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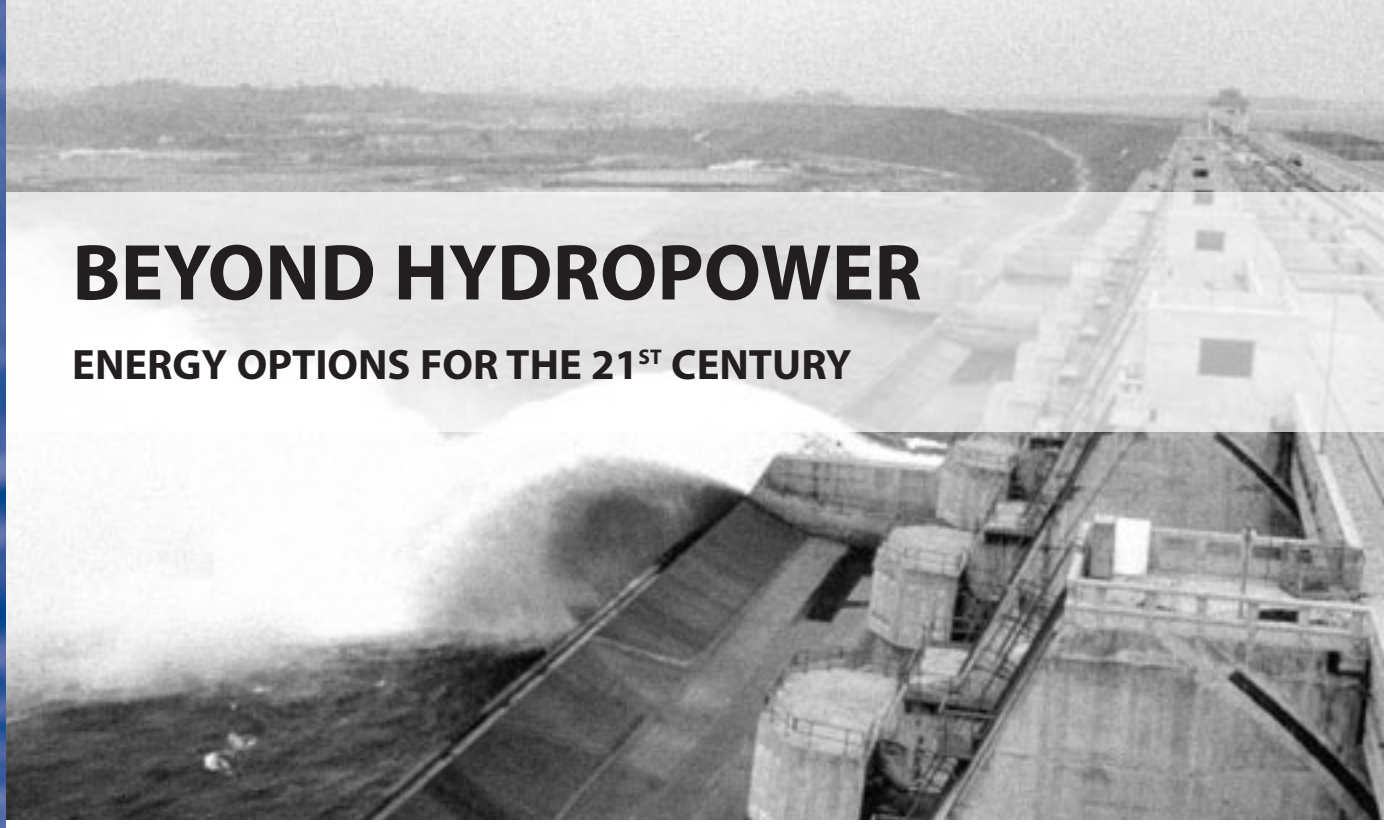

BEYOND HYDROPOWER

ENERGY OPTIONS FOR THE 21ST CENTURY

Electricity brings many benefits. But generating electricity has also caused massive environmental and social problems. We must revolutionize the way we produce and use energy to reduce these impacts while providing energy services to the billions of people who have inadequate or no access to electricity. Population growth makes the challenge even harder.

The energy revolution will require moving from 20th century electricity systems based on large-scale fossil fuels, large hydro and nuclear fission plants to a 21st century energy system based on new renewables and massive improvements in the efficiency with which we produce, transport, store and use energy.

In 2000, the World Commission on Dams (WCD) issued a report criticizing the performance of dams and laid out a set of recommendations which could revolutionize how energy-related decisions are taken. If implemented, these recommendations would open up energy planning to public participation, limit the distorting influence of vested interests, and expose the true economic, social and environmental costs of different energy choices.

DIRTY HYDROPOWER

The WCD, which was set up by the World Bank and the World Conservation Union (IUCN), found that the costs of dams have been "unacceptable," particularly in terms of impacts to people displaced, downstream communities and the environment.

According to the WCD, 40-80 million people have been forcibly evicted from their homes to make way for dams. Millions more have lost their land, livelihoods and access to natural resources and have endured irreparable harm to their cultures and communities.

Dams have taken a huge toll on the environment. They have flooded diverse wildlife habitat and fertile farmlands, blocked fish migration and disrupted river flow patterns. Dams are a leading reason why one-third of the world's freshwater fish species are extinct, endangered or vulnerable. Efforts to mitigate these impacts have met with little success.

Further, growing evidence suggests that reservoirs emit significant quantities of greenhouse gases. Emissions are particularly high from hydropower in the lowland tropics – in some cases greater than those from similarly sized gas-fired plants.

While only a minority of the world's 45,000 large dams generate electricity, the largest dams which have displaced the most people and had the greatest environmental impact almost always have a hydropower function.

UNRELIABLE AND EXPENSIVE POWER

Hydropower is often falsely promoted as cheap and reliable. While the operating costs of hydropower dams are low compared to fossil fuel plants, their construction costs are extremely high, running into the billions of dollars for major projects. They are also prone to cost overruns. The WCD found that on average dams cost 56 percent more than projected.

Hydropower dams often do not produce as much power as predicted. Fifty-five percent of the hydropower projects studied by the WCD generated less power than planners promised.

Because it depends on the vagaries of the hydrological cycle, hydropower is not a reliable source of energy. Many hydropower-dependent countries, including Brazil, Norway, Ghana, Sri Lanka, Ecuador and Vietnam, have suffered serious power shortages due to droughts.

Global climate change will increase rainfall variability and unpredictability, making hydropower production more undependable. Increased flooding due to global warming also poses a major hazard to the safety of dams. Countries that are heavily dependent on hydropower must diversify their energy sources if they are to reduce their vulnerability to climate change.

In addition, all reservoirs lose storage capacity to sedimentation. While the rate varies widely, in many cases sedimentation seriously diminishes the capacity of dams to generate power. Up to one percent of world reservoir volume is lost to sedimentation annually.

BUILDING BLOCKS OF THE ENERGY REVOLUTION

The lowest impact, quickest and most cost-effective alternatives to building new generation projects are to reduce waste and improve the efficiency of electricity use. Another important option is to upgrade existing generating plants and distribution networks. In some countries, transmission losses are as high as 40 percent.

Most of the two billion people who do not have electricity live in remote villages in developing countries. Expanding electrical grids to these people is expensive and slow. Decentralized, small-scale projects provide the greatest opportunity for providing power to unserved rural areas. Options for off-grid rural electrification include biomass and biogas-powered generators, micro-hydro units, windmills and solar photovoltaics. More than 1.3 million small solar systems have been installed in homes in the developing world since 1980.

Wind power

Wind power is one of the world's fastest growing energy sources. In many areas wind power is already economically attractive compared to fossil fuels and hydropower. In 2002, total installed wind power capacity grew by a third in the European Union to reach 23,000 megawatts (MW). Wind power is also growing rapidly in developing countries: India's installed capacity, for example, exceeded 1,700 MW last year.

The European Wind Energy Association projects that by the year 2020 the installed capacity of wind turbines could reach 1.2 million MW (nearly twice current global hydropower capacity).

Solar photovoltaics

While sales of solar photovoltaic (PVs) cells are growing fast they still account for only 0.04 percent of the world's electricity generation. PVs are expensive for grid-connected generation although their prices are coming down fast as production volumes increase and research intensifies. The European Photovoltaic Industry Association predicts that solar energy could provide a quarter of global electricity demand by 2040.

The main constraint to both solar and wind power is that they only generate when the sun is shining or wind is blowing. The rapid progress in fuel cell technology should help overcome this problem. Excess power from solar panels or wind turbines during sunny days or windy periods could be used to produce hydrogen by passing a current through water. Hydrogen-powered fuel cells could then cleanly generate electricity as needed.

Other options

Other clean generating options include geothermal power (an established technology with about 8,000 MW installed worldwide), new efficient biomass-powered turbines, and ocean energy systems such as wave and tidal power.

The best of the fossil fuel options is natural gas-fired cogeneration which achieves a high efficiency by using heat from the combustion process for heating water or buildings. Biomass and fuel cells can also power cogeneration systems.

In Europe and North America where rivers have already been extensively dammed, environmentalists are often opposed to new hydropower plants of any size. In many developing countries, however, sustainable power advocates favor small hydro (plants with a generating capacity of under 10 MW) because it can be built with local expertise, capital and materials, and has few social and environmental impacts.

NO MORE HYDROPOWER AS USUAL

Hydropower plants come in so many shapes and sizes and are built in so many different social and environmental contexts that it is difficult to make categorical statements against the entire technology. International Rivers Network strongly believes, however, that too many destructive hydropower dams have been built and too many are being planned, and that better alternatives are being ignored.

Following the recommendations of the World Commission on Dams would ensure that new hydropower plants are built only when they are democratically agreed to be the best option for meeting people's genuine needs. By following the WCD's recommendations, we can advance toward a more just and sustainable energy future.

IRN supports local communities working to protect their rivers and watersheds. We work to halt destructive river development projects and to encourage equitable and sustainable methods of meeting needs for water, energy and flood management. Published in 2003.