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Policy Strategies for Developing Renewable Sources of Energy:

The Philippine Experience

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CHAPTER 1

POLICY STRATEGIES FOR DEVELOPING RENEWABLE SOURCES OF ENERGY: THE PHILIPPINE EXPERIENCE

INTRODUCTION

This paper discusses the policy strategies undertaken by the Philippine government to commercially harness renewable energy forms. Specifically, the paper cites the Philippine experience between 1970 and 1984 in its attempt to develop and utilize geothermal and other renewable sources of energy.

The Philippine Energy Situation

The 1983 Energy Accounts

Commercial energy use reached 93.6 million barrels of fuel oil equivalent in 1984. Although oil still accounted for 60 percent of that volume, biomass fuels owned the second largest share, contributing almost 16 percent to total.

Hydro power represented another 9.7 percent and geothermal energy came close at the heels with 8.3 percent. One might say therefore that purely renewable types (biomass, hydro and geothermal energy) jointly answer for 33 percent of total commercial energy needs. Coal supplied the residual 6 percent of commercial demand.

If one were to add the non-commercial household use of another 30 million fuel-oil barrels equivalent consumed in traditional energy forms, national energy consumption would then total 123.6 million barrels of fuel oil equivalent, based on the results of material energy balances constructed for 1979. Under this more comprehensive accounting, renewables would dominate the energy mix with a 49 percent share. Oil's share would be down to 45 percent.

It is noteworthy that energy imports in 1984 (for oil and coal) dropped to 58 percent of total commercial consumption, down from the hefty 92 percent of 1973. Year 1985 will see the 50 percent threshold of import dependence penetrated for the first time. This continuous reduction in energy imports has consistently characterized the relentless pursuit and implementation of the decade-long program of energy diversification.

The Power Sub-sector

Almost 40 percent of 1984 commercial energy demand was consumed in the form of electricity. For 1985, the share of oil-based output in the electricity subsector will not exceed 16 percent. The hydro and geothermal shares will dominate electricity generation with 29 percent and 23 percent, respectively. Coal will inch up to 15 percent. Biomass and nuclear energy bring up the rear with some 8 percent apiece. In the power configuration, renewables will own a significant collective presence (60.5 percent) but biomass fuels alone provide only a residual 5.36 percent of the subtotal.

The Energy Machinery

Presently, the Ministry of Energy oversees the major components of energy policy and program implementation. It attends to the major investments that go into operationalizing centralized energy and the power facilities or infrastructures that generally service a national clientele. The National Electrification Administration, on the other hand, administers the more politicized diffusion process that includes rural electrification as well as minihydro and dendrothermal power subsystems, which are directed at the needs of the more immediate local constituency. The National Power Corporation (NPC) concentrates on bulk power generation and transmission across major grids and transcends purely local requirements and boundaries.

Philippine National Oil Company (PNOC) looks after government venture interests in energy resource prospecting, fuel refining, and marketing, competing alongside private interests in these activities. Both NPC and PNOC are totally owned by the national government and are at times expected to pursue and implement central government energy policy and priorities over its own corporate interests.

Government Energy Objectives

By and large, the principal objective of the government's energy program is to provide the body politic with cost-effective alternatives to the once dominant and largely-imported fuel that was petroleum. To the extent that idigenous alternatives are commercially developed, it supports the national economic goal of improving the balance of payments. At its peak in 1980, oil imports accounted for 30 percent of the country's total import bill and staked claim to easily 40 percent of annual export revenue.

Apart from the good fortune that renewable fuels abound in the country at presently afforadable costs relative to fossil-fuel options, there is no particular or special role of a permanent nature that is assigned to or expected of them. For the intermediate planning horizon, they do offer plenty of promise. But this situation may or may not persist. If more valuable applications are found for these renewable resources, then it just might pay to revert to earlier patterns in our energy mix.

For the present, government recognizes the contribution that renewable fuels can make not only in terms of realizing cheaper energy alternatives, better international payments balances, but more importantly under recessionary conditions, the local employment impact and the resultant tax and expenditure multiplier that may result from investments in this energy source.

As such, they are being actively promoted by government and this paper seeks to discuss the strategies employed to realize the proliferation of selected renewable energy technologies. At the minimum, incentives are being offered to match or neutralize those given for the production and use of expensive fossil fuels like oil. Adherence to the principle of realistically pricing conventional fuels is one important incentive. Incentives for the local exploration and production of renewable fuels have attempted to match if not surpass those extended to local oil production.

However, it would be a mistake to put so much emphasis on incentives alone. The government approach was more holistic and started from more solid fundamentals.

Basically, the strategies fall into three distinct categories: a systematized institutional approach, financial mobilization, and risk reduction for private capital. For technologies that were entirely new, the problem of how to proceed institutionally became the prime concern. Clearly, institutional systematization was required and the steps taken in this direction are discussed in the paper.

The second problem was financing - both for launching the government's promotion effort and for acquiring the commercial infrastructure. In almost every case, resort to grants and bilateral/multilateral credit institutions was inevitable. The task of attracting venture capital or private equity reduced the problem to a matter of fiscal and financial incentives. These strategies yielded handsome pay-offs and proved largely successful in creating an institutional environment that sufficiently awakended private investor curiosity to the new technologies.

A third, and perhaps more important, consideration was the problem of how to hold this private sector interest so that the use of relevant technology would sustain itself in terms of reliable supply, larger demand, timely delivery and in-situ maintenance. It turned out that for the more successful technologies, the important ingredients that sustained commercial interest, were:

1) The provision of a ready market (the corollary of which is affordable price); and

2) The presence of a field maintenance capability that enables rapid repair of the technology on site.

For this reason, the geothermal, dendrothermal, and gasifier expeditions had an easier time taking off than, for instance, direct solar or wind-power initiatives. The target "captured markets" in the former case possessed sufficient engineering or maintenance staff to accelerate product acceptance of new technologies. In general, equipment using biomass fuels found more acceptance than other renewable energy devices because of the familiarity of the users with the fuels and the devices introduced. The biomass sector did not have to rely much on government financial assistance or incentives. For the more exotic technologies, a major deterrent was the high front-end costs and the doubtful economics, aggravated by the expensive need for duplicative back-up systems. While government financial incentives naturally alleviate the monetary burden on users, the feedback so far is that incentives alone could not overcome the above fundamental impediments to the proliferation of certain technologies, which then will have to wait a few more years before commercial success can be realized. A gauge of the general market reaction may be useful in redesigning the promotion strategy for these technologies in the future.

CHAPTER 2

THE GENERAL MARKET RESPONSE TO GOVERNMENT PROMOTIONAL EFFORTS: A SURVEY-BASED ASSESSMENT

An initial assessment of the market or industry response to government promotion work on renewable energy technology can be obtained from the results of two separate surveys of equipment suppliers and end-users involved with devices that use four types of renewable energy: biomass, minihydro power, direct solar, and wind energy.

The supplier survey included a total of seventeen (17) firms, thirteen of which are classified as corporations and the rest single proprietorships. Most of the respondents (8) were engaged in the production and/or distribution of biomass equipment.

The survey of end-users involved stratification of the respondents into existing and potential users among households and firms. Based on the sampling, the household-user group had a slightly larger respondent base (166) compared to the firm-user group (142). (See Table 1).

Table 1 Respondent base for end-user survey

Equipment	Household		Firm		Total	
	Existing	Potential	Existing	Potential	Existing	Potential
Biomass	68	61	61	40	129	101
Solar	16	11	11	5	27	16
Wind	5	5	10	8	15	13
Minihydro	-	-	3	4	3	4
	89	77	85	57	174	134

The stabilization of the oil price in the mid-1980s constricted the growth of the renewable energy sector to a large degree. The initial interest in solar, biomass, windmill, and minihydro technologies tapered off as oil price stabilized.

Recent surveys indicate that the small portion of the population which opted for alternative energy systems reverted to using conventional fuels. Although the government launched a number of alternative energy promotion programs, it had difficulty attaining commercialization targets in many areas,

with the possible exception of large-scale biomass, biogas, minihydro, and dendrothermal undertakings. Household response was particularly slow.

Suppliers' Reaction to Government's Promotion Efforts

The government has played a major role in promoting nonconventional ene development in the country. The technology suppliers approached numerous government agencies for technological information such as ERCD/Center for Non-Conventional Energy Development (CNED), Farm Systems Development Corporation (FSDC), National Electrification Administration (NEA), Ministry Human Settlements (MHS), NPC, Commission on Volcanology (COMVOL), MOE, PNOC, Bureau of Animal Industry (BAI), National Institute for Science and Technol (NIST), National Science and Technology Authority (NSTA), Philippine Atmospheric, Geophysical and Satellite Authority (PAGASA), National Food Authority (NFA), University of the Philippines at Los Banos (UP LB), University of the Philippines at Diliman (UP DIL), Philippine Women's University (PWU) and Technology Resource Center (TRC). The government agencies approached most frequently are presented in Table 2.

Table 2 Government agencies approached most frequently

Agency	No. of Respondent Suppliers
1. Energy Research and Development Center/CNED	7
2. Ministry of Energy	5
3. NFA	5
4. Philippine National Oil Company	4
5. NIST	4
6. UP (LB)	4
7. PAGASA	3

Incentives and Assistance

Ten of the 17 enterprises surveyed indicated that they had availed themselves of government incentives or assistance. Among the different type of government incentives or assistance, the extension of financial incentive was perceived to be the most important. The forms of government support mentioned by the suppliers included: (a) provision of adequate research and te...ing facilities, (b) provision of preferential loans, (c) more effective dissemination of current technology, (d) promotion of nonconventional energy usage, (e) training of personnel, and (f) granting of tax incentives.

Impact of Other Government Policies

Energy conservation measures and the development of nonconventional ener sources were considered the most significant government policies that benefited the industry in recent years. Other relatively important benefici policies were: (a) anti-pollution measures (b) regulation of collective bargaining agreements and strikes, (c) price control, and (d) the implementation of major development projects.

Government measures to restrict the availability and to raise the effective cost of loanable funds were considered to exert the most adverse impact on the industry. The respondents stressed that the establishment of

nonconventional energy facilities entails considerable capital outlays during the initial stages. Consequently, restrictive financial policies serve to hinder the industry's development.

Not surprisingly, the high import duties also figured prominently among the impediments to faster growth in renewable energy technologies. The temporary decline in the value of the peso also increased the domestic cost of imported energy equipment, spare parts, and raw materials, thereby reducing the cost advantage of renewable forms of energy using imported equipment.

Nonconventional Technology Market: Interim Results

Information gathered from the 17 supplier respondents and the government's own listings identified a total of 754 nonconventional energy users. Of these, biomass-equipment users (consisting of 471 residential users and 158 firm users) make up 83.4 percent. The solar-technology users, who account for 9.8 percent, consist of 55 households and 15 firms. These two energy forms account for more than 90 percent of the alternative energy-technology market. A summary of the results of the survey of users is presented in Tables 3 and 4.

The windmill and minihydro users account only for a small portion of the market 5.8 percent and 1.0 percent, respectively. High capital costs limit users of the minihydro technology to either the government or large electricity cooperatives. In the case of the windmill sector, its major drawbacks seem to be its high initial investment cost and the fact that the volatile wind regimes in the country do not favor the installation of windmills except in a few areas.

In broad terms, it can be observed that of the four nonconventional energy forms, biomass technology proved most promising for mass commercializaton.

The survey highlights the relative "open-market" popularity of biomass-equipment over devices using more exotic renewable energy forms (e.g. solar and wind power), to wit:

1. Eighty-three percent of the respondent sample represented biomass equipment users. More importantly, 91 percent of the households and 81 percent of the firms using biomass devices acquired hardware through the open market.

2. Biomas equipment was able to penetrate the poorer segments of the household market, who reported monthly incomes of less than P5,000 and where almost 2/3 of the household respondents belonged. Solar and wind equipment required higher income markets but, unfortunately, had to compete with other well-entrenched alternatives (e.g. electricity) in these markets.

   In the corporate market, establishments affiliated with agriculture dominated the clientele profile.

3. A lower fraction of household biomass-equipment users (33 percent) reported equipment problems. On the other hand, a larger propostion of solar and wind equipment users (50-60 percent) reported equipment problems.

   Likewise, corporate biomass equipment users reported a lower incidence of equipment trouble compared to corporate solar and wind equipment users.

4. While after sales maintenance service by the suppliers was not crucial to technology proliferation, easy repairability of the technology itself seemed nevertheless to be a critical factor. For biomass equipment repairs, there was a significant household reliance on self-help (61 percent), another 26 percent had access to real-time service from nearby repair shops. By contrast, wind equipment users had to rely more heavily on dealer or manufacturer services (50 percent). This might have introduced an element of inconvenience, especially where large distances are involved.

5. Credit did not turn out to play a significant role in successful biomass commercialization. Only 7 percent of biomass and wind equipment users among households availed themselves of outside borrowing to purchase equipment. By contrast, 62 percent of the households purchasing solar devices turned to outside credit. It appears that immediate family and relatives were willing to contribute financially for technologies whose benefits were more clearly recognized. But this might also be due to the lower costs of biomass equipment compared with solar and wind devices.

The next two chapters treat in more detail and more systematically the process by which the government managed the successful commercialization of two renewable energy technologies -- first, geothermal, and second, biomass (dendrothermal fuel and producer gas).

Table 3 Survey of households using nonconventional energy devices
Comparative summary table of findings

	Biomass	Solar	Wind
1. Major User Group	Rural household	Urban household	Business/industrial
2. Most Typical Use	Cooking/baking	Water heating	Water pumping
3. Major Supplier	Local dealer	government	Local dealer
4. Income-Level of Users	P2,000-P2,999/P5,000 and up	P5,000 and up	P5,000 and up
5. Price Range of Equipment	P1,000 -P4,999	P5,000 and up	P5,000 and up
6. % of Users with Equipment Problems	35.3%	56.2%	60.0%
7. Common Maintenance Problems	Frequent breakdowns/unreliable energy output	Frequent breakdowns/unreliable energy output	Lack of input
8. % with Maintenance Contracts	11.8%	25.0%	40.0%
9. Equipment Repair Made	Self-repair	Local repair shop	Local repair shop
10. Source of Financing	Built own equipment	Loan/installment	Savings
11. Distribution Method	Direct sales	Direct sales	Direct sales
12. Marketing Media	Pilot projects	Special publications	Media/pilot projects
13. Future Marketing Thrust	General periodicals	General periodicals	General periodicals
14. Perceived Market Conditions	Competitive	- Not clear -	Not very competitive
15. Perceived Future Market Conditions	More competitive	More competitive	More competitive
16. Additional Acquisition (Yes) %	13.2%	6.2%	-
17. Reason for Non-Acquisition	No need for additional equipment	No need for additional equipment	Dissatisfied with equipment
18. Extent of Potential Users Research (%)	19.6%	40.0%	18.2%

Table 4 Survey of firms using nonconventional energy technologies
Comparative summary table of findings

	Biomass	Solar	Wind	Mini hydro
1. Major User Group	Government	Business/Industrial	Business/Industrial	Government/Business/Industrial
2. Most Typical Use	Operations	Drying	Water pumping	Power generation
3. Major Supplier	Local dealers	Local dealers	Local dealers	Direct import
4. User's Sales Profile	P1.0 million	P1.0 million	P1.0 million	P10.0-P19.9 million
5. User's Activity Sector	Agriculture, fishery forestry	Services	Services	Water
6. Price Range of Equipment	P10,000 and up	-	-	-
7. Percent with Equipment Problems	54.2%	63.6%	60.0%	66.7%
8. Common Maintenance Problems	Frequent breakdown/ unreliable energy output	Lack of input	Frequent breakdown/ unreliable energy output	Frequent breakdown/ unreliable energy output lack of input
9. Percent with Maintenance Contracts	15.2%	9.1%	60.0%	66.7%
10. Equipment Repairs	Company's maintenance	Company's maintenance	Distributor/manufacturer	Distributor/manufacturer
11. Marketing Media	Pilot projects	Special publication	Media/pilot projects	Trade exhibits
12. Future Marketing Thrust	General periodicals	General periodicals	General periodicals	- Not clear -
13. Percieved Market Conditions	Competitive	- Not clear -	Not very competitive	- Not clear -
14. Perceived Future Market Conditions	More competitive	More competitive	More competitive	More competitive
15. Expansion Plans	Yes	Yes	Yes	Yes
16. Potential Industrial Clients	Food processing	Construction	Farms	Mining and quarrying

CHAPTER 3

GOVERNMENT-INITIATED RENEWABLE ENERGY PROGRAMS: GEOTHERMAL DEVELOPMENT STRATEGIES

The second part of this paper discusses the strategies taken by government with respect to directly administered programs involving renewable energy forms, in particular, geothermal and fuelwood. This chapter addresses the country's geothermal program.

The Philippine experience in geothermal development and production has become a success story in the government's efforts to tap indigenous and renewable forms of energy.

The strategic geographical location of the country along the boundary between the Pacific plate and the adjacent continental plates makes the Philippine archipelago rich with geothermal resources, since decadent volcanisms and crustal movements occuring along the active blocks of major structural lines (which traverse most of the country's major structural islands) provide favorable conditions for the formation of geothermal systems. Recognizing the geothermal potential in the country, a law was passed by the now defunct Congress and signed by President Marcos in 1967, Republic Act No. 5092, which provided that geothermal energy, among other patrimonial resources, belonged to the State. The Act set the basic law that geothermal steam is a patrimonial resource and therefore the Philippines should get at least 60 percent of the net benefits from the commercial development thereof.

The policy measures implemented by the Philippines in the development of geothermal resources can be classified into three (3) major categories, as follows:

1) Systematizing geothermal resource development;
2) Financial mobilization strategies for expenditures in geothermal resource development; and
3) Promotional strategies for maximizing private sector participation in geothermal resource development.

A discussion matrix describing the various geothermal development policies is presented in Table 6 at the end of this chapter (page 20).

Systematizing Geothermal Resource Development

Establishing Technical Feasibility, 1960s - 1970s

It was recognized early enough in the history of goethermal development in the Philippines that the first step would be proving the technical feasibility. The pioneering work was undertaken by the Commission of Volcanology (COMVOL), predecessor of the Philippine Institute of Volcanology (PIV), in 1964. The National Science and Technology Authority (NSTA), formerly National Science and Development Board (NSDB), and the Bureau of Mines provided financial and technical assistance to the experiment. The proponents selected the Tiwi geothermal area as site of the first scientific and pilot studies for geothermal power utilizaition. The study, which was completed successfully in 1967, examined the extent of the Tiwi thermal springs and their heat output.

A second project, undertaken in 1967, obtained more information on the extent and potential of the Tiwi geothermal field for use by the government in the full exploration of the field. During that year the first pilot test run of a small turbo-generator using geothermal steam took place and, by 1969, a well was successfully discharged and was used to power a 2.5 kilowatt non-condensing geothermal pilot plant in Tiwi.

The success of the studies in Tiwi paved the way for a government decision to proceed with the commercial exploitation of geothermal energy. As a result, Presidential Proclamation No. 739, signed in August 1970, set aside some 17,661 hectares (42,623 acres) in Tiwi, Albay, as a geothermal reservation area.

Resource Surveys, 1971 - Present

To follow-up on the success of that earlier work, the government initiated nationwide field resource surveys to identify the various potential geothermal areas which could be developed. Sites were then identified, usually from surface-thermal manifestations. Once identified, the potential areas were evaluated for geologic, geochemical and geophysical properties, under supervision by the Bureau of Energy Development (BED), with the aim of acquiring sufficient positive information to establish commercialization opportunities.

Exploratory Drillings for Commercial Development

The development of the geothermal areas in Tiwi, Albay and Makiling-Banahaw (Mak-Ban) in Laguna, which preceded the creation of the Ministry of Energy (MOE) in 1977, enabled development drillings to start in 1972 through 1974. Geothermal activities were intensified further in the late 1970s under the umbrella organization of the Philippine National Oil Company (PNOC). PNOC's subsidiary, the Energy Development Corporation (PNOC-EDC), was the main vehicle used to transfer field development technology from New Zealand through a technical assistance grant for the geothermal field in Tongonan, Leyte.

Today, the country has identified a number of geothermal areas suitable for commercial development. Those being developed include:

1. Tiwi geothermal field in Albay (NPC-PGI);
2. Mak-Ban geothermal field in Laguna (NPC-PGI);
3. Tongonan geothermal field in Leyte (PNOC-EDC);
4. Palinpinon geothermal field in Southern Negros (PNOC-EDC); and
5. Bacon-Manito (Bacman) geothermal field in Albay (PNOC-EDC).

Other prospective areas include: Acupan-Itogon in Benguet, Mt. Labo in Camarines Norte, Batong-Buhay in Kalinga, Biliaran Island in Leyte, North Davao and Northern Negros.

Various stages of geoscientific works have been undertaken in these areas by BED to provide prospective investors with sufficient basis to enter into deep exploration drillings for possible service contract agreements.

PNOC-EDC was one of the first subsidiaries organized when PNOC was expanded into an energy company in April 1976 by virtue of Presidential Decree No. 927. Primarily, EDC was established for the prupose of accelerating the development of indigenous sources of energy other than oil and gas. The Geothermal Division of PNOC-EDC was then tasked with the exploration, development, production, generation and marketing of geothermal sources of heat and power. Its function differs from those of BED in that PNOC-EDC was essentially conceived to be a service contractor responsible for carrying a project through to commercialization, whereas BED's work was mostly promotional, administrative and regulatory. Theoretically PNOC-EDC, as a service contractor, must compete with privately-owned companies to obtain contractual rights to develop promising goethermal fields.

Financial Mobilization Strategies for Expenditures in Geothermal REsource Development

Considering the huge capital investment and extensive technological requirements for the development of geothermal resources, the Philippine government resorted to some strategies aimed at supplementing locally-available funds for the acquisition of foreign technology for geothermal development and assuring, to a substantial degree, the transfer of geothermal prospecting technology to the country. These measures include the country's entry into bilateral and multilateral arrangements with countries and institutions noted for their financial capability and technical expertise in the utilization of geothermal energy, as well as the use of concessional loans from international lending institutions.

Bilateral and Multilateral Grants

The continued transfer of goethermal development technology was, to a considerable degree, made possible by the government's bilateral and multilateral cooperation with the following:

(1) Training assistance under the Philippines-New Zealand Bilateral Agreement on Energy Cooperation, which advanced the country's knowledge on hot-water dominated geothermal reservoirs;

(2) A bilateral arrangement with Italy, through Electro-Consult (ELC), which covered not only geothermal training but also conducted a more detailed geothermal resource inventory. This enabled the government to identify a set of priority areas for commercial development;

(3) A financial assitance package from the government of Japan, through the Overseas Economic Cooperatin Fund (OECF), which helped the country purchase equipment for geothermal power plants and other electro-mechanical parts; and

(4) Multilateral cooperation with the United Nations Development Program (UNDP) which also facilitated the transfer of a fair amount of geothermal technology to the local experts. Among others, the Philippines was recipient of formal local and foreign training on the science of geothrmal resources and development from:

(a) UNDP - New Zealand aid-funded training program at Auckland University;

(b) UNDP-funded courses in reservoir engineering conducted in the Philippines; and

(c) United Nations Geothermal University in Iceland.

Among the countries with which the Philippines had bilateral arrangements for promoting the transfer of geothermal development technology, the country relied mostly on New Zealand's technical assistance because the quality of its own steam, which is hot-water dominated, approximated that of the Philippines' geothermal resource.

The New Zealand government's geothermal aid program to the Philippines, awarded in 1974, was executed by KRTA (Kingston, Reynolds, Thom and Allardice, Ltd.), a New Zealand agency which has extensive experience in geothermal exploration and development. The aid, initially amounting to NZ $10 million, was given in the form of equipment and technical training assistance. A drilling rig was among the equipment donated with the New Zealand aid. Through this aid program, the Tongonan and Palinpinon geothermal fields were explored and discovered to have enough geothermal steam to support commercial-scale power generating plants. The Tongonan and Palinpinon plants, which started commercial operation in March and July 1983, respectively, added 234 megawatts (MWe) to the country's geothermal power generating capacity.

However, since the New Zealand aid covered only the exploration stage, the Philippines, through PNOC-EDC, engaged the services of KRTA as commercial consultants when EDC's geothermal activities reached the development stage. The transfer of technology from KRTA to PNOC-EDC personnel was facilitated with the creation in 1981 of the PHOC-Geothermal Technology Corporation (PNOC-GTC), a 70-30 joint venture company between PNOC and KRTA. The establishment of PNOC-GTC assured transfer of geothermal technology since all KRTA personnel were given Filipino understudies to train and work with.

Concessional Loans

Aside from bilateral and multilateral arrangements, the country also availed itself of concessional loans from the World Bank. A loan agreement between the World Bank and PNOC-EDC signed in 1982 further promoted geothermal development in the Philippines. This Geothermal Exploration Project, amounting to U.S. $36 million and expected to be completed by June 1986, has three components, as follows:

(a) Expansion of geothermal exploration, to be carried out by PNOC-EDC. This component includes geological, geophysical and geochemical studies to identify appropriate locations and targets for drilling operations; and drilling of exploration wells based on the results of the geoscientific studies;

(b) Technical Assistance. This component will support PNOC-EDC personnel in geoscientific and reservoir studies and drilling operations; and

(c) **Policy Studies.** This component will study the approach for determining the priorities among the various geothermal locations in the Philippines and the appropriate bases for contracting steam supplies in the country. Likewise, this component will evaluate the economics of non-power uses of steam and the appropriate extent of geothermal drilling required for such purposes.

Promotional Strategies for Maximizing Private Sector Participation in Geothermal Resource Development

The country's efforts at embarking in the geothermal development program was primarily initiated by the government sector with the aim of attracting local as well as foreign private investors to venture into the commercialization of geothermal energy. Several promotional strategies were undertaken by the government to maximize private sector participation and these can be grouped as follows:

1. Reducing technical risks of private entry into geothermal projects;
2. Circumventing constitutional limitations to foreign investments in geothermal activities in the country;
3. Fiscal and financial incentives for service contractors; and
4. Guaranteeing purchase of geothermal steam.

Technical Risk Reduction for Private Entry

One of the first efforts undertaken by the government to reduce technical risks for private sector entry in geothermal activities, as well as promote widespread use of geothermal energy, was funding pre-feasibility and feasibility studies to verify and confirm the commercial potential of geothermal energy in the country. The pioneering studies of COMVOL in the Tiwi geothermal field was funded by the government and their early success resulted in the government's decision to embark on a geothermal program to comercially tap the geothermal resource.

However, during the early stage of implementation of the geothermal program, the country did not have yet the expertise to commercially explore, exploit and develop geothermal power. To address this, the government adopted a service contract system as part of its policy to attract technically and financially qualified foreign firms into large-scale geothermal development.

For the first geothermal project in Tiwi, a service contract was concluded in September 1971 between the National Power Corporation (NPC, the state power monopoly) and Philippine Geothermal, Inc. (PGI). The initial COMVOL studies and the further feasibility studies undertaken by PGI finally confirmed the commercial viability of the Tiwi project. By 1973, the first production well was drilled in Tiwi. On the basis of field successes, plans to establish a geothermal plant in Tiwi, connected to the Luzon Grid, were undertaken by the government. NPC contracted with Rogers International to prepare the plan, which was completed in 1975.

The encouraging results of the activities in Tiwi led to another NPC-PGI joint-venture agreement for the exploration and development of Mak-Ban geothermal field in Laguna. The first exploratory well drilled in Mak-Ban in November 1974 turned out to be commercial.

The success of the geothermal activities jointly undertaken by NPC and PGI in Tiwi and Mak-Ban further encouraged the government to assess other potential geothermal areas in the country through government funding of exploration and other geoscientific surveys with foreign financial and technical assistance. These efforts led to the development of the Tongonan and Palinpinon geothermal fields, which were undertaken by PNOC-EDC as the service contractor, with technical assistance from New Zealand (KRTA) and financial assistance from Japan (OECF). By July 1977, the country entered into semi-commercial use of geothermal energy with the operation of a 3 MWe pilot power plant in Tongonan.

Two years later in 1979, the Philippines was ready to harness geothermal on a large scale with the commissioning of two 55-MW plants for each field in Tiwi and Mak-Ban. Generating a total capacity of 220 MWe destined for the Luzon Grid, geothermal power, displaced some 1.06 million barrels of fuel oil equivalent (MMBFOE).

Aside from the existing geothermal fields undergoing advanced development, other potential areas are being explored both by government agencies and private companies. Should some of these new prospective areas show sufficient commercial potential, other service contractors are expected to enter into geothermal activities to maximize the power utilization. Several companies, among which are Caltex Oil Company, Occidental Geothermal, Inc. (OXY), Ultrana Nuclear and Minerals Corp., TOTAL Exploration, and Philippine Oil and Geothermal Energy, Incorporated (POGEI), as well as PNOC-EDC, have carried out preliminary investigation and exploration in these areas. The BED has likewise been assisting in the preliminary geoscientific surveys in the new areas under bilateral agreements with Japan and Italy.

Circumventing Constitutional Limitations through the Service Contract Scheme

As a patrimonial resource, geothermal development using foreign capital faced certain Constitutional handicaps which had to be legally circumvented in order to gain access to foreign "risk-capital" and technology. To address such limitations, the government introduced the service contract system. Presently, the scheme, which asserts state ownership of the resource, posits that foreign companies can invest as service contractors to the government. If they successfully locate and develop a reservoir, the government commits to pay them a service fee. Presently, there are two operative models, namely: The NPC-PGI type of contract as applied in the Tiwi and Mak-Ban geothermal fields, and the BED service contract, which is implemented under Presidential Decree No. 1442 issued in June 1978.

There are only minor differences between the two. In the first type, NPC rather than BED awards the contract. Also, there is no government royalty in the first type as there is in the second.

NPC-PGI Service Contract

The NPC-PGI scheme (concluded in September 1971 and last amended in July 1975) has a duration of 25 years upon the contractor's option. The contract is a "fuel supply contract" wherein PGI is the fuel supplier, providing geothermal steam to NPC for its power generation. PGI is also responsible for the disposal of the effluent.

PGI furnishes technical assistance and 45 percent of the operating expenses and the receipt of a service fee out of the sale of power produced from goethermal energy. NPC provides the remaining 55 percent of the operating cost and is committed to install, at its own expense and with technical assistance from PGI, such plants and machinery necessary for the conversion of geothermal steam into electric power and the distribution of such power to the end-users.

BED Service Contract Under P.D. 1442

Under P.D. 1442, the contractor would provide the necessary expertise, front-end financing, and technology for developing geothermal fields. The contractor is paid, in turn, a fee equivalent to a maximum of 40 percent of the adjusted net proceeds from the sale of the steam to end-users. The net proceeds are computed after deducting the expenses incurred in the exploration and development of the field. The computation of the service fee paid to the contractor, as provided by the decree, is illustrated in Figure 1.

Figure 1 Geothermal finance scheme

Gross proceeds (GP)
Less: Recovery (Max. 60% of GP)
1. Depreciation
2. Amortization of intangibles
3. Operating expenses

Net Proceeds (NP)
Less: Production Allowance (Max. 50% of NP)

Adjusted Net Proceeds

60% Government Share	40% Contractor's Share
	Contractor's Take: 1. Cost Recovery 2. Production Allowance 3. Contractor's Share
	Income Tax: National Internal Revenue Code Applies

So far, only one corporate entity has been the recipient of a service contract award as implemented under P.D. 1442, although several companies have shown interest in geothermal prospecting activities and have, in fact, started preliminary investigatin and geoscientific surveys together with BED. Because of pricing uncertainties, only PNOC-EDC pursued service contracts for its geothermal projects in Tongonan, Palinpinon, and Bacon-Manito (Bac-Man). One of the problems currently facing prospective service contractors is the issue of the steam transfer price, as it affects the financial returns on their investments. Prior to commercial development, the service contractor must first resolve with a buyer (NPC) the prices at which geothermal steam will be sold. Some price negotiations with BED are still working toward agreement.

Among the companies which have negotiated with BED for service contracts are:

Caltex (Phils.) - Batong Buhay, 1982
TOTAL Exploration - Mt. Labo, 1982
Philippine Oil and Geothermal Energy, Inc. (POGEI) - Mt. Labo, 1982
Ultrana Nuclear and Minerals Corporation - Buhi-Isarog, Carmarines Sur, 1983

Occidental Geothermal, Inc. - Tongonan and other areas, 1983

Fiscal and Financial Incentives for Service Contractors in Geotheraml Activities

The basic financial terms of the NPC-PGI contract are as follows:

(a) As described in a previous section, contractor shall provide 45 percent of all expenses and NPC the remaining 55 percent. NPC shall update payments to Contractor which were incurred prior to the revision of expense sharing to 45-55 percent;

(b) Contractor shall pay corporate income and contractor's tax imposed by the Philippines, while NPC shall bear all imposts, duties and taxes;

(c) Upon start of power generation, NPC shall reimburse contractor for the latter's advances, at some fixed rate per KWH until ful recovery. In addition, NPC shall also pay contractor a fixed fee per KWH as a service fee. The "Base Rates" are subject to escalation; and

(d) NPC shall provide, at no charge, all power requirements at the site, including power infrastructures.

P.D. 1442 provides certain fiscal and fiancial incentives. These include:

(a) Exemption from payment of tariff duties and compensating tax on the importation of machinery and equipment, and spare parts and all materials required for geothermal operations;

(b) Entry of alien technical and specialized personnel, including immediate members of their families, who may exercise their profession soley for the operations of the Contractor;

(c) Repatriation of capital investment actually brought into the country and the remittance abroad of foreign exchange earnings in excess of operating requirements; and

(d) Other privileges provided in Section 12 of Presidential Decree No. 87 (Oil Exploration and Development Act of 1972) as may be applied to geothermal operation.

Guaranteeing the Market for Geothermal Steam

Because the technology was largely untried, it was clear that successful commercialization at that early step would require the immediate availability of a ready and willing market. This came in the person of the National Power Corporation (NPC).

The original involvement of the NPC gave the initial assurance of a market for geothermal steam in commercial volumes. For incstance, NPC was designated in 1971 to negotiate the service contract with Philippine Geothermal Inc. (PGI), a subsidiary of Union Oil of California, for the development of the Tiwi geothermal field and also, later in 1974, for the Mak-Ban geothermal project. By 1974, a Geothermal Division under the Engineering and Construction Department was set-up at NPC in order to, among others, review the work done by PGI, ensure the supply of geothermal steam for the projected power plants, protect the interest of the Philippine government in matters concerning transactions with service contractors, and embark on exploration an development activities in other potential geothermal areas.

That initial mandate and the positive results therefrom had prepared NPC to accept the geothermal option more readily even under the present arrangements as governed by P.D. 1442, where NPC is no longer the field developer but the steam buyer. As a result, the State, through NPC, guarantees the purchase of geothermal steam produced by service contractors for the pwoer expansion program.

Results

Performance Indicators

The government's efforts in the development and commercial production of geothermal resources have led to the continuing contribution of geothermal energy to the annual total energy consumption of the country. From the 3 MWe installation of 1977, geothermal power capacity has dramatically increased to 894 MWe by 1984, delivering annually 4,500 gigawatthours of electricity, equivalent to a fuel-oil displacement of 7.8 million barrels (see Table 5 below).

Table 5 Geothermal power expansion 1977-1984

	1977	1978	1979	1980	1981	1982	1983	1984
Installed Generating Capacity (MWe)	3	3	223	446	559	784	784	894
Power Generation (Gwh)	-	5.8	615	2,030	2,755	3,625	4,077	4,536
Oil Displacement (MMBOE)	-	.01	1.06	3.5	4.75	6.25	7.03	7

Capital Investments/Expenditures

Investments in geothermal resource development between 1973 and 1983 in the Philippines totalled 5.29 billion. Furthermore, investments in geothermal power plants totalling 4.0 billion were made between 1973 and 1983.

Exporting Geothermal Expertise

With the field experience the Philippines has gained over the years, the country has become a contributor to, rather than mere recipient of, geothermal technology transfer. Through PNOC-EDC, the country is now exporting its expertise in geothermal field exploration.

Recently, PNOC-EDC has signed a geothermal exploration contract with Japan's Agricultural Energy Resources Development Foundation. Under the contract, PNOC-EDC will undertake, on a cost-plus basis, geothermal exploration in the Kuju volcanic complex in Kyushu to identify potential geothermal areas and recommend the drilling of wells where warranted.

Prospects

The euphoria of the initial geothermal success has tended to overshadow an earlier concern about the optimal extent of field development. The delivery capacities of the first two fields have been stretched to provide 330 MW of power per field due to the sense of urgency caused by the oil price crisis. As a result of maximizing power output from these fields, some wells have begun to "drop" their individual and collective output, thus threatening their sustainable yield. Some quarters have expressed the opinion that each field should be developed only to a maximum 220 MW for the time being and suggested that the pace of geothermal commercialization has been too fast within each field.

Surprisingly, there are others who believe geothermal development could have proceeded much faster if some policy impediments were removed by government. Among these are the state monopoly policy on power generation and NPC's adherence to average grid power pricing in contrast to hour-of-use marginal cost pricing. It is believed that a relaxation of the rigid government posture on both could have eliminated some uncertainties that continued to confront interested private investors. An avoided cost approach to the pricing of geothermal steam, if politically acceptable, would have accelerated geothermal exploration much faster.

TABLE 6

POLICY STRATEGIES FOR GEOTHERMAL RESOURCE DEVELOPMENT

POLICY STRATEGIES/ INCENTIVES	DESCRIPTION	ACTORS	RESULTS/COMMENTS
I. Systematizing Geothermal Resource Development			
A. Establishing Technical Feasibility, 1960's-70's			
1. Pioneering studies of COMVOL	1. Selected the Tiwi geothermal area as site of the scientific and pilot studies for geothermal power utilization (1964/1967)	1. COMVOL, NSDB and Bureau of Mines	1. The results of the studies provided the country with firm basis to proceed with the commercial production of geothermal steam for power generation.
2. Republic Act. No. 5092	2. Recognized the commercial potential of energy and provided the legal framework for commercial exploration of geothermal steam as a patrimonial resource.	2. Congress, Pres. of the Philippines (Nat'l Gov't)	2. The law assured that the Phils. should get at least 60% of the net benefits from the commercial development thereof.
3. Presidential Proclamation No. 739	3. Set aside some 17,661 has. (42,623 acres) in Tiwi, Albay, as a geothermal reservation area.	3. Pres. of the Philippines (Nat'l. Gov't)	3. The proclamation heralded the decision to commercially develop geothermal resource in the country.
B. Resource Surveys, 1971-present	- identified the various potential geothermal areas to be developed.	- MOE/BED, PNOC-EDC, NPC/PGI	- enabled geoscientific evaluation of potential areas.
C. Exploration Drillings	- further evaluated the potential geothermal areas.	- MOE/BED, PNOC-EDC, NPC/PGI	- enabled determination of the commercial viability of identified geothermal fields.

POLICY STRATEGIES/ INCENTIVES	DESCRIPTION	ACTORS	RESULTS/COMMENTS
II. Financial Mobilization Strategies for Government Expenditures in Geothermal Resource Development	- To supplement locally-available funds for the purchase of capital equipment and assure technology transfer.		
A. Bilateral Cooperation			
1. New-Zealand Bilateral Agreement on Energy Cooperation	1. Provided training assistance in geothermal development Initiated the formation of the PNOC-Geothermal Technology Corporation (PNOC-GTC)	1. National Government, PNOC-EDC, New-Zealand KRTA	1. Advanced the Country's knowledge of hot-water dominated geothermal reservoirs Assured the transfer of geothermal development technology
2. Bilateral Arrangement with Italy, through Electroconsult (ELC)	2. Provided training and conducted a more detailed geothermal resource inventory	2. National Government, MOE/BED, Italy/ELC	2. Enabled the government to identify a set of priority areas for commercial development of geothermal resource
3. Cooperation with Japan, through OECF	3. Provided financial assistance package	3. National Government, MOE, NPC	3. Helped the country purchase capital equipment, geothermal power plants, and other electro-mechanical parts
B. Multilateral Cooperation			
1. UNDP Assistance	1. Provided formal local and foreign training on the science of geothermal study	1. UNDP, MOE/BED, PNOC-EDC	1. Facilitated the transfer of a fair amount of geothermal development technology
C. Concessional Loans			
1. World Bank-PNOC-EDC Loan Agreement, 1982	1. Loan of US$36 million for Geothermal Exploration	1. WB, PNOC-EDC	1. Will serve to further promote geothermal development in the country.

POLICY STRATEGIES/ INCENTIVES	DESCRIPTION	ACTORS	RESULTS/COMMENTS
III. Promotional Strategies for Maximizing Private Sector Participation in Geothermal Resource Development			
A. Risk Reduction for Private Entry			
1. Government Funding of Pre-feasibility Studies	1. The COMVOL pioneering studies in 1964/1967 - Contracted Rogers International to prepare the plan of the Tiwi geothermal plant for connection in the Luzon Grid	1. National Government, NSDB, COMVOL, NPC, Rogers Int'l.	1. Establishing technical feasibility of generating power from local geothermal steam.
2. Governemnt Funding of Surveys and other Geo-scientific studies	2. Funded surveys and studies in the prospective geothermal areas.	2. BED	2. Confirmed the commercial potential of geothermal energy and laid the groundwork for entry of private investors to geothermal activities.
3. Introduction of Geophysical Contract	3. Limited contract to step prior to full exploration	3. Prospective Service Contractors	3. Allowed exploration activity with more liberal or limited work obligation and financial commitment.
B. Circumventing Constitutional Limitations, through the Service Contract System			
1. NPC/PGI Contract	1. A "fuel supply contract" wherein PGI is the fuel supplier providing NPC geothermal steam. It covers Tiwi and Mak-Ban areas and has a 45/55 sharing scheme on expenditures.	1. NPC, PGI	1. Led to successful development of Tiwi and Mak-Ban geothermal fields.

POLICY STRATEGIES/ INCENTIVES	DESCRIPTION	ACTORS	RESULTS/COMMENTS
2. Service Contract Under P.D. 1442	2. Service contractor provides the expertise, front-end financing and technology for developing fields. A service fee is paid to the contractor equivalent to a maximum of 40% of net proceeds from sale of steam to end-users.	2. MOE/BED, NPC PNOC-EDC and other prospective contractors	2. Problem of government royalty tended to make transfer price higher than otherwise.
C. Fiscal and Financial Incentives for Service Contractors			
1. NPC-PGI contract financial terms	1. Provides a 45-55 cost sharing scheme between PGI and NPC - PGI pays corporate income and contractor's tax while NPC bears all imports, duties and taxes.	1. NPC, PGI	1. Made PGI's venture in Tiwi and Mak-Ban gain realistic returns.
2. Incentives under P.D. 1442	2. Provided fiscal incentives on imports of capital equipment and foreign expertise as well as financial incentives like repatriation of capital investments brought into the country and foreign exchange remittances of earnings.	2. Nat'l gov't, and service contractors.	2. Encouraged contractors to invest in geothermal activities and facilitated transfer of geothermal technology. However, royalty issue somehow made transfer price higher, thus, affecting the contractor's financail returns.
D. Guaranteeing purchase of geothermal steam	The national power utility (NPC) will purchase all steam produced from the fields.	NPC, PGI, PNOC-EDC	Assured service contractors of a guaranted market for geothermal steam.

CHAPTER 4

BIOMASS PROLIFERATION STRATEGIES

Although biomass sources of energy have long been utilized in the Philippines, especially in the rural areas, it was only in 1977 that the government started implementing clear-cut policies on harnessing rural, nonconventional sources of energy which abound in an agricultural country such as the Philippines.

Considering the vast potential of the country's regenerative energy resources, of which biomass fuels showed the largest intermediate promise, the President issued Presidential Decree No. 1068 in January 1977, directing a full-blown program on nonconventional* sources of energy. The decree integrated the research and development efforts of the government in the noncon energy field toward commercializing reliable noncon technologies. Utilizing government and foreign funding, the noncon program worked at demonstrating the feasibility of selected renewable energy technologies.

The key strategies to commercially develop and utilize biomass energy forms can be categorized similarly to the strategies for geothermal development:

1. Systematization of the commercialization of noncon energy;
2. Financial mobilization strategies for government expenditures on noncon energy resource development; and
3. Promotional strategies for maximizing private sector participation in the commercialization of renewable energy technologies.

A discussion matrix is present in Table 9 at the end of the chapter (page 30).

Systematization of Non Con Energy Commercializaton

Energy Use Surveys, 1977-1984

In order to establish "how much of what form of energy was used by which sector for what purpose," the Planning Service (Ministry of Energy) conducted the first energy demand survey of households in 1977. It provided the government with the first baseline information on urban and rural energy use. The encouraging data on nonconventional fuel use which resulted from that first survey led to a series of follow-up surveys, each time deliberately concentrating on a different sector for noncon energy monitoring. Subsequent surveys systematically looked at usage in the industrial, commercial, transport, and agricultural sectors.

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*The term "nonconventional" or "noncon" is officially adopted by the Philippine government to include direct and indirect forms of solar energy, as well as other energy sources not conventionally identifiable with any of the commercial forms of energy. Noncon energy resources are classified into three areas, namely: biomass, wind, and direct solar.

In the meantime, industrial utilization of biomass fuels (specifically, biomass fuels) were also being surveyed and monitored through the Bureau of Energy Utilization (BEU) to determine the extent of comercial usage. The biomass fuels largely used in the industrial sector include bagasse and agriwaste.

Prioritization of Noncon Technologies for Commercialization

A second step in the government strategy to systematize implementation of policies for promoting noncon resources is technology prioritization. To establish priorities, studies were conducted to asssess the state of noncon technologies in the country in order to determine the potential or readiness for commercialization, and the proper launch-time therefor. These studies included market/industry viability assessments. Between 1977 and 1984, for instance, the Planning Service of the MOE conducted the following six surveys/studies:

- Energy Consumption and Conservation Practices of Urban Households and Commercial Establishments (1979)
- Industrial Energy Profiles (1979)
- Household Energy Audit (1981)
- Rural Energy Needs Survey (1981)
- The New Energy Systems Delivery Assessment (1982)
- The Agricultural Crop Production Survey (1984)

The studies were aimed at enabling cost-effective promotion strategies for favored technologies to be formulated, as well as at designing technology-specific incentive packages for possible legislation.

The Ministry's objective was to give promotional priority to noncon technologies which were economically mature, close to commercialization, and capable of a significant contribution to oil displacement. Among the noncon technologies that emerged as warranting priority were commercial-scale biogas systems and biomass conversions for commercial-size boilers.

Integrated Monitoring and Implementation of the Nonconventional RD & D Program

Since the renewable energy sector would cover quite a number of technology options, it was anticipated that individual biases which could blur or confuse the government's vision could be reduced if the entire range were to be overseen by only one office.

The Nonconventional Resource Division (NCRD) of the Bureau of Enregy Development (BED) was therefore created in 1977 to be the lead government office for research, development, and demonstration (RD & D) on noncon technologies. NCRD also acts as the government funding agency providing financial assistance to deserving research-proponents for noncon RD & D.

One of the largest implementors of the noncon RD & D program is the Energy Research and Development Center (ERDC), organized in September 1981 as a subsidiary of the government-owned Philippine National Oil Company (PNOC). It was believed that with its corporate mandate, ERDC would favor applied and adaptive RD & D activities which will enable the substitution of economically competitive renewable energy forms for depletable fuels. It is not a coincidence therefore that ERDC is the implementing agency of most of NCRD's noncon projects.

Since the launching of the noncon RD & D program in 1977, a total of almost 40 projects have been financed through NCRD. More than 50 percent of these related to biomass.

Financial Mobilization Strategies for Government Expenditures on Nonconventional Technologies

Government Budget for the Noncon Program

To provide a catalytic boost to the renewable energy program, the government allocated a substantial amount to NCRD for its RD & D projects. Between 1977 and 1983, the government released around P65 million. Of the total expanditures, almost 50 percent were used for biomass research projects.

Bilateral Grants for Financing Noncon Priority Projects

Cognizant of the large financial requirements in undertaking renewable energy RD & D projects, the government availed itself of bilateral grants to supplement government funds. Among others, the government received financial and capital equipment grants from USAID and the Federal Republic of Germany.

Promotional Strategies for Maximizing Private Sector Participation in the Commercialization of Nonconventional Technologies

Realistic Pricing of Commercial Fuels

To encourage energy consumers to shift to competitive renewable energy sources, the government resisted delaying required price adjustments on commercial fuels. The imposition of more tariffs on certain petroleum products also provided an additional incentive for the use of renewable energy forms.

Fiscal and Financial Incentives Under P.D. 1068 and Other Incentives Under the Board of Investments

The financial and fiscal incentive package embodied in Presidential Decree No. 1068, issued in 1977, is a government policy employed to promote the use of alternative noncon sources of energy. P.D. 1068 allows duty-free importation of equipment for noncon energy facilities, as well as accelerated depreciation and tax credits on domestic capital equipment. The decree also provides for the carry-over of net operation losses and an exemption from capital gains taxes.

Furthermore, an energy priority plan sub-component was introduced to the Investment Priorities Plan (IPP) of the Board of Investments (BOI) since 1981. Under the energy priority plan, standard BOI investment incentives are extended to projects that utilize, among others, renewable energy forms, as well as energy conversin projects which result in a more efficient use of energy. Since 1981, a number of firms have engaged in energy-related projects and have registered with the BOI for incentives. Among the notable energy-related projects that have been granted incentives is a project of Procter and Gamble (Philippines) Manufacturing Corporation that replaced existing oil-fired boilers with solid waste (coconut shell)-fired boilers.

Risk Reduction for Private Sector Participation in the Commercialization of Noncon Technologies

Considering the high-cost/high-financing risks in the commercialization of noncon technologies, the government attracted private sector investments in noncon technology by providing the necessary ground work to assure such ventures. These goals were effected through government funding of R D & D projects, as well as studies on their commercial applications. Likewise, the government funded noncon energy resource surveys and market/industry surveys to help ensure the technical and economic viability of private sector investments in noncon projects.

Guarantees Markets for Noncon Technologies

1. Electric Cooperatives for Dendro-Thermal Plantations

One notable program on biomass utilization, in which the government took a direct and more aggressive stance, is the Dendro-Thermal Energy Development Program. The program envisioned a managed energy plantation scheme combining energy, reforestation, and livelihood objectives. Under this system, wood (specifically, ipil-ipil) produced by Farmers' Associations is sold at predetermined rates for use in dendrothermal power plants of electric cooperatives financed by the National Electrification Administration. Wood as fuel is then converted into electricity and sold to power consumers. To support the program, the government extends development loans for the plantation and for the maintenance of the tree farms.

Rural Use of Gasifiers

The use of gasifiers to produce low BTU gas for power application is not new to the country, since it is a mere revival of the charcoal-fed vehicles made popular during World War II when fuel oil was scarce. However, the recent developments in the field of gasification technology is geared toward supplying more energy for rural industry. From the early research at the University of the Philippines, the Economic Development Foundation, and Project Santa Barbara, and at the behest of the Ministry of Energy, under the Nonconventional energy Resources Development Program (NERDP) conceived in 1977, the technology advanced to a commercial phase in 1981. During that year, the Gasifier Equipment Manufacturing Corporation (GEMCOR), a government-owned and controlled corporation, was established as a subsidiary of Farm Systems Development Corporation (FSDC) and given the task of the commercial fabrication and marketing of gasifier systems, primarily for agricultural-related applications.

The Seven-Year Gasifier Program for the period 1983-1989 has for its target the production and installation of 500,000 gasifier units. To support these gasifiers with fuel, 750,000 hectares of land will be planted to fast-growing trees. Some 75,000 kilns with a production capacity of one ton of charcoal per week will be constructed, requiring some 350 million clay bricks.

GEMCOR intends to supply 72,000 gasifier units or 14 percent of the toal target. This shall be accomplished through the setting up of three satellite regional gasifier plants in addition to GEMCOR's original plant in Carmona, Cavite. To accelerate gasifier production for vehicular applications, another government-supported gasifier corporation, the Philippine Dendro Gasifier Corporation (PDGC) was organized in 1983, with roughly three times the productive capacity of GEMCOR when fully operational. Table 7 shows GEMCOR's seven-year production targets on a per-application basis.

It is by deliberate design that GEMCOR is a subsidiary of Farm Systems Development Corporation (FSDC), an organization that develops and finances farms and irrigation associations. Since agricultural infrastructures eventually include such machinery as irrigation pumps, turbo-charged engines, rice threshers, palay driers, portable pumps and generating sets, ricemills, transport vehicles, etc., manufactured gasifiers at competitive prices and acceptable quality are assured a captive market.

Table 7 Gasifier and equipment manufacturing corporation production targets per application, CY 1983-1989 (in units)

Application	1983	1984	1985	1986	1987	1988	1989	Total
Small Engine (Thresher/ Pumps/Genset Mixer)	1,200	2,000	4,000	4,800	5,600	5,600	5,600	28,000
Banca*	750	1,250	2,500	3,000	3,500	3,500	3,500	18,000
Larger Stationary Engine								
1. Genset/Ricemill/Ice plant	450	750	1,500	1,800	2,100	2,100	2,100	10,800
2. Irrigation	250	400	800	960	1,120	1,120	1,120	5,760
Vehicle (Jeep/Truck)	360	600	1,200	1,400	1,680	1,680	1,680	8,640
TOTAL	3,000	5,000	10,000	12,000	14,000	14,000	14,000	72,000

* Definition of Banca

Government Program Results

Overall Noncon Contribution

The renewable energy sector started out by contributing only 2.25 million BFOE to the commercial energy use of the country in 1973. By 1983, this had increased almost seven-fold to 14.6 million BFOE, excluding gasifier and dendrothermal contributions.

A 1979 Materials-Energy Balance, using data from the 1977 survey of the Planning Service, yielded the result that the total (including non-commercial) consumption of biomass fuels may have reached 51.3 million BFOE, of which 31.2 million BFOE were attributable to household use (25.7 million BFOE of this in rural households).

Installation of Dendrothermal Plants

The dendrothermal program of the government, first commercially launched in 1980, started to contribute to the country's energy needs only 4 years after. The four dendrothermal power plants commissioned in 1984 have a total installed capacity of 12.7 MWe, generating around 7,870,350 KWH annually. The power generated from these plants is equivalent to what approximately 1.66 million barrels of fuel oil equivalent (MMBFOE) would have generated. Against the total biomass contribution, the results of the dendrothermal program still appear modest. Its major impact will probably lie less in terms of oil displacement, and more in employment-generation.

For the moment, Philippine expertise in dendro thermal energy is starting to break into the export market with joint-venture agreements presently being negotiated with Indonesia.

Gasifier Installation

The commercial production of gasifiers by GEMCOR from 1981 to June 1983 accumulated to 1,661 units, against order-volumes of 973 units. However, installations have reached 985 units by end 1984. The market so far has been dominated by the irrigation sector, the fishing industry, and the jeepney sector (Table 8).

Table 8 Gasifier production, sales, installation by application

Application/Model	Production (Units) As of June 1983	Sales/Purchase (Order Closed) As of June 1983	Installations (Units) As of Dec. 1984
Irrigation	452	421	435
Ricemill	2	2	2
Power Generator	20	20	27
Thresher	230	5	6
Dryer	1	1	2
Ice Plant	2	2	4
Banca	726	318	295
Jeepney, Light Truck	226	202	186
Direct Heat	2	2	28
	1,661	973	985

The installation of these gasifier units are undertaken by GEMCOR, Farm Systems and Development Corporation (FSDC) and the National Electrification Administration (NEA)

The interim achievements represent roughly 12 percent of the original targetted sales of GEMCOR. The low fraction need not automatically imply failure, but may instead mean that the original projections were too optimistic. Perhaps the technology requires a promotion and gestation period of another 1 to 2 years.

The sale closest to target occured, not unexpectedly, in the irrigation sector, which provided a captive market by virture of GEMCOR's relation to FSDC. This sector also represents the largest market (44 percent) so far.

Table 9 Policy strategies for noncon/biomass resource utilization

Policy Strategies/Incentives	Description	Actors	Results/Comments
I. Systematization of noncon commercialization	Noncon Program under P.D. 1068		
A. Rural Energy Use Surveys, 1977-1984	Surveys undertaken by the MOE Planning Service and BEU	National Government MOE	Determined what forms of alternative noncon energy resources to promote in order to displace oil.
B. Prioritization of Noncon Technologies for Commercialization	Studies by Planning Service to assess noncon technologies	Planning Service BED-NCRD, BEU, PNOC-ERDC	Determined the commercialization potential of noncon technologies
C. Integrated Monitoring and Implementation of the noncon RD & D program	Creation of NCRD in 1977		NCRD became the lead agency for RD & D of non non con technologies
II. Financial Mobilization Strategies for Government Expenditures of Noncon Technologies			
A. Government budget for the noncon Program	Allocation between 1977 and 1983 of P65 million to NCRD for RD & D projects	National Government & MOE-NCRD	Provided a catalytic boost to the noncon RD & D programs
B. Bilateral grants	Grants from USAID and Germany	NCRD, Donor countries	Supplemental government funds in financing noncon activities
III. Promotional Strategies for Maximizing Private Sector Participation			
A. Realistic pricing for commercial fuels	Included imposition of more tariffs on certain fueld commodities	National Government	Encouraged to some degree, energy diversification by consumers. This was, however, constricted with the stabilization of oil prices in mid-80s.
B. Fiscal and Financial Incentives	Granted, among others, duty-free importation of noncon equipment and exemption from capital gains taxes, as well as included an energy sector in the BOI Investment Priorities Plan.	National Government	Further promoted the development and utilization of noncon energy
C. Risk Reduction for Private Entry	Government funding of RD & D projects, studies on noncon applications and energy resource/market/industry surveys	National Government	Helped ensure the technical and economic viability of private sector investments in noncon projects
D. Guaranteeing Markets for Noncon Technologies			
1. Electric Cooperatives for Dendrothermal plantations	Dendrothermal Energy Development Program	National Government NEA, Cooperatives	Cooperative assured a market for ipil-ipil produced by Farmer's Associations
2. Irrigation Associations for [illegible]ers	The creation of GEMCOR as a subsidiary of of Farm Systems Development [illegible]ation	GEMCOR, FSDC, NEA	Farm systems infrastructures assured a captured market for gasifie[illegible]