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Summary

The main source of power generation in Sri Lanka is hydropower. Four main hydropower schemes have been completed in the country so far which contribute to around 75 per cent of the total power generated.

Some of the positive effects of these schemes are mass scale power generation, supply of water for irrigation and domestic purposes, increase in employment opportunities, development of infrastructural and basic need facilities, flood control and conservation of wildlife. Mass scale evacuation of people, destruction of valuable forest and nature reserves, displacement of indigenous people, degradation of downstream water and land and loss of waterfalls are some of the drawbacks of such schemes among many others.

Frequent power cuts introduced during droughts cause much inconvenience to people and adversely affect the country's economy. Therefore thermal, wind and other means of power generation need to be explored and considered to reduce the mere dependency on hydropower.

1.0 **Introduction**

Sri Lanka is a tropical island situated southeast of the Indian subcontinent with a land area of 65,525 square kilometres. The topology and climate of the country along with the traditional dietary habits of its people having rice as their staple food, have determined the country's development on an agricultural and hydraulic basis from ancient times. Therefore there's always been a great need to conserve water received from rain for cultivation purposes [1].

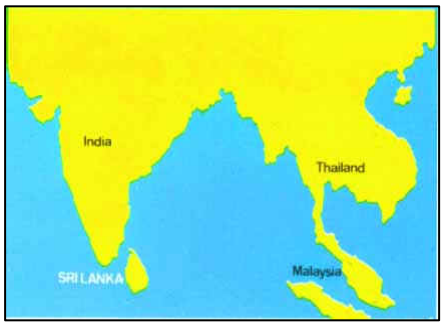


Illustration 01: General location of Sri Lanka [2]

Present day's irrigation systems in the country are based on multipurpose national development programs [1,3] which include hydropower generation, efficient supply of water for agricultural and other household purposes, irrigation and development of new land, flood control, enhancing new employment opportunities, wild life conservation, development of infrastructural and basic need facilities, drainage and prevention of wider spread of diseases such as malaria and diarrhea [1,3-5].

Four main hydropower generation schemes have been completed in Sri Lanka so far, out of which the Accelerated Mahaweli Development Program (AMDP) is the largest ever launched in the history of the country contributing approximately 660MW to the national power grid. Six projects have been completed under this scheme using water of the Mahaweli River, the longest in the country. The others contribute about 531MW altogether [1,5].

Construction of these large reservoirs and dams has many positive and negative social, economic and environmental effects. Some of these effects are briefly discussed herein.

2.0 **Positive social, economic and environmental effects of hydropower generation by means of constructing large dams**

2.1 **Large scale generation of electricity:**

This is the sole purpose of constructing power stations near reservoirs which use the high speed flow of water to turn turbines and generate electricity. The installed capacities for the main hydropower schemes are shown below.

Name of Project	Installed Capacity (MW)
1. Mahaweli Scheme:	
1. Kotmale	201
2. Ukuwela	38
3. Victoria	210
4. Randenigala	122
5. Rantambe	49
6. Bowatenna	40
	660
2. Walawe Scheme	
1. Samanalawewa	120
2. Uda Walawe	6
	126
3. Kalu Scheme	
1. Kukule	70
	70
4. Kelani Scheme	
1. Wimalasurendra	50
2. Old Laxapana	50
3. Canyon	60
4. New Laxapana	100
5. Polpitiya	75
	335
Total	**1191**

Data source: [5]

Figure 01: Installed capacities of power generation in Sri Lanka

Hydropower contributes to around 75% of the total power supply of the country [1,5] thus serving millions of people's electricity needs.

2.2 **Supply of water for agricultural purposes:**

Since this was the main purpose of traditional irrigation systems developed by ancient Kings, there has been a highly sophisticated, cascaded tank system in the country for many years. By using these tanks and other newly built reservoirs, water is provided for irrigation development of about 565,000 ha at present [1,4].

2.3 **Supply of drinking water to the community:**

The National Water Supply and Drainage Board of Sri Lanka uses the water of many reservoirs to supply water to the majority of population in the country, while all the reservoirs and tanks generally meet the domestic water needs of the inhabitants around the scheme [1].

2.4 **Flood control:**

During high floods, large amounts of flood water could be stored in reservoirs due to their high storage capacities. The dam and other water outlets can be used to discharge excess water (Illustration 01) if necessary to lessen the reservoir water level. The vast surface area of reservoirs also increases the rate of evaporation thus controlling floods [4,6].

Illustration 02: A dam channeling out flood water [6]

2.5 **Increased employment opportunities:**

Many employment opportunities have sprung up in the areas of power systems, security, labour, agriculture, transportation, water and resource management, plantation, survey, fishing, housing and construction due to the many multipurpose development schemes implemented [1,3,4].

2.6 **Environmental protection:**

The Mahaweli Scheme has named four National Parks and two Nature Reserves in its attempt to conserve wildlife and forest reserves. Some of the animal species protected in these reserves are elephants, wild buffalos, monkeys, mongoose, ant-eaters, wild boars, porcupines, jackals, deer, Sri Lankan leopards (Illustration 02) and loris (Illustration 03), the latter two being rare and unique to the country [4,7].

Illustration 03: Picture of a Sri-Lankan Leopard [8].

Illustration 04: Picture of a Loris [9].

2.7 **Irrigation and development of new land, sanitation facilities and community and social development:**

Many new villages have been created to accommodate resettling processes due to the mass evacuation of people. Infrastructural facilities such as hospitals, schools, postal services, co-operative stores, banks (*Fig* 02) and many other basic need facilities (*Fig* 03) have been established in these newly developed areas to provide suitable living conditions while supplying water for irrigation and domestic purposes [1,10].

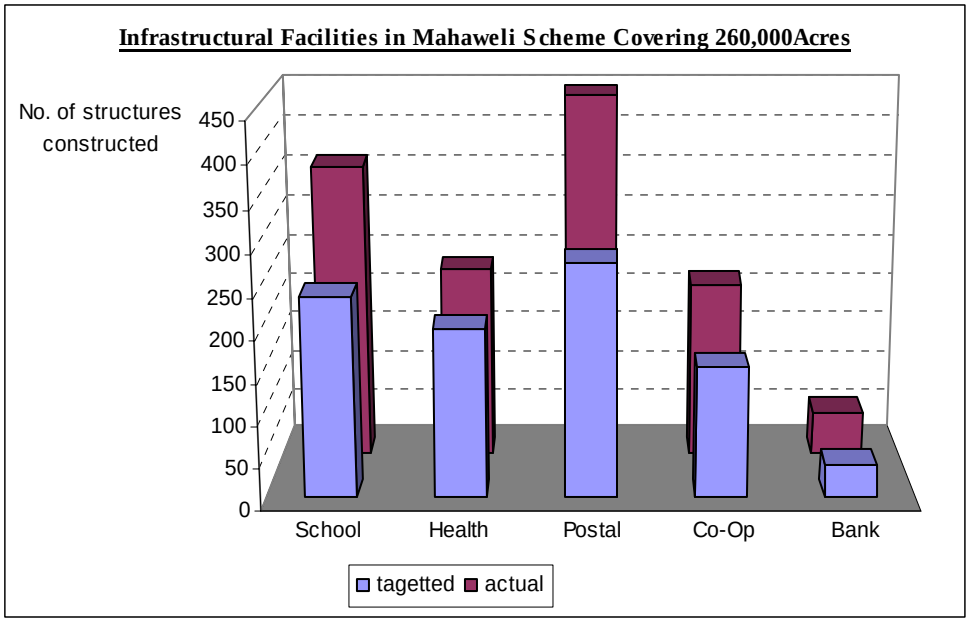


Figure 02: Targeted and actually constructed number of schools, health care centres, postal shops, co-operative stores and banks under Mahaweli Scheme [10].

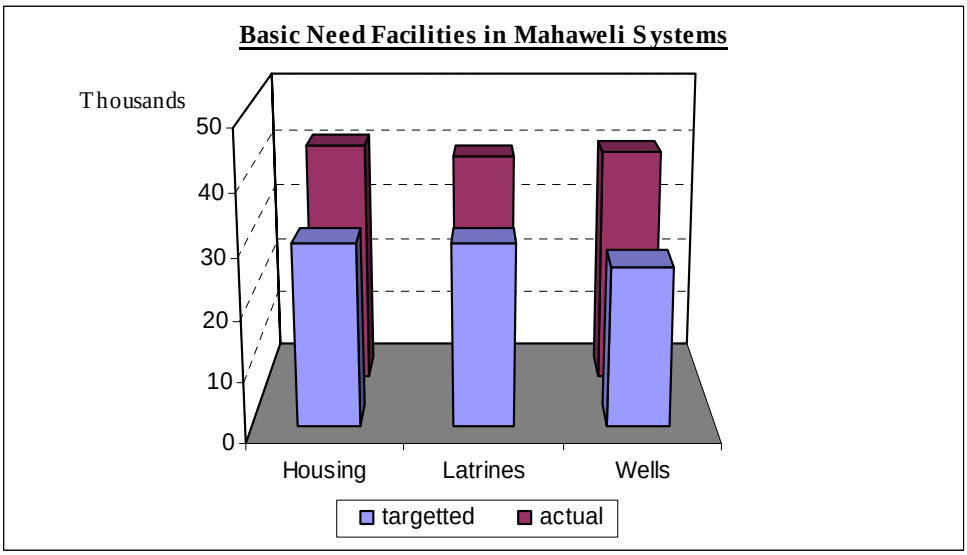


Figure 03: Targeted and actually constructed number of houses, latrines and wells under Mahaweli Scheme [10].

Various social, health care, community and training programs have also been introduced with aids of UNICEF [1]. For example, "Kotmale Community Radio" and "Communication Centres" introduced under the Kotmale Scheme have provided people with access to the internet, recreation facilities, news and weather updates and overseas educational and health facilities [11].

Although dams and reservoirs have many positive social, economic and environmental effects, they also have many drawbacks. Some of these are briefly discussed below.

3.0 **Negative social effects of dams and reservoirs**

3.1 **Mass scale evacuation of people:**

This is one of the greatest social impacts when constructing dams and reservoirs of large scale. By the end of 1992, more than 700,000 people had been evacuated in total only under the AMDP scheme [1,4]. People were given alternative land and compensation, but most of these land areas were highly degraded and not suitable for agricultural use and compensation given inadequate for housing and other needs. For example, whole of Teldeniya area known for its fertile paddy fields was submerged under the Victoria Project, Kotmale town under the Kotmale Project and Maskeliya town under the Laxapana Project dislocating thousands of people [12]. Shown beside is a scanned photograph of part of Teldeniya town, taken when reservoir water level was extremely low due to high droughts in 1999, revealing some of its old buildings and the ancient shrine.

Illustration 05: Part of submerged Teldeniya Town revealing some of its old buildings during droughts.

3.2 **Frequent power outages during droughts:**

Due to the high dependency on hydro power, frequent power cuts need to be introduced when low rainfalls are experienced in the hydro catchment areas. In 2001 the rainfall received in these areas was able to fill up only 30 per cent of storage capacity of reservoirs. Thermal power plants and other small hydro power schemes could not cope up with the peak power demand of the country thus power cuts had to be introduced for almost 3 months, some being as long as 8 hours a day [5], causing many problems in day-to-day life while adversely affecting the country's economy.

3.3 **Soil erosion, downstream land and water degradation and sedimentation:**

Variations in discharge of water from reservoirs have disturbed stability of soil and river banks giving rise to soil erosion. This has lowered depth of reservoirs and downstream river levels causing frequent floods in the vicinity [10].

An increase in temperature of downstream water, due to flow rates, shade, reservoir storage and amount of water released has created another series of problems such as degraded soil, crop diseases, lowered yield, productivity and agricultural incomes and caused drinking water problems. People living downstream have also been more exposed to increased levels of pesticides and other fertiliser residues [14,15].

Sedimentation is settling out of solid particles due to slow movement of water, causing a reduction of sunlight available for photosynthesis and respiratory problems in fish. This in turn has affected people making their living out of fishing. [15].

3.4 **Loss of natural heritage:**

Implementation of the Upper Kotmale Project is still under consideration although it has been rejected thrice due to its great social and environmental impacts. Seven of the ten waterfalls that can be viewed from a vehicle have been sacrificed already and

two more, namely Devon (Illustration 06) and St.Clairs (Illustration 07) will be added down the line if this project gets approved [16,17].

Illustration 06: Devon Waterfall [18]

Illustration 07: St.Clairs Waterfall [19]

3.5 **Drying up of downstream stretches of rivers:**
Once a dam is built across a river to store water, rest of the river dries up affecting the fauna and flora while causing many problems to the downstream water users [4,17].

3.6 **Change of life styles and inadequate supply of water:**
Due to the resettlement process many people have had to give up their old farming practices and adapt to new life styles in the areas provided. However most of the farmers who worked their own fields and therefore had their own food supply have ended up being daily paid labourers due to lack of proper fertile land [16].

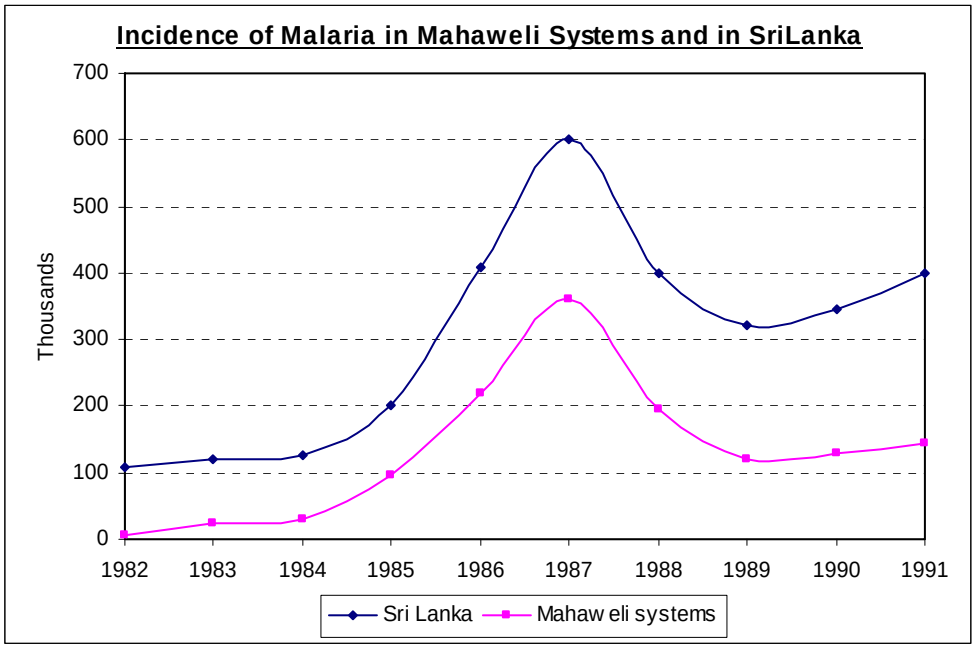
The AMDP and other development schemes have not been able to provide adequate water to the community as expected due to long droughts, lack of planned irrigation systems and unacceptable technical faults. For example the Samanalawewa reservoir is unable to fill up as expected because of a leak in its right bank and therefore unable to generate the expected electricity and provide people with required water facilities [16,17].

3.7 **Destruction of valuable forest land and displacement of indigenous people:**
Forest lands are used as means of herbs for traditional medication apart from their many other uses. Destruction of these lands deprives people of these natural herbs and also of natural habitats for “hunting, honey-gathering and chena cultivation” for the “Veddha” [20] community, the indigenous people of the country. These people have moved to new lands where they could preserve their traditional lifestyle and identity, but still are on the verge of extinction [20,21].

Illustration 08: Part of the “Veddha” community of Sri Lanka [20]

3.8 **Loss of agricultural and cultivated land:**
The Mahaweli Scheme has destroyed over 7,000 acres of cultivated land of paddy, vegetable, fruit, cocoa, coffee, coconut, spices, tobacco, pepper, rubber and sugar cane [22] creating vast unemployment apart from the invaluable land loss.

3.9 **Spread of diseases such as malaria, dengue and diarrhea:**
Due to stagnant water in reservoirs there is a greater tendency for larvae to breed giving rise to wider spread of malaria and dengue in these areas (Figure 03). Pesticides, DDT and other pest control methods used could also contaminate water causing diarrhea and other diseases related to poor hygienic conditions [1,4].



Data source: [10]
Figure 04: Incidence of malaria in reservoir areas Vs. total recorded

4.0 **Conclusion:**

Hydropower generation by means of constructing large dams and reservoirs has many advantages and the absence of this would become a huge hindrance to people's day-to-day life activities as experienced during high drought periods. However the negative impacts of this on the society and environment are so great that they cannot be neglected by any means. In the absence of fossil fuels, coal deposits and nuclear technology, hydropower has always been looked upon to meet most of the country's energy demand hence increasing its dependency. Therefore it is vital for the country to increase the efficiency of the existing dams due to lower-than-potential power generation and also look at alternative options such as introducing thermal and wind power plants while considering minimal environmental and social costs.

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