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The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 10 member countries: Cambodia, China, Indonesia, Lao PDR, Malaysia, Papua New Guinea, the Philippines, Sri Lanka, Thailand, and Vietnam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to policymakers.

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# Local Power, Local Pollution? An Analysis from the Philippines

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Energy generation is one of the biggest environmental challenges facing Southeast Asia. Governments across the region are searching for ways to meet burgeoning energy demands while keeping environmental impacts to a minimum. A new report from the Philippines has found that boosting the use of a variety of indigenous energy resources could help limit air pollution as power production is increased to meet future needs. ➔

A summary of EEPSEA Research Report 2003-RR3, *Air Quality Impacts of Increased Use of Indigenous Fuels for Power Generation in the Philippines* by Elvira M. Orbeta and Carlito M. Rufo, Jr. (contact [eorbeta@mozcom.com](mailto:eorbeta@mozcom.com), [eorbeta@gate.pids.gov.ph](mailto:eorbeta@gate.pids.gov.ph))

# Indigenous energy resources

→ The report was carried out by Elvira M. Orbeta and Carlito M. Rufo, Jr. from the Resources, Environment and Economics Center for Studies (REECS), Quezon City. It looked at the environmental impact of new legislation - the 2001 Electric Power Industry Reform Act (EPIRA) - designed to improve the poor record of power supply in the Philippines. The Arroyo government implemented the act to privatize some elements of the power generation system, change tariffs, and promote environment-friendly indigenous energy sources and greater energy conservation.

## A New Start for Energy?

Energy demand in the Philippines is expected to grow at an average of nearly 10% per year, rising from 48 TWh in 2002 to 110 TWh in 2011. The researchers therefore set out to compare how the government's "indigenous" power generation plan would compare to a "business as usual" scenario in which energy

production is increased using current sources such as imported oil. Their research focused on the air pollution and public health impacts of the plan.

Orbeta and Rufo started their study by analyzing proposals set out for the development of indigenous and renewable energy sources. EPIRA's plans entail the construction of an additional 10,443 MW of indigenous resource-based generating capacity. Under the plan, this type of generating capacity is projected to reach 15,600 MW or 71% of the total capacity (compared with 37% under a business as usual scenario).

The indigenous power plan is expected to increase self-sufficiency in energy sources from 49% to 84% by 2011. Much of the switch will be away from imported oil. However, the indigenous fuels that will replace oil include some that are relatively clean (like geothermal power) and others that are relatively dirty (like coal). This means that the net

impact on the emission of pollutants is not immediately obvious.

## Costing the Power Plan

To find out what the impact of the indigenous power plan would be, the researchers used a rapid assessment approach and air dispersion modeling. They charted the changes in ambient pollution concentrations of PM<sub>10</sub>, SO<sub>2</sub> and NO<sub>2</sub> that the plan (and the business as normal scenario) would produce from 2001 to 2011. The assessment covered all power plants connected to the main or national grid and used plant-level data, appropriate emission coefficients and climatologic and topographical data.

Overall, the researchers found that under the indigenous power plan, emissions would be markedly higher in 2011 than in 2000. For example, emissions of PM<sub>10</sub> would have increased by 117%. This is not surprising given the projected increase in power generating capacity. But the plan would bring significant

Shares of Power Generation by Energy Source: Business as Usual and High Indigenous Scenarios

Energy Source	2000	2002		2011	
	Actual	BaU	High Ind.	BaU	High Ind.
	Percentage (%)				
Coal	37	34	33	21	24
Oil-based	20	6	6	9	8
Natural gas	0	30	30	17	44
Hydropower	17	13	11	6	9
Geothermal	26	17	19	9	12
Other	0	0	0	38	2
<b>Total (TWh)</b>	<b>45.3</b>	<b>51.6</b>	<b>51.7</b>	<b>116.2</b>	<b>114.4</b>



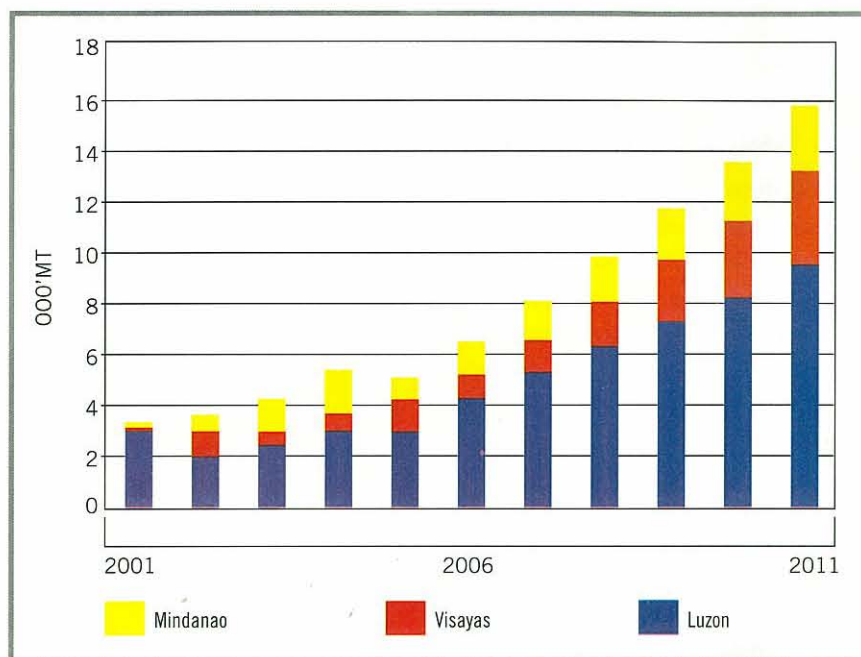
# could help limit air pollution

annual reductions in air pollutant emissions compared to the business as usual scenario. They found that this incremental reduction would be largest for  $\text{SO}_2$  - 41% annually, compared with 38% for  $\text{PM}_{10}$  and 34% for  $\text{NO}_2$ . They calculated that average annual incremental reductions would be about 128,840 metric tonnes (t) for  $\text{SO}_2$ , 5,240 t for  $\text{PM}_{10}$  and 34,650 t for  $\text{NO}_2$ .

## Pinpointing Pollution

The researchers made detailed projections for emissions and, not surprisingly, found that they reflected the development and decommissioning of certain types of power stations. For example, they calculated that air pollution emissions would drop between 2002-2004 due to the scheduled operation of three natural gas-fired power plants, the decommissioning of about 400 MW oil-based capacity, and increased utilization of hydro and geothermal power. They also predicted that between 2005 and 2010 emissions should increase due to the planned commissioning of additional fossil fuel-based generating capacity.

Changes in emissions were found to vary from district to district; the indigenous power plan would have particular impact in Luzon. This area, which accounted for 86% of the total fossil-based generating capacity in 2000, would benefit from an average reduction in emissions of 6% for  $\text{SO}_2$  and less than 1% for  $\text{PM}_{10}$  and  $\text{NO}_2$  (relative to the business as usual scenario). They also found that these projected reductions in Luzon



*Annual  $\text{NO}_2$  Emissions: Business as Usual Scenario*

would be matched by corresponding increases in Visayas and Mindanao, particularly in levels of  $\text{SO}_2$ .

Not all aspects of the government's indigenous power plan were found to be environmentally positive. The researchers found that the increased use of local coal would be particularly polluting and that it would lead to incremental annual increases in emissions of 167 t for  $\text{PM}_{10}$ , 9,767 t for  $\text{SO}_2$ , and 3,701 t for  $\text{NO}_2$  (compared to emissions from local coal under business as usual).

## A Question of Health

Once the researchers understood how the indigenous power plan and the business as usual scenario would affect emissions, they focused on the impact these emissions would have on the health of the general

population. To do this they used dose-response functions established in other studies and economic values based on the benefit transfer technique. They focused this aspect of the research on the impact of four coal-fired power stations in Luzon. These four plants accounted for over 40% of the country's  $\text{PM}_{10}$  and  $\text{NO}_2$  emissions in 2000. Fifty-three municipalities with an estimated population of 1.75 million (in 2000) lie within a 30-km radius of the plants.

The researchers calculated that the indigenous power plan would result in between 1,740 and 3,724 premature deaths, mainly associated with changes in  $\text{PM}_{10}$  ambient concentrations. They also found that the plan would cause between 129,000 and 500,000 cases of asthma, 35,000-135,000 cases of

acute bronchitis, and 2,000-7,800 cases of chronic bronchitis.

### The Price of Power

Taking these health impacts into account, they found that the plan would result in total health damage over the period 2002-2011 of Pesos 19.2 billion (discounted at 15% in constant 1994 prices). This represents an average of Pesos 0.109/kWh. The annual benefits of the indigenous plan over a business as usual scenario for the four power stations would be negligible, averaging 0.03%.

### Making Power Greener

Overall, the researchers found that, relative to business as usual, the government's indigenous power plan, with the exception of its local coal projects, would reduce the amount of air pollution and its associated adverse health effects. These improvements would result from policies to boost energy resources such as natural gas and renewables and reduce dependence on imported fuels, along with plans to retire old oil-based and coal-fired generating capacities.

However, they also found that all

their power generation scenarios would result in significant overall increases in emissions. Because of this, they recommend that a number of steps should be taken to mitigate this problem. These included concentrating monitoring and control efforts on PM<sub>10</sub> and SO<sub>2</sub> emissions in Luzon; reviewing policies on the use of local coal for power generation; and introducing more aggressive policies to encourage energy conservation.

53 Pesos = 1 USD (December 2002)

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