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REGIONAL WOOD ENERGY DEVELOPMENT PROGRAMME IN ASIA
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THE WOODFUEL SCENARIO AND POLICY ISSUES IN THE PHILIPPINES

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FOREWORD

In the Philippines, woodfuels account for about 18 percent of the primary energy and 44 percent of the indigenous energy consumption (i.e. oil, coal, hydropower, geothermal, woodfuels, biomass residues, others). Among the various new and renewable energies, the share of woodfuel is as high as 62 percent. Its use is mostly confined to the household and traditional industry sectors. According to the statistics of the Department of Energy, biomass fuels in the form of bagasse, coconut husk and shell, rice husk, and woodfuels contributed as much as 67.5 million barrels of fuel oil equivalent in 1997, worth about 1.2 billion US dollars. Woodfuel is more than just another of the many non-conventional energy sources. It is being supplied from both forest and non-forest lands, and a large number of people are employed in processing and trade, not to mention in activities related to numerous woodfuel based industries. This has many implications: economic, social, environmental and others (i.e. health and gender). The woodfuel trading system is still unclear and undefined. Woodfuel is not yet recognized as an important commodity and so woodfuel production and trade statistics are not regularly collected in the energy or forestry sector. However, its trade in the rural areas is economically significant and some 536,000 households depend on gathering and selling fuelwood, 158,000 households make charcoal, and 40,000 households act as traders of woodfuels. Moreover, the woodfuel markets operate efficiently linking woodfuel resources with the urban consumers and this is achieved without utilizing significant quantities of capital.

Woodfuel-related issues in the Philippines are complex and heterogeneous and they present policy makers with major challenges because they are associated with a range of intricate problems, particularly involving small farmers, and the landless poor. At the same time, however, the potential of wood energy extends beyond subsistence, providing sound and viable options for modern development and energy applications. The central questions are then: to what extent and in what manner can woodfuel be subject to policy making? Who should make the policies? Whose priorities should they be based on?

It is not an easy matter to address these issues. However, the FAO-RWEDP along with the combined expertise of Dr. L. L Rebugio, Dean, and two senior researchers in the College of Forestry and Natural Resources (CFNR), UPLB - Dr. J. T. Dizon and Dr. N.O. Espiritu - have made a critical analysis of the wood energy sector and identified the major woodfuel concerns in the Philippines. These include concerns related to supply sources, government policies and programmes, the role of NGOs and the private sector, and economic aspects of wood energy development. These concerns plus numerous recommendations to address the identified issues are included in the present document.

Initially this material was prepared as a reference document for training in forestry and related subjects in UPLB, including the mandatory continuing professional education for all practicing foresters. But the subject is of far more than academic importance and RWEDP hopes that it will also be of use to many others.

The invaluable assistance of Mr. Tara N. Bhattarai, Wood Energy Resources Specialist at the RWEDP is gratefully acknowledged.

Auke Koopmans
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PREFACE

On July 25, 1995, the Philippine government imposed a mandatory training program for all practicing professionals with the issuance of Executive Order No. 266, which institutionalized the Continuing Professional Education (CPE) of the various Professional Regulatory Boards. Under the CPE Program, all practicing foresters are required to refresh their knowledge, skills, and proficiency in order to enhance their professional competencies.

The University of the Philippines Los Baños (UPLB), as an accredited center for imparting the CPE, currently offers refresher courses through the College of Forestry and Natural Resources (CFNR), particularly through the Center for Tropical Resources and Ecosystems Sustainability (CTREES). Through the CPE, CTREES aims to conduct a series of short courses on various forestry topics for foresters employed by government agencies, local government units, non-government organizations, and private companies.

The Regional Wood Energy Development Programme (RWEDP) considered it an opportune time to assist the UPLB in integrating the wood energy related issues into the CPE. Hence, the RWEDP supported this study to critically review and analyze the woodfuel scenario and policy issues in the Philippines. The objective was to produce an informative report which would serve as reference material for the trainees pursuing academic and refresher courses under the CPE. The authors hope that not only the CPE trainees will benefit from this report, but also the students, academicians, policy makers and even the members of the civil society who are dependent on the woodfuel for their energy needs.

The first part of the report provides an overview of wood energy in the Philippines and highlights the major woodfuel concerns in the country today, namely, problems of the wood energy sector, supply sources, relevant government policies and programs, role of the NGOs and the private sector, and economic aspect of wood energy. Towards the end of the report, a number of recommendations to address some of the identified issues are presented.

Sincere thanks and gratitude go to Dr. W. Hulscher, FAO/RWEDP Chief Technical Adviser for supporting the study and to Mr. T. Bhattarai for Wood Energy Resources Specialist at the RWEDP, reading through the report and providing constructive comments for its improvement.

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LIST OF ABBREVIATIONS AND ACRONYMS

A&D	Alienable and Disposable
ARECOP	Asian Regional Cookstove Program
ARMM	Autonomous Region of Muslim Mindanao
CADC	Certificate of Ancestral Domain Claim
CALC	Certificate of Ancestral Land Claim
CAR	Cordillera Administrative Region
CARL	Comprehensive Agrarian Reform Law
CARP	Comprehensive Agrarian Reform Program
CBFM	Community-Based Forest Management
CBFMP	Community-Based Forest Management Program
CCFS	Certificate of Community Forest Stewardship
CEPNA	Committee on Energy Project in NIPAS Areas
CFMA	Community Forest Management Agreement
CFP	Community Forestry Program
CRMDP	Community Resource Management and Development Plan
CSA	Community Stewardship Agreement
CSC	Certificate of Stewardship Contract
CTF	Communal Tree Farms
DA	Department of Agriculture
DAP	Development Academy of the Philippines
DAR	Department of Agrarian Reform
DENR	Department of Environment and Natural Resources
DOE	Department of Energy
DOST	Department of Science and Technology
ERDB	Ecosystems Research and Development Bureau
ESMAP	Energy Sector Management Assistance Programme
FAO-RWEDP	Food and Agriculture-Regional Wood Energy Development Programme
FAR	Family Approach to Reforestation
FLMA	Forest Lease Management Agreement
FLMP	Forest Land Management Program
FMB	Forest Management Bureau
FOM	Forest Occupancy Management
FPRDI	Forest Products Research and Development Institute
FWD	Foundation for Woodfuel Dissemination
HECS	Household Energy Consumption Survey

IEC	Information, Education and Communication
ISFP	Integrated Social Forestry Program
ITDI	Industrial Technology Development Institute
LOI	Letter of Instructions
LPG	Liquefied Petroleum Gas
MBI	Market-Based Instrument
Mbfoe	Million Barrels of Fuel Oil Equivalent
MOA	Memorandum of Agreement
MPFD	Master Plan for Forestry Development
NCED	Non-conventional Energy Division
NCR	National Capital Region
NEA	National Electrification Administration
NEP	National Energy Plan
NFP	National Forestation Program
NGO	Non-government Organizations
NIPAS	National Integrated Protected Areas system
NRE	New and Renewable Energy
NSO	National Statistics Office
OEA	Office of Energy Affairs
PSSD	Philippine Strategy for Sustainable Development
PV	Photovoltaic
R & D	Research and Development
REAP	Renewable Energy Association of the Philippines
SIFM	Socialized Industrial Forest Management
TLA	Timber Lease Agreement
TSI	Timber Stand Improvement
UNDP	United Nations Development Programme
WB	World Bank

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EXECUTIVE SUMMARY

Energy sources in the Philippines can be classified into imported sources and indigenous sources. Imported sources comprise oil and coal. Indigenous sources comprise conventional energies like domestically produced oil, coal, hydropower and geothermal energy and non-conventional energies (or NRE) like bagasse, agri-residues, woodfuel etc.

Woodfuels are the most important non-conventional source of energy of the household and industrial sectors of the country. However, the woodfuel industry is not recognized as an important sector of the economy primarily because many considered it as a traditional or an old-fashioned source of energy.

While woodfuels are sourced from both public and private lands, a large portion of these comes from private lands and only a small fraction comes from government forests. The public sources include the forests (natural and man-made), mangroves, and brushlands, while the private sources include the non-forest areas (farmlands, coconut plantations, and idle A&D lands)

Woodfuel trade consists basically of a three-fold intricate system of (a) consumption, (b) distribution and (c) production. Woodfuel trade can be characterized as unclear and undefined because woodfuel is not recognized as an important commodity leaving many market transactions unrecorded.

Woodfuel trade is economically significant in rural areas. It was estimated that there are 536,000 households dependent on gathering and selling fuelwood, 158,000 households are charcoal makers, and 40,000 households act as traders in rural areas. An additional estimated 100,000 households are urban traders. Furthermore, it was estimated that close to 10 percent of all rural households receive income from woodfuel trade.

Distribution and marketing of woodfuels involve many conduits and intermediaries before it finally reaches the consumers or end-users. Hence, there is a considerable price build-up from the source to the final consumers. Data also reveal that there is not much inter-regional variation in prices. Price structure of woodfuels is largely determined by the mode of sale, i.e. whether it is picked-up or delivered; the number of sellers; availability as influenced by the season of year; and quality as affected by wood species. The woodfuel markets operate efficiently linking woodfuel resources with urban markets and achieve it without utilizing significant quantities of capital.

Upland development programs and all other rural development programs can only succeed if the people have security of tenure over the land and trees. In this regard, various tenurial instruments are issued by the government depending on the type of project and beneficiaries involved. However, the various tenurial instruments are generally confusing and difficult to administer. Processing is also slow and cumbersome.

There are also numerous government policies affecting wood energy in the country. However, these policies are not direct and explicit, instead they are embodied and subsumed in general terms and under the National Energy Plan (NEP), the Master Plan for Forestry Development (MPFD) and the Philippine Strategy for Sustainable Development (PSSD), thus diluting the intended goals and expected outputs.

There are at least three key government agencies which have varying mandates closely related to woodfuel management. They are the DOE through its NCED, the DENR through its attached agencies namely the FMB, ERDB and the Planning and Policy Studies Office of the Department and the DOST through ITDI, and FPRDI.

Studies however showed that there is no agency or body specifically designated to be responsible for spearheading and conducting fuelwood-related programs and projects. What is needed at present is effective coordination among these relevant agencies and a mechanism whereby institutional linkage can be strengthened. This is to ensure that the biomass fuel resource based is properly managed through a consistent set of policies and programs.

In addition to these, there is a need to involve the Departments of Agriculture and Agrarian Reform in the planning and development of the country's wood energy program since non-forest lands are the major sustainable sources of woodfuels.

1. WOOD ENERGY IN THE PHILIPPINES

1.1 Wood as an Energy Source

In the 1970s, statistics show that no less than one and a half billion people in developing countries derived at least 90% of their energy requirements from wood and charcoal. Another billion people met at least 50% of their energy needs by using woodfuels (National Academy of Sciences, 1980).

Energy sources in the Philippines can be classified into imported sources and indigenous sources. Imported sources comprise oil and coal. Indigenous sources comprise conventional energies like domestically produced oil, coal, hydropower and geothermal energy and non-conventional energies (or NRE) like bagasse, agri-residues, woodfuel etc.

In 1997, the country's total primary energy consumption amounted to 230.7 million barrels of fuel oil equivalent (Mbfoe). This represents a 4.3% increase from the 1996 consumption figure of 221.3 Mbfoe (DOE, 1997).

Table 1 reflects that the utilization of imported energy rose to 135.7 Mbfoe from 125.7 Mbfoe in 1996. Imported oil comprised the biggest share in the energy mix at 123.3 Mbfoe or 53.4%, representing a 5.0% increase from the 1996 figure of 117.4 Mbfoe. Meanwhile, imported coal contributed 5.4% in the energy mix at 12.4 Mbfoe, posting a considerable increase of 49.0% compared to the 1996 level.

Table 1. Primary energy consumption in the Philippines (Million Barrels of Fuel Oil Equivalent, Mbfoe)

ENERGY SOURCES	1997	Percent Share	1996	Percent Share	Percent Change
Indigenous Energy	**95.0**	**41.2**	**95.5**	**43.2**	**(0.6)**
Conventional	27.2	11.8	28.9	13.1	(6.0)
Oil	0.04	0.0	0.4	0.2	(91.4)
Coal	4.4	1.9	5.0	2.3	(12.1)
Hydropower	10.3	4.5	12.2	5.5	(15.5)
Geothermal	12.5	5.4	11.3	5.1	10.5
New and Renewable Energy	67.8	29.4	66.5	30.1	1.8
Bagasse	7.0	3.0	7.9	3.6	(11.7)
Coconut Husk/Shell	13.9	6.0	13.0	5.9	7.5
Rice Husk	4.3	1.9	4.1	1.9	5.3
Woodfuel	42.2	18.3	41.3	18.7	2.2
Others	0.3	0.1	0.2	0.1	26.8
Imported Energy	**135.7**	**58.8**	**125.7**	**56.8**	**7.9**
Oil	123.3	53.4	117.4	53.0	5.0
Coal	12.4	5.4	8.3	3.8	49.0
Total Energy	**230.7**	**100.0**	**221.3**	**100.0**	**4.3**

Source: DOE, 1997

Utilization of indigenous energy during the year amounted to 95.0 Mbfoe, a figure lower than the 1996 level (95.5 Mbfoe) by 0.6%. Of the indigenous energy sources, new and renewable energy (NRE) accounted for 29.4% of the total energy mix, an increase of 1.8% from 66.6 Mbfoe in 1996 to 67.8 Mbfoe in 1997. It can be noted that among the NRE, woodfuel accounted for 18.3% of the total energy mix at 42.2 Mbfoe.

The use of conventional energy sources amounted to 27.2 Mbfoe, a 6.0% decrease from the 1996 level of 28.9 Mbfoe. Of the conventional sources, hydropower and geothermal provided 4.5% (10.3 Mbfoe) and 5.4% (12.5 Mbfoe) share in the total energy mix, respectively.

Table 2 provides a breakdown of the different components of the non-conventional energy and their corresponding contributions to total NRE. Biomass provided the largest share of about 67.5 Mbfoe of the total 67.8 Mbfoe, a very big share of 99.5%. Among the biomass resources, woodfuel contributed the largest volume of about 42.2 Mbfoe (62.2%), while bagasse and coconut residues contributed around 7.0 Mbfoe (10.3%) and 13.9 Mbfoe (20.6%), respectively. Other NRE sources such as solar, wind, hydro and industrial wastes had a meager share of about 0.312 Mbfoe (0.5%).

With regard to the use of woodfuel, Table 3 shows that woodfuel ranked first among the top three fuels Philippine households used. The HECS data show that about 13,083 households used woodfuel while 10.8 million households (84%) used electricity and 10.2 million households (80%) used kerosene. The same table reflects that the number of households using non-conventional fuels like woodfuel and biomass residues decreased as income increased. Households tend to used electricity, LPG and kerosene as their major fuels as their incomes increase.

In 1995, the annual household consumption of woodfuel in the country was recorded at 15.3 million tons, compared to 3.7 million tons for biomass residue and 0.5 tons for LPG (Table 4). Hence, in the Philippines, woodfuel still supplies the bulk of the household's energy demand.

Table 2. Non-conventional energy consumption, 1997

RESOURCE	VOLUME (Mbfoe)	PERCENT
Biomass	**67.462**	**99.5**
Bagasse	6.970	10.3
Coconut Residue	13.944	20.6
Rice hull	4.344	6.4
Woodfuel	42.204	62.2
Others	**0.312**	**0.5**
TOTAL	**67.774**	**100.0**

Source: DOE, 1997

Table 3. Number of households (in thousands) by type of fuel used and monthly income class: 1995

FUEL TYPE	MONTHLY INCOME CLASS (Peso)						
	< 5,000	5,000 - 9,999	10,000 - 14,999	15,000 - 24,999	> 25,000	Not reported	Total House-holds
Electricity	5,531	3,044	1,128	627	417	12	10,760
LPG	1,128	1,545	809	479	264	10	4,236
Gas	28	6	10	4	6	-	55
Diesel	24	19	5	5	1	-	55
Kerosene	6,536	2,350	643	374	284	7	10,245
Woodfuel	7,935	3,099	1,013	575	448	11	13,083
Biomass residue	2,724	689	150	109	70	2	3,744
TOTAL							**12,821**

Source: DOE, 1995

Table 4. Annual household fuel consumption by type of fuel used and monthly income class: 1995

FUEL TYPE	MONTHLY INCOME CLASS (Peso)						
	< 5,000	5,000 - 9,999	10,000 - 14,999	15,000 - 24,999	> 25,000	Not reported	Total House-holds
Electricity (MWH)	1,631,365	2,588,972	1,561,356	1,286,022	1,028,466	37,653	8,133,814
LPG (Tons)	120,275	181,019	102,678	62,126.	35,618	1,203	502,919
Gas (M^3)	12,751	1,473	2,941	564	1,214	-	8,943
Diesel (M^3)	4,456	9,804	3,176	1,308	30	-	18,774
Kerosene (M^3)	474,882	197,868	52,474	26,295	24,125	351	775,996
Woodfuel (Tons)	10,860,706	2,791,878	732,464	456,582	483,511	1,928	15,327,068
Biomass residue (Tons)	2,737690	607,533	148,093	97,895	76,172	887	3,668,272

Source: DOE, 1995

1.2 Wood - Largely Traditional But Not Phasing Out

In the Philippines, woodfuel remains the traditional and principal source of household energy. In 1977, the National Household Energy Survey reported that the national woodfuel consumption of the country was about 48% of the total consumption. The 1989 Household Energy and Consumption Survey (HECS) revealed that 67% of the households still used woodfuel for their energy requirements (DAP, 1992). In 1995, the HECS reported that woodfuel ranked first among the different fuels households used.

Regarding sources of woodfuel, fifty-eight percent of the households resorted to self-collection or gathering while 28% purchased woodfuel. Very few (3%) resorted to both modes of woodfuel acquisition. On the other hand, the majority (73%) of the charcoal-using households purchased charcoal while 24% produced their own charcoal. A small number (1%) acquired charcoal through both means (Table 5).

In terms of sources of self-collected fuelwood, Table 6 shows that about an equal percentage (45%) of the households gathered fuelwood from their own land and from other private land. About 7% reported that they collect fuelwood from government lands. These data support the findings that the majority of the fuelwood comes from private lands and only a minority come from government forests.

The time spent for woodfuel collection varies significantly between specific areas. The availability and accessibility of wood energy resources in a locality are the prime factors that determine the length of time devoted to woodfuel collection. Different studies reported varying times spent for collection. For instance, OEA (1982) as cited by DAP (1992) reported that about 26 minutes were devoted to woodfuel collection daily from a woodfuel source with an average distance of less one kilometer. On the other hand, Misajon *et al* (1989) reported an average of 45 minutes per day as the average collection time. The study conducted by Delos Angeles (1991) reported that an average of 7.7 hours/day are spent for woodfuel collection. The same study highlights the role of women in woodfuel collection. Hence, in addition to their household chores, agriculture and other occupations, women devote a large part of their time to woodfuel gathering.

Although more of the households surveyed agree that fuelwood gathering causes deforestation, there are several reasons for the continuous use of fuelwood among the households in the rural as well as in the urban areas. For one thing, cooking with fuelwood gives a hotter flame and results in better tasting dishes. People think that fuelwood is relatively easy to get and it is inexpensive compared to commercial fuel (Table 7).

This misconception that woodfuel gathering causes deforestation (in fact the majority of woodfuel come from private lands) stems from the differences between the administrative status of land, i. e., the distinction between forest and A & D land, and the actual land use. For instance, there are cases when supposedly A & D land is categorized as forest land just because its slope is within 18%. Following the technical definition of forest land, this piece of land can be easily categorized as such even though its actual land use is not forestry.

1.3 Woodfuel Use

In general, woodfuel is used for domestic and small and large scale industries. The Master Plan for Forestry Development (1990) projects the woodfuel demand for both sectors from 1990 to 2015. It can be noted that on average, households account for about 82% of the total woodfuel demand (Table 8).

Table 5. Number of households (in thousands) using woodfuel, their source/mode of acquisition: 1995

AREA	MODE OF ACQUISITION								
	TOTAL	PURCHASED	%	SELF-COLLECTED/ GATHERED	%	BOTH	%	OTHERS	%
FUELWOOD									
Philippines	8,142 (16,434,927)	1,305 (1,744,051)	16	6,458 (13,012,436)	79	283 (1,678,440)	3	96	1
Urban	2,841 (4,335,959)	799 (902,330)	28	1,840 (3,226,769)	65	130 (206,860)	4	72	2
Rural	5,300 (12,098,968)	506 (841,721)	10	4,618 (9,785,667)	87	153 (1,471,579)	3	24	<1
CHARCOAL									
Philippines	4,941 (810,785)	3,607 (510,242)	73	1,181 (261,476)	24	57 (39,067)	1	96	2
Urban	2,793 (412,430)	2,519 (332,913)	90	227 (53,310)	8	17 (26,207)	<1	30	1
Rural	2,147 (398,377)	1,088 (177,329)	51	955 (208,166)	44	39 (12,860)	2	65	3
TOTAL WOODFUEL									
Philippines	13,083 (17,245,712)	4,912 (2,254,293)	38	7,639 (13,273,912)	58	340 (1,717,507)	3	192	1
Urban	5,634 (4,748,389)	3,318 (1,235,243)	59	2,067 (3,280,079)	37	147 (233,067)	3	102	2
Rural	7,447 (12,497,345)	1,594 (1,019,050)	21	5,573 (9,993,833)	75	192 (1,484,439)	3	89	1

Note: Figures in parentheses represent the annual quantity (in tons) of woodfuel by mode of acquisition.
Source: DOE, 1995

Table 6. Number of households (in thousands) by sources of self-collected fuelwood: 1995

REGION		TOTAL	OWN LAND	OTHER PRIVATE LAND	GOV'T LAND	OTHERS
Philippines		6,741	3,026	3,062	448	206
NCR		141	44	63	11	24
CAR		180	98	37	41	4
Region I	Ilocos Region	526	302	164	51	10
Region II	Cagayan Valley	363	152	147	59	5
Region III	Central Luzon	586	368	118	82	18
Region IV	Southern Tagalog	864	379	417	42	27
Region V	Bicol	496	239	228	18	11
Region VI	Western Visayas	741	225	461	33	21
Region VII	Central Visayas	575	250	306	2	18
Region VIII	Eastern Visayas	480	233	209	34	4
Region IX	Western Mindanao	312	121	183	7	-
Region X	Northern Mindanao	465	123	287	33	22
Region XI	Southern Mindanao	537	276	225	21	15
Region XII	Central Mindanao	262	114	125	3	20
ARMM		212	101	93	11	8

Source: DOE, 1995

Table 7. Household respondents' perception on fuelwood usage: 1995 (In Thousands)

PERCEPTION	AGREE	DISAGREE
1. Fuelwood is difficult to get.	4,879	6,670
2. It is expensive.	4,106	7,101
3. It is dirty.	8,732	2,921
4. Kitchen is inappropriate for fuelwood.	4,116	7,055
5. It is inconvenient to use.	5,405	6,233
6. Cooking with commercial fuel is more expensive than fuelwood.	7,658	3,058
7. Fuelwood gives a hotter flame.	7,999	2,490
8. Cooking with fuelwood creates better tasting dishes.	9,107	1,600
9. Fuelwood gathering causes deforestation.	6,784	3,769

Source: DOE, 1995

Table 8. Projected woodfuel demand for the household and industrial sectors

USER	1990	1995	2000	2005	2010	2015
Households	31.1	33.0	36.0	38.0	40.0	43.0
Industries	7.7	7.8	8.4	8.4	8.4	9.1
TOTAL	38.8	40.8	44.4	46.4	48.4	52.1

Source: DOENR, 1990

1.3.1 Domestic and Household Use

Based on the HECS results (Table 9), of the 8,142,000 households that use fuelwood (i.e. not including charcoal) 8,123,000 households (99%) use it for cooking; 915,000 households (11%) use it for heating water; and 193,000 households (2%) use it for other purposes. As generally expected rural households use more fuelwood than their urban counterparts. The annual average household consumption of fuelwood in the Philippines in 1995 was 1,803.74 kg.

1.3.2 Small-scale Industries

A number of small industries in the Philippines use woodfuel as an energy source. These include bakeries, tobacco curing, smithy, pottery, brick making, and furniture making The types of woodfuel-using small-scale industries in the various regions of the country are listed below in table 10.

Table 9. Number of households (in thousands) using woodfuel, annual average household and per capita consumption (kg), 1995

END USE	HOUSEHOLD TYPE								
	RURAL			URBAN			PHILIPPINES		
	No. (`000)	Qty. (kg.)	Per Capita	No. (`000)	Qty. (kg.)	Per Capita	No. (`000)	Qty. (kg.)	Per Capita
FUELWOOD									
Cooking	5,293	1,987	372.8	2,830	1,371	259.1	8,123	1,773	333.8
Heating water	647	359	67.4	269	386	73.0	915	368	69.3
Other uses	160	872	163.7	34	565	106.9	193	824	155.2
Total	5,300	2,025	380.0	2,841	1,390	262.7	8,142	1,804	339.7
CHARCOAL									
Cooking	83	417	78.3	2,171	154	29.1	3,002	224	42.3
Heating water	70	106	20.0	102	181	34.2	172	151	28.5
Ironing	1,650	49	9.7	953	54	10.3	2,603	51	9.7
Other uses	16	20	3.8	25	208	39.4	40	142	26.8
Total	**2,147**	**199**	**37.2**	**2,793**	**143**	**27.0**	**4,941**	**166**	**31.3**

Source: DOE, 1995

Note: Each record of end use of woodfuel (i.e. cooking, heating, Ironing, etc.) was treated as a separate household.

Table 10. List of different woodfuel-using industries in the country

REGION	TYPE OF INDUSTRIES
I - Ilocos	Tobacco flue-curing; iron smelting
II - Cagayan Valley	Wood processing; furniture industry; wood carving; bakeries
III - Central Luzon	Furniture industry; ceramics; metal craft; bakeries; food processing
IV - Southern Tagalog	Food processing; furniture industry; lime industries;
V - Bicol	Furniture industry
VI - Western Visayas	Sugar refinery
VII - Central Visayas	Rattan furniture industry
VIII - Eastern Visayas	Wood and rattan furniture industry
IX - Western Mindanao	Bakeries; furniture industry; ceramics; metal craft; rubber industry
X - Northern Mindanao	Furniture industry; ceramics
XI - Southern Mindanao	Furniture industry
XII - Central Mindanao	Furniture industry
National Capital Region	Bakeries; cooking (restaurants and eateries)

Source: DAP, 1992

Among these industries, bakeries are probably the greatest users of fuelwood. In 1992, it was estimated that bakeries consumed an average of about 74 cu m per unit per year while flue-curers use about 25 cu m of fuelwood to cure a one-hectare yield of 1.8 tons. Misajon *et al* (1989) projected the number of bakeries and tobacco production units and their corresponding fuelwood demand up to the year 2000 (Table 11).

Table 11. Projected number of bakeries and tobacco production units and their corresponding fuelwood demands

YEAR	BAKERIES		TOBACCO FLUE-CURING	
	NUMBER	FUELWOOD DEMAND (million cu m)	PRODUCTION (million kg)	FUELWOOD DEMAND (million cu m)
1980	55,609	4.149	39.605	0.550
1985	57,505	4.258	42.346	0.588
1990	59,457	4.406	44.046	0.612
1995	61,475	4.562	45.813	0.636
2000	63,562	4.817	47.657	0.662

Source: Misajon et al 1989

1.3.3 Large-scale Industries

Woodfuel is used by large-scale industries basically for steam and power generation. Triggered by the energy crises, the wood-based processing industries and sugar centrals (mills) have for sometime switched to woodfuel for their energy source. For instance, in the Western Visayas where there were 21 sugar centrals (mills) in 1985, the sugar sector consumed about 600,000 cu m of woodfuel. Woodfuel is being used to supplement bagasse for generating steam and electrical energy.

As part of NEA's rural electrification program, integrated tree farms and wood-fired thermal power plants were installed in the country in the early 1980's. The power plants relied heavily on fuelwood from energy plantations to generate power. However, only a few units were installed out of several plants originally targeted. According to the DOE, the program suffered some problems regarding the silvicultural aspects of tree planting, the techno-economic aspects of wood-fired power plants and the impact of a monetized fuelwood market with a large urban-based demand. Part of DOE-NCED's future R & D directions for new and renewable energy sources is to assess the past experiences with dendrothermal power plants, and if found viable, a new Dendrothermal Power Program will be implemented.

2. PROBLEMS OF THE WOOD ENERGY SECTOR

Non-conventional energy resources which include bagasse, coconut husk/shell, rice husk, wood/woodwaste, charcoal and others will continue to be an important source of energy in the Philippines. Overall, the use of biomass fuels in the household sector of the country appears to be sustainable for the foreseeable future. There is also little evidence that the current patterns of fuel use gives cause for widespread concern either on economic or environmental grounds. The country is not experiencing a fuelwood crisis but there are signs of emerging stress in some specific environments which needs careful attention (Soussan, 1991). While the picture of the wood energy sector is generally favorable, there are some problem areas which should concern us.

2.1 Wood Energy Data Collection and Management

Availability of accurate data is basic to sustainable energy development planning. However, in the wood energy sector, there are at least five major problems and constraints with regard to wood energy data collection and management. They are: (1) inconsistency of existing data; (2) no standard units of measurements for fuelwood; (3) varied parameters and methodologies used in conducting and processing surveys; (4) inefficient delivery of information since institutional relationships among agencies are unclear; and (5) insufficient funds for woodfuel studies (FAO-RWEDP, 1995).

The greatest problem is the inadequateness and inconsistency of available data and information. This problem could be traced to the very nature of the woodfuel production and distribution system. In general, woodfuel traders are not organized and are widely and thinly dispersed. Very few market transactions pass through commercial channels. Only those woodfuels gathered within titled lands or tax-declared alienable and disposable lands are monitored and regulated by the DENR. Hence, a large part of the woodfuel trade is unrecorded.

Gathering primary data on woodfuels through a survey also entails a lot of problems as there are no standard units for measuring the volume or weight of fuelwood. Figure 1 shows how the actual measurement of woodfuels is done in the field. It is quite easy to estimate smaller quantities of fuelwood but estimating a jeep-load or a truck-load of fuelwood involving different species with different sizes and varying moisture contents poses a significant problem.

There is also lack of coordination among the different agencies involved in planning and developing the wood energy sector. The institutional responsibility for this sector involves three important Departments, namely: Agriculture (DA), Environment and Natural Resources (DENR), and Energy (DOE). The DA is more preoccupied with crop production to meet the food demands of the growing population hence woodfuels coming from trees and plants in agricultural areas are not their priority. The DENR likewise, is more concerned with the major forest products like timber and with the bigger problems confronting the environment. Finally, the DOE and other energy planning institutions have in the past paid little attention to woodfuels as a conventional source of energy. These institutional relationships, therefore, must be clarified so that wood energy development can be pursued effectively.

Figure 1. Taking actual measurements of woodfuels used in pottery making

2.2 Concerns for the Environmental Impacts of Woodfuel Use

The greatest concern about woodfuel as a source of energy is its impact on the environment in the form of carbon dioxide (CO_2) emissions during the combustion process. Rising concentration of greenhouse gases (GHGs) like CO_2 in the atmosphere could lead to climate change or global warming. Based on estimates, CO_2 emissions are greatest when cooking with charcoal and fuelwood (Table 12).

Table 12. Carbon dioxide emissions by various household fuels

HOUSEHOLD FUEL	UNIT	ENERGY VALUE	CARBON DIOXIDE EMISSIONS		
		Per Unit MJ	Per Unit gram	Per MJ gram	Cooking per utilized MJ gram
Fuelwood	kg	16.0	425	27	180
Charcoal	kg	30.0	2125	71	355
Kerosene	l	34.1	648	19	48
LPG	kg	45.2	817	18	33
Electricity	kWh	3.6	136	38	55

Source: UNDP/ESMAP/WB, 1992

While it is true that wood combustion emits CO_2 into the atmosphere, the same amount is recaptured from the atmosphere by the regrowth of wood and by the natural vegetation itself. This approximation is supported by the following evidence. First, it is observed that by far the largest part of woodfuel use takes place on a sustainable basis. This is true for all woodfuels gathered from non-forest lands (e.g. agricultural land, plantations and home gardens) and forest lands. Sustainability implies carbon neutrality. This means that there is no net emission of CO_2 into the atmosphere because the same amount of CO_2 emitted by combusting wood is recaptured from the atmosphere by the standing trees. Second, woodfuels that are the left-overs of non-sustainable logging, slash and burn farming and land conversion and are not utilized as fuel would decompose by natural processes and lead to the same amount of carbon emitted in to the atmosphere as when the woody material is combusted (RWEDP, 1997).

All other non-renewable commercial energy only add to the CO_2 concentration in the atmosphere.

Another concern is the on-site and off-site environmental impacts of woodfuel collection and utilization. These include greater surface run-off and soil erosion, changes in the microclimate, extinction of a number of flora and fauna, hydrologic impairment of watersheds, to name a few. However, it is very difficult to isolate the environmental effects that could be attributed solely to woodfuel collection and utilization. Intensive data collection is needed before meaningful scenario-building and projections can be made.

3. SUPPLY SOURCES

The Philippines has a total land area of 30 million hectares. Roughly 15.9 million hectares are classified as forest land and 14.1 million hectares are certified A & D lands. Of the total forest area, about 5.49 million hectares remain covered with forests of various types: dipterocarp forests, 3.62 M ha.; pine forests, 0.23 M ha.; mossy forests, 1.05 M. ha.; mangrove forests, 0.11 M ha.; submarginal lands, 0.48 M ha. (1996 Philippine Forestry Statistics).

In the Philippines, as in most other Southeast Asian countries, woodfuel is sourced from both public and private lands. The public sources include the forests (natural and man-made), mangroves and brushlands, while the private sources include the non-forest areas (farmlands, coconut plantations, and idle A & D lands).

3.1 Forest Areas

3.1.1 Natural Forests

One of the sources of firewood is the natural forests. Table 13 shows the wood production including firewood from the dipterocarp forests under the Master Plan for Forestry Development from 1990 to 2015. It was projected that firewood supply would increase from 2.68 million cu m in 1990 to 3.03 million cu m in 2000 and 3.76 million cu m in 2015.

From the pine forests, 0.23 million cu m of firewood was projected to be produced in 1990 and 0.26 million cu m would be available in both 2000 and 2015.

3.1.2 Forest Plantations

According to the Master Plan for Forestry Development (1990), in 1990 there were about 483,000 ha of forest plantations in states all over the country, established to produce wood products such as sawlogs, peeler logs, pulpwood and poles. Under the existing plantations (those established on or before 1990), firewood production was projected to increase from 1.14 million cu m in 1990 to 2.33 million cu m in 2000 and to 3.05 million cu m in 2015 (Table 14).

Table 13. Wood production from the dipterocarp forests (million cu m)

TYPE	1990	2000	2015
Sawlogs	1.60	2.15	2.55
Peeler logs	0.90	1.21	1.43
Poles	0.70	0.94	1.12
Pulpwood	0.25	0.40	0.40
Firewood	2.68	3.03	3.76
Total	**6.13**	**7.73**	**9.26**

Source: DOENR, 1990. Master Plan for Forest Development

Table 14. Wood production from forest plantations (million cu m)

TYPE	EXISTING PLANTATIONS			NEW PLANTATIONS			TOTAL		
	1990	2000	2015	1990	2000	2015	1990	2000	2015
Saw logs	0.38	0.77	1.09		1.62	9.59	0.38	2.39	10.68
Peeler logs	0.00	0.00	0.20		0.00	2.04	0.00	0.00	2.24
Pulpwood	1.51	1.64	1.64		1.98	1.98	1.51	3.62	3.62
Poles	0.00	0.13	0.58		0.48	1.20	0.00	0.61	1.78
Firewood	1.14	2.33	3.05		2.82	9.97	1.14	5.15	13.02
Total	**3.03**	**4.87**	**6.56**		**6.90**	**24.78**	**3.03**	**13.64**	**31.34**

Source: DOENR, 1990

Under the new plantations (those established after 1990), firewood production was projected to increase from 2.82 million cu m in 2000 to 9.97 million cu m in 2015. Considering both sources, firewood production was projected to increase from 1.14 million cu m in 1990 to 5.15 million cu m in 2000 and to 13.02 million cu m in 2015. It should be noted that in these forest plantations, firewood is included as a by-product.

3.1.3 Mangrove Forests and Brushlands

Mangrove forests are a type of forest composed mainly of mangrove species such as *Rhizophora* and *Avicenia* species located on tidal flats along the sea coast extending along the streams where the water is brackish. As of 1996, the total mangrove area in the Philippines totalled 115,100 ha (1996 Philippine Forestry Statistics). Using the MPFD estimate of 2.02 cu m per hectare available for fuelwood from mangrove forests, a total volume of 232,502 cu m of firewood is available.

Brushlands are degraded areas dominated by a discontinuous cover of shrubby vegetation and small trees and other species that grow on marginal lands. According to the 1996 Philippines Forestry Statistics, the Philippines has about 2,262,500 ha of brushlands. Again, using the MPFD estimate of 1.95 cu m per hectare available for fuelwood from brushlands, a total volume of 4,411,875 cu m will be available.

3.1.4 Forest Residues

Residues from logging and wood products industries are another source of woodfuel. Serna (1989) cites the studies conducted by the Forest Products Research and Development Institute (FPRDI) which disclosed that about 0.8 m^3 of logging wastes are left in the forest to rot for every cubic meter of logs harvested. These wood wastes are in the form of tree tops, branches, stumps and damaged residuals. Thus, from 1976 to 1996 when annual log production averaged approximately 4 million m^3 (1996 Philippine Forestry Statistics), about 3.2 million m^3 of logging wastes were generated annually by logging operations. Moreover, about 45 m^3 of wood wastes were generated for every 100 m^3 of logs processed.

Another potential source of fuelwood is the trees cut during timber stand improvement (TSI) operations in logged-over areas. Unfortunately, no estimates of available woodfuel have been made (Serna, 1989).

3.2 Non-forest Areas

Non-forest areas can be considered potential sources of fuelwood. These areas include agricultural lands (a source of agricultural crop residues), coconut plantations, unproductive A & D lands, home lots and backyards, and roadsides and railroad tracks.

3.2.1 Coconut Plantations

Coconut plantations can be potential sources of fuelwood when intercropped with tree species. As of 1995, there are about 3,078,900 ha of coconut plantation in the country (1995 Philippine Statistical Year Book). Assuming that an average of 1,500 sq m can be allocated per hectare of these coconut plantations for fuelwood production, an area of 461,835 ha can be developed and managed as fuelwood plantations within the coconut plantations. Based on an estimated average yield of 20 cu m per hectare per year, the total volume yield could be about 9,236,700 cu m.

3.2.2 Unproductive Alienable and Disposable Land

According to the 1996 Philippine Statistical Year Book, there were about 14.12 million ha of alienable and disposable lands in the country in 1995. Of this number, about 5 million ha are not productive and virtually lying idle, hence can be developed by planting fuelwood species. Granting that only 50% of the idle A & D lands can be developed as fuelwood plantations, an estimated volume of 50 million cu m is attainable in one year using an average volume of 20 cu m per hectare as estimated by Revilla and Gregorio (1983). The DAP study (1992) and that of Misajon et al (1989) used the same yield when they estimated the volume of fuelwood that can be produced in unproductive A & D land and open and degraded land, respectively.

3.2.3 Home lots and Backyards

Home lots and backyards could be potential fuelwood production areas especially in the rural communities. The 1996 Philippine Statistical Year Book reports that in 1995 there were about 12 million families in the country, six million of which live in rural areas. If each family allocates an average of 1,000 sq m of their home lots or backyards to plant fuelwood species, about 600,000 ha can be developed. Based on an estimated average yield of 20 cu m per hectare per year, these areas can generate a total volume of 12,000,000 cu m of fuelwood.

3.2.4 Agricultural Crop Residues

Included under this category are rice hull, sugarcane bagasse and coconut husks and shells.

In 1995, about 3.758 million hectares of agricultural land were planted with rice, producing 10.540 million tons at an average of 2.80 tons/ha. At 20% recoverable rice hull from rice produced, some 2.108 million tons is produced. Rice hulls are used as fuel for household cooking in special stoves. In rural industries, rice hulls are used by rice mills to generate steam and electricity for in-plant use and as common fuel for paddy drying and brick making.

Baggase is the residue remaining after juice is extracted from the prepared sugarcane. Most of the bagasse produced is used as boiler fuel, which accounted for about 87% of the sugar industry's total fuel mix in 1992.

Coconut wastes (husks and shells) are largely used as domestic and industrial fuel. Households commonly convert coconut shells into charcoal for cooking, ironing, and water heating while dessicator facilities are practically the only users of the shells. The major use of coco husk is for copra drying and to a much lesser extent for cooking in the rural households. In 1993, the reported national annual consumption of coconut wastes was: coco shell charcoal, 520,000 tons; raw cocoshells, 139,000 tons; and coconut husks, 450,000 tons.

3.2.5 Roadside

In the Philippines, the existing road network totalled 161,009.23 km as of 1995. Since the road can be planted on both sides in two rows at 1.5 meters spacing between trees, approximately 322,018 km of strips can be planted. Assuming further that only 50% of this can be planted due to existing infrastructure, then there will be 214,680,000 trees which can provide protective (ecological), productive (fuelwood source), and aesthetic values to the environment.

3.3 Supply and Demand Balance

In 1990, the Philippine Master Plan for Forestry Development estimated the fuelwood supply for 1990, 2000 and 2015 to be 23.1, 27.7 and 36.3 million m^3 and the demands for the same years to be 38.7, 24.4, and 52.1 million m^3, respectively (Table 15).

In an effort to verify the findings of the Master Plan, the HECS study used satellite imagery and biomass inventory data. Based on its findings, the annual yield of woody biomass (excluding coconut fronds and husks) was over 100 million m^3. Whereas the MPFD figures imply, a deficit of 15.5 million m^3, the DOE estimates picture a positive balance of over 60 million m^3 (UNDP/ ESMAP/World Bank, 1992).

Table 15. Firewood supply and demand balance (in million m^3) based on MPFD

FOREST TYPE	1990	2000	2015
Dipterocarps	2.68	3.03	3.76
Pine forests	0.23	0.26	0.26
Existing plantations	1.14	2.33	3.05
New plantations	0.00	2.82	9.97
Marginal lands	0.21	0.20	0.20
Mangroves	0.24	0.22	0.22
Brushlands	4.80	4.07	1.76
Grasslands	0.05	0.03	0.02
Other extensive farmlands	4.78	4.09	3.62
Intensive farmlands	7.74	7.83	7.96
Urban, others	0.17	0.24	0.34
Wastewood	1.14	2.26	6.01
Supply	23.17	27.78	36.37
Demand	38.70	24.4	52.10
Balance	-15.5	-16.6	-14.9

4. SOME RELEVANT GOVERNMENT POLICIES AND PROGRAMS IN THE LAST TWO DECADES

4.1 Forestry Sector

One of the government programs aimed at enhancing fuelwood supply is the Integrated Social Forestry Program (ISFP). Launched in 1982 by virtue of Letter of Instruction (LOI) No. 1260, ISFP enjoined the participation of the forest communities in the government's reforestation efforts. Under the program, forest occupants are provided security of tenure over their claimed area either through a 25-year Certificate of Stewardship Contract (CSC) or Forest Lease Management Agreement (FLMA) or Community Stewardship Agreement (CSA), all of which are renewable for another 25 years. As project participants, the forest occupants are bound to comply with certain program requirements, one of which is to plant at least 40% of their clearings with forest and fruit tree species which will help stabilize the fragile uplands and at the same time provide the occupants a stable source of fuelwood.

Another government-initiated program aimed at arresting rapid forest destruction is the National Reforestation Program (NFP) which started in 1987 and will last until the year 2000. The program aims to reforest some 1.4 million hectares, or a yearly average of 100,000 hectares. Of the total area to be reforested, 436,300 hectares were earmarked for fuelwood production (Serna, 1989). Table 16 shows the NFP program targets from 1987 to 2000.

The Community Forestry Program (CFP) launched in 1989 by virtue of DENR Administrative Order No. 123, series of 1989, gave communities a forest lease for a period of 25 years renewable for another 25 years through a Certificate of Forest Management Agreement (CFMA). Through the agreement the communities were given the privilege to utilize the forest products in the area while they have also the obligation of protecting the same forest area. The program gave the upland communities direct access to the resources inside the leased area.

The Forest Land Management Program (FLMP) is another DENR program involving the rural poor. Under DENR Administrative Order No. 71, series of 1990, in the last stages of the contract reforestation program, the contracted area will be turned over/leased to the participating communities or individuals, NGOs or any qualified parties who will then protect, maintain and benefit from the trees/perennials. Through a Forest Land Management Agreement (FLMA) program participants shall be entitled to harvest, process, sell or utilize the products grown in the area, with the corresponding obligation to share with the government the harvest, and ensure that the trees/prevails are conserved by implementing protection and maintenance measures.

Table 16. National forestation program targets, 1987-2000 ('000 ha)

AGENCY	ANNUAL	TOTAL
Government Sector		
DENR	30	420
Other National Government Agencies	3	42
Local Government	12	168
Others	5	70
Sub-total	**50**	**700**
Private Sector		
Timber Lease Agreements (TLA)	25	350
Leasee, industry	10	140
Private holder	5	70
Others	10	140
Sub-total	**50**	**700**
GRAND TOTAL	**100**	**1400**

Source: DOENR, 1990. Master Plan for Forestry Development

The government has also incorporated energy development projects in the National Integrated Protected Areas System (NIPAS). Republic Act No. 7586 of 1992, otherwise known as the NIPAS Act, requires that energy programs and environmental protection be developed and implemented in NIPAS areas. The Department of Energy (DOE) and DENR have finalized a Memorandum of Agreement (MOA) which included the creation of the Committee on Energy Projects in NIPAS areas or CEPNA and the complementing rules of both departments on the development and implementation of energy programs and environmental protection in support of sustainable development.

In 1995, the President issued Executive Order No. 263 which mandated the adoption of community-based forest management (CBFM) as the national strategy to ensure the sustainable development of the country's forestland resources. Under the strategy, participating communities are granted access to the forestland resources under long term tenurial agreements, provided they employ environment-friendly, ecologically sustainable and labor intensive harvesting methods. The CBFM program actually is an umbrella program subsuming all people-oriented programs previously implemented such as ISFP, CFP and FLMP.

4.1.1 Newly Emerging Trends

In the Philippines, the upland farmers, locally called kaingeneros, have always been the sector involved in fuelwood production. But government policies have been punitive and government authorities have prosecuted the upland farmers who were considered agents of forest destruction. However, with the birth of social forestry in the 1970's, government policies were drastically changed. Kaingeneros were no longer prosecuted but were allowed to participate in the people-oriented programs of the government such as Forest Occupancy Management (FOM, 1974), Family Approach to Reforestation (FAR, 1976), Communal Tree Farms (CTF, 1979). As program participants, they were allowed to stay in the forest with the obligation not to increase their clearings and participate in forest conservation efforts through reforestation and agroforestry. In 1982, these programs were placed under an umbrella program with the issuance of Letter of Instruction No. 1260, otherwise known as the Integrated Social Forestry Project (ISFP). As mentioned in the previous section, ISFP, CFP, FLMP, and all other people-oriented programs were later merged into one big program named the Community-Based Forest

Management Program or CBFMP. Its goals include promoting sustainable management of forest resources, social justice and improved well-being of local communities, and strong partnership among local communities and the DENR. Hence, forest policies have shifted from being punitive to becoming people-oriented and have enabled people to have access to forest resources and benefit from the utilization of such resources.

4.2 Energy Sector

In the energy sector, there has been an accelerated diversification from depletable to new and renewable energy sources. The DOE's Non-conventional Energy Division (NCED) has comprehensively designed its program for non-conventional energy systems under the 1993 - 2000 National Non-Conventional Energy Program. Senate Bill No. 2448 entitled "An Act to Ordain Reforms in the Electric Power Industry, Pursuing the Goal of Total Electrification with Optimal Use of Indigenous New and Renewable Energy Resources, Promoting the Active Participation of the Private Sector in Power Generation, Transmission and Distribution, Defining the Powers and Responsibilities of Appropriate Government Agencies, Amending Pertinent Provisions of Related Laws, and for Other Purposes" which will support the Program is pending.

4.3 Limitations of Fuelwood Related Policies/Programs

Past government projects in the uplands popularized the use of exotic tree species such as *Leucaena leucocephala, Acacia auriculiformis, Acacia mangium, Gmelina arborea, Calliandra calothyrsus, Eucalyptus camaldulensis, Pinus caribea* and *Pinus oocarpa*. But the use of exotic species in monoculture stands has posed some risks for a number of reasons (DAP, 1992). First, many of the exotic species met problems in adapting to the submarginal areas in the uplands, hence were easily attacked by pests and diseases. Their susceptibility and vulnerability to pest and/or disease outbreaks can be traced to their very narrow genetic bases since they are derived from few parents.

Second, exotic species are not self-generating and their use make reforestation expensive. The seeds produced usually drop under the very thick mat of litter under the mother tree and germinate poorly. It has been observed that stands of exotic species do not grow their seedlings under their own shade. Even indigenous tree seedlings/wildlings find it difficult to thrive in the undergrowth of exotic stands. Hence, plant succession and natural regeneration are delayed.

Third, there is low biodiversity under the exotic stands. As mentioned in the previous paragraph, exotic species tend to discourage the influx of diverse indigenous tree seedlings/wildlings in their undergrowth. There is also smaller diversity of wildlife in the monoculture plantation as birds often avoid exotic tree plantations because of the lack of food in these stands. Hence, bird dispersal of the seeds of indigenous pioneer trees is reduced.

The National Electrification Administration (NEA) spearheaded the planting of industrial tree plantations to produce wood energy for its dendrothermal power plants. Seven dendrothermal plants have been established throughout the country (Serna, 1989). Four plants have been rendered inoperable by rebels/outlaws while the other three can not be operated due to lack of fuelwood supply. One such dendrothermal plant is the Bolinao dendrothermal project which collapsed due to pest and disease infestation. Since exotic species were planted, plantations were easily wiped out.

5. THE ROLE OF OTHER AGENCIES

5.1 Role of NGOs in Forest Resource Management

Non-government organizations (NGOs) have always been active in the Philippines in various community projects like relief work and improvement of small infrastructures related to basic necessities. However, in the ENR sector, consistent with the state policy to promote the participation of NGOs in the development process, the DENR has adopted programs involving NGOs in the development, conservation, management, and protection of natural resources. Hence, NGOs like the Haribon Foundation, the Lingkod Tao-Kalikasan, Kalahan Educational Foundation, Philippine Business for Social Progress, and other church-based NGOs have been actively involved in economic development and environmental conservation in the uplands. The World Bank study notes that the principal roles of NGOs in natural resource management can be in the areas of: 1) advocacy of the rights of the poor, 2) community mobilization, 3) capacity building and skills development, 4) participatory research and extension, 5) provision of access to resources, and 6) provision of linkages and communication among NGOs and between NGOs and the government. These roles that have been identified coincide basically with the activities that DENR has defined for NGOs.

Under the government's community-based forest management program (CBFMP), NGOs have played critical roles as assisting organizations in the planning and implementation of the program. They help farmers' organizations secure contracts to reforest denuded forest lands and they provide the communities the required social and technical preparation needed in the program implementation.

In Cebu, for instance where virtually no forest is left, the Mag-uumad Foundation Inc. (MFI) uses a farmer-based research and development strategy in implementing soil and water conservation programs. Now in its 17th year, the program continues to provide farmers with skills development activities like small-scale experimentation, farm cross visits, seminars, trainings and regular meetings between farmer leaders. One of the models used is the integration of multipurpose trees in the farmers' fields for protective as well as productive purposes, as exemplified in the corn/fuelwood rotation in the steep hillsides. Some of the *Leucaena* and *Gliricidia*, the most common fuelwood species planted, are sold to industries, bundled for urban domestic use, or used for charcoal making (RWEDP, 1992).

5.2 Role of Private Sector

5.2.1 Forest Plantations

To ease the pressure on the natural forest stands while at the same time ensuring the continued production of forest goods and services, the government has embarked on a widespread program of establishing forest plantations. The National Forestation Program was launched in 1986 to restore the country's forest cover and ecological balance. It includes both private (concessionaires) and the public sector investments. The role of the private sector in the establishment of forest plantations is well documented. The plantations carried out by the private sector include: 1) plantation development by (Timber Lease Agreement) TLA holders in fulfilment of their reforestation obligations, 2) industrial forest plantations, 3) tree farms, 4) agroforestry farms, and 5) plantations under Presidential Decree 1153.

To encourage the private sector to become involved in industrial tree plantations and tree farming ventures, the government has offered several incentives, i. e., fiscal and financial incentives, technical and marketing assistance, and no restrictions on the export of plantation products. Furthermore, on March 15, 1996, the President issued Memorandum Order No. 353 (Appropriating the 1996 Investment Priorities Plan), whereby industrial forest plantation development and management was included as a priority investment area for the year. As such, private investors can avail themselves of a number of incentive packages, including tax holidays. Other incentives for private sector participation in the development and management of forest resources currently being studied are streamlining of the bureaucracy to minimize red tape and provision of market-based instruments (MBIs) to investors.

It is foreseen that most of the wood requirements of the country in the future will come from the plantations. Based on existing information on plantation achievements, the plantation wood yields from the private sector plantations are given in Table 17. For the six-year projection (1990-2015), fuelwood accounts for an average of 45% of the annual wood production.

5.2.2 Biogas, Solar and other NRE Development

The DOE's technology program for 1996-2000 has identified the role of the private sector in renewable energy development using biomass, solar, wind and ocean energy (Table 18). The private sector is composed of the commercial banks, suppliers, NGOs, consumers groups, contractors, private companies, and the Renewable Energy Association of the Philippines (REAP). REAP is a local organization which consists of suppliers and distributors of non-conventional energy equipment and devices.

For biomass using technologies such as biogas, biomass-fired boilers, biomass-fired furnaces, biomass stoves, biomass-fired dryers, and gasifiers, the private sector is involved in the market development and commercialization of NRE-based technologies. Activities under market development include promotional activities and financing. Under commercialization, activities include commercial dissemination, commercial installation, training and technical assistance/ services.

For solar-based technologies such as photovoltaic (PV) systems and solar water heaters, the private sector is involved in the research and development of local PV and solar heater manufacturing; market development, which includes promotional activities; and commercialization, which includes commercial distribution, training and other technical services.

Similarly, the private sector is involved in research and development, market development, and commercialization of wind-based technologies such as wind pumps and wind turbine generators and microhydropower systems.

For ocean energy systems, the private sector is involved in market development, particularly financing and commercialization, i. e. installation of ocean energy power facilities.

Table 17. Estimated wood volumes from existing forest plantations (000 m^3)

Assortment	1990	1995	2000	2005	2010	2015
Saw log	378	542	766	916	988	1088
Peeler log	0	0	0	30	110	200
Pulpwood	1511	1645	1646	1645	1646	1645
Pole, non-industrial sawn wood	0	85	127	249	390	578
Fuelwood	1136	1716	2332	2523	2767	3052
TOTAL	**3025**	**3988**	**4871**	**5363**	**5901**	**6563**

Source: MPFD, 1990

Table 18. Role of private sector in NRE development

RESOURCE/ TECHNOLOGY	APPLICATIONS	PRIVATE SECTOR INVOLVED	ROLE
Biomass			
Biogas system	Cooking, heating, electricity generation	REAP, commercial banks, suppliers	MD, C
Biomass-fired boilers	Generation of power, steam, hot water, hot air	REAP, suppliers	MD, C
Biomass-fired furnaces	Generation of power, steam, hot water, heat	REAP, commercial banks, suppliers	MD, C
Biomass stoves	Cooking	NGOs, suppliers	MD, C
Gasifiers	Heating, electricity generation	Suppliers	C
Biomass-fired dryers		REAP, suppliers, commercial banks	MD, C
Solar			
Photovoltaic systems	Electricity generation	Suppliers, REAP, consumers' organization, private companies	R & D, MD, C
Solar water heaters	Water heating	Suppliers, REAP, private companies	R & D, MD, C
Solar dryers	Drying of fruits, fish, meat, crops	Contractors, suppliers, REAP	MD, C
Wind			
Wind pumps	Drinking water	Contractors, suppliers, REAP, consumers' organization, wind energy association	R & D, MD, C
Wind turbine generators	Electricity generation	REAP, consumers' organization, contractors, suppliers	R & D, MD, C
Microhydropower	Electricity generation, mechanical power (grain milling)	Suppliers, REAP, contractors, NGOs	R & D, MD, C
Ocean energy systems	Electricity generation	Commercial banks	MD, C

Note: R & D - research and development, MD - market development, C - commercialization
Source: DOE, National Non-Conventional Energy Program 1993 -2000

5.2.3 Improved Cookstove Development and Dissemination

Biomass-fuelled stoves have been developed mostly by private investors. According to DOE, more than 30 models of improved cookstoves were patented from 1980 to 1990 but very few models have successfully penetrated the market due to lack of private support to the manufacturers, and very limited promotion and distribution of cookstoves. In response to this, the DOE has initiated efforts to renew the interest of the private sector such as NGOs and the manufacturers, promoters and distributors of biomass-fuelled cookstoves to formulate and implement a National Cookstove Program. The Asian Regional Cookstove Program (ARECOP), an NGO based in Indonesia and the focal point in Asia of the Foundation for Woodfuel Dissemination (FWD) is assisting the DOE and concerned agencies in formulating a national program toward the development, promotion, and commercialization programs of improved cookstoves.

6. ECONOMIC ASPECTS

6.1 Woodfuel Supply and Distribution System

Woodfuel trade is depicted in Figure 2. It is basically consists of (a) consumption, (b) distribution and (c) production. There is woodfuel trade because there is demand from households, and commercial and industrial establishments. In turn, their demand is answered by the production system which is composed of fuelwood gatherers and charcoal makers. The distribution and marketing system of the woodfuel industry can be characterized as unclear and undefined. This is because woodfuel is not recognized as an important commodity. Hence, market transactions are generally unrecorded. In addition, distribution and marketing of woodfuel involves many conduits and intermediaries before it finally reaches the consumers or end-users.

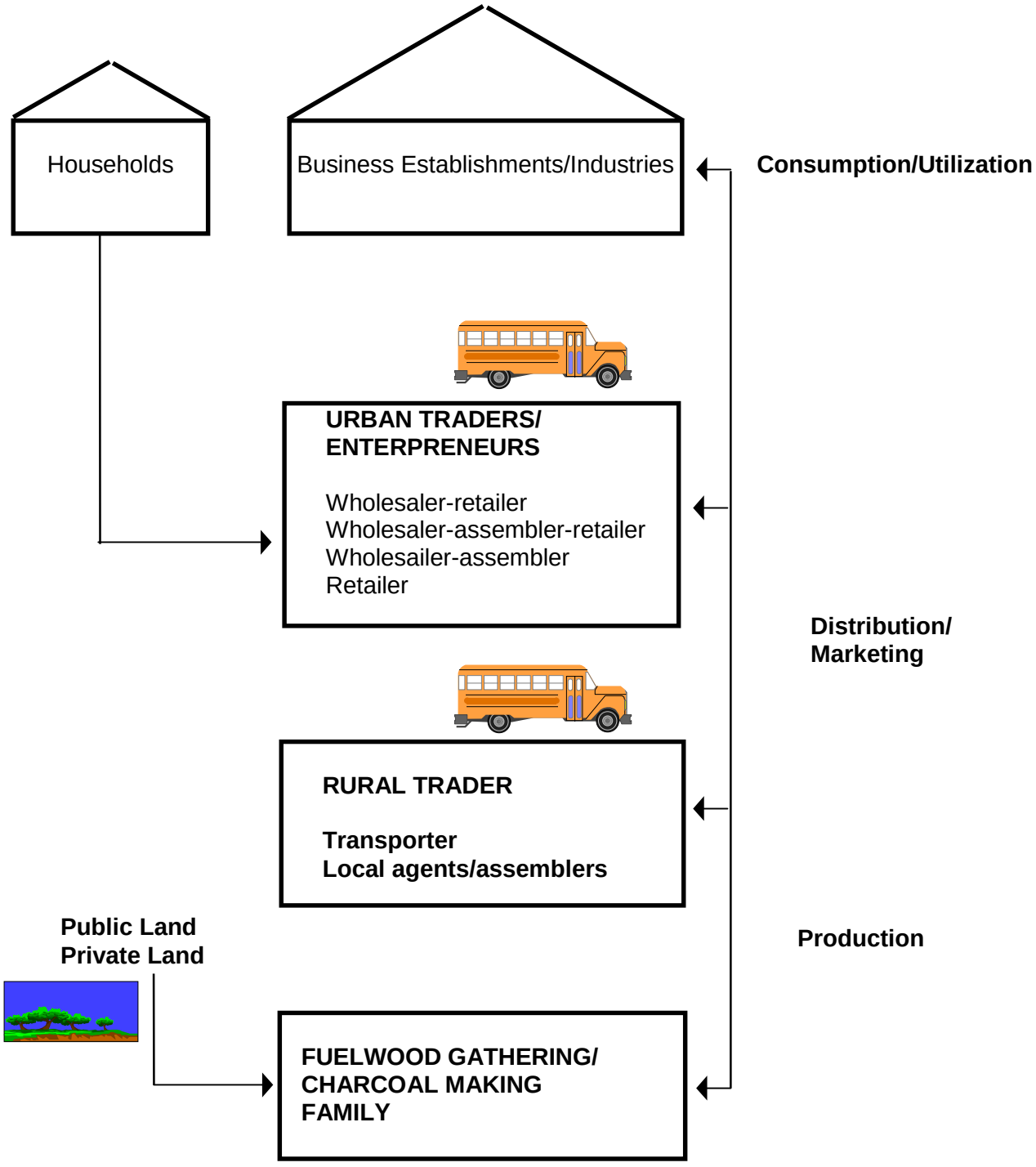
Basically, the urban and rural traders play a paramount role in the distribution system of woodfuel. The urban traders are the sellers of woodfuel operating in the city. Included in the category of urban traders are the wholesaler-assemblers; wholesalers-assemblers-retailers; wholesalers-retailers and retailers. A wholesaler sells woodfuel in large quantities at a time. An assembler is a seller involved in gathering or bringing together woodfuel from different sources to accumulate large volumes. A retailer, on the other hand, sells woodfuel in small quantities directly to consumers. Hence, an urban trader may be a combination of the above.

The rural traders, on the other hand, are the persons responsible for bringing woodfuels from the rural areas to the urban users. They are composed of the woodfuel transporters and dealers. These groups of traders may procure woodfuel directly from the source, i.e., from the gatherers and charcoal makers, from sawmill operators, and local agents or the assemblers of woodfuels in a particular area. Rural traders can also be fuelwood gatherers and charcoal makers who market their goods by themselves.

6.2 Economic Value of Woodfuel Trade

The growing demand for woodfuels by households, and by commercial and industrial establishments created the woodfuel industry. In a study conducted by Misajon *et al* (1989), the majority of upland households reported that fuelwood gathering is an activity done throughout the year. Some households also reported that intensive wood gathering is done during the dry season when dried woods are abundant and during seasons when the labor demand in the agriculture and industry is slack (Misajon *et al,* 1989).

The same study also reveals that the urban fuelwood markets provided an average of 40 percent of the cash income for these households. For many of these poor households with few alternative sources of off-farm income, urban fuel trade is a vital component of their household economy. Thus, woodfuel trade is economically significant in rural areas.



Source: Espiritu et al, 1990.

Figure 2. Woodfuel supply and distribution system

The Philippine Household Energy Strategy Study conducted by the UNDP/WB ESMAP estimated that there are 536,000 households dependent on gathering and selling wood, 158,000 households are charcoal makers and 40,000 households act as traders in rural areas. An additional estimated 100,000 households are urban traders. Almost all of these households have other occupations. In rural areas this is principally farming, and the traders are mainly shopkeepers or market stall operators, selling wood and charcoal as part of a range of goods. Furthermore, the study estimated that close to 10 percent of all rural households receive income from woodfuel trade.

6.3 Price Structure of Woodfuels

Table 19 shows the price build-up for the trade of fuelwood and charcoal. As can be discerned from the table, the prices of fuelwood and charcoal increase considerably as they move from the source to the final consumers. Initially, fuelwood is priced, on average, at Peso 140/ton by wood gatherers who supply Metro Manila. By the time it reaches the city, urban traders charged Peso 930/ton for the same product. Studies have shown that woodfuels are artificially priced because of the numerous middlemen handling the commodity. These traders in turn incur a lot of costs in transporting the woodfuel, and a major portion of these costs are the varying amounts paid to facilitate the processing of papers and for easy entry and exit to and from different checkpoints as they make their way to the city from their provinces.

Table 19 also reveals that there is not much inter-regional variation. In general, final retail prices do not vary considerably across the different areas. This is further attested to by the monthly retail prices gathered by the DENR (Table 20). Retail prices for charcoal do not vary much across the different regions except for the extreme value in Region VI. Charcoal prices are also not affected by seasonal variation. Unlike charcoal, retail prices of fuelwood vary across the different regions. However, the fluctuations in prices are not very pronounced. The data also reveal that seasonal variation is only observable in Regions II, IV and V. Thus, the price structure of woodfuels is largely determined by the mode of sale, i.e., whether it is picked-up or delivered; the number of sellers; availability as influenced by the season of the year; and quality as affected by wood species. The markets for woodfuels are also characterized as informal. They either expand or contract according to the level of demand of the consumers. The fuelwood supply studies done by the Non-Conventional Energy Division of the DOE also indicate that woodfuel markets operate efficiently to link woodfuel resources with urban markets, and achieve it without utilizing significant quantities of capital.

These findings need to be highlighted so that actions can be taken to legitimize and encourage woodfuel trade in areas where they do not exhibit adverse environmental impacts.

6.4 Uses of Woodfuels in Small-scale Industries

Small-scale industries and other commercial establishments also consume significant amounts of woodfuels. Their woodfuel consumption accounts for approximately one-third of the country's overall woodfuel consumption and they rely mostly on traded woodfuels (DAP, 1992). Some of these fuelwood-based industries include the textile industry and sugar milling and refining which need fuelwood to run their boilers; bakeries; tobacco curing; food processing, e.g. fish meal factory and dried and smoked fish industry; salt-making; and brick/lime industry, to name a few (see Figures 3, 4, 5 and 6). The charcoal-using establishments, on the other hand, are the shoe

manufacturing and the food services and establishments like pork “lechon”, “chicken lechon”, barbecue stands and other grillers.

Table 19. Price build-up for urban fuelwood and charcoal

ITEM	AVERAGE SELLING PRICE (Pesos/ton)				
	Metro Manila	**Cebu City**	**Cagayan de Oro City**	**Tacloban**	**Isabela**
Fuelwood					
Wood gatherers	140	630	210	260	500
Rural traders	650	820	630	630	650
Urban traders	930	1,100	930	1,000	N/A
Charcoal					
Charcoal makers	1,700	1,800	1,600	1,430	1,720
Rural traders	2,700	2,900	2,600	1,640	2,100
Urban traders	3,350	3,800	4,000	4,000	N/A

Source: DOE, 1990. Fuelwood Supply Studies of the Non-Conventional Energy Division.

Figure 3. Bundles of coconut midrib and ipil-ipil wood ready for sale and for use as fuelwood by eateries in the rural area

Table 20. Monthly retail prices of fuelwood and charcoal in selected regions of the Philippines, 1995

Products/Regions	Unit	Average	PESO / UNIT											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug.	Sep	Oct	Nov	Dec
Fuelwood	Bundle													
R-II Cagayan Valley		9.58	7.00	7.00	8.00	8.00	7.00	8.00	10.00	12.00	12.00	12.00	12.00	12.00
R-IV Southern Tagalog		16.58	15.00	15.00	18.00	15.00	15.00	15.00	18.00	18.00	20.00	15.00	15.00	20.00
R-V Bicol		13.29	7.50	7.50	7.50	7.50	7.50	7.50	7.50	15.00	20.00	22.00	25.0	25.00
R-VI Western Visayas		11.08	12.00	11.0	11.00	10.00	10.00	10.00	11.00	14.00	11.00	11.00	11.00	11.00
R-IX Westen Mindanao		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
R-X Northern Mindanao		8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
R-XI Southern Mindanao		10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
R-XII Central Mindanao		11.50	10.00	10.00	10.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Charcoal	Sack													
R-II Cagayan Valley		73.75	75.00	70.00	75.00	75.00	70.00	70.00	75.00	75.00	75.00	75.00	75.00	75.00
R-III Central Luzon		73.75	85.00	85.00	85.00	70.00	70.00	70.0	70.00	70.00	70.00	70.00	70.00	70.00
R-IV Southern Tagalog		80.83	75.00	85.00	60.00	75.00	85.00	85.00	100.00	75.00	80.00	80.00	85.00	85.00
R-V Bicol		89.18	85.00	85.00	85.00	90.00	95.0	90.00	90.00	90.00	90.00	90.00	90.00	90.00
R-VI Western Visayas		102.50	70.00	100.00	100.00	100.00	110.00	100.00	100.00	110.00	1120.00	110.00	110.00	100.0
R-IX Western Mindanao		80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
R-XI Southern Mindanao		80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00

Source: 1995 Philippine Forestry Statistics

Figure 4. A concrete tobacco curing barn

Figure 5. A tobacco curing barn made of clay

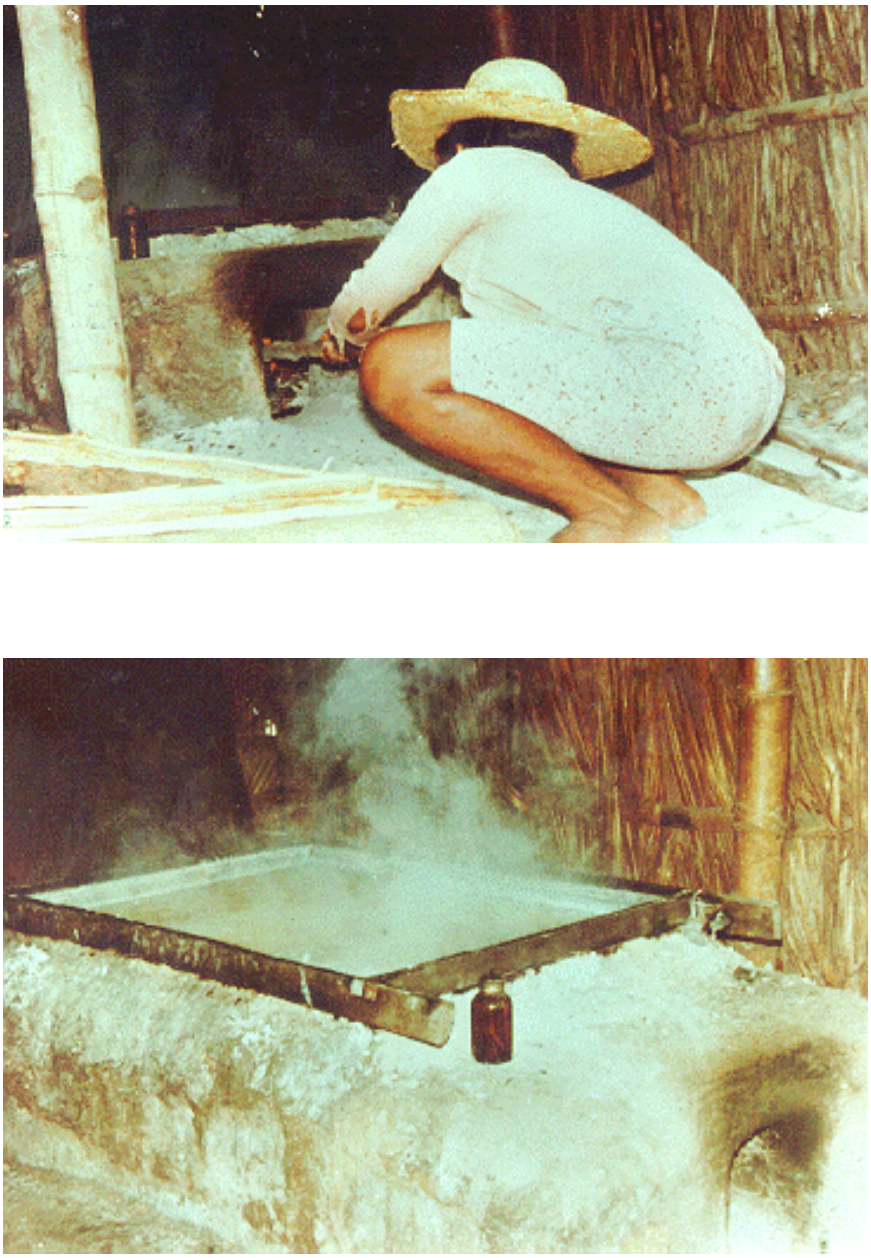


Figure 6. Furnace used in salt-making

A fuelwood consumption survey of business establishments conducted by the FMB and the NSO estimated that about 14.15 M cu m of woodfuel equivalent were used by the industrial sector in 1990; about 55 percent of this is woodfuel (composed mostly of the roots, stems, barks, branches, twigs and stumps) while the rest consists of agricultural wastes like coconut shells and bagasse.

7. GOVERNMENT POLICIES

At present, policies affecting wood energy in the country are embodied in at least three different documents, namely, the National Energy Plan (NEP), the Master Plan for Forestry Development (MPFD) and the Philippine Strategy for Sustainable Development (PSSD).

7.1 The National Energy Plan

The NEP seeks to:

- ensure the availability of energy to the markets in the country at reasonable prices;
- promote the judicious and efficient use of energy resources;
- accomplish the above objectives with minimal adverse effects on the environment.

In consonance with these objectives, the specific energy policies of the government include:

- promotion of energy self-reliance;
- rationalization of energy prices to reflect the true costs of production and distribution;
- encouragement of energy conservation measures to promote efficiency;
- participation of the private sector in energy projects;
- maintenance of environmental and safety measures for energy projects.

One important component of the NEP is the New and Renewable Energy (NRE) Program which was formulated to develop and promote the utilization of new and renewable energy systems which are technically feasible, economically viable and socially desirable and which have vast commercialization potentials to substitute for conventional energy systems.

The New and Renewable Energy Program has four strategic sub-programs each addressing a number of concerns, namely:

- Technology Sub-Program - this aims to develop economically viable NRE systems to levels of technical maturity at which NRE systems can be commercially competitive with conventional energy;
- Commercialization Sub-Program - this envisions the creation of a favorable market environment to encourage private sector investment and participation in NRE projects and activities;
- Promotion Sub-Program - this attempts to heighten public awareness on the advantages and benefits of the use of NRE systems;
- Area-based Energy Sub-Program - this is a mechanism to accelerate the promotion, commercialization and use of NRE technologies at the regional and sub-regional levels through a decentralized, area-based approach.

7.2 The Master Plan for Forestry Development (MPFD)

The MPFD envisions the country's forest resources under efficient and equitable management, conservation and utilization, satisfying in appropriate ways and on a sustainable basis the needs of the people for forest-based commodities and services. Its objectives are to:

- meet the needs of present and future Filipinos for wood and other forest products by putting all of the country's production forest resources under sustainable management;
- contribute to the production of food, water and energy and other needed commodities by properly managing the upland watersheds and through the effective interaction between forestry and farming practices;
- protect the land and its resources against degradation and other ecological devastation through proper land management systems and practices;
- conserve the forest ecosystems and their diverse genetic resources through wise use;
- contribute to employment and growth of national and local economies through fully developed and integrated forest-based industries;
- promote social justice and the recognition of the rights and indigenous cultural communities in the management, conservation and utilization of forest resources.

7.3 The Philippine Strategy for Sustainable Development (PSSD)

The PSSD seeks to achieve economic growth with adequate protection of the country's biological resources and its diversity, vital ecosystems functions and overall environmental quality. Its objectives include to:

- ensure the sustainable utilization of the country's natural resources;
- promote social and intergenerational equity in the utilization of the country's natural resources;
- develop management programs to preserve the country's heritage of biological diversity;
- promote the technologies of sustainable lowland, agriculture and upland agroforestry through the encouragement of research and development and demonstration projects.

There is a set of core implementing strategies formulated by the PSSD which is directed towards resolving various issues arising from the country's development efforts:

- integration of environmental considerations in decision-making;
- proper pricing of natural resources;
- property rights reform;
- establishment of an integrated protected areas system;
- rehabilitation of degraded ecosystems;
- inducing growth in rural areas;

- promotion of environmental education;
- strengthening of citizen's participation.

7.4 Policy Issuances Affecting Fuelwood Resources

The DENR is the primary government agency responsible for the sustainable development of the country's forest resources. Like in many Asian countries, forest policy in the Philippines does not give adequate importance to fuelwood. The reason for this could be the low economic value of fuelwood. It can be noted that before a tree can be used for fuelwood, its higher value parts such as timber, pulpwood, or lumber come first. A scrutiny of the different forest policies issued points to six administrative orders directly addressed to firewood, namely:

- **Ministry Administrative Order No. 4, January 19, 1987** - lifts the restriction in the harvesting, transporting and sale of firewood, pulpwood or timber produced from ipil-ipil (*Leucaena spp*.) and falcata (*Albizzia falcataria*) planted in private lands.

- **DENR Administrative Order No. 86, October 4, 1988** - prescribes the rules and the deregulation of tree harvesting, transporting and sale of firewood, pulpwood, or timber planted in private lands.

- **DENR Administrative Order No. 27, Series of 1989** - bans the exportation of fuelwood to assist the local enterprises using wood to generate energy.

- **DENR Administrative Order No. 26, February 22, 1990** - amends DENR Administrative Order No. 86-88 by including all other tree species planted in private lands, except premium hardwood species, and in the lifting of restrictions in the harvesting, transporting and sale of firewood.

- **DENR Administrative Order No. 79, September 19, 1990**. - amends DENR Administrative Order No. 26, Series of 1990 by excluding Benguet Pine (Pinus kesiya) in the list of species whose harvesting, transporting and sale of firewood have been lifted. Hence, the cutting, transport and disposition of Benguet pine within private lands shall be covered by a Private Land Timber Permit (PLTP).

- **DENR Administrative Order No. 24, Series of 1991** - prohibits logging in old growth forests beginning 1992.

There are other government policies in which fuelwood is incidental. For instance, government policies on the establishment of forest plantations would have direct bearing on increasing the woodfuel supply. It would be logical to assume that with more plantations established, more fuelwood will be available. Some of the pertinent administrative issuances for the establishment of forest plantations are:

- **Department Administrative Order No. 21, June 21, 1996** - established the guidelines for the establishment of pilot dipterocarp plantations. Its objective is to promote species diversity in forest plantations through the establishment of dipterocarp plantations whenever feasible.

- **Department Administrative Order No. 24, August 23, 1996** - defined the rules and regulations governing the Socialized Industrial Forest Management (SFM) Program. It aims to involve, in the reforestation efforts of government, interested individuals who do not have much capital to develop tree/forest farms by defining the minimum size of the area that may be subject of SIFM Agreement, i. e. 1 to 10 hectares for individual/single families; and over 10 hectares to 500 hectares for associations/co-operatives.

- **Department Administrative Order No. 60, October 4, 1993** - provided the revised regulations and guidelines governing the establishment and management of industrial forest plantations. The objectives are: conversion of the country's open and denuded lands, brushlands and degraded residual forests into productive forests to supply the raw materials for forest-based and related industries; effective protection and sustainable management for industrial purposes of suitable portions of the country's remaining residual forests; and development and implementation of mutually beneficial partnership with forest dependent individuals and communities.

7.5 Institutions Involved in Woodfuel Energy Development

There are at least three key government agencies which have varying mandates closely related to woodfuel management. These agencies are:

1. Department of Energy - through its Non-Conventional Energy Division (DOE-NCED)

   This is the government agency mandated to formulate and direct the comprehensive New and Renewable Energy (NRE) Program which aims to increase the contribution of non-conventional energy resources to the national energy mix.

2. Department of Environment and Natural Resources (DENR)

   This is the government agency concerned with the conversion, management, development and promotion of the proper use of the country's environment and natural resources. The Forest Management Bureau (FMB), the Ecosystems Research and Development Bureau (ERDB), and the Planning and Policy Studies Office of the Department are the primary units involved in woodfuel research and development and related activities.

3. Department of Science and Technology (DOST)

   This agency is primarily tasked to provide the central direction, leadership and coordination in scientific and technological efforts in the country. There are two institutions within DOST which are tasked to undertake wood energy activities. The Industrial Technology Development Institute (ITDI) is responsible for research and development in the fields of industrial manufacturing, mineral processing and energy. The Forest Products Research and Development Institute (FPRDI) is responsible for conducting applied research and development in secondary and tertiary processing of forest products.

The FPRDI has contributed much to the development of fuelwood conversion technologies. Past research works on fuelwood utilization dealt with carbonization techniques for various fuelwood species, cooking devices, gasification and pyrolysis techniques and densification techniques (PCIERD, 1990 and PCARRD, 1988).

Carbonization studies were centered on improving the yield of existing charcoal-making techniques, and appropriate techniques for other biomass materials. Cookstove development was directed towards the improvement of both charcoal and firewood stoves in terms of heat efficiency and style. Energy systems studies were concentrated on the development of small-scale village level technologies. The use of pyrolysis and producer gas was the focus of these energy systems. Densification activities focused mainly on the search for suitable binders and designs for small-scale briquetting machines (DAP, 1992).

7.6 Legal and Tenurial Issues

For more than 20 years, the government, through the DENR, has funded and implemented a number of upland development programs which later on were collectively termed "community-based forestry programs and projects". In all these projects", the participation of communities is tapped in the development and management of forest resources. Four general strategies are adopted to attain the sustainable development goals: (1) securing resource tenure of participants through the issuance of appropriate instruments; (2) preparing the communities to become resource managers and entrepreneurs through community organizing, extension, research and other social facilitation techniques: (3) enhancing the capabilities of support organizations, particularly the DENR, the non-government organizations (NGOs) and the local government units (LGUs) through education, training and institutional linkages; and (4) promoting forestry or agroforestry development and livelihood activities.

Several tenurial instruments are issued depending on the type of project implemented and the type of beneficiaries involved. These includes the following:

- Certificate of Stewardship (CS) which is granted to individual participants in the Integrated Social Forestry Program (ISFP).

- Certificate of Community Forest Stewardship (CCFS) which is awarded to ISFP community associations, including indigenous peoples.

- Community Forest Management Agreement (CFMA) is granted to communities under the Community Forestry Program. It allows the community to harvest products from naturally growing resources as well as from plantations developed by the community.

- Forest Land Management Agreement (FLMA) is granted to communities interested in establishing and managing areas identified as reforestation or watershed sites. As a form of community tenure, the community has the right to harvest the plantations when these become mature.

- Certificate of Ancestral Land Claim (CALC) which gives the heirs (individual family or clan) rights over a given area of ancestral land.

- Certificate of Ancestral Domain Claim (CADC) gives rights to the entire tribe over an extensive area of ancestral domain.

The tenure of the instruments is 25 years, renewable for another 25 years. Prior to the issuance of a particular tenurial instrument, the recipient must comply with the following: (1)completion of a community organizing process; (2) a manifested understanding of the obligations, responsibilities and benefits of the community arising from the management of the forest resource; and (3) completion and approval by the DENR of a comprehensive community resources management and development plan.

For a decade, the government has been implementing the Comprehensive Agrarian Reform Law (CARL) in the lowlands. This places the entire country under the Comprehensive Agrarian Reform Program (CARP).

Increasing production areas for fuelwood is restricted by the CARL. Although a law exempting tree farms from the CARL was approved in 1994, this has so far been poorly implemented. Information still has to be disseminated about the existence of this new law.

Javier (1995) found that while these tenurial instruments provide secure tenure to program participants, the same can not be utilized to generate capital badly needed to finance farm agroforestry and other livelihood activities. Eventually, this has led to the sale of tenurial instruments, which violates the provisions of the agreement.

Upland development programs and all other rural development programs, can only succeed if the people have security of tenure of the land and trees. Where possible, recommendations to ease or remove some obstacles should be made.

7.7 Critical Review of the Legal and Tenurial Instruments

An extensive review of the various community-based forestry programs and policies was conducted in 1995 by Rebugio and Javier. The objectives of the study were to determine the constraints on the effective implementation of CBFM programs and to recommend measures to ensure more effective community participation in sustainable forest management. The highlights of the findings of the study related to the issues surrounding the legal and tenurial instruments are the following:

- Considering the fact that most of the claimants are poor and uneducated, the various tenurial instruments are generally confusing and difficult to administer.

- Processing of the tenurial instruments is cumbersome and slow because the DENR lacks the financial, human and other resources needed to expedite processing.

- Processing is also expensive for claimants, especially in the case of ancestral land and domain claims. Without ample assistance from the government, it is feared that tenurial

processing will tend to benefit more the better-off claimants. This would aggravate the inequities rather than promote equity in natural resource development.

- The restrictive forest policies on forest products harvesting and utilization discourage forest communities from actively participating in the program. The communities are allowed to do TSI (timber stand improvement) removals and harvest timber and non-timber forest products only upon the awarding of the appropriate tenurial instrument and the development of organizational capability to prepare and implement a community resource management and development plan (CRMDP).

The following recommendations were made by the same authors:

- Speed-up the processing and awarding of appropriate tenurial instruments to participants of community-based forestry programs, including tenurial rights to indigenous cultural communities (ICCs) by:

  (a) simplifying tenurial processing rules and requirements (this is very necessary considering the low economic and educational status of the community-based forestry program participants);

  (b) providing an effective coordinating system for all CBFM programs/projects. Among the means to achieve this are to formulate a comprehensive implementing plan for community-based forestry programs, to set-up a unified coordinating structure at all levels of the DENR, and to institutionalize mechanisms for promoting program synergy;

  (c) increasing the DENR's funding, personnel and other resources required for speedy tenurial processing. In spite of the availability of funding from various sources, the DENR suffers from a perennial lack of resources.

- Hasten the awarding of CFMA, FLMA and other types of community tenure by intensifying the social and technical preparation of the community-based forestry program participants.

- Allow for a more liberal policy on forest products harvesting and utilization in CBFM areas to encourage communities to actively participate in the rehabilitation of critical areas.

7.8 Assessment of Government Policies Affecting Woodfuels

Based on the foregoing discussion of the policies affecting woodfuels, the following assessment can be made:

- There are already numerous government policies related to woodfuels but these policies are not direct and explicit; instead they are subsumed in general terms under the National Energy Plan (NEP), the Master Plan for Forestry Development (MPFD) and the Philippine Strategy for Sustainable Development (PSSD), thus diluting the intended goals and expected outputs.

- The woodfuel industry is not recognized as an important sector of the economy. In spite of the economic importance of woodfuels in the energy-economy nexus, there is still much to

be done in terms of increasing the appreciation and awareness of wood energy policy-makers and the different concerned agencies. Uncoordinated efforts among these various agencies are common. There is a need to integrate the policy plans of forestry, agriculture and energy and come up with a strong and unified policy.

- Woodfuels are mainly offshoots of multi-purpose tree production and farming systems. Also, non-forest lands are the major sustainable sources of woodfuels. Hence, there is a need to involve the Department of Agriculture and Agrarian Reform in the planning and development of the country's wood energy program.

- The concept of integrating woodfuel production into the major upland and rural development programs pursued by the different concerned agencies should be clearly identified and developed.

- There are several institutions with varying mandates related to woodfuel management. What is needed at present is effective coordination among these relevant agencies and mechanisms whereby institutional linkages can be strengthened.

8. CONCLUSIONS

Wood energy continues to be an important source of energy for the household and industrial sectors. Though the use of wood energy is said to be traditional, it still remains a major energy source. It contributes significantly to maintaining energy self-reliance by reducing the need for imported energy sources such as oil and coal.

Despite the importance of woodfuel in the country's energy economy, the wood energy sector continues to face a number of problems. One is the inadequateness and inconsistency of available data and information on fuelwood supply sources, production, and distribution.

Another problem is the environmental impacts of wood collection and utilization. There is a growing concern from some sectors about the environmental impacts of woodfuel use. Woodfuels as sources of energy emit CO_2 into the atmosphere during the combustion process. Rising concentration of greenhouse gases (GHGs) like CO_2 contribute to global warming or climate change. However, it is important to take note of the following. First, studies show that by far the largest part of woodfuel use takes place on a sustainable basis. Second, the forest ecosystem or the natural vegetation acts as sources and sinks of CO_2. Since sustainability implies carbon neutrality, this means that there is no net emission of CO_2 into the atmosphere because the same amount of CO_2 emitted by wood combustion is recaptured from the atmosphere by the natural vegetation.

With regards to the negative impact of unsustainable woodfuel use on the environment (e.g. changes in the microclimate, extinction of a number of flora and fauna, hydrologic impairment of watersheds) intensive data collection and more *in situ* studies are required to isolate the environmental effects that could be attributed solely to woodfuel collection and utilization.

With regard to fuelwood supply and demand, the Master Plan for Forestry Development and the DOE's Household Energy Consumption Survey gave two totally different estimates, i. e., a deficit of 15.5 million m^3 and a positive balance of over 60 million m^3, respectively.

Over the last two decades, the government, particularly the DENR, has instituted relevant government policies and programs aimed at enhancing fuelwood supply. And the energy sector through the DOE has accelerated diversification from depletable to new and renewable energy sources, including fuelwood.

Apart from the government agencies, both NGOs and the private sector play important roles in the energy sector. These roles can be seen in the areas of forest plantation development and management, biogas, solar and other new and renewable energy development, and improved cookstove development.

The woodfuel trade is composed mainly of production, distribution, and consumption. Of these systems, the distribution and marketing system is characterized as unclear and undefined because woodfuel is not recognized as an important commodity. Ironically, the Philippine Energy Strategy Study estimated that 536,000 households are dependent on gathering and selling woodfuel, 40,000 households are traders in rural areas, and 100,00 households are urban traders. Hence, the economic value of woodfuel trade cannot be ignored.

In the Philippines, government policies affecting wood energy are subsumed under the National Energy Plan, Master Plan for Forestry Development, and the Philippines Strategy for Sustainable Development. As such, these policies are not direct and explicit and tend to dilute the intended goals and expected outputs. In addition, a number of agencies (DENR, DOE, DOST, etc.) are involved in woodfuel management yet their activities are not effectively coordinated.

9. RECOMMENDATIONS

On the basis of the preceding discussion, the following recommendations are suggested.

1) The conflicting estimates of the country's national biomass resources need to be resolved, especially with the use of ground truthing. Inasmuch as forests and agricultural areas/private land are the main sources of woodfuel, a series of resource base inventories should be jointly undertaken by DENR, DOE and DA to ascertain the true situation of the country's biomass resource base.

2) There is an apparent widespread misconception about the environmental damage caused by fuelwood use and about its assumed association with deforestation despite the fact that a large percentage of the fuelwood produced comes from private lands. The DOE and the DENR need to correct this misconception through vigorous information, education and communication (IEC) campaigns.

3) With the promulgation of pro-people forestry policies, strong partnerships with the local communities can be forged so that the people directly involved in the woodfuel business can participate in identifying the problems affecting them, and consequently the intervention opportunities most appropriate to their local conditions. As determined by the UNDP/World Bank study (1992), woodland plots in agricultural areas are important sources of fuelwood. However, not much is known about the management systems of these areas. The local communities can therefore participate in community-based fuelwood production ventures to determine the required improvements in the present management system so as to achieve the desired level of efficiency.

4) There is a need for a concerted effort to integrate the policies and programs of government agencies like the DENR, DOE, and DA which are responsible for natural resources, energy, and agriculture, respectively. This is to ensure that the biomass fuel resource base is properly managed through a consistent set of policies and programs. Joint project implementation in the field is also recommended.

   Since the private sector and the NGOs have also their roles to play, it will be necessary to strengthen institutional linkages between and among the government and non-government agencies (private sector) with regard to biomass resource management and utilization.

5) Despite the economic value of woodfuel production and distribution that rural and urban producers and traders derive, the woodfuel trade is not recognized as an important sector of the Philippine economy. The DOE should take the lead role in emphasizing the biomass fuels' contribution in terms of meeting the energy requirements of households and other sectors, providing considerable employment opportunities and income sources to rural and urban families, and providing a substitute for imported fuels, thereby contributing to national energy self-reliance.

   A vigorous IEC strategy will be effective in achieving this objective. Through IEC, concerned government agencies and the wider community will better understand the importance of woodfuel in the energy mix of the country.

6) Under its NRE program, the DOE is promoting the use of modern wood energy applications such as dendrothermal power plant, biomass-fired cogeneration system, biomass densification (briquetting), and gasification (e. g. charcoal-fired gasifiers). At present, however, these application systems are not widely used due to technical, financial, and marketing constraints. In order to realize the extended use of these wood energy applications, the DOE should undertake the following:

- research and development such as pilot testing and feasibility studies;
- aggressive promotion and commercialization activities such as information campaign, financing, dissemination, training, and technical services.

All these activities are presently incorporated under the DOE's NRE sub-programs, namely:

- Technology sub-program aimed at developing economically viable NRE systems to levels of technical maturity;
- Commercialization sub-program aimed at creating favorable market environment for NRE and increasing private sector investment in NRE activities;
- Promotion sub-program aimed at heightening public awareness and acceptance of NRE systems.

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