POLICY BRIEF: STRATEGIC ENVIRONMENTAL ASSESSMENT OF POWER DEVELOPMENT PLANS IN VIET NAM

ADB

GREATER MEKONG SUBREGION CORE ENVIRONMENT PROGRAM

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Cover photo: Stephen Griffiths

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ABBREVIATIONS

CEP-BCI	Core Environment Program and Biodiversity Conservation Corridors Initiative
DSM	Demand side management
EVN	Electricity of Vietnam
IE	Institute of Energy
MoIT	Ministry of Industry and Trade
PDP	Power Development Plan
PES	payment for environmental services
PM	particulate matter
SEA	Strategic Environmental Assessment
SEDP	Socio-Economic Development Plan
VEEP	Viet Nam Energy Efficiency Program

Strategic Environmental Assessment of Power Development Plans in Viet Nam

Under CEP-BCI Phase I, assistance was provided to Viet Nam in conducting a Strategic Environmental Assessment (SEA) of both Power Development Plans (PDP) VI and VII. The PDP is the national-level strategic development plan for power production and utilization in Viet Nam. The PDP VII provides a long-term strategic framework to guide the development of the power sector for the period 2011-2030. It analyzes likely future electricity demand scenarios by sector, taking into account likely future economic and social development trends. It also assesses the most effective, least costly (taking into account full economic costs) methods for meeting this likely future demand.

The focus of the SEA of PDP VII was on optimizing the potential contribution of power generation to national development through a strategic planning approach that balances economic development, social equity and environmental sustainability. This, in turn, reflects the goals of the 2006-2010 SEDP and the Viet Nam 2020 Vision, which underline the national development aspirations of Viet Nam. These principles have been carried through to the 2011-2015 SEDP, which incorporates new regulations and decrees

Photo: Stephen Griffiths

on different aspects of sustainable development and environmental protection. These include: measures to ensure reasonable, effective and sustainable use of natural resources in watershed areas, the expansion of forest coverage and the integration of climate change into strategic planning and natural resource management.

The central goal of PDP VII, to meet future demand through the most effective and responsible strategy for the expansion of generation capacity, is valid and essential. Meeting this goal require a series of trade-offs between the costs and benefits associated with different types of power generation, each of which has a different set of social, environmental and economic costs (and benefits). The same is true for the expansion of the power transmission system, which is essential for distributing the power generated to the right places. These contrasting sets of costs and benefits have been examined in this SEA, and clear conclusions and recommendations have been identified on what is the most effective strategy for the future development of the power sector in Viet Nam.

The calculation of power demand is based on existing power consumption data for each sector, combined with assumptions

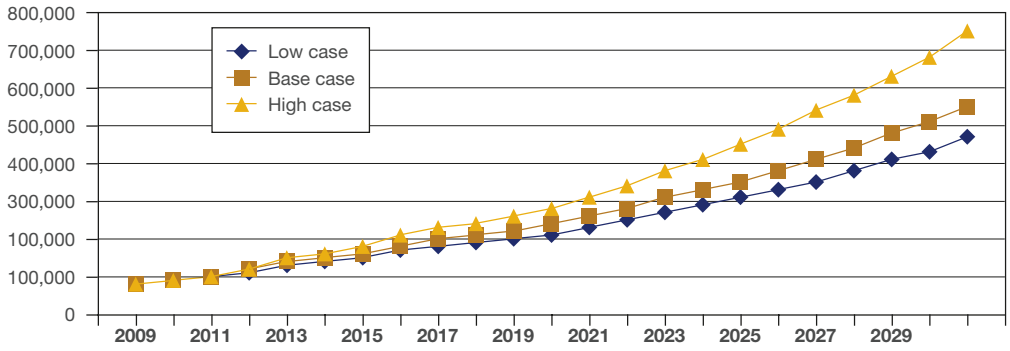

Figure 1.
Power demand forecast figures for the period up to 2030

on the speed and character of socio-economic development during the plan period and on savings from energy efficiency improvements. Three growth scenarios have been used to estimate future patterns of demand: i) a high growth scenario in which economic development remains above 9 percent for the period up to 2030; ii) a base scenario in which growth is around 8 percent for the period; and iii) a low growth scenario where economic growth is between 7 percent and 7.66 percent for the plan period. This analysis has led to the power demand forecast figures presented in Figure 1.

Comparing and Balancing Impacts: The SEA has analyzed the potential social and environmental impacts of the package of generation development options contained in the PDP VII base case. The main conclusions of this analysis are presented here. The impact of the planned expansion of the transmission lines in PDP VII are also discussed.

Thermal power constitutes the largest component of the power generation sector in Viet Nam; it is also the source of the largest social and environmental impacts. The most significant impacts are the atmospheric pollution resulting from the combustion of fossil fuels, particularly coal. Under the plans outlined in PDP VII, CO_2, particulate matter (PM) and SO_2 releases will increase more than seven-fold during the PDP VII period up to 2030, and those for NO_x will increase three-fold. The impacts of these atmospheric pollutants will be severe and widespread. These impacts, it is estimated, will cost Viet Nam nearly US$9.0 billion per annum by 2030 unless actions are taken to reduce the levels of atmospheric pollutant releases, particularly from coal-fired power generation.

Hydropower is the second largest source of power generation in Viet Nam. It has the potential to produce a number of adverse social and environmental impacts. These include the loss of land, the disruption of sensitive ecosystems, the displacement of people and effects on the culture and livelihoods of communities not physically displaced, disruption to hydrological systems and ecosystems that depend on them and other effects. With hydropower, most of the social and environmental impacts are associated with the development of the scheme. The wider effects on people and the environment are a mixture of both positive and negative impacts, with potential improvements to dry season water flows having positive

Year	2011	2015	2020	2025	2030
PM	98.86	134.95	289.57	439.40	710.24
SO_2	93.77	148.09	311.85	448.18	728.74
NO_x	234.15	274.48	386.09	494.30	638.86
CO_2	1,215.50	2,190.50	4,118.70	6,075.90	9,071.90

Table 1.
Total environmental costs for each pollutant (Unit: million US$)

Figure 2.
Thermal power station clusters in north and south Viet Nam

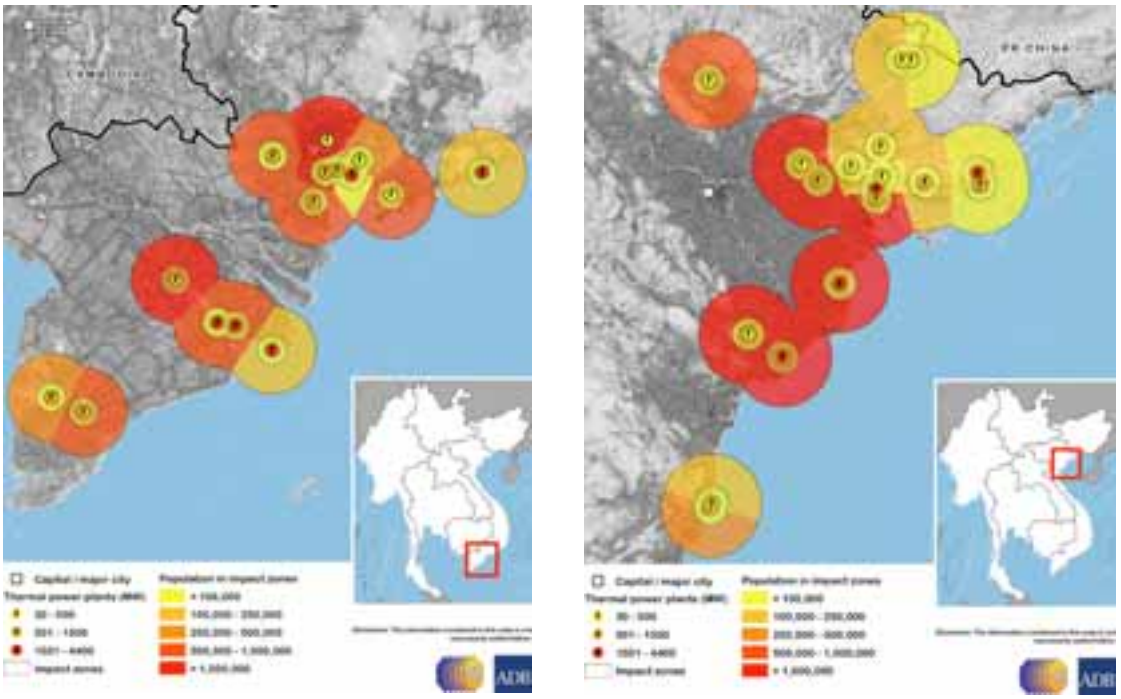

Figure 3.
Construction of a hydropower dam in Viet Nam, 2007
(Photo: Jiao Xi)

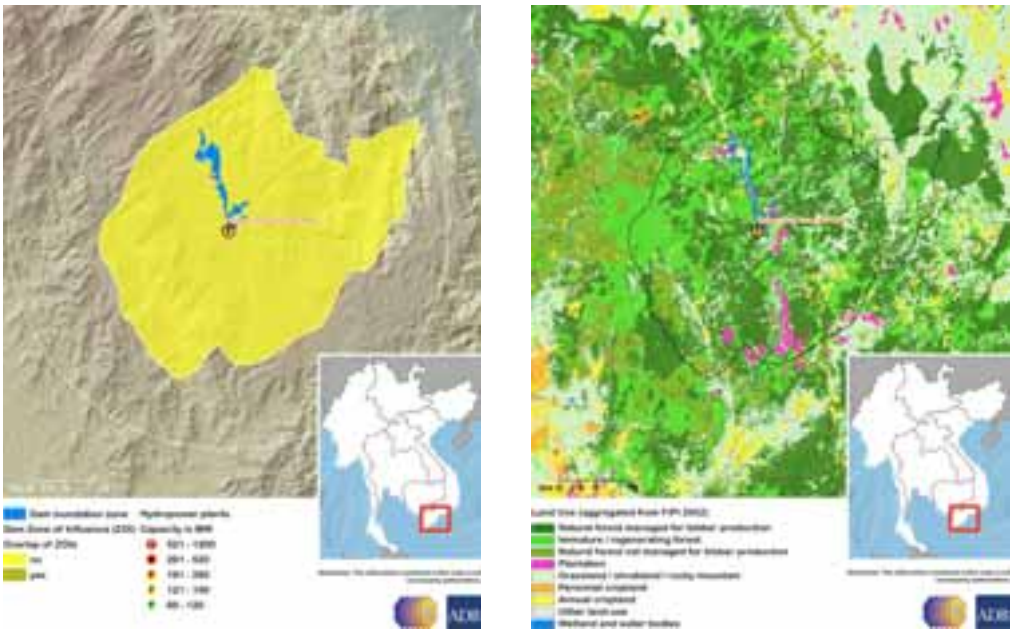

Figure 4.
Examples of Zones of Influence (ZOI) around hydropower schemes: left, Dong Nai 2; right, Dong Nai 2 and surrounding land use

benefits over whole river basins, while several river ecosystems become vulnerable to degradation in the immediate vicinity of hydropower schemes. The impacts of hydropower development are complex and widespread, but many can be minimized depending on how the schemes are planned and developed. The more effective and sustainable approaches to hydropower have the potential to produce the benefits such schemes generate without many of the negative impacts.

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

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

Payment for environmental services (PES): A new national decree will apply a charge of 20 VND/kWh to act as payment for environmental services in the watershed of hydropower schemes in relation to soil conservation and water regulation. These charges reflect environmental services that have, to date, been treated as externalities. This will not be the case in the future and such charges, which will provide incentives for upstream resource owners to manage their lands sustainably, need to be

Photo: John Soussan

reflected in the assessment of the costs and benefits of hydropower development. The charge levels have been applied to the planned generation levels from hydropower for each year of the PDP VII period (2011 to 2030). The levels of PES income generated are significant: starting at US$41,182,000 in 2011 and rising rapidly over the next decade (during which there will be significant expansion of hydropower generating capacity) to reach US$71,152,000 by 2021 and stabilizing thereafter to be US$71,535,000 in 2030.

Nuclear Power will be a new development for Viet Nam. It is a source of power generation that is characterized by risks that are low probability but extremely high in impact if they do occur: reflecting the extreme hazards associated with the use and management of radiological materials. It is essential that Viet Nam develops the capabilities and management systems to handle radiological materials before nuclear power development starts. There are additional predictable impacts that are a cause for concern, especially associated with the use and release of the very high levels of cooling waters that nuclear power stations require. The site selection of the power station is the key issue here: any locations in the proximity of sensitive or high value ecological areas must be avoided and the possible impacts of cooling water on riverine and marine ecosystems must be carefully assessed.

Improved Energy Efficiency: EVN's Demand Side Management (DSM) Assessment Study shows that a savings potential of around 36 percent could be achieved in the residential sector and more than 20 percent and 12 percent could be attained in the industrial and commercial sectors. The World Bank's Commercial Energy Efficiency Program (CEEP), which involves pilot projects in commercial and industrial sectors, shows project savings of 15-30 percent. Although challenging, it is possible to significantly improve energy

Year	2011	2015	2020	2025	2030
Coal (10^6 tons)	10.90	28.2	57.9	89.6	135.1
Domestic	10.60	26.2	39.8	53.2	69.5
Imported	0.34	2.0	18.1	36.4	65.6
Coal reduction (10^6 tons)	**0.60**	**3.8**	**19.2**	**26.9**	**56.3**

Table 2.
Energy Efficiency: Reductions in Demand for Coal 2011-2030

Year	2011	2015	2020	2025	2030
PM	312.91	995.04	3,552.45	4,933.26	9,873.90
SO_2	4,538.23	5,837.31	22,184.68	32,609.93	72,868.86
NO_x	12,140.97	113,65.97	20,593.53	29,154.38	41,291.30
CO_2	6,921.10	115,08.16	39,806.59	49,275.07	104,685.02

Table 3.
Reduction of Pollutant Emissions Compared to Base Case (Unit: ton, CO_2: 1,000 tons)

Year	2011	2015	2020	2025	2030
PM	-45.05	9.72	73.19	101.65	203.47
SO_2	13.19	17.21	65.59	96.41	215.45
NO_x	31.55	36.14	66.38	93.97	133.09
CO_2	644.4	791.7	1,578.7	2,195.8	3,348.1

Table 4.
Reduction of Health Costs (Unit: million US$)

efficiency in Viet Nam. This study considered achieving the 5-8 percent electricity savings target set under the Viet Nam Energy Efficiency Program (VEEP) for the period 2010-2015 and gradually increasing this savings target to 20 percent of the total electricity demand during the period 2015-2030. These targets would bring down the country's electricity elasticity (ratio of growth rate of electricity demand and growth rate of GDP demand) from a high of 1.90 in 2010 to 0.85 in 2030, which is consistent with those of many efficient developing and developed countries.

A scenario was analyzed in which the plans in PDP VII base case were adjusted to increase energy efficiency according to the national strategy. This scenario includes 46 coal power plants with a total capacity of 53,560 MW, including 28 plants in the north (four plants less than the base scenario), nine plants in central Viet Nam (three plants less) and nine plants in the south (nine plants less), as well as a balance of other thermal, hydropower, nuclear and other generation sources to meet the projected demand. Under this scenario, electricity generation savings increase from 1639 GWh in 2015 to more than 22000 GWh by 2030. The reduction of the electricity demand would, potentially, greatly reduce dependency on coal-fired power generation: 16 coal-fired power plants throughout the country that were to be commissioned between 2027-2030, as identified in the baseline scenario, would no longer be needed during this period.

The results show the potential of a sustained effort to increase energy efficiency as a key element in any effort to reduce the negative impacts of coal-fired power generation. The energy savings would save over 56 million tons of coal a year by 2030. This in turn will reduce CO_2 emissions by over 100 million tons a year, SO_2 emissions by over 72 million tons, NO_x emissions by over 42 million tons and PM emissions by nearly 10 million tons. These reduced emissions would have huge benefits in terms of reduced climate change, acidification impacts and greatly reduced risks to human health from the power generation sector. The economic value of these reduced social and environmental impacts is calculated to be over US$3.3 billion, a figure that would be much higher than any likely costs of the energy efficiency measures and investments implemented.

Achieving these high levels of energy efficiency improvements requires successful implementation, enforcement and large-scale replication of the measures identified in the Viet Nam Energy Efficiency Program (VEEP). This includes: i) legislative frameworks on energy efficiency and conservation in all sectors of the economy are formulated and effectively enforced; ii) education and information dissemination systems established, and projects in the residential sector implemented; iii) energy efficiency standards and labeling systems introduced and assistance extended to domestic appliance manufacturers; iv) energy efficiency and conservation management models developed, with support provided to industrial enterprises; and v) capacities strengthened in relation to energy efficiency and conservation in building design and management, as well as successful demonstration of projects related to building energy efficiency improvement.

One of the critical factors, in addition to the regulatory and management measures, is the financing of energy efficiency activities and projects. An energy efficiency fund could be established to support activities and leverage private sector investments. Similarly, the market for energy efficiency services and the establishment of energy efficiency service companies should be stimulated and supported by the government.

Increased Renewable Energy in Power Generation: The second major element of any strategy to reduce the levels of coal-fired power generation needed in the future is to generate the electricity from other sources. Under the existing base case of PDP VII, large-scale hydropower will be close to maximized in terms of feasible hydropower construction sites, nuclear power will be developed at a rate that is feasible for Viet Nam, both oil and gas will be at levels that are as high as is likely to be economically and technically feasible. This leaves further rapid expansion of power generation from renewable energy sources as the outstanding option for reducing coal consumption and impacts through substituting alternative power generation sources.

Under the baseline scenario, the share of renewable energies increases from 3.6 percent in 2015 to 5.8 percent in 2025, but declines to 4.4 percent in 2030 due to the rapid growth of coal-fired power generation. In absolute terms, renewable energies' capacity improves from 1679 MW in 2015 to 6029 MW in 2030. Although significant, these figures can be regarded as conservative and are far below the levels of renewable energy development that would be possible given the potential resource base of these energy sources, particularly wind, solar power and mini-hydro. Consequently, the scope for a more vigorous development of renewable energy as a means of replacing coal-fired power generation has been examined.

The analysis examined an increased proportion of renewable energy from 4.1 percent in the base case to 8-10 percent based on the PDP VII base case, which would mean a capacity expansion of an additional 7800 MW by 2030 when compared to the base case. The target is to attain a 5 percent share in 2015, 8 percent in 2020 and reach close to 10 percent in 2030. This entails raising the capacity from 1979 MW in 2015 to 13829 MW in 2030, more than double the level presently found in the PDP VII base case scenario. At present, grid-connected renewable energies are mainly from small hydropower systems, which are projected to increase from 461 MW in 2011 to 3,129 MW in 2030. Wind power generation will increase from the current minimal level to 2900 MW by 2030. For this renewable energy scenario, an additional 4800 MW of small hydropower systems and 3000 MW of wind power plants are to be installed. This expansion would result in the reductions in the use of coal for power generation and a reduction in atmospheric pollution.

These reduced emissions would in turn produce a significant reduction in environmental costs compared to the base scenario of over US$1.7 billion by the year 2030, reflecting the significant reductions in environmental and human health impacts from the power generation sector. These savings would be permanent, sustained and would far outweigh any

Year	2011	2015	2020	2025	2030
Coal (10^6 tons)	11.20	31.9	75.8	111.9	177.5
Domestic	10.80	29.9	46.2	61.9	64.8
Imported	0.38	2.0	29.7	50.0	112.7
Coal reduction (10^6 tons)	**0.00**	**0.1**	**1.2**	**4.6**	**10.6**

Table 5.
Reductions in Demand for Coal with Expanded Renewable Energy

Year	2011	2015	2020	2025	2030
PM	-7.03	35.23	223.81	849.02	1,941.73
SO_2	377.61	818.72	940.08	4,865.65	13,575.04
NO_x	12,356.55	11,253.20	10,166.70	13,561.26	14,575.81
CO_2	7,440.86	6,635.29	7,056.78	14,736.98	26,264.91

Table 6.
Reductions of Atmospheric Pollution from Expanded Renewable Energy (Unit: ton, CO_2: 1,000 tons)

Year	2011	2015	2020	2025	2030
PM	-57.42	-15.65	4.59	17.48	40.00
SO_2	0.87	2.34	2.76	14.37	40.12
NO_x	31.33	35.43	32.77	43.71	46.98
CO_2	638.50	694.20	938.80	1,472.50	1,739.90

Table 7.
Reduction of Health Costs due to Reduced Emissions (Unit: million US$)

likely increase in the direct financial cost of power generation associated with the use of renewable energy in present conditions. In any case, it is likely that the relative economics of renewable energy, when compared to conventional power generation sources, will change in the coming decades with technological developments and economies of scale as the amounts of renewable energy used around the world continues to expand.

Transmission Line investments in PDP VII will represent a major, but necessary, expansion of the transmission system. There will be adverse impacts, especially associated with the clearance of land along the routes of the transmission lines. The economic value of the forests lost is estimated at US$218 million. The line routes will pass through a total of 59 protected areas and 39 key biodiversity areas. This has potentially negative ecological impacts due to the fragmentation of habitats, with several areas likely to be divided into fragments that could potentially compromise the integrity of high value biodiversity areas.

General Recommendations

On SEAs: SEAs are a relatively new process in Viet Nam. Experience is growing but their effective integration into strategic planning is still limited. The use of SEAs as an integral part of the preparation of PDP VII has demonstrated the utility of this approach, providing a means through which possible issues can be identified and alternative approaches are explored before the plan is finalized. The integration of the SEA process also provides a means through which key stakeholders can be consulted during the plan preparation. Executing an SEA requires capabilities that are often beyond those found in many planning agencies, including the Institute of Energy (IE). It is recommended that further **capacity development** takes place in IE, as well as the MoIT and other agencies associated with them in planning, to strengthen their capability to execute an SEA independently with no external support.

It is further recommended that additional efforts are made to ensure the necessary **data** are available for undertaking SEAs. In this SEA, there were a number of data

Photo: Stephen Griffiths

limitations, most notably on aspects of the calculation and **valuation** of the impacts of the different supply option proposals, the implications of **climate change** for the sector's development and the verifiable potential of **renewable energy** development options. Steps need to be taken to systematically assess and address these data gaps so that future SEAs can provide more rigorous analyses.

The current **SEA Guidelines**, as reflected in Circular No. 05/2008/TT-BTNMT, dated 8 December 2008, provide a strong national framework for the execution of SEAs. However, it has been found that the structure of the SEA report, as set out in Annex 1 of this Circular, is not the most convenient or effective one for producing an efficient SEA report. It is recommended that this required report structure should be reviewed, drawing on international experience and good practice in SEA preparation.

A key step in the full integration of social and environmental issues into the PDP VII is the **internalization of all economic costs** into the calculation of the least costly alternatives for power generation. Important steps towards this have been taken in this SEA but the full internalization into the base case scenario calculations has not yet been possible. This should be developed for future PDPs so that a more rigorous and transparent means to compare the full implications of the different power generation options is available within the core structure of the PDP.

The most important recommendations in this SEA relate to the **reduction of future dependency** on coal as a principle means to generate electricity. The greatest impacts come from coal-fired power generation, with impacts that will cost several billion dollars per year by 2030. A strategy that combines improved energy

Photo: Jiao Xi

efficiency and accelerated renewable energy development would go far in reducing these impacts and it is recommended that such a strategy is elaborated on. This would include further assessments of the potential scale and the best sites for renewable energy development, as well as the means through which greater energy efficiency can be achieved.

The assessment of approaches to improve **management and operational efficiency** in the power sector needs to be explored. This includes options to charge a fee for the use of cooling waters, polluter-paid fees that reflect levels of atmospheric emissions of particular pollutants, the establishment of a management mechanism for the collected fees and the implementation of the recent national decree on the payment or forest ecosystems services in relation to upper watershed management for hydropower development. The MoIT should also define and enforce clear regulations on the technologies to be used for thermal power generation so as to ensure that the highest standards of power generation efficiency and pollution mitigation are found.

For **hydropower**, a number of recommendations were provided for the achievement of a more sustainable hydropower development in the earlier SEA of the Hydropower Master Plan. These recommendations have been examined in this SEA and are still valid. The recommendations fall into three categories: i) recommendations that are concerned with the institutionalization of SEA as part of the strategic planning process for the power sector; ii) recommendations that define actions that are necessary if Viet Nam is to more adequately accord with international best practice for sustainable hydropower development; and iii) other recommendations concerning the larger power sector development context.

Photo: Stephen Griffiths

Actions in all three areas are needed. The present practice of planning in the sector has many strengths but does not adequately take account of social and environmental factors, for instance in decisions on the cost and design of hydropower schemes.

Further specific recommendations for sustainable hydropower development include the improvement of the existing package of support and compensation for displaced people, the multi-purpose management of reservoirs to ensure an integrated approach to water resources management, the development of community forestry and protected area plans for the areas surrounding hydropower sites, and the preparation of biodiversity management plans in localities of high ecological value. It is further recommended that the cancellation of two planned schemes, Dak Mi 1 and Dong Nai 5, should be considered due to the probability of their severe impacts on biodiversity in the future.

For **nuclear power**, two key recommendations are made. The first is the need for a series of steps to develop the regulatory framework and operational capacities for the safe development of nuclear power. Central to this is the development of radioactive management regulations and norms that meet the highest international standards. The second recommendations relate to the site selection for nuclear power, as it is essential that the sites selected do not place any sensitive ecosystems nearby at risk from either the cooling waters or the accidental release of radioactive materials. Sites must be avoided that are close to areas of either ecological sensitivity or high ecological value.

For the **transmission lines**, actions to limit their impact on forest resources and high value ecological areas are needed. This includes the active consideration of re-routing line routes where they will result in the fragmentation of key biodiversity areas or protected areas. The scope for increasing the capacities of transmission

lines to 1,000kV, in order to reduce the total number of lines, should be examined where this is technically possible.

Taken together, these general and specific recommendations would make a significant contribution to reducing the adverse social and environmental impacts of the necessary expansion of the power sector planned in PDP VII. Many negative impacts can be reduced and vigorous actions to ensure that this takes place are essential. Of course, all such impacts cannot be eliminated altogether and there should be a transparent recognition of the likely trade-offs needed for the effective development of the sector. Further analysis of costs, benefits and further consultations with relevant stakeholders are both essential and should be continued once the present SEA finishes and PDP VII is finalized.

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