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Welfare Impacts of Electricity Generation Sector Reform in the Philippines

Natsuko Toba

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NATSUKO TOBA

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Natsuko Toba is a poverty reduction economist in the Infrastructure Division, East and Central Asia Department, Asian Development Bank. The author expresses appreciation to Ian Hodge, Michael Pollitt, David Newbery, Jon Stern, Preetum Domah, and two anonymous referees. Participants at the Regulation seminar in May 2001and the Land Economy seminar in April 2002 of the University of Cambridge also made valuable comments.

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FOREWORD

The ERD Working Paper Series is a forum for ongoing and recently completed research and policy studies undertaken in the Asian Development Bank or on its behalf. The Series is a quick-disseminating, informal publication meant to stimulate discussion and elicit feedback. Papers published under this Series could subsequently be revised for publication as articles in professional journals or chapters in books.

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ABSTRACT

This paper reports an empirical investigation into the welfare impacts of introduction of private sector participation into the Philippine electricity generation sector, through liberalization of the market for independent power producers (IPPs) during the power crisis of 1990-1993. This study uses a social cost and benefit analysis. The main benefits came from IPPs, which contributed to resolving the crisis and promoted economic and social development. Consumers and investors are net gainers, while the government lost and an air pollution cost was incurred. The paper concludes that reform with private sector participation increased social welfare.

I. INTRODUCTION

Sector reform has been a major pillar of policy agendas across the world since 1980. Common reasons across all sectors are government failure and financial crisis, institutional failure, technological advancement, and globalization. Increasing private sector involvement in government activities such as infrastructure services assumes that resources are better allocated through market mechanisms in a competitive and decentralized environment, rather than through the highly centralized and bureaucratic decisions of government. There is an ongoing debate on the superiority of performance of private versus government-owned enterprises. This paper presents a social cost and benefit analysis to contribute to the debate on ownership effects on social welfare, focusing on the electricity generation sector in the Philippines.

This paper is organized as follows. Section II provides a brief background on the Philippine electricity sector. Section III briefly discusses the theoretical and empirical review surrounding the issue of ownership effects. Section IV discusses the methodology used, Section V the data, Section VI the scenarios, Section VII the results, and Section VIII concludes.

II. BACKGROUND ON THE PHILIPPINE ELECTRICITY SECTOR

A. Generation Sector Profile

In 1999, the country's electric generation capacity was 12 GW; electricity generation was 40,745 GWh;[1] and electricity consumption was 37,900 GWh (US Energy Information Agency 2002). A breakdown is shown in Table 1.

In 1998, electricity generation was 41,192 GWh[2] while total installed capacity was 11,788.6MW, of which small island grids shared only 1.47 percent (oil-based, 1.46 percent; hydro, 0.02 percent) (Department of Energy [DOE] 1999). The Philippines has tried to reduce its dependence on fuel imports.

Table 1
Philippine Electricity Capacity Profile

CAPACITY	OIL-BASED	IMPORTED COAL	LOCAL COAL	HYDRO POWER	GEOTHERMAL POWER	NATURAL GAS
Electricity generation (percent)	47.01	19.23	3.89	10.25	19.57	0.05
Total installed capacity (percent)	48.15	8.91	7.21	19.54	16.17	0.03

[1] Consisting of 65 percent thermal; 19 percent hydro; and 16 percent geothermal, solar, wind, wood, and waste.
[2] From the International Energy Agency's *Energy Balance of Non-OECD Countries 1997-1998*, cited in documents obtained from the Japan Electric Power Information Center.

Around 8 percent of the country's self-supply of total energy in 1973 had increased to over 40 percent by 1997. The only indigenous energy resource that merits significant investment is geothermal steam. The proportion of imported oil to total energy was reduced from 92 percent in 1973 to 50 percent in 1999 (DOE 2000). The share of indigenous oil within the total energy mix was expected to increase from 0.11 percent in 1998 to 2.18 percent in 2009, contributed by the Malampaya offshore field (DOE 1999, 2000). The average annual electricity generation growth from 1973 (10,910 GWh) to 2000 (40,700 GWh) was about 5.3 percent.[3]

B. Historical Context

Under the macroeconomic stabilization program of the mid-1980s introduced by President Aquino after the fall of the Marcos government, an overall public sector investment in the Philippine economy was cut back sharply. In 1986, energy investment was only 30 percent of the 1979 level in constant prices. Furthermore, the government decided to mothball its one nuclear power plant that had received most of the 1970s investments and was designed to meet an increasing power demand. As a result, between 1988 and 1993, the Philippines experienced a major crisis in electricity supply due to generating capacity deficits, which greatly affected national economic and social development and stability. At the depths of the crisis in 1992-1993, brownouts averaging seven hours per day (4-8 hours in Luzon and up to 12 hours in Mindanao) were common in many regions of the country, hurting industrial production and development of new and commercial recovery projects of the Aquino government. These brownouts led to unemployment and economic loss, estimated at 1.5 percent of GDP per year by the World Bank[4] and at US$1-1.3 billion by the business community (in 1993 prices) (World Bank 1993). Many essential services were jeopardized both directly and indirectly, as the power outages interrupted other key services that depended on electricity such as traffic management, pumped water, and sewerage (World Bank 1993, 2-3). Real annual GDP growth rate fell from 6.1 percent in 1989 to –0.99 percent in 1991, and to 0.72 percent in 1992 (DOE 1999).

With the stabilization of the power situation in 1994, the economy posted a real annual GDP growth rate of 4.4 percent (DOE 1999). The power crisis had also stimulated the development of many inefficient and expensive self-generators. To mitigate the shortages, 1600 MW generation-capacity generation sets were reported to have been imported in 1993 (World Bank 1994a, 10).

The main causes of the power crisis were, inter alia; (i) rapid growth of electricity demand; (ii) mothballing of a completed nuclear plant without alternative generation capacity; (iii) lack of government equity infusion into the government-owned generation and transmission monopoly National Power Corporation (NPC), coupled with lack of a long-term debt instrument in the domestic financial system; (iv) inordinate delays in implementing new base load plants and in environmental clearances due to public protests; (v) declining hydro power generation capacity; (vi) insufficient maintenance of aging power plants causing frequent and prolonged outages; (vii) standardization (e.g., salary conditions, etc.) in administration of all government agencies including NPC; and (viii) politicized tariff adjustment process, which further constrained NPC's financial capability.

Ironically, the crisis followed the government's substantial steps to strengthen NPC both

[3] Calculated from 1973 data of DOE (1999) and from 2000 data from the US Energy Information Agency (2002).
[4] Estimated by the World Bank (1993, 2), using US50 cent/KWh as the cost of unserved energy.

operationally and financially. Moreover, because its existing capacity was considered sufficient to meet projected increases in demand till about 1991, although NPC did have sufficient lead time to implement least cost additions to its generating capacity, it did not make use of the time to invest in much-needed new capacity.

Just before the power crisis, the government promulgated Executive Order (EO) 215 in 10 July 1987 to end NPC's generation monopoly, and designated NPC to accommodate the Philippine National Oil Company (PNOC), which could not sell the geothermal steam it was developing to NPC since the government's required royalty increased the cost of geothermal steam-powered electricity well above that of coal and oil-fired alternatives (World Bank 1994a). As the power crisis deepened and private development came to be viewed as the only viable approach for quickly addressing the shortages, the government developed a plan to privatize the power sector by rewriting exclusionary laws, drafting new policies to support IPPs, streamlining clearance processes, restructuring the public energy sector policy departments and regulatory agencies, and removing constraints to broader participation of IPPs in Build-Operate-Transfer (BOT) and similar arrangements. In that context, EO 215 developed a legal framework to enable foreign investors to win and operate generating facilities.

EO 215 laid the foundation for private sector participation in the Philippines (World Bank 1994a). Rules, regulations, and Congressional endorsement came through in 1989, subsequently legislated as Republic Act (RA) 6957, dated 9 July 1990 (World Bank 1994a). The policy objectives of this Act are to (i) recognize the indispensable role of the private sector for infrastructure development; and (ii) provide the most appropriate incentives to mobilize private resources for financing the construction, operation, and maintenance of appropriate infrastructure projects, freeing the government from financing and undertaking such projects (World Bank 1994a). Also, under the Electric Power Crisis Act of 1993, the President was granted special powers to solve the energy crisis, such as facilitation of tariff increases, acceleration of project approvals, and salary improvements for technical staff in the sector (World Bank 1993).

Since the successful commissioning of the first IPP project (a 210 MW Hopewell Navotas gas turbine project) in 1991 that the NPC contracted via a negotiated process, the Philippines has successfully attracted further private offers for power generation (e.g., about US$5 billion in 1994 prices in foreign investments between 1992 and March 1994) (World Bank 1994a). The NPC has continued to implement various types of scheme for IPPs, including BOT, Build-Own-Operate (BOO), Build-Transfer-Operate (BTO), Rehabilitate-Operate-Lease (ROL), Rehabilitate-Operate-Maintain (ROM), and Operate-Lease (OL), providing a total capacity in excess of 3500 MW and completing installation of 1,300 MW by 1993 (World Bank 1994a). Most of the early IPP projects were made via solicited and unsolicited proposals followed by negotiated arrangements, although competitive bidding procedures were introduced later. In 1997, IPP generation increased to 46.3 percent of total generation or about 35 IPPs. By the end of 1996, the private sector had completed 3,270 MW of installed capacity on a mostly BOT or BOO basis. An additional 5,655 MW of power plant capacity had either been contracted or was under negotiation with the IPPs and was scheduled for completion between 1997 and 2004. The private sector had also become involved in the rehabilitation and operation of a number of NPC's power plants. As of 31 December 1996, private participation in the operation of power plants with a total installed capacity of 1,299 MW had been arranged under ROL and ROM contracts. In addition, the NPC Power Development Plan as of December 1996 had provided for distribution utilities such as Manila Electric Company (Meralco) to make arrangements with the IPPs for the construction of power plants with a total installed capacity of 11,274 MW (ADB 1997).

The government's introduction of private participation in the electricity sector was indeed a major success in ending the power crisis, and its approved IPP contracts have contributed to the improvement of the environment for foreign investment in the Philippines as a whole. To put an end to the crisis, "fast track" plants were constructed. Most of the fast track plants were gas turbines, which are characterized by low capital cost, short construction period, and high operational costs typical of peaking facilities. However, for these capacity additions to meet unmet demand, they were run at plant factors more appropriate for base load facilities. As these were the first investments by IPPs in the Philippines, the government offered generous terms and favorable risk-sharing arrangements. Under power purchase agreements (PPAs) in these early projects, NPC assumed market, fuel supply, location, and foreign exchange risks, with the government providing a performance undertaking on behalf of the NPC. The terms of the PPA included government-guaranteed commercial obligations of NPC and off-take through take-or-pay provision, including substantive incentives to exceed that off-take and thereby run the facility as a base load or intermediate plant. Most of these early projects were undertaken at a time of relatively stable exchange rates. The sustainability of these PPAs tended to become vulnerable in the face of major shocks such as the Asian financial crisis in 1997, as they lacked appropriate mitigating mechanisms and procedures in dealing with such circumstances (Stern 2001).

In addition to the high cost of gas turbines whose direct operational costs were very high, payments were 90 percent or more based on capacity due to the high utilization factors to alleviate the power shortage. Thus, these high-cost plants needed to be operated in very low utilization factors once appropriate base plants become commissioned. IPP plants were neither cheaper nor more fuel-efficient than NPC plants. This was justifiable since the fast track projects' reduction in power outages avoided large costs to the economy.

However, after the end of the power crisis, although later IPP projects became less expensive and regulation over them has improved, IPP contracts that are still unfavorable to NPC have been exacerbating the NPC's already chronically weak financial position. The regional economic crisis since 1997 especially hit NPC because a considerable proportion of payments to IPPs is denominated in foreign currency. The decreased energy demand due to the crisis meant that NPC had to run the IPPs' costly plants at relatively high capacity utilization factors due to the take-or-pay contracts, instead of running their own cheaper plants at higher capacity. As a result, the external balance of government deteriorated to the extent that it could no longer continue to guarantee these projects. Although the electricity tariff settings to the distribution sector and its customers are highly politicized involving multiple levels of cross subsidy, these prices had to be increased as a result. These developments in turn caused a further deterioration of the already financially and operationally weak distribution sector. The subsequent increasing oil prices and political turmoil after the crisis of 1997 put the Philippine electricity sector further into dire straits.

These trends toward increased private development in the power sector, taken together, indicated that a major transformation in the structure of the power sector had already taken place. While the government was addressing many constraints to private sector-led growth in this sector, little attention has been paid to ensuring that the resulting structural framework would serve the national interest.

The government has been considering further radical reform and the eventual privatization of the entire power sector for a few decades now. Many proposals and studies have been made of alternative structural models for reform.[5] The present arrangements of the electric power sector are putting major financial, operational, and institutional constraints on government capacity to maintain a stable, efficient, and cost-effective sector. This was even further aggravated by the regional financial and the country's political crises since 1997. Introducing competitive electricity markets will lead to an improvement of governance related to additional supply capacity, a shift of market risk to the private sector, removal of the heavy financial burden from the public sector, and a downward pressure on power tariffs. The government expects that the resultant efficiency gains will enhance the export competitiveness of the country's industries.

The current partial privatization of the generation sector is incomplete with many problems as explained above. However, nobody has actually questioned and quantified the extent to which this was costly or beneficial to society as a whole. It would be useful to evaluate this partial privatization, so as to gain some insight on the sector reform and total privatization still pending as well as to indicate useful lessons.

III. THEORETICAL AND EMPIRICAL REVIEW ON OWNERSHIP EFFECTS

Pollitt (1997) discusses several approaches to examine differences in performance between private and government-owned electricity enterprises, whose literature is dominated by direct comparisons of performance between private and government owned electric utilities (e.g., Pollitt 1995). The approaches include analysis based on: (i) financial and physical indicators (e.g., Yarrow 1992); (ii) labor productivity or total factor productivity (TFP) (e.g., Haskel and Szymanski 1992); and (iii) frontier analysis (e.g., Burns and Weyman-Jones 1994), such as data envelopment analysis. All these approaches are, however, partial approaches to welfare measurement.

The number of studies focused on welfare impacts is small compared to the other approaches. There are two studies on poverty and consumer impacts of Philippine electricity sector reform (Asian Development Bank [ADB] 1998, Navigant Consulting Inc. 2001). The poverty impacts assessment study assumes, inter alia, subsidy removal; NPC will not retain all their employees; and competition will generate efficiency gains. The consumer impacts assessment analyzed partial equilibrium effects as a short-term assessment and general equilibrium effects as a long-term assessment. The main assumptions adopted are subsidy removal and that price will reach a long-run marginal cost (LRMC) plus a universal levy of P0.23/KWh.[6] A study on Argentinean electricity sector reform also analyzed general equilibrium effects and estimated efficiency gains based on a few years' data after the privatization of the electricity service utilities (Chisari et al. 1999). These studies analyzed the welfare impacts of electricity sector reform but did not provide a pure measure of difference in performance between government-owned and private electricity enterprises. This is because these studies did not analyze the differences in performance between privatized enterprises under sector reform and state-owned enterprises going through comparable sector reform. Social cost and benefit analyses of the electricity sector reform in Chile (Galal et al. 1994) and the United Kingdom (Newbery and Pollitt 1997, Domah and Pollitt

[5] For example, Stubbs and Macatangay (2002) analyzed the British experience of electricity sector privatization to provide lessons for the Philippines.

[6] A universal charge through the Electricity Regulatory Commission (ERC) is to be imposed to meet costs associated with missionary electrification, usage of indigenous resources, environmental cost, removal of cross subsidies, and NPC's and distributors' stranded liabilities upon privatization (Government of the Philippines 2001).

2001) did analyze such difference. This social cost benefit analysis basically designs a behavioral and cost model of an industry and simulates it over the postprivatization period with and without the sundry changes attributed to the privatization. Thus a counterfactual scenario (viz., enterprise without divestiture) is constructed to serve as control group as opposed to an actual scenario (viz., enterprise with divestiture) as treatment group. This paper adapts this methodology.

Many theoretical and empirical studies conclude that while they support superior performance of private enterprises, ownership is not per se a major determinant of differences in efficiency and social welfare, as discussed in Pollitt (1995). The institutional changes associated with private sector participation/ownership could also affect the differences. While frequent progress evaluations are necessary, the private sector participation/ownership phenomenon could be too recent to distinguish between the outcomes derived from the legacy of the past state ownership regime and those from the private sector participation/ownership.

IV. THE SOCIAL COST BENEFIT ANALYSIS METHODOLOGY

Galal et al. (1994) identify three main groups in society—consumers, private producers, and government—as their framework in assessing the impacts of privatization on the economy. A full social cost and benefit analysis can, in theory, address the impact on economic efficiency and equity. The first objective is to answer the question: Does the cost of introducing IPPs warrant the current benefit gained by the society? The second objective is to address the distributional aspect of the problem: Who gained and who lost in the process of private sector participation? The former question concerns the productive efficiency and environmental impacts of IPP participation, while the latter issues relate to equity.

This paper's general approach is to set up and compare two scenarios: NPC and IPP. Under the NPC scenario it is assumed that NPC continues to control the bulk of new electricity generation under public ownership. Under the IPP scenario, introduction of private sector participation in electricity generation is assumed. Comparison of these two scenarios (with associated sensitivity analysis) allows putting a value on the policy of introducing IPPs into the Philippines. In line with Galal et al. (1994), the NPC scenario may be considered as involving continuing government operation, and the IPP scenario as involving private operation.

The fundamental methodology of Jones et al. (1990) is followed:

$$\Delta W = V_{sp} - V_{sg} + (\lambda_g - \lambda_p)Z, \quad (1)$$

where

ΔW = change in social welfare

V_{sp} = social value under private operation

V_{sg} = social value under continued government operation

λ_g = shadow multiplier on government funds

λ_p = shadow multiplier on private funds

Z = actual price at which sale is executed

The given reform will increase social welfare if ΔW is positive.

Alternatively, welfare change can be expressed as a distributional function as in Equation (2) below, which is adapted from Galal et al. (1994):

$$\Delta W = \Delta S + \Delta \pi + \Delta G + \Delta L + \Delta E \tag{2}$$

where

ΔS = change in consumer surplus and avoided cost

$\Delta \pi$ = change in private (investors') profit

ΔG = change in effects on government via income and tax

ΔL = change in effects on providers of inputs, of which labor is the most important

ΔE = change in externalities cost-effects on others arising from impacts on environment and natural resources, i.e., air pollution costs

Equation (2) defines the NPV of change in welfare as the sum of the NPV of changes in welfare for each of the groups directly (as in a partial equilibrium model) affected by the private sector participation in the generation sector. The resulting impact on social welfare is calculated firstly without giving social weights and secondly by giving two different sets of social weights taken from different sources. Social weights recognize a different social value of each monetary unit of consumption by each agent.

Before the estimation of distributional social welfare effects using the model postulated in Equation (2), net welfare impact is estimated by constructing a model as follows:

$$\Delta W = \Delta I + \Delta E + \Delta R \tag{3}$$

where

ΔI = change in investment cost (capital, coal, oil)

ΔE = change in externalities cost (air pollution cost from oil and coal plants: e.g., gas turbine, imported or domestic coal, geothermal, hydro, etc.)

ΔR = change in restructuring cost (controllable cost, avoided cost, and privatization and subsidization cost)

The elements of the welfare functions in Equations (2) and (3) are discussed in Section V below.

V. DATA

The data set covers the preprivatization and postprivatization periods over the last 5-10 years. All data are disaggregated and detailed as much as possible. Most of the data and information used for the social cost and benefit analysis were collected from the field, whereby different locations were visited including: government agencies, nongovernmental organizations (NGOs), international organizations, universities, and private companies. Data were collected from sources outside the Philippines.

Data from 1988 up to 1997 were gathered (some were from 1983 and others were up to 2000). Based on these data, projections until 2010 were made, although some projections go further. Based on the data and documents, actual and counterfactual scenarios were constructed. The actual scenario is referred to as "IPP scenario (the generation sector shared between NPC and IPPs)" and the counterfactual as the "NPC scenario (the generation sector continuing NPC monopoly)."

A. Controllable Cost

Generation is now shared between NPC and IPPs but transmission is still an NPC monopoly. Accounts on generation and transmission sectors were reconstructed for the actual IPP scenario by consolidating the accounts of NPC and IPPs, and for the counterfactual NPC scenario, by estimating the "would-have-been" NPC accounts without IPPs.

Efficiency gains are examined in terms of savings in controllable cost following Newbery and Pollitt (1997), which includes such costs as manpower-related cost; operating and maintenance cost including materials and services, but excluding costs of fuel, depreciation, and depletion (of mineral sources); local government tax; and provision for doubtful debts. The major data required and details to estimate controllable costs are presented in Table 2. It was estimated that NPC's controllable cost would have been about 14.6 percent higher than IPPs' if NPC plants had been constructed instead of IPPs during the crisis. NPC's controllable cost is assumed to decline, with the influence from the IPPs, as discussed later.

B. Capital Cost

Estimates of the capital costs for each type of plant are presented in Table 3. Results show that, excluding interest charges, annual NPC project costs were lower than IPP project costs. Assuming that the time taken for construction of NPC projects is the same as that of IPPs, annual NPC project cost is about 96 percent that of IPPs.[7] The reasons for the higher capital cost of IPP projects could

[7] An interest rate on project cost is assumed to be 12 percent in the IPP scenario and 7 percent in the NPC scenario. From 1999, an interest rate of the IPP scenario at 9.5 percent is assumed to reflect increased competition and better negotiation of NPC for IPP contracts.

Table 2
Controllable Cost of the Generation Sector

ITEMS	SOURCES AND DETAILS
Controllable cost of the NPC	As NPC accounts include its transmission sector, the transmission and distribution cost components including associated manpower-related costs are subtracted.
Controllable cost of IPPs	Purchased power cost obtained separately from various unpublished documents of ADB, World Bank, and Philippine Energy Regulatory Board are used to estimate controllable cost of IPP.
Controllable cost of the NPC plants that would have been constructed instead of the IPP plants	To compare BOT coal plants with NPC turn-key coal plants, the source is World Bank (1994b, Annex 21); to compare with the NPC's Masinloc coal plant (turn-key), the source is ADB (1995, Appendix 6).
NPC and IPP-generated units (KWh)	NPC unpublished data were obtained, showing actual generation data for NPC-operated plants and IPP-operated plants owned privately and owned by NPC for 1990-1999.

Table 3
Capital costs for IPP and NPC projects

ITEMS	SOURCES AND DETAILS
IPP project costs	IPP project cost estimates were based on published and unpublished data from the Philippine National Oil Company–Energy Development Corporation (PNOC-EDC) (1998), ERB, and World Bank reports, representing data on a total of 34 IPP projects for 1990-2001. For those IPP projects for which cost data were unavailable, the average cost of similar types of plants constructed elsewhere is used.
NPC project costs	To supplement the very few available data from NPC annual reports and development plans and to make future projections, data from a *Financial Times* publication (Daniel 1997) are used. As many plants in the Philippines are constructed by international constructors, the use of such data was assumed to be appropriate in this study.

be, due to the urgency to end the crisis, there were (i) insufficient procurement time and procedures by NPC; (ii) inadequate time for IPPs to specify and canvass equipment and technologies; and (iii) competition that may have inflated the project costs. Also, most of the projects used a project financing method (off-balance sheet, nonrecourse or limited recourse financing), which is riskier and more expensive (e.g., high interest rates and debt proportion, short-term repayment period unmatched to plant life) than corporate balance sheet financing (see Clifford, n.d.). Lack of experience in project financing in the Philippine electricity sector might also have incurred higher preparation, transaction, adjustment, and administrative costs; and the project cost data obtained may not have included cost overruns. After the 1983-1993 Philippine power crisis, the above situations were improved. The prices and costs of postcrisis IPP project plants in the Philippines, were, on average, 12 percent lower than those of the initial IPP projects (World Bank 1994a).

C. Fuel Cost

Fuel cost is examined as part of the changes in investment cost. Power purchase agreements between NPC and IPPs require NPC to supply expensive diesel oil and less expensive bunker C oil to IPPs, regardless of the fluctuations in oil prices and exchange rates and their contribution to higher air pollution, which lead to distortion of the least cost dispatch. Based on available data from NPC, the oil costs per KWh of land-based and barge gas turbines are, respectively, about 1.97 and 2.29 times higher than those of other oil-based plants on average during 1993-1999. The cost of coal was calculated from ADB data on cost, insurance, and freight (CIF) price, which was $34.2/ metric ton in 1995, adjusted by relative movements in World Bank commodity price projections until 2022; and from 2022 to 2034, the year of termination of the last plants concerned, at a constant 2022 price (ADB 1995, 41).

D. Avoided Cost

The main benefit of partial restructuring of the generation sector is that IPPs solved the power crisis one year earlier than NPC alone could have done, given the financial and institutional constraints on NPC. This one-year generation gap between the IPP and NPC scenarios is an economic cost to the society arising from power shortages, which would have delayed economic recovery and growth, and development one year further. This benefit is referred to as avoided cost, i.e., the cost to consumers in the absence of an adequate service, assuming that NPC would have been unable to complete similar projects during the shortage period. The avoided cost was derived from a World Bank estimate (in 1994 prices: US$0.43/KWh of lost output for 1991-1993 and US$0.28/KWh for 1994 onward) (World Bank 1994a). This is derived from NPC's estimate of US$0.50/KWh in 1994 prices for the gross economic cost of outages that the NPC uses in its planning process. While further information and data on how the NPC and the World Bank arrived at these costs are not available, these estimates are quite conservative compared to other estimates for the Philippines and other countries (for review, see Toba 2002, Willis and Garrod 1997). According to the World Bank, this was lower than the estimated outage cost in other developing countries, but it was consistent with the conditions predominant in the NPC's power system. This is because after a long period of unreliable service, consumers tended to be better prepared for outages and a large number of consumers have purchased a total of 1600

MW of generating sets as backup units during the crisis, thus reducing its impact. On average, this avoided cost was 6.8 times the NPC wholesale tariff and 4.0 times the retail tariff (Meralco's tariff) during 1990-1993 in real terms.[8]

From 1994 onward when the situation normalized after the end of crisis, on average, this avoided cost was 4.6 times the NPC wholesale tariff and 2.7 times the retail tariff (Meralco's tariff) during 1994-1997 in real terms. This is the cost of the best alternative energy supply of NPC instead of the more expensive electricity supply from IPPs, estimated as the cost of alternative NPC projects implemented under a turn-key modality for construction and operation (World Bank 1994a, 44). The power shortage in a normal situation would not have affected the society and economy so severely as minor brownouts and blackouts occur in the Philippines even during normal times and the people are used to them. From 1998 onwards, enough capacity and NPC's capability to complete their projects on time were assumed so that there was no avoided cost.

E. Externality Cost

Concurrently, there are externalities arising from plant and fuel use and investment. In order to be consistent within the context of social cost benefit analysis, differences in the environmental impact between the NPC and IPP scenarios need to be evaluated. This is especially important because the introduction of IPPs has negative environmental impacts. Most obvious are the air pollution effects. Two different sets of air pollution data were used. Pollution Data 1 (carbon dioxide, particulates, sulfur dioxide, and nitrogen oxide) estimate air pollution costs of different types of plants per KWh in the Philippines, which were estimated by Logarta (1994) at 1993 cost levels. Pollution Data 2, which were obtained from ADB, consist of carbon dioxide and nitrogen oxide emission costs and have been used to estimate emission costs of diesel fuel, bunker fuel, and coal plants in this analysis. Pollution Data 2 provide average annual global climate change damages from carbon emissions as 1992 US$/ton of carbon emissions (ADB 1996, Appendix H). Indirect nitrogen oxide effects (premature respiratory disease, 70 percent; adult chronic morbidity, 10 percent; material soiling, 10 percent; acute morbidity, 5 percent; and visibility reduction, 5 percent) were reported because nitrogen oxide emissions can contribute to deleterious effects caused by ozone and fine particulates, which are themselves formed by the release and transformation of nitrogen oxide emissions. Pollution Data 2 are chosen for the base analysis as they provide more information. Sensitivity analyses are performed using the other data set.

F. Privatization and Subsidization Cost

There are very limited data on the cost of privatization of NPC triggered by the introduction of IPPs. However, privatization and subsidization cost was documented in the income statements of NPC annual reports from 1996. This cost includes accelerated retirement benefits such as gratuity

[8] NPC tariffs are taken from NPC annual reports and retail tariffs are taken from Meralco annual reports.

pay, terminal and accrued leaves, etc. and the expenses incurred by the Privatization and Restructuring External Office of NPC. This data was available until 1999. As projecting this cost is highly speculative, from 2000, an average cost of the available years was used for the projection ending in 2003.

G. Consumer Surplus

Detailed unpublished electricity price data were obtained from NPC, ERB, Meralco, World Bank, and ADB to calculate consumer surplus. In 1995 automatic tariff adjustments on fuel and exchange rate fluctuations were implemented. Since 1996, ERB allowed NPC and the distribution sector to make a partial adjustment to their prices to reflect the fluctuation of power purchase costs. Until these automatic tariff adjustments were introduced in 1995, the NPC scenario is assumed to have the same tariff as in the IPP scenario. From 1995, the counterfactual scenario's retail electricity prices were based on estimates of NPC's operating costs and the rates of return on assets that were obtained from its annual reports. Up to 1999 for which data were available, the actual rate of return was applied and from 2000 a rate of return of 8 percent on asset base (the percentage required in compliance with the World Bank and ADB's loan covenant) was used.

H. Government Benefits

Government benefits are represented by transfers to the government. As a government-owned corporation, NPC's net income was assumed to be a transfer to the government. Under the NPC scenario, transfers were measured using an actual net income return on rate base obtained from NPC's annual reports. Where actual rates were not available, it was assumed that a return of 3 percent would be earned on the rate base, following trends of the past data. Under the IPP scenario, an estimated corporate tax from IPPs was added in addition to an estimated NPC net income presented in its annual reports. Earlier IPPs had income tax holidays for the first 7 years of operation, thus it was assumed that IPPs would pay an income tax accordingly and that from 2005, all IPPs would pay the tax.

I. Private Benefits

Deriving from Equation (2) in Section IV, private (IPP) net benefits are the residual after subtracting the discounted consumer net benefits and government net benefits from total net benefits (DW) excluding externalities. Private profits are further allocated between foreign and domestic investors, assuming 75 percent of the profit goes to foreign investors and 25 percent to domestic investors, as most of the IPP projects are financed from foreign sources.

J. Employee Benefits

Since 1996, NPC has been downsizing its workforce in preparation for privatization through the Special Disengagement Plan. NPC estimates that the proportion of casual workers with a college degree or vocational training is about 90, and that they are likely to be able to find alternative employment. No data are available on IPP employees. Since the BOT Law of 1994 requires hiring of Philippine nationals where Philippine skills are available, any difference in the number of Filipino employees in the generation sector between the NPC and IPP scenarios would be insignificant. For these reasons, there was assumed to be no gain or loss for employees between the two scenarios.

VI. SCENARIOS

In undertaking the analyses, a number of different assumptions were made. The three most plausible cases are presented, viz., Central case (the present study's preference), Pro-IPP case, and Pro-NPC case. Further, electricity retail prices are assumed to equalize at two dates, i.e., 2010 and 2020 for each case.

A. Central Case

Restructuring and private sector participation (R&P) have effects that must be kept separate. The first effect was that IPPs contributed to the resolution of the power crisis. Based on available information, it is assumed that the private sector's efficiency and speedy fundraising were effective in ending the crisis one year earlier than the NPC.

The second effect was the efficiency with which plants and fuels were used to generate electricity. It is assumed that there would be differences in efficiency improvement between the NPC and IPP scenarios, as described in Table 3 and Figures 1-3 below. The plants operated by NPC were assumed to have become more efficient due to the additional competitive pressures from the presence of IPPs, influence of IPPs' efficient operation, technology transfer from IPPs to NPC, and scheduled privatization of NPC (Government of the Philippines 2001).

The third effect was that R&P prevented least cost generation and fuel mix. This is due to the PPAs between NPC and IPPs, most of whose plants, such as gas turbine and diesel plants, were expensive to operate. Further, high margins were allowed to cover capital recovery costs incurred by IPPs. The patterns of generation dispatch, fuel use, and investment were thus altered, generally increasing the costs of generating electricity. Also, presuming that there would be no more government guarantees for later projects, it is assumed that the private sector would construct coal plants that would have cheaper capital cost, instead of hydro and geothermal plants that would have lower operation and air pollution costs.

The fourth and final effect is the impact of R&P on the environment: changes in fuel and plant type had a direct result of increasing emissions, influencing climate change and human welfare.

B. Pro-IPP Case

The only differences between the Central case and this Pro-IPP case are the assumptions of lower controllable cost and altered plant mix in the IPP scenario. The mix is assumed to be environmentally less damaging and less threatening to the country's energy security and foreign exchange

Figure 1
Central Case Controllable Cost (1988 prices)

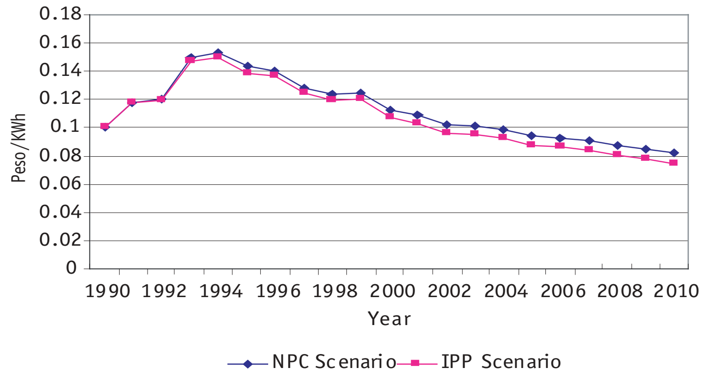


Figure 2
Pro-IPP Case Controllable Cost (1988 prices)

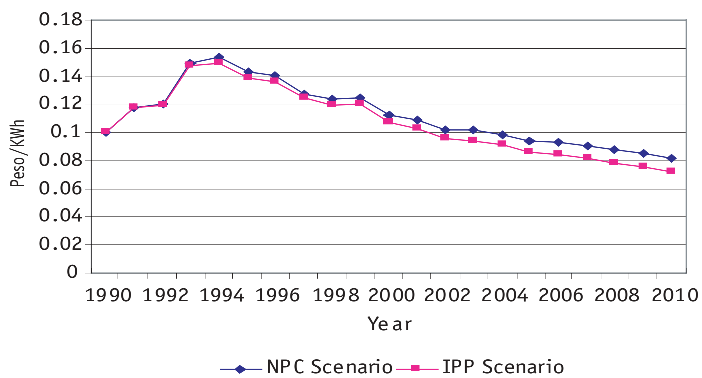
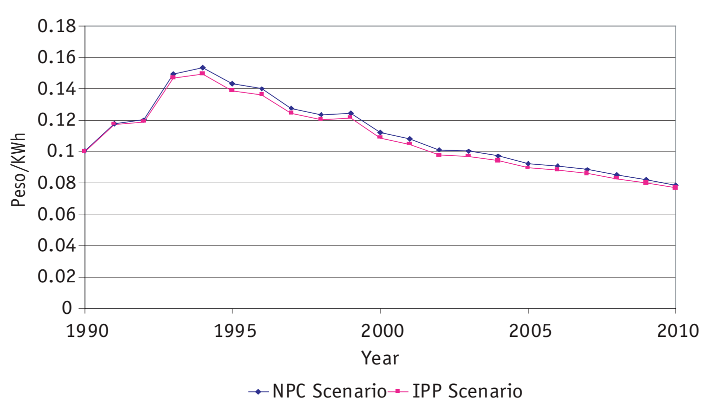


Figure 3
Pro-NPC Case Controllable Cost (1988 prices)



exposure by making greater use of indigenous natural resources and reducing the Philippines' heavy dependency on oil imports. This is due to the assumptions of a highly effective regulatory regime to protect investors, competitive pressures from IPPs, more technology transfer from IPPs, and development of financial systems that made it easy to obtain large capital through long-term financial instruments, to pursue more environment-friendly electricity generation such as hydro, geothermal, or other new and renewable energies. Other assumptions remain the same as in the Central case.

C. Pro-NPC Case

The Pro-NPC case assumes that the NPC scenario would have a lower controllable cost than in the other cases, and the same construction years and same commissioning year of rehabilitated and new plants as in the IPP scenario. Other assumptions remain the same as in the Central case. Detailed assumptions for each case are presented in Table 4, followed by the differences in controllable cost between the NPC and IPP scenarios in the three cases presented in Figures 1-3.

Each analysis used two public discount rates, viz., 15 percent, which is the normal real discount rate used for selected public investments in the Philippines (World Bank 1994b, Annex 21), and 10 percent for sensitivity analysis following Newbery and Pollitt (1997). All analyses were conducted in 1988 peso prices with base year of NPV of 2000. All the results were thus in 1988 peso prices but were converted to 1999 peso prices, and then 1999 US$ using nominal exchange rate (exchange rate US$1=P38.346 in 1999). All the analyses were undertaken once more using the Purchasing Power Parity (PPP) exchange rate (PPP exchange rate at US$1=9.96 in 1998) in converting the data whose original values were in US dollars as a sensitivity analysis.[9] Here, all the results are presented in US$ at 1999 prices unless otherwise noted.

VII. RESULTS

A. Total Net Benefits

The net impacts of R&P come from five sources: (i) investment including capital cost and fuel costs, (ii) environmental cost, (iii) efficiency gains in terms of reduced controllable cost and changes in plant use and mix, (iv) avoided cost in quickly ending the power crisis, and (v) privatization and subsidization cost. These are separately quantified in Table 5.

The major sources of the net benefit of R&P were the avoided cost during the power crisis and the improvement in operating efficiency. The net benefit was equivalent to an NPV of US$10.4 billion in the Central case and an NPV of US$11.8 billion in the Pro-IPP case. These results may be compared

[9] Although no other country study comparable with the present study exists so far, using this study's PPP exchange results, differences in the rate fluctuations between the official and PPP exchange rates could change the results from negative to positive. Actually, both exchange rates did not follow the same trend in the Philippines during the 1990s. The official exchange rate fluctuated especially during the power crisis and during the Asian financial crisis, although in general, both exchange rates followed a positive linear path. Also, using both exchange rates might indicate the relative magnitude of the different results.

Table 4
Assumptions for the Three Base Cases

	ASSUMPTIONS
Shared Assumptions Annual electricity sales growth rate (percent): 1999-2010, 8.2; 2010-2020, 5; 2020-2030, 3; 2030, 1. Controllable cost in 1994: NPC new plant is 14.5 percent higher than IPPs.	
Central Case: Assumptions	
NPC scenario:	For 1995-2010, rehabilitated and new plants' controllable cost decreases by 1 percent per annum due to efficiency improvement until 1997, thereafter, both efficiency improvement and fuel mix change from oil to more hydro-based and geothermal-based generation instead of coal. For 1998-2010, NPC's existing plants' controllable cost decreases by 0.5 percent per annum. There is a 1-year delay in commissioning rehabilitated and new plants until 1999.
IPP scenario:	For 1998-2010, rehabilitated and new plants' controllable cost decreases by 1 percent per annum, due to efficiency improvement and fuel mix change from oil to coal. For 1998-2010, NPC's existing plants' controllable cost decreases by 1 percent per annum.
Pro-IPP Case: Assumptions	Same as in the Central case, except in the IPP scenario for the period 1998-2010, where rehabilitated and new plants' controllable cost decreases by 1.5 percent per annum due to efficiency improvement and fuel mix change from oil to hydro and geothermal energy instead of coal.
Pro-NPC Case: Assumptions	
NPC scenario:	In 1995-1997, rehabilitated and new plants' controllable cost decreases by 1 percent due to efficiency improvement; and in 1998-2010 by 1.5 percent per annum due to efficiency improvement and fuel mix change from oil to more hydro and geothermal power instead of coal. No delay in commissioning rehabilitated and new plants is foreseen.
Both scenarios:	For 1998-2010, NPC's existing plants' controllable cost decreases by 0.5 percent per annum. Other assumptions remain the same as in the Central case.

with NPC's debts in 2001 of US$10 billion (2001 prices), 1999 net operating revenue of US$2.3 billion, and net income of US$-155 million (1999 prices). The air pollution costs are significant. In the Pro-NPC case, the net benefit becomes negative. This is an unlikely outcome because in practice NPC alone would not have been able to meet the required power demands. As clearly noted in an official report (PNOC-EDC 1998, 7), the introduction of IPPs and government assumptions of all risks were rational responses to the power crisis, while the government guarantees were justified given NPC's cost planning methodology and traditional financing options (NPC estimated this as the least cost solution to the crisis). The paper's assumption of a 1-year delay in NPC's completion of new and rehabilitated plants was proved by the fact that over the past several years only minor generating plants were constructed by NPC, and that NPC alone had no financial provision for constructing new plants and rehabilitating deteriorated plants around the time of the power crisis. IPPs proved that the private sector could mobilize funding faster than the government sector.

TABLE 5
NET BENEFIT OF IPP PARTICIPATION
(IN US$ BILLION, 1999 PRICES; DISCOUNT RATE OF 15%)

	CENTRAL	PRO-IPP	PRO-NPC
Investment Cost			
Capital	-2.0	-2.2	-0.7
Oil	-0.6	-0.6	-0.7
Coal	-0.1		-0.1
Total investment cost savings	-2.6	-2.7	-1.5
Externality Benefits			
Total pollution cost from oil	-0.3	-0.3	-0.3
Carbon dioxide (climate change)	-0.2	-0.2	-0.2
Nitrogen oxide (human welfare)	-0.1	-0.1	-0.1
Total pollution cost from coal	-1.5		-1.5
Carbon dioxide (climate change)	-1.1		-1.1
Nitrogen oxide (human welfare)	-0.3		-0.3
Total externality benefits	-1.7	-0.3	-1.7
Restructuring			
Controllable cost	0.4	0.5	0.2
Avoided cost	14.5	14.5	
Privatization and subsidization cost	-0.1	-0.1	-0.1
Total restructuring benefits	14.7	14.8	0.1
Total Net Benefits			
Excluding externalities and avoided cost	-2.3	-2.4	-1.4
Including externalities and avoided cost	10.4	11.8	-3.1

The contribution of avoided cost of US$14.5 billion in the Central and Pro-IPP case was very large. In our estimation, the ratio of avoided cost per capita to GDP per capita is about 19 percent, based on 1999 data (World Bank 2002a) of US$76.2 billion GDP (1999 prices) and 74.2 million total population. The ratio of annual average avoided cost per capita to GDP per capita during 1991-1998 when the avoided costs were assumed and calculated was 2.3 percent, based on 1999 data. However, this avoided cost may still be a conservative measure, as the loss due to the power crisis was estimated at US$20 billion (Private Finance International 2000, as quoted by Henisz and Zelner 2001). This was not an avoided cost, but was a loss even with the IPPs' additional generation. ADB (1998) reported that the power crisis was one of the main reasons for the decline in the country's GDP growth rate, and that with the stabilization of the power situation, GDP growth rate increased.

B. Distributional Impact

The resulting distributional impact from the net benefit excluding externalities on social welfare is shown in Table 6.

Table 6
Distributional Benefit
(US$ billion at 1999 prices; discount rate of 15 percent)

	CENTRAL	PRO-IPP	PRO-NPC
Net Benefit (excluding externalities)	12.1	12.1	-1.4
Case 1: Prices Converge in 2010			
Consumers	10.8	10.8	-3.7
Consumers surplus	-3.7	-3.7	-3.7
Avoided cost	14.5	14.5	
Government	-1.5	-1.5	-1.1
After tax profit, of which:	2.8	2.8	3.4
Foreign, 75%	2.1	2.1	2.6
Domestic, 25%	0.7	0.7	0.9
Global social welfare	12.1	12.1	-1.4
Domestic social welfare	10.0	10.0	-3.9
Case 2: Prices Converge in 2020			
Consumers	9.2	9.2	-5.2
Consumers surplus	-5.2	-5.2	-5.2
Avoided cost	14.5	14.5	
Government	-1.5	-1.5	-1.1
After tax profits, of which:	4.4	4.4	5.0
Foreign, 75%	3.3	3.3	3.7
Domestic, 25%	1.1	1.1	1.2
Global social welfare	12.1	12.1	-1.4
Domestic social welfare	8.8	8.8	-5.1

Our results show that except in the Pro-NPC case, consumers benefit most, largely due to the avoided cost. We note that an inclusion of the avoided cost captures some general equilibrium effects. Foreign and domestic investors also benefit, with 75 percent of this benefit accruing to them. While the government is a loser, with possibilities of divestiture in the future and increased corporate income tax collection from IPPs, government could gain more. Case 2 prices converging in 2020 is less favorable to consumers and more favorable to private investors than Case 1 prices converging in 2010, and results in decreased domestic social welfare. The preferred assumptions are for the Central case with prices converging in 2010. This is because it is anticipated that the government would take appropriate measures such as a lifeline rate[10] to protect vulnerable consumers from higher tariff. Further, not defaulting on the even more expensive PPAs after the Asian crisis of 1997 may have strengthened the credibility of the Philippines' institutional frameworks, increasing investor confidence that would attract more investors and thus promote cheaper, more competitive, and increased investment flows, supporting further electricity sector reform and securing eventual benefits to the economy and Philippine society. The resultant gain in global social welfare was equivalent to an NPV of US$12.1 billion and in domestic social welfare to an NPV of US$10 billion.

C. Sensitivity Analyses

We have experimented with numerous sensitivity analyses for each of the three cases presented in Tables 5 and 6. Further variations of the Central case are presented in Tables 7-9. Table 7 shows the sensitivity analysis of the net benefit.

The left hand side of the first panel shows the base case. From the second column to the fourth column, all the assumptions remain the same as in the base case except for a few changes as follows. In the second column of the panel, a 10 percent discount rate was used. In the third columns, Pollution Data 1 were used. In the fourth column, PPP exchange rate was used in converting the data originally denominated in US dollars during the analyses, but during conversion of final results from original peso result to US dollars, the nominal exchange rate is used.

The change in discount rate to 10 percent from 15 percent makes noticeable differences in net benefits. Also, the use of different pollution data creates differences in externalities depending on valuation methods and coverage of impacts included. The use of PPP exchange rates makes significant differences in the outcomes, which could be very important for developing countries with a significant informal economy such as the Philippines. To be conservative, the base case is preferred because (i) the 15 precent discount rate is officially used by the Philippine government, (ii) the pollution data source 2 has more information on the data backgrounds, and (iii) it is difficult to estimate accurate PPP exchange rates with reasonable confidence.

The sensitivity analysis of the distributional benefit in Table 8 follows the same variations as above, except that there is no column on pollution data variation, as externalities are not included in the distributional benefit analysis. The overall comments are generally the same above, and the base case is still preferred.

The sensitivity analysis applying different social weights to the distributional benefit is presented in Table 9. The social weights set 1 (NP) was estimated based on the UK, a developed economy, which was derived from a study by Newbery (1995) and Newbery and Pollitt (1997). In the study, social weights of Hungary, a less developed and former communist economy, were also estimated and the estimates were not significantly different from those of the UK. This suggests that the social

[10] Lifeline rate is a subsidized electricity price for lower-income consumers for a certain block of electricity consumption. Republic Act 9136 Section 73 (Electric Power Industry Reforms Act of 2001) states that "a lifeline rate for the marginalized end-users shall be set by the Energy Regulatory Commission, which shall be exempted from the cross subsidy phase-out under this Act for a period of ten years, unless extended by law" (Government of the Philippines 2001).

Table 7
Net Benefit of IPP Participation, Central Case Sensitivity Analysis
(in US$ billion at 1999 prices)

	1 (BASE) 15% DISCOUNT RATE	2 (DATA 2) 10% DISCOUNT RATE	3 DATA 1	4 PPPEX.
Investment Cost				
Capital	-2.0	-1.1	-2.0	-0.6
Oil	-0.6	-0.6	-0.6	-0.6
Coal	-0.1	-0.2	-0.1	0.0
Total investment cost savings	-2.6	-1.8	-2.6	-1.2
Externality Benefits				
Total cost from oil	-0.3	-0.2	-0.3	-0.1
Carbon dioxide	-0.2	-0.2	-0.1	0.0
Nitrogen oxide	-0.1	-0.1	-0.1	0.0
Particulates			0.0	
Sulfur dioxide			-0.1	
Total cost from coal	-1.5	-2.8	-0.1	-0.4
Carbon dioxide	-1.1	-2.1	0.0	-0.3
Nitrogen oxide	-0.3	-0.6	-0.1	-0.1
Particulates			0.0	
Sulfur dioxide			0.0	
Total externality benefits	-1.7	-3.0	-0.4	-0.4
Restructuring				
Controllable cost	0.4	0.6	0.4	0.3
Avoided cost	14.5	11.2	14.5	0.9
Privatization and subsidization cost	-0.1	-0.1	-0.1	-0.1
Total restructuring benefits	14.7	11.8	14.7	1.1
Total Net Benefits				
Excluding externalities and avoided cost	-2.3	-1.3	-2.3	-0.9
Including externalities and avoided cost	10.4	6.9	11.7	-0.5

weights of the Philippines also might not considerably differ from those of the UK but this might still need verification. The social weights set 2 (B) was estimated based on the Philippines, but the original data was published in 1976 (Bruce 1976, cited in Jones et al. 1990), adjusted using recent available data. Although the current Philippine economy has developed since 1976, we assume that the basic economic and social structure of the Philippines has not changed significantly, it is still dominated by a small elite and has a large gap between the rich and poor. Thus, social weights set 2 could be still applicable to this analysis.

The social weights in set 1 regard the values of public money and input as the same as the printed value of currency by weighting as 1; the value of money to consumer as consisting of half consumption (weight of 0.95) and half inputs to production (weight of 1) by weighting as 0.975; and the value of private investors' money as half the printed value of currency by weighting as 0.5 assuming private investors are wealthier. On the other hand, social weights in set 2 were estimated in a much broader and extended scope. This considers multiplier effects of public and private investments into the Philippine economy, by putting more weight on public (weight of 3) and private investors' (weight of 1.94) money than the printed value of currency. The money of the consumers is valued the same as the printed value of currency. A questionable issue in determining social weights in set 2 is whether private investors' money, especially that of global investors, would be reinvested into the Philippine economy. If, for example, global investors reinvest into the US, the social weight could have a different value.

TABLE 8
DISTRIBUTIONAL BENEFIT CENTRAL CASE SENSITIVITY ANALYSIS
(IN US$ BILLION, 1999 PRICES)

	BASE CASE AT 15% DISCOUNT RATE	10% DISCOUNT RATE	PPP EXCHANGE
Net Benefit (excluding externalities)	12.1	9.9	-0.1
Case 1: Prices Converge in 2010			
Consumers	10.8	7.6	-2.8
Consumers surplus	-3.7	-3.7	-3.7
Avoided cost	14.5	11.2	0.9
Government	-1.5	-0.1	-1.5
After tax profit, of which:	2.8	2.5	4.2
Foreign, 75%	2.1	1.9	3.2
Domestic, 25%	0.7	0.6	1.1
Global social welfare	12.1	9.9	-0.1
Domestic social welfare	10.0	8.1	-3.2
Case 2: Prices Converge in 2020			
Consumers	9.2	5.3	-4.3
Consumers surplus	-5.2	-5.9	-5.2
Avoided cost	14.5	11.2	0.9
Government	-1.5	-0.1	-1.5
After tax profit, of which:	4.4	4.8	5.8
Foreign, 75%	3.3	3.6	4.3
Domestic, 25%	1.1	1.2	1.4
Global social welfare	12.1	9.9	-0.1
Domestic social welfare	8.8	6.4	-4.4

Table 9
Central Case Distributional Benefits with Social Weights
(in US$ billions, 1999 prices; 15 % discount rate)

	NO SOCIAL WEIGHTS		SOCIAL WEIGHTS, SET 1 (NP)		SOCIAL WEIGHTS, SET 2 (B)
Net benefit (excluding externalities)	12.1		12.1		12.1
Case 1: Prices Converge in 2010					
Consumers	10.8	0.975	10.5	0.33	3.6
Consumers surplus	-3.7	0.975	-3.6	0.33	-1.2
Avoided cost	14.5	0.975	14.1	0.33	4.8
Government	-1.5	1.0	-1.5	1.0	-1.5
After tax profit, of which:	2.8	0.5	1.4	0.65	1.8
Foreign, 75%	2.1	0.5	1.1	0.65	1.4
Domestic, 25%	0.7	0.5	0.4	0.65	0.5
Global social welfare	12.1		10.4		3.9
Domestic social welfare	10.0		9.4		2.5
Case 2: Prices Converge in 2020					
Consumers	9.2	0.975	9.0	0.33	3.1
Consumers surplus	-5.2	0.975	-5.1	0.33	-1.7
Avoided cost	14.5	0.975	14.1	0.33	4.8
Government	-1.5	1.0	-1.5	1.0	-1.5
After tax profits, of which:	4.4	0.5	2.2	0.65	2.8
Foreign, 75%	3.3	0.5	1.6	0.65	2.1
Domestic, 25%	1.1	0.5	0.5	0.65	0.7
Global social welfare	12.1		9.7		4.4
Domestic social welfare	8.8		8.0		2.3

To compare the results from different sets of social weights, we need to choose the same numeraire among them. Since we evaluate welfare impacts from the point of view of the government as policy decision maker, we chose the government as numeraire. Accordingly, social weights in set 2 were adjusted (social weight of government to 1, consumers to 0.33, private investors to 0.65). Significantly different results were exhibited, influenced by the sources of social weights with different assumptions. Compared to the results without social weights, the use of social weights in Set 1 makes social welfare lower and the private benefit is reduced by half. In contrast, the use of social weights in set 2 significantly reduces social welfare compared to the unweighted results—consumers' benefit is reduced to one third, and private benefit decreases to about two thirds. It should be noted however, if we choose consumers as numeraire, compared to the unweighted results, global social welfare with the use of social weights in set 2 does not change significantly, decreasing by a small amount to US$11.8 billion; domestic social welfare decreasing to US$7.6 billion (as for example, in Case 1); and government losing three times more and private investors gaining almost twice over. Due to the uncertainties in estimating values of the social weights above, the conservative results without social weights are preferred.

These tables illustrate that the choice of discount rate, the choice and use of exchange rates, the choice of emission values, and the choice of social weights can change the estimated benefit and cost dramatically. This alerts us to the need to be careful in making assumptions, choosing data, and interpreting the results. Choice of which of the results to be preferred seems to depend on the assumptions, scope, coverage, and time span of the social welfare impacts that the decisionmaker has in mind.

VIII. CONCLUSIONS

This paper estimated the costs and benefits from the introduction of IPPs in the Philippines, making various assumptions about what might have happened had IPPs not been introduced in the generation sector and what might happen in the future. Findings show that the main gains came from two sources. One is the avoided cost during the power crisis, which promoted economic growth and social development and may have even saved lives by restoring vital social services such as water and sanitation. The other is the efficiency gains in generation, arising from the additional competitive pressures on NPC from the presence of IPPs, the IPPs' efficient operation and technology transfer to NPC, and the envisioned privatization of the NPC (Government of the Philippines 2001). Only about one quarter of the total private investors' gain is transferred to the domestic investors, as most of the investors are assumed to be foreigners. Further sensitivity analyses indicate the need for caution in choosing data and making assumptions.

The Philippines's partial electricity sector reform through IPPs was a good option available considering the circumstances prevailing at that time such as the power crisis and limitations of institutions, regulatory capabilities, and financial system. Social cost benefit analysis prove that consumers were large net gainers. The analysis, of course, does not imply that introduction of IPPs is the only solution to power shortages in developing countries. It may well have been the case that freeing up the NPC from financial constraints without IPPs would have been equally successful. As with all real world analyses of the impact of liberalization, it is impossible to distinguish between impacts of the various elements of reform when the elements are introduced simultaneously. However social cost benefit analysis still suggest that the reform package compared to a business-as-usual scenario was successful.

Can electricity sector reform and private sector participation/ownership increase social welfare? Based on the analysis of the Philippine electricity generation sector, the answer would be affirmative. This could be true in other economies, especially in those experiencing a large capacity shortage, because private enterprises could mobilize funding and deliver faster, and could be more efficient than government-owned enterprises. As many as 2.5 billion people in the world are estimated to still remain without access to modern energy supplies (World Bank 2002b). This could mean that a significant capacity shortage in the world continues and private enterprises could contribute to filling the gap of unmet demand for electricity, thereby promoting global economic and social development and welfare.

In the Philippine context, the legacy of IPP solution to the power crisis put a heavy burden on electricity consumers to pay off the high IPP electricity supply price. However, without the IPPs, the social and economic loss during the power crisis would have been much larger and the current level of development they enjoy may not have been possible.

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