The Future of Hydropower in Malaysia

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Introduction

Hydropower is the only renewable energy technology that is presently commercially viable on a large scale. It has four major advantages, namely it is renewable, it produces negligible amounts of greenhouse gases, it is the least costly way of storing large amounts of electricity, and it can easily adjust the amount of electricity produced to the amount demanded by consumers. Hydropower accounts for about 17% of global generation capacity and about 20% of the energy produced each year [1].

Hydropower provides about 10% of the electricity in the United States. Norway produces more than 99% of its electricity with hydropower and New Zealand uses hydropower for 75% of its electricity [2]. Malaysia uses hydropower for 11% of its electricity [3].

Hydropower energy is widely used throughout the world, varying in size from small (mini-hydro) to mammoth schemes serving several countries or regions. Industrialised countries have utilised their hydro potential to a considerable extent, although in the developing world, particularly in the equatorial and tropical belts, the use of hydropower is an option with considerable potential for satisfying energy needs.

How is Hydropower Generated?

Most conventional hydropower plants will include four major components:

- Dam. Raises the water level of the river to create falling water. The dam also controls the flow of water and the reservoir created is in effect stored energy.
- Turbine. The force of falling water pushing against turbine blades causes the turbine to spin. A water turbine is much like a windmill, except that the energy is provided by falling water instead of wind. The turbine converts the kinetic energy of falling water into mechanical energy.
- Generator. Connected to the turbine by shafts and possibly gears so when the turbine spins it causes the generator to spin as well. This converts the mechanical energy from the turbine into electrical energy. Generators in hydropower plants works like generators in other types of power plants.
- Transmission lines. Conducts electricity from the hydropower plant to houses and businesses.

400MW Kenyir Hydropower Station in Terengganu

Examples of major hydropower plants in Malaysia are those belonging to TNB, namely the Kenyir Sultan Mahmud Power Station with 400MW installed capacity, the Pergau Hydroelectric Power Station with 600MW installed capacity and the Temenggor Hydroelectric Power Plant with 348MW installed capacity.

The current total installed capacity for Peninsular Malaysia as of August 2004 is 17,326MW with hydro making up 11.0% of the total [3]. The detailed breakdown of energy sources is as follows:

- Hydro – 11.0%
- Conventional thermal (coal) – 21.2%
- Combined cycle – 11.8%
- Conventional thermal (oil/gas) – 6.9%
- Gas turbine – 9.2%
- Diesel – 0.4%
- IPPs – 39.5%

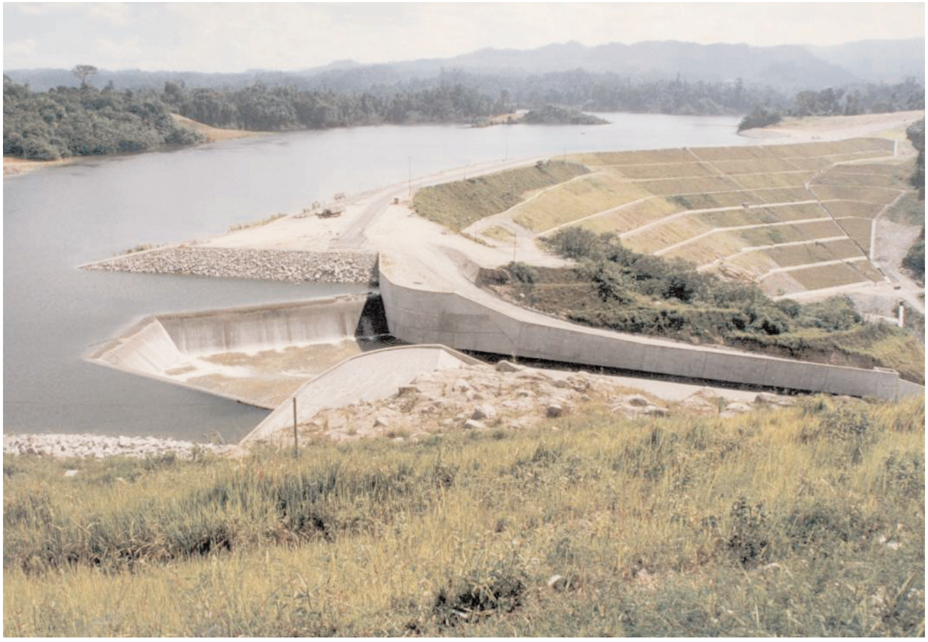
In Peninsular Malaysia, TNB operates a mixed hydro thermal system which is in line with the Government's policy on fuel diversification. The Independent Power Producers (IPP) make up almost 40% of the total energy supply [3].

Overview of Hydropower Development

Let us briefly look at the history of hydropower dam development in Peninsular Malaysia. The first major dam, the Chenderoh Dam, was constructed in 1939. There followed a long gap before construction recommenced after the Second World War, starting with the Sultan Abu Bakar Dam (Cameron Highlands) in 1963.

A temporary lull in construction activity occurred between the late 60s and early 70s when fuel oil was still very competitively priced as to offer a viable thermal alternative for power generation.

The oil price increase in the mid 70s shifted attention back to hydropower in



Kuala Yong Dam in Pergau, Kelantan

the overall energy development plan. This eventually led to the construction of four more dams between 1974 and 1984. These are Temengor (1974), Bersia (1980), Kenering (1980) and Kenyir (1980).

The 90s saw the development of two more hydro schemes, namely Sg. Piah (1993) and Pergau (1991).

Currently the only major hydro project under construction is the Bakun hydro in Sarawak.

Status of Hydropower Potential

Malaysia has a total land mass of 332,000 km^2 and its mean elevation is about 300m. The average rainfall is slightly more than 2,600mm per year. The total gross hydro potential is 414,000 GWh/year, of which about 85,000 GWh/year is available in Peninsular Malaysia. Hence, whilst Peninsular Malaysia has 39% of the land area, its share of hydropower resources is only slightly more than 20% [4].

Geographically, the peninsula is relatively narrow, and its main range of low mountains, the Titiwangsa Range, runs along the interior to form the main watershed. Thus, the river basins formed are moderately small. The largest river basin is Sg. Pahang with a drainage area of 28,500 km^2. In addition, topographic features and rainfall are comparatively less favourable than Sabah and Sarawak. These are the main factors which contributes towards the limited hydropower resources in the peninsula.

Of the 85,000 GWh/year gross potential, the utilised resources amount to 4,900 GWh/year (6%) whilst another 5,000 GWh/year (6%) has been identified. The Sg. Perak river basin is the most developed in terms of hydro-power development utilisation (2,500 GWh/year), and it is reaching the limit of hydropower potential development. For Peninsular Malaysia, it has been estimated that the economic limit of hydropower utilisation is unlikely to exceed 10,000 GWh/year.

Future development

As for future hydro development in Peninsular Malaysia, several projects have been identified and studied at feasibility and pre-feasibility levels. These potential projects have to compete with alternative energy sources such as coal and gas in terms of economic viability.

From the economic point of view, it is clear that hydropower requires substantial initial investment costs which can be a deterrent to potential developers. It has been proven in some countries of the inability of the private sector to undertake such investments. However, this should be balanced against the long life and low operating costs of hydro plants, and the fact that there is no consumption of fuel for energy generation. Globally, in comparison with other plants, and considering the quality of the energy produced, the balance shows a clear advantage for hydropower.

At the 17th Congress of the World Energy Council in 1998, it was concluded that clear priority should be given to the development and use of appropriate renewable energies with the aim of limiting emissions resulting from the use of fossil fuels. This declaration supports the recommendations of the International Hydropower Association as listed below [5]:

- The remaining hydro potential should be developed to the maximum possible extent, provided it is implemented in a technically, economically and socially acceptable way;
- Hydropower development should go hand-in-hand (rather than in competition) with further development of other renewable sources of energy;
- The cost of the kWh produced by a hydro plant is competitive. The initial investment is substantial but the life of the plant is long (about 100 years). This is part of the sustainable character of hydropower. The operating cost is low. Financial solutions will have to be found to facilitate the initial investment in hydropower in developing countries without requiring the owners to give guarantees that they cannot afford;
- The state cannot totally entrust hydropower development to the private organisation (as is the case for thermal plant). It should be involved in the planning and development process;
- It has been demonstrated in many countries that hydroelectric potential is a form of potential wealth and sustainable development. Its implementation, with a strong backing of the state, contributes to the well-being of society. ■

References

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