



<b>1. Project Data:</b>		<b>Date Posted :</b> 08/20/2001	
<b>PROJ ID:</b> P003562		<b>Appraisal</b>	<b>Actual</b>
<b>Project Name:</b> Xiaolangdi Multipurpose	<b>Project Costs (US\$M)</b>	2295	2247
<b>Country:</b> China	<b>Loan/Credit (US\$M)</b>	460	429.7
<b>Sector(s):</b> Board: RDV - Flood protection (50%), Power (49%), Central government administration (1%)	<b>Cofinancing (US\$M)</b>		
<b>L/C Number:</b> L3727			
	<b>Board Approval (FY)</b>		94
<b>Partners involved :</b>	<b>Closing Date</b>	12/31/2000	12/31/2000
<b>Prepared by :</b>	<b>Reviewed by :</b>	<b>Group Manager :</b>	<b>Group:</b>
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<b>2. Project Objectives and Components</b>			
<b>a. Objectives</b>			
The objectives were to:			
<ul style="list-style-type: none"> <li>Introduce flood control in the lower reaches of the Yellow River Basin to protect major infrastructure and 103 million people.</li> <li>Control siltation in the 800 km downstream channel of the river and prevent further aggradation (raising of the bed of the river downstream, which then requires the raising of flood protection dikes .)</li> <li>Provide water for assured irrigation and more stable water supplies for downstream cities and industries .</li> <li>Generate 5,400 GWh per year of hydropower for supplementing the base load of thermal stations in Henan and the Central China Shanxi power networks .)</li> </ul>			
Xiaolangdi (XLD) was identified as the priority project in the Bank-supported 1992 Yellow River Investment Planning Study. It also plays a key role in the Water Sector Strategy for North China (April 2001) and the ongoing 3-H Action Program for Water Resources in the 3-H (Hai, Huai and Yellow) river basins in North China.			
<b>b. Components</b>			
The project cost of \$2247 million comprised:			
<ol style="list-style-type: none"> <li>1. Site preparation / Local Civil Works (12.9%)</li> <li>2. Dam and Appurtenances (51.8%)</li> <li>3. Turbines and Gates (4.1%)</li> <li>4. Generators and Electrical Works (4.1%)</li> <li>5. Institutional Development and Training (.1%)</li> <li>6. Engineering and Administration (7.1%)</li> <li>7. Implementation Consultants (1%)</li> <li>8. Environmental Management (.4%)</li> <li>9. Ministry of Water Resources (MWR) and YRCC (Yellow River Conservancy Commission ) (.1%)</li> <li>10. Physical Contingencies (4.5%)</li> <li>11. Interest during construction (14%)</li> </ol>			
<b>c. Comments on Project Cost, Financing and Dates</b>			
The economic cost of XLD include the resettlement project approved in 1994 (the Bank contributed \$110 million of a total appraisal cost of \$571 million.) The Phase II project added another \$430 million of Bank funding in 1997. The ICR economic analysis adopts 1997 as the base year and compounds earlier costs forward at a 12% interest rate. The cash flow for the ICR economic evaluation suggests a cost of \$2 billion (after shadow pricing.) Construction and equipment costs were 5 % below SAR levels (from better contracting and procurement) but after adding completed resettlement to the unadjusted financial cost the total will probably exceed \$3 billion.			
<b>3. Achievement of Relevant Objectives:</b>			
<ul style="list-style-type: none"> <li>The dam was completed on time and is now capable of regulating flows of the Yellow River during both wet and dry seasons for flood control, irrigation, water supply, hydropower needs and to avoid ice floods (an adequate flow can be released from the reservoir to prevent freezing .)</li> </ul>			

- Silt control of 300 million tons/annum are expected over 20 years, which would mean that by 2021 5-6 billion m3 of silt will have accumulated; the remaining 6.0 billion m3 of reservoir capacity can be sustained by reducing the generation of silt at its main source on the Loess Plateau, permitting periodic flushing. This is predicated on the success of other river engineering and watershed management projects.
- The project was already supplying water in 2000, one year ahead of schedule, allowing 2 billion cubic meters to be supplied downstream for irrigation, municipal, industrial and household use.
- Power generation has not been as high as estimated in the SAR - generation was only 33% of the target. Fortunately the multipurpose design of the project has permitted a more appropriate set of operational objectives to be formulated given the changed circumstances. The relatively high value of water for irrigation/M&I (Municipal and Industrial) sectors has been magnified by a 1 in 80 year drought in 2000. The increased demand for irrigation/M&I users was serendipitously matched by a much-reduced demand for electricity due to economic downturn and substitution by lower-priced energy from thermal power stations.

Achievement of the major outputs as defined in the Staff Appraisal Report were:

1. **Dam and Inlet and Outlet Structures** : flood control, water supply and silt control objectives have been achieved. Flood control provides 1:1000 year event protection to 103 million people. Water should also be available to restore some of the river capacity by flushing the river from time to time (from 1958 to 1996 the river has lost 65% of its flow capacity due to aggradation.)
2. **Power Generation** : achievement of power production benefits will depend on economic growth and energy market reform restoring demand. The closing of coal-fired plants and introduction of two-tier pricing will help XLD's financial viability. XLD was designed to provide both peaking supply as well as baseload supplementation.
3. **Environmental Impacts and Protection Measures** : By the end of March 2001, 148,000 of a full development target of 197,000 people have been resettled with the available funds. 300,000 people have been indirectly benefited by construction of the dam. Safety measures are working effectively and programs of excavation and preservation of relics have been completed. An independent review of the XLD Resettlement Project was conducted for OED's 2000 study of the Bank's water resources management policy and resettlement performance was rated highly - "*the best resettlement option was deduced from the Country's past resettlement experience. The women's role in resettlement is emphasized.*" An International Panel of Experts on Environment and Resettlement (POE) has conducted 12 meetings and helped ensure effective management of adverse environmental impacts, by overseeing implementation of a systematic environmental management plan (EMP.)
4. **Training and Technical Assistance** - training was carried out satisfactorily but with omission of Cash/Treasury and Personnel Management. Engineering services were provided by joint Chinese-International Consortia.
5. **Institutional Program** Accounting and water-pricing reform, the development of a real time water dispatch system, river basin organization and licensing were important institutional sub-components. This project will help achieve national water resource development and management objectives, and builds on the wide past experience of the Bank and Borrower on similar projects in China.

The economic rate of return is reported as 17.9% compared to 17.5% at appraisal. However, the analysis did not include resettlement costs nor the benefits of value of lives saved from flood control, and reduced costs of water treatment. There are also air pollution reduction benefits to the extent that thermally generated power is displaced by cleaner hydropower.

The ICR financial analysis projects a \$1.2 to 1.8 billion government subsidy to YRWHDC as compensation for loss of hydropower revenue. These subsidies are for 5 years and in 2006 cash flow should be sufficient to cover all costs. Financial sustainability could be improved by negotiating better prices from the irrigation /water supply sectors and introducing separate peak and base load electricity tariffs.

#### 4. Significant Outcomes/Impacts:

- The dam will reduce floods from a 1 in 2 year (without the dam) to a 1 in 7-10 year (with the dam) occurrence. Floods spilling over the riverbanks, causing extensive damage to the 1 million people in the floodplains, have occurred in recent years even with the 1 in 2 years events. Historically, flood calamities in the lower reaches have affected 12 million ha and 70 million people in the provinces of Henan, Shandong, and parts of Anhui, Hebei and Jiangsu.
- Despite a drought in North China, the dam has enabled continuous flow in the lower reaches of the Yellow River. The last 10 years have seen much publicized periods when nothing would reach the sea for 180-270 days a year. Additional water supply available for irrigation at times of high-water stress is expected to increase production significantly and agricultural benefits represent 44% of the projected total.
- Improved surface water availability will make it easier for Government to achieve the more difficult but equally important goal of replenishing the severely over-mined North China aquifer, through a combination of improved pricing of water and stricter regulation of groundwater abstractions.
- For the first time in centuries the river downstream of XLD is relatively clear and silt free (the Yellow River carries one of the highest silt loads in the World.) This will reduce the cost of water treatment and enhance freshwater ecology.
- Environmental and social impacts have been mitigated by Bank participation and China's adoption of standards and procedures developed largely on other Bank-supported projects.

- XLD is the first large-scale multipurpose dam project in China to use only international contracting and construction management procedures. This has improved management of the projects' quality, work flows and costs, allowing a large and complex scheme to be built in 7 instead of the originally planned 12 years.

#### 5. Significant Shortcomings (including non-compliance with safeguard policies):

There are no significant shortcomings. Minor shortcomings were:

- Monitoring and evaluation systems could benefit from broader participation from civic society to improve designs for and confirm the benefits of present projects. OED's review of XLD and XLD Resettlement projects, part of the evaluation of the implementation of the Bank's water resources management policy, also noted that "The state and provincial leading groups are responsible for planning and developing resettlement strategies. Participation discussion is lacking"
- In the early stages of implementation there were delays due to the YWHDC's (Yellow River Water and Hydropower Development Corporation) inability to make quick decisions. This was largely overcome after the incorporation of foreign consultants as part of the team.

6. Ratings:	ICR	OED Review	Reason for Disagreement /Comments
<b>Outcome:</b>	Satisfactory	Highly Satisfactory	All main objectives were achieved and due to the multipurpose nature of the project, flexibility of operation has allowed adaptation to changed national priorities. Environmental impact is positive and the resettlement project regarded as best practice. The project was on time and within budget.
<b>Institutional Dev.:</b>	Substantial	Substantial	The shared benefits of XLD, across provinces, improve the prospects for reorganization of the Yellow River Basin Authority, building on bottom-up and voluntary provincial participation in a system of shared governance.
<b>Sustainability:</b>	Likely	Likely	Likely overall, albeit with some outstanding issues to be resolved regarding water pricing, river basin management and adequacy of measurement and control systems.
<b>Bank Performance:</b>	Satisfactory	Highly Satisfactory	From design through completion, performance has been highly satisfactory.
<b>Borrower Perf.:</b>	Satisfactory	Highly Satisfactory	The client has made excellent use of the Bank and other foreign partners to supplement its own high level of resolve and technical competence.
<b>Quality of ICR:</b>		Exemplary	

**NOTE:** ICR rating values flagged with '\*' don't comply with OP/BP 13.55, but are listed for completeness.

#### 7. Lessons of Broad Applicability:

1. At a time when dams are rightly receiving a high degree of critical scrutiny, the success of XLD shows the value of continued Bank involvement in both dam construction and assistance with water resources policy. China is a country whose continued partnership in international water initiatives will be a major positive factor in resolving global resource and public good issues in the coming century.
2. For projects of this magnitude and complexity, the implementing organization should be commercially independent, have decision-making authority and responsibility for its performance. As a bureau of the Ministry of Water Resources (MWR), YRWHDC could not make difficult construction management decisions without referring back to MWR.
3. Communications difficulties (between owner, designer, engineer, advisors, contractors etc) were the most difficult to resolve and extended beyond language, to ideas and concepts, across international boundaries of training and culture. This should be given more attention in the design of future projects.
4. Project management systems should commence before construction, to protect their owners (e.g. YRWHDC) from exposure to claims arising from failures to provide systems they are responsible for themselves.
5. The pattern of increased allocations for irrigation /water-supply is likely to be sustained since the economic value of water used to supply dry-season municipal and industrial (M&I) demands is estimated to be \$1.25 - 1.9 billion/annum, compared to the hydropower subsidy of \$240 to 360 million.

6. As the only major peaking plant in the Central China Grid there will always be a demand for peaking power, so the reduction in economic benefits is likely to be less than a simple prorating based on reduction of generated power. To the extent that reduced generation of hydropower increases the use of dirtier sources, environmental benefits will be decreased.
7. The use of a body like the POE is necessary to ensure successful implementation of EMPs, especially for those large-scale projects with significant environmental damage potential .

**8. Assessment Recommended?** ☒ Yes ☐ No

**Why?** The project offers many lessons and could be easily be clustered with other important Bank-supported water resource projects in China .

**9. Comments on Quality of ICR:**

Exemplary.