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BIG DAMS: THE ECONOMIC, POLITICAL AND SOCIAL ISSUES

The main purpose of dam construction is the provision of drinking water, flood control, hydropower, irrigation, navigation and water storage. Until relatively recently, big dam construction was considered economically beneficial to countries with the right physical conditions. In the United States, important dams were constructed along the Tennessee River and in the mountain states of the West. Multi-purpose schemes such as the Boulder Dam (on the Colorado River) provided power and irrigation water, improving farming conditions and benefiting the growing populations of the western states. In Australia, the Snowy Mountains scheme diverts the Snowy River through tunnels to the Murray River valley, providing power and much needed irrigation water for interior New South Wales and Victoria.

World-wide, some 45,000 large dams (i.e. over 15m high) have been built in the past 60 years. Construction is not confined to the more developed countries. Dams provide an important source of power for Egypt, as well as Uganda, Ghana and Zambia. As schemes became larger and more expensive to construct, countries borrowed large sums to finance projects, resulting in severe debt repayment problems for some of them.

The 1950s was the peak of the big dam era, but since then perceptions have changed and no longer are they seen universally as signs of progress and development. Some scientists and engineers now question the overall benefits for flood control and navigation.

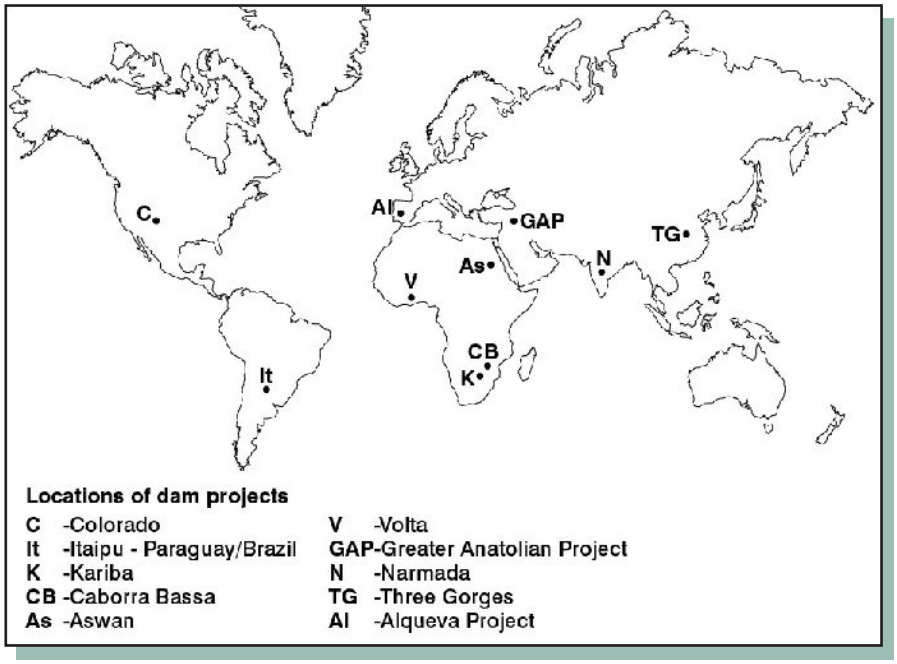
The World Commission for Dams report in November 2000 recommended:

- No large dams in future without wider consultation and agreement with local populations and international organisations.
- Greater assessment of the real need for the project together with viable alternatives.
- Existing water and energy sources should be maximised before any large project is undertaken.

Figure 1: Arguments for and against big dam construction

Benefits	Costs
1. Clean drinking water 2. Support for economic growth • Diversion of water for power • Better navigation • Improved flood control • Increased irrigation water • Recreational use (especially in developed world)	1. Disruption of ecosystems • Reduction in river levels below dams • Nutrient flows blocked • Change in water temperatures and oxygen levels • Natural movement of fish and wildlife changed 2. Decline of fish stocks 3. Forced resettlement of population 4. Spread of disease.

Figure 2: Major dam projects



There must be greater social reparation for those affected by the scheme together means of restoring ecosystem damage.

- India – food supply increased, now almost self-sufficient as a result of supplies of irrigation water. The Narmada Dam is a major source of controversy because of the proposed relocation of small farmers from the valley.
- Ghana – Akosombo Dam provides hydropower for homes and industry and has helped to raise the general standard of living in the south. It is subject to severe fluctuations under drought conditions.
- Nigeria – Kainji Dam on the Niger River has serious problems of siltation, reducing the effectiveness of irrigation and power supplies.
- Zambia/Zimbabwe – Kariba Dam on Zambezi river is now an ageing structure and there are problems of storage capacity with increased water levels (Feb 2001).
- Mozambique – Caborra Bassa Dam also on Zambezi River produces hydropower mainly

exported to South Africa. In spite of large water storage capacity, in wet years (e.g. 2000 and 2001) the dam valves have had to be opened, causing heavy flooding downstream. More people are living closer to the river than before the dam construction. There is a need for co-operation and consultation on a strategy for the whole river basin.

- Navigation has been improved on the Danube, Mississippi and Nile by maintaining more constant river levels.

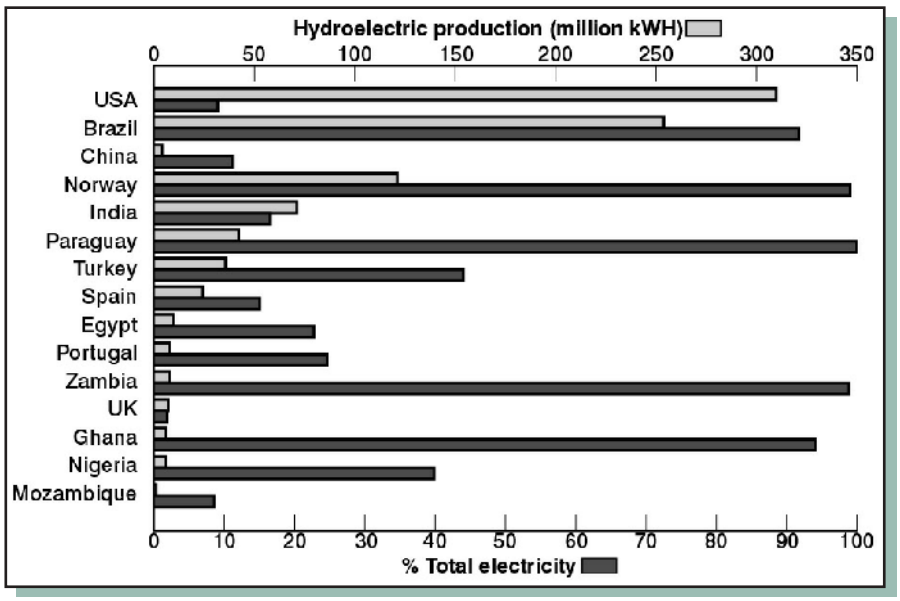
Dam projects have high environmental and human costs. However, it can be argued that without them, much development would not be possible. World Bank environmental scientists believe that there are good and bad dams. Bad dams are shallow and flood a wide area, producing relatively little power. In tropical areas this type of dam is often associated with the spread of diseases such as schistosomiasis and malaria; these are not a problem, however, in temperate countries.

Ecosystem disruption

The effects of the 11 major Colorado dams in the south-western USA are well documented. The river no longer flows freely out into the delta, and the water has been recycled up to 18 times before it reaches Mexico (Marc Reisner (1987) Cadillac Desert; Philip Fradkin (1984) River No More). Native fish can no longer live in its waters, which have become colder due to the deep reservoirs. On the Columbia-Snake catchment there has been severe reduction in Pacific salmon stocks, as the fish can no longer reach their natural spawning grounds. Only 10% of the numbers of salmon seen 30 years ago are now found, according to recent figures (1999). This is in spite of the 'runs' provided alongside the large hydro schemes. The USA now has strong environmental laws to restore riverine ecosystems. Developing countries, however, cannot always afford to provide the technical improvements such as fish ladders alongside major dams.

Restoration does bring conflict with recreation groups, including sport-fishing groups in the USA, where non-native species of cold water fish have been introduced to rivers and lakes such as Lake Powell.

Figure 3: Hydropower around the world



Water quality

Reservoirs provide good clean drinking water – vital in developing countries with increasing populations. In tropical regions, however, health risks increase due to the high rates of evaporation. Dams act as nutrient traps as the sediment increases, reducing the volume of water and increasing eutrophication. The loss of oxygen allows algae to develop at the surface. The lakes can then become breeding grounds for malaria-carrying mosquitoes, as well as snails and flies which are the causes of river blindness and bilharzia. Schistosomiasis, a parasitic disease spread by water-snails, now affects 200m people in 75 countries (WHO). Many infections are linked to irrigation canals from the large lakes behind the dams. Scientists now urge the use of smaller-scale programmes to improve water supplies and sanitation. It must be noted that reservoir illness is not confined to developing countries: in 1995 Las Vegas had a serious outbreak of cryptosporidiosis as a result of contaminated water from the Colorado.

Provision of hydropower – good or bad?

Hydropower is clean, reliable and renewable. Without it, oil- and coal-fired power stations would be needed, emitting carbon dioxide. It is efficient and cheap to run, once the scheme has been constructed. The demand for energy continues to grow. Hydropower becomes a more economic proposition when oil prices are high.

It is reliable in the developed world, but less so in the tropics and areas where drought may affect the river flow seriously, as in Ghana. Hydropower produces little carbon dioxide, but in the shallow reservoirs of the tropics, greenhouse gases are produced because of biomass decay. Studies have found that wetlands now immersed by dams have been changed to become large-scale emitters of carbon dioxide and methane, and that there is evidence of increased mercury in the lake sediments.

Construction costs are a major problem. These can escalate because of delays in completion, local corruption and the channelling of grants and aid to officials. For example, the Itaipu Project on the Brazil/Paraguay border was estimated to cost $3.4 billion over 15 years. This became $20 billion over 18 years. Another problem is siltation in the dams, which reduces the capacity and the generating power. Traditional agricultural land below dams loses valuable silt, and agricultural production suffers.

Population resettlement is a social cost. World-wide, some 30 million people have been moved over the past 50 years as a result of dam-building. Farmers forced to leave their traditional homes and lands do not tend to receive the full benefit from construction of the dams. 100,000 people were moved out of the Nile valley when the Aswan

Dam was built, and 90,000 Ghanaians were forced to move to make way for the Akosombo Dam and Lake Volta. Most moved into the urban areas. It is projected that 1.3 million people will have to move if China's Three Gorges Dam is filled to its highest level.

Power and water from Aswan High Dam help to produce three crops a year for food and cash on the farmlands along the Nile Valley.There is a serious problem of salinisation and loss of nutrients through the lack of silt, however. The sardine industry in the Nile delta is seriously handicapped, and over 175 kg fertiliser per hectare are now being used on 25,000 square km of farmland in the Nile valley.

Political issues

The Tigris and Euphrates
Dam construction on rivers that form political boundaries can be a controversial issue.
Turkey, Syria and Iraq are currently in dispute over the waters of the Tigris and Euphrates Rivers. Turkey, which controls the headwaters of these rivers, initiated the South East Anatolian Project (GAP) in 1983. It is planned that 21 dams and 19 hydropower stations will produce 27,300 GWh of electricity for Turkish industry. It is proposed to irrigate 176 million hectares (30,000 sq. miles) of low rainfall land to produce cash crops of cotton, sugar beet and tobacco. The project is estimated to cost $32 billion, which it is hoped to raise from international sources (although the World Bank has pulled out). Syria and Iraq rely on the river waters for agriculture, across the borders.

The Kurdish population in the GAP region is opposed to the project. They are mainly peasants who cannot afford the intensive irrigation farming methods being introduced. Many have become landless. Farmers from western Turkey are moving in to take over farms. Compensation for loss of land is not being paid to peasant farmers. In addition the rising waters threaten historic Kurdish sites such as Hasankeyf.

Opponents insist that GAP will result in serious environmental problems.

- The creation of lakes behind the dams could reduce the biodiversity of the region because of a lack of oxygen.
- The dams will act as sediment traps caused by summer rainfall on the cleared hillsides. Reafforestation is planned.
- River beds will erode, below the dams (cf. Colorado).
- There will be a drop in ground water levels, causing damage to local agriculture, and wells will dry.
- Changes in river regime will affect wetlands on the plains and also fishing at the coast.
- There is no provision for migration of fish around the dams as in USA and Western Europe.
- Much of South Eastern Anatolia is a seismically active region.

One major dam – the Ataturk Dam – was completed on the Euphrates in June 1992. This is the world's fifth largest dam. Its lake has submerged farms, villages and historic sites and reduced the flow of water to Iraq and Syria. Farms along the borders of these countries with Turkey have little water for their crops.

The Ilisu dam, a rockfill dam 1820m long and 135m high, is planned but is the subject of a large protest movement because of its likely environmental impact and the human rights issues in the region. The lake will cover 313 km^2, storing water for hydropower but not for irrigation. There will be a possible summer loss of 3% surface water because of evaporation. 50 villages and hamlets will be flooded; the Kurds claim that 65 villages and a minimum 25,000 people will be affected.

The Turkish government claims that the whole project should bring prosperity to the area, with better roads and communications, and new towns encouraging people to move from the mountains. This is disputed.

The Euphrates carries 7,000 billion gallons of water into Syria. Half that could be diverted into the Turkish system. Both Syria and Iraq expect increased salinisation and pollution from industrial and human effluent. Syria has its own plans for diversion of water from the Euphrates, which could further reduce the water supply to Iraq. There are tributaries of the Tigris in Iraq which could be used to supply more water for farmers and industry.

The Alqueva Project, Guadiana River, Portugal

Some 82 km downriver from the Spanish border, the largest reservoir in Europe is under construction at Alqueva in Portugal. First considered in the 1950s, the project is mainly intended to provide irrigation water for the dry region of the Alentejo province to the south. A 240MW power station will provide power. One estimate suggests that 20,000 new jobs could be created as a result. When complete (in 2002) the dam will be 152m high, forming a 250 km^2 lake which will stretch to the Spanish border near Badajoz. The waters will drown two villages and force the resettlement of 400 people. This is a small number when compared with resettlement problems associated with the Narmada dam in India, and China's Three Gorges Dam, but still significant. A new village is being built higher up the valley sides from the present settlement at Luz. Conservationists condemn the felling of 1.5 million trees (mainly oaks) on the catchment.

The dam is partly financed by the European Union on condition that Portugal and Spain agree on the allocation of the Guadiana River waters. There are already 38 dams on the upper catchment within Spain (the Badajoz project). It is feared that in drought years the amount of water flowing into the Portuguese section of the river may be badly diminished by extensive Spanish use.

680 km of main irrigation channels and 4,400 km of secondary channels are planned to provide water for intensive agriculture in the Alentejo region, which at present is mainly a dry farming area.

Opposition to the project

- Construction of irrigation channels will not be complete until 2025.
- High costs of construction are to be passed on to the farmers who are mainly poor. The present returns from irrigation farming in Portugal are low because of poor land and water quality. The return from using irrigation for intensive farming is only expected to add 0.65% to the Portuguese farm economy.

- The quality of water for intensive farming needs to be high.
- Irrigation is expected to lead to extensive salinisation of farmland and to problems associated with increased use of farm chemicals.
- An unknown quantity of archaeological sites, including pre-historic, Roman and Muslim sites, will be submerged by the reservoir.
- The Guadiana estuary is an internationally known resting place for migrant birds from Africa to Northern Europe and their return. Intensive agriculture could affect this migration.
- Changes in water quality will affect small fishing and gypsy communities who make their living from the river.

Opposition to the scheme has been strong. Local people had hoped to negotiate a lower dam with less capacity, which would have had less impact. It remains to be seen whether the hoped-for benefits to indigenous farmers will be forthcoming. Already developers are planning more golf courses for rich foreign tourists making use of the planned supply of expensive irrigation water.

Dam decommissioning

Increasing numbers of dams are now over 50 years old and coming to the end of their useful or planned life. Issues of safety are resulting in the removal of small and medium-sized structures; strict safety checks are the rule, especially where there are settlements close to the structures.

In the case of large dams such as those along the Colorado or the Columbia-Snake, environmentalists are taking a lead in the movement to decommission dams and to restore rivers to their original conditions. Dam removal is no longer considered radical, but rather as a reasonably cost effective method of river ecosystem restoration. Flood control can be more effective and cheaper if wetlands are restored and homes and business relocated out of flood plains. The use of alternative energy would reduce the amount of hydropower required.

Resources

United Nations (2000) *World Resources 1998-99*.
World Commission on Dams report – November 2000
The Independent, 29 October 2000
Daily Telegraph
New Scientist.

Web Sites
European Rivers Network – www.rivernet.org.

This has a wide selection of river links throughout the world on environmental and social issues connected with rivers.

Focus Questions

1. Large hydropower schemes may be seen by LEDCs as important keys to development. Why is this so? Explain why there may be opposition to such schemes.

2. Why is dam decommissioning now being considered in countries such as the USA, France and Canada? What could be done to restore rivers?

3. Research details of controversial schemes under construction in Malaysia, Brazil and the Philippines. Draw up a table of costs and benefits and assess whether these schemes are really in the interests of the populations of the countries affected.