

Dams and the Environment



International Commission
On Large Dams

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A Viewpoint from the International Commission on Large Dams



Dams Help Manage Water – A Critical Resource

Water is a critical natural resource. Without it, life could not exist and people could not survive. For more than 5,000 years, dams have provided people with a reliable source of the water they need to live. Dams have enabled people to collect and store water when it is plentiful and then use it during dry periods. Dams have been essential in establishing and supporting towns and farms as well as providing food by irrigation of cropland. Today, dams and reservoirs also help control flood waters to protect people and property, keep rivers navigable, provide electricity from renewable energy for towns

and factories, and provide recreational opportunities such as fishing, camping and water sports.

Today more than 40,000 large dams improve the living conditions of the world's population that continues to grow at a rate of more than 100 million people per year. Yet, about 1.5 billion people still do not have access to a reliable source of suitable drinking water and more than two dozen countries do not have enough water to properly sustain their populations. Today more than one billion people are malnourished or starving. In many countries, increased food production is only possible through improved irrigation, which frequently depends on diminishing groundwater resources. Therefore, more dams are needed now and into the foreseeable future to improve the management of existing surface water resources.



The availability of energy is essential for the socio-economic development of a nation. Today energy is largely supplied by fossil fuels, but these fuels are being depleted and they contribute to air pollution and to climate change. It is clear that we should look for ways to generate electricity without releasing harmful substances in the air. In many countries hydropower is the only natural energy source. Hydropower accounts for about 20 percent of electricity production and about 7 percent of total energy production in the world. Hydropower is clean and the production from existing projects can be increased without a harmful impact on the environment. This potential is at least six times greater than its current level of production. At present, hydropower is the largest renewable source of energy. In other words, hydropower from dams is one of the key sources for providing energy for expanding development.



Dams provide domestic and individual water supply, energy, agricultural irrigation, industrial use, flood control and recreational opportunities, but there is a cost. Our quest to provide the growing world population with a better life means we will change the natural environment. Natural resources will be used and the environment will be transformed to meet human needs. People and other forms of life are inevitably effected when dams and reservoirs are built. Engineers must avoid or mitigate any environmental damage caused by the project.

Historically, the priority was given to meeting people's immediate needs for water and energy. Today we recognize the importance of the natural environment and the need for long-term protection against pollution. The International Commission on Large Dams, comprised of professional engineers and scientists, believes that we must preserve the environment for long-term benefits while also providing dams and reservoirs to meet immediate human needs.



Today the Design and Operation of Dams Reflect the Public's Strong Concern for the Environment

Social and environmental impacts of dams and reservoirs built today must be avoided, or mitigated. The operation of existing dams is reviewed and if necessary, modified to accommodate current concerns. Every effort is made to have the dam and reservoir enhance the environment. Today's water resources professionals are guided by environmental policy as well as engineering and safety concerns. Planners and engineers, many of whom are members of the International Commission on Large Dams, include the environment among their responsibilities. Teams of engineers and specialists from many disciplines - planning, engineering, environmental and social science consider the following when developing modern water projects:

- **Concern for the environment, both natural conditions and social aspects, is foremost from the first planning stage.** This concern is incorporated into all phases of engineering, construction and operation of the project. From the beginning of project planning, alternative solutions should be identified that will provide the required water at the lowest long-term cost to society with the least impact to the environment. Dams are not the only way to increase the available water supply. Efficiencies can be gained by recharging of ground water. Desalinating seawater and saline inland waters can also provide additional water without a dam. Additional efficiencies can be gained in agricultural and industrial water use. Water losses can be reduced in supply systems, and more water can be treated and recycled.
- **ICOLD engineers include environmental protection among their responsibilities.** Today, they use their collective knowledge and experience to design environmentally responsible water projects.



- **Dam and reservoir projects require system planning which recognizes the impact on an entire river basin and its ecosystems.** The larger the project, the greater the potential effects will be on the natural and social environment. In the planning phase, consideration is given to the best balance between small dams and reservoirs on a river and larger dams and reservoirs as well as management of sediment. The project size is determined based on regional and local needs.
- **Many countries now require the formal identification of environmental impacts during the conceptual phase of a project.** Comprehensive environmental impact assessment assists planners and engineers in designing projects which take into account and reduce the costs to society and the environment. Even countries without formal requirements can design better projects using the information gained from such an assessment.
- **Rigorous economic analyses of the benefits and costs of large projects provide critical information to decision-makers.** Benefits and costs as well as social and environmental considerations form a common basis for decision making. Realistic project costs, including impacts on the natural and social environment, must be weighed against project benefits. Benefits include enhanced assets, project revenues compatible with the environmental and social advantages of the selected alternative as well as the multipurpose benefits, which aid the entire economy.
- **With careful planning and implementation, the people required to be resettled because of the reservoir project, can and must, benefit first.** Resettlement should provide for an improvement in living standards of the effected people. A new dam should allow the resettled people to take advantage of the new economic opportunities such as fishing, tourism or agriculture based on irrigation.
- **Public consultation and input to obtain a consensus is necessary for the most effective project planning, implementation and operation.** This consent is often driven by the environmental compatibility of the project. A free exchange of information among the various interest groups, technical experts and decision makers is critical for this consent and must be implemented at the earliest possible stage of the project. Dam sponsors, acting as facilitators and educators, can enhance their role of being good neighbors who care for the local community.
- **Monitoring of the environmental impacts of existing projects provides a better understanding of the true impacts rather than projected impacts.** Monitoring must begin during the planning and design of the project and continue through construction. As soon as the project becomes operational, its impact and the effectiveness of mitigation measures must be monitored at regular intervals. The results are evaluated and implemented to continually improve the project operations.

- **Research on the ecological aspects of the many existing dams and reservoirs can provide important lessons for future projects.** The results obtained from the monitoring of existing dams must be compared with the current environmental standards. Research on the ecological behavior of many existing dams and reservoirs provides important lessons for future projects and improves environmental technology.



Many Stakeholders Are Involved in the Development of Today's Dams and Reservoirs

When dams and reservoirs are planned, built, and operated today, many groups of people are involved, such as:

- People in the affected area. Those receiving the benefits of irrigation, hydropower, water supply, navigation, flood control and/or recreation assist in defining the project scope and purpose,
- Decision makers providing the financing,
- Owners responsible for the safe operation,
- Interest groups guarding the natural resources, and
- Technical experts bringing the project from an idea to reality and managing it during operation.

Many of these technical experts have joined together to exchange knowledge and experience about dams. The International Commission on Large Dams (ICOLD) provides a forum for this discussion and knowledge exchange.

With a present total of 81 member countries, ICOLD leads the profession in ensuring dams are constructed and operated safely, efficiently and economically with minimal negative environmental impact.

ICOLD, through discussions and information, encourages and assists those involved in dams today to put environmental consciousness into the planning and construction process, to conduct environmental impact assessments and to implement measures to mitigate those impacts.



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