UP SCALING MICRO HYDRO
A SUCCESS STORY?

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Introduction

In early 1990s, Practical Action (then Intermediate Technology Sri Lanka, ITSL) embarked on an innovative mode to provide electricity to rural households, deprived of the benefit of having household electricity due to poverty and geographical location. With nearly 70% of the population living in rural areas, grid connected electricity was provided to only 40% of the population[1].ITSL with a mandate to serve the poor to up lift their livelihoods, recognize the need to intervene with the provision of rural household electrification.

Sri Lanka being a country bestowed with abundant rainfall, there is great hydro potential to generate adequate power for household illumination. Backed by experience on micro hydro from Nepal[2] ITSL took the challenge to experiment with micro hydro for rural electrification. Micro hydro technology is nothing new to Sri Lanka. By 1940s there were approximately 500 micro hydro units, mainly in the tea plantations providing power to tea factories. These units were providing a power out put of about 75kw per unit, which matched the factory demand for much of the year[3]. However, the concept of micro (village) hydro for rural electrification was new. Further, "community managed" approach adopted to establish rural electrification was novel.

Since, the first village hydro intervention in Kohugoda in the Matara distract, micro hydro programme has advanced to established more than 250 projects mainly in Southern, Central, Sabaragamuwa and Uva provinces. ITSL used the Community Management approach as a 'model'. 'Electricity Consumer Societies' a village organization formed for development, function and maintenance of village hydro schemes were later hailed as one of the best interventions in sustainable rural electrification[4]. In the process of development, ITSL expanded its micro hydro coverage, conducted research on locally manufactured hardware, influenced policy makers and made an impact as a viable option for off grid electrification. The Ceylon Electricity Board (CEB) recognized the importance of off – grid electrification and the niche for micro hydro. Commitment shown by ITSL on promotion of micro hydro made international donors like the World Bank supporting the programme through the Energy Service Delivery Project . Consistent improvements to the approach and reducing poverty through provision of rural electrification. Influenced National Energy Policy to accept micro hydro as an viable option to rural electrification. This was followed by Sabaragamuwa and Uva Provincial Councils accepting micro hydro in their long term development plans. In the process of development ITSL networked with many local and international organizations. Capacity building of local NGOs and manufacturers of micro hydro hardware reassured organizational and managerial capacity to sustain micro hydro without active support from ITSL. While the concept of micro hydro was well accepted by all stakeholders in Southern Province, introduction of micro hydro to the estate sector in the Central

[1] Miranda R, and R. Gamage (undated) Rural Energy options, Micro/Village Hydro projects in Sri Lanka. ITDG. Colombo.
This is the situation as of 1999. Currently the situation is much improved with nearly 73% covered with grid electricity (Central bank of Sri Lanka, (2003/4), The Consumer Finances and Socio economic Survey Report).

[2] IT Nepal having a strong programme on micro hydro

[3] Breaking Energy Bonds- 'Electricity Consumer Society' and micro hydro- a new approach to decentralized energy development in Sri Lanka.

[4] ITSL was awarded the 'Global Energy Award ' for the best environment friendly rural energy option in 2001.

province was a major breakthrough. With low level of grid electrification and high use of kerosene oil, introduction of off grid electrification through micro hydro was well accepted especially by the estate worker community.

It is over a decade since ITSL first embarked on micro hydro. There are number of success and some failures during the development process. This report attempts to capture some of the highlights in the development process and assess the path of up scaling micro hydro beyond the initial goal of ITSL or "Practical Action" in the present context.

Potential for Micro Hydro

With large scale development of hydro power in 1940s and 1950s peoples lives began to change. Household electricity became a necessity with economic improvements in livelihoods. In spite of large hydro development projects like Laxapana, Victoria, Kothmale etc, government could not meet the electricity demand of all households[5]. Especially, electricity demand in rural areas could not be satisfied due to high transmission cost. This encouraged development of micro hydro for household illumination. However, people had to be satisfied with limited power supply due to restricted power generation.

Table 1 indicates grid electricity development over the past decade.

Table 1 Sources of energy for Lighting by Sectors 1996/97 and 2003/04

Source of Energy for Lighting	Sector			
	Rural		Estate	
	1996/97 [a]	2003/04 [b]	1996/97 [a]	2003/04 [b]
Grid electricity	54.4	71.6	9.8	51.3
Electricity from other sources	1.1	1.8	2.5	1.8
Use of kerosene	44.4	26.5	87.3	46.9

a Excluding Northern and Eastern Province
b Excluding Killinochchi, mannar and Mullaitivu districts
Source : Central Bank of Sri Lanka (2005), The Consumer Finance and Socio economic Survey Report 2003/04 Part I

Table 1 indicates the growth in the energy sector over the past decade. This indicates the policy shift in energy development from predominantly an urban to more rural and estate sector. However, in both the sectors there is still lot of potential for off grid electrification. Use of kerosene oil has reduced over time but more than 40% in the estate sector and over 25% in the rural sector still depends on kerosene for household lighting. These are indication for further development of off grid electrification, i.e micro hydro where adequate hydro potential is available.

[5] Increasing at a rate of 10 % per annum

Breakdown of grid electrification in provinces indicate that Uva, Sabaragamuwa and NCP still holds a large potential for development of off grid electricity (table 2).

Table 2 Source Energy for Lighting by Province (percentage households)

Source of Energy for Lighting				
	Provinces			
	Uva	Sabaragamuwa	NCP	Southern
Grid Electricity	51.3	61.3	59.3	77.6
Electricity from Other sources	5.4	3.7	2.7	0.8
Kerosene	43.2	35.2	38	21.5

Source: Central bank of Sri Lanka, (2005), The Consumer Finance and Socio Economic Survey Report 2003/04.

Table 1 and 2 gives an indication to the extent of possible off grid electricity development. Uva and Sabaragamuwa being two backward provinces[6] hold the best potential for micro hydro development. With high rainfall, approximately, 2000mm and 1500mm respectively, give adequate assurance of hydro potential. High labour force participation in these provinces supports the concept of 'Community Management' in micro hydro development. Thus, Practical Action/private providers should be looking forward to promoting micro hydro in these two provinces with adequate facilities for productive end users of micro hydro power.

Intervention

Challenge ahead of ITSL was to 'achieve a wider up take of micro hydro technology in Sri Lanka'. Strategy adopted was 'to strengthen technological and institutional base to reach a wider geographical coverage for application of micro hydro technology'.
Initial interventions to meet this challenge identified few key factors.

1. Developing a sustainable 'institutional model' which involves all stakeholders.
2. Understanding micro hydro as decentralized energy option
3. Strengthening and Capacity building of local manufacturers for hardware development.

Integration of these factors established a solid base for up scaling of micro hydro as an renewable energy option.
There are few important achievements in this approach. a) Recognizing the importance of rural institutions to develop and manage micro hydro as a rural energy option (change in pre occupation of hardware development).b) taking development and management away from the center and c) having confidence on local manufacturing capacity and capability.
Developing the 'Institutional Model'

Potential for micro hydro development was more in the Southern wet zone characterized by undulating terrain and dense forest vegetation. Establishing micro hydro in these settings required active corporation of people in the area. Active community participation

[6] Low education levels but high labour force participation among age group of 35-44 and 45-54

was essential as they were expected to manage the scheme after completion, impart their knowledge with respect technical specifications and give them a sense of 'ownership' to the scheme. This model realized the value of 'community ownership'. Given the geographical location of micro hydro sites, external agencies will not be able to manage on a long term basis. Thus, establishing community groups for management was the best option for sustainability of micro hydro schemes.

The ITSL model established 'Electricity Consumer Societies' (ECS) based on the principal of 'village development societies' in late 1970s. Membership of ECS was essentially from the micro hydro village. They function as an autonomous body, responsible for raising funds, contributing labour, setting tariff structures and managing operation and maintenance. ESC was ably supported by the 'technical advisory committee' (TAC) of ITSL. Thus the partnership between TAC and ESC bonded well at the initial stages of micro hydro development. It was the mutual understanding between ECS and TAC which later advanced to form the 'micro hydro model'. This model included technological innovations, institutional development and knowledge sharing which subsequently influenced policy makers to accept micro hydro as a viable option for rural electrification.

Strength of ECSs could be attributed to the political environment they were initially established. Deep South in Sri Lanka has a sense of sharing among communities and helping those in need. This was reflected in the tariff structure in most micro hydro schemes initially established in the South. ECS maintained a tariff of Rs 100/ household with a maximum power usage of 100 watts/ household. Any abuses in power use would lead to disconnection. Tariff subsidies or free power were given to poor and invalids so that they will not be 'drop out' in the rural electrification process[7]. Households were willing to donate ones share of power to households in need of extra power at times of social functions. ECS functioned well as long as funds were forthcoming from donors, government and private parties. But in order to access commercial funding through ESD/WB, ECS had to be registered as limited liability companies. This was a major turn of events, where ECS had to compete with private commercial entities for funding. In order to be competitive, ECS had to be technically competent. In the absence of technical capability, they could obtain the services of a consultant, in which case the cost of such service will be beyond the capacity of ESCs. The alternative suggested was to build capacity of village level NGOs to serve in the capacity of technical assistants to facilitate preparation of technical documentation required for external funding. The proposal for mobilizing village NGOs for micro hydro development was a positive step towards up scaling and sustainability of micro hydro in rural areas. Empowering local NGOs will also contribute to the exist strategy of ITSL.

Success of ECSs and the 'micro hydro model' enabled ITSL to approach the estate sector without much resistance. Failure of earlier intervention with the estate sector was due to over emphasis on estate management ignoring the estate worker community who were the beneficiaries of micro hydro electrification.

[7] Rural water supply schemes in the dry zone have not been able to develop a similar system to help the poor and invalids. Social and economic drop outs from mainstream pipe water supply schemes is a common occurrence

'Micro hydro model' was accepted by the community with full community participation in establishing estate hydro schemes. The package of practices which followed the intervention, empowered estate workers to make their own choice and interact with other organization to express their need. This was a major achievement in the process of rural electrification through micro hydro. Experience with estate hydro indicates workers had been bold enough to abandon some of their trusted trade unions and join new unions in order to facilitate micro hydro development in the estate sector.

These are clear pointers towards sustainability of micro hydro schemes and up scaling micro hydro to other estates with similar issues.

Success of the 'micro hydro model' was a key factor for World Bank to include micro hydro in the ESD project. However, process of establishment of ECSs and its functioning was for the well-being of the community as opposed to commercial orientation. It appears that micro hydro projects implemented through ESD did not realized the distinction between serving the community and commercializing power generation through micro hydro projects. The new model under ESD/RERED project allowed a 'project developer' to submit a proposal to the bank (DFCC) and on the strength of the proposal a loan is approved for implementation. However, the model recognizes ESC as the recipient of the loan, for which they are collectively bound to repay. Though ESC is responsible to pay back the loan, they are not equal partners in the process. Often they are unaware of the consequence. They associate the ESD/RERED project as "world development aid"[8]. Studies suggest that 98% of ECS representatives do not have any knowledge of ESD/RERED projects. There is no pre knowledge on the project, awareness and social mobilization which were considered key features of the earlier 'micro hydro model'. Implementing micro hydro under projects under the new model has led to frequent power failure. Poor operation and maintenance, lack of post construction maintenance, dearth of technicians have caused pre mature breakdown of projects leading to inconsistent service resulting in non payment or delayed payment of tariff. Many ECSs face the twin problem of loan repayment and maintaining micro hydro schemes. Often, tariff is not adequate to meet the demand. This is evident more in provinces like Uva, where incident of poverty is high. Many locations selected for micro hydro projects are faced with watershed degradation. Thus, ESC is faced with an added burden of protecting watersheds to maintain minimum flow requirement to sustain the project. Use of wooden poles for transmission cables, replacement of these poles annually or once in two years have compounded environment problems[9] coupled with economic burdens for ECS. With improved economic condition of people and increase in demand for electrical appliances, ESC has to enforce strict controls to maintain uninterrupted electricity supply. ECS believe that these problems are due to poor coordination between project developers, equipment suppliers and the community. Thus, it is proposed that an external intervention is necessary to share knowledge on success stories of micro hydro, create awareness on different models of micro hydro projects along with technical and institutional capacity building programmes for micro hydro communities.

[8] Which is a wrong interpretation as ESD/RERED is a loan scheme which ESC has to pay back with interest.

[9] Federation of ECS and Energy Forum have embarked on programme to replace wooden poles with concrete poles with RERED project support.

The new model for promoting micro hydro denies the benefit of rural electrification to the poor.[10] Technical limitation of transmitting power beyond 1.5 km and cost of power generation (Rs 150,000 per kw) are depriving the poor who are residence within 1.5 km radius. While it was difficult to sustain micro hydro projects on total grants, the method currently used through bank loans appear to favour only those who could afford to pay the loan installment, contribute towards initial project costs (Rs 2500-5000), contribute voluntary labour for civil works and pay for individual house wiring (Rs 5,000- 20,000 depending quality of material, size of the house). Besides these contributions in cash and kind they are also expected to participate in project meeting at the expense of their labour time.

Impact on Poverty

ENPOGEN survey of households in Sri Lanka indicates that 58% of poor and very poor households in the grid area of micro hydro projects can't afford to contribute towards initial project costs. Thus they are 'economic drop outs' from micro hydro projects. Besides, there are others who did not join the mainstream due to lack of understanding, mistrust or personal problems. Unfortunately, due to limitation in generation capacity, there is no provision for those who want to join later.[11]

In the process of up scaling micro hydro, different models have been used by different developers and lending institutions. Often these models indicate progress in terms of number of projects implemented but not necessarily quality of projects in terms of service reliability, tariff collection, operation and maintenance, performance of ESC and sustainability. Instead of serving the poor who are deprived of grid electricity due to their location of residence and poverty, they are further marginalized through the new model. While those who can afford get the benefit of additional power and access to better electrical equipment, others have to suffer in the dark.

This situation is most evident in Uva province where peoples livelihoods depend on subsistence agriculture. Direct impact of micro hydro on poverty is not well established. However, attempts have been made to justify the cause through establishment of productive end users but with mix results (refer productive end uses –conflict of interest). Nevertheless, there is adequate evidence to saving on kerosene (Rs 200-225/ month) and on torch batteries due to use of micro hydro power. However, with the new model where beneficiaries have to repay the loan as well such small saving will be hardly significant. Improved household security due to electrification and reduce risk of kerosene lamp injuries and fatalities are significant benefits poor derive through use of micro hydro power.
Benefits of micro hydro projects vary depending on the category of people. Those who access power through micro hydro schemes for household illumination are direct

[10] Fundamental deviation from the original objective serving the poor who are deprived from grid electricity.
[11] Situation appears very similar to rural water supply projects in Sri Lanka. There are on the average 5-10% economic drop outs in rural water supply schemes (unable to contribute towards initial cash payment and some times not being able to contribute voluntary labour). However, rural water supply schemes have the technical capacity to accommodate later comers but community based organizations charge a penalty for joining late)

beneficiaries[12]. Others who recharge their batteries within an accessible distance and those who are engaged in productive end uses are indirect beneficiaries. The third category are the manufacturers who were trained by ITDG. The last category gained more economic benefits than the first two categories. With increase in demand for micro hydro due to ESD/RERED project and robustness of locally made hardware, manufacturers were in heavy demand. Heavy demand at times have compromised on quality of products. Unfortunately, as at present there is no regulatory regime or quality control of micro hydro equipment.[13] A new group (fourth) of beneficiaries have emerged after micro hydro was open to private sector. 'Project developers' can be individuals or organizations who are directly benefited form ESD/RERED project. While the purpose of developers can be genuine, public view on developers are not too encouraging. Communities see them as profit motivators with least concerned about the society which they are supposed to serve.[14]

Productive End uses – Conflict of Interest

Introduction of micro hydro in early 1990s was primarily for household electrification. Since the success of the preliminary goal of household lighting, concept of 'productive end uses' through day time power was introduced. Initially, the concept was well accepted mainly because productive end uses were expected to serve the community. Thus it was a service associated with micro hydro. Two of the popular end uses were battery charging and grinding and paddy mills. These enterprises, operated at low scale mostly by the ESC itself or individual, at times served the community improve its livelihoods by significantly reducing travel time to obtain these services. Besides, there were few enterprising individuals who ventured to establish ironing centers, tailoring shops and saw mills. These end uses at the initial stages of micro hydro development process were small scale enterprises, established for service or for livelihood purposes. The concept of profit making enterprise development under micro hydro was not an issue. Grid connected micro hydro was the only profit making enterprise which was considered at the initial stages.[15] ITSL documents number of grid connected MH schemes by late year 2000. There was approximately, 3MW installed capacity in operation while, 14.5 MW under construction and 60.5 MW under pre construction stage.[16] However, grid connected micro hydro was not an option to all MH sites. Generation capacity should be high, substantial excesses of generated power, technical and entrepreneurial skills, conducive policy to purchase power and right tariff settings. Some of these were beyond the control of ECSs. Thus, grid connected micro hydro was more suitable for estate hydro with established management and skills already in place.
In phase II[17] micro hydro development most households enjoy more than 100watts/ household, at times 200 -300 watts per household. Thus, day time power generation too

[12] Especially interventions made in the estate sector during late 1990s improved livelihoods of most estate labourers who live in consistent poverty due to style of management. ITSL interventions through estate community instead of estate management resulted in a new phase of estate hydro which continued but may not be in the scale it was anticipated.
[13]Energy Forum is in the process of developing a "Code of Practice and Quality standards for the Micro Hydro Power sector in Sri Lanka"
[14] Energy Forum and ITDG –South Asia (2003), Strengthening Stakeholders: Ensuring the Long term Sustainability of the Village micro Hydro Sector in Sri Lanka.
[15] I would call this phase I, of micro hydro development, as the concept of MH development was more for serving the poor to improve their livelihoods.
[16] Annual report 1999, ITSL
[17] Micro hydro development under ESD/RERED project by 'project developers'

was high. Under this situation, number of entrepreneurial persons have initiated productive end uses. However, ESCs do not necessarily encourage day time productive end uses which consumes substantial power. This can be attributed to number of reasons, disturbing the social equity which ECSs have to maintain in the community. Power fluctuations during day time due to heavy use of power by few individuals, dispute between high power users and normal users and reluctance to change the current flat rate tariff structure to progressive tariff depending on use of electricity. This clearly indicates conflict between the welfare oriented service which micro hydro was initially established and the current development under phase II. Recently conducted surveys identify this scenario as 'ECSs not business oriented'[18]. The conclusion in some of the studies indicate that 12 year old ITDG concept still continues and as a result people are not oriented towards establishing business enterprises from micro hydro power. The pertinent issue in this case therefore is, should business enterprises be pursued under micro hydro? Reluctance of ECS management, technical limitations and non availability of other facilities like, transport, credit and markets are adequate evidence not to promote business enterprises under micro hydro projects. However, business ventures can be profitable under different scenario of enhanced power generation coupled with availability of other facilities.

Knowledge Sharing and Policy Influencing

Wider uptake of micro hydro could not be achieved only by ITSL. High staff turn over and small capacity within ITSL restricted its capacity to broad base micro hydro technology. However, success achieved up to year 2000[19] has made an impact on policy maker and planners. Application of the 'micro hydro model' technical robustness of the technology, information dissemination all accounted to improved knowledge generation and knowledge sharing among a wider section of the public. By 1998, micro hydro project had made major progress through influencing the Ceylon Electricity Board to accept micro hydro as a viable alternative to grid electricity in rural areas. Hence, micro hydro technology was included in the National Energy Policy for the first time. This was followed by ESD/RERED including micro hydro in the credit facility scheme.

Though there was wide scale recognition by the center, it was recognized that wider uptake and sustainability of micro hydro will only be possible with effective participation of Provincial Administration in micro hydro development.

Thus, a concerted effort was made to influence Provincial Administrations in the up take of micro hydro technology. Knowledge generated through research and implementation of micro hydro over number of years were disseminated through the print media, newsletters, workshops and seminars. As a direct result of influencing policymakers, Sabaragamuwa Provincial Administration requested ITSL to present the case of micro hydro to its staff, who were skeptical of benefits of the technology. A successful knowledge sharing through awareness programmes made a major impact on regional rural electrification policy. By 1998, Sabaragamuwa Provincial Council had spent up to

[18] Energy forum (2006) Use of electricity form micro hydro projects for Economic development

[19] 75 village hydro schemes with a combine capacity of 400kw providing electricity and other benefits to over 2000 families in 75 under privileged villages

Rs 2.2 million on three micro hydro projects providing electricity to 130 rural households and a rural hospital.

Subsequently, in 1999, the Sabaragamuwa Provincial Council adopted micro hydro as an option for rural electrification. Policy statement further qualifies with the quote *"…. In addition to medium scale grid connected electricity supply schemes carried out by CEB with the support of Asian Development Bank, Provincil Council shall pay attention to use of off grid micro hydro technology for small rural electrification schemes. PC shall encourage CEB and other privates sector to invest in micro hydro and shall allocate funds from its own decentralized budget and offer administrative support…"*

Following the policy statement, the Sabaragamuwa action plan for 2000-2005 identified the possibility of implementing 35 micro hydro schemes in 14 of the 24 DS areas in the province. Action Plan further illustrates that varying capacity[20] of micro hydro plants could be implemented at a rate of 1kw per 5 households, with a total coverage of 1,650 families. Current status of micro hydro development in Sabaragamuwa province is shown in table 3

Table 3 Annual uptake of Micro Hydro in Sabaragamuwa Province

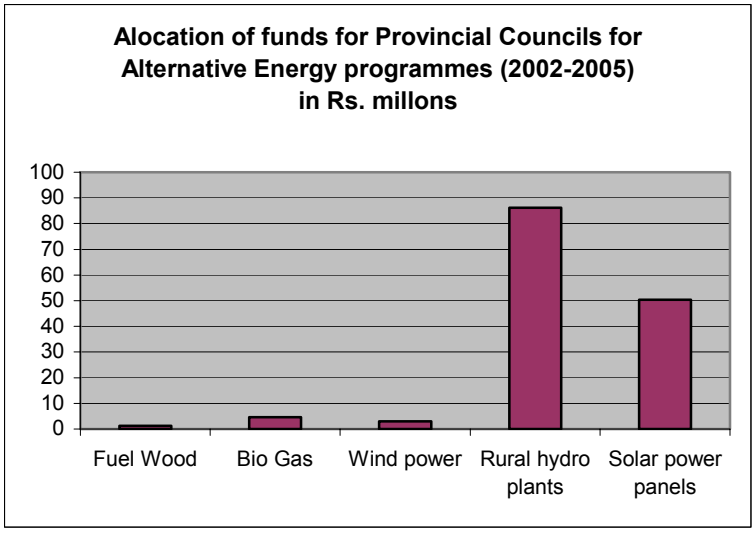
Year	No. of Projects Funded.	Amount Spent by Provincial Council.
2001	15	Rs. 3,998,500.00
2002	39	Rs. 3,970,500.00
2003	20	Rs. 4,350,000.00
TOTAL	74	Rs. 12,319,000.00

While 2000-2005 action plan identifies only 35 micro hydro projects to be implemented, by end of 2003 there were nearly 74 project off ground. This indicates the degree of enthusiasm expressed by the provincial administration.

Provincial Funding Policy for Alternative Energy Programmes

Commitment of Provincial councils for alternative energy sector development is commendable. At present approximately.20-25% of the total budget allocated for rural electrification is assigned for development of alternative energy. Provincial Councils can request for additional funds if they are equipped with long term and medium term rural energy development plans. This can be a niche for a knowledge center to work in the process of up scaling micro hydro in future. The 4 key provincial councils of Sabaragamuwa, Uva, Central and Southern allocate a major share of investments for micro hydro development (fig 1).

[20] Action Plan proposes to implement 5,10,15,20, 25 and 30kw micro hydro in the province.



Source, Energy Forum, [21]

However, Rs 10,000/household allocated under the *Mahinda Chinthanaya* for rural electrification is been used more for promoting solar power as opposed to micro hydro[22]. Allocation priorities to an extent depend on the initiatives of project developers on different alternative energy sources.

In terms of development of hydro schemes and beneficiaries, Sabaragamuwa Province leads with 94 micro hydro schemes benefiting nearly 4200 families, followed by Uva with 22 schemes benefiting 1079 families (table 4)

Table 4 Micro hydro projects, beneficiary families and power generation capacity

Province	2001			2002			2003			2004			2005		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Sabaragamuwa	15	558	107	23	1300	291	34	1721	285	10	298	63	12	353	120
Uva	-	-	-	5	250	50	6	278	50	5	179	40	6	372	69
Southern	-	-	-	3	66	12	2	50	75	1	46	5	2	63	15
Central	-	-	-	2	90	20	-	-	-	2	48	16	2	12	50

Source, Energy Forum

A- Number of projects B- Number of beneficiary families C- Generation in Kw

Total project summary for all four provinces are given in table 5

[21] Energy Forum, An overview of the current provincial Council's Decentralized Alternative Energy Programme

[22] Personal communication with Mr. Bandula Chandrasekera, Programme Coordinator, Energy Forum

Table 5. Total projects, beneficiary families and generation capacity

Province	A	B	C
Sabaragamuwa	94	4230	866
Uwa	22	1079	209
Southern	8	225	107
Central	6	150	86
Total	130	5684	1268

Source; Energy Forum

This indicates the commitment by provincial councils and the RERED (Renewable Energy for Rural Economic Development) project which envisaged a development of the kind that is expressed table 4 and 5.

However, rapid up take of micro hydro schemes through the new model is now creating problems for provincial councils. As mentioned earlier, increase in numbers of projects have compromised on quality, standards and sustainability of project components. There are many problems reported from project implemented during 2002-2005 period. Currently, provincial councils are exploring possibilities of rectifying this problem through standardizing, training and capacity building of project providers, manufacturers and equipment suppliers.

Though there is no common policy for allocation of funds, different Provincial Councils have adopted there own mechanisms for disbursement of funds. Between the four provincial councils 25% -60% of budget for rural electrification is allocated for hydro power projects[23]. While most provincial councils adopt system of community contribution in developing village hydro projects, Southern Province has given total grants by the Southern Development Authority. Deviation from standard practice of project development creates inconsistencies and compromise on quality and standards. Provincial secretaries are expected to formulate a common methodology for disbursement of funds. While Sabaragamuwa PC has developed an innovative fund disbursement methodology, similar methods are not practiced in other provinces. This could be an area of interest for the proposed knowledge center.

Developing Micro Hydro – Policy issues

One of the greatest challenges faced by the micro hydro sector is inconsistency in policy. According to the 13th amendment to the constitution, provincial councils have the powers for '*development, conservation and management of sites and facilities in the province for the generation and promotion of electrical energy'**(other than hydro electric power and power generated to feed the national grid)*[24] . According to this clause, provincial councils have the right to develop and manage all other off grid power projects excluding micro hydro and grid connected hydro. It is this ambiguity in the constitution which makes provincial councils to have their own policy statements and charters from which they derive statutory powers to develop and manage micro hydro

[23] Sabaragamuwa, 20-60%, Uva 40-50%, Southern 60% and central 25-50%.
[24] The Constitution of the Democratic Socialist Republic of Sri Lanka, 13th amendment to the constitution, section 34.

projects. Inconsistency in policy and lack of a common legal framework among provincial councils makes it difficult to relate to a common nation policy on off grid rural electrification. This has led to non existence of an institutional base responsible for off grid power development and management. Lack of clear legislation and policy allows undue influence by politicians, state bureaucracy, financial institutions and equipment suppliers alike.

Lack of clear policy has led to poor coordination between provincial councils and central government regarding rural electrification. Sabaragamuwa provincial council has reported that areas identified for micro hydro electrification has been taken over by the center for grid electrification. Central province had experienced difficulties obtaining necessary approvals due to lack of awareness and interest by provincial officials. Southern PC has identified lack of an independent "authority" as an impediment to promote alternative energy programmes. Similarly, in Uva it is due lack of a clear provincial policy which impedes development of alternatives, especially micro hydro. These are some of the examples cited due to lack of a policy and related legislation on development of alternative energy which includes micro hydro as well.

Initial policy influencing and knowledge sharing among provincial councils by ITSL recognized the niche for micro hydro. As a result provincial councils actively participated in development and promotion of micro hydro as an option for rural electrification. However, consolidation of the initial phase is now faced with the challenge of stabilizing and sustaining micro hydro policy and legislation. Hence, support required in the current phase is for policy formulation, establishment of legislation and development of regulations. Sri Lanka is ailing with numerous legislations and regulations which are not implemented due to various reasons. These regulations envisaged under micro hydro should be adequately flexible for Provincial Councils to implement with existing resources. If these regulations can be affectively implemented it could control poor performance of 'private project developers' which is increasingly becoming a problem for provincial councils. These steps would strengthen development and sustainability of micro hydro as a rural energy option, thus contributing to support government objectives for rural electrification.

The government seeks to promote and support rural electrification in order to ;

1) Expand access to 75% of Sri Lanka's population by 2007 in the most economically efficient manner, including connection to the main grid and where it is not feasible , off grid services at village or household level.
2) Maximize economic, social and environment benefits of rural electrification
3) Maximize the leverage of government resources through participation of private sector and civil society[25]

Institutional Reforms and Networking

While micro hydro development is decentralized to provincial levels, further reforms are advocated by some provincial authorities to boost its development. Experience in working with authorities has influenced Southern provincial administration to propose establishment of an 'authority' while, Sabaragamuwa opts for an 'advisory body' under the ministry of power in the provincial council. Uva, PC proposes to implement micro hydro under 'provincial development plan' without forming new institutions. These

[25] Ministry of Power and Energy, Sri Lanka, Sri Lanka Rural Electrification Programme, November 2002.

suggestions appears to be very typical for governance in Sri Lanka. When issues are not resolve or new ideas to be promoted, immediate reaction is to appoint a committee or establish a new authority/ body. Some of these interventions especially with respect to natural resources management in Sri Lanka have been failures[26]. Therefore what is pertinent will be to work within the existing structure with enhanced capacity building, knowledge sharing and awareness creation, as suggested by the Central provincial council.

At the initial stages of micro hydro development through ITSL, networks were established with government bodies (pre electrification unit, CEB Provincial Councils etc), lending agencies (World Bank, DFCC), NGOs (IDEA) and development organizations (UNDP).Most of these networks were focused at promoting micro hydro. Since consolidation of the concept of micro hydro, networks are essential to share knowledge, dispute resolution and arbitration. While there were informal networks among ECSs in different provinces, the first focused attempt to network among ECSs was initiated by the Energy Forum in the form of a Federation of Electricity Consumer Society (FECS). Currently this is being coordinated by the energy forum and hosed at the same premises. FECS functions as a 'voice of ECSs' Role of energy forum is to facilitate upward mobility of ESC voice to be heard by a wider section of the population. FECS is a registered body under the social services ministry. Its functions are;

1. Improving status and sustainability of village micro hydro schemes.
2. organizing capacity building for its membership in ECSs
3. Networking with various organistions for and individuals for the benefit of ECSs
4. Represent as a national body for all village ECSs and make representations in all activities and fora for the benefit of ESCs at large.

Within the short span of existence FECS has been able to;

1. Register itself as an voluntary organization under the ministry of Social Services
2. Obtain Acceptance as a National Apex body of ECS by RERED project of the World Bank
3. Act as a facilitator to mediate in problem solving between ECSs and relevant institutions in Uva province
4. Publication of a booklet on operation and maintenance on micro hydro
5. Recruitment of a full time coordinator
6. Provide assistance to solve technical and social problems in village micro hydro schemes.

FECS has the potential to play a key role in up scaling micro hydro to a sustaiable rural electrification option. However, it may be necessary for the FECS to network with project developers and equipment suppliers while building strong partnerships with lending institutions other than DFCC. Future success of FECS will largely depend on multi stakeholder nature of the federation.

Provincial Councils too recognize the importance of networking with all concerned stakeholders. Incidentally, provincial councils propose the networks to be used as a quality control mechanism, where 'project developers, equipment supplier and provincial council staff form an alliance to streamline efficient implementation of micro hydro schemes. Sabaragamuwa, Central and Southern provincial councils prefer the network

[26] New institutions often threatens existing institutional structures resulting in immediate resentment from people. Recently aborted water sector reforms is a case in point

to be used as a problem solving mechanism. Hence, there are numerous ways an efficient network may assist build stronger and sustainable partnership between the electricity users, developers and suppliers. The proposed knowledge center can act as a facilitator to identify and help build stronger partnerships among stakeholders.

Role of the State

One of the obstacles identified at all stages of micro hydro development is access to water resources. Dependant on natural water flow to generate hydro power, micro hydro developers have to obtain prior approval to use water resources of the country. Though water use for hydro electric development is a non consumptive use, it could affect water rights of users in the downstream. While there are no established legal rights to water in Sri Lanka, traditional rights through customary use have been accepted as written law in Sri Lanka. In the absence of a clear definition to 'ownership' of water resources[27], various agencies and departments have been approached by 'developers' to obtain approval. It is not very clear whether these agencies have the authority to approve use of water resources for other than intra provincial irrigation works. Micro hydro project developers have been experiencing long delays in approvals due this uncertainty. Some times they have been asked obtain approval from more than one sources, eg, divisional secretary and Forest department.

Facilitating project developers to obtain necessary government approvals will be another task ahead for the proposed knowledge center. It would be an important task to study the13th amendment to the constitution and interpret its section with regards to development of village micro hydro projects[28]

Way Forward

Rural electrification through micro hydro has entered a new phase. Experience up to now in implementing micro hydro by provincial councils through RERED support have had mix results. On the one hand success of micro hydro depends on degree of decentralization and private sector participation. However, there are inherent problems of private sector participation in natural resources development, especially for rural poor. On the other hand it is not possible for an NGO like 'Practical Action' to sustain development of rural electrification. Merits and demerits of the two approaches have to be harmonized.

Some efforts in harmonization are evident with the establishment of Federation Electricity Consumer Society and the facilitator role played by the Energy Forum. However, it has become evident that 'Practical Action' still has a role to play. In late 1990s when ITSL was deliberating on an exist strategy, there were pressures from leading donor agencies like the World Bank, not to exit totally from the micro hydro sector. This was due to the competence and knowledge expressed by ITSL in promoting micro hydro. The situation ironically has come back, after a 10 year cycle. The role,

[27] All water resources including rainwater, surface and ground water in Sri Lanka is a public asset. Draft National Water Resources Policy, October 2005.

[28] 13th amendment to the constitution is clear with regards to use of provincial water for irrigation and land development schemes but use of water for hydro power development is not recognized as a provincial subject.

identified for Practical Action is not only technology development but also policy influencing, knowledge sharing and knowledge generation. It is proposed to establish a *Knowledge Center* on micro hydro development preferably by Practical Action or in collaboration with Energy Forum for knowledge collation, knowledge processing and knowledge dissemination. It is expected that problems currently faced by provincial councils, project developers, equipment manufacturers and consumers will be discussed at the knowledge center and remedial action taken accordingly. Rapid development of micro hydro needs to be supported by a 'One Stop Shop' for information. Currently this function is partly performed by FECS and EF. However, the need is for a comprehensive knowledge center where all information can be obtained without delay for efficient implementation of micro hydro projects in future, fig 2.

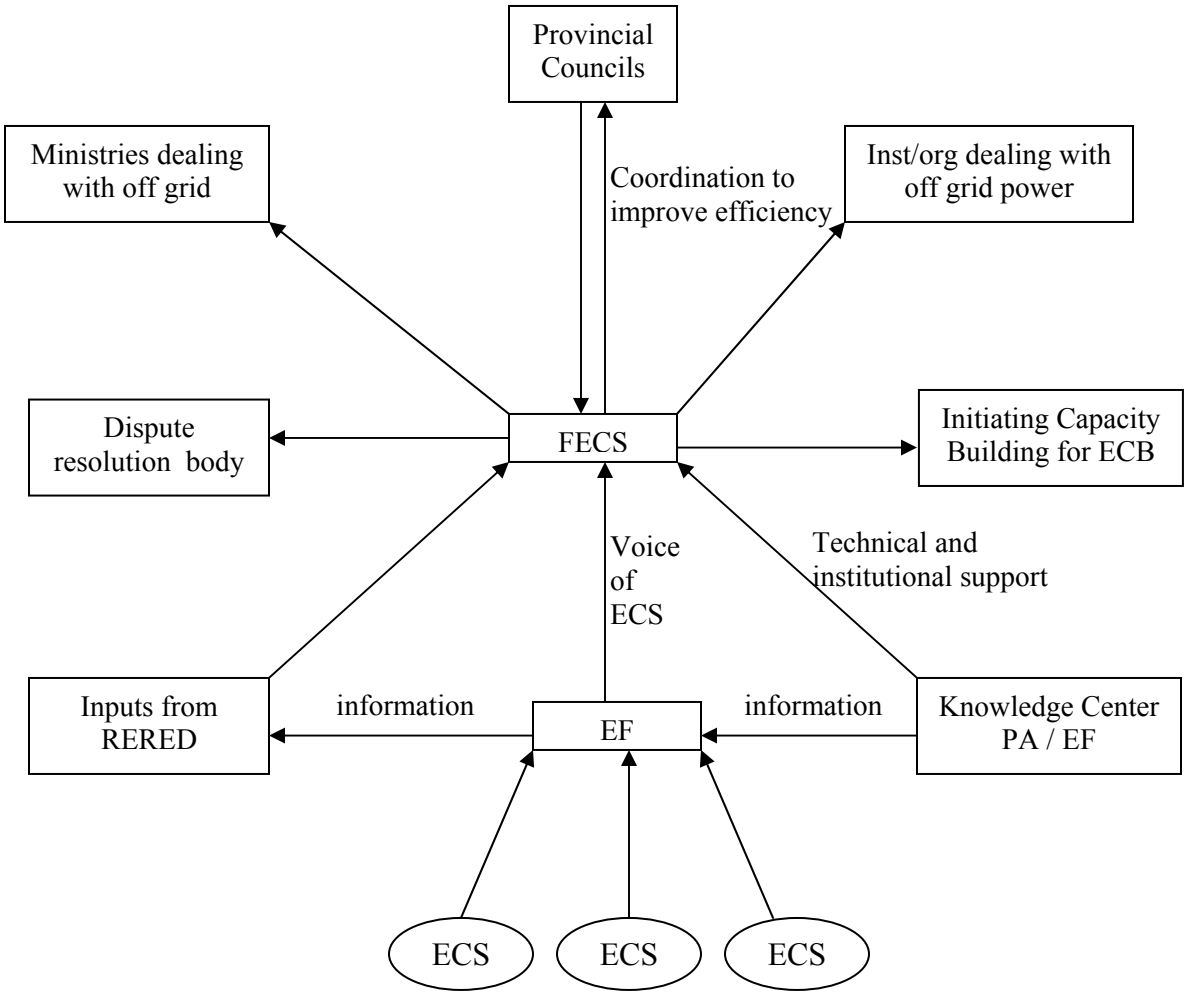


Fig 2. Up Scaling Micro Hydro- Potential Institutional structure

Concept of a Knowledge Center

In spite of rapid development of rural grid connected electrification over the past decade, potential for off grid electrification especially, development of micro hydro is high. Currently, number of players have entered the village micro hydro market. Opening of

micro hydro to private sector developers have increased the efficiency of project implementation. However, the process of micro hydro development entails involvement of the State (approval and clearances), provincial councils (decentralized programme implementers), private sector and NGOs (project developers), manufactures and equipment suppliers (project supporters) Electricity consumer societies and FECS (representatives of consumers) and consumers. All these stakeholders have a role to play and have a wealth of knowledge and experiences. Since phase II of micro hydro development (through PC and RERED project), there are number of issues that needs to be address as priority if the project is to be a success. There are technological , institutional, policy, capacity building and management issues for which reliable data and information is a necessity . Currently, most players in the industry do not have access to good reliable information. However, those who have been involved in micro hydro development do have a wealth of knowledge, information and data (in some cases). It is very important that this information is collated in a central place for easy access. It is proposed that the knowledge center performs this function and make use of the information in future development of the industry and especially for policy influencing. Though the initial phase of policy influencing was successful, the need to formulate a consistent micro hydro policy for provinces still exist. There are issues with regards to use of streams and water ways for micro hydro development. Knowledge center should be in a position to address these issues through right interventions. Knowledge sharing will be one of the main tools for development of micro hydro in future.

Once the Knowledge center is well developed it should be accessible to regional partners as well. Thus, in the long term it should be a center of excellence to all partners and interested parties on Micro Hydro in South Asia

Objectives of the knowledge center
To establish a knowledge center which would strengthen the current weak knowledge sharing function among different stakeholders locally and regionally and to ensure sustainable village micro hydro development and management in South Asia

Output

- Establish an active village micro hydro knowledge center
- Establish a centralized data and information system which is accessible to all partners including developers, manufactures, consumers and policy makers

Outcome

- Local and Regional partners are better informed of good village micro hydro (VMH) schemes
- Donors will be better informed of information generated at country and regional level.
- Strengthened interactions and new partnerships established
- Better opportunity for partners to access reliable information.

Activities

- Policy influencing and advocacy
- Research and development, eg low head turbines,
- Increasing geographical coverage.

- Strengthening provincial councils with consistent policy formulation
- Strengthening institutional mechanisms, eg FECS, private – community partnerships
- Capacity building of provincial staff, manufactures and developers.
- Establishing quality standards for micro hydro development
- Improved coordination between national institutional (CEB) and Provincial Councils

Conclusions and Recommendations

Clearly there are two phases of Micro Hydro development in Sri Lanka. Phase I was the more welfare oriented community projects implemented essentially by NGO. Phase II was more market oriented private projects. While both had their own distinguishing characters, both worked for rural communities. Future up scaling micro hydro in Sri Lanka depends on decentralized provincial institutions , private providers and World Bank supported RERED loan scheme. However, the approach adopted by phase II, implementers are not too favorable for rural communities. Involvement of ECS as community representatives in phase II loan scheme is not very clear. However, ECSs have to pay back the loan with interest and maintain the micro hydro system, which is difficult with a uniform tariff system. This system therefore is not sustainable unless action is taken to rectify the problem with subsidies or high tariff. Increasing tariff could further marginalized the poor precipitating in absolute poverty.

Lack of quality standards is adding to the problem of poor performance and maintenance of private micro hydro schemes. Technical problems have often resulted in institutional and social fall outs. While the national government recognizes micro hydro as a viable option, policy support for development is inadequate. Up take of micro hydro by provincial councils is impressive over the last 5 years. However, there are issues which need to be addressed on a priority basis for successful micro hydro development as a decentralized option. A consistent policy for MH development in all provincial councils is an urgent need for future sustainability of MH programmes. While the institutional structure for implementation of MH has improved over time, functions and links needs to be further strengthened.

Federation of Electricity Consumer Society (FECS) will be the key institutional body in future up take of MH. FECS should be supported by the Energy Forum and the proposed Knowledge Center to strengthen its position.

MH development has been essentially limited to pelton wheel technology. This need to be broaden to cover low flow, cross flow type technologies. Research and development in innovative technology development will be essential in future.

Finally, if the concept of Knowledge Center can be realized, it can be a central store house for information and knowledge which will be vital in rapid development of MH under phase II. It should be noted that the knowledge center should be in a position to provide adequate information and support to sustain MH development beyond 2007, by with time additional support mechanisms will be identified.