



# Dams and Development

A source of information, guidance, and weblinks related to planning and implementing dam projects

Compiled by Jeremy Bird



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## **Acknowledgments**

The author would like to sincerely thank all referenced organizations for permission to reproduce material on the CD-ROM version of the e-paper in the spirit of disseminating such information more widely. Thanks, too, to all who provided valuable inputs and comments in the preparation of the various components of the information package, most especially to Wouter Lincklaen Arriens, Francisco Roble, Jay Delfin, Mario Cabrera, and Gino Pascua.

## **About the Asian Development Bank**

The work of the Asian Development Bank (ADB) is aimed at improving the welfare of the people in Asia and the Pacific, particularly the 1.9 billion who live on less than \$2 a day. Despite many success stories, Asia and the Pacific remains home to two thirds of the world's poor. ADB is a multilateral development finance institution owned by 64 members, 46 from the region and 18 from other parts of the globe. ADB's vision is a region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their citizens.

ADB's main instruments for providing help to its developing member countries are policy dialogue, loans, technical assistance, grants, guarantees, and equity investments. ADB's annual lending volume is typically about \$6 billion, with technical assistance usually totaling about \$180 million a year.

ADB's headquarters is in Manila. It has 26 offices around the world and has more than 2,000 employees from over 50 countries.

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Extracts from ADB policies and guidance documents have been included as illustrations. They undergo periodic review, therefore, reference should be made to the ADB website for current versions.

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# Foreword

**M**ention the word ‘dams’ and strong emotions are likely to emerge—both for and against them. Yet, dams are not a technology that can be ignored. They have provided, and continue to provide, much needed services—water, electricity, agriculture, and flood management. At the same time, we are keenly aware of the associated social and environmental impacts that need to be addressed and mitigated. In some cases, alternative solutions may be better suited to meet development needs.

Development challenges remain intense. Although the incidence of poverty reduced from 30% in 1990 to 22% by 2000, the population of the Asia and Pacific Region is growing at an annual rate of 1.2%, with some countries exceeding 4%. Approximately 700 million people lack access to improved drinking water supplies, and clearly, much more is needed to overcome this shortfall in both urban and rural areas. Economies are growing dramatically at rates of up to 10%, with demand for electricity exceeding 15% in places. Climate change is focusing our minds on renewable sources of energy and energy conservation measures. Dams will inevitably be one of the many means to address such development challenges.

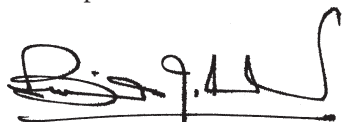
From 1970 to mid-2005, ADB provided financial support to about 65 projects with dams, either directly to the construction of the dam itself or to associated infrastructure. ADB recognizes the complex nature of issues surrounding dam projects and the opportunities and risks they present. Together with our development partners, we continue to monitor and evaluate our experience and learn lessons for future implementation. Over the past 5 years, ADB has participated in a number of reviews and discussions, and these are referenced in the e-paper. In addition to our standard procedures, we sponsored an independent evaluation study of four dam projects in Asia as a submission to the World Commission on Dams (WCD), and financed regional meetings on dams and development in Hanoi in 2000 and Manila in 2001. We are also active members of the Forum of UNEP’s Dams and Development Project (DDP).

In considering new projects, we look at each proposal on its merits within the framework of ADB’s policies. New concepts are being incorporated into planning processes, for example, sharing benefits with the affected communities, introducing financing mechanisms for environmental protection, and assessing cumulative impacts. Our Water Policy provides a framework of integrated water resources management within which individual projects are assessed. Ensuring meaningful consultation is also of paramount importance. In planning processes, we actively engage with affected people and wider civil society to improve the effectiveness, quality, and sustainability of our operations

Much new insight on technical, social, and environmental aspects of dam projects is available from a wide range of sources—governments, professional associations, international organizations, academic institutions, NGOs, multilateral development banks, and multi-stakeholder processes such as WCD and DDP. Yet, even though the Internet provides a vehicle to access such information, there is often a gap in knowing what is available and where to find it. The result is that our awareness of much of this work remains limited.

Based on our engagement in the dams debate, we saw a need to provide a tool to organize and access such information. This e-paper in the Water for All publication series is a first step to responding to that need. It provides extracts and links to guidance documents, analysis, research, and regulations that can be used in the planning and development of future projects. It is intended as a means of accessing information with interpretation wholly the responsibility of the end-user. Inclusion of a particular document or link in the e-paper does not represent an endorsement by ADB—it remains up to policy makers, planners, and other stakeholders to decide on the utility of the material within their own specific context. What we do endorse, however, is a development process where new ideas are considered, evaluated and, where considered appropriate, are incorporated.

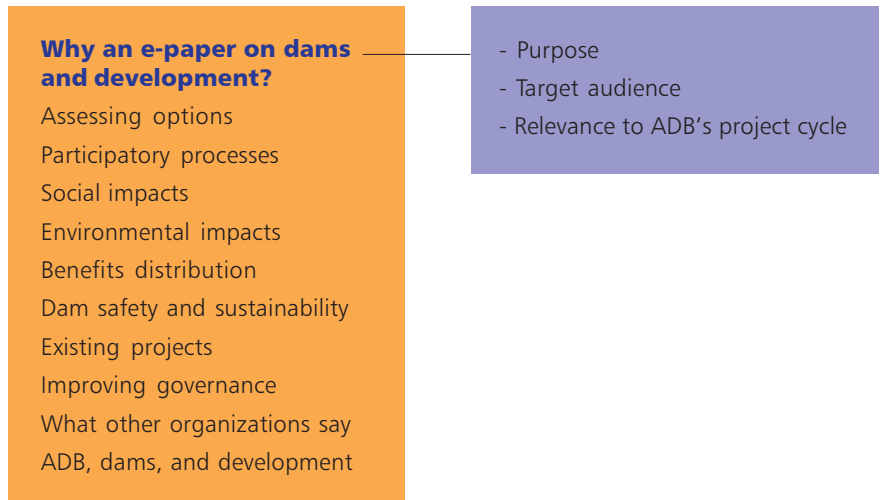
This e-paper is published within ADB's Knowledge Management Framework that promotes two mutually supportive outcomes: (i) increased assimilation of, and dissemination by, ADB of relevant and high-quality knowledge to DMCs and other stakeholders, and (ii) enhanced learning—knowledge capture and sharing—within ADB. Within this framework, we recommend this e-paper to you and trust it will assist in the process of making choices about dam projects in a spirit of constructive and informed engagement.



**Bindu N. Lohani**  
Director General and Chief Compliance Officer  
Regional and Sustainable Development Department  
March 2006

# Some Tips for Using the E-paper

Each screen includes a side menu on the right-hand side as a primary navigation tool for the e-paper. The headings expand to show the material covered.



Referenced reports, guidelines, and websites of other organizations open in a separate window for ease of reference. In the web version of the e-paper, these are live links. In the CD-ROM version, the material is dated 1 May 2005. Reference to the web version of the e-paper should be made for up-to-date material.

Adobe Acrobat 5.0 or later will need to be installed to view certain content of the e-paper. It can be installed from the CD-ROM or from the website.

This is the first draft of the e-paper. You are encouraged to send your comments and suggestions for inclusion of other reports, guidance, case studies, etc. to [water@adb.org](mailto:water@adb.org).

# Why an E-paper on Dams and Development?

## Purpose

Dams continue to be one of the most controversial topics in the water sector—there has been much debate about the benefits and impacts of dam projects. The main purpose of this e-paper is to provide structured and easy access to a range of papers, case studies, and websites that deal with the planning and implementation of such projects.

This e-paper aims to

- make information more accessible within and outside ADB;
- generate informed discussion on the challenges facing future projects; and
- provide a resource document for the review of implementation of ADB's Water Policy in 2005.

**A guide to sources of material:** The e-paper offers a structured guide to find out what other organizations are doing on dams and development issues in and outside of Asia, to view information about new concepts, and to see what ADB policies say.

**Good practice and lessons learned:** In drawing together examples of planning processes and real life project experiences, the e-paper provides an illustration of some emerging principles related to dams. A number of them describe good practice on specific aspects of planning and implementation, but the paper does not attempt to make judgments or identify 'good' dams or 'bad' dams.

**Not a new policy but part of a policy review:** The e-paper makes reference to a number of ADB's policies to assist quick reference and scoping of the issues. The full text of the policies should be considered in all project-related work and links are provided to each policy document and ADB's operational manual. Information contained in the paper, and the discussion it generates, can be considered as part of the ongoing review of implementation of ADB's Water Policy in 2005.

**Quick access:** The internet has increasingly made large quantities of information readily available to us at our desks. But for those without fast or reliable connections, downloading large documents can be a frustrating and tedious process. Making this e-paper and related materials available on both CD-ROM and the web will, hopefully, overcome some of these problems.

**What the e-paper is not:** The intention of the e-paper is not to provide a comprehensive reference book on dam design or everything you need to know on social and environmental issues. Standard texts on these subjects should be referred to. Rather, the aim here is to provide access to information on some of the emerging issues being introduced and recent trends—information that may be available on the web, but is often difficult to locate.

### Why an e-paper on dams and development?

Assessing options  
 Participatory processes  
 Social impacts  
 Environmental impacts  
 Benefits distribution  
 Dam safety and sustainability  
 Existing projects  
 Improving governance  
 What other organizations say  
 ADB, dams, and development

New information will be added to the web version from time to time.

## Target Audience

The e-paper reflects ADB’s commitment to sharing and dissemination of information as part of its knowledge management framework.

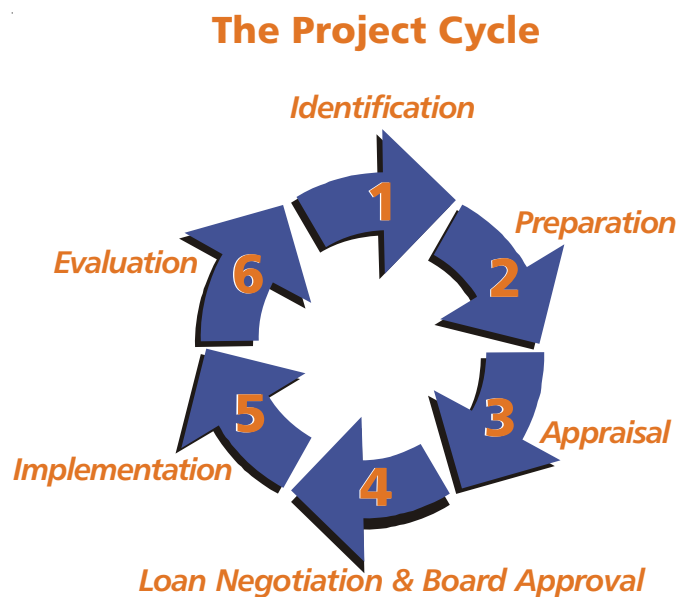
The contents are expected to be of use in the planning and implementation of projects that may involve a dam component by

- ADB staff;
- officials of ADB member countries;
- the private sector; and
- civil society.


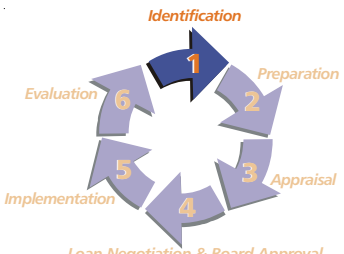


## Relevance to ADB’s Project Cycle

Many of the principles highlighted in the e-paper, such as more meaningful participatory processes, benefit sharing, and improving governance, need to be considered right from the beginning of the planning cycle. There is, however, no single blueprint approach to planning, and the process has to adapt to realities on the ground.

The components and stages of the project cycle vary from agency to agency but generally follow a pattern similar to the six main phases of ADB’s project cycle, as shown in the figure below.



The following table maps out how some of the principles and planning tools described in the e-paper can fit within the planning and project cycle of development institutions, such as ADB.

ADB Planning Cycle	Principles	Processes / Tools
<p><b>Policy development / sector analysis</b></p> 	<ul style="list-style-type: none"> <li>▪ Policy options</li> <li>▪ Policy framework for participation</li> <li>▪ Policy framework for compensation and benefit sharing</li> <li>▪ Policy on environmental flows</li> </ul>	<ul style="list-style-type: none"> <li>▪ Strategic planning options assessment</li> <li>▪ Strategic environmental assessment</li> <li>▪ Cumulative impact assessment</li> <li>▪ Participatory processes</li> <li>▪ Life cycle and multi-criteria analysis</li> </ul>
<p><b>Country Strategy and Program (concept clearance)</b></p> 	<ul style="list-style-type: none"> <li>▪ Targeting poverty reduction</li> </ul>	<ul style="list-style-type: none"> <li>▪ Assessing project options, including improving existing systems</li> <li>▪ Participatory processes – gaining acceptance</li> </ul>
<p><b>Project preparatory technical assistance / project appraisal</b></p> 		<ul style="list-style-type: none"> <li>▪ Assessing project options</li> <li>▪ Stakeholder involvement</li> <li>▪ Designing benefit-sharing mechanisms</li> <li>▪ Determining environmental flows</li> <li>▪ Enhancing project sustainability</li> <li>▪ Compliance mechanisms</li> </ul>
<p><b>Project implementation and operation</b></p> 		<ul style="list-style-type: none"> <li>▪ Stakeholder involvement</li> <li>▪ Compliance mechanisms</li> </ul>

Why an e-paper on dams and development?

### Assessing options

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# Assessing Options —the First Step

Options assessment is about making choices. In providing electricity, this includes the choice of generation technology (thermal, hydropower, wind, etc.), the extent that improvements in existing systems can satisfy demand, the merits of centralized grid systems or off-grid solutions, and the potential for savings through demand side management (e.g., conservation and efficiency improvements). Similar choices are faced in planning for irrigated agriculture, water supply, and flood management.

The following links in the e-paper provide a description of options assessment at the three levels of policy; strategic and sector planning; and feasibility and project studies, together with case study examples:

- What is options assessment?
  - An enabling policy environment
  - Strategic planning and sector analysis
  - Targeting poverty reduction
  - Relevance to the Country Strategy and Program
- Where does options assessment fit in the project cycle?
- What do ADB policies say?
- Sector specific guidance
  - Electricity
  - Irrigation
  - Water Supply
  - Flood Management
  - Operations
- Tools for options assessment
- Examples and case studies
  - Policy level
  - Strategic and sector planning level
  - Feasibility and project level

# Participatory Processes

## — Involving People

### Listening to Stakeholders

Participation in decision making was identified as an important element of development at the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002. The WSSD Declaration stated:

*“We recognize sustainable development requires a long-term perspective and broad-based participation in policy formulation, decision making, and implementation at all levels. As social partners, we will continue to work for stable partnerships with all major groups, respecting the independent, important roles of each of these.”*

Numerous approaches to participation have evolved, and processes vary considerably depending on the nature of the proposal, the stage of planning (from policy formulation through to detailed project planning), and the political and social context within which decisions are taken.

Within this diversity, however, there are some basic common principles and features. This section of the e-paper draws on recent guidance on the following:

- What are the different levels of participation?
- How to identify the stakeholders – defining rights, risks, and responsibilities
  - ‘Rights and risks’ approach of the World Commission on Dams
  - World Bank guidance – defining responsibilities
  - Other examples
- Assessing social impacts
  - Guidance from the International Association of Impact Assessment
  - US Interorganizational Committee on Principles and Guidelines for Social Impact Assessment
  - WCD – Baseline Social Conditions
- What does ‘prior-informed consent’ mean in practice?
  - International Labour Organisation and Indigenous Peoples
  - WCD approach to prior-informed consent
  - InterAmerican Development Bank and Indigenous Peoples
  - Extractive Industries Review recommendation on PIC
  - Examples of national laws and negotiated agreements
- What do ADB policies and strategies say?

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# Social Impacts

## —Beyond Resettlement

Displacement of people from the area to be inundated by a reservoir is generally considered as the main area of social impact of a dam.

However, experience has shown that dam projects often have a far wider social effect. Impacts are also felt by

- host communities, among which those displaced will be resettled;
- communities living upstream and downstream of a dam that are affected by changes in river flows, water quality, and aquatic ecosystems; and
- communities living in the periphery of the project and affected by changes in access to natural resources or the local economy.

Assessing baseline conditions and the scale of impacts requires intensive surveys and sensitivity to issues related to ethnic minorities, gender, cultural heritage, and customary rights.

The e-paper includes information on some emerging approaches that address social impacts consistent with the overall development perspective of a project:

- Resettlement: compensation or development?
  - Resettlement as development
  - Some examples of national resettlement policies
- How can upstream and downstream impacts be addressed?
- Gender design – ADB case studies
- What do ADB policies say?



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# Environmental Impacts

## —Avoid, Minimize, Mitigate

Understanding the nature and scale of environmental impacts early in the planning process is fundamental to devising alternative plans to avoid, minimize, or effectively mitigate the consequences.

This raises an immediate challenge—how to obtain the level of information required when plans and financing arrangements are at a conceptual or preliminary stage of planning?

Diversity is also a major challenge in assessing potential impacts, with no two dam sites the same. This is particularly the case for some of the emerging techniques in environmental assessment and management, such as environmental flows and cumulative impact assessments.

As an introduction to these and other emerging issues, including improving our understanding of the linkages between aquatic ecosystems and people's livelihoods and the difficulties in preserving key fish species, the e-paper covers the following:

- Strategic environmental assessment (How can problems be identified earlier?)
  - Guidance from the International Association of Impact Assessment
  - Protocol on SEA-UN Economic Council for Europe
  - SEA Directive of the European Parliament
  - WCD Guideline on Strategic Impact Assessment
  - World Bank Technical Paper
  - South African Guideline Document on SEA
- Dams within the framework of international environmental conventions
  - Convention on Biological Diversity
  - Ramsar Convention
  - UN Convention on Non-navigational Uses of Watercourses (not yet in force)
  - UNECE Convention on Environmental Impact Assessment in a Transboundary Context
- Using environmental flows to meet ecosystem needs
  - IUCN Flow: The essentials of environmental flows
  - World Bank Working Papers

- WCD recommendations on environmental flows
- South African legislation: the ecological reserve
- Case studies
- Assessing cumulative impacts: taking a basin perspective
  - US Council on Environmental Quality – handbook on Cumulative Effects
  - World Commission on Dams – assessment of cumulative impacts
  - International Energy Agency on cumulative impacts
- Incorporating cultural assessments
  - World Commission on Dams on cultural assessment
  - World Bank guidance on cultural property being updated
- Incorporating health assessments
  - World Commission on Dams on health assessment
  - World Health Organization – submission on Human Health and Dams
  - UK – Health Impact Assessment
  - UN Economic Council for Europe and health impact assessment
- Greenhouse gas emissions from reservoirs: what is the debate about?
- Some examples of mitigation measures
- What do ADB policies say?



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# Benefits Distribution

## —Who Gets What?

Dam projects can provide considerable benefits to national economies and the targeted beneficiaries. For example, the Tarbela dam in Pakistan, with an installed capacity of 3,500MW, generates approximately one fifth of the country's electricity and is part of a network of dams, barrages, and canals that irrigates 18 million hectares.

Concerns have been raised, though, over the often inequitable distribution of benefits from dam projects and led to calls for a new emphasis on benefit sharing in planning and project design. The e-paper provides information on how project benefits can be shared with affected people, as well as analytic tools for determining the nature and distribution of benefits, in particular:

- What benefits can be shared?
  - World Bank – benefit sharing report
  - World Commission on Dams – project benefit-sharing mechanisms
  - International Energy Agency – optimizing regional benefits
  - Examples from Canada, Norway, Brazil, and Nepal
- Distribution analysis – who benefits and who bears the costs?
- Secondary benefits – what are the multiplier effects?
  - Secondary benefits quantified in Sri Lankan irrigation
  - Study on Multiplier Effects of Dams
- What do ADB policies say?

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# Dam Safety and Sustainability

Planning, design, operation, and monitoring all play an important part in the safety and sustainability of a dam project.

Safety issues go beyond the structural integrity of the dam itself to the safety of communities downstream as a result of dam operation.

Two of the main aspects of prolonging reservoir life relate to

- water quality – ensuring its suitability both for intended purposes and for the ecosystem, and
- sedimentation – the rate at which sediment accumulates within the reservoir and its impact on project outputs and duration.

For information on issues related to dam safety, preserving water quality, and minimizing sedimentation, the e-paper provides links to:

- Guidance on dam safety
  - World Bank Policy on Dam Safety
  - World Bank Comparative Study on Dam Safety Regulation
  - Guidance of the International Commission on Large Dams (ICOLD)
  - UK Reservoir Safety
  - US Bureau of Reclamation – Dam Safety Office
  - World Commission on Dams – thematic review on operations
  - Earthquakes and dams
  - Downstream safety and livelihoods – impoundment and emergency drawdown
- Coordinating operation in times of flood
  - US Federal Emergency Management Agency
  - Managed floods – an ecosystem approach to basin management
  - ICOLD Bulletin No 125: Dams and Floods
  - Floods and reservoir safety, UK Institution of Civil Engineers
- Monitoring and maintaining reservoir quality
- Managing sedimentation to prolong reservoir life

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# Existing Projects

## —a Development Opportunity

There are an estimated 45,000 large dams worldwide. On the performance side, this presents a significant base within which to increase production—in both developed and developing countries.

At the same time, there is growing awareness of the need to resolve outstanding social and environmental problems.

Taken together, the attainment of improved performance of existing projects and the resolution of past problems offer an opportunity to demonstrate and engender confidence in a new approach to water resources planning.

Information on improving the performance of existing systems and addressing outstanding social and environmental issues is given in the following links:

- Enhancing performance – upgrading the system and revisiting operating rules
  - World Commission on Dams – restore, improve, optimize
  - Examples of enhancing performance
- Addressing outstanding social and environmental problems
  - Addressing outstanding issues – World Commission on Dams
  - Examples of reparation programs
- What do ADB policies say?



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# Improving Governance in the Water Sector

As indicated in the policies of international organizations and examples outlined in this e-paper, extensive guidance on planning and implementation of projects exists to promote the core principles of equitable and sustainable development.

Often, problems occur in the implementation of those policies and guidelines or as a result of institutional constraints, differing interpretations, vested interest, or lack of awareness.

Key governance challenges at a macro level of government management and fiscal operations are described on ADB's Governance web pages.

This section of the e-paper touches on two areas: first, the overall institutional framework, in terms of encouraging greater cooperation across sectors and introduction of the concept of integrated water resources management; and second, compliance mechanisms related to project implementation and delivering on commitments.

For further information in these two areas, the e-paper provides links to

- Institutional reforms in water resources
- Regional cooperation
  - International Law
  - Regional agreements
- Mechanisms to encourage compliance
  - WCD recommendations – Compliance Plan
  - Dams and Development Project Workshop on Ensuring Compliance
  - Environmental performance bonds
  - Trust funds
  - International Hydropower Association – Compliance Protocol
  - Environmental Product Declaration – ISO 14025
- Reducing corruption
- What do ADB policies say?

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# What Other Organizations Say

The debate over dam projects remains highly controversial, and each planning process and project raises a range of sensitive issues to be considered within the individual country context.

In 2000, the World Commission on Dams proposed a new framework for decision making on dams and their alternatives. Since then, the WCD report itself has been the subject of considerable debate.

Its framework of five core values and seven strategic priorities has gained support, although there are major disagreements among different stakeholder groups on some of the implementation guidelines.

Following publication of the WCD report, a number of organizations have reviewed and developed their own guidance on large dam projects.

For information on the WCD report, spectrum of reactions to the report, and guidance of other agencies, see

- World Commission on Dams
  - Reactions to the WCD report
  - Institutional follow-up to WCD
- UNEP Dams and Development Project
- World Bank
- Examples of in-country dialogues on dams and development
- Emerging policies in the private sector and export credit agencies
- Professional associations
- International organizations
- Nongovernment organizations

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# ADB, Dams, and Development

ADB's portfolio in the period 1970 to mid-2005 included 65 projects with dams (large and small). Currently, the pipeline includes an average of one to two dam projects per year.

A set of safeguard and sectoral policies provides the framework within which such projects are implemented. A continually changing environment requires that such policies need to be interpreted in line with emerging good practice.

This section of the e-paper provides links to ADB's existing policy framework; its response to recent initiatives, such as the World Commission on Dams; an information base on past and current projects with dam components; and suggestions for areas where further policy dialogue is required as part of the process of policy review. Specifically, the section includes the following:

- ADB's policy framework
- ADB follow-up to the World Commission on Dams
- Information base on ADB's dam projects
  - Database on ADB projects with a large dam component
  - Links to resettlement action plans and environmental assessment reports
  - ADB evaluation reports
  - Communications with civil society
  - ADB statements on dams and development
- Recommended areas for policy dialogue



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# Dams and Development

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Dams as a technology cannot be ignored. They continue to provide much needed services—water, electricity, agriculture, and flood management. However, one should also be keenly aware of the associated social and environmental impacts that need to be addressed. It is hoped that this e-paper, which is available on the Internet and compact disc, will assist you in making constructive and informed choices in planning and implementing dam projects and their alternatives.

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