# Gender Mainstreaming in Pico Hydro Technology

*Policy brief*

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## Summary

Pico hydro is an alternative energy source for scattered and isolated households which lack access to the national grid or other community based energy systems. The use of pico hydro technology carries with it important economic, environmental and social benefits, for women in particular. Given its success on the ground, the recognition and promotion of this simple technology needs to take place at the policy level to ensure an enabling environment for it to spread with adequate financial and service support for users.


## Background

Sri Lanka is, like its many Asian counterparts, becoming increasingly dependent on fossil fuels to generate energy. The comparative high efficiency and well developed market delivery systems of these fuels make them an increasingly popular energy source. However, linked to this fuel source are negative environmental impacts and the inability for large power networks using this fuel to reach isolated communities. Technology like pico hydro makes energy more accessible for those who do not have access to large grid energy supplies. Using locally available resources, this simple technology provides energy access to communities in isolated areas with access to water resources. Inextricably linked to household energy is energy for women. It is often the women in these rural communities that run the households and as such are in charge of meeting the energy needs of the family. With technology like pico hydro most of the basic energy needs of a household can be satisfied. The need to support the use of this technology and build the efficiency of these units is important in bringing about a certain level of energy independence and development.

Pico hydro technology uses the potential energy or kinetic energy of water streams to generate electricity. Usually the power generation range is less than 1kW but in this policy brief a generation potential of up to 2 kW is considered[1].

Pico hydro technology was very popular approximately 100 years ago in Sri Lanka, especially in the tea plantation areas where water resources were in abundance. However, the use of the technology has gradually faded away due to the expansion of the national grid and the low efficiency of the system compared to other energy alternatives. The Sri Lanka Domestic Pico Hydro Survey carried out in 2005/6 by a group of engineers from Engineers Without Borders (EWB) revealed that there are still over 300 indigenous pico hydro systems in operation in the central part of the country, mainly in areas to which the national electricity grid has not yet been extended. The efficiency of these systems remains low, in some instances as low as 8%. The survey also revealed that there are over 5,000 potential sites for pico hydro installation in Sri Lanka. The combined total potential capacity of these sites is estimated to be over 5 MW. Based on the aforementioned study Practical Action has carried out extensive research in to the development of the pico hydro technology and has been able to improve the efficiency levels up to 40%. Over 40 pico hydro systems have been installed at field level and the entire system and technology has proven to be viable in terms of scaling up at national level.

1 the classification is not universal (eg: in China up to 10kW is considered under Pico)

## As a Power Source

The central National Electricity Grid is the most preferred means of obtaining electricity due to its capacity and quality of power. However, at least 5% of Sri Lankan households will not be able to connect to the national grid due to geographical and economic constraints. These households should be provided with suitable alternatives which can provide quality power to fulfil their main energy needs.

Most of these houses will be located in remote hilly terrains in the Central, Uva, Sabaragamuwa, and Southern Provinces where the presence of free flowing water falls and streams provide ideal locations for pico hydro units. The power generated from efficiency improved pico hydro units can be sufficient for domestic lighting and for TV/mobile charging etc. The quality of electricity is on par with the national grid and for most of the locations it will be available at least for a period of 10 months of the year.

## Economic Benefit

Generating hydroelectricity remains the cheapest form of electricity generation to date (compared to all other methods) according to Ceylon Electricity Board's (CEB) statistics. Therefore a combined total capacity of 3MW installed through 4,000 units (assuming 60% of the total potential is utilised) will save 9 million units per year which would otherwise have to be generated through the CEB by burning fossil fuel in thermal power plants. At present, the cost of generating a thermal unit of power is more than LKR 20. Thus, the use of pico hydro technology would result in a saving of LKR 180 – 63 million annually for the country. These units if integrated in to a national recording system will also create an opportunity for carbon trading.

In terms of the individual household the average investment required for a pico hydro system is approximately LKR 100,000. Installing a pico hydro unit will result in households saving on the cost of kerosene used for lighting purposes, and the battery charging cost to watch TV - an estimated net saving of LKR 1,000 per month. As such, the unit would pay for itself in 9 years. Another additional benefit is that the electricity which is generated during daylight hours could be used by women (who most often are at home during these hours) to engage in some form income generating activity or to make existing small cottage industries more efficient and cost effective. This would not only help bring in additional income to the family but also ensure that the power produced during the daytime does not go to waste.

## Environmental Benefit

Renewable energy provides the best alternative to the current global warming and climate change issues created by the extensive use of fossil fuel. Small scale energy systems are ideal solutions as they take in to account the sustainability of the energy source and incurs minimum disturbance to the existing ecological system. The reliance on a local resource, such as streams/rivers, for power will promote the beneficiaries to protect the catchment area of the water resource as it would otherwise deprive them of electricity. In general the $CO_2$ emission saving per annum by a combined total installed capacity of 3MW of pico hydro units would be 8,100 tonnes of kilograms[2].

The clean and safe energy produced by a pico hydro unit is a benefit to the whole family. Often the responsibility of energy within the household rests with the women – from lighting kerosene lamps for illumination to collecting firewood for cooking and boiling water. The illumination provided by harnessing power generated from the pico hydro unit is cleaner and safer than using kerosene.

2 Source: Carbon Dioxide Emissions from the Generation of Electric Power in the United States, July 2000 http://www.eia.gov/cneaf/electricity/page/co2_report/co2report.html

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## Social Benefit

Given that the entire pico hydro technology is localised, this means that all the instruments/ equipment can either be manufactured locally or obtained easily from local hardware shops. This creates a very conducive environment for developing a highly sustainable local industry which is capable of generating and maintaining its electricity requirements. The simplicity of the entire pico hydro system creates ample opportunities for young people, especially young women, to enter in to this new pico hydro industry thus creating new job opportunities. Income generated from this as well as small cottage industries supported by the pico hydro energy supply can help uplift the living standards of the respective communities.

In addition, the actual process of installing a pico hydro provides potential for the upliftment women. While helping to improve the living standards and energy independence of the family, the process of installing a unit also increases the involvement of women in making decisions for the family regarding their energy needs and use. It should be noted that women provide useful inputs during the planning, installation and operation of a pico hydro unit as they have the most knowledge of the streams (from which they fetch water, bath and wash clothes etc.) and the household energy needs/ patterns of use, and they are also often times at home and can therefore operate the unit. The use of hydroelectricity to carry out household duties, such as boiling water etc. also means that less firewood is used and as a result women's exposure to indoor pollution is also reduced.

## Policy Adaptations and Improvements

While the debate over what energy source would best answer the energy needs of the country, it is essential that the energy poor are not overlooked in energy policy considerations. Often simple, home grown, technology such as pico hydro provides an answer to meet basic energy needs. The following recommendations are proposed in order to make such a technology viable, effective and responsive .

- Pico hydro should essentially be promoted keeping in mind the wide range of benefits it can provide to society.
- Overall coordination among relevant ministries - for example power and energy, small businesses, women's affairs - should be improved to develop integrated plans to utilise the benefits derived from installing pico hydro units at domestic level.
- Policies should be in place at provincial level to utilise at least 60% of the total pico hydro potential in each of the provinces.
- Local manufacturers and implementers should be developed through Vidatha Centers
- Pico hydro technicians courses should be included at provincial vocational training institutes. A special focus should be given to encourage young women to get trained as field officers and technicians as this will create good job opportunities in the local environment.
- It is important to ensure that the technology is user friendly and that the operators of the unit (who are usually women in the household) are able to handle the equipment with ease.
- A provincial level certification schemes should be developed to maintain the quality of production, installation and maintenance. Such a system would involve having certifications for installers and engineers who install and maintain the pico hydro systems.
- Financial mechanisms should be developed to create a level playing field with other energy alternatives (to support the beneficiaries) by
  - Giving subsidies similar to what is given to kerosene – A grant should be given to a household willing to install a pico hydro unit. The amount can be

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equivalent to the amount of kerosene saved (for example during a period of 10 years ) as the government will have to incur this cost anyway if the users continue to use kerosene, but the grant given for pico hydro installation will be channelled back to the local economy.

- Providing loan schemes at low interest rates
- Developing a carbon saving fund through the national government and provide incentives to pico hydro users. The central government can record all pico hydro installations under one project and apply for carbon credits/ or carbon saving funds ( for example Global Environment Fund grant and World Bank funds). These funds can then be used to provide grants for pico hydro installation and research work.
- Relaxing loan scheme mechanisms for women headed households (for example where in most cases the head of the household does not have a permanent job but still will be able to pay the cost of the hydro unit).

*Pico hydro providing light for rural houses in Sri Lanka*

## Cost benefit analysis of installing a Pico Hydro Unit

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|---|---|
| Cost of installing one unit | LKR 150,000 |
| Saving of kerosene and travel time per year | LKR 9,500 |
| Saving of $CO_2$ kilograms per year | 130 kg |

*Source : www.carbonfootprint.com

Note : The additional income generation possibilities from the excess power generated during day time has to be calculated separately based on the local environment

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This policy brief has been funded by ENERGIA