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Policies and Measures to Mitigate the Potential Environmental Impacts of Cross-Border Infrastructure Projects in Asia

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Abstract

While bringing positive impacts and benefits, cross-border infrastructure projects face additional challenges relative to national projects. Moreover, such projects involve a variety of technical, regulatory, institutional, and legal factors, and their obstacles constrain the development of cross-border infrastructure projects. This paper argues that proper technical specifications and well-functioning regulatory, institutional and legislative/legal frameworks with clearer lines of oversight are crucial to getting such projects off the ground in the first place and to ensure that they operate properly and reliably while minimizing their environmental impacts. It is pointed out that many issues in theses areas need to be addressed at the national level. The paper concludes that such domestic efforts, coupled with regional frameworks and arrangements wherever necessary, will promote the further development of cross-border infrastructure projects.

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1. INTRODUCTION

Cross-border infrastructure investment projects can bring many positive impacts, primarily by supporting the integration of national economies, creating economies of scale, and promoting trade, economic growth, and poverty reduction. These kinds of impacts can be significant for land-locked, low-trade, and resource-poor countries. However, cross-border infrastructure projects also hold the potential to negatively impact affected parties, for example, by displacing communities inhabiting proposed investment sites and causing environmental degradation. Cross-border routes, in particular those that open up remote areas, can also become conduits for communicable diseases and the trafficking of people and drugs.

This study will limit its consideration of infrastructure projects to those that lie within two main economic sectors, namely, energy (power and natural gas) and transport. Cross-border energy infrastructure projects are essentially cost-reducing investments which aim to secure energy supplies at a lower cost than domestic alternatives. Cross-border transport infrastructure projects have the potential to be both cost-reducing and trade-creating because they help to both cut transport costs and enlarge markets beyond national boundaries.

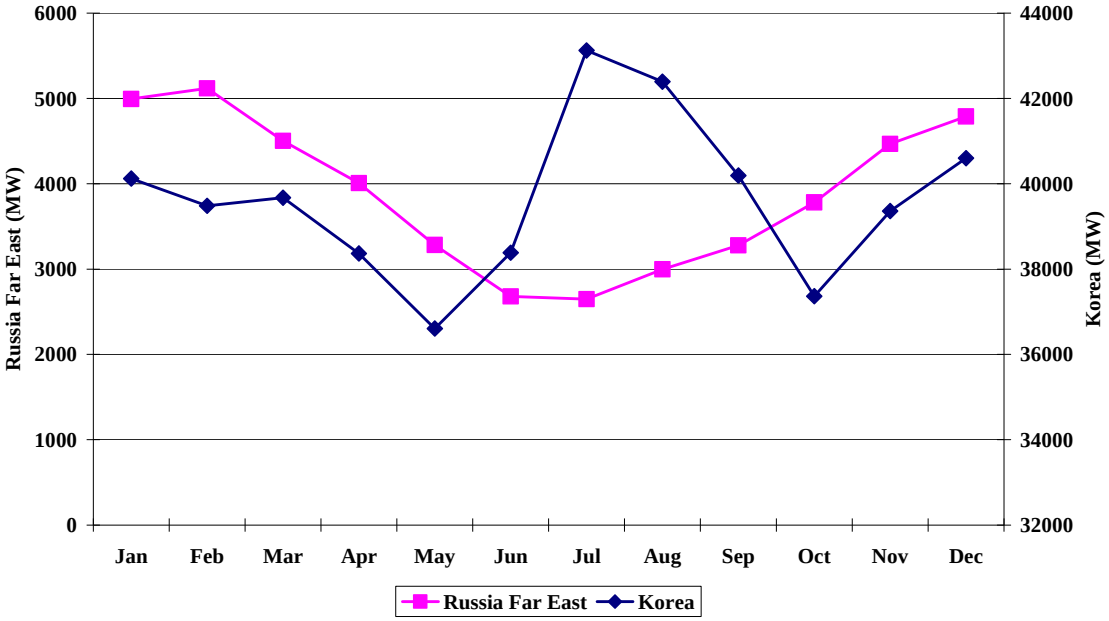
Energy infrastructure projects, in particular the Nam Theun 2 Hydroelectric Power Project and the Association of Southeast Asian Nations (ASEAN) and Northeast Asia (NEA) Power Grid interconnection projects, cut the costs of delivering power by:

- exploiting the low-cost hydroelectric power potential of the Lao People's Democratic Republic (Lao PDR) and the Yunnan Province in the People's Republic of China (PRC), as well as the low-cost power potential of the Russian Far East;
- reducing overall additions to generating capacity by expanding access and minimizing reserve capacity needs for peak demand periods;
- optimizing economies of scale for both power stations and energy networks; and
- taking advantage of dispatching the generation plants of lowest marginal cost as a result of expanded access.

Figure 1 shows the seasonal differences in maximum electricity loads in the Russian Far East and the Republic of Korea (hereafter Korea). Even though the NEA countries are all situated in the northern hemisphere, there are notable differences in climate. As a result, electricity demand peaks during the summer in Korea, whereas in winter there is an excess of power generating capacity. By contrast, the Russian Far East has a demand peak during the winter and faces an excess of power-generating capacity during the summer. Clearly, interconnecting power grids between the Russian Far East and Korea would bring about substantial benefits by enabling them to share their mutually complementary seasonal excess capacities. In other words, mutual benefits can be realized by importing electricity produced by inexpensive foreign generators during peak demand times and exporting when demand is at a low. Podkovalnikov (2002) has estimated that the proposed Russian Far East—Korean interconnection would reduce the demand for generating capacity through 2020 by 8 gigawatts (GWs), or one quarter of the new capacities to be commissioned if power systems continue to be separately operated. As a result, while the interconnection itself is expected to cost around US$2 billion, it would reduce expenditures on new generating capacity by about US$14.3 billion, leading to an overall capital cost saving of about US$12.3 billion. Annualizing this capital cost saving at a discount rate of 8% and adding in operating savings leads to estimated total cost savings from the proposed interconnection of around US$2 billion per year.

Figure 1: Seasonal Difference in Load Curves in the Russian Far East and Korea

(Megawatts [MW])



Source: Yun and Zhang (2006)

The Trans-ASEAN Gas Pipeline (TAGP) was proposed in the ASEAN Vision 2020 as a means of linking natural gas production centers with markets in neighboring countries (Association of Southeast Asian Nations [ASEAN] 1997). The TAGP proposal recognizes natural gas's superior qualities as a fuel source and is designed to catalyze cross-border linkages to connect national gas grids and cut energy costs by:

- providing a cheaper, cleaner, and more efficient alternative to traditionally used diesel-fired plants;
- encouraging price competition among suppliers; and
- promoting the potential development of stranded gas fields whose small sizes do not currently justify production.

Cross-border energy projects like the TAGP or the Nam Theun 2 not only cut the cost of energy supplies, they also provide local and global environmental benefits by reducing local pollutants and greenhouse gas (GHG) emissions through the use of hydropower and/or natural gas in place of coal and/or oil. Cross-border transport (highway) projects cut vehicle operating costs and improve traffic safety, while increasing the passage of goods across borders. In addition to these measurable economic and environmental benefits, intangible benefits such as the strengthening of energy security and the promotion of regional economic cooperation with neighboring countries may well be generated from cross-border energy and transport projects. When a cross-border project has components in several countries, and when each component is viable in its own right, the project's overall viability will only be increased when regional benefits are taken into account.

Despite their great positive potential, cross-border projects pose additional challenges as compared to national projects. For example, technological problems could arise due to differences in the standard and quality of power across countries, or the existence of differing frequencies and voltages. There can also be increased concern about the reliability of interconnected power grids, especially as their malfunctioning may lead to costly and hazardous blackouts. Moreover, because a cross-border project has components in more than one country, the issue of the sustainability of each country's component(s) over time

can be of great concern. For example, with regard to a cross-border highway project, it may be the case that one country's infrastructure degrades much more rapidly than its partner's due to less strict adherence to load limits and inadequate levels of expenditure for road maintenance.

Cross-border projects, in particular energy projects, often turn out to be large scale and highly capital intensive. The likelihood of a, say, cross-border energy project going ahead will depend on such determining factors as:

- the cost difference between the proposed new power supply and other energy alternatives;
- progress in regional transmission systems and power and gas grids;
- the development of competing power plans in other neighboring countries;
- arrangements for access and use; and
- the legal framework for investments, etc.

The range of considerations listed above illustrate that cross-border infrastructure projects involve a variety of technical, regulatory, institutional, and legal factors. Getting these factors right at the national level and/or, wherever necessary, at the regional level is crucial to getting such projects off the ground, in the first instance, and then to ensuring that projects operate properly and reliably while managing and minimizing their environmental impacts.

The next section of this paper will focus on identifying the potentially negative environmental impacts of cross-border infrastructure projects in Asia, looking predominantly at the energy sector but also at the transport sector. These impacts will be identified at the project level and, wherever necessary, beyond the project level. Section 3 then looks at how the adverse impacts identified in Section 2 can be reduced to a minimum or acceptable level, during the project's planning, design, and construction stages. Given the fact that cross-border projects face specific additional challenges relative to national projects, and given that technical, regulatory, institutional, and legal obstacles can constrain the development of cross-border infrastructure projects, the paper argues that proper technical specifications and well-functioning regulatory, institutional, and legislative/legal frameworks with clear lines of responsibility for oversight institutions are crucial to the development of cross-border infrastructure projects. It will be seen that many issues in these areas need to be addressed at the national level. Such domestic efforts, coupled with regional frameworks and arrangements, wherever necessary, will promote the further development of cross-border infrastructure projects. Finally, the paper calls for a strengthened role for multilateral development banks, like the Asian Development Bank, in supporting positive environmental outcomes in cross-border infrastructure projects.

2. ANTICIPATED ENVIRONMENTAL IMPACTS DURING PROJECT PREPARATION

The construction of any project will directly impact the surrounding environment, as well as have potential climatic impacts. Furthermore, some of the environmental impacts will only become known after a project becomes operational. Project managers, therefore, need to anticipate the project's environmental impacts in the preparatory stage, as well as be ready to respond to environmental effects during the project's operation. Depending on its scale, type, and location, a cross-border infrastructure project can have environmental impacts that extend beyond the project level and into the national, subregional, or even global level. This section will look at four cross-border infrastructure projects that have been proposed for or undertaken in Asia—three energy-based and one transport-based—and discuss both project-level impacts and anticipated impacts beyond the project level, based on the current available information.

2.1 Environmental Impacts at the Project Level

The type and extent of a project's potential environmental impacts are highly context-specific and depend on factors such as topography, land use, vegetation cover, and settlement patterns.

2.1.1 The Nam Theun 2 Hydroelectric Project in the Lao People's Democratic Republic (Lao PDR)

The Nam Theun 2 Hydroelectric Project in the Lao PDR will dam the Nam Theun River, creating a reservoir and generating power. The key environmental impacts from this project will be upon the physical and biological environments and will affect hydrology, water quality, erosion rates, climate, groundwater, aquatic and terrestrial habitats, species diversity, protected areas, and local endangered species. Hydrology impacts include the impoundment of the Nam Theun River, the diversion of water, and changes in river flow. Water quality impacts include low dissolved oxygen concentrations, increased nutrient concentrations in the initial years, wastewater discharges from construction sites and work camps, and sedimentation from construction sites. Erosion and sedimentation impacts include changes in sedimentation both in the reservoir and downstream, and changes in riverbank erosion. Impacts on aquatic species include alteration of habitats and the associated disfavoring of certain species, imposed barriers to migration, alterations in species composition and productivity of the river, and damage due to sedimentation. Terrestrial biodiversity impacts include effects on land and vegetation, including loss of land to the reservoir and increased human access to area including habitation. Other impacts include the generation of minor micro-climatic changes on the plateau and effects on endangered species. Mitigation measures for these various impacts have been formulated (Norplan 2004).

The Nam Theun 2 Project also involves the construction and operation of a 138 kilometer (km) long, 500 kilovolt (kV) double circuit transmission line to transmit power from the Lao PDR to Thailand. The primary impacts associated with this component of the project are land use change and vegetation loss. The transmission line will require a 60 meter (m) wide right of way (ROW) along its 165 km length, amounting to 9.7 square kilometers ($km^{2)}$ of land. Further, the construction of around 300 transmission line towers will require the permanent acquisition of 12 hectares (ha) of the ROW land (Asian Development Bank [ADB] 2004). While only the land under towers is permanently acquired, land use restrictions will be placed on all land within the ROW. Vegetation will be restricted to a 3 m height, while no structure over 3 m in height will be permitted to be constructed within the easement. This will reduce the agricultural capacity of the land in rural areas by prohibiting the cultivation of most trees in the ROW, and restrict construction possibilities on urban or industrial lands. Restrictions to tree height will also be applied immediately outside the ROW.

2.1.2 Transmission Line Project from Tai Ninh, Viet Nam to Kampong Cham, Cambodia

The proposed 115 kV transmission lines from the Viet Nam border to Kampong Cham, Cambodia will have similar effects on land use and vegetation as those outlined for the Nam Theun 2 project, although to a lesser extent as only 1.74 ha of land needs to be acquired to construct the transmission line towers and poles and three substations (Korea Electric Power Corporation 2007).

2.1.3 Phnom Penh to Ho Chi Minh City Highway Project

This highway project connects Phnom Penh and Ho Chi Minh City and is part of a longer corridor between Bangkok, Thailand, and the southern Vietnamese port city of Vung Tau. The 240 km road, with 160 km in Cambodia and 80 km in Viet Nam, was reconstructed to meet the expected increase in traffic flows as trade between the two countries increases. As

the first road project under its Greater Mekong Subregion[1](GMS) initiative, ADB provided US$40 million for the Cambodian portion (ADB Loan No. 1659-CAM) and US$100 million for the Viet Nam section (ADB Loan No. 1660-VIE) (ADB 1998). The project involved the rehabilitation of an existing road and the project road aligns with the pre-existing road for most of its length, with minor realignments made at some locations to improve safety and to minimize the need for land acquisition and resettlement. In Cambodia, one section was realigned to bypass a built-up area and the statutory ROW was reduced from the 18 m from the road centerline identified at the project appraisal stage to 10–15 m, resulting in a reduction in the number of project-affected households from 1184 to 1086 (ADB 2007b). There were no environmentally sensitive areas along the length of the project road. The initial environmental assessments undertaken concluded that the potential environmental impacts during the construction and operation of the project would be minor (ADB 1998; ADB 2007b). Although no specific level of reduction in vehicle operating costs was set, it has been conservatively estimated that the upgraded road has reduced operating costs by 10% for passenger cars and by 15% for trucks and buses (ADB 2007b).

2.2 Environmental Impacts Beyond the Immediate Project Study Area

A project can have impacts beyond its immediate project study area, but these impacts can only be revealed if the scope of study is extended accordingly. Therefore, a cumulative impact assessment (CIA) needs to be undertaken to study the combined impacts of the project under study and other development projects, whether they are to be implemented together or sequentially. This is a unique aspect of the environmental impact assessment (EIA) of cross-border infrastructure projects. The CIA studies:

added impacts—the impacts that other (concurrent or future) development projects have on the type and magnitude of the proposed project; and

induced impacts—the impacts of developments in other sectors that have been induced by the proposed project.

2.2.1 The Nam Theun 2 Hydroelectric Project in the Lao PDR

A CIA was undertaken in relation to the Nam Theun 2 Hydroelectric Project to analyze the combined impacts of a raft of projects, both concurrent and sequential, and of future developments and plans. The geographic coverage of the CIA included the Mekong River Basin; the Nam Theun/Nam Kading, Xe Bang Fai, and Hinboun basins; and the linear development zone of transmission lines and roads. In addition, border areas were assessed in terms of social development, transport, and biodiversity. Two development scenarios were assessed, based on five-year and twenty-year planning horizons. These scenarios covered several sectors and examined the present situation, existing plans, and development trends. The elements covered were: hydropower, transport, irrigation, water supply and sanitation, urban development, fisheries, forestry, industry, social development (including ethnic minorities, health, education, and social inequality), and conservation (biodiversity issues). Of all these elements, hydropower is the most planned and has the greatest potential to affect the whole Mekong Basin in terms of active (seasonal) storage of water. This will result in increased dry-season and decreased wet-season flows. Table 1 presents a preliminary summary of the anticipated cumulative impacts of the Nam Theun 2 Project on the Nakai plateau (the project area) and the Mekong River Basin, when combined with the anticipated developments in the other sectors listed above over five-year and twenty-year planning horizons.

[1] The Greater Mekong Subregion (GMS) comprises Cambodia, the PRC, the Lao PDR, Myanmar, Thailand, and Viet Nam.

Table 1: Cumulative Impacts of Anticipated Regional Developments including the Nam Theun 2 Project

Impact Zone	Five-Year Scenario	Twenty-Year Scenario
Nakai plateau	Impacts are dominated by Nam Theun 2 project activities. Some additional impacts are envisaged due to improved access following the construction phase and temporary population increase. Key impacts will be: increased pressure on wildlife (e.g., from hunting and logging due to the influx of people from improving access to the area), increased health risks (sexually transmitted diseases including HIV/AIDS), and increasing frequency and severity of motor vehicle accidents.	The situation is stabilized but significantly changed from the current baseline. Transport and communications will be significantly improved and new activities will have been attracted to the reservoir area (e.g., commercial fisheries and tourism). The anticipated situation is: (i) sanitation and water supply improved; (ii) Oudomsouk population higher than during the project construction period by some 140–150%; (iii) commercial fisheries established; (iv) health conditions improved with reduced incidence of malaria and food- and water-borne diseases, and shift from communicable toward non-communicable diseases; (v) heath and education services improved but struggling to keep up with demand due to population increase; (vi) increased employment in service sector including tourism; and (vii) increased cultural integration on the plateau with blurring of ethnic identities.
Mekong River Basin (scenarios include all hydropower developments in the basin including Yunnan)	The dominant factor will be some additional development of hydropower in Yunnan (PRC) and the Lao PDR. The impacts are calculated to be: (i) dry-season discharge at Savannakhet may increase by 45%. During floods, discharge reduced by 7%; (ii) water levels at Phnom Penh will be lower during floods and increased during the dry season. Average annual maximum level of the Tonle Sap lake and river system will also be reduced; (iii) changes in flow pattern will have an insignificant negative impact on floodplain and Tonle Sap fisheries as these are favored by high wet-season water levels; (iv) changes in flow pattern will, however, have a small positive impact by damping damaging flood incidents and by increasing dry-season water level which will support irrigation and reduce salt intrusion into the Mekong delta.	The dominant impact will be further development of hydropower in Yunnan (PRC) and the Lao PDR. Impacts are calculated to be: (i) dry-season discharge at Savannakhet may increase by 135%. During floods, discharges may reduce by 22%. (ii) water levels at Phnom Penh will be lowered further during floods and increased further during the dry season. Average annual maximum level of Tonle Sap will be further reduced; (iii) changes in flow pattern will have a significant negative impact on the floodplain and Tonle Sap fisheries; and (iv) changes in flow patterns will, however, have a significant positive impact by damping damaging flood incidents and by increasing dry-season water levels that will support irrigation and reduce salt intrusion into the Mekong delta.

Notes: HIV/AIDS = human immunodeficiency virus/acquired immunodeficiency syndrome

Source: Nam Theun 2 Power Company, Cumulative Impact Analysis and Nam Theun 2 Contribution, Final Report, November 2004 (cited in ADB 2004).

The CIA also examined the specific contribution of the Nam Theun 2 Project to the downstream changes in the Mekong River. The Nam Theun 2 Project alone is predicted to result in an increase of about 8% in dry-season discharge at Savannakhet while reducing

flood discharges by 2%. The Nam Theun 2 reservoir is also expected to cause only a minimum retention of sediments. The CIA concluded that the Nam Theun 2 Project alone will have an insignificant[2] negative impact on the Mekong floodplain and on all aspects of the Tonle Sap lake and river system, including fish production (ADB 2004).

2.2.2 The Papua New Guinea Gas Project[3]

The Papua New Guinea (PNG) Gas Project was proposed to develop existing oil and gas production fields in the PNG Highlands to produce natural gas for export to Australia by pipeline. Of the range of existing and possible future activities arising from this project, those with the greatest potential for cumulative environmental impacts were commercial forestry, enhanced population mobility, and the hunting of fauna and collection of flora. Agricultural development was constrained by various factors, and other forms of development (such as fisheries, tourism, and mining) seemed unlikely to be extensive in scope. On the hunting of fauna and collection of flora, the improved public road system associated with the project would enable poachers to use vehicles to travel further afield to poach wildlife. Close supervision by any related government agency will be difficult because of the remoteness of the area. Thus, mitigation measures that can respond to this problem needed to be explored. Measures would also be implemented (during project operations) to limit the impact on biodiversity caused by project workers in project-managed areas, for example, the institution of policies and prohibitions related to wildlife disturbance and harassment, hunting, and vegetation gardening, etc. Involving landowners in the supervision of road sections was one possible approach to managing this issue. Restrictions on carrying guns for hunting also needed to be considered (Esso Highlands Ltd. 2006).

2.3 Sector-Wide and Economy-Wide Environmental Impacts

A project can be very large relative to a sector and/or economy. In the case of a small economy, implementation of a large project may have sector-wide and/or economy-wide implications. Therefore, a strategic impact assessment (SIA) needs to be undertaken to identify potential impacts at the sector- and/or economy-wide level, as well as the options available to avoid the impacts identified. An SIA integrates environmental issues with economic and sectoral policies at the planning stage, rather than at the implementation stage, and is thus a useful tool to bridge the policy divide that separates the government institutions responsible for economic planning from the line industries in charge of environmental protection at the planning stage of any development activity (Zhang 2008).

2.3.1 The Nam Theun 2 Hydroelectric Project in the Lao PDR

In recognition of the fact that this is a large project which may have sector-wide implications, an SIA was undertaken to examine the broader issues faced by hydropower development in the Lao PDR and to develop strategic priorities for use by government institutions, donors, private investors, and other stakeholders to improve the management of environmental and social issues within the sector. Specifically, the SIA reviewed the planning, legal, regulatory, and institutional frameworks in the Lao PDR, estimated the environmental and social

[2] Significance is based on whether or not the induced impacts of Nam Theun 2 are within the range of normal fluctuation.

[3] ExxonMobil and its partners have abandoned the concept of a pipeline for exporting natural gas to Australia due to low relative benefits and sharply higher construction costs. They are now pursuing the concept of producing LNG to export natural gas internationally, targeted principally to Asian markets. In comparison with the total value of output estimated at US$14 billion–US$23 billion (in 2006 US$) attributed to the Papua New Guinea Gas Project (Esso Highlands Ltd. 2006), the total value of output for the LNG project is estimated at US$55 billion–US$123 billion (in 2007 US$), with US$95 billion in the study case (ACIL Tasman Ltd. 2008). Despite this, the Papua New Guinea Gas Project is still cited in this paper because it exemplifies how a variety of issues need to be addressed in the project design stage. The author of the paper is grateful to Barry Reid who provided the reports for the two projects.

impacts of the other 21 hydropower projects that, based on plans, are the most likely to be built in the next 15 years, and identified, at the sector level, the numerous strategic opportunities available to avoid impacts and improve environmental and social management (Norplan 2004; ADB 2004).

2.4 Climate Adaptation and Mitigation

Cross-border infrastructure projects may lead to changes in land use, forest and vegetation coverage, ecosystems and biodiversity spots, and relocation of human settlements, etc. These changes may put the affected regions, in particular those already vulnerable to climate change, at great risk, and affect their abilities to adapt to climate change and maintain carbon sinks. On the positive side, some cross-border energy projects will enable existing energy consumers to use hydropower and/or natural gas in place of coal and/or oil. This will benefit the environment, both locally and globally, by reducing local pollutants (e.g., emissions of sulfur dioxide [$SO_{2]}$ and nitrogen oxide [NOx]) and global pollutants (e.g., emissions of carbon dioxide [$CO_{2]}$ and other greenhouse gases [GHGs]). However, because climate issues have not been at the top of the agenda in this region, very few cross-border infrastructure projects have to date factored climate adaptation and mitigation into overall considerations. When these issues have been considered, they have not been done so in detail.

Because current developments will set the patterns for energy and transport use in this region, and will have a lasting effect on climate change, there is a great need to thoroughly document both the negative implications for climate change that arise from cross-border infrastructure projects and the potential climate benefits that these projects can bring in terms of reduced GHGs and the maintenance of carbon sinks (for example, through the preservation of land and forest coverage). However, it should be pointed out that while it is relatively easy to calculate the reduced GHG emissions that will result from replacing the existing use of coal and/or oil with cross-border hydropower and/or natural gas, it is very difficult to estimate other climate impacts, such as the impact on carbon sinks, particularly when a project involves huge changes in land use, forest and vegetation coverage, ecosystems and biodiversity spots, and relocation of human settlements, etc.

2.4.1 The Papua New Guinea Gas Project

The gas supplied by this project to consumers in Australia would enable existing energy users to transfer to clean-burning natural gas and away from carbon-intensive fuels such as coal. The significant GHGs that were released during the combustion of natural gas were CO_2 and nitrogen dioxide ($NO_{2)}$. It had been estimated that the GHG emissions avoided would be around 1 million tons of CO_2 (Mt CO_2) equivalent[4] per year for the first two years of gas supply. The avoided GHG emissions would peak at 4 Mt CO_2 equivalent in 2015, and remained at around 2 Mt CO_2 equivalent throughout the remainder of the life of the project. However, the overall GHG emissions would be 0.90% higher in 2020 under the “with-project scenario” because of demand creation by new projects, while total GHG emissions would be 1.05% less as a result of the greater proportion of natural gas in the fuel mix (Esso Highlands Ltd. 2006).

3. MITIGATION MEASURES

Adverse impacts need to be avoided wherever possible. In the cases where adverse impacts can not be completely avoided, ways need to be found to reduce impacts to a minimum or acceptable level. Possibilities include: comparing the proposed project with alternative

[4] CO2 equivalent describes how much global warning a given type and amount of GHG may cause, using the functionally equivalent amount or concentration of CO2 as the reference.

options to determine whether the proposed option is indeed the most attractive; carefully selecting project sites and routes; reducing the number of camp followers; developing and implementing proper contract awarding systems; specifying the green credentials required of head construction contractors; and engaging project-affected people and communities and other concerned stakeholders in public consultation and disclosure processes during the project design stage. Based on the information available for three proposed and completed cross-border infrastructure projects, this section will discuss, to the extent possible, whether these projects have taken the available mitigation options into account during the project design stage.

3.1 A Study of Alternatives to the Proposed Project

An assessment of the EIAs for three completed projects in the Lao PDR (Theun Hinboun, Houay Ho, and Nam Leuk) revealed that crucial information and analyses were only available after construction had started on the projects. As a consequence, project design and operations could not be modified in advance to mitigate environmental impacts (Norplan 2004). This experience demonstrates that carefully studying alternatives to the project at the project design stage, and making corresponding modifications wherever needed, can act as an important measure to help mitigate the negative impacts of the proposed project.

A study of alternatives is undertaken to determine whether the proposed project is indeed the most attractive of the available options. This involves first determining how the project in question compares with alternative options (including a without-the-proposed-project alternative) for achieving the same goal, as measured against technical, economic, financial, environmental, and social criteria. If the proposed project is confirmed as the superior option, then the project configuration should be examined to ensure that it is optimal. This requires considering alternative configurations of the project, particularly with respect to those parameters that are critical to the overall environmental and social impacts. If the proposed configuration is determined to be optimal, then the proposed project is indeed the most attractive option.

3.1.1 Without-Project Option

There are two criteria for assessing the without-project option for any proposed project: i) the strategic opportunity costs, and ii) the impacts avoided and benefits foregone.

3.1.1.1 The Papua New Guinea Gas Project

There were two strategic opportunity costs associated with the without-project option for this project. The first was the failure to take advantage of the synergies inherent in the existing oil and gas infrastructure and the second was the loss of future opportunities to build on the project's infrastructure to develop new fields. With regard to the second opportunity cost, the foreclosed future development options included: i) potential value-adding, gas-based industries—such as methanol, liquefied petroleum gas (LPG), and compressed natural gas (CNG) production—would have no supply source, and ii) undeveloped gas and condensate fields to the northwest of existing production operations would not be able to exploit production synergies with the proposed project. Instead, they would have to face the more difficult commercial hurdle of stand-alone development, with a correspondingly reduced chance of meeting investment criteria.

In quantitative terms, the without-project option would forego the following: i) net present value to Papua New Guinea of US$3 billion–US$4 billion over about 30 years from first gas; ii) direct employment from construction peaking at 2,500 jobs (the employment generated from combined oil and gas operations, including contract service providers, would be similar to that for construction, with the number of permanent direct operations positions estimated to be around 2,400); iii) net cash flow to the Government and project area landowners of between US$3.2 billion–US$5.6 billion over a 30-year period from first gas— compared to

US$1.7 billion from 2009 to the projected end of oil production in 2025; and iv) a substantial contribution to gross domestic product (GDP), estimated to peak at 9% some 12 years after first gas (Esso Highlands Ltd. 2006).

3.1.1.2 The Nam Theun 2 Hydroelectric Project in the Lao PDR

For the Nam Theun 2 Hydroelectric Project in the Lao PDR, the consequences of adopting a without-project option would be:

- continued low GDP rates and high poverty levels in the Lao PDR;
- forgone direct economic benefits, including improvements in infrastructure, health services, etc.; and
- accelerated exploitation of forests and biodiversity in the Nakai Nam Theun national protected area (ADB 2004).

3.1.1.3 Indonesia-Singapore Gas Pipeline Project

Construction of the US$420 million pipeline connecting Sumatra and Singapore commenced in February 2001 and was completed on 4 August 2003. This 470 km pipeline provided the city-state with its third natural gas supply. Without this pipeline project, the traditional fuel of diesel would be used to generate the electricity to meet increasing demand. Natural gas was introduced for electricity generation in 1992 when Singapore started importing gas from Malaysia via pipeline. From 2003 to 2005, the gross efficiency of the power system increased by about 5% (Asia Pacific Energy Research Center [APERC] and Institute of Energy Economics of Japan [IEEJ] 2007), which would be foregone without the pipeline project. Clearly, natural gas-fired power plants provide a cheaper, cleaner, and more efficient alternative to the traditionally used oil-fired plants.

3.1.2 Alternative Options

3.1.2.1 The Nam Theun 2 Hydroelectric Project in the Lao PDR

Both ADB-assisted and World Bank-assisted studies were carried out to examine and compare 19 alternatives to the Nam Theun 2 Project, as measured against technical, economic, financial, environmental, and social criteria. Both studies ranked the Nam Theun 2 Hydroelectric Project first in relation to other potential hydropower developments for the Lao PDR. Table 2 presents the rankings and characteristics of the 10 highest-ranked projects.

Table 2: Preliminary Rankings and Characteristics of Hydropower Projects for the Lao PDR

Rank	Project	Project Type	Installed Capacity (MW)	Annual Energy Output (GWh p.a.)	Adjusted Weighted Generation Cost[a] (¢/kWh)
1	**Nam Theun 2**	Storage/transfer	1,074	5,922	1.6
2	Theun Hinboun Expansion	Storage/transfer	105	686+	2.4
3	Thakho	R-of-R/Mekong	30	214	2.6
4	Nam Mo	Storage	125	603	2.7
5	Xe Kaman 3	Storage	250	1,369	2.8
6	Xe Kaman 1 (u/s reg.)	Storage	470	2,086	3.1
7	Nam Ngum 2 (u/s reg.)	Storage	460	1,901	3.2
7a	Nam Ngum 2B	Storage	140	196	8.7
8	Xe Kong 5	Storage	400	1,795	3.2
9	Nam Sane 3	Storage	60	283	3.3
10	Nam Ngiep 1 (+ reg. dam)	Storage	330	1,537	3.8

Notes: GWh = gigawatt hour, KWh = kilowatt hour, MW = megawatt, p.a. = per annum, reg. = regulating, R-of-R = Run-of-River, u/s = upstream.

[a] The economic weighted average cost of generation has been calculated using economic, social, and environmental evaluation software. It takes into account the economic and financial costs and revenues of developing each scheme, weighted against monetary valuations of their environmental and social impacts. It attempts to provide a more objective analysis of environmental and social costs and benefits.

Source: Meritec/Lahmeyer International (2004 preliminary results) Power Sector Development Plan undertaken for the World Bank (cited in ADB 2004).

The study of alternatives also assessed the tradeoffs between the best alternative scenario (the second-ranked in Table 2) and the Nam Theun 2 Project. The tradeoffs would be US$320 million less income to the Government of the Lao PDR, in exchange for 2430 fewer people to be resettled, 286 km^2 less area flooded by reservoirs, and 138 km less river inundated (ADB 2004).

3.1.2.2 The Papua New Guinea Gas Project

The Papua New Guinea (PNG) Gas Project was initially proposed to build a pipeline to export natural gas from the PNG Highlands to Australia. Three alternative products were evaluated: liquefied natural gas (LNG), liquefied petroleum gas (LPG), and compressed natural gas (CNG). LNG projects require a very large gas resource to underwrite long-term supply contracts with customers, and project lead times are long. LNG projects also require major capital investments. Such projects are generally adopted when customers are too far from the gas resource to be economically reached by pipeline. As this was not the case for the PNG Gas Project, the LNG option was not retained. LPG is traded globally. When the production of LPG traded globally on an export scale was evaluated, it was found that the cost of fractionation, storage, and offloading facilities made this option uneconomical. CNG involves pipeline-quality natural gas being compressed and transported in pressure tanks by tanker to export markets. A group of energy and transport companies were studying the possibility of shipping CNG from PNG to New Zealand in order to replace a declining local gas supply in New Zealand and cover what was expected to be a national shortage of natural gas beginning in 2009. As far as the PNG Gas Project was concerned, a feasible CNG development would have added to, rather than replaced, natural gas exported by pipeline (Esso Highlands Ltd. 2006).

3.1.2.3 Electric Power Grid Interconnection in Northeast Asia

Given that 70% of its territory is covered with mountains and its residents are reacting extremely negatively to proposals for the construction of power facilities, Korea faces great difficulties in finding new sites for power facilities. In order to meet the need for increased electricity supply, the Government of the Republic of Korea seems to be very enthusiastic to pursue power grid interconnection between the Russian Far East and Korea, although this possibility has not yet been officially endorsed by the government.

Several possible electric power interconnection routes have been proposed. One route proposes to link the Russian Far East and Korea directly via North Korea, as shown in Figure 2. Simply put, this route entails transporting electricity between the Russian Far East and Korea via the construction of high voltage, direct current, transmission lines passing through North Korea. According to the 2004 preliminary analysis undertaken by the Korea Electrotechnology Research Institute (KERI), the approximate distance of this interconnection route is 1,260 km. It is assumed that it would take five years to construct the interconnection line and its life expectancy has been calculated as 30 years. Assuming a four GW-capacity interconnection, the total investment cost has been estimated as US$2.51 billion, of which the line construction cost would be an estimated US$1.06 billion and the converter cost US$1.45 billion (KERI 2004). Compared to the alternative routes of Russia–PRC–North Korea–Korea and Russia–Japan–Korea, the route traversing North Korea has received the most attention from academic scholars and practitioners in recent years. The alternative routes are considered to be more expensive due to their even lengthier interconnection distances and the technical difficulties involved in constructing submarine cables (Yun and Zhang 2006).

Figure 2: Alternative Routes of Power Grid Interconnection in Northeast Asia

Notes: The nomenclature is not consistent with ADBI usage

Source: Park, Yoon, and Kim (2004)

Concerns about the reliability of interconnected power grids are considerable because their malfunctioning can lead to costly and hazardous blackouts, as evidenced by huge blackouts that occurred in North America and Europe in the summer of 2003.[5] These concerns may have led some NEA countries, like the PRC (Zhao 2004), to take a very cautious stance toward importing power from the Russian Far East. For this reason, the PRC needs to look into other alternatives to diversify its power supply before considering interconnecting power grids with the Russian Far East. The options for diversifying power supplies may be not

[5] Leaving tens of millions of people without power, these blackouts were the largest in history but far from the first. While the underlying cause of such blackouts is systematic underinvestment in transmission grids as demand for power grows and trading for power becomes more widespread, the immediate cause may be operational in nature, with slow reactions to a failure in one part of an interconnected system leading to rapidly cascading failures in much of the rest of the system (APERC 2004).

limited to interconnecting power grids among the NEA countries. Instead, other means of diversification, e.g., building nuclear power stations with the support of Russia and importing from Russia power equipments for nuclear power plants are worth exploring. As far as Korea is concerned, however, these other means may be irrelevant given its earlier discussed difficulty in finding new sites for the construction of power facilities (Yun and Zhang 2006).

3.1.3 Alternative Configurations

A study of alternative configurations aims to examine whether the proposed configuration of the identified project is optimal by investigating those parameters that are critical to its overall environmental and social impacts. For the Nam Theun 2 Hydroelectric Project in the Lao PDR, three parameters have been identified as critical, namely, the size of the Nakai reservoir, the flow pattern in the Xe Bang Fai River, and the flow pattern in the Nam Theun River. The options considered and conclusions reached are summarized in Table 3. It shows that alternative configurations to divert the upper Xe Bang Fai River and increase the size of the regulating pond have been incorporated into the final scheme in order to reduce the effects of discharges into the Xe Bang Fai River.

Table 3: Comparison of Alternative Configurations for the Nam Theun 2 Project

Alternative Configurations	Options Assessed	Conclusions
Reduce size of the Nakai reservoir	Seven alternatives were considered in relation to the size of the reservoir. Following public consultation, it was agreed that three options would be examined further. These were a dam at Nakai, a dam further upstream at Ban Thalang, and developing the project as a run-of-the-river scheme.	Generation capacity decreases and relative cost per unit of energy generated increases as reservoir size is reduced. For example, if the reservoir is reduced to run-of-the-river, 3,220 GWh less power per year will be generated and the relative generation cost would be 236% compared to the Nakai dam option of the Nam Theun 2 Project.
Reduce effects of discharges into the Xe Bang Fai River	The following means were investigated: (i) divert power station releases into the Nam Thon, a tributary of the Nam Hinboun; (ii) deepen the river channel of the Xe Bang Fai at strategic locations; (iii) provide regulation upstream where the Xe Bang Fai receives water from the project, so as to reduce the natural flood hydrograph; (iv) build a reservoir in the Nam Se Noy tributary, which could then possibly be diverted to the Nam Phong river system for irrigation use; (v) divert the upper Xe Bang Fai River; and (vi) increase the size of the regulating pond to enable a more consistent discharge into the Xe Bang Fai during periods when the power station is not operating; and shut down the power station when the Xe Bang Fai floods to reduce the potential for increased flooding.	Of these options (i) to (v) were found to have either no marked impact, were prohibitively expensive compared to their beneficial impacts, or were technically not feasible. Furthermore, a subsequent mitigation measure agreed with EGAT is to enable electricity generation to stop and therefore stop discharge into the Xe Bang Fai when this river is close to flooding. Options (vi) and (vii) have been incorporated into the scheme.
Reduce the impacts downstream in the Nam Theun	Three options are available to reduce the impact of a limited riparian release into the Nam Theun; (i) increase in mandatory riparian release; (ii) aeration of riparian release; and (iii) partial diversion of a natural stream into the Nam Theun to increase its flow.	These options were not considered in the study of alternatives. The project already provides for the riparian release to be aerated through a cone valve in order to increase the levels of dissolved oxygen in the released water. Means for optimizing the release for environmental and social benefits are being considered under the riparian flow study. The diversion of another stream into the Nam Theun immediately downstream would increase the cost of construction for the Nakai dam and may not have a significant effect on the quality of discharge.

Notes: EGAT = Electricity Generating Authority of Thailand

Source: Nam Theun 2 Power Company, Environmental Assessment and Management Plan, November 2004 (cited in ADB 2004).

3.2 Sites and Routes

To the extent possible, sites and routes should not be located in sensitive areas such as watersheds, forest reserves, natural reserves, cultural and historic heritage sites, or tourism spots. This may lead to choosing a longer route over a shorter-distance alternative in order to avoid disturbing, or to minimize the disturbance of, these kinds of areas. Moreover, construction areas, and the associated areas of vegetation clearance, need to be kept to the minimum required for project efficiency.

3.2.1 An Alternative for the Sales Gas Pipeline Route in the Papua New Guinea Gas Project

An alternative for the sales gas pipeline route would have been to build an entirely new ROW to cover the shortest distance over land to the shortest sea crossing of the Torres Strait. This would have involved a corridor running roughly southwest from the Kutubu Central Production Facility; passing to the south of Mt. Bosavi; running across the floodplains of the Strickland, Bamu, and Aramaia rivers to cross the Fly River; then tracking south across swamps, savannah, and flooded grassland to a landfall on Torres Strait. A sales gas pipeline running along this general corridor might have involved up to 300 km less offshore pipeline and could have been some 160 km shorter overall. However, the majority of the new corridor would have passed through largely undisturbed forested areas, swamps, and other wetlands, causing greater adverse environmental impacts than would the use of the existing Kutubu-Kopi-Omati ROW for the sales gas pipeline route**.** The new ROW would also have been technically more challenging than the Kutubu-Kopi-Omati ROW since it would have passed through both mountainous and floodplain areas, making both construction and logistics more costly. The choice of the existing Kutubu-Kopi-Omati ROW was found to be more advantageous in terms of engineering, environmental impact, and cost (Esso Highlands Ltd. 2006).

Even if sites and routes are not located in sensitive areas, the residents near to and along routes may react negatively to the construction of large projects due to environmental concerns. The potential impact of local public resistance should not be underestimated. The not-in-my-backyard (NIMBY) syndrome is not uniform everywhere, but it can delay a project or even cause it to be cancelled, even if the extent of the syndrome is modest (Yergin and Ziff 2004). Dukert (2005) shows that even where the NIMBY opposition was relatively small in scope, it successfully blocked pipeline routes from Canada's Maritime provinces to New England and New York, as well as proposed LNG installations in the United States. This clearly suggests that there is great need for project proponents to devise and implement outreach and communication strategies aimed at educating the general public in order to increase public support.

3.3 Work Camps and Followers

The impacts of work camps can be minimized through careful location that helps to minimize the associated vegetation clearance and the destruction of endangered species' and wildlife habitats. Based on the experience of the Theun Hinboun Hydroelectric Project in the Lao PDR, work camps can attract up to four times as many camp followers (namely, families of workers and service providers) (ADB 2004). The workforce and the camp followers put pressure on land and natural resources, generate solid and liquid wastes, and increase public health risks. An assessment of the EIAs undertaken for three completed projects in the Lao PDR (Theun Hinboun, Houay Ho, and Nam Leuk) found that the negative impacts connected with the influx of workers and camp followers were, in general, inadequately addressed and planned for (Norplan 2004). Mitigation measures need to be well developed in order to reduce these potential impacts. Otherwise, inappropriate solid waste disposal could lead to the contamination of soil, groundwater, and rivers, and the spread of pests and

communicable diseases, while inadequate treatment of wastewater could cause water quality problems in adjacent water bodies. In addition, project developers need to investigate how the impact of work camps could be further reduced by minimizing the number of followers through, e.g., maximizing the employment of people from and/or close to the project area.

3.4 Awards of Memoranda of Understanding (MOUs) and Licenses for Prospective Project Developers

Developing and implementing a proper contract awarding system can help to avoid or minimize the potentially negative environmental and social impacts of planned projects. To ensure greater transparency and the better integration of EIA findings with technical planning, it is preferable that a competitive bidding system be introduced to replace the MOU negotiation-based awarding system. Alternatively, the content of MOUs should be standardized to include environmental and social requirements. At a minimum, contract-awarding authorities need to develop a comprehensive document, for up-front presentation to prospective developers, which outlines the environmental and social requirements contained in laws and regulations. There is also a need to standardize concession licenses to include environmental and social provisions so as to ensure that these requirements are made legally binding (Norplan 2004).

3.5 Environmental or Green Credentials of the Head Construction Contractor

The head construction contractor (HCC) is responsible for implementing measures to avoid or minimize environmental, social, and health impacts during construction. The HCC's environmental credentials, in addition to its other technical and financial credentials, are crucial, and certain standards of credential should be considered a prerequisite for qualifying as a contractor. This means that the HCC should apply international standard quality assurance procedures and an environmental management system in full compliance with either International Organization of Standardization (ISO) 14001 or the European Union Eco-Audit and Management Scheme (EMAS). To avoid the potentially limiting effects of this specification, governments may refer to, or demand adherence to, the specified environmental management standards "or equivalent" (Zhang and Assunção 2004). This will allow those contractors in full compliance with comparable or similar environmental management systems to be eligible to participate in bidding for construction contracts.

3.6 Public Consultation and Disclosure Processes

A lack of both transparency and civil society participation during the project design stage is often cited as a particular problem of cross-border infrastructure projects. To minimize a project's potential negative impacts, project-affected people and communities and other concerned stakeholders need to be engaged in a public consultation and disclosure process during project design. This not only enables project-affected people and communities to speak freely about their concerns. More importantly, this process ensures that concerns are addressed and, wherever necessary, incorporated into project planning and design, the selection of resettlement sites, and the formulation of appropriate remedial measures. The affected parties' close involvement in and understanding of this process will in turn help to minimize the likelihood of adverse outcomes with regard to the resettlement, compensation, and rehabilitation plans. An assessment of the EIAs for three completed projects in the Lao PDR (Theun Hinboun, Houay Ho, and Nam Leuk) found that compensation and resettlement needs were underestimated and insufficiently planned and budgeted for (Norplan 2004).

For new projects, there is also a general tendency to underestimate resettlement needs in the initial phases of project preparation, partly to keep the overall costs down in order to make the proposed projects appear economically sound, and partly to avoid triggering a demand for a resettlement action plan, as required by the multilateral development banks and national regulations.[6] As a result, throughout this region, project developers and project-affected people and communities are frequently in conflict with one another regarding compensation and resettlement settlements. In the case of the Phnom Penh to Ho Chi Minh City Highway Project, complaints were filed claiming that the level of compensation paid was not adequate to restore the economic and social bases of the people affected by the Cambodian component. Of the total of 18 review missions undertaken by ADB after their loan became effective, 7 were resettlement review missions in response to the problems that had occurred. ADB undertook these review missions and the subsequent resettlement audits to determine the validity of the complaints and work with the government to resolve them (ADB 2007b). Clearly, having project-affected people and communities involved in a process of public consultation and disclosure should help to determine the proper compensation and resettlement arrangements in advance of project implementation.

3.7 Advisory Groups

An advisory group or panel of experts needs to be established for every project. This group should have a mandate to undertake an independent review of and provide guidance on the overall aspects of the project, including environmental and social issues. Amongst other duties, the group should produce independent reports concerning the project's compliance with environmental and social safeguards and funding agency guidelines, and it should recommend remedial measures to be applied in the event of non-compliance with said safeguards and guidelines. A coordinator should be appointed, at the request of the countries concerned, in cases where projects encounter implementation difficulties.

4. KEY ISSUES OF CROSS-BORDER INFRASTRUCTURE PROJECTS

In addition to the issues outlined in the previous two sections of this paper, issues which are shared by all infrastructure projects regardless of their location, cross-border projects face additional challenges relative to national projects. The existence of technical, regulatory, institutional, and legal obstacles constrain the development of cross-border infrastructure projects. Achieving a policy framework—at the national level and/or, wherever necessary, at the regional level—that can support the development of such projects and ensure that they operate properly and reliably while also managing and minimizing their environmental impacts, requires proper technical specifications and well-functioning regulatory, institutional, and legislative/legal frameworks with clear lines of oversight.

4.1 Technical Specifications

One of the challenges for cross-border infrastructure projects is that each participating country may have different standards, guidelines, and procedures for technical matters. Because these standards and procedures etc. can vary in both content and point of implementation, the extent to which they impede the development of cross-border projects differs depending on the project type. For example, technical specifications specific to a cross-border road project will only involve road and bridge design and signage standards at the construction stage, whereas technical standards are essential throughout both the

[6] For example, World Bank and Lao PDR guidelines require a resettlement action plan be produced once the number of anticipated resettlements arising from any one project exceeds 200 people (Norplan 2004).

construction and operation of a cross-border power project if it is to maintain its operational integrity. To remedy this, once sites and routes have been set, the involved countries need to agree to detailed technical specifications and develop harmonized standards for design, construction, operation, maintenance, health, safety and environment, and measurement in order to mitigate potential risks and environmental impacts. Differences in standards and procedures etc. may also contribute to the previously mentioned concerns about the reliability of interconnected power grids.

4.2 Regulatory Frameworks

Regulatory issues include pricing, tariffs, transit and user fees, access and use, transmission regulation, metering, load specifications, insurance standards, health and safety, security of supply, and emergency supply arrangements. Arrangements for pricing, tariffs, and access and use are especially critical, because under-pricing in the receiving markets, excessive transit and user fees, restrictions on or unfavorable transmission of transit access, unclear interconnection requirements, and excessive liability insurance requirements all hamper the development of cross-border projects. In this section, the focus will be on these key regulatory issues. Special attention is devoted to the ways in which problems associated with these key regulatory issues can be tackled.

4.2.1 Pricing and Tariffs

“Energy security” is often a readily used defense for a country’s reluctance to be dependent on another country for its energy supply or to export what is viewed as a strategic national asset. This political consideration, combined with under-pricing of natural gas and power in receiving markets, further hampers the development of cross-border power and natural gas projects. For example, in a receiving country where diesel is heavily subsidized, diesel-fired utilities are also, in effect, heavily subsidized unless tariffs include at least the amount of subsidies to diesel inputs. Utilities such as these will resist the opening of the domestic market in the first place. Even if domestic markets are open for competition, piped natural gas-fired utilities will not be able to compete on price until diesel and other fossil fuel subsidies are removed in the receiving markets. This suggests that domestic regulations must contain the correct economic incentives at the outset, in order to encourage the building of cross-border projects. Individual governments need to move towards market-based pricing systems and away from practices such as price interventions and tax distortions, which lead to the inefficient pricing of natural gas or power.

Similarly, power tariffs are crucial in determining whether electric power grid interconnection takes off, because average generation costs and price levels in receiving markets will serve as benchmarks for imported power. Take the proposed power grid interconnection between the Russian Far East and Korea. As of 2003, the average generation cost and electricity price were, respectively, 4.1 and 6.2 cents per KWh in Korea, whereas the average power tariff in European Russia was reported to be around 1.0 cent per kWh as at late 2001 (Korea Power Exchange 2004; Belyaev, Marchenko, and Podkovalnikov 2003). This substantial differential in electricity prices suggests that substantial cost savings could be achieved through grid interconnection and power trade between the two countries. However, electricity prices in Russia have historically been determined in large part by state-owned enterprises and have not fully reflected the costs of generating and delivering power. As the Russian government has planned to both relinquish subsidies for electricity by lifting price controls on generation fuels, natural gas in particular, and introduce a bidding mechanism for supply contracts, competition among suppliers in the power market can be expected to intensify and prices can be expected to rise towards market levels. Consequently, the differential in electricity price as currently observed between Korea and Russia will diminish in the future.

This picture may change or at least prices may not converge that quickly if electricity tariffs include externality costs, such as environmental costs associated with the generation and

transmission of power. This is because of the increased share of hydropower in the total generating capacity in the Russian Far East. Currently, hydropower accounts for about 20% of the total. As the Russian government has made hydropower generation a priority, particularly in the Russian Far East (Energy Information Administration 2004), this share is estimated to rise to more than 35% in 2025 (Podkovalnikov 2002). So, if the environmental and social costs were to be internalized into electricity tariffs, this would correct distorted competition and increase the competitiveness of cleaner power supply, such as hydropower, electric power grid interconnection and power export from the Russian Far East (Yun and Zhang 2006).

One method through which to internalize environmental benefits is to add the value of carbon credits. Cross-border energy projects often provide global environmental benefits in terms of reduced GHG emissions, by using hydropower and/or natural gas in place of coal and/or oil, and/or by preserving carbon sinks, e.g., through the maintenance of land and forest coverage. Table 4 presents a preliminary economic assessment of the environmental and social impacts of the Nam Theun 2 Project. It shows that the global benefits arising from the value of both the maintenance of the carbon sink and reduced GHG emissions are six times that of the identified local costs. When discounted at a rate of 10%, the estimated global benefit of the Nam Theun 2 Project accounts for 6.8% of its total estimated base cost of approximately US$1.25 billion (ADB 2005). A cross-border project of this kind may well qualify as a so-called clean development mechanism (CDM) project under the Kyoto Protocol. If so, the additional cash flow from CDM credits, the so-called certified emission reductions (CERs), will boost internal rates of return. Whether the added value arising from CERs is sufficient to cover the incremental costs of implementing cross-border projects depends on the price of CERs. If the price is high enough, the corresponding stream of CERs could be the decisive factor that renders these projects viable (Zhang 2006a). Let me elaborate this point a little further.

The report on the environmental and social impacts of the Nam Theun 2 Project (ADB 2004) does not give the carbon price that was used in calculating the aforementioned global benefits, but it can be assumed that the price used in this calculation did not exceed US$5 per ton of CO_2 equivalent. The rationale for this assumption is as follows. In the early stages of the carbon market, the World Bank and the Dutch government were the two most active buyers of carbon credits in project-based transactions. In terms of volume, these two players represented over half of the world's market for carbon at that time. The World Bank's Prototype Carbon Fund, the first global carbon fund, paid the highest purchase price of US$4.25 per ton of CO_2 equivalent for CERs until the end of 2004. The Dutch CER unit procurement tender (CERUPT) program was aiming at price levels of about US$5 per ton of CO_2 equivalent at that time. The offering prices of the PCF and CERUPT were not intended to serve as market prices. However, given their dominant roles on the buyers' side in the early stages of the carbon market, in practice they acted as standard-setters for this market. Given the fact that the publicly disclosed offering prices of PCF and CERUPT projects provided information on abatement costs[7], both in economies in transition and developing countries, it is conceivable that private players were unwilling to go beyond these price boundaries (Zhang 2006b). Since then, the carbon market has expanded rapidly. The CDM market increased from 563 million tons of CERs and €3.9 billion in 2006, to 947 million tons of CERs and €12 billion in 2007 (Point Carbon 2008). The expansion of the carbon market has been accompanied by a significant increase in the price of CERs, arising from the CDM projects. Currently, the price of CERs ranges from US$12 to US$22 per ton of CO_2 equivalent in forward purchase agreements and CERs are traded at around the US$26 mark per ton of CO_2 equivalent in the secondary issue market. If the prevailing price of CERs were used, this would significantly increase the aforementioned global benefits arising from the

[7] An abatement cost is a cost borne by many businesses for the removal and/or reduction of an undesirable item that they have created as a byproduct of production.

Nam Theun 2 Project. This case clearly indicates how crucial the value of carbon credits is to rendering a cross-border infrastructure project viable.

Table 4: Preliminary Economic Assessment of Environmental and Social Impacts for the Nam Theun 2 Project

(present value terms using 10% discount rate)

Areas	Local (US$ million)		Global (US$ million)		Remarks
	Cost	**Benefit**	**Cost**	**Benefit**	
Nam Theun downstream of the Nakai Dam	N.I.	N.I.	N.I.	N.I.	· Costs result from potential loss of fisheries · Results from a riparian release study
Nakai Nam Theun National Protected Area	N.I.	17.0-36.0	N.I.	50	· Local benefits result from improved and maintained income levels due to better resource management and developments of new economic activities (e.g., ecotourism) · **Global benefits arise from maintenance of the carbon sink value of the NPA.**
Nakai plateau	4.4-5.4	8.5-11.5	0	35	· Local costs result from loss of existing economic activities on the plateau. - Local benefits result from the higher levels of income expected from the livelihood programs. · **Global benefits result from reduced emissions of greenhouse gases from the Project compared to the best alternative energy source (gas combined cycle).**
Xe Bang Fai	6.8-9.4	0.25	0	0	· Local costs mainly derive from the estimated loss of fisheries. Results of hydrology study are still to be incorporated. · Benefits do not include potential for significant increase in irrigation and agricultural production. To be realized, these benefits require additional investments not supported by the Project.
Mekong River	N.I.	N.I.	N.I.	N.I.	· Analysis will incorporate the findings of the CIA study.
Total	**11.2-14.8**	**26-48**	**N.I.**	**85**	

Notes: N.I. = none identified or quantified at the time of report preparation, NPA = national protected area.

Sources: Nam Theun 2 Power Company, Environmental Assessment and Management Plan, November 2004; Social Development Plan, November 2004; Social and Environment Management Framework and First Operational Plan, October 2004 (cited in ADB 2004).

4.2.2 Access and Use

For cross-border projects involving two countries, regulatory issues can be resolved by the governments. Indeed, cross-border gas pipeline interconnections in ASEAN are currently based on bilateral arrangements between the two countries concerned. However, for wider power grid or pipeline interconnections, more formal arrangements are necessary to provide participants with sufficient assurances with regard to system operation, pricing or tariffs, transmission or transit access, and fees. Unlike the gas market in Europe, which is well developed, cross-border gas pipeline interconnections in ASEAN are still in an early stage of development. Nevertheless, cross-border issues such as transit across third countries will become increasingly important as the implementation of the TAGP evolves. The experience

of Russia, the Ukraine, and the Asian republics of the former Soviet Union shows that the setting of tariffs for energy flows in transit, lack of transparency in conditions for gaining access to export capacity in gas pipelines, and the illegal taking of gas in transit, have been the main problems associated with cross-border energy flows. These problems have also been experienced over the last 15 years in Eurasia.[8] Clearly, these issues are not easy to agree on or resolve, but nevertheless they will need to be addressed through more formal arrangements before a more integrated cross-border TAGP infrastructure can be realized.

One avenue would be to take the relevant article under the Energy Charter Treaty (ECT) as a reference in setting transit tariffs. This is feasible given that all NEA countries, except for North Korea, have signed, acceded to, or obtained observer status with (the PRC and Korea) the ECT, and ASEAN as a single entity has had a seat as an observer since 2003. Article 7.3 under the ECT requires that transit tariffs be no less favorable than export and/or import tariffs. This means that in the case of transit of gas from one ASEAN country to another, via the medium of a more integrated cross-border TAGP network, the transit tariffs in the first country must be no less favorable than the export and/or import tariffs on gas into/from the second. However, it is not in violation of the ECT provisions if transit tariffs are higher than tariffs on domestic transportation (Konoplyanik 2005).

Another avenue would be via the establishment of a structured regional regulatory regime. In the GMS, for example, power flows are currently mostly one-way, but the goal of the GMS nations is to create a regional power trade. At the first GMS summit in 2002, the leaders of the six countries signed the Inter-Governmental Agreement on Regional Power Trade in support of this concept. This agreement reflects the highest political commitment to promote a regional power trade. The first step in establishing a GMS power market will be to build or strengthen the necessary institutional structures within the GMS countries themselves. Transmission lines must be planned and built in each country to allow for an increase in cross-border power transfers (ADB 2007a). Following this, there will be a need for a regional regulatory regime for power interconnections and their operation. In this regard, the Regional Electricity Regulatory Authority (RERA) in Southern Africa provides an interesting example. The RERA was established in 2001 as a formal association with separate legal status. Each of the member economies of the Southern Africa Development Community is entitled, through its energy regulatory arm, to a single membership. The RERA cannot interfere with national mandates but works toward establishing common regional rules related to issues such as system operation, transmission access, transmission pricing and cross-border trading, and towards the establishment of a regional regulatory framework for market liberalization (Stafford 2005).

Appropriate measures to ensure security of supply and emergency supply arrangements are also essential. Further, having a framework of cooperation helps in the event of a serious disruption of power or natural gas supply. The strengthening of safety and security standards is necessary to ensure the safe and secure operation of cross-border infrastructure projects and the lack of common standards has indeed been a problem for these projects. Therefore, incentives for investments in safety and security should be provided. They should be market-based, and the level of incentives should be commensurate with infrastructure risk assessments (Borchert and Forster 2007).

4.3 Institutional Frameworks

Institutional arrangements, either formal or informal, are crucial to the success of cross-border infrastructure projects. However, the specifics of institutional requirements will differ according to project type. The level of institutional arrangements required will also vary and

[8] The Transit Protocol to the Energy Charter Treaty, which is currently being negotiated, aims to address these problems. Although a wide degree of agreement has been achieved on nearly all substantive aspects of the draft text, the Transit Protocol remains unfinished because of differences in position between the European Union and Russia regarding the aforementioned three issues.

can extend from the project level to the national or even higher level arrangements. With regard to EIAs, detailed institutional arrangements are needed to provide the required legal framework, promote coordination among agencies, and ensure the responsibility and accountability of each party involved in the entire process.

On the topic of project-specific institutional arrangements, one project-specific issue is the asymmetric distribution of costs and benefits between involved parties. While some cross-border projects are mutually beneficial to parties, in most cases there is an unequal sharing of the benefits. This issue needs to be addressed at the project planning and design stages. The financing and upgrading of a road in the Lao PDR that forms part of the GMS North-South Corridor provides an interesting example of an arrangement that recognizes the different benefits to the different parties. This 228 km road aims to complete the missing section in an all-weather road link between Kunming Province in the PRC and Bangkok in Thailand and, as agreed, is financed equally through loans from ADB, and the Governments of the PRC and Thailand. The Lao PDR is only financing some of the local costs, despite the project being wholly within its boundaries. This example illustrates the possibility that while the country through which the road passes may not gain the largest benefit from it, a win-win arrangement can be made to align the costs with the benefits of the main parties.

Another issue is the overall sustainability of a cross-border project. As the project may have several country components, the issue of the sustainability of each country's component over time is of great concern. In the case of the Phnom Penh to Ho Chi Minh City Highway Project, expenditure on the maintenance of the Cambodian component has been well below the required level. The roads are currently in good condition, with little sign of damage, but as the level of overloaded truck traffic on the project roads increases in step with growing trade movement between Cambodia and Viet Nam, the need for regular periodic maintenance will intensify (ADB 2007b). The less strict adherence to load limits and inadequate levels of expenditure for road maintenance raises the question of the sustainability of the Cambodian component. Clearly, if the Cambodian component is not sustainable the overall project is not sustainable, even if the Vietnamese component is rigorously maintained. This case clearly illustrates the need for coordinated arrangements among the involved parties to ensure the overall sustainability of a cross-border project.

Also at the project level, an environmental management office (EMO) needs to be established. The EMO is assigned the responsibility for technical planning, implementation, and internal monitoring of all the environmental mitigation and compensation measures under the project developer's responsibility. It is also responsible for ensuring that the HCC fully meets its contractual and environmental management obligations. The EMO needs to regularly review the status of project impacts and make recommendations to the project developer that will enable it to rectify any failure to meet its environmental obligations as specified under the agreement with the central government. The EMO also needs to report regularly to an environment management unit, as will be discussed below.

Strong national institutions are also crucial to reduce the negative impacts of cross-border projects. At the national level, institutions are often not equipped with the necessary resources, staff, skills, and experience to either enforce existing regulations or to design, implement, monitor, inspect, and enforce new and effective environmental polices. Take, as an example, the responsibility to both undertake and implement an EIA. Having a mandatory EIA and a good EIA report are just the first steps. It is more important that the measures to mitigate the environmental effects of construction projects outlined in the EIA are implemented and monitored. It is common to this region that there is a weak delineation of responsibility and accountability when it comes to the planning and implementation of EIAs. The respective roles of the agencies responsible for undertaking EIAs and those authorities responsible for approving and monitoring EIAs (for e.g., environmental ministries or equivalent agencies) are unclear and ill-defined under present EIA processes. Moreover, the interrelationships between the undertaking, approving, and monitoring authorities and the parties (contractors) proposing the measures to meet and execute EIA requirements are

usually informal and not well set out. Consequently, coordination across the ministries and authorities concerned is weak, ineffective, and sometimes totally absent. This has given rise to weak enforcement, absence of monitoring, and lack of commitment from the various agencies in charge of undertaking, approving, implementing, monitoring, and evaluating EIAs. As a result, even if the quality of EIA reports looks good on paper (in other words, the EIA reports have genuinely assisted in planning better projects and identifying needs for mitigation measures and compensation), a lack of coordination and commitment from responsible agencies can thwart desirable outcomes.

Clearly, there is a need to clearly define the roles and responsibilities of the agencies involved to ensure that environmental and resettlement plans are effectively implemented. To that end, an environment management unit (EMU) should be established under the direction of the relevant government department. This unit should consist of representatives from the concerned departments at the level of central government and also from the affected provincial and local governments. The EMU is specifically designed to implement and manage the environmental components of the agreement signed with the project developer and it is also responsible for ensuring good environmental management at spontaneous settlements. The unit also reviews the EMO's reports on the monitoring performance of both the HCC and project developer during project construction and operation, and should then make the corresponding recommendations to the government on any remedial steps that need to be taken to rectify problems. Empowered by the central government, the EMU, in consultation with the project developer, should engage an independent monitoring agency to externally monitor and evaluate the environmental measures implemented. This agency then reports its findings to the EMU and the project developer.

Another reflection of weak institutions at the national level is the failure to integrate regional infrastructure projects with national plans and priorities. Regional infrastructure projects require commitments from all of the countries involved. If a country's domestic infrastructure is substantially underdeveloped, its government may, understandably, give priority to domestic infrastructure development before embarking on a regional project that may be perceived as giving a large portion of the benefits to outsiders. Clearly, national institutional capacity needs to be strengthened in order to have a better understanding of domestic infrastructure programs, priorities, and resources, and the potential domestic benefits of cross-border infrastructure projects. There is no point in having ambitious regional infrastructure goals if national institutions are unable to integrate regional infrastructure projects with national plans and priorities, and to align regional ambitions with a realistic assessment of domestic implementation capacities.

Regional institutional frameworks or arrangements are also crucial to effective cooperation on cross-border energy projects. Indeed, the lack of a regional institutional framework has been one of the major obstacles impeding electricity sector cooperation among the NEA countries. In this subregion, there is no overall trade agreement or convention, such as the General Agreement on Tariffs and Trade (GATT), which binds the six countries involved. In addition, there is no trade or economic-focused organization, such as the Asia-Pacific Economic Cooperation (APEC) or the World Trade Organization (WTO), which includes all six countries as its members. Therefore, the creation of a regional institutional framework is important for energy cooperation among the NEA countries. The highly collaborative planning process that supports the ASEAN Power Grid Project, and which is clearly backed by governments and supported by power system experts, is a valuable model. If the proposed power grid interconnection in NEA is to achieve sufficient support and momentum to be realized, a similar process with political backing may be needed (APERC 2004).

To make energy cooperation more effective, the governments of the NEA could go further by establishing a regional institutional framework specifically for energy cooperation. This framework would set up the common rules of the game and the countries involved would be obliged to observe these rules in practice. However, views do differ regarding the specific

form of such a framework. Some favor the option that all six NEA countries become members of the ECT, whereas others support the establishment of an NEA ECT (Yun and Zhang 2006). At this stage, it is uncertain which option will prevail, but it is safe to say that, even if the six NEA countries decide to establish an NEA ECT to promote even closer energy cooperation among member countries, the experience of the Energy Charter process will provide a reference for regional cooperation in the NEA region. Taken together, these various instruments should be seen as complementary parts of integrated international efforts to strengthen overall global energy cooperation and security.

The institutional arrangements in place at country borders are also important. Despite progress in Malaysia–Thailand railway collaboration, container trucks and their drivers are still not permitted to cross the border in either direction, and boxes must be transported from one set of equipment to another (Stafford 2005). A commission needs to be established or assigned to regulate the cross-border flow of goods and trading.

4.4 Environmental Legislation

The majority of Asian countries have comprehensive and modern environmental assessment legislation in place. However, the implementation of legislation has been a big issue for the region and has depended upon the capacities, power, and resources of the regulatory agencies as well as the overall environmental awareness of project developers. For example, the PRC's EIA law, which took effect on 1 September 2003, mandates that all construction projects must have undergone a proper EIA prior to construction commencing. In January 2005, the PRC's State Environmental Protection Agency (SEPA) called for a halt to 30 industrial projects (the majority of which were power-generating projects) worth CNY119.7 billion, on the grounds that they had not undergone proper EIAs. Many of these blacklisted projects were so-called "national key projects," approved by the powerful National Development and Reform Commission, the PRC's top economic planning agency, and the projects themselves were not necessarily highly polluting. This unprecedented move by the SEPA served as a public education campaign to increase awareness of the EIA law (Zhang 2007a; Zhang 2007b).

Even where EIAs have been undertaken, based on an assessment of the EIAs for three competed projects in the Lao PDR, they have in general tended to underestimate both the environmental and social impacts of their projects and the mitigation costs (Norplan 2004). This may largely be because, throughout this region, EIAs have often been taken as a supplementary requirement that is secondary to overall economic issues (United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP] 2001). Understandably, underestimating environmental and social impacts and their associated costs will make the proposed project look good on paper and thus increase its chance of being implemented, in particular if those projects are favored or put forward by the administrative authorities.

As far as the legislation itself is concerned, it suffers from common weaknesses, namely, inadequacies in: setting out institutional responsibilities at different stages of the process; coverage; requirements and guidelines for impact assessments for projects of different scales; and enforcement procedures. If project developers are to follow guidelines and procedures, legislation needs to be concise, clear, and transparent. All projects must then be required to conduct EIAs in accordance with legislative requirements. EIAs identify types and sources of environmental impacts and develop environmental management plans detailing mitigation and compensation measures and plans for monitoring project construction and operation.

Once EIA guidelines and procedures have been clearly defined, the quality of EIA reports then depends on the credentials of the agencies carrying out the assessments. Unfortunately, EIA laws are often vague on the recommended credentials and scopes of these kinds of agencies. There is a need to establish additional means for defining the

credentials required of agencies that wish to undertake EIAs of construction projects. For example, the PRC introduced new rules effective from 1 January 2006. Under these rules there are two grades of credentials: Grade A and Grade B. The required qualifications for each grade and the corresponding scope of EIA work are clearly specified. An agency with Grade A credentials is allowed to undertake an EIA on any construction project, whereas agencies with Grade B credentials are only allowed to carry out an EIA on a construction project that requires approval by the environmental regulatory agency below the provincial level (SEPA 2005). Therefore, the EIAs of construction projects that range across provinces and river basins can only be done by Grade A agencies. As cross-border projects will, by definition, cross provincial borders, this implicitly means that only Grade A agencies are eligible to perform the EIAs on these projects. To maintain the quality of EIAs, the PRC also limits the total number of agencies awarded Grade A credentials,[9] and provides that all agencies with either Grade A or Grade B credentials will be held accountable for their EIAs. Those found violating the relevant provisions will be downgraded or their credentials' certificate forfeited, and a penalty of one to three times their EIA service charge will be imposed (SEPA 2005).[10]

All EIA guidelines stress the importance of the public consultation and disclosure process. However, an assessment of the EIAs for three competed projects in the Lao PDR (Theun Hinboun, Houay Ho and Nam Leuk) found that consultation and public involvement processes have, for the most part, been inadequate in relation to internationally-accepted safeguard procedures (Norplan 2004). This may be primarily because EIA guidelines are unclear as to the extent to which the public should be engaged in these processes. It is often the case that the project developer starts engaging the public only after the project has received approval from the administrative authorities. At this stage, the public is not in a position favorable to the effective voicing of concerns and suggestions. Therefore, the EIA guidelines need to clearly specify that public consultation needs to be undertaken at the earliest possible stage, albeit conditional upon the public's right to know. At present there are hardly any provisions under the EIA laws throughout the region that stipulate to whom, how, and in what format project information must be disclosed. This hampers public participation in the EIA process.

When preparing EIAs other relevant legislation, for example, on endangered species and environmental quality, etc., also needs to be considered because such legislation may have its own EIA provisions which are relevant to all or part of the project. For example, the Thai National Environmental Quality Act requires an EIA be undertaken for transmission lines that pass through a watershed area of a specified class and an initial environmental examination be prepared if the line passes through a forest reserve (ADB 2004).

As discussed earlier, for a large project that may have sector-wide and/or economy-wide implications, a strategic impact assessment (SIA) needs to be undertaken in order to identify both the potential impacts at these broader levels and the options available to avoid them. However, the current environmental assessment legislation in many Asian countries does not contain SIA provisions. This means that even if externally-funded projects have undergone a proper SIA, the governments of certain countries do not have to commit to its implementation because it is not mandated under their domestic legislation. Moreover, for those countries that do have SIA provisions in their environmental assessment legislation, the provisions are too general to be of much practical use. For example, they do not specify which kinds of projects require mandatory SIA reports, nor the approval procedures for SIA reports once prepared. Thus, detailed regulations need to be established to put SIA provisions into effective operation. This will not be an easy matter, as exemplified in the PRC

[9] The PRC has 201 agencies with Grade A credentials and 772 agencies with Grade B credentials (China Environmental Daily 2005).

[10] The PRC's Ministry of Environmental Protection circulated a notice of criticism regarding three EIA-undertaking agencies highlighting their low quality work and ordering the three-month suspension of one key EIA engineer who took main responsibility for one of the aforementioned low quality EIAs (Sina Net 2009).

whose state environmental regulatory agency drafted the legislation on SIAs in 2005, in order to move the EIAs mandated at the project level to a deeper level of planning, with the expectation that it would be adopted in the first half of 2007. However, as of now this legislation is still under review by the legal office of the State Council (the PRC's Cabinet). The main reason for delay is that the SIA's focus on long-term general interests is in conflict with local governments' focus on pushing for high economic growth in their regions by pursuing projects that can achieve quick, short-term results as well as the sectoral focus on examination and approval rights over planning.[11] Moreover, based on the PRC's tentative legislation, the legitimated planning, examination, and approval agencies will be the ones empowered to approve SIA reports, rather than the PRC's environmental regulatory agency. As a result, environmental regulatory agencies in charge of environmental protection will play more of an advisory role and will not be able to determine the contents of, nor reject, the SIA reports.

4.5 Legal Frameworks for Investment

Cross-border infrastructure investments are highly capital intensive, and involve fixed infrastructure formation and long project cycles with long payback periods. These characteristics make a stable legal framework especially important for these kinds of infrastructure investments. It is the lack of legal frameworks that hampers cross-border projects. Therefore, this section is dedicated to a discussion of business and investment legislation. While the environmental legislation discussed in the previous section is essential to ensuring that the impacts of an approved cross-border project are kept to a minimum or acceptable level, the business and investment legislation will be the decisive factor that determines whether such a project will get off the ground in the first place.

The major subjects that need to be clearly defined in legal frameworks include:

- rights of passage for goods, people, and vehicles;
- measures to facilitate transit rights (e.g., permits, licenses, consents, or other authorizations) and arrangements for compensation to transit states for the rights that they grant as well as for property and risk;
- provision of dispute resolution mechanisms to deal with consultation and settlement of disputes; and
- determination of jurisdiction and responsibility over, or title and ownership of, the offshore segments of a pipeline, particularly those outside a state's own territorial waters.

It is often a tedious process to obtain the required permits. Meanwhile, legal uncertainties resulting from overlapping national, regional, and municipal jurisdictions only compound the problem. In the case of a project that faces overlapping jurisdictions, there is no assurance as to when the project can start, even if it obtains central authorization, because many other local authorizations must be obtained, a process over which the central government has no control. For example, in the case of the aforementioned NIMBY syndrome, NIMBY protests can stem not only from local publics but also from resistance on the part of local authorities who operate in areas that, say, pipelines must cross to serve markets beyond their vicinity. Thus, it is imperative not only to have legal frameworks in place, but also to have streamlined and transparent procedures and sound governance, and clearer lines of responsibility and function at various levels of government. Clearly, there is much scope for governments at all levels to improve in these areas.

[11] See Zhang (2008) for further discussion on coordination between central and local governments on environmental issues.

When it comes to investment protection, the ECT is the only multilateral investment treaty in the energy sector that provides a high level of investment protection. It sets out dispute resolution procedures that allow for binding international arbitration in the event of disputes between states, or between states and individual companies. In the event of investor-state disputes, the ECT mandates conciliation as a first step but if that fails the investor can choose the forum for dispute resolution—either a domestic court or international arbitration. If the investor chooses international arbitration, it can submit the dispute to the International Center for the Settlement of Investment Disputes (ICSID) if one or both parties are party to the ICSID Convention, or the United Nations Commission on International Trade Law, or the Arbitration Institute of the Stockholm International Chamber of Commerce. Awards of such institutions are binding on the parties and enforceable.

4.6 The Role of the Asian Development Bank

ADB's role as an external sponsor, serving as a disinterested honest broker, catalyst, source of assistance (both technical and financial), and mobilizer of external resources, has been an important factor contributing to the success of the Greater Mekong Subregion (GMS) cooperation on cross-border infrastructure planning and development. The multilateral development banks, like ADB, need to continue to play these multiple roles.

In the context of EIAs, ADB has played and needs to continue to play a role in building capacities for the formulation, implementation, and monitoring of EIAs, cumulative impact assessments (CIAs), SIAs, and environmental management plans (EMPs). Well-functioning assessment institutions implicitly require qualified personnel with the right understanding and appreciation of the issues and the ability to make scientific assessments and informed decisions. Given that the management and minimization of the environmental impacts of cross-border projects requires well-functioning regulatory, monitoring, and enforcement capabilities within oversight institutions, it is important that both environmental authorities and project developers are able to prepare EIAs, CIAs, SIAs and to supervise the implementation of EMPs. This calls for a strengthened role for ADB in developing these capacities among both environmental authorities and project developers. As quality of EIA reports has been a big concern, ADB involvement as a project sponsor should help to improve the quality of reports because of its stricter requirements regarding EIAs, which spring from its role, as with other multilateral development banks, as provider of loans and other risk mitigation instruments, such as guarantees.

The involvement of ADB also helps to avoid the underestimation of compensation and resettlement needs, as well as insufficient planning and budgeting for those needs, because a resettlement action plan acceptable to ADB is a prerequisite for project appraisal. ADB also serves as a point of complaint for project-affected people who believe they have received compensation inadequate to restore their lost economic and social bases. In response to reported problems, ADB can facilitate meetings between concerned stakeholders, request a resettlement audit to determine the validity of complaints, and work with the governments concerned to resolve outstanding issues.

5. CONCLUSIONS

Cross-border energy projects not only cut the costs of energy supplies, but also provide local and global environmental benefits by reducing local pollutants and greenhouse gas emissions through the use of hydropower and/or natural gas in place of coal and/or oil. Cross-border transport (highway) projects cut vehicle operating costs and improve traffic safety, and at the same time increase the passage of goods across borders. In addition to these measurable economic and environmental benefits, intangible benefits such as the strengthening of both energy security and regional economic cooperation with neighboring countries may also be generated by cross-border energy and transport projects.

Along with positive benefits, cross-border infrastructure projects can also have potentially negative environmental impacts. Many of these negative environmental impacts, including climate impacts, will occur during project construction, whereas some environmental impacts will occur and be known only during project operation. So project developers need to be able to both anticipate environmental impacts during project preparation and deal with environmental effects during project operation. Depending on its scale, type, and location, a cross-border infrastructure project can have environmental impacts that extend beyond the project level and into the national, subregional, or even global level. Thus, environmental impacts both at the project level and, wherever necessary, beyond the project level need to be taken into account. The adverse impacts identified then need to be avoided to the extent possible, or reduced to a minimum or acceptable level in cases where they can not be completely avoided.

An important lesson learned from the assessment of completed cross-border projects is that carefully investigating project alternatives at the project design stage, and making the corresponding modifications wherever needed, can act as a mitigation measure to help to reduce the negative impacts of the proposed project. A study of alternatives helps to achieve that goal by first determining how the project in question compares with alternative options for the same goal as measured against technical, economic, financial, environmental, and social criteria, and then examining whether the proposed configuration of the project is optimal. Other mitigation measures that can be applied during the project design stage include the careful selection of project sites and routes to avoid their being located in sensitive areas, reduction of the number of camp followers, the development and implementation of a proper contract-awarding system, specification of the green credentials required of head construction contractors, and engagement with project-affected people and communities and other concerned stakeholders in public consultation and disclosure processes in order to determine proper compensation and resettlement settlements and plans.

Cross-border projects also face additional challenges relative to national projects. Technical, regulatory, institutional, and legal obstacles can constrain the development of cross-border infrastructure projects. The countries concerned need to agree in detail to technical specifications and develop harmonized standards for design, construction, operation, maintenance, health, safety and environment, and weights and measures, in order to mitigate environmental risks and impacts. Arrangements for pricing, tariffs, and access and use are especially critical, because under-pricing in receiving markets, excessive transit and user fees, restrictions on or unfavorable transmission of transit access, unclear interconnection requirements, and excessive liability insurance requirements can all obstruct the development of cross-border infrastructure projects.

Cross-border projects can also be hampered by a state's politically-motivated reluctance to become dependent on another country for energy, for reasons of security of energy supply, or to export what is viewed as a strategic national asset. Therefore, governments need to move towards a market-based pricing system and away from practices such as price interventions and tax distortions, which lead to the inefficient pricing of natural gas or power. For wider power grid or pipeline interconnections, more formal arrangements are necessary to provide participants with sufficient assurances on matters such as system operation, pricing or tariffs, transmission or transit access, and fees. The Northeast Asia (NEA) and Association of Southeast Asian Nations (ASEAN) countries could take the relevant article under the Energy Charter Treaty as a reference for dealing with access and use issues and setting transit tariffs. With the GMS Inter-Governmental Agreement on Regional Power Trade as a base and the Regional Electricity Regulatory Authority in Southern Africa as an interesting example, this subregion could explore the possibility of establishing a structured subregional regulatory regime for power interconnections and operation.

Institutional arrangements, either formal or informal, are crucial to the success of cross-border infrastructure projects. The specific institutional arrangements required will vary

depending on the project type, and the level of arrangement will range from the project level to the national level and higher. At the project level, the asymmetric distribution of costs and benefits among the parties involved needs to be addressed, in order to align the costs with the benefits of the main parties. Given that a cross-border project has several country components, there is a clear need to coordinate arrangements among parties to ensure the overall sustainability the project. To integrate regional infrastructure projects with national plans and priorities, national institutional capacities need to be strengthened in order to develop a good understanding of domestic infrastructure programs, priorities, and resources, and the potential domestic benefits of cross-border infrastructure projects. Moreover, there should be a clear delineation of responsibility and accountability, and good coordination across ministries and concerned authorities. Regional institutional frameworks or arrangements are also crucial to effective cooperation on cross-border energy projects. The highly collaborative planning process for the ASEAN Power Grid project, clearly backed by governments and supported by power system experts, is a valuable model. A similar process with political backing is needed in NEA in order to achieve sufficient support for the proposed power grid interconnection. The governments of the NEA could go further and explore the possibility of establishing a formal regional institutional framework for energy cooperation, with a common set of rules and an obligation on the countries involved to observe these rules in practice.

The environmental impact assessment (EIA) legislation in the region generally suffers from inadequacies in: setting out institutional responsibilities at different stages of the process; coverage; requirements and guidelines for impact assessments for projects of different scales; and articulation of enforcement procedures. The EIA laws are often vague with regard to the credentials required and the scope of various agencies involved in EIAs. Thus, there is a clear need to establish additional measures that define the requisite credentials for agencies undertaking EIAs on construction projects. The implementation of completed EIAs has also been a big issue in the region. Further, EIAs have in general tended to underestimate both the environmental and social impacts of proposed projects and their mitigation costs. Moreover, some cross-border infrastructure projects require a strategic impact assessment (SIA) to be undertaken in order to identify both potential impacts extending beyond the project level and the options available to avoid or mitigate these impacts. However, current environmental assessment legislation in many Asian countries does not contain SIA provisions. So, even if externally-funded projects have been subject to a proper SIA, national governments may not have to commit to its implementation because it is not mandated under domestic legislation. Even where current environmental assessment legislation does contain SIA provisions, these provisions are too general to be of any real practical use. For example, they do not specify what kinds of projects require mandatory SIA reports, nor do they specify approval procedures for SIA reports once prepared. In these cases, detailed regulations need to be established to render the SIA provisions fully operational.

Cross-border infrastructure investments are highly capital intensive, and involve fixed infrastructure formation and long project cycles with long payback periods. These characteristics make a stable legal framework especially important for cross-border infrastructure investments. Thus, it is imperative to have the right legal frameworks in place. Equally importantly, there should be streamlined and transparent procedures, sound governance, and clearer lines of responsibility and function at the various levels of government.

Finally, it should be stressed that ADB's role as an external sponsor, serving as a disinterested honest broker, catalyst, source of assistance (both technical and financial), and mobilizer of external resources, has been an important factor contributing to the success of the GMS cooperation on cross-border infrastructure planning and development. The multilateral development banks, like ADB, need to continue to play these multiple roles. In the context of EIAs, ADB has played and needs to continue to play a role in building

capacities for the formulation, implementation, and monitoring of EIAs, cumulative impact assessments, SIAs, and environmental management plans. The involvement of ADB also helps to avoid the underestimation of compensation and resettlement needs, as well as insufficient planning and budgeting for those needs. Moreover, ADB serves as a point of complaint for project-affected people, and in response to reported problems, ADB can facilitate meetings between concerned stakeholders, request a resettlement audit to determine the validity of complaints, and work with the governments concerned to resolve outstanding issues.

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