Harnessing Hydropower for Development

A Strategic Environmental Assessment for Sustainable Hydropower Development in Viet Nam

Policy Summary
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Contents

Key Messages

This policy summary is a short version of the full report, which contains data, extensive analysis and all tables, data and figures that have been used as part of the SEA. Key messages, trends and recommendations are listed for easy reference. The full report can be found at http://www.gms-eoc.org/CEP/Comp1/Component1.aspx. It is also available on the attached CD-ROM.

A number of key messages have emerged from the Strategic Environmental Assessment (SEA) of hydropower in Viet Nam. These are:

SEA provides a powerful tool for the analysis of the social and environmental impacts of hydropower development and can be fully integrated into the overall strategic planning process for the power sector and in particular the preparation of the Power Development Plan VII.

The level of hydropower development envisaged in Power Development Plan VI can be justified when compared to the feasible alternative sources of power generation, which have higher economic, social and environmental costs.

The present approaches to addressing social and environmental issues in hydropower development are not adequate and more effective mitigation and compensation measures must be introduced if hydropower development in Viet Nam is to be placed on a more sustainable pathway.

Most of the necessary social and environmental mitigation measures can be costed and these costs can be internalized into the overall economic analysis of hydropower schemes without compromising their financial or economic viability.

There are opportunities in areas such as water management, agricultural development, service provision and poverty reduction for positive impacts from hydropower development, but these positive benefits are not yet fully recognized or realized.

Many mitigation measures need to be introduced pro-actively before development starts to reduce the risks of negative impacts. The measures will not be effective if they are introduced too late.

A number of mitigation measures can be linked to existing government programmes in other sectors, such as Programme 135, the Community Forestry Programme, Protected Areas Development and River Basin Planning. Making such links will reduce the costs and increase the effectiveness of mitigation measures.

Capacity development is necessary in many parts of the system for planning and implementing hydropower development if the potential of SEA as a strategic planning tool is to be realized.

Knowledge and data gaps exist and need to be reduced if more effective integration of social and environmental issues into power sector planning is to take place.

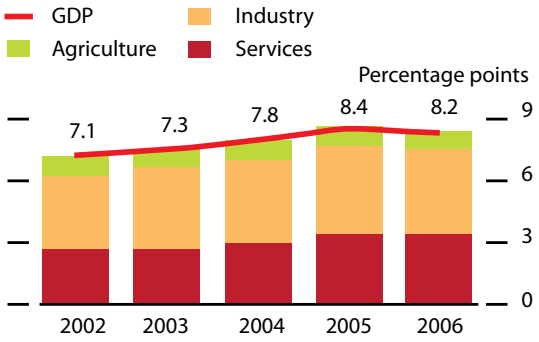
Benefit sharing mechanisms have been piloted and proven to be effective. These mechanisms provide the means through which hydropower can be more effectively linked to the wider development processes in the vicinity where schemes are constructed.

Introduction

The Ministry of Industry and Trade (MoIT), supported by the Stockholm Environment Institute (SEI), has undertaken a pilot Strategic Environmental Assessment (SEA) of hydropower in Viet Nam in the context of the Power Development Plan (PDP) VI. The pilot SEA is supported by the ADB's Greater Mekong Subregion Core Environmental Program. The main purpose of the pilot SEA exercise is to build capacities for the integration of SEA into the strategic planning of hydropower in Viet Nam, including the preparation of PDP VII.

Why This Pilot SEA Study?

Figure 1: Contributions to Growth (supply)



Sources: *Asian Development Outlook* database; General Statistics Office of Viet Nam, available: http://www.gso.go.vn, downloaded 16 February 2007.

Viet Nam has a rapidly growing demand for electricity, with current growth rates of around 15% per annum expected to be sustained and increased in the foreseeable future. This reflects Viet Nam's rapid progress in economic development, progress that has lifted millions of people out of poverty and seen a transformation of the country to the present, where the goal defined in the 2006–2010 Socio-Economic Development Plan of becoming a modern, industrialized economy over the next 20 years is realistic. Figure 1 shows that Viet Nam's economy has experienced a sustained growth rate of between 7-8% in recent years, with the electricity-intensive sectors of industry (which constitutes 44% of all electricity demand) and services dominating. Total final energy consumption was 21.8 million tonnes oil equivalent (MTOE) and demand grew by an average of 11.6% per annum between 1990 and 2005. Electricity demand

grew by 11.4% per annum in the same period. The expansion of electricity generation capacity is a high policy priority for the government. Generation capacity more than tripled from 1995 to 2005, from 2,796 MW in 1995 up to 9,255 MW in 2005, with an average growth rate of 12.7% per year. Plants under development will increase capacity to 26,209 MW by 2010.

Hydropower plays an important part in electricity generation. Present levels of installed hydropower capacity represent 22.8% of the technical potential. How much of the remaining 77.2% should be developed depends on three factors: (i) future growth of demand for electricity; (ii) how much of this potential can be developed in a socially, environmentally and economically desirable and sustainable manner; and (iii) what alternative sources of power generation are available. The plans set out in PDP VI anticipate that the majority of viable capacity will be developed over the next 10-15 years.

What is Strategic Environmental Assessment?

SEA is a structured approach to integrate environmental and social considerations into strategic decision making, such as the formulation of policies, plans and programmes. SEA developed rapidly during the 1990s and today it has been institutionalized in many countries; today, Viet Nam has one of the most advanced SEA legislations in place, but faces considerable capacity constraints in ensuring that this legislation is acted upon. It is an increasingly recognized and important procedure, seen by many as a prerequisite for moving towards sustainable development.

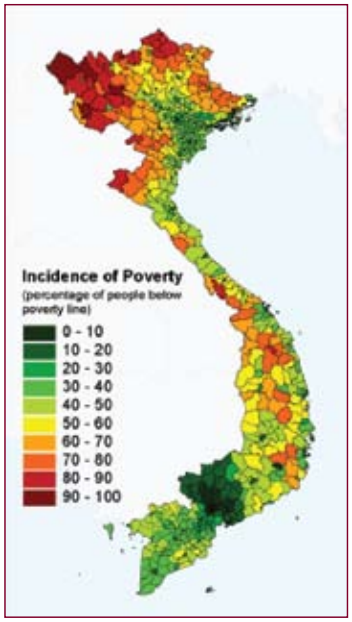
SEA departs from a growing recognition for a demand-driven approach to environmental assessment, in which the prediction of impacts has a role but is not the sole purpose. This means that it is not only set up as an environmental safeguard process, but perhaps more importantly a strategic decision-making support tool. It thus involves a broader process of policy analysis and decision support including the setting of objectives, generating alternatives and scenarios, impact analysis and weighting of different alternatives based on multiple development objectives.

The Pilot SEA of Hydropower in Viet Nam

The pilot SEA is focused at a national level on assessing the potential contribution of hydropower to national development through a **strategic planning** approach that balances economic development, social equity and environmental sustainability. This in turn reflects the goals of the 2006–2010 SEDP and the Viet Nam 2020 Vision, which represent national development aspirations. The **goal** of the SEA is to optimize the contribution of sustainable hydropower to national development over the period up to 2025. A key consideration is how the planning and development of hydropower relates to wider policy priorities. This includes maintaining economic growth and also strategic issues such as poverty reduction and ecological sustainability. As the map shows, while Viet Nam has shown remarkable progress in poverty reduction in recent years, persistent poverty pockets remain in the central and northern mountainous areas where most hydropower development will take place.

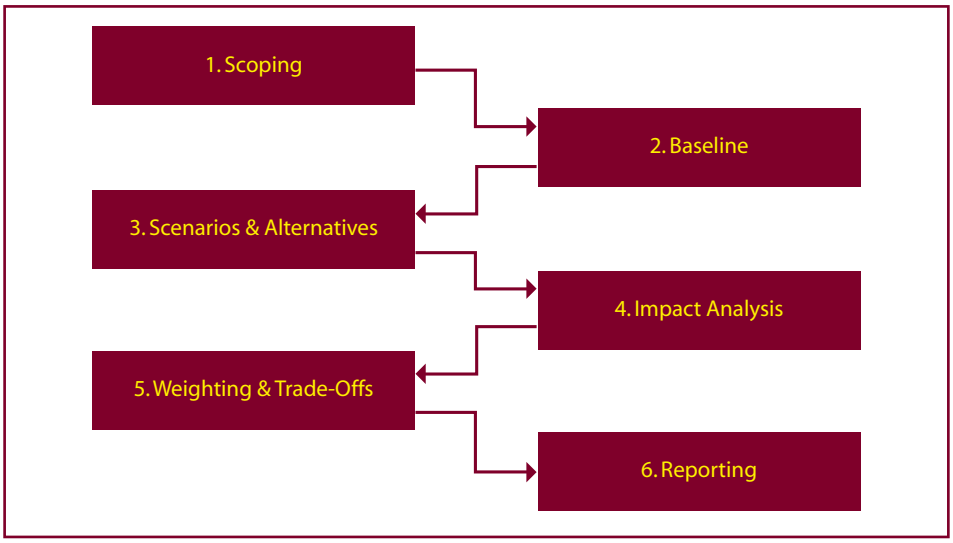
These are also the areas where the highest concentrations of ethnic minorities live, and they constitute the majority of the population in many mountainous districts. These communities also have a much higher incidence of poverty: ethnic minorities make up about 40% of Viet Nam's poor people but are only 14% of the total population.

Figure 2: Incidence of Poverty, 2003[1]



[1] Minot, Nicholas, Bob Baulch, Michael Epprecht. 2003. "Poverty and Inequality in Vietnam: Spatial Patterns and Geographic Determinants." Report, International Food Policy Research Institute, Institute of Development Studies, Washington, D.C., p. 28.

Phases in the SEA Process



The SEA goes through a sequence of activities as shown in the figure above. The study was implemented within the realm of the ADB's Core Environment Programme as one of three SEAs. Within the Vietnamese context, the project is part of a relatively wide portfolio of pilot SEAs conducted in different sectors and decision-making contexts in order to build capacity and establish technical guidance and expertise to implement the SEA law. The pilot SEA has forged institutional linkages through the direct engagement with MoIT as the PDP plan owners; the anchoring of the process in an interministerial Core Working Group, and intensive engagement with the Institute of Energy as the institution responsible for developing the Power Development Plan.

It has been an explicit strategy of this pilot SEA to place its processes and ownership within the energy-sectoral decision makers and not within the ministries and agencies concerned with environmental protection. The Working Group has held regular meetings throughout the implementation of the SEA and its members have been actively involved with the

development of all aspects of the methodology and analysis undertaken in the SEA.

Phase 1: Scoping

Phase 1 of the SEA was a **scoping exercise** that addressed what strategic issues should be included in the SEA. This scoping exercise was based on **stakeholder consultations** with key individuals and institutions in Viet Nam. The purpose of the scoping process is to build a consensus on the current situation and the key issues that need to be considered in the execution of the SEA. The findings of this scoping process are presented here. All key government agencies, NGOs, donors and other stakeholders were consulted in the process.

Strategic Issues for Hydropower Development in Viet Nam

The results of the interviews and discussions showed a strong consensus on some issues and divergent opinions on others: hardly a surprising result but nonetheless significant. It is worth noting that responses did not in any way follow institutional interests: the respondents discussed the issues on their merits and demonstrated an awareness of the wider strategic significance of hydropower in contemporary Viet Nam.

Hydropower was seen as having an important role to play in the **long-term development of Viet Nam**. All respondents recognized the importance of meeting growing energy demand that reflects the rapid economic growth the country is experiencing. The significance of hydropower in ensuring **national energy security**, including reducing dependence on imported fuels such as oil and natural gas, was also seen as a significant issue by some, but not all, respondents. A wide range of **trade-offs** were recognized, including a consensus that the negative impacts of hydropower are not fully taken into account in the present hydropower planning. The overall trade-off between developments that can be favourable nationally but have negative local impacts was accepted as a reality that has to be managed with clear and fair rules.

The results of the consultations were presented to a stakeholder meeting and **five key strategic issues** emerged from the discussion as representing a consensus amongst the consultation respondents and meeting participants. These are:

1. The importance of hydropower for **economic development** in Viet Nam. There was a consensus on the need to plan and implement hydropower in a balanced and sustainable manner, but also a consensus that hydropower development is essential when alternative means of electricity generation are considered. The goal of optimizing sustainable hydropower development was agreed as expressing the consensus on this issue, with the recognition that the SEA needs to define precisely what sustainable hydropower means.

2. The effective and sustainable use of **water resources**, which was recognized as a key for future hydropower development. This includes concerns over the allocation of water for other users within a river basin, water shortages (potentially made worse by climate change, and including possible impacts on hydropower scheme viability) and the need for integrated water resources planning and management in river basins.

3. Impacts on **project affected people**, and especially ethnic minorities, along with the process through which these impacts are compensated for. Concerns here were most clearly expressed in relation to the resettlement process, but wider livelihood impacts, concerns over the impact of the loss of land and forests and cultural impacts beyond displaced people were also identified as concerns.

4. The maintenance of **ecosystems integrity**, both around the hydropower development site and downstream and recognizing the cumulative impact of multiple hydropower schemes within a river basin. All aspects of the environmental implications of hydropower development are important but the consensus was that many of

these are already taken into account in existing environmental impact assessment procedures. The wider and long-term impact on overall ecosystems integrity was recognized as the key strategic environmental issue for national hydropower development.

5. Different aspects of the **hydropower planning process**: many respondents felt that it is not possible to separate strategic policy issues from the process through which hydropower is planned, as the nature of the positive and/or negative impacts is largely conditioned by the way the planning works. Issues of balancing goals (social, economic and environmental) and of transparency and participation in planning were raised. The need to conform to international good practice was cited as an important issue.

Phase 2: Baseline Assessment

The baseline assessment contains four components: Energy/hydropower, environmental, hydrological and social/livelihoods. Separate status reports have been prepared for each component that summarize the existing knowledge on the issues for contemporary Viet Nam. The four thematic reports provide an empirical basis for the preparation of scenarios and the analysis of impacts and weightings. Care was taken to ensure that the key strategic issues that were identified during the scoping exercise are reflected in the appropriate thematic reports. The main content of each report is summarized in the following paragraphs.

The **energy baseline** provides an overview of the overall energy sector in Viet Nam and detailed sections on the power sector, coal, oil and gas, new and renewable sources of energy and the identification of key drivers in hydropower development.

The **social baseline** includes sections on demographic characteristics and trends; poverty incidence and livelihoods patterns; the situation of ethnic minorities; the institutional setting; main social, demographic and developmental trends that have implications for sustainable hydropower development

The **environmental baseline** summarizes information on climatic conditions, water resources and aquatic ecosystems, forest types and conditions, agricultural land-use, trends in natural systems and environmental quality, major agro-ecological zones and an assessment of the major drivers of environmental and natural system trends.

The **hydrological baseline** contains the results of the hydrological modeling work undertaken by the Institute for Water Resources Planning. This includes an analysis of water resource and demand trends for the river basins containing planned hydropower developments up to 2025. It also includes an assessment of potential changes to dry season water availability and to flood risks and mitigation potentials.

Phase 3: Scenarios

The next phase of the SEA concentrated on the development of a series of scenarios for future sustainable hydropower development. The point of departure for the development of the scenarios was the pattern of future power demand as outlined in the PDP VI, using the baseline demand assessment as the basis for the development of the SEA hydropower scenarios. Scenarios provide a powerful tool for identifying and assessing plausible futures, in which key factors are varied according to the defined purpose of preparing the scenario analysis. In this study, the focus of the scenarios was on assessing the social, environmental and economic consequences of different levels of hydropower development within the overall power development plan.

A consequence of this is that where scenarios are premised on lower levels of hydropower development, the lost generating capacity needs to be replaced with additional capacity from non-hydropower sources. Given the context of this study, the alternatives were those defined through the PDP process: the least-cost sources as defined in PDP VI. The scenarios were developed and analyzed through an eight step process, outlined below:

- The first step in developing the scenarios was to identify hydropower schemes in PDP VI where decision on building was still open to influence. Although PDP VI contains a larger number of hydropower schemes, many are already under construction or in an advanced stage of planning and it was resolved that there are 21 schemes where the decision to develop or not was open to influence.

- The second stage was to define 5 scenarios from the base scenario where all 21 schemes are built through progressively less hydropower to where none of 21 schemes are built.

- This was followed by the definition of the alternative generating sources to replace lost hydropower capacity, based on the least cost formula used in PDP VI.

- The fourth stage, discussed at length below, was to assess the total social and environmental risks and impacts (both positive and negative) for each scenario, both hydropower and alternatives. This is a key aspect of the SEA scenarios: hydropower is not treated in isolation, but rather as part of the overall power sector planning system.

- Once the risks and impacts are assessed, the scenarios define, where possible, an economic valuation of the social and environmental costs and benefits for each scenario.

- The next stage is to internalize these costs into the overall economic assessment of each scheme and for each scenario.

- Step seven is to undertake a weighting assessment in relation to the key strategic issues identified in the scoping stage of the SEA.

- The final, critical, step in the scenarios analysis is to define actions to internalize cost in the overall economic appraisal of the different power generation mixes and to identify actions that will reduce risks and mitigate impacts on people and the environment associated with hydropower development.

The scenarios take account of the PDP VI plans for the period 2011 to 2025 as projects to be commissioned before 2011 are already under construction or in an advanced stage of planning. The total increase in generation capacity for 2011-2025 is estimated to be 62,639 MW and is anticipated in PDP VI to be covered by the following energy sources:

Table 1: Assessment of Energy Sources

Energy Source	Capacity in MW 2010	Capacity in MW 2025	Capacity in MW 2011-2025
Hydro	9,412	20,178	10,766
Coal-fired	6,595	36,290	29,695
Gas-fired	9,072	17,224	8,152
Diesel & Oil-fired	472	2,400	1,928
Nuclear	0	8,000	8,000
Import (Hydro)	658	4,756	4,098
Total	**26,209**	**88,848**	**62,639**

It will not be possible to replace all the 10,766 MW of installed capacity scheduled for hydropower in the period 2011 to 2025 as many of the projects are under construction, and some consist of small hydropower and pumped storage hydropower that in this study are assumed to remain as scheduled in PDP VI, but some 4,600 MW as seen in capacity balance of hydropower for the year 2025 in the table below:

Table 2: Capacity Balance of Hydropower

Item of Hydro	Capacity in MW According to PDP VI
In operation 2010	9,412
Hydro under construction	2,296
Planned hydro 2011-2025	4,610
Small hydro & pumped storage 2011-2025	3,860
Total Capacity 2025	**20,178**

The National Hydropower Plan Study looked at the hydropower projects in relation to technical, economic, environmental and social criteria where the Total Preference Index (TPI) was used for the ranking of the planned hydropower projects. A high value of TPI indicates a "good" project both in terms of the economic viability of the project, and the environmental and social impacts. Whilst the limitations of the approach used are recognised, this analysis provides a viable basis for the identification of different hydropower development scenarios for the SEA.

In this study, five alternative scenarios have been developed. The goal of the SEA scenarios is to assess the full implications, including social and environmental criteria, of alternative fuel mixes where the level of hydropower development is lower and the gap in generating capacity is filled through the construction of power plants that use alternative primary energy sources, which in Viet Nam principally means thermal power.

Table 3: Hydropower Development Scenarios for the SEA

Scenario	Strategy
Base	According to PDP VI
Alt 1	Hydropower projects with TPI < 60 are replaced by thermal power
Alt 2	Hydropower projects with TPI < 65 are replaced by thermal power
Alt 3	Hydropower projects with TPI < 75 are replaced by thermal power
Alt 4	The planned hydropower projects are not implemented at all

The first scenario, which can be taken as the base case, is the implementation of all hydropower schemes as planned in Power Development Plan VI. The next three scenarios have progressively lower levels of hydropower development, with the identification of which schemes to retain and which to eliminate from the scenario being based on the TPI as given in the table below. The final "scenario" (which was not considered a plausible future and was included for illustrative purposes only) is for no new hydropower development after schemes presently under construction are completed.

The impact of **alternatives to hydropower**, basically thermal power, has been assessed in relation to the increased direct costs of power generation and the environmental impacts of increased thermal power generation. The latter includes an economic valuation of the increased air pollution from thermal power generation. This valuation combines total emissions in relation to climate change impacts (CO_2, CH_4, N_2O) with an assessment of other forms of air pollution that are primarily more local in their impacts (SO_2, NO_x and PM_{10}).

Phase 4: Impact Analysis

The methodology that the SEA adopted for assessing the social and environmental impact of hydropower development initially focused on an assessment of impacts for each of the planned hydropower schemes conducted individually. These were then integrated into an overall analysis, based on schemes with river basins and the schemes in each of the scenarios. The basis of the impact analysis is a rigorous interrogation of existing data based on the following components:

Reservoir Area: this includes the land areas lost in different categories and the assessment of impacts on displaced people. The total area that will be submerged in the 21 schemes is 25,133 ha, including 4,227 ha of natural forests, 1,367 ha of plantations, 5,961 ha of agricultural land, 737 ha of residential land and 12,810 ha of grasslands, bare land and other non-productive land uses. It is estimated that the value of crops from the lost farmland would be around $2.9 million/year, while the total resource value of the forest lost (including environmental service functions) is estimated at $72.4 million.

A total of 61,571 people would be displaced if all 21 schemes are constructed, but the number varies from scheme to scheme. Seven of the 21 schemes would require little or no resettlement and a further three have 650 or less people, while Bac Me would result in the displacement of 10,700 people and Ban Chat of 14,800 people. The four schemes with more than 7,000 displaced people (Ban Chat, Bac Me, Huoi Quang and Lai Chau) would result in over 41,000 displaced people, or two-thirds of the total. These schemes require special attention with regard to the resettlement issue. Over 90% of the displaced people are ethnic minorities with a poverty rate well above double the national average. These people are highly dependent on access to natural resources (including forests) for their livelihoods and a close connection to where they live is an integral part of their cultural identity.

These communities are highly vulnerable to disruption to their lives and livelihoods from resettlement. There is a danger, unless proactive actions are taken, that the poverty incidence among displaced communities will increase as a result of resettlement. International experience[2] shows that this occurs frequently, and the mitigation package proposed in the SEA is intended to provide the means for displaced people to establish themselves in a new location, gain access to an adequate level of services and have opportunities to reconstruct their livelihoods in ways that reflect the characteristics of their new locations.

The social and livelihoods impact assessment has been undertaken based on the "Impoverishment, Risk and Reconstruction" model developed by the World Bank. This model, which represents international best practice for resettlement, is based on a risk and mitigation assessment method, rather than traditional impact analysis. It is particularly suited for a long-term strategic SEA of this sort. The amended compensation package has been costed and it is estimated that the additional items (including 10 year development support for displaced communities) would add an additional 24% to the cost of the existing compensation package. The full compensation package does not compromise the economic viability of any of the schemes. The main categories of risk associated with resettlement and mitigation measures to address these risks are shown in the table below.

[2] Cernea, M. (2000) *Impoverishment, Risk and Reconstruction: A Model for Population Displacement and Resettlement* in Cernea, M. & McDowell, C. (eds 2000) *Risk and Reconstruction: Experiences of Resettlers and Refugees* World Bank, Washington D.C.

Table 4: Risks and Resettlement Mitigation Actions in the IRR Model for Viet Nam

Risk Factor Mitigation	Type of Mitigation Action	Specific Measures Recommended for the Package for Viet Nam
Landlessness	Land-based resettlement	Compensation for land, crops, fishponds
Joblessness	Reemployment	Investment for production development Investment for livestock development Investment for irrigation Extension training Community development fund
Homelessness	House reconstruction	Residential house Moving allowance within province
Marginalization	Social inclusion	Support for resettlement Allowance for the resettlement supporting group Assistance partial and indirect Project Affected People
Increased morbidity	Improved health care	Sanitation construction Health & hygiene training Communal health care centre
Food insecurity	Adequate nutrition	Rice support for 36 months
Loss of access	Restoration of community assets and services	Electricity and water supply Public architectural works Local road infrastructure development Maintaining infrastructure
Social disarticulation	Networks and community rebuilding	Moving graveyards Building cultural infrastructure Supporting for the cultural restoration and rehabilitation activities Compensation/support host population

Zone of Influence: the approach used for assessing impacts in the vicinity of the hydropower schemes was based on the identification of a Zone of Influence: an area surrounding the dam site where both most environmental impacts (other than inundation) and impacts on local communities (other than the people who are resettled) will be found. The approach used a Geographic Information System (GIS) to calculate the Zone of Influence (ZoI) for each scheme, based on a ratio of distance and altitude to reflect the 'cost of access' to the resources from the dam point (see **Figure 3** for a cluster of ZoIs in the Central Highlands, **Figure 4** for an example of the ZoI of Upper Kon Tum, and **Figure 5** for the land-use pattern in Upper Kon Tum). The land-use and population of each ZoI was calculated based on existing land use data and district population densities and main socio-economic characteristics of the local communities.

The land use data was used to calculate the overall values of the main natural resources within the ZoI. Hydropower impacts were then estimated based on the judgment of the likely change (increase/decrease) in the resource values of the different land-use types that are a result of hydropower development. Where possible, these impacts were assigned an economic value. Where this was not possible then the severity of impacts were assessed on a scale ranging from low to severe.

Figure 3: Zones of Influence in Central Viet Nam

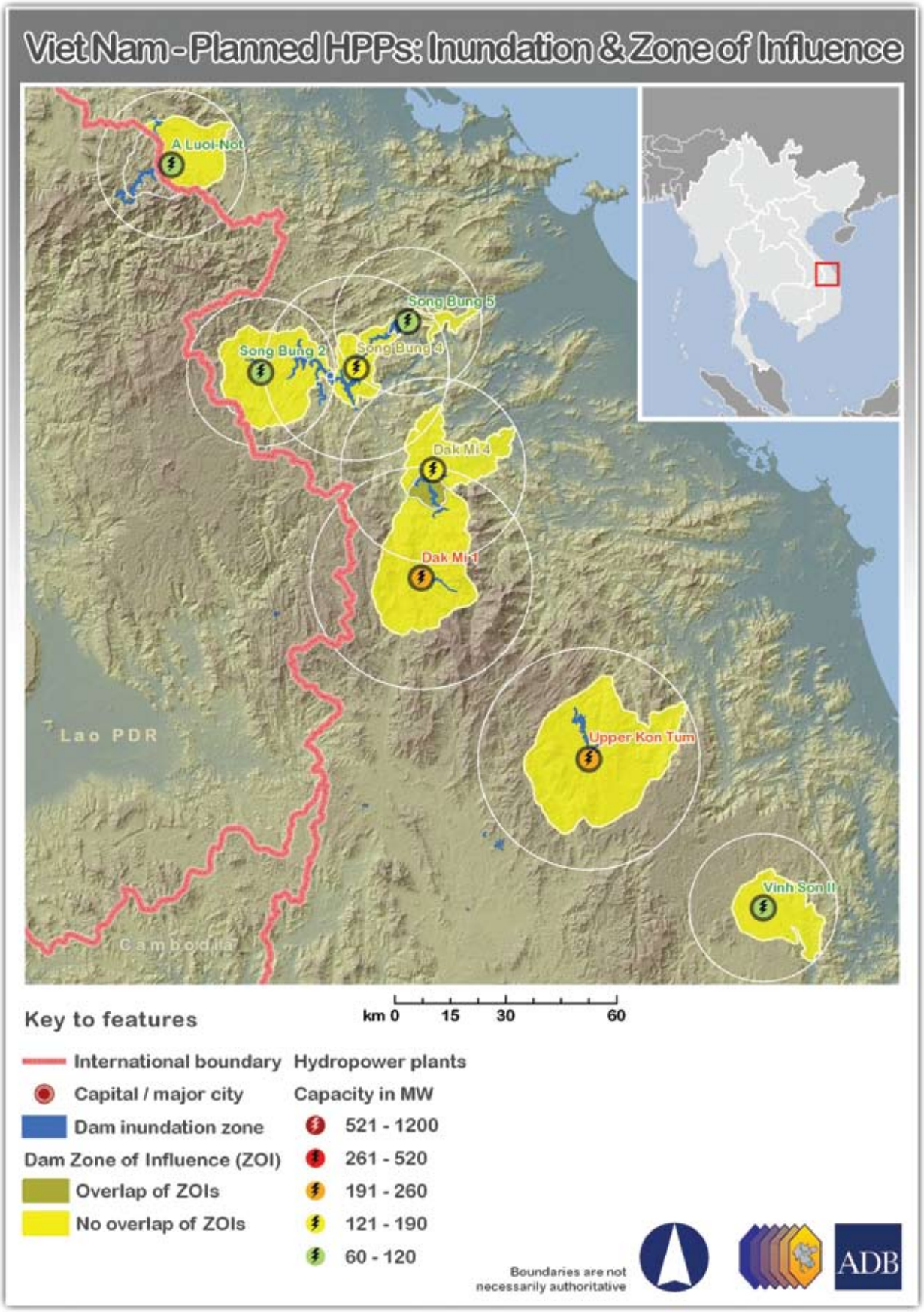


Figure 4: Upper Kon Tum Zone of Influence

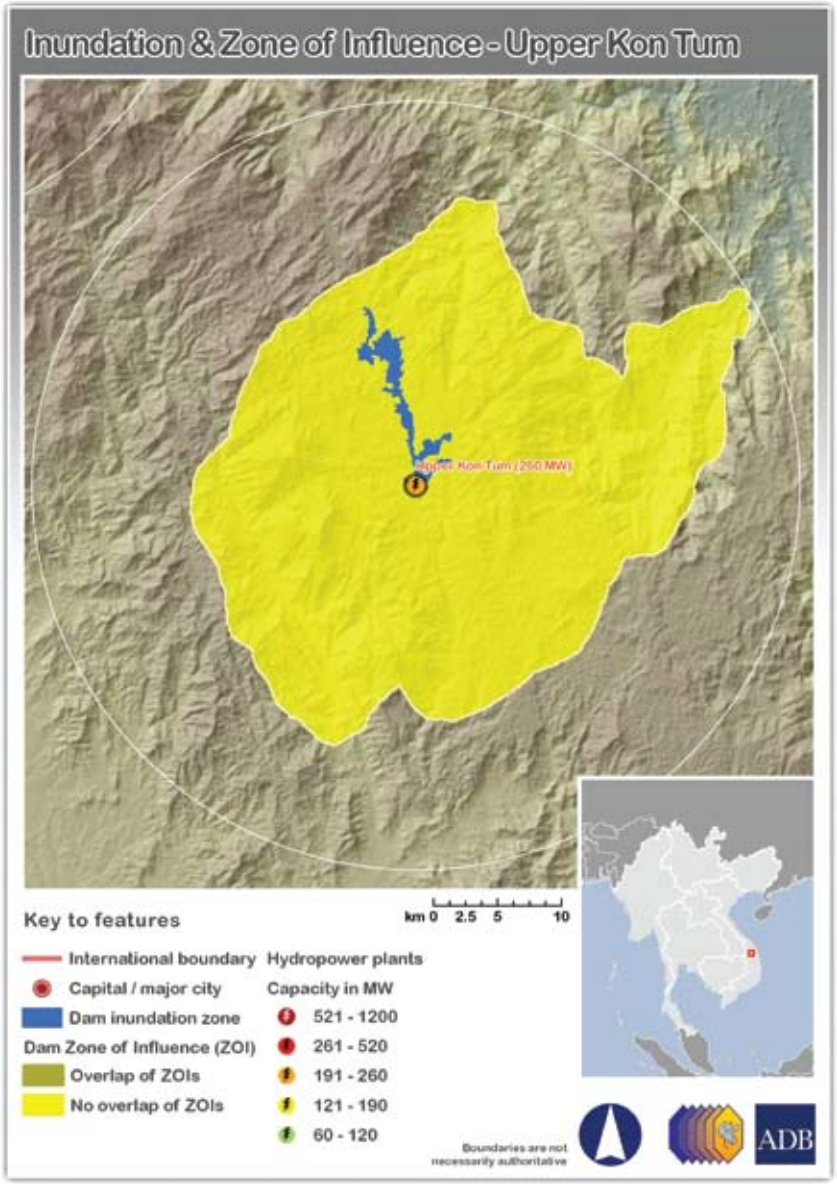
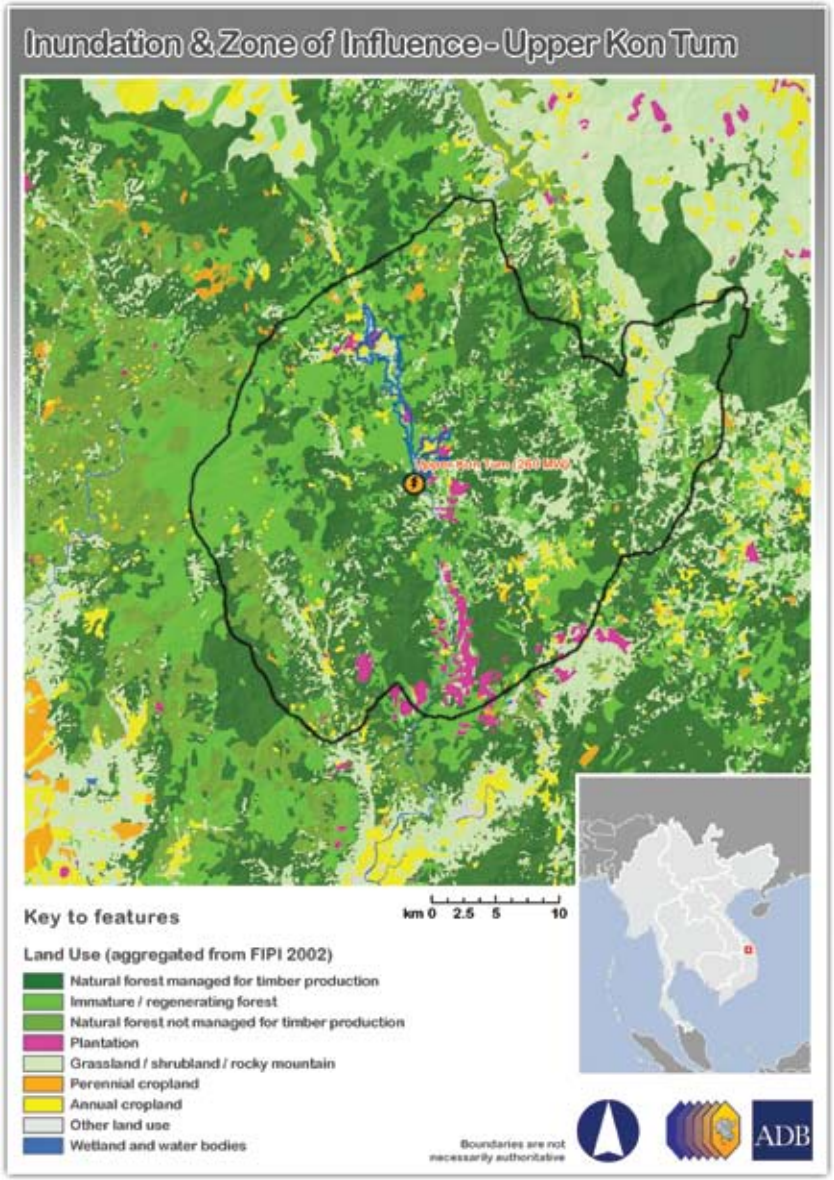


Figure 5: Land-Use Pattern in Upper Kon Tum ZoI



The social impacts in the ZoI are assessed in relation to the impacts of changes in access to natural resources and to external markets on the livelihoods of resident populations. Additional qualitative analysis of the potential social and cultural impacts is also included. The main risks have been assessed as being where increased population and reduced forest resources would result in unsustainable pressure on remaining forests, the value of which, estimated at $8.4 billion, is extremely high. The risk of unsustainable pressure is assessed using existing data through a combination of per capita forest area and the significance of forest products in local livelihoods. The analysis suggests that 11 schemes have a risk of unsustainable pressure on forests, with the risk being severe in 4 schemes. A mitigation measure in the form of community forestry has been costed for the 11 schemes where potential unsustainable pressures are a possibility. Balanced against this risk is the likely increase in agricultural incomes, with studies in Viet Nam showing that income per hectare of agricultural land increases by an average of 10% where upland areas are connected to markets through improved transport facilities.

Environmental risks in the ZoI are assessed in relation to three factors: changes to forest area and quality, impacts on river ecosystems and biodiversity impacts. The first two factors are estimated in relation to resource values, using valuation studies and estimates of the roles of forests and rivers in local livelihoods. The biodiversity impacts are assessed in relation to two main variables: the existence of endangered and/or indigenous species in the ZoI and the proportion of Key Biodiversity Areas or Protected Areas that fall within the different ZoI. The analysis suggests that there are 10 sites where the risk of damage to biodiversity resources is significant, with a recommendation for the establishment of protected areas where they do not exist and the preparation of a biodiversity action plan as part of the planning of these schemes.

Wider Impacts: the impacts beyond the zone of influence include the assessment of air pollution (from reservoirs, but with wider impacts) and changes to hydrology, assessed through the hydrological modeling. The assessment of these data includes assigning economic values where this is possible. In addition to the air pollution costs, this is principally for the improvements to dry season water availability in each river basin (not for each individual scheme) under each scenario. The value is computed by assuming all the additional water is used for irrigated paddy production (the minimum environmental flow is not problematic in any of the basins on the future water balance calculations). We have calculated the additional irrigated area on a smoothed annual average basis and, from that, the increased production and economic value of the production (based on 2007 yields and March 2008 export prices), with the results suggesting that the value of the increased production would be over $92 million a year.

Phase 5: Weighting and Trade-Off Analysis

The weighting and trade-off analysis was undertaken within the structure of a one-week SEA training programme provided for 20 participants from MoIT, MoNRE, IoE and EVN. This training provided an opportunity for the detailed consideration of all aspects of the SEA process and the weighting and trade-off analysis focused on the significance of the results of the impact analysis for the key strategic issues identified in the scoping exercise. The results of the weighting and trade-off analysis have been a key input into the identification of **recommendations** from the SEA, discussed below.

The analysis of the potential social and environmental impacts of hydropower in the PDP VI has demonstrated that the inclusion of full mitigation measures for both social and environmental impacts will not compromise the economic feasibility of the different hydropower schemes in the plan. There are a number of changes to the PDP planning process that need to be made to ensure that social and environmental impacts are fully integrated into the planning for the sector. There are also wider changes needed to the policy and regulatory system for hydropower planning to ensure that these issues are fully integrated into the planning and implementation of hydropower in Viet Nam. These changes are specified below as a series of recommendations that should be considered and worked through in detail by the Ministry of Industry and Trade and other relevant agencies in Viet Nam.

Overall Conclusions

The execution of the SEA in this study demonstrates the potential of SEA as a key part of the strategic planning framework for the hydropower sector. The SEA has provided a mechanism to assess and understand the full range of potential **risks** associated with hydropower for people and the environment, both within the immediate vicinity of dam construction and beyond. It also provides a mechanism for identifying and assessing the most effective **mitigation and compensation actions** already at the stage of overall power development planning, including actions to reduce risks and to fully compensate for negative impacts where they do occur. The SEA provides a framework for the **internalization** of the costs of social and environmental impacts and mitigation measures into the assessment of economic feasibility of hydropower schemes.

In addition, where conducted in a participatory manner, the SEA provides a framework for establishing a **consensus** among stakeholders on the most appropriate forms of social and environmental mitigation measures and the level of hydropower development that is most efficient and sustainable as part of the overall power sector planning system. The approach to SEA set out here is an important part of the consensus-building approach. It provides a means for ensuring objectivity and balance in the decision-making system.

Where an economic analysis is undertaken, the SEA also provides a basis for the internalization of costs and benefits that have traditionally been treated as externalities. This in turn provides a means for comparing the full range of risks and impacts that are very different in character. For example, through the economic analysis one can compare potential impacts on the culture and livelihoods of local communities with risks to biodiversity resources and with impacts on global atmospheric processes including greenhouse gas emissions. This in turn provides a basis for **objective decision-making** on the most desirable and sustainable levels of hydropower development.

When approached in this way, the full potential of SEA as part of strategic planning can be realised. This differentiates SEA from more traditional EIA and safeguard approaches to social and environmental issues, approaches that have often proved to be ineffective in catalyzing more sustainable patterns of development. The

introduction to SEA above emphasised that an SEA should be **decision-oriented, balanced and evidence-based**. The SEA presented in this report demonstrated that these three principles can be followed in relation to the hydropower sector.

The **evidence** and analysis presented in the SEA has not required the collection of significant amounts of new data: in almost all cases the analysis is based on readily available data from documentary sources in Viet Nam. This is essential if the SEA is to be replicable within the context of existing institutional capacities. There are a number of areas where the availability of better data would have improved the certainty of the conclusions that have been drawn in the analysis. Future SEAs should seek to enhance the quality of analysis through improving the evidence collection process, but this can be done in a gradual and incremental manner. The analysis in this report shows that effective conclusions can be arrived at within the confines of existing data availability. This significantly enhances the potential for the full institutionalization of SEA within strategic planning systems in Viet Nam.

The use of scenarios within the SEA has proved to be effective, providing an analytical tool that could compare the implications of different power generation source mixes for social and environmental sustainability. This is essential: the hydropower sector should not be considered in isolation, as any decision on hydropower development needs to consider alternatives to hydropower. The scenarios approach allows stakeholders to assess the full implications of decisions on the level of hydropower that should be developed.

The effectiveness of the SEA as a mechanism for strategic planning in the hydropower sector in Viet Nam, which is inherently complex and controversial, is demonstrated in this report. This suggests that the SEA approach is **transferable**, both to other sectors in Viet Nam and for analysis and planning for hydropower in other countries in the region. As such, as a **pilot**, this SEA has been extremely successful: it has shown that the approach works in a challenging context and can be applied elsewhere. Indeed, the MoIT has already stated their intention to apply the SEA approach to the planning of the power sector as a whole and to other sectors within the responsibility of their ministry. Other sectors in Viet Nam, including both water supply and sanitation and fisheries under MARD, have expressed their interest in learning from the experience of this SEA.

Key Strategic Issues

The scoping phase of the SEA identified a number of key strategic issues that have guided the analysis presented in this report. This section provides brief conclusions on the lessons learnt from the SEA in relation to each of the strategic issues.

The contribution of hydropower to **economic development** was the first strategic issue. The SEA demonstrates that the level of hydropower planned in PDP VI is essentially a desirable one in terms of the least cost means to ensure that Viet Nam's future power needs are met. This is true even where the full range of social and environmental costs are internalized into the economic analysis of hydropower, as the full costs of alternative generation sources that are deemed as being realistic within the current planning context are even higher. As such, the significance of hydropower in contributing to overall national development has been demonstrated.

The SEA also suggests that hydropower can contribute to development in another way if appropriate measures are taken: it can be a catalyst to the development of the economies of remote locations inhabited by poor and marginalized people. This is far from guaranteed and the planning of hydropower needs to include measures to take advantage of local development opportunities. Where this is the case, hydropower can provide significant benefits to local communities through improved access to external markets, new livelihood opportunities and better access to a range of services.

The **displacement of local communities** is a key and controversial issue for hydropower development. It is an inevitable consequence of hydropower in many localities. Past experiences

in mitigating the impact of displacement have not been adequate when compared to international good practice on resettlement. The SEA has demonstrated that this need not be the case: it is possible to provide a mitigation and development package that will provide a means to ensure that displaced people have long-term development support and ultimately become better off after they are resettled. This package entails additional costs, but these costs are not at a level that has impact on the economic viability of any of the planned schemes. The package also requires political will and more effective coordination with other development efforts, but this is achievable if and when the sector recognises its obligations to demonstrate social responsibility and the need to establish better relations with local government institutions and the communities in the areas where dams are built.

Water Resources are inevitably affected by hydropower development and many stakeholders expressed concerns that these effects are not taken into account in the planning and management of reservoirs. The present management regimes are in general single purpose: to maximise power generation. The analysis presented in the SEA demonstrates that, at a minimum, it is necessary to take into account the need to ensure minimum environmental flows if serious downstream impacts on ecosystems integrity are to be avoided. The analysis also demonstrated the potential benefits in terms of flood protection and improvements to dry season water availability that could be accrued if more effective multipurpose management regimes are adopted.

The impacts of hydropower on **ecosystems integrity** was identified by stakeholders as a key strategic issue. The SEA demonstrated that some levels of impact are inevitable across three areas: for forest resources, for aquatic resources and for biodiversity. In some cases the potential impacts are severe, and must ultimately be explicitly weighed into the decision-making processes at the policy level, in the master planning, and for each planned site. The risks of such impacts can, however, be significantly reduced through the adoption of effective anticipatory mitigation measures, with the cost of these measures internalized in the costs of hydropower development. Such measures require much closer links to other agencies responsible for forestry, fisheries, protected areas, etc.

The final strategic issue is the **hydropower planning system**, which was identified as needing change if social and environmental issues are to be more effectively taken into account in hydropower planning. This includes the need for more effective consultation and participation of other stakeholders including local communities. A model for achieving this through the integration of SEA into the power development planning system is outlined in the next section.

Summary of Overall Recommendations for PDP VII

The SEA Study has shown that hydropower development inevitably affects the people and environment of the areas in which schemes are constructed and that specific concerns about the environmental and social impacts are quite different for different energy sources. Effective planning for the future power system, including sustainable hydropower development needs to integrate a full understanding of these factors in the sector's decision-making process, as well as the positive and negative aspects on water resources from the construction and management of reservoirs for hydropower projects.

The analysis of the potential social and environmental impacts of hydropower in the PDP VI has demonstrated that the inclusion of more wide-ranging mitigation measures for both social and environmental impacts will not compromise the economic feasibility of the different hydropower schemes in the plan: in essence, developing hydropower in a sustainable manner and up to the highest international standards is both achievable and affordable for contemporary Viet Nam.

There are a number of changes to the PDP planning process that need to be made to ensure that social and environmental impacts are fully integrated into the planning for the sector. There

are also wider changes needed to the policy and regulatory system for hydropower planning to ensure that these issues are fully integrated into the planning and implementation of hydropower in Viet Nam. These changes are specified in this section as a series of recommendations that should be considered and worked through in detail by the Ministry of Industry and Trade and other relevant agencies in Viet Nam.

The recommendations fall into three main categories: (i) recommendations that are concerned with the institutionalisation of SEA as part of the strategic planning process for the power sector; (ii) recommendations that define actions that are necessary if Viet Nam is to more adequately accord with international best practice for sustainable hydropower development; and (iii) other recommendations concerning the larger power sector development context. Actions in all three areas are needed. The present practice of planning in the sector has many strengths, but does not adequately take account of social and environmental factors, for instance in decisions on the cost and design of hydropower schemes.

The result is a combination of missed opportunities and substandard practices with regard to protecting the environment and ensuring that the needs and interests of local communities are adequately protected. The SEA has identified a range of costs that are at present not included in the calculation of the costs and benefits of hydropower schemes (the costs are "externalized"). The same is true for the rest of the PDP: for example, in relation to the costs and impacts of air pollution and greenhouse gas emissions from thermal power plants. These costs need to be included ("internalized") in the assessment of the economic feasibility of and allocation of budgets for all aspects of power development as well as, ultimately, included in the price of electricity.

Recommendations on the Power Development Planning System

Power Development Planning: the PDP process should be adjusted so as to ensure that a SEA is an integral part of the planning system and the MoIT should adjust relevant decisions and guidelines for the Power Development Plan to ensure that this is a mandatory requirement for the agency assigned with the task of detailed plan preparation. A proposal for how this could be achieved is set out in figures below. The resources allocated to plan preparation should likewise be adjusted to take account of the additional tasks that integrating a SEA into the planning process entails. The SEA process should be extended to include the whole power sector and not just hydropower. This should include a detailed assessment of clean production technologies for thermal power investment. The figure below illustrates the suggested integration of a SEA mechanism, as outlined in this Study, into the present power development planning of the PDP.

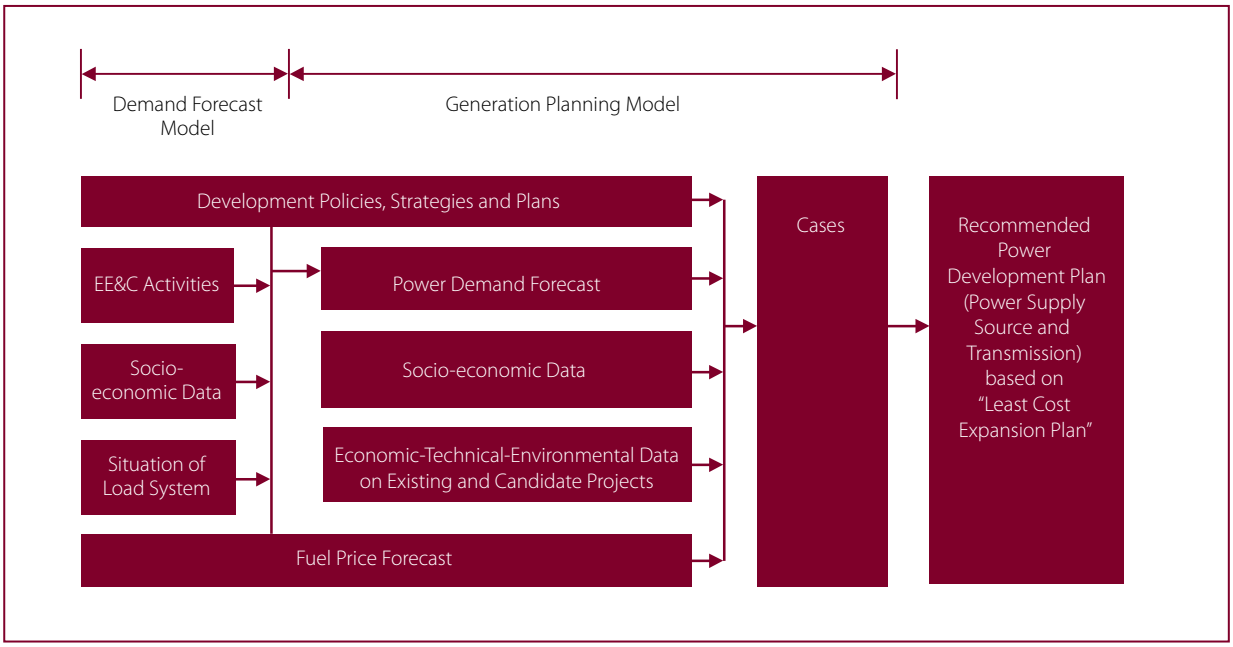
These recommended changes build on the existing PDP system, but reflect the findings of this study and are in accordance with the key principles and guidelines identified by the World Commission on Dams,[3] which include the assessment of all development options, ensuring public acceptance, sustaining rivers and livelihoods, recognizing entitlements and sharing benefits and the strategic assessment of environmental, social, health and cultural issues based on multi-criteria analysis and the valuation of all costs and benefits.

The sequence of **Figures 6–8** below sets out the sequence through which SEA can be fully integrated into the PDP process. **Figure 6** shows the present procedures in the PDP from collection of basic data at national and project levels to the recommended power development plan. **Figure 7** shows the process undertaken in the

[3] World Commission on Dams (2000) *Dams and Development*, Earthscan, London, chapters 8 & 9.

present study to include SEA into the PDP VI analysis, reflecting the fact that PDP VI was already completed and so the SEA analysis took place within the limitations of an existing and complete structure. **Figure 8** has been prepared based on the experience of undertaking the current study and represents recommendations for the changes to the PDP planning process. The relevant steps undertaken in each option are outlined after each figure.

Figure 6: Current PDP Process

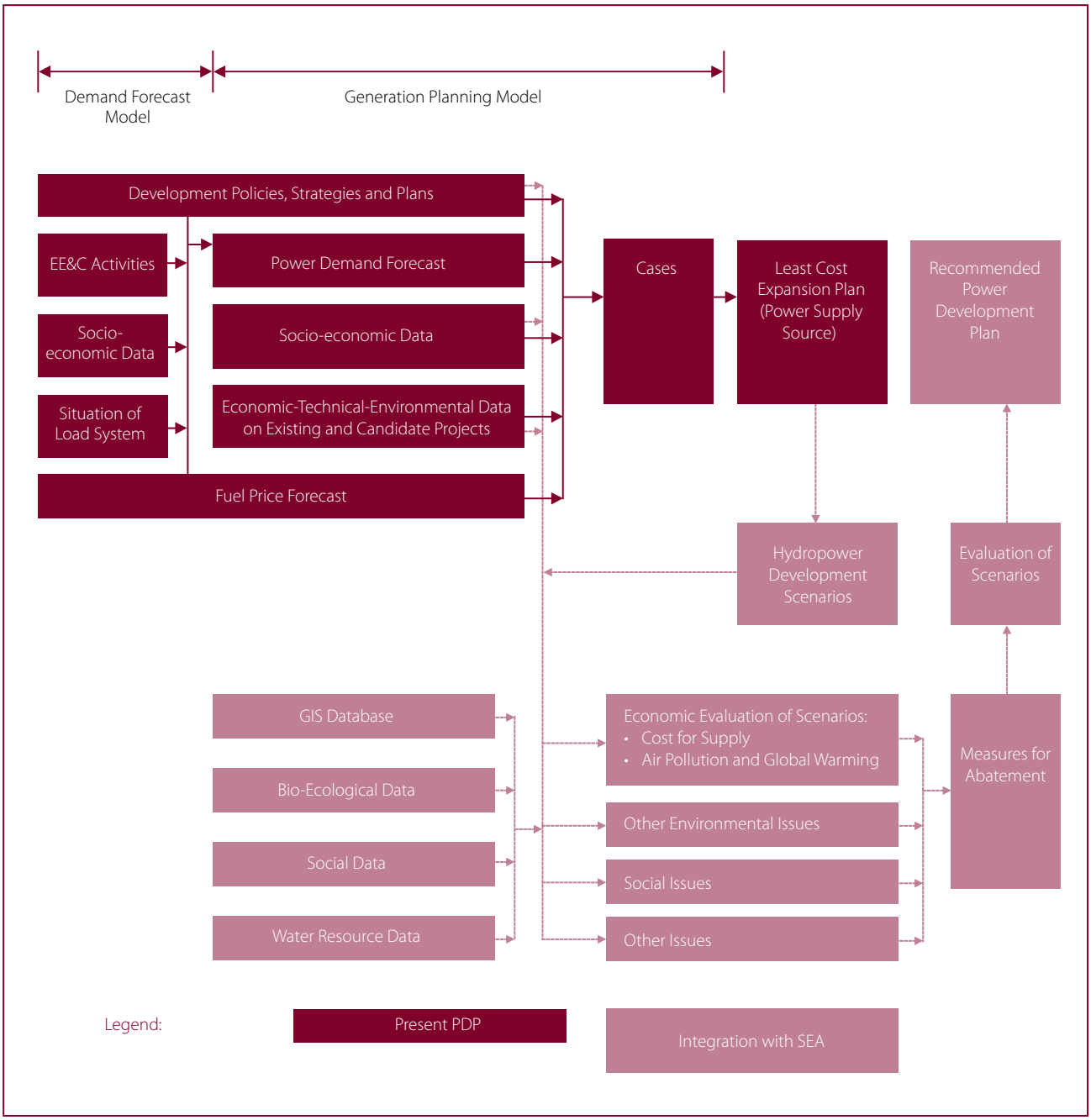


Main blocks: (1) Demand Forecast, (2) Generation Planning and (3) Transmission Planning (500kV and 220kV)

Alternative Cases: fuel price, 500kV interconnection, limitation on gas and coal supply

Power Demand: high, base and low

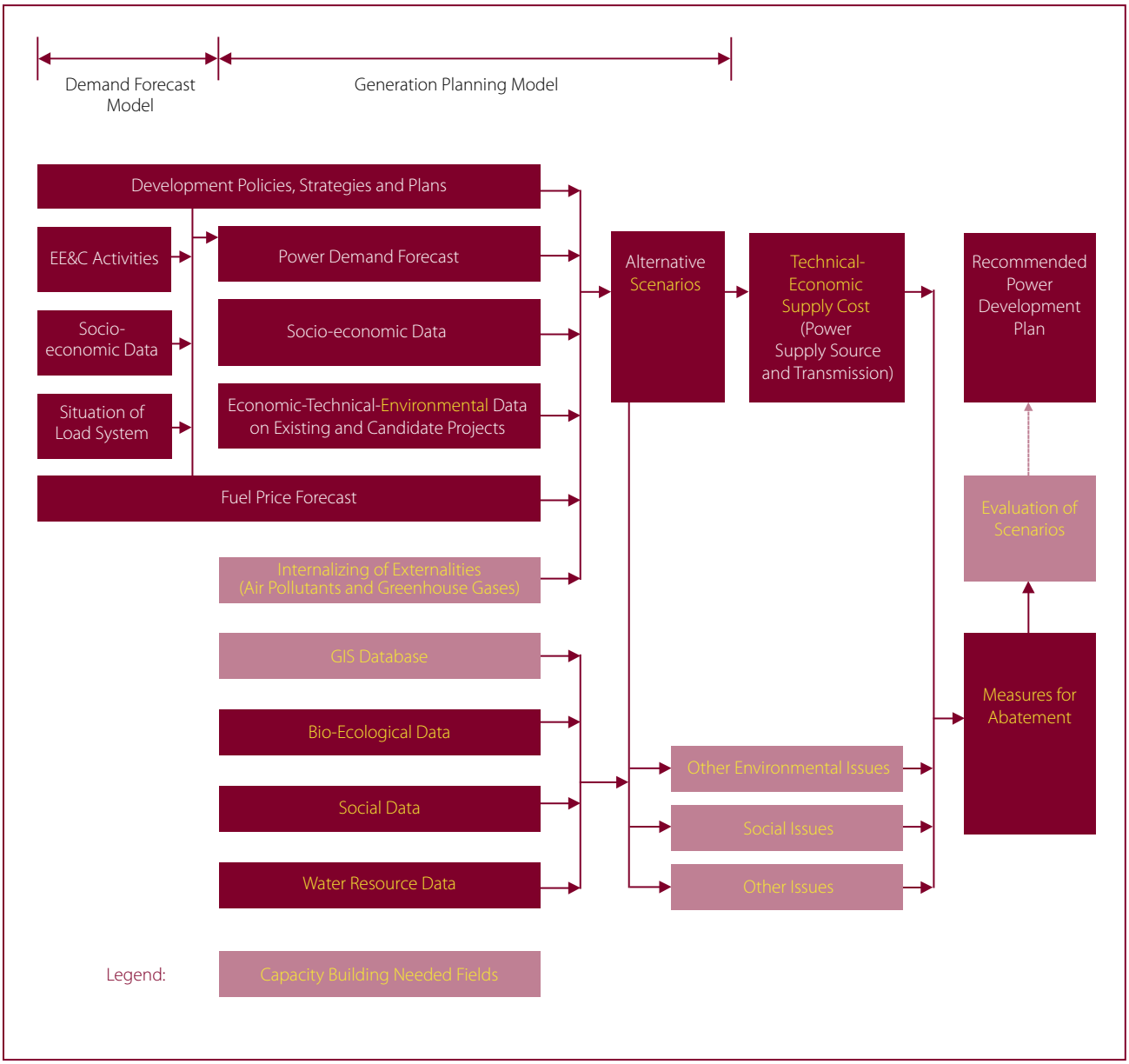
Figure 7: Integrating SEA Into the Current PDP in the Pilot Study



Main steps:

(1) Building five different scenarios for hydropower development based on the least-cost plan from PDP6 and the ranking study on NHP
(2) Proposing methods for valuation of supply cost, environmental, social and other aspects
(3) Valuing all mentioned above aspects for the five scenarios based on huge amounts of data on different aspect of hydropower development and impacts
(4) Recommending measures for mitigating impacts
(5) Weighting evaluation of scenarios

Figure 8: Suggested Integration of SEA into PDP VII



Main steps:

(1) Assessing environmental damage costs for air pollutants and greenhouse gases
(2) Internalizing these external costs into generation planning model
(3) Developing different alternative scenarios on power supply source (not only hydropower but also other sources such as coal, gas, nuclear, renewable etc…)
(4) Obtaining least-cost plans (total cost and generation mix) for each scenario taking into account both supply and environmental costs
(5) Valuing other environmental, social and other issues
(6) Recommending measures for mitigating impacts
(7) Weighting evaluation of scenarios
(8) Recommending a power development plan

There are a number of barriers for the implementation of the full integration of SEA into PDP, such as:

(1) Is assessing environmental damage costs possible for Viet Nam? (Using international data adapted for Viet Nam's circumstances)
(2) How can the modeler include external cost in generation technologies? (some generation planning models do not allow the modeler to apply environmental tax. The simplest way is including external costs in variable cost of both fossil fuel and renewable technologies)
(3) GIS database is required for valuation of all aspects. (GIS technology transfer)
(4) Valuation of impacts of transmission network. (A pilot study or capacity building needed)

Capacity building: in the above figures 6-8, capacity development needs are easily identified:

(1) Assessment of environmental damage cost
(2) Development of scenarios
(3) Methods for valuation of environmental, social, water resource and other issues
(4) GIS database
(5) Evaluation of scenarios

For the above suggested integration of the SEA into the planning process of the PDP, the Ministry of Industry's Decision No. 42/2005/QD-BCN needs to be changed to introduce the concept of SEA and give detailed regulations on the methodology and criteria to be adopted in respect of the following:

- Methodology to be used for defining alternative energy scenarios.
- Methodology and criteria to be used for defining and valuing environmental issues.
- Methodology and criteria to be used for defining and valuing social issues.
- Methodology and criteria to be used for defining and valuing other issues.
- Methodology and criteria to be used for defining and valuing the economic costs of air pollutants and greenhouse gases.
- Methodology and criteria for weighing all aspects above in the evaluation of the Alternative Energy Scenarios.
- Criteria for selection of "least cost" scenario.

Not only legal changes are required as mentioned above, but also institutional changes are necessary for the successful integration of the SEA into the present planning process of the PDP such as the following:

- Changes in the organizational structure of the organization performing the PDP (Institute of Energy) including recruitment of additional expertise, such as for environmental and social aspects, GIS, etc.
- Establishment of inter-agency working groups that provide expertise and technical input to the SEA as well as oversee its overall implementation.
- Capacity building in the fields of SEA in general, scenario development and analysis, methods for valuation of environmental and social aspects including air pollutants and greenhouse gases from thermal power plants, definition of zone of influence for power projects, inclusion of water resources aspects, etc. The capacity building needs specifically include the MoIT's Department of Science and Technology and Environment, who are responsible for formulating PDP ToRs, for reviewing the PDP and for reviewing SEAs and EISs prepared during investment design.

Further development of policy-oriented SEA in power sector development: the current SEA has been a pilot to test the effectiveness of the tool when applied to a national-level strategic plan. It has shown that SEA can be an effective and cost-efficient means to enhance the planning such as the PDP by taking account of social and environmental issues in a policy-oriented way. It has also shown that such policy-oriented SEAs are very different in character to a number of SEAs that have been undertaken in Viet Nam to date.

In particular, the approach of preparing scenarios and undertaking a risk and mitigation assessment, based where possible on economic valuation, have proved to be valuable, as well as the significance given to empirical evidence to support the assessment. It has also been valuable

to maintain a relatively broad sustainable development focus as opposed to only looking at environmental impacts. It is recommended that a full consideration of the adaptation of existing SEA guidelines be undertaken to ensure that they provide for this type of policy-oriented SEA process.

Stakeholder consultation: the PDP process should also be adjusted to require wider stakeholder consultation as an integral part of the system. This should in particular ensure that the full understanding of potential impacts is taken into account in the planning and that the needs and interests of potentially affected people are included in the delineation of mitigation measures. It is also essential that the process of PDP development is more effectively integrated with wider administrative reforms such as decentralisation and full participation of affected stakeholders at grass-root level.

Provincial authorities are at present not involved in the PDP process in anything other than a marginal manner. It is essential that their more effective participation is included in the future. This is especially true for provinces that are in river basins where several hydropower schemes are planned, as these schemes will have much wider effects on the future sustainability and development of these areas, including their influence on water resources, agriculture and large numbers of local communities in and around dam sites.

SEA capacity development: including a SEA as an integral part of the PDP planning process will significantly enhance the quality of sector planning, but this will require capacity development in the agencies involved if it is to be fully effective. This is particularly true with relation to both professional capabilities in areas such as social and environmental analysis and in investments to collect and process the wider range of data and data management tools (for example, GIS) needed to undertake an effective SEA.

Internalization of external costs of power technologies in PDP optimization modeling: the differences in externalities between different technologies suggest that the optimization represents optimum only for the electricity-producing sector. For Viet Nam as a whole, the optimal generation mix will be different. Integrating external costs into the optimization runs will lead closer to a social optimum.

Recommendations on Policy and Regulatory Changes

It was noted that a number of changes are needed to the policies and regulations that affect hydropower development if it is to be brought in line with international best practice and if it is to be both sustainable and beneficial to the areas in which construction takes place as well as the country as a whole. These changes will entail the introduction of new guidelines and regulations that will involve some direct costs, but these are an integral and indivisible part of the full cost of hydropower development that need to be integrated into the overall assessment of economic feasibility. When compared to both the benefits they will generate and the overall scale of hydropower investments, these costs are minor and generate high and important returns in terms of local economic development and socially responsible infrastructure investments. The principle areas where changes are needed are:

Water resources management: the SEA has demonstrated the potential benefits of the adoption of multipurpose water resources management within the power sector. This includes both the design stage, where hydropower schemes should consider their impacts on the whole river basin and assess the costs and benefits of design modification to include purposes beyond power generation. It also includes the key issue of reservoir management (including of existing schemes) to take account of the full potentials of multipurpose management. The criteria for this should reflect national water management policies and priorities and should specifically include the assessment of water release regimes necessary to guarantee minimum environmental flows in order to ensure the maintenance of the integrity of downstream ecosystems.

Although general regulations on the need for this exist, they are not specific enough to provide clear guidance for reservoir managers on the most appropriate regimes. The basis for achieving this is the full participation of the hydropower sector in the emerging river basin management systems of Viet Nam. It is recommended that a more detailed and thorough assessment of the costs and benefits of multipurpose management should be undertaken (including distributive effects) and that new reservoir management regulations should be issued for both existing and future reservoirs to reflect the benefits of multi-purpose management within an integrated water resources management context and based on cumulative river basin effects where multiple reservoirs exist.

Mitigating social impacts: the SEA demonstrates that hydropower development has a wide range of potential impacts on local communities, both in relation to displaced persons and with regard to the impacts on communities in the zones of influence. There are several components to the recommendations on the mitigation of social impacts:

- A mitigation package for displaced persons
- Mitigation support for "host" communities in localities where resettlement takes place
- Support to agricultural development
- Mitigating risks of reduced access to forest resources
- Mitigating risks or reduced access to resources from aquatic ecosystems

Taken together, these different dimensions of the social mitigation measures identified in the SEA go significantly beyond traditional "safeguard" approaches, which are limited to identifying and compensating for measuring direct impacts only. The different components of the package provide a comprehensive approach to ensuring that hydropower can be a positive force for development and poverty reduction in the localities where schemes are constructed.

Displaced persons: a detailed social mitigation package for communities that are displaced by hydropower development has been identified in the full SEA report, based on the "Impoverishment, Risk and Reconstruction" model[4], which represents an established model of international best practice for resettlement of project affected communities. This package includes measures to ensure long-term support to livelihoods development and poverty reduction amongst affected communities. The costs of the mitigation package should be fully internalised into the calculation of the economic costs of each hydropower scheme. The costs of the expanded package do not affect the economic feasibility of any of the schemes and are estimated to be only 23% above the cost of existing compensation measures as calculated in the NHP study. They should be accepted as part of the costs of sustainable and socially responsible hydropower development. The MoIT should issue regulations that specify the compensation package as a mandatory requirement for all future hydropower development, including hydropower schemes that are planned and developed at provincial levels and by private sector investors.

Resettlement "host" populations: the risk of negative impacts on the host populations where resettlement takes place are significant but are impossible to predict until the specific resettlement sites are identified. Nonetheless, mitigation measures can be identified. The approach recommended is to ensure that the host populations are provided with the same development possibilities as the resettled households, with in particular investments provided to ensure that they have equal access to basic services and livelihood development opportunities. The planning of resettlement and development activities should be jointly undertaken by the resettled and host communities, providing a means to build mutual understanding and shared development objectives and ensuring that the potential resentment of host populations to the resettled communities is reduced.

Mitigating negative forest resource impacts: the SEA has identified the risk of negative impacts

[4] Cernea, M. (2000) Impoverishment, *Risk and Reconstruction: A Model for Population Displacement and Resettlement* in Cernea, M. & McDowell, C. (eds 2000) *Risk and Reconstruction: Experiences of Resettlers and Refugees* World Bank, Washington D.C.

on forest resources in the areas affected by the planned schemes. The valuation of these resources estimated their total value as being over $7 billion, so even a relatively minor negative impact can have a high value. These risks reflect increased pressures on forest resources due to a combination of increased population and the possible reduction of forest area and quality. These impacts may be significant in some places, but can be mitigated by proactive measures to ensure the future availability of the resources in question.

For forest resources, this can be achieved through the introduction of a community forestry programme in areas where there is a risk of increased stress on forest resources; that is, in zones of influence where there is a high dependency on forests as part of local livelihood patterns and where the density of population is such that potential declines in forest area and/or quality could result in unsustainable pressures. The costs of the community forestry, which should follow the guidelines and costs of the national community forestry programme, should be internalised in the calculations of the hydropower development costs. Community forestry is organised at a village level, with standardised unit costs per village of approximately $45,000 per village group. It is estimated that the likely total cost of the introduction of community forestry would be minor compared to the resource value of forest areas under risk from hydropower development and that economic rates of return in the order of 10:1 or more could be expected.

Mitigating negative impacts on aquatic resources: the National Hydropower Plan (NHP) identifies the lengths of upstream and downstream rivers that are likely to be severely affected by the individual hydropower schemes. The impact on the availability of aquatic resources is likely to be severe in most cases. It is estimated that over 100,000 people live within one kilometre of these lengths of affected rivers and rely on these resources to a greater or lesser extent. These can be mitigated by the introduction of measures such as aquaculture development, the introduction of hatcheries to reintroduce productive fish species and the development of alternative livelihood options. The provision of these investments should be an integral part of the planning of each scheme and the costs of such measures (which in most cases will not be particularly expensive) internalised in the cost calculations of the different schemes.

Identifying and mitigating biodiversity impacts: the assessment of potential biodiversity impacts of the hydropower schemes analyzed in detail in the SEA found that there are a number of schemes where potential risks to biodiversity are of particular concern. This is a combination of fragmentation risks, where a high proportion of key biodiversity areas lie within a zone of influence, and inherent biodiversity value as represented by the presence of endangered or indigenous species. These concerns are compounded where there are several schemes within a river basin. Where risks to biodiversity are high it is recommended that the planning process for the hydropower scheme include the detailed assessment of likely impacts and a biodiversity action plan, including necessary funding, to ensure that adequate protection measures are introduced and implemented.

A key part of this will be the establishment of protected areas in localities where threatened key habitats do not have a protected status. The mitigation measures should also include exploring the costs and technical feasibility of transferring key endangered species to new habitats. It is also recommended that an education and awareness programme on the importance and value of biodiversity resources is developed for implementation both in the sites where schemes are constructed and for wider stakeholders involved in the sector. As with other areas of mitigation, the costs of biodiversity protection measures should be internalised to the calculation of the economic costs of individual hydropower schemes.

Benefit sharing mechanisms: the contribution of hydropower development to the long-term development of communities in the vicinity of dam development is a key means for ensuring that hydropower has positive impacts for local communities. The financing of such development actions (such as infrastructure development, community forestry, improved agriculture and enterprise development activities) should come

from a benefit sharing mechanism whereby a percentage of revenues from electricity generation is provided for local development activities. A successful piloting of such a mechanism under an ADB-funded project in relation to the A'Vuong hydropower scheme in central Viet Nam demonstrates the viability of such an approach and it is recommended that this mechanism be adopted for all future hydropower development.

Policy Recommendations Concerning General Power Development

Internalization of external costs of power technologies in energy pricing: all power generation technologies, but in particular coal-based thermal power, brings with them serious environmental externalities. These external costs are paid by society and need to be taken into account in the pricing of electricity from different sources, for instance by leveling a tax or fee on the production or consumption of electricity. We recommend appointing an investigation to develop recommendations for internalization of the external costs at the national level.

Grid interconnections: the very ambitious power development schemes implemented in Viet Nam to keep up with economic demand brings with it important social and environmental costs. Viet Nam is a densely populated country and conflicts and issues over land and impacts will always be prominent. In general, the potential generation capacity in Laos brings with it less environmental and social impact per kWh, because fewer people are (on average) affected. Therefore, it makes economic, social and environmental sense to pursue with vigour grid interconnections with Laos.

Institutional harmonization to prepare for regional power trade: further integration between countries in the GMS, will eventually enable capacity planning and balancing of a much larger system, which as the recently published GMS energy strategy brings with it significant efficiency gains. This gives the opportunity for lower prices and lower environmental impacts since expensive and dirty marginal thermal power can be reduced.

Pursue CDM funding for replacement of thermal with biomass and wind power: the Clean Development Mechanism has so far not been integral to the PDP discussions. Integrating these types of funding opportunities will provide an opportunity to replace the fossil power sources, providing great environmental benefits at very little cost to Viet Nam.

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The Greater Mekong Subregion (GMS) Core Environment Program and its flagship Biodiversity Conservation Corridors Initiative (BCI) is a subregional program facilitated by the Asian Development Bank. It aims at mainstreaming environmental considerations into the GMS Economic Cooperation Program. The program is implemented by the Environment Operations Center in partnership with GMS governments, local communities, university networks, development partners and non-governmental organizations.