New Approaches for Medium-Scale Hydropower Development in Vietnam

Lessons from Preparation of the Trung Son Hydropower Project

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THE WORLD BANK

Australian AID
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Preface

The challenge for hydropower is in implementation—maintaining quality project development under the pressure to meet tight timelines imposed by rapidly growing demand for electricity. With demands to accelerate project implementation, the question is how to achieve the best results, especially in delivering new sources of electricity efficiently, at least cost, with minimum environmental and social impacts and ensuring subsequent safe operation of the plant. Vietnam has made great progress in developing a modern framework for project selection, design, and management, but delays and cost overruns are frequent, though by no means confined to either hydropower projects or the power sector as a whole. In reservoir resettlement work, Vietnam’s policy and financial commitment is high, but there is room for improvement in terms of complementing the focus on resettlement-site infrastructure with attention to livelihoods restoration. Environmental assessment work has improved, but enhancements can be made in defining and ensuring that mitigation measures are carried out. Dam safety practices can benefit from gradually moving away from rules-based systems that may not devote adequate attention to the risks to life and property in the event of unexpected flood events. Mitigating and managing risks proactively so that they do not become a distraction during project implementation requires institutions and mechanisms that can provide timely and effective solutions.

Purpose of This Paper

This paper provides an overview of the Trung Son hydropower project preparation experience and highlights the innovative features of the project, primarily focusing on the adoption of new approaches in project design and integration of social and environmental concerns. Through disseminating the Trung Son project experience, this paper is intended to contribute to the sustainable scale-up of medium-scale hydropower in Vietnam, based on practical experience.

This paper was funded by the Australian Agency for International Development (AusAID) as part of a broader activity supporting sustainable hydropower development in Vietnam. Resources from the AusAID–East Asia Infrastructure for Growth Trust Fund supplemented those available to the World Bank task team in charge of the project. These funds were made available to

- provide targeted expert assistance for supporting project preparation efforts to adopt new approaches in the Trung Son hydropower project case, with a focus on enhancing local capacity to implement international good practices in medium-scale hydropower development;
- evaluate the practical experiences during project preparation in adopting new approaches, assessing their advantages and disadvantages in the Vietnamese context, providing evaluations of the lessons learned, and making recommendations for the future;
disseminate these lessons and views for future work; and
work with government agencies and companies on plans to institutionalize the most promising and relevant new approaches developed through the Trung Son project.

Examples of specific activities for which AusAID funds were used include the hiring of expert international consultants to advise on and participate in consultations between the project developer and affected communities to discuss the proposed environmental and social mitigation measures; assisting Vietnam Electricity (EVN) to review lessons learned from the first round of consultations; analyzing economic aspects of the project and its fit within the system expansion plan; helping the investor prepare for negotiation of the Power Purchase Agreement by carrying out extensive financial analyses of the financial implications of various options; and building capacity at EVN throughout the project preparation process.

The full set of outputs produced during the preparation of the project, whether financed by EVN, the World Bank, or AusAID funds, have been disclosed on the project website1 and provide practical examples of the application of good practice in dam safety; environmental assessment and mitigation; resettlement program design; livelihoods restoration planning for project-impacted persons; consultation with local people, most of whom are from ethnic minorities; grievance mechanisms; economic and financial analysis; and greenhouse gas accounting.

Target Audience
This paper may benefit Vietnamese government agencies and entities involved in hydropower development, nongovernmental organizations (NGOs) and sector practitioners in other countries interested in sustainable hydropower development, and World Bank staff preparing hydropower projects in East Asia or elsewhere in the world.

Organization
This paper is made up of three parts:

Part A introduces the Trung Son Hydropower Project. It contains basic information about the project and its background, scope, implementation arrangements, and financing. It also provides an overview of the main social and environmental impacts expected from the project, and the mitigation measures designed to address them.

Part B presents highlights from the Trung Son Hydropower Project, focusing on the main themes addressed during preparation. It is not intended to be an exhaustive review of each aspect of the project, rather, it emphasizes the aspects that are innovative in the context of hydropower development in Vietnam.

Part C contains the authors’ conclusions about why the Trung Son Hydropower Project experience matters, and discusses the features that make it a good example for future scale-up of sustainable hydropower development in Vietnam as well as for hydropower development in other countries.

Acknowledgments

This paper was prepared by Defne Gencer and Richard Spencer. It relies on official project documentation, background reports, and underlying analyses generated during the preparation of the Trung Son Hydropower Project.

The paper benefited from information, insights, and feedback provided by individuals who were core team members during project preparation or outside advisers with knowledge of the project. They include Stephen Lintner, Alessandro Palmieri, Panneer Selvam, Juan Quintero, John Butler, Daniel Gibson, William Rex, and George Ledec, among others. The paper also benefited from inputs from the Vietnam energy team, and we would particularly like to thank Ky Hong Tran for his unstinting help and support. The authors would like to recognize editor Sherrie Brown, graphic designer Laura Johnson, and Adam Broadfoot, Assistant Project Manager, World Bank Printing and Multimedia Services, for their contributions to the production of this publication.

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The authors would also like to recognize all those who contributed to the broader activity supporting sustainable hydropower development in Vietnam and the Trung Son Hydropower Project in particular. They are too numerous to mention by name and include representatives of the government of Vietnam, Vietnam Electricity, Trung Son Hydropower Company, World Bank staff past and present, NGOs, and most important, those who are affected by the project.

Last, the team thanks AusAID for providing the resources to make this activity and its final product possible. The team would like to acknowledge the contributions from Aldo Baietti and Hye-Yon Kim for their role in facilitating cooperation between the team and AusAID.

None of those who have been so generous with their help are answerable for any errors, all of which are the responsibility of the authors alone.
## Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AusAID</td>
<td>Australian Agency for International Development</td>
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<td>Bank</td>
<td>World Bank</td>
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<tr>
<td>CLIP</td>
<td>Community Livelihood Improvement Plan</td>
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<td>CO₂</td>
<td>carbon dioxide</td>
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<td>EIA</td>
<td>environmental impact assessment</td>
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<td>EMDP</td>
<td>Ethnic Minorities Development Plan</td>
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<td>EMP</td>
<td>Environmental Management Plan</td>
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<td>EVN</td>
<td>Vietnam Electricity</td>
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<td>GHG</td>
<td>greenhouse gas</td>
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<td>GWh</td>
<td>gigawatt-hour</td>
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<td>IBRD</td>
<td>International Bank for Reconstruction and Development</td>
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<td>IGP</td>
<td>Independent Grievance Panel</td>
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<tr>
<td>km</td>
<td>kilometer</td>
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<td>km²</td>
<td>square kilometer</td>
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<td>kV</td>
<td>kilovolt</td>
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<tr>
<td>m</td>
<td>meter</td>
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<td>m³</td>
<td>cubic meter</td>
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<tr>
<td>MW</td>
<td>megawatt</td>
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<tr>
<td>NT2</td>
<td>Nam Theun 2 hydropower project</td>
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<tr>
<td>NGO</td>
<td>nongovernmental organization</td>
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<tr>
<td>NPT</td>
<td>National Power Transmission Corporation</td>
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<tr>
<td>O&amp;M</td>
<td>operations and maintenance</td>
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<tr>
<td>PDR</td>
<td>People’s Democratic Republic</td>
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<tr>
<td>RLDP</td>
<td>Resettlement, Livelihoods and Ethnic Minorities Development Program</td>
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<tr>
<td>RP</td>
<td>Resettlement Plan</td>
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<td>SESIA</td>
<td>Supplementary Environmental and Social Impact Analysis</td>
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<td>TSHPCo</td>
<td>Trung Son Hydropower Company</td>
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<td>TSHPMB</td>
<td>Trung Son Hydropower Management Board</td>
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<td>TSHPP</td>
<td>Trung Son Hydropower Plant</td>
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Key Points and Conclusions

Why does the Trung Son Hydropower Project matter? The Trung Son Hydropower Project is the first hydropower project in Vietnam financed by the World Bank. This project matters because it is a practical example of a project prepared according to international good practices in technical design, analysis of alternatives, and particularly environmental, social, and dam safety elements. The project preparation process has been instrumental in introducing new approaches to ensuring sustainability of medium-scale hydropower development in Vietnam. If replicated, the Trung Son example can contribute to scale-up of hydropower development in Vietnam as well as in other countries interested in sustainable hydropower development in the future. The lessons from preparation of this operation could apply to similar operations, especially in how the government, EVN, and the Bank worked in partnership on challenging issues.

What are the innovations and highlights of Trung Son? The Trung Son Hydropower Project reflects international good practice and is innovative in the Vietnamese context in a variety of respects, as summarized below.

- Preparations of a low-impact project for the scale of energy it is designed to produce. When completed, the power plant will have an installed capacity of 260 MW, but it is expected to have a relatively low impact compared with other hydropower. The project has a comparatively small reservoir area of 13.13 km² and affects an area with low population density—about 2,300 households are affected by the whole project, of whom about three-quarters will be affected by the reservoir.
- Completion of an environmental impact assessment that more fully considers all of the main impacts of the project, and provides greater detail on mitigation measures to be adopted.
- Incorporation of approaches for ensuring the design safety of the dam that focus on results under a series of plausible scenarios, not simply conformity with a static safety design standard applicable to all dams of a specified height and size.
- Adoption of an integrated and adequately budgeted livelihoods restoration plan, which is a first in Vietnam for either a domestically or donor-financed hydropower project.
- Capturing of social and environmental mitigation measures as part of the project objective.
- The government’s willingness to borrow for social and environmental impact mitigation, and dedication of funds provided by the International Bank for Reconstruction and Development to improved resettlement, livelihoods development, support for ethnic minorities, and environmental protection during project implementation.
- Setting aside of project funds for continued financial and technical assistance to improve social, environmental, and dam safety practices in the country’s hydropower sector, which effectively builds into the project the potential replication of sustainable hydropower development.
Preparation and mandating of a Governance and Accountability Framework, the implementation of which in its entirety was made binding for Trung Son Hydropower Company (TSHPCo) through covenants in the project’s legal agreements, and is reflected in the Project Operations Manual.

Establishment of an independent grievance mechanism to complement the official channels to allow project-affected communities to voice their concerns.

Assignment of a formal role to continued involvement by international technical experts through entities such as the Project Technical Advisory Panel, the Social and Environmental Panel of Experts, and the Independent Grievance Panel, among others.

Incorporation of an adaptive management mechanism, in recognition of the inability to fully predict and confirm all impacts, and hence mitigation measures, in advance of the implementation of a large infrastructure project, thereby building realism, proactivity, and responsiveness into the project design.

Continued focus on disclosure of project information and key documents as they become available, as part of a communications strategy.

What is noteworthy about the Trung Son project preparation effort? Preparation for the project served as an opportunity to strengthen country systems, develop local capacity for sustained results during implementation, conduct extensive consultations, and address governance issues. Noteworthy aspects of preparation for the Trung Son Hydropower Project are summarized below.

Early on in project preparation, various options were comprehensively analyzed to optimize hydropower generation while minimizing environmental and other impacts, especially the number of people affected by the project and area flooded. An equally comprehensive economic analysis provided a solid understanding of alternatives.

During project preparation, all parties made major efforts to address social and environmental issues and challenges identified, based on international good practice for sustainable hydropower development, especially with regard to dam safety and social and environmental factors.

Key environmental and social programs were prepared by building on country systems. Gap analysis between Vietnamese and World Bank standards—in which gaps were identified and additional reports were commissioned to address the gaps—were prepared primarily by senior Vietnamese experts with support from international consultants.

Various international experts were engaged in project preparation and design of social and environmental mitigation measures and will continue to advise on technical construction, operations, and dam safety issues.

During preparation, the focus was on building capacity of Vietnamese staff and encouraging learning by doing. Extensive training was provided to TSHPCo Project Management Bureau staff on a range of subjects, including project preparation, implementation, and management; preparation and implementation of action plans and measures for environmental impact mitigation; and assessment, minimization, and mitigation of social impacts of the project during preparation and implementation. The specific capacity-building initiatives were complemented by a focus on the preparation of all major reports primarily by senior Vietnamese experts. This focus on learning by doing differs significantly from an approach that relies on international consultants preparing key project documents on behalf of a borrower, in varying degrees of isolation from the borrower’s team. Furthermore, throughout project preparation, significant transfer of knowledge took place between international and national experts.

In light of the multipurpose nature of the project, a more complete assessment was conducted to determine the optimal management of water controlled by the reservoir to meet environmental requirements, flood protection, and power generation needs.
Local communities were engaged in broader discussions on how the project might best meet local development aspirations and contribute to improved local livelihoods, with efforts to incorporate these ideas into project and resettlement design work.

Various innovative approaches were used during preparation of the project and of programs for mitigating the project’s potential impacts, particularly consultations in local languages using a variety of visual media, integrated with a comprehensive communications strategy. Project design and programs for mitigating the project’s potential impacts were updated or changed after the consultations.

Early and open consultations were undertaken with local NGOs and civil society, including advocacy NGOs with international linkages. This cooperation helped enhance mutual understanding between the Bank, EVN, and the local NGOs, the aims of which are broadly similar to the Bank’s safeguard policies, in that they are focused on ensuring that the people affected by the project benefit from it and that their concerns are properly addressed.

During preparation, special attention was dedicated to governance and accountability aspects, starting with targeted capacity building for individuals involved in project management, focusing on improving understanding of processes and specific implementation arrangements for ensuring transparency, integrity, and accountability. As part of project preparation, and at EVN’s request, the Bank initiated an assessment of the fraud and corruption environment in the power sector. The assessment and its findings and recommendations were received positively, with enthusiasm and strong ownership on the part of EVN and TSHPCO leadership, and have since been instrumental in informing the broader governance and anticorruption dialogue with Vietnam. With the agreement of EVN and TSHPCO management, recommendations from the assessment are being piloted in the project and will be fed back to the rest of EVN as the project progresses.

What did the task team learn? Lessons from the Trung Son project experience are summarized below, and are explored in further detail throughout the paper.

Building on country systems provides an opportunity to achieve broader development impacts while encouraging ownership at the country level.

Composition of the preparation teams is critical on both the client’s and the Bank’s side and needs to draw on the widest range of skills possible. The use of high-quality international and local consultants to support preparation is preferable to the use of large firms. The benefits to project preparation far outweigh the heavier management burden.

Methodological coordination can be challenging with diverse teams of varying experience; pairing international and local consultants, then using a coordinating author is effective in bringing complex documents together but requires close attention to sequencing.

If all parties are able to accept that they do not have all the answers, they are bound to disclose, consult, listen to grievances, and adapt as well as change the nature of the dialogue.
Electricity demand in Vietnam has been growing at 14–15 percent per year for the past several years, and is expected to continue to grow as the country moves toward middle-income status. Vietnam envisages growth of all major domestic power generation sources and of electricity imports to meet its burgeoning energy needs.

Hydropower is a vital source of renewable energy, and is part of the least-cost solution to meeting Vietnam’s rapidly growing demand. The country has hydropower potential of 25,560 MW, in addition to sizable resources of coal and gas and a renewable energy potential of possibly more than 13,000 MW. The country’s least-cost expansion plan for the next decade includes 22 hydropower plants, providing about 4,800 MW of new capacity. Alongside a few relatively large plants in this expansion plan, such as the Son La (2,400 MW) and Lai Chau (1,200 MW) hydropower plants on the Da River, the main focus of hydropower development during the next decade will be on medium-scale projects (typically 100–600 MW each) distributed throughout the country.

The Trung Son Hydropower Project includes the development, construction, and operation of a power plant on the Ma River in northwest Vietnam. The 260 MW Trung Son Hydropower Plant (TSHPP) is designed as a multipurpose project, providing power generation, flood control, and irrigation, although the benefits of the latter two are minor in comparison with power generation.

In addition to supplying least-cost power to Vietnam’s electricity system, the project will contribute to the adoption of improved social, environmental, and dam safety practices in the hydropower sector. The mitigation and management of social and environmental impacts and safety of the project follow international good practices, and during both preparation and implementation, the focus has been on building Vietnam Electricity’s (EVN’s) capacity to prepare hydropower projects to international standards.
EVN, the country’s main electricity generator, will build the TSHPP with financial and technical support from the World Bank. It is the first hydro-power project financed by the Bank in Vietnam and is the country’s first investment loan from the International Bank for Reconstruction and Development (IBRD).

**Description of the Project**

The objective of the project is to supply least-cost electric power in a safe and environmentally and socially sustainable way.

**Area affected by the project.** The project site is located at the junction of Son La, Thanh Hoa, and Hoa Binh provinces in northwestern Vietnam, with the plant in the territory of Trung Son commune, Quan Hoa district, Thanh Hoa province, about 40 km east of the border with the Lao People’s Democratic Republic (PDR), following the course of the Ma River.

The area is remote and sparsely populated with extremely poor communities composed largely of ethnic minorities, where infrastructure and services are underdeveloped and income sources other than agriculture and forestry are limited.

The project site was chosen based on detailed analyses to optimize hydropower generation while minimizing environmental and other impacts, especially the number of people affected by the project and the area flooded. The project includes resettlement, compensation, and restoration of the livelihoods of the people who will be directly or indirectly affected by the construction of the dam and the ancillary works. It also includes mitigation of the environmental consequences of construction and operation of the dam. In addition, the project provides financing for technical assistance to scale up hydropower in Vietnam by identifying and supporting preparation of one or more additional projects. A map of the project area is presented in figure 1.
**Project features.** The main features of the project are presented below:

- An 84.50 meter (m) dam, which will use water from the Ma River and release it back into the river a few hundred m below the dam.
- A powerhouse containing four 65 megawatt (MW) Francis turbines, each designed for a maximum water head of about 72 m.
- A reservoir area of 13.13 square kilometers (km²), with total storage volume of 348 million cubic meters (m³) and an active volume or flood control capacity² of 112 million m³.
- Expected generation of 1,019 gigawatt-hours per year (GWh/year), which is about 10 percent of the 10,000 GWh/year additional power generation expected to be required between 2010 and 2020, based on conservative estimates made after the 2008–09 global financial crisis.
- Avoided net carbon dioxide (CO₂) emissions as a result of the project are estimated to be about 900,000 tons per year, taking into account the additional, but low, emissions from the reservoir.

The project is the first to dam the Ma River, as contemplated by the Vietnamese Energy Master Plan, the Ma River Basin master plan, and the hydropower master plan.

**Project components.** The project has four components:

- The dam and ancillary construction component provides for the construction of the power plant and supporting structures.
- The transmission line component is the means by which the generated power is moved to electricity consumers.
- The social and environment impact mitigation component focuses on ensuring the environmentally sustainable and socially responsible construction and operation of TSHPP, and comprises the programs to manage and mitigate the project’s expected and unexpected impacts, direct or indirect, on households in the project area.
- The capacity development and scale-up component focuses on capacity building and continued technical assistance, to contribute to the scale-up of environmentally and socially sustainable hydropower development in Vietnam.

**Financing.** The total project cost is estimated to be US$411.72 million, out of which, US$330 million is financed through a loan from the IBRD. Financing for the project was approved by the Board of Executive Directors of the World Bank Group on April 26, 2011.

The loan is financing equipment, civil works, and technical assistance for the dam, reservoir, and hydropower plant. Of the total IBRD financing, a sum of US$26 million is reserved for improved resettlement, livelihoods development, support for ethnic minorities, and environmental protection. An estimated amount of US$58.1 million is included for physical and price contingencies as well as for front-end fees and other unallocated expenditures.

**Allocation of responsibilities among project entities.** The main parties involved in the preparation and implementation of the project are summarized below.

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² This active volume corresponds to about one day’s average daily inflow for the wet season, and about 5.5 days average annual inflow. Maximum outflow through the turbines running at 533 m³ per second would exhaust the storage volume in 58 hours.
**Trung Son Hydropower Project Management Board (TSHPMB)**, a unit under EVN, was responsible for preparation of the project. A semiautonomous department of EVN, TSHPMB was responsible for ensuring the entire project was prepared according to government and World Bank requirements.

**Trung Son Hydropower Company (TSHPCo)** was created by EVN as a wholly owned subsidiary of EVN and replaced TSHPMB shortly before the World Bank loan was negotiated. TSHPCo is responsible for implementing the main project—planning and contracting for the dam and ancillary works, including construction of the power lines and substations up to 110 kV; the access road and bridges; and the social and environmental mitigation measures, as expressed by Components 1 and 3. It will also implement Component 4 on behalf of EVN, providing capacity building. TSHPCo will remain a wholly owned subsidiary of EVN, into which all the assets of TSHPP will be placed. Staff at TSHPMB transferred to TSHPCo on its creation.3

**Vietnam Electricity** is the project owner, and through its corporate Appraisal, Planning, Procurement, and Finance and Accounting Departments, it is responsible for oversight of TSHPCo. A task force consisting of representatives of these departments and the Director of TSHPCo will help EVN to oversee the project.

**The National Power Transmission Corporation (NPT)**, a wholly owned one-member company subsidiary of EVN, through its Northern Power Projects Management Board is responsible for the design, construction, commissioning, and operation of the 220 kV transmission line to evacuate power from the hydropower plant into the national transmission network. NPT enjoys substantial autonomy from EVN, with delegated powers for procurement, financial management, and reporting.

**Works contractors, goods suppliers, and consulting firms** are collectively responsible for construction, supply of goods, and project management. Some works contractors will be responsible for implementation of those aspects of the Environmental Management Plan that are required under the contracts, including, for example, the remediation of site works.

In addition, responsibilities for the implementation of the social and environmental mitigation component are shared between Province and District People’s Committees, TSHPCo, and contractors responsible for construction work. This is further discussed in Part B.

### Overview of Social and Environmental Impacts

About 10,600 people in 2,327 households are expected to be directly or indirectly affected by the project. Of those people, 7,012 live in the main project area—reservoir, dam, and ancillary works construction. The affected population consists largely of ethnic minorities:4 Thai, Muong, H’mong, and Kho Mu. There are a small number of Kinh, which is the majority ethnic group in Vietnam.

From a social perspective, the primary concern is to minimize and mitigate the impact of the resettlement of people affected by the project, restoration of their livelihoods, and addressing the needs of ethnic minorities in these very remote areas where rural poverty is prevalent, along with mitigating the effects associated with the arrival of a large workforce in the project area, including security challenges, spread of disease, and social tensions.

Key environmental impacts that may arise from the project concern hydrology and water quality; protected areas, fish, and fisheries; impacts associated with worker camps and construction; health impacts; and physical cultural resources.

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3. To allow the introduction of the Vietnam Competitive Generation Market, it is expected that EVN will be restructured and required to transfer its generation assets into one or more generation companies (Gencos) except for the strategic and multipurpose hydropower plants. TSHPCo may eventually be transferred to another owner. The creation of the special purpose company is intended to ensure that critical covenants for the performance of the project can be retained with the new owner. TSHPCo will sign a power purchase agreement with the Electric Power Trading Company, the actor in the Vietnam Competitive Generation Market responsible for all power purchases from generators and all power sales to distributors.

The major environmental and social impacts from the project are summarized below.5

- The primary environmental consequences of the project stem from the dam and the reservoir it will create. Construction of the access road and transmission lines is expected to have minor impacts that can be easily mitigated.
- Beyond the impacts that could normally be expected from the change in use of the land, the construction of the dam itself was found to pose the highest environmental and social risk. At its peak, a labor force of about 4,000 workers will be housed in camps for dam construction. Indirect impacts from them include about 400–1,000 “camp followers” moving into the project area prompted by the construction of the dam and the enhanced access provided by the improved roads.
- Direct impacts on biodiversity are considered minimal. The project will not flood any critical natural habitat.
- Fish migration in the Ma River occurs mainly in the lower and middle segments of the river basin, up to 100 km from the river mouth, whereas the distance from the dam site to the river mouth is approximately 200 km. Movement of fish upstream of Trung Son was not found to be prevalent. Therefore, the magnitude of the impacts on fish and fisheries is also estimated to be low.
- The reservoir area does not have a rich cultural heritage value, but some paleontological sites identified in the area will be excavated before flooding.
- About 98 percent of the people identified as affected by the project are from four ethnic minority groups: the Thai, the Muong, the H’mong, and the Kho Mu. Thus, the project has the potential to disrupt cultural and social structures in the area, create additional pressure on community infrastructure and services, and increase the risk of spreading sexually transmitted diseases. The least-integrated of the four ethnic minorities, the H’mong, are potentially the most vulnerable.
- The resettlement of the population to new areas in the river basin is expected to put additional pressures on natural resources (forest, bamboo, and wildlife), especially in the Xuan Nha Nature Reserve in Son La Province, the Pu Hu Nature Reserve in Thanh Hoa Province, and the Pa Co-Hang Kia Nature Reserve in Hoa Binh Province.

The project triggers 8 out of 10 World Bank safeguard policies:6

- Environmental Assessment (OP/BP 4.01)
- Natural Habitats (OP/BP 4.04)
- Pest Management (OP/BP 4.09)
- Physical Cultural Resources (OP/BP 4.11)
- Involuntary Resettlement (OP/BP 4.12)
- Indigenous Peoples (OP/BP 4.10)
- Safety of Dams (OP/BP 4.37)
- Projects on International Waterways (OP/BP 7.50)

How the project’s social and environmental impacts were identified and could be mitigated or managed and how the requirements of the government of Vietnam and the World Bank were met are discussed in Part B.

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5. Comprehensive detail on the social and environmental aspects of the project is available in Annex 11 of the Project Appraisal Document (World Bank Report No. 57910-VN) and the series of documents disclosed on the project website.

6. Details and latest information on World Bank safeguards policies can be found at www.worldbank.org/safeguards.
This part discusses highlights of the Trung Son Hydropower Project, focusing on the preparation process. It is not intended to be an exhaustive review of each aspect the project, but instead emphasizes those that are innovative in the context of hydropower development in Vietnam. Greater detail on the project is available in the Project Appraisal Document, as well as in the set of more than 50 documents available on the Trung Son Hydropower Project website.7

The summary of noteworthy features of project preparation and the resulting innovations is organized around seven main themes: project screening and identification; environmental aspects; social aspects; dam safety; communications, consultations, and community relations; economic analysis; and identifying and managing critical implementation risks.

**Project Screening and Identification**

**Technical Screening to Identify Which Power Generation Technology to Support**

Foreseeing significant power sector investment needs in the coming years, the government and EVN leaders and officials requested direct World Bank financial support for one or more power generation investment projects. Accounting for 70 percent of sector investment requirements and the bulk of the design, development, and construction effort, development of new generation capacity was the crux of Vietnam’s power investment and implementation challenge. On the financing side, power generation lent itself well to an opening for support from the IBRD.

In 2004, the World Bank reviewed alternative generation project options in Vietnam. The review took into account not only suggestions from the Ministry of Industry and Trade and EVN for hydro, coal-based, and gas-based power generation,
but efforts also focused on energy conservation, demand-side management, and transmission and distribution loss reduction. The review found that given Vietnam’s need for economic development, the increasing demand for electricity in general, and peaking supply in particular, could not be accommodated by demand-side options alone. World Bank assistance would also be important in project design, development, and management: in an environment of heavy pressure to bring new plants on line as fast as possible, the challenge was to design and build plants quickly and efficiently, but responsibly and with a view to longer-term consequences.

The central role that hydropower would play in Vietnam’s power sector development was highlighted in the 2005 National Hydropower Plan, the outcome of a multiphase study completed with Scandinavian technical assistance. It assessed virtually all of the 30-odd projects included in the government’s medium-scale hydropower development program. The analysis concluded that, with the goal of providing almost 6,000 MW of power, Vietnam’s program to develop the bulk of its medium-scale hydropower sites during the next 10 years would provide a core contribution to the overall power development program throughout the country. The study included an assessment of a series of capacity expansion scenarios involving progressively less hydro and more thermal power development over time, finding that the cost of not developing the hydro resources in Vietnam would be prohibitive. The assessment indicated that, in the development of the potential sites across Vietnam, planning and operational improvements could be made to optimize complex choices and trade-offs to (a) maximize multiple water control benefits; (b) minimize adverse impacts, including negative social and downstream impacts; and (c) maximize the value of electric power within the overall power system.

The conclusion reached by the World Bank review was that hydropower would allow the Bank to provide the greatest added value, if the risks could be either mitigated or managed adequately.

**Review and Assessment of Policy Framework for Environmental and Social Aspects of Hydropower Development**

The existing Vietnamese legal and policy frameworks for resettlement and environmental assessment and mitigation were reviewed. The review found these frameworks to be generally satisfactory. There were (and still are) differences between Vietnamese and World Bank policies, but there was also flexibility to accommodate those differences. Weaknesses identified in the general policy framework included lack of specific requirements for compensation of indirect losses of project-affected households; vague requirements for income restoration for resettled households; and loose requirements concerning consultation and monitoring and evaluation. Although several government regulations mandated support to ethnic minorities, there were no specific requirements about how ethnic minorities should be supported in the framework of projects. On the environmental side, the legal framework was found to be clear and satisfactory about the needs for assessment and mitigation plans, their basic purposes, and assignment of responsibilities. The Law on Environmental Protection (2005) introduced requirements for conducting proper consultation as part of the environmental assessment process. The law also made Strategic Environment Assessments mandatory for long-term plans such as the country’s hydropower development plan. The main issues identified were related to the timing and quality of implementation.

Vietnam’s policy basis for resettlement planning was solid, but the way in which that policy basis was translated into design and implementation guidelines and, eventually, positive outcomes on the ground, could be improved. The screening process carried out early on also highlighted that Vietnamese counterparts were searching for solutions to the most difficult core implementation issues related to reservoir resettlement, namely, detailed planning and program execution for providing sustainable incomes for resettled households, especially ethnic minorities.
Vietnamese counterparts expressed keen interest in techniques and approaches tried abroad, in lessons from the experience of others, and in training and other support for practical efforts to improve the Vietnamese programs.

**Project selection**

Trung Son was one of several projects in the remaining inventory of candidates included in the government’s medium-scale hydropower development program. This raised the question of whether there were better hydropower projects than Trung Son. An analysis of the optimization of capacity expansion found Trung Son to be the most attractive. In addition, when Trung Son was compared with the other potential hydropower projects on the basis of the main environmental attributes (loss of forest, persons displaced, power density, and cost of energy), its high ranking was confirmed. Given that the power expansion strategy required the development of Vietnam’s remaining economic hydropower resource endowment, Trung Son stood out as one of the most attractive projects.

The master plan for development of the Ma River considered a range of sites and development options for the Trung Son project. The subsequent evaluation of alternative Trung Son project configurations was based on a trade-off analysis between optimal hydropower generation on the one hand, and environmental, social, and risk considerations on the other. The considerations taken into account included minimizing geotechnical risks, minimizing the number of project-affected persons, and avoiding reservoir impacts in Laos PDR, which constrained the full reservoir elevation to 164 m above sea level.

The resulting project configuration is relatively low impact for the amount of power output expected, especially with regard to reservoir area, density of population affected, and likely carbon emissions. The reservoir created and the number of people affected, though significant, are by no means out of the ordinary for hydropower projects or other infrastructure projects already being implemented in Vietnam. Table 1 presents a comparison of Trung Son Hydropower Project with other major infrastructure projects financed by the World Bank in and around Vietnam, including in the urban and roads sectors.

**Building on lessons learned from past project preparation experience**

With the scope of the project broadly understood, it was possible to review the key elements that would have to be covered during project preparation. Experiences with hydropower projects elsewhere in the world, and with the larger and more complex infrastructure projects carried out in Vietnam, provided a number of key lessons to guide preparation:

- According equal or higher priority to social and environmental issues during preparation and implementation. Hydropower projects are often led and implemented by engineers, and technical issues dominate management thinking. Environmental and social issues tend to be treated as secondary, and implementation of mitigation plans often lags behind technical progress. In consequence, the

<table>
<thead>
<tr>
<th>Country</th>
<th>Project</th>
<th>Capacity (MW)</th>
<th>Reservoir (km²)</th>
<th>Affected households*</th>
<th>People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vietnam</td>
<td>Trung Son</td>
<td>260</td>
<td>13</td>
<td>2,327</td>
<td>10,591</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Son La Hydropower Plant</td>
<td>2,400</td>
<td>233</td>
<td>20,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Nam Theun 2 Hydropower Plant</td>
<td>1,070</td>
<td>450</td>
<td>16,000</td>
<td>80,300</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Vietnam Urban Upgrading Project (urban)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>21,621</td>
<td>80,000</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Expressways (roads)</td>
<td>n.a.</td>
<td>n.a.</td>
<td>6,194</td>
<td>30,000</td>
</tr>
</tbody>
</table>

Source: Authors’ compilation.

* Includes reservoir resettled population, project lands, and the two downstream tributaries. Does not include population living in catchment area.
Lessons from Preparation of the Trung Son Hydropower Project

impacts of the project on people are more severe and last longer than necessary. High budgets do not equate to success; dedicated teams within implementing agencies are needed, as is reflection of the social and environmental issues in the project objectives and design.

Designing with sufficient flexibility to incorporate lessons learned during implementation. In complex projects, lessons learned early in implementation can be used to improve project outcomes, particularly if there are long-term resettlement and livelihoods impacts. Advisory panels can be especially effective by enabling a more objective view. Such panels’ terms of reference and composition should be informed by the specifics of the project and the needs of the implementing agencies, and should be regularly reviewed to ensure continuing relevance and appropriate staffing.

Ensuring readiness. In operations in Vietnam, including in the energy sector, implementation success has typically been constrained by the lack of readiness at project initiation. Project stakeholders must have adequate capacity to undertake their roles in the project. The key to readiness, however, is ensuring that the main project activities have been well prepared and procurement is under way. Providing technical assistance during preparation to potential participants is also important to ensuring readiness.

Providing investment lending and technical assistance in one package. It is preferable to combine technical assistance with investment lending for two reasons. First, investment lending on its own results in slow uptake of new ideas because there are few opportunities for learning, and lessons learned cannot easily be disseminated. Second, technical assistance on its own does not facilitate learning by doing.

Streamlining fiduciary oversight and execution. Oversight by the Vietnamese government and its agencies can be slow at times, particularly for procurement and disbursement. Projects that have minimized processing steps and approvals consistent with sound management, and that encourage decision making, have done better than those with multiple layers of oversight and approval.

Environmental Aspects

During preparation of the project, significant resources were dedicated to developing a series of plans to mitigate the project’s potential impacts, which are summarized in Part A, and discussed in extensive detail in the Project Appraisal Document and other project documentation. While preparing these programs, EVN and the World Bank made significant efforts to ensure that the project not only met the requirements of Vietnamese law and World Bank safeguard policies, but also that mitigation measures were based on international good practice for sustainable hydropower development with regard to environmental, social, and dam safety issues. This section discusses the environmental aspects. Other sections address the social and dam safety aspects.

Initial assessment

The Trung Son Hydropower Project is rated “Category A” under World Bank Operational Policy (OP) 4.01 on Environmental Assessment in light of the scale of potential environmental and social impacts and the sensitivity of the project areas. The Category A rating means that a project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. The impacts affect an area broader than the sites or facilities subject to physical works. According to the Policy, a project rated Category A requires a full environmental
impact assessment (EIA), which examines the project’s potential negative and positive environmental impacts, compares them with those of feasible alternatives—including the “without project” scenario—and recommends measures to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

Vietnamese environmental law also requires the preparation of an EIA. Accordingly, the first round of environmental impact studies had been undertaken by EVN in 2003. This EIA was then updated in 2007, as required by Vietnamese regulations. These studies were thoroughly reviewed by Vietnamese authorities, and the updated EIA was approved by the Ministry of Natural Resources and Environment, as also required by Vietnamese law.

The approach for assessing the environmental aspects of the Trung Son Hydropower Project was to base preparation on the approved Vietnamese EIA, and provide support for TSHPMB counterparts to prepare a supplementary environmental and social impact analysis (SESIA) and environmental management plan (EMP), instead of requiring the Vietnamese documentation to be revised. This supplementary work was intended to bring the current preparation into compliance with Bank policies, align it with international practice, and provide a knowledge-transfer opportunity.

Supplementary studies

The screening to identify the necessary supplementary work was based on the framework presented in a 2003 paper on environmental criteria for site selection of hydropower projects. This paper provides a series of quantitative indicators for rating and ranking proposed hydropower projects based on their likely adverse environmental impacts, using data that are relatively easy to obtain.

Table 2 contains a select set of indicators for TSHPP, based on the methodology presented in the paper. In the table, the cells corresponding to Trung Son indicators are colored to show whether Trung Son is considered a “good” (green) or a “bad” dam (red), or uncertain (yellow). Using these criteria, Trung Son is in the “good” range for a significant share of the indicators.

This initial analysis allowed the team to identify additional data and studies that would be needed, prepare terms of reference for each study, and provide guidance to EVN on the selection of consulting teams. Efforts were concentrated on the areas in which Trung Son’s performance was “bad” or “uncertain.” The more innovative ways in which the environmental impact mitigation frameworks were developed are summarized below.

- Environmental supervision and management of camps and construction. During project preparation, specific attention was focused on the management of impacts from camps and the incoming construction workers. Such impacts had usually not been included in EIAs in Vietnam. It was agreed that the impacts of camps and construction workers would be handled as part of the environmental management planning even though they might be considered social in some respects. This was a pragmatic decision to avoid overlaps and allow the social team to focus on the resettlement and livelihoods impacts of the project. The impacts from camps and construction workers were the subject of intense discussions during project preparation, and their management is one of the main components of the EMP. Another innovation was the introduction of a requirement for environmental supervision teams during construction. The detailed specifications developed for the management of these impacts from camps and construction of TSHPP can be used in future projects in Vietnam, and could be a useful input to the development of standard practice in the sector.

- Natural habitats. Although TSHPP would not have any direct impacts on critical natural habitats, indirect impacts on the three nature reserves in the project area were considered significant. The project provides easier access to this remote

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area now that the access road is complete. The presence of 4,000–5,000 workers and camp followers will put additional pressures on natural resources (from logging, poaching, and hunting), and resettlement of families will move people into new areas. These impacts could, in turn, be exacerbated by weak management and enforcement in the reserves. The SESIA assessed these impacts and proposed compensation measures to strengthen protection of the reserves. At the time of project preparation, the concept of compensation for loss of natural habitat was relatively new in Vietnam, and much discussion was needed for it to gain acceptance. Though modest for the Trung Son Hydropower Project, the introduction of compensation and offsets for protected areas has set a precedent that may make it easier for this valuable environmental tool to be included in future hydropower projects in Vietnam.

**Environmental flows.** Vietnam’s regulatory framework does not require minimum river flows to maintain environmental conditions downstream—so-called environmental flows. TSHPMB and its consultants carried out additional hydrological analysis, water use surveys, and fish assessments downstream from the dam to determine the environmental flow. As a result of these efforts, the Trung Son project incorporates a minimum environmental flow requirement. Through this real-world example of performing a minimum environmental flow analysis and incorporating it into project design, the Trung

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**Table 2. Select environmental and social impact indicators from initial screening of Trung Son**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Units</th>
<th>Good dam site</th>
<th>Bad dam site</th>
<th>Trung Son</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir area/MW</td>
<td>ha/MW</td>
<td>low (&lt;20)</td>
<td>high (&gt;100)</td>
<td>5.05</td>
</tr>
<tr>
<td>Water retention time</td>
<td>days</td>
<td>short (&lt;180)</td>
<td>long (&gt;180)</td>
<td>16.5</td>
</tr>
<tr>
<td>Flooded biomass</td>
<td>ton/ha</td>
<td>little or none 10–20</td>
<td>extensive 200–600+</td>
<td>24</td>
</tr>
<tr>
<td>Length of river impounded</td>
<td>km</td>
<td>short (as % of total length of river)</td>
<td>long</td>
<td>38.5 (7.5%)</td>
</tr>
<tr>
<td>Length of river left dry</td>
<td>km</td>
<td>little or none</td>
<td>extensive</td>
<td>0</td>
</tr>
<tr>
<td>Likelihood of reservoir stratification*</td>
<td>Froude number</td>
<td>&gt; 0.31</td>
<td>&lt; 0.31</td>
<td>0.29; moderate tendency</td>
</tr>
<tr>
<td>Useful reservoir life</td>
<td>years</td>
<td>long (&gt; 50–100)</td>
<td>short (10–20)</td>
<td>150</td>
</tr>
<tr>
<td>Access road through forest</td>
<td>km</td>
<td>short</td>
<td>long</td>
<td>20.4</td>
</tr>
<tr>
<td>Persons requiring resettlement</td>
<td>people displaced/MW</td>
<td>few or no people</td>
<td>many people, urban areas, indigenous communities</td>
<td>9.4</td>
</tr>
<tr>
<td>Critical natural habitat affected</td>
<td>number and ha</td>
<td>low (minimal loss)</td>
<td>high (even with wildlife rescue efforts)</td>
<td>Few ha of provincial reserve flooded; 5.3 ha of natural forest</td>
</tr>
<tr>
<td>Fish species and endemism</td>
<td>diversity; endemism</td>
<td>few species, no vulnerable endemics</td>
<td>many species, including vulnerable endemics</td>
<td>198 fish species of 141 genera, 57 families, and 13 orders. Little knowledge of migratory patterns of fish.</td>
</tr>
<tr>
<td>Cultural property affected</td>
<td>indicative</td>
<td>none to very little</td>
<td>significant amount</td>
<td>No known historic sites; potential for paleontological sites.</td>
</tr>
<tr>
<td>Number of river tributaries</td>
<td>number</td>
<td>major (or many minor ones)</td>
<td>none (or just a few minor ones)</td>
<td>1 major tributary 170 km downstream (Chu River); however, flow increases by 50% from watershed drainage.</td>
</tr>
</tbody>
</table>

*Source: Authors’ compilation.  
* Densimetric Froude number, derived from reservoir length, depth, flow, and volume.
Son preparation experience can benefit future projects in Vietnam.

- **Cumulative impacts.** Even though the analysis of cumulative impacts is not required in Vietnam, it is widely practiced internationally. Consistent with the vision of incorporating international good practice into Trung Son preparation, the EIA included a preliminary assessment of cumulative impacts, mainly on fish. Following this initial assessment, the EMP set aside funds for a more thorough assessment of cumulative impacts. A first in Vietnam, the analysis can be replicated, scaled up, and eventually become standard practice.

- **Intact rivers.** Based on the preliminary assessment of cumulative impacts, an “intact river approach” in one of the branches of the Ma River was proposed, to maintain active fish populations in the river when all planned dams in the catchment are built. The EMP includes terms of reference and budget to carry out a study of the possibility of identifying an intact branch and what would be needed to keep it intact. Although it has been proposed in another hydropower project in the country, this approach has never been studied or implemented in Vietnam.

These additional studies required intense collaboration between TSHPMB staff, international expert consultants, local consultants, and World Bank team members. The World Bank team and international consultants spent significant time working with and building the capacity of local consultants on critical issues, including water quality modeling, environmental impact assessment, management of camps and construction workers, and environmental design of roads, among others. The exhaustive preparatory work often required travel to the project site to evaluate potential impacts and identify solutions firsthand. In these visits, concerted efforts were made to go beyond the easy access points and fully access the project site. Bank staff and international consultants joined local consultants and TSHPMB staff on as many site visits as possible.

The SESIA and the EMP, dated January 2011, bring together, summarize, and update the findings of all previous studies and identify mitigation and compensation plans and actions to address environmental and social impacts caused by the project. The SESIA includes a comprehensive assessment of impacts and outlines the necessary measures to avoid, mitigate, manage, and compensate for the potential adverse impacts identified. The SESIA also provides linkages with the Resettlement, Livelihoods and Ethnic Minorities Development Program (RLDP), which is discussed in greater detail below. The EMP for the reservoir and downstream area identifies the principles, approaches, procedures, and methods that will be used to control and minimize the environmental impacts of all construction and operational activities associated with the project. It complements the SESIA and is a companion document to the RLDP. Box 1 presents a summary of the EMP.

The project’s potential environmental impacts and associated mitigation measures are covered in a package of four documents: the original EIA, the SESIA, the EMP for the reservoir and downstream area, and the EMP for the road. An environmental management framework for the transmission line was also prepared. The full set of environmental studies and underlying reports were disclosed on the project website.

**Social Aspects**

An initial review of the project’s potential impacts made it clear that a considerable resettlement and livelihoods restoration program would be required to ensure compliance with World Bank safeguard policies concerning Involuntary Resettlement (OP/BP 4.12) and Indigenous Peoples (OP/BP 4.10). The Social Assessment emphasized the needs for livelihoods development among the communities expected to be affected. This applied particularly to the seven communes and one town adjacent to the reservoir and main construction site but also included the 325 households preliminarily estimated to be affected by the transmission line, and the 486 households affected by development of the access road.
Resettlement activities were split into three parts, reflecting different timing of completion of different portions of the project: access road construction, main works for dam construction and reservoir filling, and construction of the transmission line. Because the access road construction was set to start before dam construction and reservoir filling, a separate set of safeguard instruments were prepared.

A Resettlement Plan (RP) with an integral Ethnic Minorities Development Plan (EMDP) was prepared, disclosed, and implemented. Because the transmission line will not be required until the power plant is completed and ready to export power to the grid, it was considered premature to prepare detailed design and alignments. A Resettlement Policy Framework, Ethnic Minorities’ Planning Framework, and

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**Box 1. The Environmental Management Plan for the Reservoir Area**

The project’s main environmental issues are related to the upstream and downstream impacts on water quality, hydrology, health, and fish and fisheries; the impact of a construction workers’ camp housing about 4,000 people during the construction period; the impacts of auxiliary project components, including the access road and borrow pits; and indirect impacts on the area’s natural resources and biodiversity, including within three adjacent natural reserves.

A number of management plans will be implemented throughout the construction and operation phases of the project, including the following:

- **Construction impact management plan**—measures to minimize negative impacts of construction activities on local communities and the natural environment, to reduce the induced impacts of camp followers, to prevent pollution and ensure that hazardous materials are stored properly without risk to the environment.

- **Biodiversity and protected areas management plan**—measures to ensure protection of local and regional biodiversity and minimize project impacts on three adjacent protected areas.

- **Reservoir Clearing Plan**—measures to minimize biomass loss as a result of reservoir clearing and to coordinate the timing of vegetation removal to allow salvage benefits to local communities.

- **Environmental monitoring plan**—measures to ensure project compliance, measure the success of proposed mitigation, continue baseline monitoring, and review environmental and social performance.

- **Community relations and safety plan**—measures to inform local communities about the progress of the project and ensure community safety.

- **Regional health management plan**—a plan to mitigate project impacts on the health of local people.

- **Physical cultural resources management plan**—measures to prevent inadvertent loss of physical and cultural resources during project construction and operation.

- **Environmental management framework** to address environmental issues during construction and operation of infrastructure to be built in resettlement sites.

- **Additional studies** to provide more baseline information for the project,

- **Training and capacity building** will be provided in all aspects of the EMP.
Environmental Guidelines were prepared and adopted by the National Power Transmission Corporation (NPT). During detailed design, NPT will prepare an RP, EMDP, and EMP. The rest of this section concentrates on the resettlement plan for the reservoir, construction, and downstream areas.

The major innovation in the social aspects of the project is the focus on livelihoods restoration. Reservoir resettlement in Vietnam has historically concentrated on compensation and resettlement site infrastructure rather than on livelihoods restoration. International experience with hydropower development clearly demonstrates that successful reservoir resettlement, which is highly transformative, especially with regard to livelihoods restoration, cannot be seen as a linear process of planning, costing, and implementing. The outcome is largely contingent on the behavior and responsiveness of those affected to changed (and changing) circumstances, including the opportunities the project may attempt to provide. Having recognized the importance of changing circumstances and the need to focus on contingencies, EVN, the local authorities responsible for implementation, and the World Bank approached the resettlement and livelihoods restoration problems strategically, yet practically. In explicitly analyzing and emphasizing the relationship between domestic practice and expertise on the one hand, and the international state of the art on the other hand, the need for capacity-building, adaptive management, and contingency funding became clear. This negated a standardized approach to livelihoods restoration measures, and stepped beyond a narrow focus on compliance within a Vietnamese context.

As a result of these efforts, the comprehensive RLDP, which includes an RP, a Community Livelihood Improvement Plan (CLIP), and an EMDP, was completed, after comprehensive consultations with affected communities, civil society organizations, and local and national authorities. Box 2 provides an overview of the resettlement, livelihoods and ethnic minorities mitigation measures developed under the project.

Four points are particularly noteworthy with regard to the preparation of social aspects of the project, as summarized below.

- The reliance on domestic practice and expertise recognizes that country ownership, capacity, and interagency coordination are essential for effective management of implementation under uncertain future circumstances.
- The emphasis on adaptive management, too, recognizes that unquestioning adherence to plans will not work in a constantly changing environment. Delivering material inputs may be unnecessary and wasteful four years after they were allocated in a planning process, and procedural steps may not make sense when events fall out of an assumed sequence. To ensure the effectiveness of adaptive management, considerable effort was needed to clarify roles and define boundaries for what could be adapted and what should remain intact.
- The approach to livelihoods restoration is much more open-ended compared with many other hydropower projects. Compensation for assets—and assuming that asset substitution is all that is needed—is insufficient and fails to recognize the need for new skills and relationships imposed by a move to new areas with unfamiliar soils, neighbors, and conditions. Intensive livelihoods planning has generally been based on designs developed by external experts, often devised years in advance, assuming fairly uniform levels of productivity among an “averaged” population. The community livelihoods approach devised for Trung Son intends to deliver material inputs, training, and agricultural extension services to those being resettled, but relies on community-based livelihoods-planning processes intended to allow each community to determine their own preferences based on their own circumstances,
Box 2. Resettlement, Livelihood and Ethnic Minorities Development for Trung Son

A Policy Framework for Compensation, Resettlement and Rehabilitation of Project Affected Persons (RPF) was prepared and received the approval of the Prime Minister. It establishes the principles, objectives, and definitions to be used in resettlement planning and implementation. It defines affected persons and establishes eligibility criteria for compensation or other forms of assistance; describes the legal and institutional framework; establishes modes of asset valuation and compensation payment, and arrangements for consultation and participation; and sets out procedures for pursuing grievances. The RPF applies to all aspects of the project, including impacts associated with the dam construction area, reservoir impoundment, area for resettlement activities, and upstream or downstream impacts associated with loss of access to land or other resources, but not to the access road or transmission lines.

The Trung Son Hydropower Project meets its social obligations to those affected by the project through the RLDP, which is made up of the RP, the CLIP, and the EMDP. The RLDP includes resettlement, rehabilitation, compensation, and livelihoods development measures that will improve, or at least maintain, people’s preproject living standards and income-earning capacity. It also includes activities to help ethnic minorities maintain their cultural identity. The RLDP also requires monitoring of households, and makes use of social accountability and grievance-reporting mechanisms.

The main features of each plan follow:

- The RP for the main project (dam and support works) is designed to provide full compensation to all individuals losing houses, land, or other assets as a result of construction, reservoir flooding, or downstream impacts of the dam, and to provide for effective relocation for households unable to stay in their current residences.

- The CLIP enhances the capacity of communities affected by resettlement to restore and improve their livelihoods. Early piloting and vocational training needs assessments will be used to refine the CLIP and customize it for villages and individuals.

- The EMDP sets up a consultation and participation framework for use in all RLDP activities, and sets up measures to mitigate remaining risks for ethnic minorities, especially in health and culture.

- The management and communication activity provides management capacity, communication, a protocol for adaptive management, formal and informal grievance mechanisms, and a monitoring and evaluation system.

The RP, the CLIP, and the EMDP form a single program because a significant proportion of project-affected households are eligible for all three plans, and because implementation will be carried out in a largely integrated manner. Because almost all of the people residing in the project area are from ethnic minorities, the RLDP applies in its totality to ethnic minorities and has been designed in every part to address their vulnerabilities. The program includes measures for adaptive management, governed by a protocol to ensure that it does not conflict with the principles set out in the RPF, Bank Policies, and the RLDP.
and that can be undertaken during the resettlement process, when the communities have developed a more informed awareness of project impacts and opportunities.

The focus on stepping beyond compliance reflects an awareness that livelihoods restoration is not, and cannot be reduced to, a compliance issue; compensation and other forms of livelihoods assistance cannot guarantee successful restoration of livelihoods. The reaction of people affected is not assured in advance, and it cannot be known whether they will respond with the degree of competence and enthusiasm that plans and procedural expectations predict.

Innovation, capacity building, adaptive management, and community-based livelihoods planning will push development in a positive direction, yet it is also necessary to acknowledge that they all reflect relatively high levels of uncertainty, involve relatively untested methods, and pose risks of their own. They will mean very little if implementation goes awry, and for that reason the willingness to adapt the management of resettlement and livelihoods restoration will remain critical to a successful outcome.

**Dam Safety**

An early review of Vietnamese dam safety requirements identified a few areas of divergence from the requirements of World Bank OP 4.37 on Safety of Dams, summarized below.

- Most significant, Vietnamese dam design practices, in particular, the extreme conditions that dams should be designed to withstand, are based on a “standards” approach. Dams are classified primarily according to their type and height. This means they are only implicitly classified according to their potential adverse social, economic, and environmental consequences in the event of failure. Analysis of risks concentrates more on damage to the dam structure itself than on the broader impacts on society. Trung Son is a “Class II” dam under the Vietnamese classification because it is less than 100 m high. Therefore, it is required to withstand a design flood frequency of 0.5 percent—that is, the worst flood expected to occur in 200 years, which in Trung Son’s case is estimated at 10,400 m³ per second—and a check flood frequency of 0.1 percent (13,400 m³ per second) without being overtopped. The Vietnamese standards do not require that any consideration be given to a worse flood, or to the consequences of overtopping or dam failure should such a flood occur.

- Another difference was that Vietnamese rules do not require dam safety reviews, whereas World Bank safeguard policies require reviews by independent panels of experts throughout the project cycle from design, construction, and filling of the reservoir, to the start of operation.

- Although there are stipulations regarding operation and maintenance (O&M) and emergency preparedness, Vietnamese regulations do not specifically require that a detailed O&M plan and an emergency preparedness plan be prepared at the design stage and before reservoir impounding.
Moreover, where possible failure of an upstream existing dam or a dam under construction could cause extensive damage to the new downstream structure, no assessment of dam safety or recommendations for improvements to the upstream dam are required.

Having noted the differences, the World Bank and EVN worked together to study the concerns in detail and address them to ensure compliance with international good practice. Details and outcomes from this effort are discussed below.

EVN and TSHPMB analyzed the dam’s performance under extreme flood conditions, which was assumed to be the 72-hour probable maximum flood (PMF) at the dam site, estimated to be 31,100 m³ per second. A review by an international hydrology expert confirmed the estimate and found that the dam as initially designed would have been overtopped by up to 5 m and for up to 50 hours, which could, in turn, have been expected to lead to dam failure. Therefore, TSHPMB reviewed several design options that could withstand PMF, and selected a fuse gate dam and emergency spillway as the most cost-effective solution. With these revisions to its design, the project was brought in line with international standards for dam safety.

TSHPMB established a Dam Safety Review Panel (DSRP), which conducted site visits at both the feasibility and detailed design stages of the project. The panel reviewed and accepted the proposed revision to the dam’s design to allow safe passage of the PMF. The panel also reviewed the construction plans, dam safety program, hydrology, geology, quality assurance, O&M, instrumentation, and emergency preparedness plans prepared by TSHPMB and found them satisfactory. All recommendations made by the panel with regard to potential issues were met, and the DSRP issued a letter providing its clearance of the plans.

In addition, an emergency plan was prepared to protect downstream villages, among other things. As a result of the efforts described above, TSHPP meets the requirements of international practice with respect to dam safety. The dam safety analysis and the subsequent improvements in project design, through leveraging local technical knowledge with international expertise, can serve as a useful example that can be replicated in other hydropower projects in Vietnam.

Communications, Consultation, and Community Relations

Communications, consultation, and community relations were central to the preparation of the project. The principle of free, prior, and informed consultation in ethnic minority villages was pursued, and the outcomes of the consultations were incorporated into the project design. The work carried out during preparation will be continued through ongoing disclosure, communications, and additional channels for addressing grievances during implementation.

Consultations

The objectives of the consultations were to inform the affected households, communities, local authorities, and civil society organizations about potential project impacts and proposed mitigation measures; collect opinions and feedback to enable the preparation of resettlement plans and frameworks; and, in the later stages, to complete the RLDP and EIA-EMP; and obtain broad support for the project.

The approach followed during the consultations differed from previous consultations in Vietnam. EVN and the World Bank adopted an approach that focused on listening to affected people, asking them to share their concerns, and eventually designing a better project that addresses these concerns and responds to their needs. Consultation was based on an acknowledgment that people affected by the project would have useful ideas about what would be likely to work and what would not work during project implementation.
Consultations were held continuously with the people who will be affected by the reservoir and the access road, as well as with various levels of local government (districts, provinces), civil society, and other stakeholders.

Carrying out consultations with the affected people presented multiple challenges, including that the project areas were quite remote with limited access; the houses were sparsely distributed; and the four ethnic minority groups, Thai, Muong, H’mong, and Kho Mu, had limited education. Members of the Thai and Kho Mu speak Thai and Vietnamese. The Muong speak Muong and Vietnamese. The H’mong consultations were particularly critical because this group has high levels of illiteracy, and many, particularly the women, do not speak Vietnamese. After extensive preparation, three major rounds of consultations were carried out between 2008 and 2010, with several weeks-long visits to the site by the project team in each round. Multilingual consultations were conducted in 53 villages in four districts of three provinces. The consultations were held at the hamlet or village level, and led by respected members of the community.

Many of the consultations were held in the evening because most of the people work during the day, and it was difficult for them to leave daily work to join the meeting. Minority or underrepresented groups, including women and young people, were encouraged to participate in all meetings.

Vietnamese national NGOs participated in the local consultations as independent observers at village, district, and provincial consultation meetings. The consultations and TSHPMB’s responses were posted on the project website. After completion of the consultations, the documents were updated and re-disclosed.

Well in advance of the consultations, written, visual, and audio materials in form, substance, and language appropriate for the audiences were provided. Figure 2 illustrates examples of the visual material prepared for these consultations.

The nature and extent of the consultations with affected people and local governments evolved over time. Initial consultations were designed to provide information to affected communities and to gather factual information from them. Information from
those affected by the project tended to be gathered in quantitative form. The latter stages of consultation, particularly the second and third rounds in late 2008 through early 2009 and in late 2009 through early 2010, aimed at presenting the plans based on the earlier consultation with the intention of building consensus, as well as responding to concerns previously voiced by those affected by the project. The third round of consultations, during which the draft final versions of the EMP and RLDP were discussed, are worthy of attention.

At least three weeks before each consultation meeting, information of appropriate form and in local languages was provided at district, commune, village, and household levels. The information varied depending on the level at which it was supplied. Full versions of the EMP and the RLDP were made available at the district and commune level. A summarized and simplified version of about 20 pages was provided to the Commune People’s Committee and village head. Information sheets, posters, and calendars with project information, frequently asked questions, and contact details were given to village heads and distributed to all households. Audio recordings of project information, frequently asked questions, and contact information, along with a machine on which they could be played, were provided at village level. Recordings were in four languages: Vietnamese, Thai, Muong, and H‘mong.

At each consultation, efforts were made to ensure participation by as many villagers as possible and any other interested individuals or organizations, especially women and others who might otherwise be excluded from attending; and consideration was given to having separate meetings with any group that was reluctant to attend the village meetings. A short oral summary of the project, its impacts, and proposed mitigation measures was presented in each meeting. All questions, feedback, and requests were recorded and responded to appropriately. Group discussions were held if needed. In addition to Vietnamese, discussions were held in local languages as necessary. Photographs and video recordings were taken, but only if they did not inhibit the consultation process. Minutes were prepared for each consultation and agreed to with participants. A summary report describing the consultation process and main findings was prepared no later than one week after each consultation. At least one observer from a Vietnamese NGO was present at each of the village consultations.

After each consultation, all questions were collated and summarized, and responses provided. If appropriate, changes were introduced into the EMP and the RLDP. The questions, responses, and revised versions of the EMP and the RLDP were provided to all affected villages.

**Consultations with civil society.** In addition to the participation of Vietnamese NGOs in consultations with project-affected communities, a separate round of public consultations was carried out in Hanoi in March 2010 to enable broader engagement. The event was open to the public and was advertised in newspapers to promote participation. The event was attended by more than 100 members of civil society organizations, think tanks, and academic institutes in Hanoi. A panel discussion took place, following presentations on the RLDP, and the EIA-EMP. The World Bank invited the NGOs that had participated in the consultations to make a presentation, which they were not asked to provide to the World Bank beforehand.
Outcome of consultations. The consultations not only created goodwill and built trust among stakeholders, but also played a central role in the completion of core documents. The consultations were pivotal in finalizing the SESIA and the EMP; creating the RLDP and its communication and management component as one integrated whole; and initiating an open dialogue between TSHPMB authorities, village leaders, affected households, local governments, and NGOs. Some significant outcomes of consultation with communities during preparation follow:

- The revision, in two communes, of the initially planned resettlement sites. Local people identified sites they preferred, which were smaller—and thus involved dividing the community—but had more fertile soils and better water resources. The sites were also closer to their holdings of luong bamboo, an essential part of their livelihoods.

- A revised approach to compensation for loss of luong bamboo holdings. Initially, the level of compensation was determined using a method based on the number of culms (stems) but this method did not take account of the ability of the plant to generate more culms in later years. In response to several comments and experience with compensation for the access road, a revised method was worked out based on the lifetime value of the bamboo plant.

- More flexible allowances for ethnic differences. Ceremonies for moving houses and reburial of the remains of ancestors vary between the ethnic minorities, but support was initially designed somewhat inflexibly. Following consultations, a more flexible means of support was adopted that will allow the different ceremonies to be supported by TSHPMB.

More detail about the consultation, communications, and community relations aspects of the project are available on the project website.

Ongoing disclosure

TSHPMB and the World Bank devised and implemented a coordinated communications strategy. To ensure effective communication with a large and diverse group of stakeholders, a comprehensive plan, aimed at maintaining understanding and ownership of the project, is now in place. The plan is based on the primacy of EVN in communications, ensuring that information is accessible to all stakeholders in formats appropriate for the audiences, and that communication is candid and proactive. At the center of this approach were web pages dedicated to Trung Son, one set up on the World Bank Vietnam website and the other on the TSHPMB website.9

Throughout preparation, the World Bank and TSHPMB disclosed through multiple channels all major documents concerning project preparation. Key project documents were made available to the public at the Vietnam Development Information Center in Hanoi; at the World Bank Public Information Center (Infoshop) located in Washington, DC; the World Bank Vietnam website and the project website in Vietnamese and English; in addition to being disclosed at the project area (district, commune, and village levels) in Vietnamese. More than 50 documents were disclosed, covering a wide range of issues including technical, economic, and financial aspects of the project; key environmental and social studies; and consultation reports. The

complete list of documents disclosed is available in the Project Appraisal Document.10

Disclosure of project information will be continued through implementation.

**THE COMMUNITY RELATIONS PROGRAM**

The community relations program aims to address concerns and grievances from people and communities affected by the project, to maintain information flow, and to be the point of contact for the resolution of complaints and grievances. The program is integral to the work of the Social and Environment Department of TSHPCo and is budgeted and staffed by it. Contractors, especially the main civil works contractor, will be required to support this program with staff and information.

The community relations function is for all people affected by the project, whether previously identified as such or whether incidentally or subsequently affected. Its responsibilities are to

- address in a timely way concerns and complaints from the people and communities affected by the project;
- ensure communities are promptly and adequately informed in advance of impacts and actions programmed as part of project implementation;
- offer a vehicle for mutual interaction between TSHPMB and those affected by the project to receive inputs from individuals and the local communities; and
- act as the forum for discussion and consultation about unanticipated project impacts that arise during implementation.

**AN ADDITIONAL CHANNEL FOR ADDRESSING GRIEVANCES**

The project also puts in place an independent grievance mechanism to complement the formal Vietnamese grievance procedures. The independent grievance mechanism, combined with the adaptive management mechanism, is intended to ensure that not only does the project ex ante meet Bank policies, but can continue to do so by adapting its support to affected people throughout its lifetime.

The formal Vietnamese mediation system involves people’s committees from commune up to province level. The grievance process, based on the national procedure outlined in the Land Law, comprises four stages, with the issue being elevated to the next level if a certain stage does not deliver a satisfactory outcome for the aggrieved person. The first stage is the communication of a verbal or written grievance to commune authorities. The commune-level mediation is followed by the District People’s Committee, the Provincial People’s Committee, and finally the Court. Grievance resolution at each stage is required to take place within a set time. TSHPMB is required to support the formal grievance process by recording all grievance files, reporting them in the monthly monitoring process, and following up to ensure timely resolution. TSHPMB must also exempt persons registered as residents in project-affected communities from administrative or legal fees associated with pursuit of grievances.

The grievance mechanism run by TSHPCo is independent of the system established under Vietnamese law. The independent grievance mechanism is extended to anyone affected by the project, not only those that are to be resettled. TSHPCo is required to monitor complaints continuously to improve quality of the resettlement process and to ensure project compliance with the EMDP for ethnic minority issues. The safeguards team in TSHPCo is required to provide a monthly
monitoring report to the Independent Grievance Panel (IGP) on all complaints and grievances.

Under this mechanism, complaints or grievances can be relayed to TSHPCo by a variety of sources, including directly from either an individual or a group, or through a representative such as the village head, a representative of a mass organization, or an NGO. Complaints and grievances can be communicated in Vietnamese or any local language, and they can be relayed orally or in written form. They may also be reported through the Commune People’s Committee, which informs the TSHPCo safeguards staff, or directly to the safeguards team during monthly compliance monitoring. The company is required to set up a dedicated hotline for complaints and grievances.

The way in which the independent grievance mechanism works is summarized in box 3.

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**Box 3. Principles and Procedures of the Independent Grievance Mechanism**

Key principles in the independent process are (a) to deal with the matter at the lowest possible level and (b) to address complaints as quickly as practicable to prevent minor issues from becoming major.

A complainant’s first point of contact with TSHPCo will be the project Community Relations Officer, a member of TSHPCo’s Social and Environment Department. The officer will take up the matter with relevant members of the department to try to reach a solution. If no solution satisfactory to the complainant can be achieved, the complainant meets the Manager of the Social and Environment Department, who addresses the issue in conjunction with heads of other departments in TSHPCo, contractors, and local authorities as necessary.

Records of meetings between complainants will be maintained and reviewed by the project’s Independent Monitoring Consultants. Meetings are conducted in a language acceptable to the complainant and in a setting appropriate to the needs of the meeting (which may include the site of the complaint, or the offices of TSHPCo).

If the complainant is not satisfied with the solutions on offer from the head of the Trung Son Safeguards Team, the IGP will hear the case. The IGP is composed of the head of the Trung Son Safeguards Team, and at least one member of the independent Environment and Social Panel of Experts. It is chaired by the Director of TSHPCo. It may add other members as required including, for example, independent social and environmental monitoring consultants, a technical expert, or an NGO. It may also take independent advice from consultants or other experts, at its discretion.

Complaints received by the IGP will be publicly disclosed when they are received. The IGP will hear the complaint in a face-to-face meeting, at which the complainant and any adviser or representative may be present. The IGP will publish its findings promptly after it has completed its deliberations, and one member of the IGP will be delegated to communicate the findings to the complainant in a suitable form and language.

The IGP convenes quarterly to review all complaints dealt with by either the Community Relations Officer or the Manager of the Social and Environment Department, and to discuss any ongoing complaints. The IGP can be convened by any member to deal with urgent matters that cannot wait until the next scheduled meeting.

Project information leaflets provide practical information about grievances to local residents, such as contacts and addresses. They mention both the formal Vietnamese mechanism and the IGP, and provide information about how to access both channels.
Economic Analysis

As with any project, one key purpose of the economic analysis for Trung Son was to identify alternatives to ensure the project meets the development needs of the country as efficiently as possible. The economic analysis started with project screening, discussed above. The analysis for Trung Son also focused on risks and in some respects helped inform project design to address them. It also assessed greenhouse gas (GHG) emissions to be avoided by the project.

Analysis of Alternatives

The consideration of alternatives took place during the project screening stage. It was incorporated into the formal economic analysis through a paper on alternatives, which sought to quantify the options of avoiding additional generation altogether; building generating capacity using other, mainly thermal, technologies; building other hydropower plants in Vietnam; and choosing different sites for the Trung Son plant. The alternatives analysis asked four questions:

- Could the need for additional peaking power be met by more aggressive energy conservation, demand-side management, and transmission and distribution loss reduction? In other words, is there a need to expand supply at all?
- Given that Vietnam does indeed need to add capacity, what is the optimum supply-side expansion strategy, and does it include hydropower? That is, is there a cost-effective alternative to the strategy of developing hydropower as the best source of peaking power? The reasonable alternatives are natural gas in some combination of open and combined cycle generators, possibly using imported liquefied natural gas; and pumped storage (in combination with either nuclear or coal).
- Given that hydropower is indeed the best option for peaking power, how does Trung Son compare with other hydropower options? Are there more attractive hydropower projects that should be built in its place (or built before Trung Son)? Would imports from Lao PDR, Cambodia, or China be more attractive (lower costs or lower environmental impacts)?
- Given that a hydropower project in the Trung Son section of the Ma River is the best option, what specific site alternatives are available, and what are the general alternatives for project configuration (particularly with respect to high water elevations and environmental and social impacts of the project alternatives)?

The analysis of alternatives concluded that

- Vietnam’s strategy of developing its indigenous conventional hydropower resources, and its domestic natural gas and coal resources, before turning to other imported fuels is robust to a wide range of uncertainties in input assumptions, including assumptions about load forecasts and international energy prices.
- Alternatives to this strategy would be extremely costly, with significant increases in GHG emissions.
- Vietnam’s power development plan already envisages a substantial program of small hydropower and renewable energy development, as well as efforts to promote supply- and demand-side energy efficiency. Not building any additional peaking power generation projects is not a reasonable alternative, given Vietnam’s likely economic development and progress in poverty alleviation.
- Among the hydropower projects remaining to be developed, Trung Son has favorable economics and relatively modest environmental impacts, which are expected to be fully mitigated or managed to international standards.
- The Trung Son investment decision is robust with respect to load forecast uncertainty and international oil price uncertainty.

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11. Environmental considerations may limit operation as a pure peaking project because generation ramp-up times are constrained by the nature of hydropower (and should not exceed increases in stream flow rates experienced under natural conditions), and because of the minimum downstream flow requirement. However, detailed studies (reported in the Economic Analysis Background report) show that the contribution of the capacity credit to the total economic benefit is modest, and that ramp-up constraints have a correspondingly small impact on the economic returns.
**Risk Analysis**

The risk assessment derived a probability distribution of economic returns using a Monte Carlo simulation in which the input variables were specified as probability distributions. The input variables selected were those most likely to affect economic viability and took into account the following risks:

- World oil prices, which in turn impact coal, gas, and fuel oil prices, and hence the level of benefits.
- Capital cost, specified as a multiplier of the baseline estimate. This is a highly skewed distribution because cost overruns are far more likely than cost underruns. Consideration was also given to delays in the time for completion of the project, which is correlated with cost overruns.
- Average annual generation, as a general proxy for hydrology risk.
- Climate change scenarios, to reflect long-term changes driven by climate change or any systematic errors in the inflow series definition. Given the uncertainties, climate change was specified as a discrete probability distribution for five climate change scenarios based on forecasts for Vietnam prepared by the Ministry of Natural Resources and Environment.
- O&M cost variations, specified as a uniform distribution of assumptions on the annual O&M cost as a percentage of capital cost.
- Value of the carbon externality. In the baseline this value was assumed to be $30 per ton, unchanged in real terms into the future.

The result of the simulation is shown in figure 3, which shows the most likely value of the economic rate of return (ERR) to be 18.3 percent. It also shows that there is a 1.9 percent probability of not meeting the hurdle rate for capital in Vietnam of 10 percent. Thus, the analysis demonstrates that the project is robust to the identified risks.

**Assessment of Greenhouse Gas Impacts**

The World Commission on Dams indicates that hydropower cannot, a priori, be automatically assumed to emit less greenhouse gas (GHG) than the thermal alternatives. Net emissions should be established on a case-by-case basis.

Vietnam’s GHG emissions have risen sharply, and a World Bank comparative study showed Vietnam to have the second-highest GHG emission growth rate among countries in the decade 1994–2004, albeit from a very low base. In consequence, the project economic analysis also included a section on carbon accounting.

During the wet season, when TSHPP will run virtually 24 hours per day, it was assumed that the plant will displace coal generation in the north of the country, meaning that the most inefficient coal unit should be taken off line for this period. There are significant variations in heat rate (and hence variable cost) among the older coal units, with resultant efficiencies in the range of 20.7 percent to 36.6 percent. During the summer months, when TSHPP would run as a peaking plant, the least efficient gas-fired power plant would be taken off line. These plants also have a range of efficiencies, from 40.8 percent to 50.7 percent. To the extent that TSHPP allows use of the thermal plant to be avoided, it contributes to reduced GHG emissions. GHG emissions avoided by the power generated by Trung Son during the 123 days of the wet season were estimated to be...
6,000 tons of CO\textsubscript{2} per day, and during the 242 days of the dry season were estimated to be 800 tons of CO\textsubscript{2} per day. These are conservative estimates based on the assumption that the avoided thermal generator is a gas-fired plant in the summer.

GHG emissions from the reservoirs for storage hydropower projects remain a controversial topic. The so-called power density, measured in Watts of nominal installed capacity (W) per square meter (m\textsuperscript{2}) of reservoir area has come into increasing use as a proxy for the GHG efficiency of a hydropower project.

With a flooded area at full reservoir level of 13.1 km\textsuperscript{2}, and a power output of 260 MW, the power density of Trung Son is 19.8 W/m\textsuperscript{2}. Trung Son compares favorably with the range of power densities for Brazilian projects, which are the basis for the thresholds proposed by the United Nations Framework Convention on Climate Change in determining eligibility of hydropower projects for Clean Development Mechanism financing. This comparison is presented in Table 3.

Based on these data and the median methane and CO\textsubscript{2} fluxes obtained from the Brazilian surveys, it was estimated that 56 tons of CO\textsubscript{2} equivalent would be emitted from the Trung Son reservoir per day. The calculation demonstrated that in comparison with the avoided CO\textsubscript{2} emissions from the reduction in thermal generation, reservoir emissions were trivial, and suggest that the net CO\textsubscript{2} avoided by the project is more than 900,000 tons per year.

**Identifying and Managing Critical Implementation Risks**

A key aspect of preparation was to identify the critical risks to successful project implementation and the mechanisms needed to overcome them. This section reviews some of the approaches adopted in the Trung Son project that may be useful in other projects.

**Managing focus on outcomes**

A problem often faced in projects in Vietnam is their propensity for delay during the start-up phase. This is particularly a risk in the Trung Son project; although TSHPCo bears overall responsibility for implementation, some corporate EVN entities retain management oversight and accountability, including for procurement, financial management, governance, and environment. Although events could normally be expected to run smoothly, with good collaboration between the corporate EVN functions and TSHPCo, exceptions and unusual

### Table 3. Comparison of power densities for Brazilian hydropower projects and Trung Son

<table>
<thead>
<tr>
<th>Project</th>
<th>Country and province</th>
<th>Installed capacity (MW)</th>
<th>Reservoir area (km\textsuperscript{2})</th>
<th>Power density (W/m\textsuperscript{2})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xingo</td>
<td>Brazil—Caatinge</td>
<td>3,000</td>
<td>60.00</td>
<td>50.00</td>
</tr>
<tr>
<td>Trung Son</td>
<td>Vietnam—Thanh Hoa</td>
<td>260</td>
<td>13.13</td>
<td>19.80</td>
</tr>
<tr>
<td>Segredo</td>
<td>Brazil—Mata Atlantica</td>
<td>1,260</td>
<td>82.00</td>
<td>15.47</td>
</tr>
<tr>
<td>Itaipu</td>
<td>Brazil—Mata Atlantica</td>
<td>12,000</td>
<td>1,549.00</td>
<td>8.13</td>
</tr>
<tr>
<td>Miranda</td>
<td>Brazil—Cerrado</td>
<td>390</td>
<td>50.60</td>
<td>7.72</td>
</tr>
<tr>
<td>Tucuri</td>
<td>Brazil—Amazonica</td>
<td>4,240</td>
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</tr>
<tr>
<td>Serra da Mesa</td>
<td>Brazil—Cerrado</td>
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<td>1,784.00</td>
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</tr>
<tr>
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<td>0.45</td>
</tr>
<tr>
<td>Samuel</td>
<td>Brazil—Amazonica</td>
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<td>559.00</td>
<td>0.39</td>
</tr>
<tr>
<td>Tres Marias</td>
<td>Brazil—Cerrado</td>
<td>396</td>
<td>1040.00</td>
<td>0.38</td>
</tr>
</tbody>
</table>

situations—inevitable in a large project—tend to cause delay because they are subject to multiple layers of oversight and approval.

To improve coordination during project implementation, when there will be a greater degree of autonomy for TSHPCo, EVN created a task force comprising staff from key corporate departments and the Director of TSHPCo. This task force is mandated and empowered to make all relevant decisions and will oversee activities and ensure coordination between TSHPCo and the corporate functions of EVN as long as it remains owner of the project. The task force is accountable to an EVN Vice President who is the World Bank’s main counterpart for all EVN’s operations.

**Incorporation of Social and Environmental Mitigation into Project Scope and Results Indicators**

A common problem in hydropower projects is that progress in environmental and social aspects lags behind progress on the technical and construction side. For Trung Son at least, this is not for want of commitment: the government of Vietnam has demonstrated its commitment to ensuring the implementation of the social and environmental mitigation measures by borrowing IBRD funds for that purpose. The project objectives include social and environmental goals, which are reflected in the outcome measures and intermediate results in the monitoring and evaluation framework—the project must meet those goals to be considered a success. The project design includes a separate component that focuses on social and environmental impact management, and includes, among other items, the mitigation of the environmental consequences of construction and operation of the dam and the implementation of the EMP and the RLDP.

One outcome measure will assess whether the livelihoods of those affected by the project are maintained at preproject levels, at a minimum. A second measure will assess compliance with the EMP. Several intermediate results indicators address other safeguard elements, which are included in the environmental and social component. These indicators focus on resettlement compensation, livelihoods development, health risk awareness, implementation of the public health action plan, the environmental management plan, and corrective actions and adaptive management implementation if existing mitigation measures are not adequate.

**Governance and Accountability**

During preparation for Trung Son, an anonymous complaint alleged collusion in the selection of the contractors for building the access road and bridges. In consequence, EVN’s senior management asked the task team to undertake an assessment of EVN’s governance and accountability systems, including those for the project. The assessment and its findings and recommendations were received positively, with enthusiasm and strong ownership on the part of EVN and TSHPCO leadership. Recognizing the challenges in the sector, senior EVN management and TSHPMB indicated their intention to improve governance and accountability while also taking into account that TSHPMB was a young organization that needed additional support at the corporate level.

Eventually, a combination of two main approaches was adopted. The first approach focused on strengthening TSHPCo. Targeted capacity building for individuals involved in project management focused on improving understanding of processes and implementation arrangements for ensuring transparency, integrity, and accountability. Moreover, a Governance and Accountability Framework was developed for TSHPCo, together with a time-bound action plan and agreement on equipping the staff to implement the framework. The framework identifies the following risk reduction actions: enhancing integrity by raising awareness; strengthening accountability; strengthening project controls; enhancing transparency in project procurement and implementation;
improving capture of complaints; and broadening stakeholder involvement. The implementation of the framework in its entirety was made binding for TSHPCo through covenants in the project’s legal agreements. In keeping with the general principles for adaptive management, adjustments may be made after experience is gained and through discovery of what works and what does not. The second approach involves strengthening the inspection process in EVN. This is a longer-term effort, and the lessons learned in TSHPCo will be used as the basis for a broader effort to improve inspection and other activities that can then be transferred to EVN as a whole.

**Advisory Bodies**

Two advisory bodies were set up to facilitate project preparation: the Panel of Environmental and Social Experts and the Dam Safety Review Panel (DSRP). Both are required by Bank policy, and have continuing roles during implementation; therefore, it is legitimate to look beyond compliance and at their value added from the client’s perspective. Both bodies bring international expertise to the project and are able to see risks from a different perspective. They also can help manage risks through their objectivity and independence and by being on hand to advise on concerns that may arise during implementation. Such concerns can often start off as minor issues but unless addressed early on may grow to the point that they become major points of contention, diverting management attention, attracting adverse publicity, and causing delay, and in some cases, abandonment of the project. During implementation the two advisory bodies will evolve:

The functions of the DSRP, which provided safety advice during preparation, will be absorbed by a Project Technical Advisory Panel that will be tasked with providing general project technical and engineering advice during the construction phase—in addition to meeting the requirements of the Bank’s policy on dam safety.

The panel of experts, which provided advice and input in the definition, execution, and review of background studies on social and environmental aspects of the project during project preparation, will continue to have a role during implementation. The panel’s composition and terms of reference will be adjusted to reflect project implementation needs, focusing more on monitoring of the plans prepared during implementation. At least one member of the panel will participate in the IGP, thus helping to maintain impartiality in the independent grievance mechanism.

These entities are intended to complement the primary oversight provided by EVN and TSHPCo and local government authorities, and regular supervision by staff of the World Bank involving real-time support from Hanoi, as well as periodic site visits and management and technical missions.

**Adaptive Management**

A key focus of the preparation for Trung Son was to ensure that the right institutional arrangements, resources, and incentives are in place to manage the challenges and risks of implementation. To some extent, this prevents the need for overly prescriptive and detailed plans, but changing circumstances often need to be reflected in revised plans. The catch

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14. “Inspection” is the Vietnamese term for internal control, not unlike a combination of the World Bank’s Internal Audit and Integrity functions.
is that many of the plans are driven by World Bank policy and are legally binding undertakings. Adaptive management is intended to provide a framework to adjust undertakings when they are no longer suitable while at the same time preventing those that should still apply from being ignored under the guise of adaptation.

Adaptive management can be used in response to changes in the legal framework, actual circumstances on the ground, budget and costs, and schedule. For example, if monitoring of environmental or social conditions indicates that circumstances in the project area have changed, or there was an oversight during preparation (such as a household not included in the initial analysis proving to be eligible for compensation), the principles set out in the SESIA, the EMP, and the RLDP will apply. Adaptive management is most likely to be used when dealing with fish and fisheries in the reservoir and downstream, with water releases and environmental flows, with increased erosion downstream, with water quality in the reservoir and downstream, with health impacts, and with resettlement and livelihoods development. To allow for adaptive management, contingencies were included in the budget of the Social and Environment Impact Mitigation Component. Accordingly, costs of environmental and social mitigation activities may be adjusted when needed during implementation.

Adaptation will only take place if it leads to better achievement of the project’s objectives and principles. Adaptive management cannot be used to justify actions that would conflict with legal principles or World Bank policies. The Project Operations Manual establishes decision-making guidelines for adaptive management, distinguishing between actions that may be taken by TSHPCo or local implementing agencies on their own initiative and actions that would require prior approval by the World Bank. Prohibited changes would include, among others,

- altering or reducing environmental standards such that the project area is not restored to its preproject condition to the greatest extent possible, or failing to mitigate known environmental impacts;
- ignoring or avoiding dealing with emerging environmental or social issues;
- restriction or elimination of entitlements and eligibility criteria, or reduction of compensation rates;
- lowering the resettlement objective below the requirement to at least restore incomes or living standards to preproject levels (or accepting a substandard outcome as satisfactory); and
- imposing activities on ethnic minority communities without free, prior, and informed consultation resulting in expression of broad community support.
Why Does the Trung Son Hydropower Project Experience Matter?

The Trung Son Hydropower Project is a good example of a well-designed, relatively low-impact, medium-scale hydropower project, prepared according to international good practice. Given Vietnam’s plans to develop a series of medium-scale hydropower projects in the coming years, the first hydropower project that the World Bank is financing in Vietnam can serve as a good practice example upon which subsequent projects can build.

Extracting lessons from the project preparation experience matters because Trung Son was prepared according to good international practices with respect to environmental, social, and dam safety considerations. Social and environmental sustainability have been at the center of the project preparation effort throughout. In fact, the project preparation process has been instrumental in introducing new approaches for sustainability of medium-scale hydropower development in Vietnam. If replicated, the Trung Son example can contribute to the sustainable scale-up of medium-scale hydropower development not only in Vietnam but also in other countries interested in sustainable hydropower development. The lessons from preparation for this operation could apply to similar operations, especially in how the Bank worked in partnership with the government on challenging issues. In particular, the Bank was able to help strengthen country systems, develop local capacity for sustained results during implementation, conduct extensive consultations, and address governance issues.

Trung Son was also the first significant hydropower project with storage that the World Bank Board of Executive Directors approved subsequent to its approval in 2005 of the 1,070 MW Nam Theun 2
(NT2) hydropower project,\textsuperscript{15} which is a high-profile multipurpose project in Lao PDR.\textsuperscript{16} Trung Son and NT2 are different in many respects, including scale, nature, impacts, and mitigation measures. NT2 is in an area of high biodiversity and cultural heritage, and the project created a 450 km\textsuperscript{2} reservoir affecting about 16,000 households, or 80,000 people. Accordingly, NT2 has a far more significant footprint than Trung Son. NT2's downstream impacts are much larger compared with Trung Son, given that NT2 is transferring water from one river basin to another, whereas Trung Son is removing water and releasing it into the same river a few hundred meters below the dam. Moreover, ownership is different: Trung Son is driven by EVN and Vietnam's domestic electricity needs with one main external financier (IBRD); in contrast, NT2 is an independent power project for export with 27 international financiers. Last, the gap between Lao PDR’s capacity, institutional maturity, and income and the demands of a world-class complex infrastructure project is somewhat greater than that between Vietnam and Trung Son. One similarity between the two projects is that the people they affect are almost entirely from ethnic minorities.

NT2, which attracted worldwide attention, is considered “best practice” in the way potential impacts were anticipated and preparatory work undertaken to address those impacts. Extensive study, analysis, consultations, and state-of-the-art communication efforts were carried out throughout the preparation of NT2, and for the programs to address the project’s potential social and environmental impacts. As a result, the project involved extremely articulated, well-prepared, and comprehensive impact mitigation and management programs and plans, to ensure each and every potential impact was anticipated.

Project preparation efforts for Trung Son were undoubtedly influenced by the example set by NT2. Trung Son, however, is taking a somewhat different approach from NT2 for meeting the requirements of World Bank safeguard policies and ensuring continued compliance with international good practice. Instead of putting in place a costed mitigation plan for every single risk identified, the project has prepared extensive social and environmental impact mitigation plans that anticipate the impacts foreseen at the time of preparation, and uses innovative social instruments and built-in mechanisms, such as consultations, a community relations program, grievance mechanisms and adaptive management, to make sure unforeseen issues can be addressed. The flexibility in the various mechanisms arises from the acknowledgment that the project may lead to unanticipated impacts over time, and the associated mitigation measures may have to be fine-tuned, revised lightly, or overhauled, based on the reality encountered on the ground, and in line with the principles agreed on at the outset. It is important to note that Trung Son in no way represents a retreat from the Bank’s standards and policies; to the contrary, it provides a more effective and flexible means for ensuring compliance with these standards and policies, and making sure the project continues to comply with these standards and policies.

Preparing a “best practice” project such as NT2 was neither cheap nor easy. NT2 preparation time

\textsuperscript{15} The other hydropower project approved by the World Bank Board of Executive Directors (in 2007) was the Bujagali Hydropower Project in Uganda, which is a run-of-river scheme. Similar to NT2, Bujagali project preparation took about seven years from concept to approval.

and transaction costs were significant—project preparation took nearly seven and a half years from concept stage to Board approval, and cost about US$7.5 million in World Bank resources, excluding any trust funds provided by bilateral donors. The preparation time for Trung Son, however, was nearly four and a half years from concept stage to Board approval—well above the Bank average, but significantly shorter than NT2. Trung Son project preparation costs were much lower than for NT2, although also well above the Bank average, with about US$1 million in Bank resources spent on preparation, excluding trust funds.

The way Trung Son Hydropower Project was prepared can be seen as a workable, replicable, and practical approach, incorporating innovative social instruments and built-in mechanisms. In that sense, Trung Son might be considered a “next step” project when compared with NT2, with regard to its focus on adopting international good practice for sustainable hydropower development while costing the client country and the Bank less, and taking less time to prepare, thanks to the innovative approaches adopted during preparation and project design. Some improvements could still be made, but it is on the right track.

What Approaches Worked Well in Preparing Trung Son?

This discussion presents the approaches that appear to have worked well during preparation. It draws on candid conversations with international experts and key team members. An overarching insight is that a little bit of humility goes a long way. If parties are willing to accept that they may not have all the answers, then they are bound to consult, disclose, listen to other viewpoints, and adapt the project design to better meet its goals.

Building on country systems, incorporating international practice, and enhancing local capacity

Environmental, social, and dam safety programs, and even the approach for consultation and for grievance redress, build on Vietnamese requirements. Where differences were identified between Vietnamese and World Bank standards, the focus was on complementing Vietnamese requirements with international good practice. The preparation of key environmental and social documents was undertaken primarily by Vietnamese institutions, with senior-level, targeted, individual expert assistance from international consultants to provide advice and guidance. Throughout the project preparation effort significant transfer of knowledge between international and national experts, as well as World Bank staff, occurred. The following insights suggest how conscious efforts to collaborate contributed to the effectiveness of this project preparation:

- Going into the project with more in mind than compliance; otherwise parties may miss development opportunities, and worse, induce others to try to cut corners.
- Seizing project preparation as an opportunity to build capacity, and beginning to work with key counterparts on technical issues and safeguards from the start.
- Being flexible and willing to revisit parts of the project design to incorporate new information that emerged along the way. Accepting that unanticipated issues may emerge during implementation, planning for contingencies, and setting aside resources to deal with them.
- Establishing and emphasizing the primacy of the client in all aspects of project preparation, communications, and community relations functions.
- Viewing safeguard policies as a development opportunity, not simply a matter of compliance, to the benefit of teams, clients, and key stakeholders.

How the preparation teams worked together

The set-up of the EVN–TSHPMB and World Bank teams, the way they were complemented by high-quality Vietnamese and foreign consultants, and the way they worked together had a major bearing on the success of the project preparation process and the resulting project.

The level of support provided by EVN to TSHPMB, the strength of its senior management team, and its openness to new ideas were essential to the collaborative process. A small, but strong,
multidisciplinary World Bank task team was a major asset for the project’s preparation. The Bank team comprised high-caliber staff from across the institution but was firmly rooted in the country office, with its deeply knowledgeable and experienced local staff facilitating progress in ways not possible in more internationally driven design processes. For both EVN and the World Bank, clear leadership and continuity throughout preparation was critical, and will remain so through the start of implementation.

The two parties—TSHPMB and the World Bank—devised a work method in which subteams, for example, the social safeguards teams, worked together with a fair degree of autonomy, but with each side responsible for keeping other parts of its team informed. This allowed the subteams to work at their own pace and to stay in touch with overall project development. A more monolithic working style would not have worked as well, given the size and complexity of the project. The autonomous style also allowed flexibility for the World Bank team to fit the work into its members’ schedules, but it required considerable coordination effort.

**Quality and the Trade-off Between Speed and Depth**

Task teams should be prepared for reaction to hydropower projects; concerns about and opposition to hydropower projects are bound to occur. Teams must prepare a good project that complies with international practice and World Bank policies, perform adequate consultations in advance, communicate their messages well, be prepared to respond to queries, and ensure mechanisms are in place to address issues that emerge during implementation. This is not necessarily gold plating: “just in case” work can be avoided or reduced with a bit of forethought, as in the following examples:

- Undertaking thorough baseline analyses—technical, economic, financial, social, and environmental—because they inform much more than the question of project viability.
- Engaging key stakeholders early on, with clear plans on how to work with them and follow through. Consultation is hard work, but can be extremely rewarding in preparing a good project and garnering support for it. Inadequate consultation up front, and a poorly prepared project, may lead to much more work during implementation.
- Putting in place and implementing a communications plan. It is advisable to be transparent and share information early in the process. Unless there is an overriding reason not to disclose, make information available to the public.
- Using expert panels to provide essential depth for task team and client alike. Finding the right people might take time, and panel composition may need to be changed based on project phase. Having no panel is better than retaining an irrelevant one.
- If choosing adaptive management, being clear from the outset that it complements good preparation and does not substitute for it; thus, setting the ground rules under which changes will be permitted requires care and attention.
What Could Have Been Done Differently?

Conversations between the authors of this paper and various individuals with extensive knowledge of the project and hydropower development provided insights on what to avoid, or do differently, when preparing future projects. Some points that emerged, which could be useful for other practitioners, include the following:

Getting the NGOs to represent themselves either as a coalition or as a group with which the Bank could engage was relatively difficult, and a demanding task on its own. It may have been useful to consider initiating work with NGOs, and think about the setup of a coordination group, earlier in project preparation.

Coordinating disclosure of documents and keeping a record of what was disclosed and when was challenging at times. It was also time-consuming to verify that the same version of each document was disclosed on the TSHMB and World Bank project websites, and at the Infoshop.

A significant challenge was methodological coordination because none of the local consultants had done the types of analysis required to fill the gap between Vietnamese and international standards. The model could be further fine-tuned for future projects by paying particular attention to sequencing and ensuring adequate coverage of all relevant topics.

Coordination at all levels could have been stronger and might have accelerated project preparation. Standardizing the inputs of the very large number of individual consultants with very different levels of English and writing styles, coordinating the activities of the subteams, and ensuring messages in communications were consistent with the published documents took considerably more effort than expected, and had to be correct in every detail.

Key staff will inevitably move on from the team, but this mobility has to be weighed against the need for continuity and the skills required during preparation and implementation. Too many major changes were probably made at once, particularly of the core team members on the Bank side, risking the loss of corporate memory of the details of preparation.

Concluding Thoughts for Successful Project Implementation

The efforts described in this paper helped prepare a good project that can stand the test of time and made sure that the project will be robust to inevitable change. But that will count for nothing without the necessary follow through, with particular attention paid to the quality of implementation, supervision, and monitoring. The importance of close involvement by the World Bank and external technical consultants, especially in the early years, cannot be overemphasized. Continuation of capacity building and technical assistance throughout implementation is essential, as is close attention to open communications. The World Bank intends to continue working with government agencies and companies on how to institutionalize the most promising and relevant new approaches introduced under this project, and to be replicated during engagement with the broader sector.