

MINI HYDRO-POWER PROJECTS AND HUMAN ISSUES

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Sri Lanka is blessed with high rainfalls, especially in and around the central mountain regions. The heavy rainfall and sloping nature of the land has resulted in a number of small and large streams carrying water around the year, allowing a number of reservoirs the power of generating and fulfilling substantial parts of the country's power requirement. While the government carries out large power generation projects, projects that are less than 10MW capacity have been permitted to the private sector. Many local companies investigate possible locations and when given the green light, construct and install power plants and the produced power is sold to the Ceylon Electricity Board.

History

During the colonial era, tea and rubber factories in the hill country had over 400 mini hydro-power generation units supplying the bulk of their electrical power needs. In the 1970's the commissioning of power stations around Laxapana, the CEB forced the factories to close down small generation units. During the 1980's Premasiri Sumanasekara who introduced the locally made cheap school mini-labs under the Vidya Silpa concept, recommissioned some of these abandoned power plants. With the knowledge and experience gained, he was responsible for the first private hydro-power generation unit at Dick-Oya, with a capacity of 1 MW and supplied power to the CEB.

Power plan

According to the 2015 report on "Sri Lanka Energy Sector Development Plan for a Knowledge-based Economy, 2015 - 2025," the country's total power generation capacity amounted to 4,050MW consisting of 900MW from coal, 1,335 from oil burning thermal, 1,375 from hydro-power and 442 from non-conventional sources such as wind, mini-hydro, bio-mass and solar power.

Presently, over 15 private sector companies are engaged in mini hydro-power projects and supply 293MW of power generated in 150 power plants to the national grid, which amounts to 17.5% of hydro-power generation in the country. The same report envisages the utilization of all possible locations contributing of 873MW of power by the year 2025.

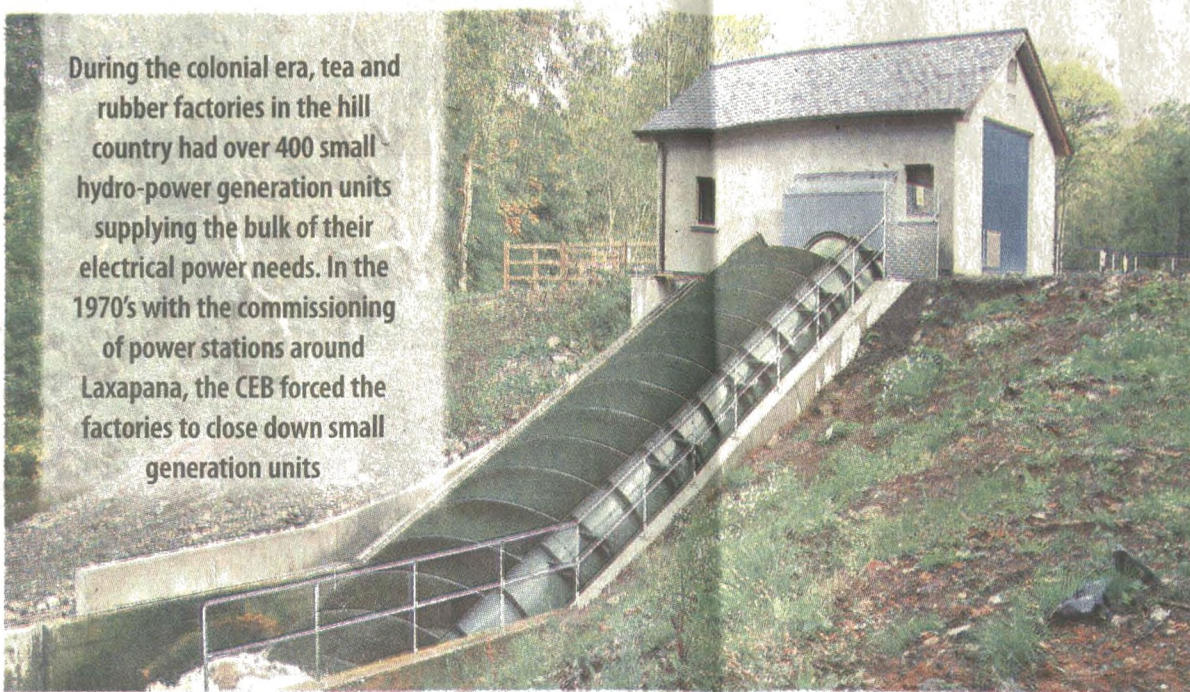
Structure of a mini power plant

The power of water flowing down a stream or a river could be used for the generation of hydro-electricity. The quantum of power generated would depend on the water quantity and the height difference between the collection point and the generator location referred to as head. Thus streams in heavy rainfall regions, with high ground level variations over short distances (steep slopes) are suited for power plants.

Water in the stream is diverted by a mini dam; generally referred as weir, into an open channel (the 'intake'). High dams store water for major power projects, but in mini-hydro storage is disallowed. The dam is incorporated with a permanently open outlet, allowing a pre-determined minimum water flow to fulfill needs of down-stream users for domestic and agricultural, for survival of fish living in streams and drinking water requirements of animals. The weir also incorporates a spillway to discharge excess water during heavy rains.

The weir would divert the water to a concrete channel and will enter the desilting tank (a settling basin), that would settle sand and mud brought by the stream. The channel follows the contour of the hillside to preserve the elevation of diverted water. At the end of the channel,

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water enters a tank known as the 'forebay'. The forebay tank forms the connection between the channel and the penstock. The forebay tank allows the last sand particles to settle down before the water enters the penstock. A sluice arrangement allows to close the entrance to the pen stock and divert water to a spillway, bypassing turbines. The penstock pipes are generally steel, conveys water under pressure from the forebay tank to the turbine, which generates power. After power generation, water is led to tail-race back into the stream.

Approval of a mini-hydro project

Mini hydro projects are implemented by private developers. Getting acceptance and approval of a mini-hydro power project involves extensive investigations and going through masses of red tape as summarized below.

When a developer discovers a possible location for a hydro-power plant, he would investigate the viability and submit an application to the Sustainable Energy Authority (SEA), who would issue a provisional approval (PA) for development. With the PA, the developer would apply for a Letter of Intent from the CEB and environmental approval from the Central Environmental Authority (CEA).

The CEA would refer the application to another authority acting as Project Approving Agency (PAA). The PAA sets in scoping meetings and government agencies from which the developer needs to get approval for the project, which would include no objections from the Grama Sevaka and Divisional Secretary, who would call public meetings. PAA also would issue terms of reference (TOR) for an initial environmental examination report (IEER).

The developer submits the IEER to PAA along with other approvals to be evaluated by the technical evaluation committee (TEC) appointed by PAA. If accepted, environmental clearance is issued to CEA for the Energy Permit (EP).

With the receipt of EP, the developer is permitted to commence physical construction at the proposed site. The developer would submit an application from the Public Utilities Commission of Sri Lanka (PUC) for Energy License and apply for signing a Power Purchase Agreement with the CEB.

Developing a mini-hydro project

While the technical feasibility evaluation of a project would be straight forward, the environmental aspects

could be extremely complicated. Most feasible projects are located in steep mountainous terrains, providing high head over a short distance, are difficult to access and sometimes the stream may have cascades or minor waterfalls. These regions are sparsely populated, but surrounding regions would be populated, as only very few areas in the country are uninhabited.

The weir and intake are located on the stream, the channel conveying water could be over a kilometer in length, the penstock is located on a steep slope ending at the power house by the stream. The construction of the weir, channel and especially the power house would require rock excavation and blasting. Most structure locations are inaccessible and developer need to build roads or improve existing foot-paths to allow construction vehicles and equipment. Power generators are very heavy and after construction, operation of the plant needs regular access, thus proper roads are required.

Environmental concerns

The acquisition of lands for locating structures as well as access roads and modifications carried out to the existing stream and neighboring grounds that have been receiving heavy criticism from environmental groups. Presently, the country having developed over 150 projects, developers are experienced and are extremely concerned of environmental issues during the design and construction phases. The acquisition of lands from private individuals would be mostly for the widening and improvement of access roads and sometimes bridges, which are negotiated and paid by the developer, would facilitate villagers as well.

But some extent of damage mostly temporally, cannot be avoided to stream beds and immediate surroundings during the construction. The highest land requirement would be for the channel carrying water from the weir to power plant, requires around 5m width and could be over a kilometer long. The total land requirement for a mini-hydro project would be around 5 acres.

The environmental approval process requires no objections from the Grama Sevaka and the Divisional Secretary, who would call for public meetings to discuss the project's impact with the villagers.

Objections by environmentalists

Although a project may not be objected by the majority of villagers, could be subjected to severe criticism from environmental groups along with some villagers. Most of their criticisms would be based on the following:

1. The project location - the stream, is a paradise for fresh water fish, with a number of species discovered in this unique habitat and the indigenous fish would be endangered by the proposed project.
2. Change of water flow in the stream would be a death sentence to many species living in the micro-habitat, not only fish, other amphibians and fresh water crabs would be affected.
3. Bio-diversity rich region hosting aquatic orchids found in spray zones of waterfall, would be destroyed when the flow in the waterfall gets reduced.
4. The cascades and waterfalls enjoyed by locals and foreign visitors, would disappear due to diversion of the stream.
5. Damaging the buffer zone of Sinharaja, the World Heritage rainforest complex.
6. Possibility of negligence of developers could cause massive environmental destruction, affecting the stream, rainforest, soil and endemic fish in the region.
7. The dam would obstruct fish moving upstream for egg-laying.
8. In one statement, environmentalists have been claimed of destroying of 6.5km stretch of stream.
9. In another, they claimed the power generation would change pH value (acidity) of water.

Reality

1. Most of our streams in the wet zone are alive with small fish, but power generators are forced to instal a permanent opening in the weir, which could not be closed, would allow agreed minimum amount of water flow for fish as well as users downstream from the weir. The entire water quantity would be discharged back to the stream after power generation. The reduction of the water flow is only between the weir and the power house.
2. Aquatic orchids found in spray zones of the waterfall are only imagination. However, wild orchids do exist in Sinharaja and the wet zone. In Matugama, Agalawatta and Kalutara during the Vesak / Poson period, villagers bring loads of Vesak orchids for sale.
3. It is common for environmentalists to refer most regions in the hill-country as Sinharaja World Heritage buffer zones.
4. Large number of cascades and minor waterfalls exist in proposed projects due to steep change of elevation in streams. Any waterfall in the list of waterfalls would not be allowed for development. In cascades, the minimum stipulated flow would not allow the cascade to disappear. The improvement of access roads by the developers would allow the region to be more accessible to visitors.
5. Negligence on the part of Developer's staff is a possibility and the developers should take action to prevent any accidents and if do happen, the developer should be heavily fined.

6. Salmon moving upstream for egg-laying is common in cold Western countries, but similar local fish is unheard of.
7. The claim of destroying of 6.5km stretch of stream is unlikely. I have details of 34 power plants in the country, the maximum canal length is 3,928m, the minimum 174m and the average length amounts to 1,299m.
8. The change of PH or acidity levels in water gone through a generator is impossible as no chemicals are added during the generation process.

Location and ownership of hydro projects

Analysis of 34 power plants indicating ownership of lands where power plants were built, as follows:

- Forest 01
- Forest and private 01
- LRCO 2
- Plantations 07
- State 02
- State and private 12
- Private 08
- Temple 01

The above shows forest land were used only in two out of 34 plants, most were state and private properties, the projects in plantations were executed in collaboration with plantation companies.

Destroying of forests

Some claim mini-hydro projects destroy forests. A power project produces at an average of 2.5MW of power and uses nearly 5 acres of land, mostly for the channel occupying a 5m wide stretch. Sri Lanka's hydro-electricity generation is 1,375MW and total power generation capacity (coal, diesel and hydro) amounts to around 4,000MW. If this total power requirement were supplied by mini-hydro, it would occupy 10,000 acres. Meanwhile, Kotmale Oya reservoir alone occupies 5,750 acres, thus considering land usage, mini-hydro the requirement is negligible.

Projects challenged by protestors

Most actions by humans would harm the environment even in a minor manner and even the meticulously planned and executed project would not satisfy every individual. Some others would be jealous and minor differences among villagers flare up. Local politicians may feel that they were not consulted or were not given sufficient prominence. These minor differences are used by so-called environmentalists, politicians and individuals to create protests. Unfortunately, for some environmentalists in the country, environmental concerns and protests are only for their income generation. They protests over flimsy incidents, with people holding placards, which lasts for only half hour, until video-clips are produced. Our TV channels too are prepared to broadcast video-clips without investigating its in depth. Some so-called environmentalists are being paid by NGOs from overseas and to get the next payment instalment they are expected to submit a progress report.

Benefits to the country

Mini-hydro organizations boast of their risk taking pioneering effects, with a long-term profit concept, ability to adapt global know-how into local ventures and their efforts being recognized by the World Bank as the "best performing project" of its kind. Mini-hydros claim to have produced 902 GWh of electricity in 2013 and if the same was generated by coal, the country would have spent Rs.19.2 billion they have saved for foreign exchange. They also claim that if power was generated by coal or oil, the environment damage due to emission of gases would have been enormous.

Projects and the locals

Most mini-hydro projects are mostly located in difficult to access, mountainous regions with sparse population. While some projects which were improperly planned could harm the environment, but decades of experience, most developers are concerned of environments and introduce measures to control and mitigate possible environmental and human problems. Improvement of access roads would help villagers, while construction activities would provide employment to villagers and running projects would employ locals. All in all, the villagers would benefit by the project.

But human issues are more complicated, petty differences among villagers and political issues could delay or cancel a project. This aspect is being manipulated by environmentalists and politicians to serve their own ends. Manipulated public protests and TV reporting would scare government officials who are expected to approve the project with public consultation. Public officials who dislike being involved in controversies, would refuse to approve or delay approvals, placing the developer in a dilemma.

Balancing concerns

Mini hydro projects developed by the private sector with no financial contributions from the government have made substantial contributions to the country. Their endeavor, especially in a field of technology and export drive need to be commended and an example to others.

As envisaged by the "Energy Sector Development Plan," Sri Lanka needs to develop every possible source of hydro-electricity by 2025, which would prevent the drain of foreign exchange. Local industries have matured to handle projects with environmental concerns, while respecting interests of local populace. Today, practically every possible location numbering around 800, have been identified for mini-hydro generation, but the majority are not financially viable. Private developers are awaiting the green light from the CEB to implement viable projects. But the CEB has a programme and will the CEB be willing to accept more power producers beyond their programme? The quicker implementation of all possible hydro power projects, mini or otherwise, would benefit the country.

The approval process of projects include, in-built conditions addressing environmental concerns and when agreed conditions are implemented, damage to the environment would be minimal. Government officers and environmentalists too need to look at projects in a more positive manner, but this should not be a license to create havoc with the environment. Everyone from developers, government officials and environmentalists should work together for the development of the country and the benefit of the local population.