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Siting and Design

The siting and design of a project affects the size of the environmental footprint; it needs to be assessed in relation to the associated aquatic and terrestrial ecological impacts and the degree to which they can be mitigated or, where necessary, compensated.

Issue

Siting and design must be appropriate to the energy system and where appropriate multiple purpose needs of a hydropower development. However, if siting and design considerations are limited to or dominated by engineering and economic considerations, the impacts on environmental and social values can have significant repercussions.

Siting and design influence the geometry of a reservoir, and hence the surface area of land flooded, the degree of loss of significant natural habitat and wildlife, and in cases the populations of people affected and risks to heritage values. Siting and design, along with operating patterns, determine the degree of impact to a hydrological system, including diversion out of or augmentation into a river system, reservoir residence time, and patterns of downstream flow delivery.

Particular assessment needs to be undertaken where considering a hydropower option sited on the mainstem of large river systems and in the lowland regions. Reservoirs sited in tropical lowlands must consider relative risks of disease and aquatic weed problems with different siting options. Siting on mainstem rivers versus tributary streams can influence a number of other environmental impacts, including the number of fish and other aquatic species affected.

Design is closely interrelated with siting, but has its own issues. In the absence of adequate environmental assessments on a range of siting and design options, potential problems such as reservoir stratification and passage of aquatic species may not be identified. It is far more costly to try to mitigate such issues post-development than to design measures into the scheme itself (e.g. multi-level offtakes or fish passage facilities).

Management

Location and design must balance the need for and ability to transmit power against the potential impacts of alternative options. Consideration of alternative options is

informed by a number of tools such as a regional energy strategy, social and environmental impact assessments, community consultation and cost-benefit analysis.

Avoidance and minimisation of impacts through choice of alternative projects or designs, based on sound environmental and social assessments, is more cost-effective for a hydropower project than trying to manage and mitigate problems after they occur.

Each site and context is unique, so it is not possible to give a formula for environmentally acceptable siting and design of hydropower schemes. The anticipated impacts can vary considerably between temperate and tropical dams, with types of scheme (run-of-river, reservoir, pump storage), with dam capacity and geometry, with ecosystem characteristics, with catchment characteristics, and with location within the catchment.

In some cases, sequencing of dams on one river or constructing a new dam in between existing dams is determined as a lower impact option than dams on several different rivers, whereas the reverse can also be true. Relatively shorter water retention time in the reservoir can lessen the degree of impact to downstream flow regimes and within reservoir water quality. Minimising the amount of forest vegetation or areas of high biomass content can result in better reservoir water quality, and lessen impacts to areas of high biodiversity. In cases, the more undammed tributaries downstream of the dam the better.

Siting and design should be based on sufficiently rigorous information to enable identification of trade-offs amongst different social, environmental and economic values for different options, which should then feed into a public consultation process.