
| 25 | Khotang | 30 | |
| 26 | Lamjung | 25 | |
| 27 | Doti | 24 | |
| 28 | Chitwan | 5 | |
| 29 | Kanchanpur | 1 | |
| 30 | Rasuwa | 0 | |
| 31 | Kailali | 0 | |

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| 145 | Mr. Rabin Sapkota | student | TU(RD) | |
| 146 | Mr. Khagendra Sapkota | student | TU | |
| 147 | Mr. Saroj Kayastha | Engineer | | |
| 148 | Mr. Upendra | President | CMS | |
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| 150 | Mr. Rajendra Parajuli | Reporter | | |
| 151 | Mr. ShivRaj Regmi | Reporter | Metro FM | 9841424660 |
| 152 | Mr. Tubel Sapkota | | Annapurna post | 9841373208 |
| 153 | Mr. Dipendra | Director | Gondrous Movies | 984141512 |
| 154 | Mr. Bikram Shah | Sub. editor | Kantipur | 5528048/9841752440 |

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| 196 | Mr. Kedar Neupane | Under Secretary | MoLD | |
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| 200 | Mr. Kamal Khadka | Driver | MoLD | |
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| 202 | Mr. Padam Kant Timilsena | | | |
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| 206 | Mr. Govinda Duwal | Member | ADDCN | |
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