7. An analysis of sustainable fuelwood and charcoal production systems in The Philippines: A Case Study

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INTRODUCTION

Background

This Philippine Case Study is part of a joint work program between IEA – Bioenergy Task 31 and FAO on the certification of woodfuel and charcoal production systems. The main assumption of this work is hinged upon the reality that there is a growing demand for woodfuels (charcoal and fuelwood) over time both as a source of household and industry end uses. The general concern is that the increased woodfuel use may cause additional pressure to the already diminishing supply of these resources against the current scenario of deforestation and devegetation on a global scale. The necessity of coming up with standards for sustainable management of the origins and sources of fuelwood and charcoal is a top priority in order to ensure renewable production systems vis-à-vis demand.

The problem however is that there are still many aspects influencing the different stages of production of both fuelwood and charcoal that need further documentation, understanding, description and quantification so that a relevant standardization can be achieved. This study then is meant to provide basic information to identify the various chain of custody within the production systems of fuelwood and charcoal with end view of identifying principles, criteria and indicators for the certification of sustainable woodfuel production systems.

Objectives of the study

The Philippine Case Study for both fuelwood and charcoal production systems was conducted with objectives as listed below. The following objectives form the topical sequence of the presentation and formatting of the entire report. First, was to provide basic information regarding the Philippines.

Second, was to examine the fuelwood and charcoal consumption and production chains based on certain facts. This was done by analyzing the socioeconomic, cultural, environmental issues associated with fuelwood and charcoal consumption and production. In addition, a characterization of the consumption and production of fuelwood and charcoal (woodfuels) in the Philippines was documented and analyzed. Objectives one and two however may over-lap in the presentation of this report.

Third, was to review institutional, legal, policy and production systems framework associated with woodfuels in order to trace critical components and links within the production process or the chain of custody that may not conform to sustainable forest management practices. This was the part where key issues that were strategic to certification of the production chain were identified and analyzed.

Fifth, was to sketch Philippine efforts in developing a prescriptive set of objectives towards criteria and indicators for sustainable forest resources management where such objectives both apply on a national scale and on a small management unit scale, for example the forest management units.

Last, was to describe, analyze and suggest criteria and indicators to implement a system of fuelwood and charcoal certification by way of conclusion and recommendations.

Methodology

Like any case study, this is a purely narrative and descriptive report. A number of charts, tables, and graphical presentations are included to provide basic profiles and quantification details to support certain claims. This case study hugely depended upon secondary sources of information obtained from pertinent government offices such as the Department of Energy (DOE), Department of Environment and Natural Resources (DENR), Forest Management Bureau of DENR, Development Academy of the Philippines (DAP), National Statistics Office (NSO), Department of Agriculture (DA), Department of Agrarian Reform (DAR) and National Statistics and Coordination Board (NSCB). The secondary literature were in the form of year end reports, workshop proceedings, contract research reports, media clippings, web posted documents and popular version documents that addressed the concerns of woodfuels in the Philippines.

About 30 percent of the information contained in this report was gathered using primary data collection. Primary collection of data was resorted to in order to verify and confirm what was uncovered from secondary sources. Courtesy calls, telephone calls, and face-to-face interviews were done from several government officials and staff of the above-mentioned institutions. A number of trips were done from Cebu to Manila and other parts of the country to comply with the data requirements of this study.

A number of relevant and valuable documents were uncovered during the course of investigation that may no longer be part of this report due to study scope and limitations. The researcher hopes that these can form part of yet future endeavours so that the initiatives may be continued. To set the study in context, a brief description of the Philippines is in order.

THE PHILIPPINE SETTING

Geography

The Philippines is an archipelago of 7 107 islands located in South East Asia. It has a land area of approximately 30 000 000 hectares. It is bounded on the west by the China Sea and on the east by the Pacific Ocean. Luzon, Visayas and Mindanao are the three principal island groupings classified further administratively into 17 regions and 81 provinces. By and large, the topography of the Philippines is varied consisting of huge masses of mountains, vast plains, extensive rolling hills, wide plateaus and undulating valleys.

Demography

The Philippines is one of the most populous countries in Asia and in the world touted to have three babies born every minute. In the year 2000, the Philippines had a population of 76.5 M with a population growth rate of 2.36 percent, a sex ratio of 101.4, population density of 255 people, and an average household size of 5. The 0–14 age range accounted for 37 percent and the 15–64 years old, 59.2 percent. In 2007, the medium assumption population projection is 88.7 million people. Much of the population still resides in the rural areas but urban migration has increased steadily. Metro Manila with its continued influx of rural migrants has become a very densely populated metropolis, in fact more populous than Metro Paris or Metro Tokyo according to literature. Yet, approximately 15 percent of the country's population resides in Manila.

Human development index

The country's human development index (HDI) ranked 98th out of 174 countries according to the 1998 UNDP Report. This meant an HDI lower than Thailand, Malaysia, China and Singapore. Poverty remains to be country's biggest problem with approximately 40 percent of the population living below poverty line.

The annual average Filipino family income as of 2003 was PHP 147 888 or US$ 616.20 per capita at the exchange rate of 1US$ = PHP 48. In 2006, the country's total labour force was 35.8 M whereby 33.1 M (20.4 M males) were gainfully employed but only 16.7 M were wage and salary workers. The consumer price index (1994=100) was recorded at 129.8 with a headline annual inflation rate of 6.2 percent. Life expectancy is 67.6 years for males and 73.1 years for females. Simple literacy rate is 93.4 percent while functional literacy rate is 84.1 percent as of the year 2003.

Philippine forests

About 30 percent of the total population of the country, particularly the poor, depends upon forest resources for their survival (Coxhead and Jayasuriya, 2003). With a total land area of approximately 300 000 square kilometres, of which 34.85 percent was under forest cover in 1972. Back in the 70s, the Philippines was touted to have the most diversified and economically valuable forest reserve in South-East Asia. It had extensive reserves of broadleaf tropical hardwoods and a considerable reserve of needle-leaf softwoods particularly in Luzon (Salita and Rosell, 1980). Today however, Francisco and de los Angeles (2003) noted that only 3 percent of the original forest covers remain. Figures cited in various literatures vary.

A National Statistics Coordination Board Report by Israel (2002) disclosed that a total forest cover of 5.7 million hectares representing 19 percent of the national land area still remains. Hence, Israel calculates that forest cover is only half of what it was 20 years ago. The numbers differ depending upon classifications, definitions, accuracy and availability of data. There are many issues surrounding 'forest cover' discussions i.e. lack of accurate data. Kummer mentioned that both the Swedish Space Corporation and the Philippine German Forest Inventory reported about 22–23 percent forest cover in the late 1980s. The Forest Management Bureau on the other hand reported about 18 percent in the mid 1990s and JAFTA (unpublished) or the Japan Forest Technical Association also reported 24.7 percent in the mid 1990s. Despite all the differences in estimates and projections, the rate at which forest resources are diminishing remains astounding.

The phenomenon of rapid deforestation is closely linked to the discussion of Philippine forests. In 2002, the World Bank reported a 1.4 percent annual deforestation rate, roughly equivalent to 89 000 hectares for the period 1900–2000. Philippine government sources claim that the average annual deforestation rate is 2 percent. Deforestation in the Philippines is caused by many factors. Land clearance for agricultural purposes brought about by population pressure to move uplands is one major reason. Other than migration patterns and population trends, commercial exploitation of forests resources is also accountable for the loss of valuable forest resources e.g. legal and illegal logging. Weak forest management control schemes and weak enforcement of regulations are also among the causes of deforestation. Lastly, pricing schemes that reflect the true scarcity values of forest resources are likewise inadequate.

The Philippine energy mix

Indigenous energy

The Philippine Department of Energy (DOE) in the year 1996 produced the Philippine Energy Plan (PEP) with a planning horizon of 30 years from 1995–2025. The DOE projection showed that much of the energy mix in the country is dependent upon Indigenous Energy. For instance in 2005, Indigenous Energy consumed stood at 47 percent, while in the year 2010 and 2015, demand is projected to be 42.75 percent and 41.25 percent, respectively. Hence, almost one-half or almost 50 percent of the country's energy need is supplied by indigenous energy resources.

The overall trend in the use of indigenous energy however is that of a decreasing rate during the 30-year planning horizon. This decreasing rate moreover is characterized as "sticky," meaning almost "unnoticed." An example will illustrate this. For the year 2005, the share of indigenous energy was recorded at 47.40 percent and this figure will continue to decrease until the year 2025 where the share will now be reduced to 41.25 percent or a decline by 6 percent spread across 30 years (approximately 0.2 percent). The implication therefore is that the Philippine energy mix will continue to depend upon indigenous energy resources for a long time to come.

Fuelwood in overall energy mix

In the PEP, the category Indigenous Energy in the Energy Mix consists of 13 sub-categories, among them is wood (or wood waste). In the Plan, three sectors have been identified as users of wood and these are: (1) household, (2) industry/commercial, (3) grid electricity [as co-generation with conventional energy].

Among the major inputs in the PEP is wood waste (fuelwood is implicitly part of this category). It is projected that this resource will continue to be a significant contributor to the overall mix accounting for 44 percent of the total new and renewable energy (NRE) demand by 2025. It is in the household sector that the usage of NREs, wood in particular, and was forecasted to be 90 percent in 1996 but will significantly decline to 64 percent by 2025.

Consistent with the overall decreasing trend in the demand for indigenous energy, wood waste has been projected to experience a decline in the next 30 years but it will not be at as sticky" or rigid as that of indigenous energy; in fact it will be more aggressive. The use of biomass resources however will increase. Biomass resource as a general category, which consists of rice residues, coconut residues, municipal waste, animal waste and wood waste, is projected to attain an annual average growth rate of 3.8 percent. Table 1 below shows the origin of fuelwood production among some countries in Asia. In the Philippines, most fuelwood is produced from non-forest lands. This is also true for Bangladesh, Indonesia, Pakistan, Sri Lanka, and Thailand.

Table 1. Fuelwood Production from Forest and Non-Forest Lands in Countries in Asia

Country	Forest (%)[a]	Non-forest (%)[b]	Unknown (%)
Bangladesh	13/75[c]	87/25/82	-
Bhutan	84	16	-
China	Na	26	-
India	51/17[d]	49/83	-
Indonesia	6	65	29
Laos	>90	<10	-
Myanmar	60	40	-
Nepal	82.5/73[d]	17.5/27	-
Country	**Forest (%)[a]**	**Non-forest (%)[b]**	**Unknown (%)**
Pakistan	12.6	84.1	3.3
Philippines	13.7	86.3	-
Sri Lanka	11/12[d]	75/69	14/20
Thailand	-	93	7
Vietnam	80	20	-

Source: Bhattarai 2001 in CIFOR Occasional Paper No. 39
[a] *forest plantations;* [b] *farms, homesteads, community lands, scrub and waste lands, linear plantations;* [c] *estimates from three sources;* [d] *estimates from two sources*

THE DEMAND FOR WOODFUEL

Woodfuel demand estimates

In principle, energy obtained from fuelwood sources may be used for power and non-power applications. In the Philippines, evidence shows that fuelwood and charcoal are used for non-power applications such as residential end uses particularly cooking and industrial uses as well. Over the years, the consumption of fuelwood and charcoal has been notably highest in the household sector, followed by industrial and commercial use. In the PEP, wood waste accounted for 44 percent of the overall NRE estimates. This 44 percent is shared among three sectors: household, industrial/commercial and grid-electricity sectors.

The Household Sector projection trend showed a decline (from 82 percent in 1996 to a mere 49 percent in 2025) in the utilization of NRE (where fuelwood is included). By and large therefore, it is projected that there will be a general decline in the use of fuelwood as fuel source among Filipino households in the years to come. The total amount of fuelwood to be used may experience a diminishing trend, but the fact still remains: fuelwood use will continue to be part of the typical Filipino household.

Woodfuel consumption estimates

Overall, consumption figures at the country-level are a matter of estimation that may be derived from various sources. Table 2 enumerates these various sources and Table 3 is a derivation of best estimates.

Table 2. Various Estimates of Annual per Capita Woodfuel Consumption

Source	Time Period	Per Cap Fuelwood Consumption[*]	Per Cap Charcoal Consumption[*]	Remarks
DAP (1992)	1979-1989	Rural: 0.82 cuM (615 kg) Urban: 0.55 cuM (412 kg)	No data	Figures reported are an average of ten different studies ranging in size from 98 to 808 respondents in different regions of the country
Carandang (2001)	1999	Rural: 0.65 cuM (487 kg) Urban: 0.19 cuM (143 kg)	Rural: 0.55 cuM Urban: 0.94 cuM	Results are from surveys conducted of 1,211 households in 13 mainland municipalities of Palawan Province
Bensel and Remedio (1993)	1992	Urban: 303 kg	Urban: 65 kg	Results based on a survey of 603 urban households in Cebu City
Bareng and Acebedo (2000)	1996	Rural: 1.8 cuM (1,305 kg) Urban: 0.93 cuM (677 kg)	Rural: 3.4 kg (20.4 kg wood equiv.) Urban: 7.1 kg (42.6 kg wood equiv.)	Results based on survey of 93 urban and 277 rural households in Ilocos Norte Province
UNDP/ESMAP (1992)	1989	Rural: 543 kg Urban: 394 kg	Rural: 78 kg Urban: 114 kg	Results of the 1989 HECS of 5,082 households
DOE (no date)	1995	Rural: 373 kg Urban: 245 kg	Rural: 33 kg Urban: 25 kg	Results of the 1995 HECS of 6,500 households

Source: Bensel and Remedio, 2002 (Figures are estimates)*

Fuelwood consumption ranges from 20–30 million MT/annum. Charcoal consumption ranges from 2–4 million MT/annum (wood equivalent from 12–24 million MT). Therefore, overall woodfuel consumption in wood equivalent is likely between 32 and 54 million MT/annum. Combined biomass residue consumption ranges from 12–19 million MT/annum. Therefore, overall biomass fuel consumption ranges from 44–73 million MT/annum. Based on the review of the sources available, a single best estimate of consumption in the various categories (reported in the last column in Table 2) was derived. The overall estimated woodfuel consumption in the Philippines is 25 million MT/annum, charcoal consumption at 2.7 million MT/annum (wood equivalent of 16.2 million MT), and biomass residue consumption at 17 million MT/annum. This translates into 41.2 million MT/annum of woodfuel (after converting charcoal to wood equivalent), and 57.2 million MT of overall woodfuel and biomass fuel consumption (Table 3).

Philippine household energy consumption surveys

In the Philippines, three (3) Household Energy Consumption Surveys have been conducted: The first in 1989, the second in 1995 and last one in 2004. A cross-sectional analysis of the three reported years of survey will show three major observations. Firstly, Filipino households do not use only one type of fuel; they use multiple types e.g. kerosene, fuelwood, charcoal, and others. There is therefore a need to distinguish between primary cooking fuels from a secondary cooking fuel.

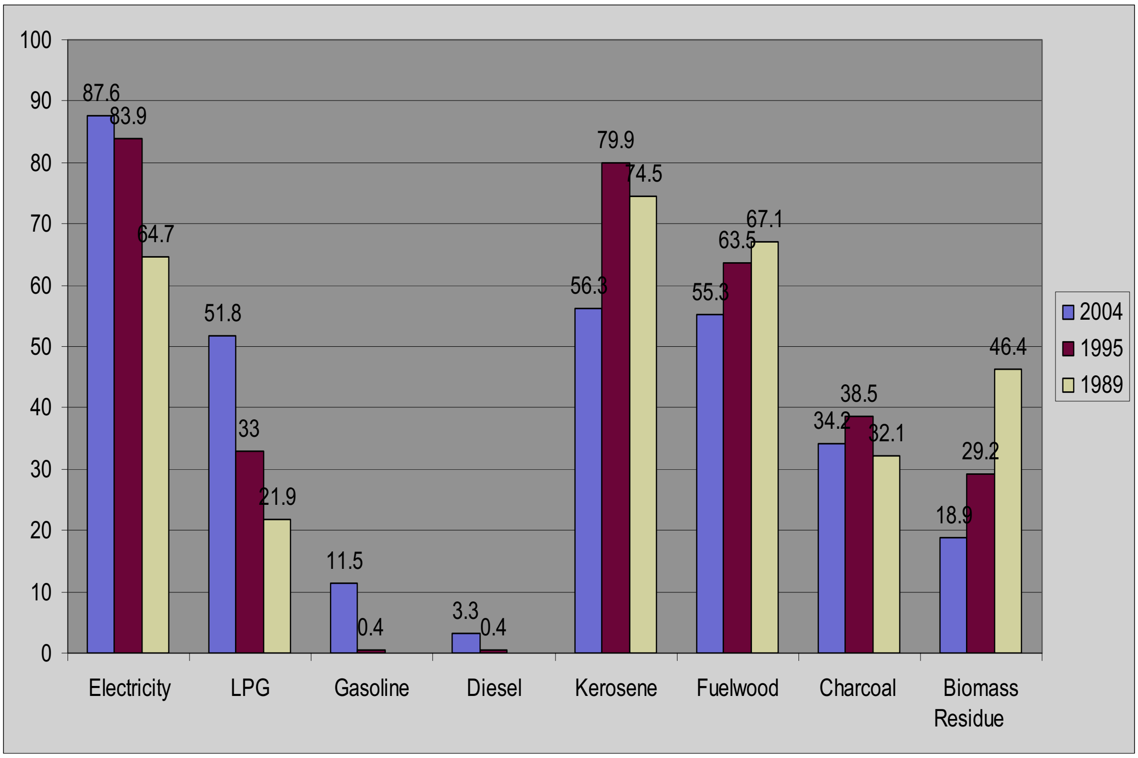
Secondly, there is an increase in the number of households using fuelwood from year 1989 (total of 7 504 households only) up to year 2004 (total of 9 196 households). This is an increase of 18 percent in terms of the number of households using fuelwood within the past 15 years.

Table 3. Best Estimates of Biomass and Woodfuel Consumption in the Philippines

Sector/Fuel	Estimates Range (million metric tons/year)	Best Estimate (million metric tons/year)
Household Fuelwood Consumption	15-20	18
Household Charcoal Consumption	1-2	1.2 (7.2 mil metric tons wood equiv.)
Household Biomass Residues Consumption	2-4	4
Commercial/Industrial Fuelwood Consumption	5-10	7
Commercial/Industrial Charcoal Consumption	1-2	1.5 (9 mil metric tons wood equiv.)
Commercial/Industrial Biomass Residues Consumption	10-15	12
Combined Fuelwood Consumption	20-30	25
Combined Charcoal Consumption	2-4	2.7 (16.2 mil metric tons wood equiv.)
Combined Biomass Residues Consumption	12-19	16
Overall Biomass Fuel Consumption (after converting charcoal to wood equivalent)	44-73	57.2

Source: Bensel and Remedio, 2002

Figure 1. Philippine household energy consumption survey 1989, 1995 and 2004.



Thirdly, there is an overall decline in the use of both fuelwood and charcoal vis-à-vis other types of fuels (such as kerosene, biomass residues), but there is a significant increase in the use of liquefied petroleum gas (LPG) whose demand is steadily rising over the past 15-year period. The demand for LPG was 21 percent in 1989 and it grew to 33 percent in 1995 and now it is at a record high of 51 percent in 2004 (Figure 1).

Biomass fuels are widely used in Philippine households in both rural and urban settings and remains so. The absolute number of fuelwood- and charcoal- using households in the Philippines increased over the 1989–1995 period. In terms of percentage share of households using these fuels, fuelwood declined while charcoal increased. Fuelwood decline can be attributed to increased use of LPG while the increase in charcoal use is due to more widespread use of charcoal for cooking and ironing, although the actual volume of charcoal consumed in the household sector declined during this period.

From 1989–1995 the percentage share of rural households using LPG rose from 9 to 17% which corresponded closely to the decline in number of rural households using fuelwood. The increase in urban household LPG and fuelwood usage is due largely to the 47.4% increase in households classified as "urban", while households considered "rural" declined by 6.1%. This shift in household demographics is due to rural-urban migration and the incorporation of some peri-urban areas into urban boundaries and the reclassification of many municipalities as cities.

Woodfuel/biomass fuel consumption in the Philippines is estimated to be between 30–50 million MT per year. Considering just fuelwood and charcoal, the estimate is between 25–35 million MT per year. The national fuelwood consumption figure is between 20–24 million MT and a charcoal consumption figure of between .86 to 1.65 million MT.

In the period from 1989–1995, household fuelwood consumption declined 3.76 MT and charcoal consumption declined .80 million MT while the population of the Philippines actually grew by 8.5 million people. Preliminary results of the 1989 Household Energy Consumption Survey revealed that in comparison to other Asian countries with moist tropical climates "the survey reported unusually low levels of per capita bio-fuel consumption by households relying on fuelwood as their primary cooking fuel" (UNDP/ESMAP, 1992, Vol. II, p.3).

The HECS reports and other household energy case studies indicate that households often view biomass fuels as easily available and relatively affordable supplemental cooking fuels. A move away from biomass fuels as a primary cooking fuel at one point in time does not preclude the possibility that households could easily revert to their use when faced with price increases or supply difficulties for conventional fuels.

LPG, fuelwood and biomass residues are almost exclusively utilized for household cooking, with very limited use for water heating. Approximately 20% of the charcoal used in the household sector is for ironing and is higher in rural areas where access to electricity is more limited. Most fuelwood, and to a lesser extent charcoal consumption, takes place with the use of crudely crafted, often homemade stones.

In Ilocos Norte, only 41% of fuelwood users and 3% of charcoal users use these fuels solely (Bareng and Acebedo, 2000). This illustrates that many Philippine households retain the ability and generally prefer to make use of multiple cooking fuels simultaneously. This combined with the ease of construction or purchase of biofuel stoves suggests that while biomass fuels may be declining in importance at this point in time, a return to greater use is always a possibility.

Households, in general, found fuelwood readily available, inexpensive and relatively less expensive than conventional fuels. The main attraction to fuelwood use is that it provides a hotter flame and that food cooked with wood tastes better (Bensel and Remedio, 1993). Surveys in Ilocos Norte (Bareng and Acebedo, 2000) and Laguna confirm the importance of factors like affordability/availability of woodfuel, affordability of stoves, availability of free fuelwood supplies, high heat, tradition, taste preferences and specialized cooking needs as important factors in woodfuel use. Majority of households also describe fuelwood as a dirty fuel, while a significant number consider it inconvenient to use. Many households are unable to use fuelwood because of the way their kitchen is set up.

Lower-income households are more likely to use woodfuel and biomass residues. The widespread use of charcoal among upper-income households than lower-income ones may be due to specialized cooking and/or more concentrated charcoal use in urban areas where incomes are higher than in rural areas.

Household fuel choice decisions in the Philippines are highly flexible and highly income and price elastic. (UNDP/ESMAP, 1992). It is important not to view fuel-switching trends over a given period as irreversible or one-directional since sudden changes in fuel prices or availability could easily reverse fuel-switching trends. The most widely cited factor in fuel-switching was convenience. Households switching from fuelwood to kerosene or LPG cited inconvenience, higher cost of fuelwood and lack of space as the primary reasons for switching. Households switching from kerosene to woodfuels did so because of problems with a kerosene stove and fear of fire or explosion.

Woodfuel use among industries

It was found out however that there some industries which also used woodfuels either as primary fuels or combined with others. Tables 2 and 3 show this information.

Table 4. Commercial/Industrial Users of Woodfuels and Biomass Fuels in the Philippines

Industry	Description	Geographic Location	Woodfuel Use Patterns
Bakeries	Use wood-fired "pogon" or brick oven	Nationwide, most rural bakeries apparently still use woodfuels, many urban bakeries have shifted to LPG	Mostly fuelwood, some charcoal
Restaurants/ Eateries	This category would include tens of thousands of "carrenderias" rarely listed as registered businesses	Nationwide, often located in urban areas near to schools, offices, hospitals, and factories. In rural areas these tend to be concentrated in market areas in the municipal centre	Extensive use of both fuelwood and charcoal. Fuelwood often used to cook large batches of food, charcoal to keep food warm for long periods
Barbecue/ Lechon Vendors	Range from sidewalk barbecue vendors to large-scale establishments	Nationwide, more concentrated in urban areas	Mainly charcoal, although some fuelwood might be used to prepare side dishes
Food Processing	Both large-scale and small-scale		

Source: Bensel and Remedio, 2003

The trends in fuel switching

The phenomenon of fuel-switching is multifarious and may not be apparent at first glance. Fuel-switching as a phenomenon needs to be classified as either a switch from a more superior type of fuel to an inferior fuel or from an inferior type of fuel to a more superior type of fuel. Fossil-based fuels are considered as more superior as their technologies are more developed than non-petroleum-based fuels such as charcoal and fuelwood.

The 2004 HECS recorded 7 million households or 43 percent of all Filipino households switched from LPG as their primary cooking fuel to charcoal and fuelwood due to high cost, unavailability and inaccessibility. About the same proportion of households who previously used electricity as their primary cooking fuel switched to LPG, kerosene and fuelwood instead. The main reasons for switching were increased price of their previous primary cooking fuel, change in family income, availability of new cooking fuel, convenience, among others. These are clearly fuel switching from a more superior fuel to an inferior fuel.

The 1995 HECS recorded an increase from 3.3 million households using LPG as primary cooking fuel in 1990, the number rose to 3.8 million in 1995. Even though LPG recorded this increase, fuelwood was still the most popular fuel since 6.1 million households or 48 percent declared that it was their primary cooking fuel. The pace and extent to which household fuel-switching will take place in the future will have an important implication on the levels of fuel demand in the household sector.

Table 5. Woodfuel Consumption by Industry, 1990 (in '000 cubic meters)

Type of Industry	Total		Fuelwood		Fuelwood Substitutes	
	Quantity	Percent	Quantity	Percent	Quantity	Percent
Philippines	14,153.3	100.0	7,822.5	100.0	6,330.8	100.0
Slaughterhouse	429.2	3.0	348.2	4.5	81.0	1.3
Fish Canning	1,960.1	13.9	1,957.7	25.0	2.4	0.0
Vegetable/Animal Oil	122.7	0.9	113.5	1.5	9.3	0.2
Bakery Products	3,925.7	27.7	3,268.3	41.8	657.3	10.4
Sugar Milling/Refining	3,712.4	26.2	100.9	1.3	3,611.5	57.0
Food Manufacturing	987.7	6.0	840.8	10.8	146.9	2.3
Distilleries	71.6	1.5	71.6	0.9	0.0	0.0
Textiles	117.5	0.8	117.5	1.5	0.0	0.0
Leather Tanning	34.9	0.1	20.0	0.3	14.9	0.2
Wood/Cork/Cane Products	92.1	5.1	76.7	1.0	15.4	0.2
Pottery/China/Earthware	917.1	6.7	274.9	3.5	642.2	10.1
Structural Clay Products	685.6	3.3	8.4	0.1	677.2	10.7
Restaurants/Eating Places	1,069.5	4.3	611.4	7.8	458.1	7.2

Source: Bensel and Remedio, 2003

WOODFUEL PRODUCTION SYSTEMS

Socioeconomic and cultural aspects

In developing countries like the Philippines, woodfuel is the major source of cooking and heating fuel for most of the rural communities and for the majority of the urban dwellers. The most important domestic energy resources of this kind include wood, wood waste, charcoal and agricultural residues. Out of total 1 169 peta joules energy consumption in 1993, woodfuel still accounted for 382 peta joules (33%). Additionally, there is no indication that this consumption will be reduced in the future despite a continuing growth in commercial energy consumption (RWEDP, 1998).

The study of Arriola (1998) reported that fuelwood remains the most important fuel in the household sector accounting about half of the energy requirements. The author added that even high income households use this form of energy. About 80% of fuelwood was self-collected and most of these came from privately-owned land with very minimal amount from government land. Her study also gave an account of the misconception that fuelwood contributes to forest denudation.

According to Texon (1998), women in most, if not all countries in Asia and sub-Saharan Africa, take care of daily fuel needs for domestic consumption, work for many hours in smoky kitchen and participate in village woodlots or care home gardens that supply the much needed fuelwood. Women, therefore, play a significant role in the production of fuelwood. They have knowledge on the art of making charcoal and can identify what the properties of materials suitable for fuelwood are. The author added that women even gather woods both for commercial and domestic purposes.

This is so because fuelwood gathering for domestic and commercial purposes requires the utilization of human energy, in which, women contribute the larger part. Fuelwood is an indispensable raw material for women’s most important and time-consuming activity, the food preparation. Women are the primary collectors of fuelwood. In various countries, women spend the most number of hours trekking long distances to gather fuelwood Texon (1998). Hence, in the event of deforestation, it would become more difficult for rural women to gather firewood. The elderly people and children also bear the burden of fuelwood collection. The children could perhaps be at school rather than gathering fuelwood and the elderly now deserve to rest rather coping with their energy needs. Texon (1998) recommended that extra efforts should be undertaken to deal with issues confronting women as they play an important role in wood energy system.

The use of wood energy has ill-effects mostly among women who are the most exposed to indoor pollution emitted by fuelwood-based cook stoves. In addition to direct heath effects of cooking with biomass, its growing scarcity and the difficulty in gathering them has indirect effect on the health of the poor. Examples cited by researcher are the tendency of the family to prepare fewer hot meals which may lead to consumption of stale leftover food that maybe contaminated, undercooking and switching to cereal staples that require less cooking but maybe less nutritious. These practices have adverse effects on family nutrition.

The paper of Arriola (1998) identifies the production and marketing systems of woodfuel industry in the Philippines, its socioeconomic and environmental impacts and some policy issues and recommendations for the industry.

Environmental aspects

The extraction activities in woodfuel production may have adverse environmental effects. But the extent in which extraction becomes detrimental or not will depend on the technology employed and the rate of extraction which in turn depends on the demand for fuelwood. It is also important to note that, in contrast to the traditional perception, deforestation is not caused by the heavy reliance of people on wood fuels for energy (Bhattarai, 1998).

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 (Rebugio *et. al,* 2000). However, the authors cited that while it is true that wood combustion emits CO_2 into the atmosphere, the same amount is recaptured from the atmosphere by the re-growth 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 leftovers of non-sustainable logging, slash and burn farming and land conversion and 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.

In addition, the nature of impacts on the environment related to wood energy production and utilization can be categorized into to two: on-site impacts and off-site impacts (Argete, 1998). The on-site impacts refer to the instant local changes of the physical and biological environment following the cutting, lopping, coppicing and transporting of fuelwood. There are negative effects on the hydrologic and nutrient cycles and biodiversity conservation. It can also cause soil erosion and carbon sequestration as well as microclimatic impacts. Off-site impacts are the negative effects on the environment seen on the adjacent and far-flung environment. These may include changes in water yield and flow patterns.

Since both upland and mangrove woodlands are sources of urban fuelwood in many areas, the extraction of wood resources for commercial purposes does give some concerns in regions which are less endowed with forest resources, are easily accessible by boat, and provide wood which is considered excellent for fuel, particularly the commercial fuelwood users (Arriola, 1998). Hence, the extraction activities which consist among other things the choice of species to be cut with or without replacement, the selection of the trees to be cut, the decisions on what of the tree to harvest and the equipment and power, must be done with environmental considerations.

Woodfuel supply and production estimates

The idea to consider when it comes to fuelwood and/or charcoal production is that woodfuel supply is more or less equal to consumption figures since most of the woodfuel consumed in the Philippines is gathered by its users who will unlikely gather more than what they need in the immediate future. All household consumption surveys indicated the same result: households themselves collected or gathered fuelwood either from their own property or other private properties of government land.

Indeed where do woodfuel supplies in the Philippines come from? How much is produced from these sources? What are the current practices in woodfuel production? The succeeding sections will attempt to answer these questions. The totality of economic activities which comprise making fuelwood available to the end user is defined as fuelwood production system regardless of whether or not the sources of the fuelwood is natural resources or plantation backyards (Argete, 1998).

Other than forest resources, woodfuel can possibly be derived from logging residues, Timber Stand Improvements (TSI) removals, processing mill residues, tree plantations, mangrove forests, brushlands, and other alternative sources. Arriola (1998) studied the woodfuel flows of six urban areas[**] in the Philippines. The researcher found out that the sources of wood used to supply the different markets vary greatly from region to region. An important source of fuel in most regions is the village woodlands in agricultural areas.

Virtucio (1970) cited that for every 100 cubic meters of log or timber produced, 80 cubic meters of logging wastes such as tops, branches, stumps, abandoned logs and damaged residuals and butt trimmings, were also produced. TSI operation, on the other hand, can produce on the average, approximately 82 cubic meters per hectare for a ten to twenty-year old second growth forest. Processing of logs including sawmilling, veneering and plywood manufacturing also generates wood wastes. Sawmilling has 36% mill waste while veneering and plywood manufacturing are both estimated to have 47% residue. Arriola (1998) reported that residues from logging and sawmills are essential fuel sources in areas where these activities are present.

The fuelwood from the forest plantations of both the government (established to rehabilitate denuded areas and protect watersheds) and private sectors (established for production purposes) are by-products of an assortment of logs, pulpwood, poles and piles. Mangrove trees as fuelwood have high demand causing also their destruction aside from the conversion to fishponds and prawn farms. Brushlands are common source of fuel wood providing an average volume of 1.95 cubic meters per hectare (DAP, 1992).

Woodfuel production is not fully integrated in farmer's production system, available technologies do not reach the intended end users, potential sources of energy are fully utilized and fuel gatherers may cut anything anywhere (RWEDP, 1998). The following solutions can address the foregoing production and utilization problems: 1) participatory technology development, 2) aggressive information dissemination on woodfuel production and utilization and 3) development of technologies related to the utilization of other potential energy sources.

[**] Areas covered included La Union, Santiago, Isabela, Metro Manila, Cebu City and Tacloban City.

According to Bensel and Remedio Desk Study Report (FAO, 2002), the Philippine Department of Environment and Natural Resources (DENR) estimated 1990 fuelwood supply at 23.18 million cubic meters and fuelwood demand at 38.7 million cubic meters. In a consultant report, John Soussan (1991) on the other hand, estimated that forests could provide over 40 million metric tons of woodfuel every year while non-forest lands could produce close to another 30 million metric tons. Soussan however failed to factor in the issue of accessibility to woodfuels in the forest. He concluded that "the Philippines is a biomass-rich country" yet at the same time he mentioned "pockets" of emerging tress and raises concerns about concentrated harvesting of mangrove forests for commercial users in some urban areas.

One of the major sources of confusion over the issue of woodfuel use and deforestation in the Philippines is the lack of a clear definition of what is a "forest." Confusing the issue further is the lack of a consistent set of land use classifications in the Philippines. The 1989 HECS study concluded that only around 15 percent of the woodfuel used in the Philippines came from forest land with the rest originating from agricultural areas. The 1995 HECS study indicated that 6.6 percent of respondents collected wood from government land, while the DENR Master Plan for Forestry Development estimated 64 percent of households using woodfuel collected wood from forest lands.

The Development Academy of the Philippines (DAP) 1982 Rural Energy Survey and the 1989 HECS reported that around 78 percent of rural household woodfuel users gather supplies from within a kilometre from their homes while over 95 percent gather supplies from within five kilometres. Since most of the rural population lives in agricultural areas, this supports the assertion that most woodfuels originate from non-forest areas or forest edges.

According to Cruz *et al.,* (1991), woodfuels originate from forest lands, although they are primarily a by-product of agricultural expansion. The same study points out those significant quantities of fuelwood and charcoal originating from fruit trees damaged by storms, from trees and shrubs grown on agricultural lands and from brushlands that may be under government or private ownership.

Carandang (2001) found that 71 percent of rural fuelwood users obtained supplies from their own farms while 27 percent obtained them from public forest. Wiersum (1982) suggests that primary forest contributed only a limited amount to overall woodfuel production and found large plantations established in response to concentrated commercial demand for fuelwood and charcoal in nearby industries or cities. Wiersum therefore concluded that most woodfuels originate from agricultural lands and brushlands.

Bensel and Remedio (1993, 2002) indicated that the bulk of the commercial fuelwood and charcoal sold in Cebu City and surrounding urban areas originated from tree and shrub fallows. Their studies revealed that most of these tree and shrub fallows were established deliberately by upland farmers and landowners on what had been a cogon grass dominated landscape. In addition to these lands, 15–25 percent of Cebu's commercial woodfuels originate from fruit trees either knocked down by storms or uprooted as part of an agricultural cycle. Woodfuels in Cebu are also sourced from brushlands stocked with indigenous tree and shrub species, and logging residues from private tree plantations.

Bareng and Acebedo (2000) reported that in Ilocos Norte, woodfuels come from tree fallows, woodlots, private tree plantations, agroforestry systems and isolated/scattered trees found throughout the landscape. Open canopy secondary growth forests in Ilocos Norte remain an important source of woodfuels especially for commercial users.

Current land use practices in the Philippines are capable of producing over 85 million MT of wood for fuel annually, excluding wood from primary forests which are inaccessible. It also does not include coconut and other crop residues that are available for use as fuel.

The 1998 Swedish Space Corporation report categorized over 10 million hectares of land as cultivated mixed with brushland and grassland with an estimated productivity of 8t/ha/year. Other areas characterized as brushland or extensive mixed land uses have an estimated productivity of 5t/ha/yr. Grasslands have an estimated productivity of 1t/ha/yr while tree plantations may yield 2t/ha/yr. Secondary forests, agricultural land and coconut plantations have an estimated yield of 6, 2 and 2t/ha/yr., respectively.

Estimating woodfuel supply accounts for the enormous woodfuel potential of "in-between lands" that make up close to 30 percent of Philippine land area. These lands have tended to escape the interest of the forestry community because they could not be considered forest. Likewise, the agricultural community cannot appreciate these lands because they are too steep and unsuitable for commercial agricultural purposes. These "wastelands" play an essential part in meeting the energy and other subsistence needs of rural communities and have come about as intentional establishments to suppress cogon or as natural re-growth in the wake of agricultural abandonment.

In his 1991 consultant report, Soussan indicated that the key fuelwood resource in rural areas is the "village woodlands," although very little is actually known about them. Other studies, including those mentioned above, make reference to more or less the same kind of resource, referring to them as tree or shrub fallows, family woodlots, brushland or shrubland, reproductive brush, secondary forest, coppice forest, shrub forests and so on.

Despite the range of terminologies used to describe them, what can be said with some certainty about these areas is as follows. First, they are generally on private land, in predominantly agricultural areas, where the bulk of the rural population resides. Second, the degree to which they can be described as open-access depends in large part on the presence or absence of commercial woodfuel markets in the vicinity. In places where commercial demand exists, which is believed to be the norm, access to the resource is monitored and restricted, although this does not necessarily mean that local woodfuel users are completely denied access and face woodfuel shortages.

Third, in some cases they represent natural re-growth of pioneer forest species in the wake of agricultural abandonment or commercial logging. Apparently just as common is that these areas were intentionally established on marginal grasslands using fast-growing species like *Leucaena* and *Gliricidia* whose chief advantages are their ability to compete with cogon, fix nitrogen and be coppiced on a regular rotation. Fourth, their area, while difficult to determine, is probably in the range of from 6–10 million hectares (20–30 percent of the country's total land area).

Lastly, they are without a doubt the major source of woodfuel for rural and urban households, and for commercial/industrial establishments in the Philippines. The fact that so little is known about the extent of this resource, its management and productivity and how it has changed over time is in large part responsible for so many of the dire warnings on woodfuel supply in the Philippines that have never come to pass. If agricultural woodlands are managed properly they alone can produce enough wood to meet residential and commercial/industrial woodfuel requirements in the Philippines.

It is assumed that woodfuel supply is more or less equal to woodfuel consumption. This is so for various reasons. For instance, most of the woodfuel consumed in the Philippines is gathered by its users and it is unlikely that users will gather much more than they would need in the immediate future. Even traded woodfuels, being a commodity subject to decomposition (in the case of fuelwood) and damage from the elements, are unlikely to be produced in quantities significantly greater than what consumers demand.

Therefore, it is suggested that woodfuel "supply" in the Philippines is roughly equivalent to the consumption figures reported earlier. However, a more interesting set of questions relates to the issue of whether this supply of woodfuels is being produced in a manner that does not compromise future supply potential. In other words, in meeting current woodfuel demands are woodfuel users and traders undermining the *potential* for a sustained production of these fuels into the future. These questions of *how* woodfuels are produced in the Philippines, *where* they originate from, and what the *potential supply* of woodfuel is that can be produced on a sustained basis, are the more relevant questions to investigate.

It is still widely assumed in the Philippines that woodfuel extraction contributes to deforestation and environmental degradation. In addition, because of the rapid loss of forests in the Philippines in the last 30–40 years it is also generally accepted that the country is facing or already experiencing woodfuel shortages. These perceptions persist despite a growing body of evidence indicating that most woodfuel production in the Philippines comes from agricultural areas, and that tree planting and management for woodfuel purposes is widespread in many regions of the country.

In order to explore these issues a presentation of a series of woodfuel production/supply estimates for the Philippines and the assumptions behind them are presented in Table 6. Next is to examine evidence on patterns of woodfuel production in the country, paying particular attention to the ways in which "trees outside the forest" contribute to the bulk of woodfuel production. This is followed by an attempt to estimate woodfuel production potential in the country given what we know about the geographical distribution and productivity of different woodfuel producing land use systems.

Table 6 presents information from eight sources on woodfuel and biomass residue production/supply potential in the Philippines. Looking first at woodfuels, the range of estimates is from 17 million MT to nearly 110 million MT. The most widely cited estimates are the highly divergent figures developed by the DENR as part of the Master Plan for Forest Development (MPFD) and those put forth by the UNDP/ESMAP 1989 HECS project, and so we focus on these.

Table 6. Estimates of woodfuel production/supply potential in the Philippines

Source	Year of estimate	Woodfuel production/supply potential	Other biomass fuel production/supply potential	Remarks
DAP (1992)	1990	MPFD estimates Forests: 4.23 million MT Non-Forests: 13.16 million MT Total: 17.39 million MT		Estimates are for woody biomass fuels only and take into consideration issues of accessibility of fuelwood users. Estimates refer to annual sustainable yield.
UNDP/ ESMAP (1992)	1988	Forests: 40.36 million MT Non-Forests: 29.68 million MT Total: 70.04 million MT	Coconut Residues: 36.61 million MT	Estimates apparently do not consider issues of accessibility of fuelwood users to potential supplies in forest areas.
DOE (1999)	1999	Wood/ Woodwastes: 84.721 MMBFOE (33.09 million MT wood equivalent)	Rice Residues: 7.666 MMBFOE (3.32 million MT) Coconut Residues: 23.245 MMBFOE (10.02 million MT) Bagasse: 18.143 MMBFOE (7.09 million MT) Total: 49.054 MMBFOE (20.43 million MT)	All figures reported in MMBFOE (million barrels fuel oil equivalent). MMBFOE converted to weight assuming 6.25 GJ/BFOE and using the following conversion factors: wood/woodwastes 16 GJ/MT; rice residues 14.4 GJ/MT; coconut residues 14.5 GJ/MT; bagasse 16 GJ/MT.
Nera (1998)	2000	Total: 27.78 million cuM (20 million MT)		Estimate derived by summing sustainable annual supply estimates from different land-uses (e.g. forest, plantations, brushlands) as well as waste wood.
RWEDP FD#50 (1997)	1994	Forests: 12.96 million MT Agricultural Areas: 30.82 million MT Waste Woodfuels from Deforestation: 45.49 million MT Total: 89.27 million MT		Forest and agricultural area estimates described as “sustainable woodfuel” while waste woodfuels from deforestation is based on an assumed annual rate of deforestation and corresponding wood by-products available from that process.
Koopmans (1998)	1997		Rice Residues: 22.81 million MT Maize Residues: 10.71 million MT Sugar Residues: 15.93 million MT Coconut Residues: 35.87 million MT Total: 85.325 million MT	Estimates divided into field-based residues, process-based residues and agro-based wood residues.
Quejas (1996)	1990	Total: 109.68 million cuM (79 million MT)		Cites Misajon et al. (1989) as original source. Not clear if estimate refers to just woodfuels or also includes other forms of biomass fuels.
PRESSEA (2002)	1996	Total: 489.77 PJ (30.62 million MT)	Rice Residues: 44.29 PJ (3.08 million MT) Coconut Residues: 112.73 PJ (7.77 million MT) Bagasse: 67.04 PJ (4.19 million MT) Total: 224.06 PJ (15.04 million MT)	Estimates derived from data provided by Philippine DOE – Non Conventional Energy Division. Converted from PJ to weight using conversion figures described above for DOE.

Source: Bensel and Remedio, 2003

The DENR estimated 1990 “fuelwood supply” at 23.18 million cubic meters (around 17 million MT), and firewood demand at 38.7 million cubic meters (28.25 million MT), indicating a fuelwood deficit of 15.52 million cubic meters (11.33 million MT).

In addition, the DENR projected fuelwood deficits of from 16.6 to 18.7 million cubic meters for 2000, and from 14.9 to 20 million cubic meters for 2015 under different scenarios. It is not made clear in the Master Plan exactly how the 1990 deficit of over 11 million MT was actually met, and just how demand could have exceeded supply. Presumably, these figures are meant to be indicative of what the DENR determined to be fuelwood supplies that were *accessible* to users and those that could be produced on a *sustained yield* basis.

Therefore, the "woodfuel gap" had to be met through unsustainable and often illegal cutting of trees in forested areas. In order to meet the projected shortfall, the DENR MPFD calls for a combination of approaches, namely the substitution of alternative fuels for woodfuel, establishment of woodfuel plantations on 300 000 hectares of land, and distribution of improved cookstoves to increase the efficiency of use. Ever since its publication in 1990, the DENR MPFD woodfuel statistics have been widely cited and used in the literature on woodfuel in the Philippines, right up to the present. The enormous supply-demand gap portrayed in the MPFD is in large part responsible for the persistence of the belief that the Philippines face serious woodfuel problems.

By way of contrast, the 1992 UNDP/ESMAP report summarizing results of the 1989 HECS project paints a much more optimistic picture. The UNDP/ESMAP woodfuel production/supply potential figures originated in a consultant report prepared by John Soussan (1991). In that report, Soussan combined recently released satellite data on forest/non-forest land uses in the Philippines with potential woodfuel yield data for each land use in order to develop his totals. For example, dipterocarp forests were assumed to yield an annual increment of between 5 and 7 tons/hectare/year (t/ha/yr), while a figure of 2t/ha/yr was used for mixed extensive farmland and 1 t/ha/yr for intensive farmland. Soussan estimates that forests could provide over 40 million MT of woodfuel every year on a sustained yield basis while non-forest lands could produce close to another 30 million MT. One apparent difference between Soussan's estimates and those in the MPFD is that Soussan did not factor in the issue of accessibility to woodfuels in the forest. But even still, Soussan's estimates of almost 30 million MT/year available from non-forest lands is nearly three times as great as the MPFD total. Combining this with an estimate of over 36 million MT in coconut residues available annually yields over 60 million MT of biomass fuels available from non-forest lands every year – at least one order of magnitude greater than household woodfuel demand. As a result, Soussan concludes "the Philippines is a biomass-rich country" (p.7), although he warns of "pockets" of emerging stress and raises concerns about concentrated harvesting of mangrove forests for commercial users in some urban areas.

The other estimates presented in Table 6 vary depending on how they were developed. The DOE estimate of 33 million MT of wood equivalent is provided without much explanation, and figures reported in PRESSEA are generally derived from information provided by DOE. The estimate by Nera follows very closely the approach used in the DENR MPFD, while the figures presented in RWEDP (1997) were calculated using a similar approach as Soussan. Estimates for other biomass fuel production/supply potential also vary quite a bit, although they all generally point to substantial quantities of biomass residues available to household and commercial/industrial users. The most abundant of these is coconut residues, with a detailed accounting by Koopmans (1998) suggesting a figure of 36 million MT of coconut residues available yearly. The fact that such large quantities of biomass residues are available, but that actual consumption remains relatively low, tends to undermine any claim of widespread woodfuel shortages in the Philippines, although high rates of consumption in some areas might reflect more localized shortages.

It is clear from these discussions that there is a dearth of knowledge on the productivity and potential of woodfuel producing land use systems in the Philippines. One of the major sources of confusion over the issue of woodfuel use and deforestation in the Philippines is the lack of a clear definition of what is a “forest.” Officially, over 50 percent of the Philippine land area of 30 million hectares is classified as “forest land,” despite the fact that recent forest surveys put actual forest cover at between 20–25 percent. This is a result of lands with a slope over 18 degrees being classified by the government as forest land regardless of its actual land use.

Further confusing the issue is the lack of a consistent set of land use classifications in the Philippines. A World Bank-funded effort to map natural conditions in the Philippines using satellite imagery classified 24 percent of the country as having forest cover and 33 percent as an “intensive land use,” mainly arable crops and plantations. However, as much as 40 percent of the country was characterized as having an “extensive land use,” with most of this described as “cultivation mixed with brushland and grassland.”

Many of these extensive land uses include significant amounts of trees and shrubs, and local people in these areas often refer to them as “forest” or “woodland.” In the end, therefore, it is extremely difficult to speak with any certainty about the actual extent of forest cover in the Philippines and the role of forests in the provision of woodfuel supplies.

With that qualification in mind, it is interesting to examine the land use data used in the development of the woodfuel supply potential figures discussed in the last section. Table 7 presents land use data from two sources. The SSC column refers to the World Bank-funded mapping project undertaken by the Swedish Space Corporation (1988) using SPOT satellite imagery. The DENR-MPFD column refers to data presented in the Forest Master Plan which was developed through a combined analysis of the SSC results and those of the Philippine-German Forest Resource Inventory. Both efforts put forest cover at around 22–24 percent of total land area. However, since they use different categories it is difficult to determine how much actual agreement exists between them. Both studies also put extensive land use at between 35–40 percent of total area, although here again the use of slightly different categories makes comparison difficult. Only the SSC report breaks down intensive land use, but here too the studies are in fairly close agreement as to the extent of coverage of this land use.

How do these land use categorizations fit with what is known about woodfuel production practices? Both the 1989 and the 1995 HECS studies asked respondents about the source of their woodfuels. The 1989 study concluded that only around 15% of the woodfuel used in the Philippines came from “forest land” with the rest originating from agricultural areas. The 1995 HECS worded the questions in a slightly different manner; asking respondents to indicate whether wood came from their own land, other private land, government land, or others. Only 6.6 percent of the respondents indicated that they collected wood from government land, the category most closely associated with forest.

Table 7. Land use classifications in the Philippines

Land Use	SSC (1988)		DENR-MPFD (1990)	
	Area ('000 ha)	%	Area ('000 ha)	%
Forest				
Dipterocarp, closed	2,434.5	8.1		
Dipterocarp, open	4,194.0	14.0		
Pine	81.2	0.3	238.3	0.8
Mossy	245.5	0.8		
Mangrove	149.4	0.5	119.1	0.4
Old growth dipterocarp			984.1	3.3
Second-growth			3,455.8	11.5
Mossy/marginal			1,412.7	4.7
Plantations			482.7	1.6
Total Forest	*7,104.6*	*23.7*	*6,692.7*	*22.3*
Extensive Land Use				
Cultivated/open forest	30.4	0.1		
Grassland	1,812.9	6.1		
Cultivated w/brush & grass	10,114.3	33.8		
Brushland			2,459.1	8.2
Large-scale grassland			1,542.9	5.1
Other extensive			6,594.8	22.0
Total Extensive	*11,957.6*	*40.0*	*10,596.8*	*35.3*
Intensive Land Use				
Coconut plantations	1,132.6	3.8	11,787.7	39.3
Other plantations	90.8	0.3		
Arable crops (sugar, rice)	4,392.3	14.7		
Crops mixed w/coconut	3,747.8	12.5		
Crops/other plantations	365.2	1.2		
Fishponds	205.3	0.7		
Total Intensive	*9,934.0*	*33.2*	*11,787.7*	*39.3*

Source: Bensel and Remedio, 2002

However, the DENR MPFD estimates that 64 percent of woodfuel-using households in the Philippines collect wood from forest lands, although no explanation is provided as to how this figure was reached. Below are observations worth considering:

- DAP (1992) reports that a 1982 rural energy survey and the 1989 HECS indicate that between 73–83% of rural household, woodfuel users gather supplies from within one kilometre of their home, while over 95% gather supplies from within five kilometres. Since most of the rural population lives in agricultural areas (either extensive or intensive), this tends to support the assertion that most woodfuels originate from non-forest areas or forest edges.

- Cruz *et al.* (1991) provide a detailed discussion of how commercial charcoal making takes place in recently logged-over areas of Laguna Province. In this case, charcoal making is part of the process of transforming secondary forest to "*kaingin*" or farm plot. Charcoal is produced from smaller diameter trees, bushes and shrubs and income from its sale helps support the family until the farm is better established. Subsequent maintenance of the *kaingin* also yields charcoal for market sale, although usually in smaller quantities than the initial clearing. In this case, woodfuels are originating from forest lands, although they are primarily a by-product of agricultural expansion.
- The same study by Cruz *et al.* also points out that significant quantities of fuelwood and charcoal originate from fruit trees damaged by storms, from trees and shrubs grown on agricultural lands, and from "brushlands" that may be under either government or private ownership. In some cases this production involves a regular coppice rotation using species like *Gliricidia sepium* or *Leucaena leucocephala*. In other cases, charcoal is produced from the stumps and roots of coppiced *Gliricidia* and *Leucaena* that have been uprooted to make way for citrus plantations. Overall, the Cruz *et al.* study indicates that in recent times significant quantities of woodfuels were made available from forest areas as a by-product of their conversion to agriculture. Elsewhere, woodfuel production on a more sustained basis from fruit trees and from planted, fast-growing species like *Gliricidia* and *Leucaena* was also important. However, the latter production system was being threatened by conversion to citrus plantations.
- In a study of woodfuel production and use on Palawan (one of the most forested provinces in the country), Carandang (2001) found that 71% of rural fuelwood users obtained supplies from their "own farms" while 27% obtained them from "public forest."
- The 1990 FCS of commercial/industrial establishments (FMB/NSO, 1990) asked respondents about the source of their woodfuel supplies and the species they used. Ninety-nine percent of businesses purchasing woodfuels were able to obtain adequate supplies from within their province, while 52% were able to obtain supplies from within four kilometres. This would tend to suggest that even in areas where woodfuel shortages are thought to exist (e.g. Ilocos, Cebu), businesses are still able to obtain supplies locally. In terms of species, 66% of the businesses reported using *Gliricidia*, *Leucaena* and other species common in agricultural and brushland areas, while 49% reported using wood from fruit trees. In contrast, only 23% reported using species like *Shorea negroensis* (Red Lauan) and *Shorea polysperma* (Tanguile), species common to forest areas.
- In a 1982 consultant study of woodfuel issues in the Philippines, Wiersum conducted rapid appraisals of production practices in at least eight provinces. In Laguna, Ilocos, Cebu and Panay, Wiersum found large areas of private land covered by what he called "indigenous" fuelwood plantations, consisting mainly of *Leucaena glauca* (native ipil-ipil), *Leucaena leucocephala* (giant ipil-ipil) and *Gliricidia*. These plantations were often established in response to concentrated commercial demand for fuelwood and charcoal in nearby industries (e.g. tobacco curing in Ilocos)

or cities. Wiersum also suggests that primary forests contribute only a limited amount to overall woodfuel production, mostly in the form of logging residues. However, an analysis of commonly used species suggests that secondary forests – which tend to be closer to rural populations and which tend to contain trees of a size that can be easily harvested – play a more important part in meeting woodfuel demand. Overall, Wiersum concludes that most woodfuels originate from agricultural lands and brushlands.

- Wiersum's mention of private fuelwood plantations in a number of provinces may not have reflected a recent phenomenon. In a series of annual reports prepared by the Director of Forestry of the Philippine Islands from 1916-1938 (DANR, various years) regular mention is made of the practice of using *Leucaena glauca* to reforest and rehabilitate degraded grasslands. *Leucaena* was favoured for its ability to "kill out cogon grass within two years," for its ease of establishment through broadcasting of seeds, because it produced firewood and fodder, because it fixed nitrogen, and because it coppiced readily, allowing rapid regeneration after repeated harvests. The 1916 report mentions "several municipalities" using it to reforest cogon lands and private individuals which have "planted ipil-ipil on their cogon lands and are cutting on a one or two year rotation for firewood" (p. 33). The 1917 report describes a "regular rotation system being followed by farmers in Laguna, Panay and Cebu" (p. 18) and the start of widespread planting in La Union, Ilocos Norte, Ilocos Sur and Zambales. Interestingly, the 1921 report describes a timber and firewood "famine" in the Ilocos region and calls for immediate reforestation activity. Overall, the Director of Forestry reports help to illustrate a couple of important points. First, large areas of tree/shrub forests in places like Cebu, Panay and Ilocos did not come about by accident. Instead, they are the result of deliberate planting and continuous management by private landowners for as long as 80 years. Second, the reports suggest that in some places the woodfuel situation may have actually gone from worse to better, a prospect not usually discussed in the literature on woodfuels in the Philippines or elsewhere.
- Two extensive studies of the woodfuel situation on Cebu – the most deforested province in the country – suggests that the *Leucaena* reforestation efforts described in 1916 eventually spread to cover a significant portion of the central uplands of the island within 20–30 kilometres of Cebu City. The 1993 report of Bensel and Remedio indicated that the bulk of the commercial fuelwood and charcoal sold in Cebu City and surrounding urban areas originated from "tree and shrub fallows" (mostly *Leucaena* and *Gliricidia*) managed on a 2–5 year coppice rotation cycle. A 2002 follow up study examined more closely the origin of these tree/shrub systems and revealed that most were established deliberately by upland farmers and landowners on what had been largely a cogon grass dominated landscape. Older respondents indicated that that this kind of planting occurred over a large area of the central uplands (covering perhaps 10 000 hectares) from the 1920s through the 1960s, and that the primary impetus for planting was to

produce wood for urban woodfuel markets. Cebu's shrub forests or "coppice lands" are usually established on steeply sloping land less suitable to farming, although a sequential intercropping of tubers, corn or other crops around coppiced stumps is also common. Many of these coppice lands have been harvested on a continuous basis every 2–5 years for over 70 years. In addition to coppice lands, as much as 15–25% of Cebu's commercial woodfuels originate from fruit trees either knocked down by storms or uprooted as part of an agricultural cycle. Likewise, Cebu's extensive coconut area also provides abundant supplies of fronds, husks and shells for rural subsistence use and urban market sale.

- Two other important sources of woodfuels on Cebu are brushlands stocked with indigenous tree and shrub species and logging residues from thousands of private tree plantations (stocked with species like Gmelina and Mahogany) established throughout the island in the last twenty years. The brushlands represent more natural re-growth of trees and shrubs in the wake of *kaingin* abandonment, and are generally found further to the south and north of the island. Private tree plantations are mainly intended to produce wood for lumber mills, pulp mills and woodcraft industries, but the "lops and tops" from harvests and the off-cuts from sawmills were found in 2002 to be making up a much larger share of total woodfuel use than in 1993. Ironically, the 2002 study found some areas of coppice lands and brushlands that were being harvested and then permanently uprooted in order to make way for either tree plantations or mango orchards. Such a land use change will generally result in reduced woodfuel supplies even if tree plantations and fruit tree orchards will continue to generate some woodfuel production. Overall, both the 1993 and 2002 Cebu woodfuel studies revealed just how significant woodfuel production from non-forest lands can be. Despite being nearly totally deforested for at least the past 100 years, its status as one of the most densely settled islands in the country, and large-scale consumption of woodfuels by rural and urban households and businesses, Cebu has remained self-sufficient in woodfuels. Repeated predictions of woodfuel shortages on the island have never materialized, illustrating well the problem with overlooking non-forest lands as a source of woodfuels in the Philippines.
- A recent study of the woodfuel situation in Ilocos Norte likewise found that much of the subsistence and commercial woodfuel demand was being met from agricultural lands. Bareng and Acebedo (2000) report woodfuels coming from tree fallows of *Leucaena* and *Gliricidia*, woodlots harvested on a 3–4 year coppice rotation, private tree plantations, agroforestry systems, and isolated/scattered trees found throughout the agricultural landscape. Unlike Cebu, however, Ilocos Norte still has over 40 000 hectares of forest – mostly open canopy secondary growth – and these remain an important source of woodfuels, especially for commercial users demanding larger diameter pieces of fuelwood.

Table 8. Woodfuel Supply Estimates from Different Land Uses in the Philippines

Land Use	Annual Yield ('000 metric tons)	
	Soussan (1991)	**DENR (1990)***
Forest	405	167
Pine	492	
Mossy	39,508	1,956
Dipterocarp	1,490	175
Mangroves		832
Plantation		153
Marginal		
Total Forest	*41,895*	*3,283*
Non-Forest	20,228	
Mixed Extensive Farmland	4,392	5,650
Intensive farmland	36,607	
Coconuts (coconut residues)	1,368	
Other Plantations	907	37
Grassland		3,507
Brushland		3,489
Other Extensive		124
Urban, Others		832
Wastewood		
Total Non-Forest	*63,503*	*13,636*
Overall Total	**105,398**	**16,919**

* DENR figures originally presented in cubic meters, converted to metric tons assuming 1 cubic meter of wood = 730 kilograms.

- A community agroforestry project in Cavite Province asked key informants to identify desirable characteristics of tree and shrub species to be propagated in the project nursery for distribution to participating farmers (Pastores and Buenaventura, 2002). The respondents wanted trees and shrubs that could be planted as pioneer species on infertile open grassland that were hardy, had good coppicing ability, multiple uses and were readily available. When asked to rank ten different species on these criteria they rated *Gliricidia sepium* first and *Leucaena* second. The popularity and widespread distribution of these species throughout the country is an indication of their suitability as a "woodfuel crop" and explains the common practice in many areas of setting aside at least some land for their propagation. In Cebu and Negros Oriental *Leucaena* is often intercropped with coconut (Cadelina, 1988; Bensel and Remedio, 1993), enhancing the biomass fuel productivity of these lands. In many regions *Gliricidia* is cultivated as a living fence (Wiersum, 1982), while both *Gliricidia* and *Leucaena* are often intercropped with root crops, corn and vegetables in between coppicings (Bareng and Acebedo, 2000; Bensel and Remedio, 1993).
- In areas with a significant logging and wood processing industry, logging and sawmill residues constitute a significant share of local woodfuel production. For example, in the area around Cagayan de Oro City in Misamis Oriental, Mindanao, logging wastes in the year 1988 were estimated at 590 000 MT. Sawmill wastes from the area's 28 sawmills were estimated at 430 000 MT (Soussan, 1991). Local woodfuel consumption in this

region is significantly less than this, and most of this consumption takes the form of logging and sawmill residues. Likewise, and FAO-RWEDP report (Field Document #50, 1997) estimated that on an annual basis waste wood from deforestation in the Philippines could yield over 45 million MT of woodfuel. However, since most deforestation occurs a significant distance away from population centres, only a tiny fraction of this wood is actually used as fuel. These findings tend to undermine any claim that woodfuel use is a leading cause of deforestation in the Philippines, and they make clear the more significant role that trees outside forests – in the agricultural landscape – play in meeting woodfuel requirements.

Two of the most widely cited supply estimates in the Philippines is presented in Table 8. Essentially, both sets of estimates originated from the land use statistics presented in Table 7. Soussan relied on the data presented in the SSC columns while the DENR estimates were derived from the data in the DENR-MPFD columns.

Here we seek to revise these woodfuel potential estimates based on a more careful consideration of evidence about the productivity of woodfuel producing land uses. In particular, attention needs to be focused on potential supplies from non-forest lands since these accounts for the bulk of the country's woodfuel production.

While there is relatively limited information on the woody biomass potential of agricultural and other non-forest lands in the tropics, what does exist suggests that the productivity factors used by both Soussan and the DENR are probably too low to reflect actual conditions in the Philippines based on the following considerations:

- In a recent article in *Wood Energy News*, Keith Openshaw suggests that woodlands in tropical regions receiving an annual rainfall of 2 000 mm (as is the case in much of the Philippines) produce approximately 14 dry tons of biomass per hectare annually, with anywhere from 40–70% of this biomass in the form of wood (6–10 tons of wood/hectare). Openshaw compares this with figures often used in forest service studies in the region of from 0.1 to 2 t/ha/yr.
- A comprehensive 1980 report on firewood crops produced by the U.S. National Academy of Sciences presented annual yield data for dozens of trees and shrubs. Of those trees and shrubs commonly found in the Philippines the following yield data were reported. *Casuarina equisetifola*, 10–20 t/ha/yr; *Leucaena leucocephala*, 22–30 t/ha/yr; *Sesbania grandiflora*, 15–20 t/ha/yr.
- In a study on woodfuel productivity of agroforestry systems in Asia, Michael Jensen reviewed dozens of studies in order to develop reasonable estimates of productivity from different tree/crop/livestock combinations. For "agri-silviculture" systems, most common in the Philippines, Jensen estimates an average wood productivity of 14.1 ± 9.9 t/ha/yr, with some systems producing as low as 3.5 t/ha/yr or as high as 42.3 t/ha/yr. It should be noted here that these wood productivity figures are for agroforestry systems that simultaneously produce food crops, fruit, fodder and other products. Large areas of extensive land use in the Philippines fit under this category.
- In his 1982 study, Wiersum estimated the average productivity of *Gliricidia* and *Leucaena* woodlots in Ilocos and Cebu at 17–29 t/ha/yr and 20t/ha/yr, respectively. In terms of home gardens and agricultural fields with scattered trees, Wiersum estimated potential yields of 5–7 t/ha/yr and 2–6 t/ha/yr, respectively. The *Gliricidia* and *Leucaena* woodlots are more reflective of what is often labelled an extensive land use in the Philippines, while home gardens and agricultural fields would fall under the intensive classification.

Table 9. Revised woodfuel potential estimates for the Philippines

Land Use	Estimated Area ('000 ha)	Productivity (t/ha/yr)	Accessibility	Total Annual Yield ('000 MT)
Brushland	4,000	8	100%	32,000
Other Extensive	4,000	5	100%	20,000
Grassland	2,000	1	100%	2,000
Tree Plantations	1,000	2	80%	1,600
Secondary Forest	4,500	6	50%	13,500
Agriculture	4,000	2	100%	8,000
Coconut, Crop/Coconut*	4,000	2	100%	8,000
Total	**23,500**			**85,100**

* Woody biomass from intercropped trees and shrubs

The above discussion makes clear that the woodfuel productivity figures used by Soussan and the DENR are probably too low for conditions in the Philippines. Soussan acknowledges this by stating "all of the estimates made where no firm measurements are available are conservative" (p. 16). Woodfuel productivity figures used by the DENR are probably on the order of ten times too low given what is known about these land use systems. Table 9 presents a revised set of estimates for woodfuel productivity/supply potential in the Philippines. Land use data from SSC (1988), DENR (1990) and more recent results from a forest survey conducted by the Japan Forestry Technical Association (JAFTA) to develop approximate estimates of the area of different woodfuel producing land use systems, were considered. An overall current land use practice in the Philippines is capable of producing over 85 million metric tons of wood for fuel annually. This figure excludes wood from primary forests since much of this is inaccessible, and it also does not include the significant quantities of coconut and other crop residues also available for use as fuel. Despite that, the figure of 85 million MT is greater than any estimate of woodfuel demand in the country, suggesting a favourable supply-demand picture.

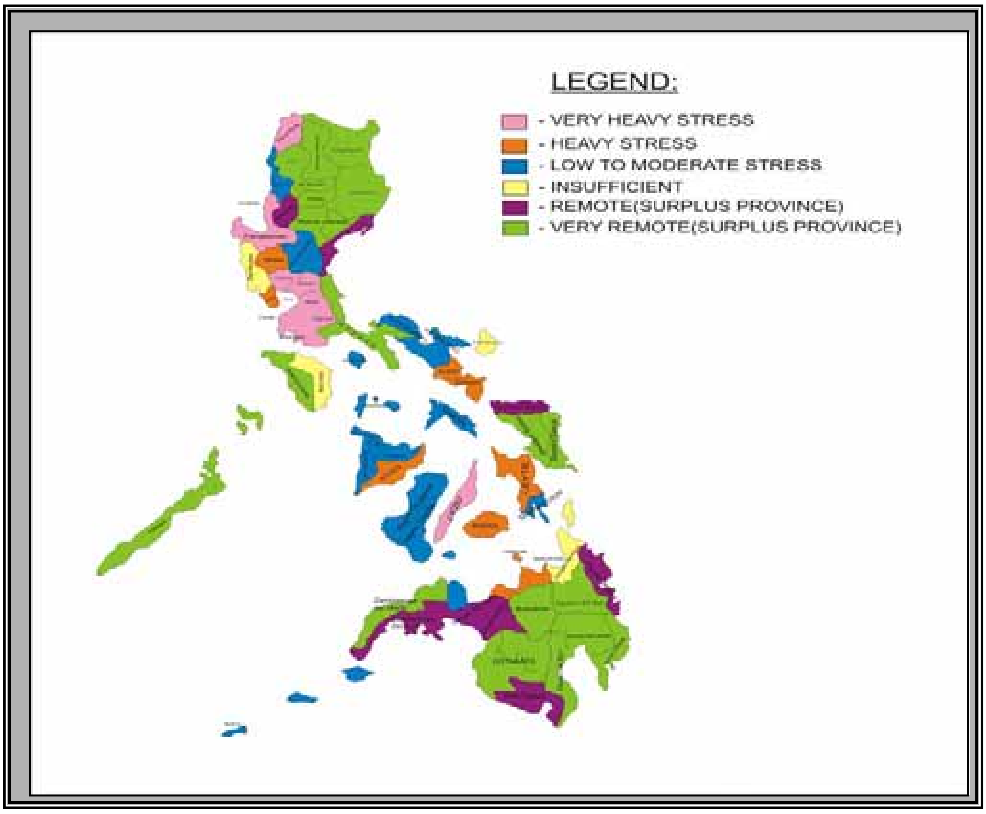
Clearly any effort to develop woodfuel supply estimates over such a large area involves a series of simplifying assumptions and educated guesswork, and the above exercise is no exception. However, what these estimates accomplish for perhaps the first time is to better account for the enormous woodfuel potential of those "in-between" lands that probably make up close to 30 percent of the Philippine land area. Classified as extensive, marginal, brushland, wasteland, or simply "other," these lands have tended to escape the interest of both the forestry community because they could not be considered forest and the agricultural community because they are usually too steep and unsuitable for commercial agricultural purposes. However, these "wastelands" play an essential part in meeting the energy and other subsistence needs of many rural communities. They have come about in different ways ranging from intentional establishment to suppress cogon to natural re-growth in the wake of agricultural abandonment – and they are subject to different management and access rules, but they are a ubiquitous feature of the Philippine countryside. The failure to appreciate their importance in meeting local woodfuel requirements has resulted in repeated predictions of woodfuel deficits at the local (e.g. Cebu, Ilocos) and national level. A more realistic consideration of their woodfuel potential, while even adopting conservative productivity factors of 5–8 t/ha/yr, demonstrates that with perhaps a few local exceptions woodfuel supplies are more than adequate to meet demand throughout the Philippines.

Provincial woodfuel supply-demand scenarios

The aggregate woodfuel demand and supply status may prove to be of less relevance if one considers the fact that if one area has a deficit it can be covered up by another area that has surplus for various obvious reasons. The Philippines, being an archipelago of more than 7 000 islands will entail an enormous road and transportation system not to mention the overall woodfuel flow that may be peculiar on a case to case basis. Hence, it may be meaningless to say that since the surplus areas exceed the deficit areas, the country is in surplus.

Apparently, many areas of the country have a supply surplus while a good number may be experiencing supply deficits. Areas have apparently emerged where local pressures exist due to concentrated local demand. This is more evident in areas with high population density and marginal local woodfuel resources such as the case of Northern Luzon where tobacco-curing industries abound; in mangrove areas and in those areas immediately adjacent to agricultural lands. This therefore suggests that in order to have a more meaningful understanding of the characteristics of woodfuel production systems, a classification of woodfuel demand units will have to be developed for the entire country. Figure 2 shows how this can be done by classifying provinces into various categories such as very heavy stress, heavy stress, low to moderate stress, remote (surplus provinces) and very remote (still surplus provinces). Note that in Figure 3, however, where a glaring comparison of how rapidly the forests is dwindling in a matter of just 10 years.

Figure 2. Philippine map with provincial categorization based on stress level of wood and biomass supply (DAP, 1992)

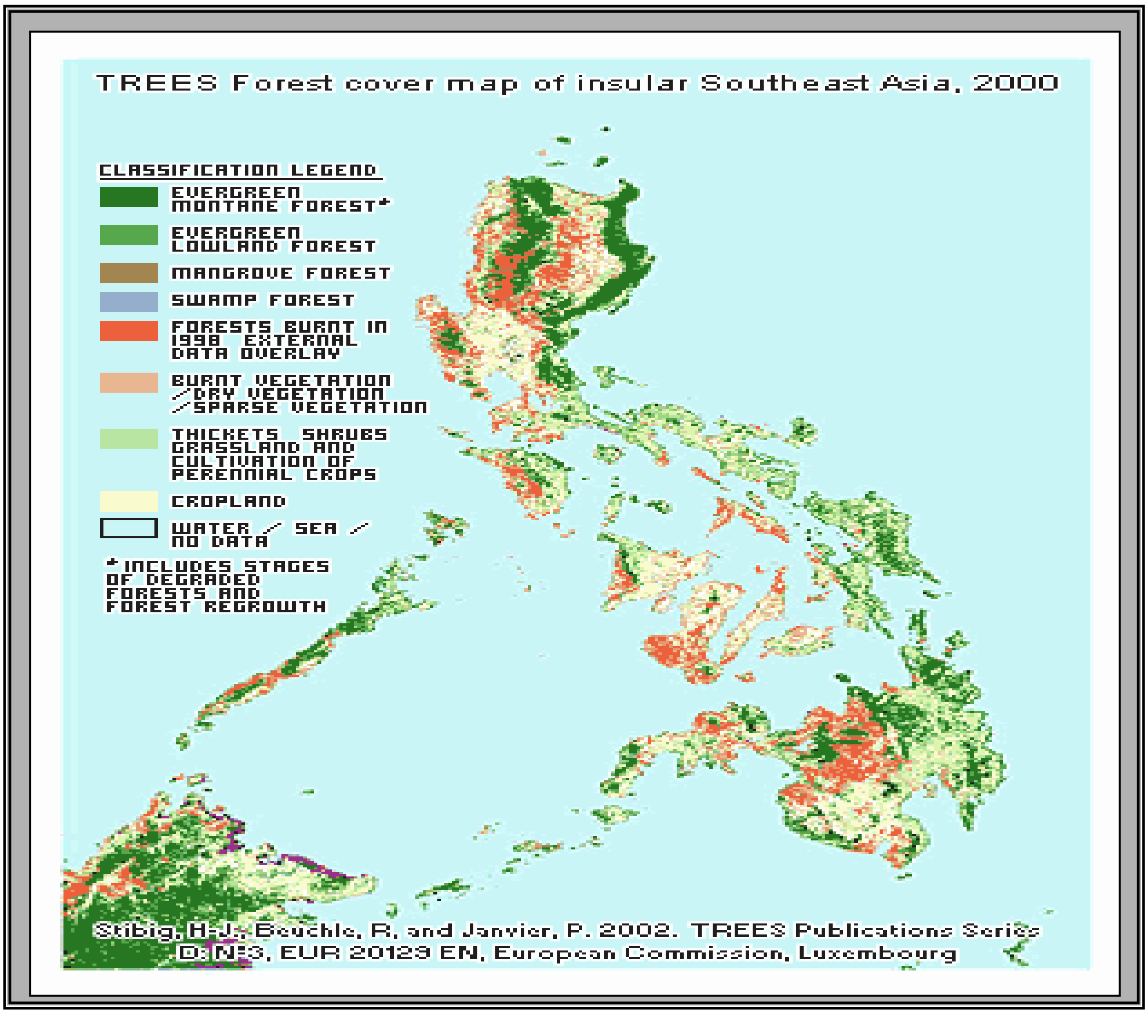


Woodfuel "commoditization" and trading: chain of custody practices

Woodfuels are not only used in the household sector but also by small enterprises such as bakeries, restaurants and food processing industries. As a result of the high demand for fuelwood by the local industries and the incentive for additional income, woodfuel has become an important commercial commodity both as fuelwood and as charcoal. Nera (1998) cited a case in Ilocos region where tobacco and salt making industries use a lot of woodfuel. Local woodfuel shortages brought about by these local industries created a demand for woodfuel not only in the local market but also in the inter-regional market as well.

The study of Arriola (1998) revealed that the market chains of traded woodfuels are not simple, i.e. many rural traders also gather fuel or make charcoal, some gatherers sell fuel directly to urban traders and that there can be several stages in the market chain in the city. The results of her study for the four cities are briefly summed up in the following sections.

Figure 3. SPOT map 2002



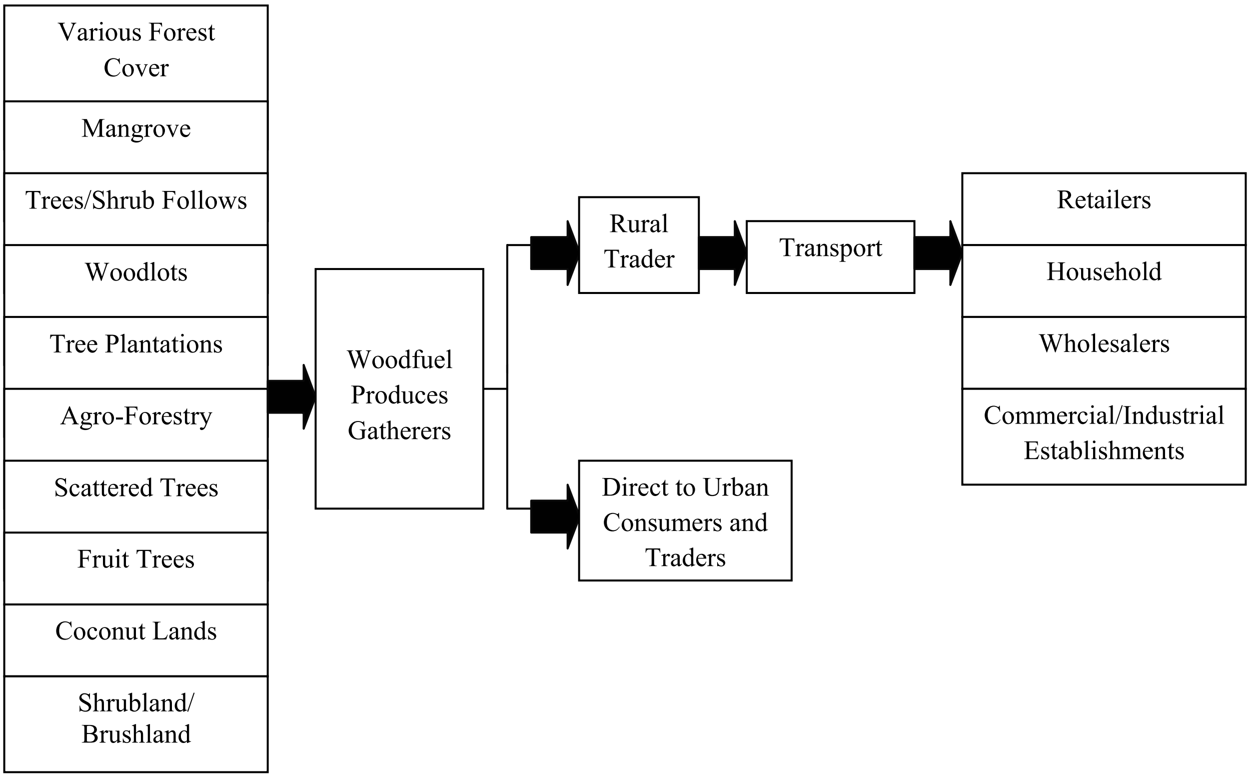
Source: CIFOR, 2003

Cagayan de Oro produced charcoal from coconut shell but an estimate of 70 percent is not used as fuel but purchased by companies for industrial use as activated carbon. The majority of their fuelwood went to household, urban traders, and commercial establishment. The commercial sector in Cebu City accounted 49 and 37 percent of the charcoal and fuelwood consumption, respectively. The barbecue and lechon vendors, restaurants and bakeries are the major users of charcoal aside from household. But charcoal sold to household is reportedly used for ironing and is not for cooking. The fuelwood gatherers in Cebu mostly sell to rural traders who in turn sell it to urban traders, wood-using industries and households. However, the researcher noted important differences of the fuelwood and charcoal markets in Metro Manila from the other urban areas, namely: 1) wood and charcoal are not important fuels in the National Capital Region, 2) transporting fuels require longer distance than those of other regions covered in the study and 3) commercial alternatives are more readily available and cheaper in Metro Manila. Industries and commercial establishment are the major end users of fuel wood (43%). Other fuelwood supply goes to local fuelwood agents or middlemen, wholesalers/retailers and household. The channels of distribution for charcoal supply included retailers, traders, household, transporters and non-fuel uses. In contrast to Metro Manila, household accounted for the biggest share of fuelwood utilization in Tacloban City. The rural traders operated on small-scale basis and considered it as an activity next to farming and shop keeping. Like in Cebu City, charcoal is not an important household fuel for it is only used for ironing or specialized cooking. But the region exports coco charcoal as activated carbon. Fuelwood gatherers sell charcoal to transporters, household and rural traders in the locality. Some also sell directly to the urban traders, bakeries and oil mills in Tacloban City.

There are two types of charcoal produced and marketed in Tacloban, namely coco-shell charcoal and wood charcoal. Coco-shell charcoal makers sell their product to rural traders who at the same time maybe producing their own coco-shell charcoal. From the rural traders, these are distributed to urban traders/retailers and wholesalers in the city or sold directly to household and bakeries while wholesalers sell to activated carbon companies outside Leyte. A simpler distribution channel is followed by wood charcoal product.

Prices of woodfuel products are fluctuating and that there is no evaluation and information campaign on the best species for fuelwood. There is also the absence of standardized unit of measurement and price. Among other things, the participants suggested that provincial/municipal issue ordinances for price standardization. Gatherers may also be formed into cooperatives. Figure 4 depicts the channels of transportation and distribution of commercialized woodfuels. It represents the typical woodfuel flow system and chain of custody. There may be various combinations and modes of layers of distribution from producer to rural and urban wholesalers and retailers before it finally reaches the final consumer. Nonetheless, the flow pattern in general is one represented by Figure 4.

Figure 4. Woodfuel production flow (various sources)



The Cebu Province case study

Environmental impacts of woodfuel production on Cebu

In Cebu, it is believed that over-cutting of trees for local woodfuel needs is the major cause of deforestation and environmental degradation of the island (Seidenschwarz, 1988; DENR, 1991; Osmena, 2001). In fact, the total absence of primary forest in the island was touted to lead to an acute woodfuel shortage. A DENR 1992 report stated:

"*The province of Cebu is now in the stage where firewood is becoming scarce. The situation is so severe that the remaining forest resources are exploited at least three times their sustainable yield. Unfortunately, there are not many fuelwood plantations in Cebu, and if measures are not instituted now e.g. improving conventional fuel distribution networks or massive establishment of firewood plantations, a widespread energy crisis could likely result (p.71).*

Until now, many academicians, government officials, NGOs, continue to perceive that woodfuel production is the major cause in the island province. The island has been labelled a "desert island" an "ecological disaster" (Collins, 1990), an island that is 99 percent denuded (Vesilind, 2002). Yet, over a million rural and urban households continue to get enough supply of charcoal and fuelwood year after year, decade after decade. What could be the reason and what could be the explanation for this inconsistency? Why is there a difference between the perception of many observers from what is actually happening?

Some of the explanation offered by the Cebu studies conducted by Bensel and Remedio (1993, 2003) are: first, much of the supplies come from trees outside forests or TOF. The practice of "coppice" or woodfuels coming from hectares of coppice land has been overlooked or simply misunderstood from the notion of woodfuels produced from “forests.” In Cebu, where the island is only 0.3 percent “forest,” much of the woodfuels are coming from trees and shrubs from woodfuel coppiced lands, woodlots, agroforestry systems and reforestation projects. Pristine primary forest does not exist in Cebu; only secondary growth of shrubs and scattered trees.

Second, there is a failure to understand and appreciate the fact that widespread tree-planting and management practices can actually also happen in private lands and not necessarily from government or NGO operations/interventions. In Cebu, many private upland and hilly-land cultivators and landowners do implement good management of tree-planting and harvest systems notwithstanding government and or NGO interventions.

Last, there seems to be a failure to understand that much of the woodfuel production is done through “coppice” system whereby the trees are cut at the base and allowed to regenerate. Much of the trees used for woodfuel production, firewood and charcoal supplies do come from trees coppiced and regenerate after harvesting.

All told, the commercial demand for fuelwood and charcoal in Cebu’s municipalities and cities is an important incentive for producers to continue planting and practice sustainable woodfuel production system. Cases of indiscriminate cutting may happen from time to time; nevertheless, it is a fact that woodfuel is a thriving livelihood generating employment and incomes to hundreds of households in Cebu for the past decades.

Woodfuel permits

A cutting permit is not required. According to DENR regulations, anyone holding a land title or anyone who can produce a tax declaration for Alienable and Disposable land (land not classified as government forest) can apply for a permit to transport woodfuel products for *planted* trees and shrubs from their land. The fuelwood, charcoal, or other wood products in principle, cannot be transported outside their “lands” without a transport permit.

The process of acquiring a permit first involves the filing of an application, followed by a DENR site visit to calculate the volume of wood products on the land and confirms the status of being “planted.” After the site visit, the applicant pays a fee of around Philippine pesos 100 (approximately US$ 2.00) and indicates the time period when the transporting of the wood products will take place. The “permit” is then issued. This permit is usually valid for only a day so that “recycling” the same permit is avoided.

By implementing this regulation to get a transport permit, illegal cutting of trees from government reforestation sites or from protected areas are addressed. However, in reality the implementation of the said regulation does not always work because of shortage of DENR personnel to police woodfuel matters e.g. the transport permit system. DENR personnel do understand and appreciate the importance and the value of woodfuel production in the province but are just constraint in many ways (i.e. limited staff).

Improving the efficiency of charcoal conversion

Over the years, the demand for charcoal has been increasing and will remain so in the foreseeable future. The question of improving the efficiency of charcoal conversion processes needs to be high on the agenda. Figures 5 and 6 show the *ham-ak* and *tinabonan* highly inefficient methods of producing charcoal compared to the adobe and brick kilns systems. If charcoal efficiency is improved, there can be reduced frequency of cutting trees from coppice lands, increased productivity of charcoal, increased incomes of charcoal makers, and reduced health impacts and air pollution associated with charcoal production.

INSTITUTIONAL, LEGAL AND POLICY FRAMEWORK

Roughly half of the world's population is cooking daily with the traditional biomass including wood and charcoal. Hence, efforts to disseminate improved and more efficient cookstoves are an ideal way to address a wide range of socioeconomic and environmental impacts (Texon, 1998). Energy must be conserved, time spent in collecting woods must be reduced and economic opportunities for both rural and urban families must be increased. Literature also identified that existing policies emphasize multiple-use forest management and that there is no clear-cut guidelines on fuelwood production. Project development programs must therefore address, among others, the woodfuel requirement of the wood-based industries and households.

On the whole, in the Philippines, there is a lack of appreciation of the role of wood energy plays in the economy and the environment and this has reduced the emphasis on energy development in planning and policy formulation (Argete, 1998; Bensel and Remedio, 2002). Argete (1998) also added that the gathering, production and used of fuelwood is unregulated.

The DENR has adopted several policies related to fuelwood utilization and management, such as: (1) Timber Licensee Agreement holders have the privilege of harvesting timber, fuelwood, rattan and bamboo through a permit or lease wherein they are given a maximum of 1 million cubic meters of natural forest species within a year, (2) DENR projects in the upland areas adopt a community-based approach enabling the upland communities to manage the forest resources with minimal government intervention and (3) areas with slopes above 50% with 1 000 meters elevations are considered old growth forests and critical watershed areas and are therefore regarded as prohibited zones. Planting of wood in these areas for fuelwood purposes has to be regulated.

The following institutions are associated with energy:

Department of Energy (DOE) is mandated to ensure a continuous, adequate, and economic supply of energy with the end view of ultimately achieving self-reliance in the country's energy requirements through the integrated and intensive exploration, production, management and development of the country's indigenous energy resources and through judicious conservation, renewal and efficient utilization of energy to keep pace with the country's growth and economic development and taking into consideration the active participation of the private sector in the various areas of energy resource development. DOE is also tasked to rationalize, integrate and coordinate with the various programs of the government towards self-sufficiency and enhanced productivity in power and energy without sacrificing ecological concerns.

National Electrification Administration (NEA) is a government-owned and controlled corporation primarily tasked to undertake rural electrification programs on an area coverage basis. The NEA is given the responsibility to establish rural electric cooperatives for the generation, transmission and distribution of electric power and also to determine privately-owned public utilities which should be permitted to remain in operation in order to attain total electrification of areas not covered by NPC grids.

Figure 5. Charcoal maker using *ham-ak* (aboveground) method. Barangay Sinsin, Cebu City (Bensel Terrence, 2003).

Figure 6. Charcoal maker using the *tinabonan* method (Underground approach) Barangay Pamutan, Cebu City (Bensel Terrence, 2003).

Energy Regulatory Board will promote and protect long-term consumer interests in terms of quality, reliability and reasonable pricing of a sustainable supply of electricity. Hence, its functions are associated with promulgation, enforcement, promotion and resolution of matters pertaining to regulations, guidelines, policies, disputes, consumer interests, among others.

National Power Corporation is the authorized implementing agency responsible in setting up transmission line grids and the construction of associated generating facilities in Luzon, Visayas and Mindanao and major islands in the country. The ultimate goal of NPC is to achieve the total electrification before the 21st century. For such ambitious plan, NPC envisions the interconnection of all-independent grids in Luzon, Visayas and Mindanao through the advanced system of overhead lines and submarine cables.

National Transmission Corporation is a government-owned and controlled corporation that has assumed the electrical transmission functions of the National Power Corporation in the major Philippine grids. It was created by the virtue of Republic Act 9136 or the Electric Power Industry Reform Act of 2001.

Department of Environment and Natural Resources (DENR) is the lead agency mandated to conserve, manage, develop and use properly the country's natural resources and environment particularly the forest, grazing and mineral resources, including watershed reservation and national parks. As such DENR has jurisdiction overall forest lands, grazing lands, mineral reservations, national parks, forest reserves and watershed reservations.

Department of Agriculture (DA) is mandated to support development through the provision of policy framework, public investment and support services needed for domestic and export-oriented agricultural enterprises. In line with this mandate is the improvement of farm income and creation of employment opportunities for farmers, fishermen and other rural workers.

Department of Agrarian Reform (DAR) is the lead agency mandated to implement the Comprehensive Agrarian Reform Program on all private agricultural lands, regardless of tenure or commodity produced and also to include selected areas of the public domain.

Department of Science and Technology (DOST) is mandated to formulate and implement policies, plans and programs, and projects for the development of science and technology and for the promotion of scientific and technological activities for both the public and private sectors and ensure that the results of these activities are properly applied and utilized to accelerate economic and social development.

The Need for a Comprehensive Woodfuel Policy Program. Back in 1992 (DAP), the following described the status of fuelwood and/or woodfuel program in the country. To date, 2007, little has changed:

- Woodfuels play a prominent role in both rural and urban areas of the economy.
- Woodfuels are important in rural industries such as bakeries, restaurants, and flue curing for tobacco.
- Despite the existence of various agencies dealing with wood energy, there is as yet, no comprehensive policy on fuelwood and or woodfuels.

- The Department of Energy is tasked with the formulation, planning, monitoring, implementation and coordination of policies and programs in the field of energy. While it has projects designed to promote the use of non-conventional energy, the department itself has no definite program on woodfuel. This may be understandable because land jurisdiction of woodfuel is vested not with the Department of Energy but with other agencies such as the Department of Environment and Natural Resources and the Department of Agriculture. As such, DOE lumps woodfuel in the more general term agri-waste as a source of non-conventional energy.
- DENR, under Executive Order No. 192 is tasked with the conservation, management, development and proper use of the country's environment and natural resources.
- With the alarming environmental state of the country, along side rural poverty in the uplands, DENR has tasked itself with massive reforestation of denuded areas under the National Forestation Program and has continued to make Integrated Social Forestry Program a priority program designed to contain the further destruction of the forests by the upland dwellers and at the same time provide them with opportunities to improve their lot.
- These two big programs offer opportunities for woodfuel development. Under the National Forestation Program, some 436 000 hectares or 31 percent of the 1.4 million hectares target goal has been earmarked for fuelwood. Under the ISF Program, DENR Administrative Order No. 28 series of 1989 mandates participants to develop at least 20 percent of their land to tree farming. In 2003, CIFOR reported the following:

This program was given a boost by the ADB/OECF loan for $240 M in 1988 for what became the Forestry Sector Project. Under this project, traditional methods of reforestation gave way to contract reforestation by families, communities, corporations, academic institutions, NGOs and LGUs. It also included watershed rehabilitation and encouragement of industrial reforestation through new agreements.

The 1990s continued to see numerous community-based and integrated development projects funded by ADB, JBIC, World Bank, ITTO, FAO, KFW and others; and executed by the state, NGOs, LGUs, and people's organizations. Community-based forest management through different types of tenurial instruments was adopted as the national strategy for reversing the destruction of Philippine's remaining natural forests and for rehabilitating degraded lands. Besides social and community forestry, reforestation activities have also included large-scale government and industrial plantations and private tree farming. The latter has cropped up spontaneously in response to market demand, particularly in Mindanao, Luzon, and Cebu. It has been suggested that private land reforestation in the last decades may have actually led to increased forest cover in places. New forest cover inventories that are underway could help clarify the situation. There have been a wide range of players involved in forest rehabilitation in the Philippines in the last few decades including the national government, NGOs, private companies, LGUs, local communities and private land owners. Approaches have been equally diverse with expansion from traditional large-scale government reforestation projects and industrial tree plantations to contract reforestation, community-based initiatives, integrated development and livelihood projects, agroforestry, and private tree farming. Results have been mixed with some promising cases and others not quite so in each of the approaches, depending on the circumstances. Also in general, some approaches such as private tree farming have been more popular and rapidly adopted than others. Ensuring long-term sustainability appears to be one of the biggest challenges facing many of the initiatives. Most evaluation is based on target areas and survival rates of plantings, and often little is known about the environmental and socio-economic impacts (CIFOR, 2003).

- While the above programs and other tree planting activities of DENR including thinning of natural and plantation forests contribute to wood energy, there is no single, purposive project on fuelwood on a national scale.
- In terms of organization, there is as yet no entity directly managing or supervising or coordinating fuelwood related projects. At the time when FAO-RWEDP was active, a National Coordinating Committee and a Technical Experts Group was formed under the DENR. Now, these are defunct.
- Given the scenario that fuelwood will continue to be the energy for the future, it is but appropriate that the government needs to formulate a national policy on fuelwood and develop programs purposely for fuelwood. It is necessary that the various organizations should be in place to lead and coordinate the various activities of the fuelwood program.

CURENT EFFORTS TOWARDS WOODFUEL PRODUCTION, MANAGEMENT, DEVELOPMENT AND SUSTAINABILITY

After a lengthy discussion of the woodfuel situation in the country, it is clear that there are two major institutions that need to take the lead in woodfuel production systems. One is the Department of Energy (DOE) and the other is the Department of Environment and Natural Resources (DENR). They both differ however in what particular chain of custody they need to be responsible for vis-à-vis woodfuel production and management systems. In the case of the Department of Energy, residential sector use and even industry use for woodfuels has taken a very minimal priority. This is because the focus is in the other types of renewable resources that need to be developed and has a greater potential. Biomass resources; however, has taken a more serious consideration relative to woodfuels (for instance the Biofuel Law recently approved). Below is a comprehensive discussion of the current treatment of woodfuels relative to the other types of renewable energy.

Current efforts of the Department of Energy in relation to woodfuel production

A Philippine Country Paper on the Utilization of Renewable Energy was presented recently (Kathmandu, Nepal, December 2006) by Dante Castillo and Enrique Navarrete (both from the Department of Energy, Philippines). In that paper, a comprehensive discussion about the direction of renewable energy vis-à-vis woodfuels (and biomass) production systems can be gleaned from. They start out with a clear energy sector agenda that is towards an aggressive development of renewable energy potential such as biomass, solar, wind and ocean resources.

According to the report, imported oil remained as the major source of energy, although its share in the total energy supply declined 45.5 percent in 2000 to 34.8

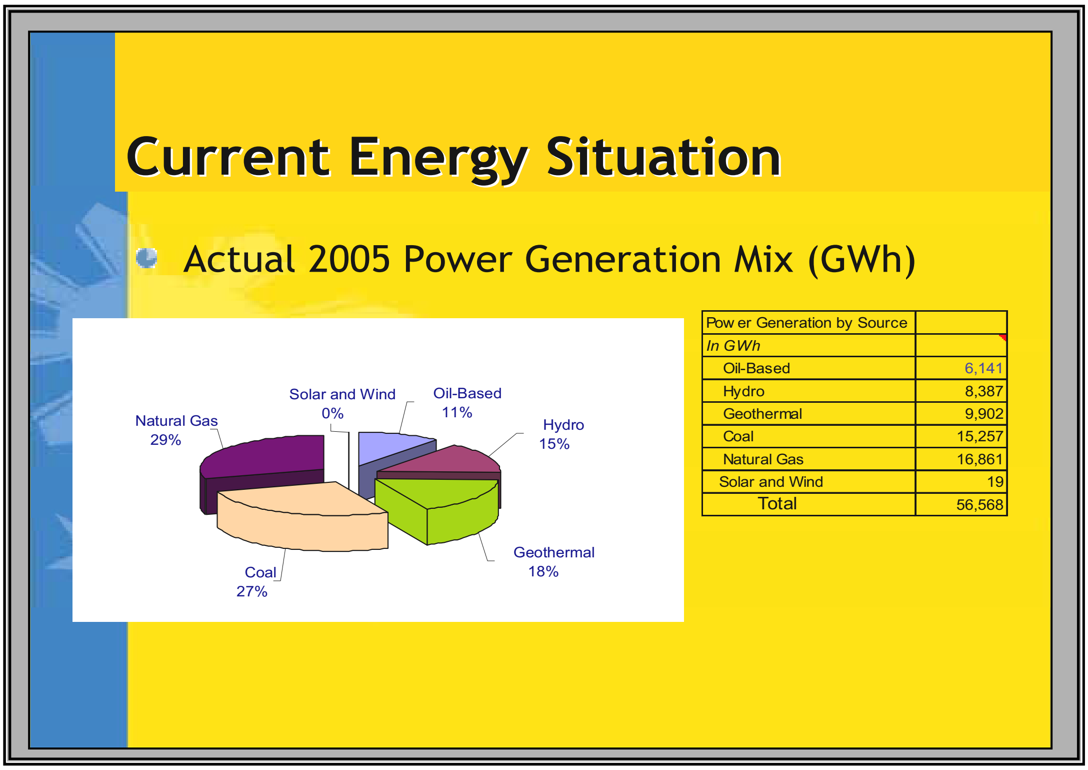
percent in 2005. Renewable energy, in particular biomass contributed about 17 percent to the total primary energy. The natural gas contributed to as high of 6.5 percent in 2005 and this was attributed to the improved production of Malampaya field. The energy self-sufficiency level stood at 56 percent.

Further, it notes that there are at least nine (9) types of energy sources or available power plants serving the country needs of power and these are the following: coal, oil thermal, diesel, gas turbine, geothermal, hydropower, natural gas and renewable energy (wind and solar). Figure 7 shows the actual 2005 power generation mix. Understandably, there is no mention of woodfuels, except that of biomass resources for biofuel.

In the Residential Sector, the total energy consumption of the residential sector in 2004 grew by 6.0 percent to 52.1 MMBFOE (7.5 MTOE). Biomass accounted for 67.0 percent of the total residential energy consumption. Demand for petroleum products, specifically liquefied petroleum gas (LPG) and kerosene used primarily for cooking declined by 5.9 percent due to fuel switching as an effect of soaring prices of these fuels. Household electricity consumption increased by 3.7 percent.

In terms of Final Energy Demand, energy consumption is primarily influenced by economic growth, population, fuel prices, incomes and supply accessibility. These indicators were used in forecasting the country's final energy demand for the 2006 Plan Update. The demand forecast was done on a sectoral basis to include the transport, residential, industrial, commercial and agricultural sectors. Final energy demand in this 2006 Plan Update shows a lower forecast in almost all sectors in contrast to the Reference Plan taking into account moderate growths in 2004 and preliminary 2005 energy consumption data. In addition, the conduct of the HECS in 2004 firmed up data on biomass consumption in the residential sector. Initial results of the survey indicate that biomass consumption by the household sector is significantly lower than the previous estimates.

Figure 7. Current energy situation 2006



In this 2006 Plan Update, the country's energy demand for the planning period is estimated to grow by 3.3 percent. The projected growth in energy demand will be sluggish compared to the projected 5.0 percent growth in the Reference Plan. Demand by the transport sector takes into account the fuel consumption of the different types of vehicles used for land, air, and water. The energy consumption of the transport sector will post an average growth of 3.5 percent. Petroleum products will remain as the dominant fuel for transport use. Meanwhile, demand for biofuels (CME and ethanol) is seen to increase by 4.4 percent annually across the planning period.

The residential sector will be the second largest user of energy among the different end use sectors, accounting for an average share of 28.9 percent to the country's total energy demand. Total residential energy demand is estimated to grow at an average annual rate of 1.4 percent. Biomass will remain as principal fuel in the residential energy requirements. However, in terms of quantity, household biomass consumption will slide down by 0.6 percent on the average due to fuel switching in cooking and lighting based on the 2004 HECS. The use of fuelwood and charcoal as major biomass fuel for cooking will decline as households shift to more efficient and convenient fuels such as LPG and electricity.

The Department is mandated by RA 7638 (Department of Energy Act of 1992) to prepare, integrate, coordinate, supervise and control all plans, programs, projects and activities of the Government relative to energy exploration, development, utilization, distribution and conservation. Hence, the government's policy towards renewable energy is a favourable one. Moving forward to the shift from fossil fuels to renewable energy, the Department of Energy has embarked on the law that will create an investment climate and will explore the use of the countries unexplored renewable energy thereby giving a chance for the private investors to participate. This gave birth to the Renewable Energy Policy Framework which is now on its final reading and approval in the Senate.

Interestingly, the report highlights biomass as the main type of renewable energy resource in the country. According to the report, the Philippines has an abundant supply of biomass resources, such as agricultural crop residues, forest residues, animal wastes, agro-industrial waste, municipal wastes (about 60% of which is biomass) and aquatic biomass among others. Fuelwood for households and fuelwood for industrial uses are mentioned (Table 11). Technologies to convert biomass into energy were already available since early seventies as a result of private initiative and government support. Through the years, biomass has contributed significantly to the national energy mix.

Biomass, solar and wind will be among the major sources of energy for the next decade, accounting for more than a third of the country's total energy demand. From 81.5 MMBFOE (Millions of Barrels in Fuel Oil Equivalent) in 2003, the absolute level of these sources will increase by 2.8 percent annually reaching 104.1 MMBFOE in 2012. Biomass will continue to take the lion's share of the total at 99 percent. Meanwhile, the contribution of solar, wind and ocean will reach 0.6 MMBFOE in 2003 rising to 1.7 MMBFOE in 2007 and 3.0 MMBFOE in 2012.

Table 10. Renewable energy goals, policies and strategies

Energy Sector Objectives	RE Goals	RE Policies and Strategies
Ensure sufficient, stable, secure, accessible and reasonably-priced energy supply	Increase RE-based capacity by 100% by 2012	Diversify energy mix in favour of indigenous RE resources
Pursue cleaner and efficient energy utilization and clean technology adoption	➢ Be the number one geothermal energy producer in the world ➢ Be the number one wind energy producer in Southeast Asia	Promote wide-scale use of RE as alternative fuels and technologies Transform Negros island as a model of RE development and utilization
Cultivate strong partnership and collaboration with key partners and stakeholders	➢ Double hydro capacity by 2012 ➢ Expand contribution of biomass, solar and ocean energy by 100MW	Make the Philippines the manufacturing hub for PV cells to facilitate development of local manufacturing industry for RE equipment and components
Empower and protect welfare of various energy publics	Increase non-power contribution of RE to the energy mix by 10MMBFOE in the next ten years	Encourage greater private participation in RE development through market-based incentives
		Establish responsive market mechanisms for RE generated power
		Formulate an effective management program for fuelwood utilization with the view of reducing environmental impact

At present, biomass technologies utilized in the country vary from the use of bagasse as boiler fuel for cogeneration, rice/coconut husks dryers for crop drying, biomass gasifiers for mechanical and electrical applications, fuelwood and agri-wastes for oven, kiln, furnace and cookstoves for cooking and heating purposes.

Contribution of biomass, wind and solar sources for non-power applications will comprise a large portion of total demand for RE in the next ten years. Demand for solar and wind energy sources is foreseen to grow with the implementation of the program to invigorate the market for solar water heaters and locally fabricated solar dryers and wind pumps. On the other hand, biomass resources will continue to dominate total non-power demand for RE, increasing from 40.43 MMBFOE in 2003 to 47.46 MMBFOE in 2012.

Table 11. Summary of biomass and other renewable resources in the Philippines (in MMBFOE)

RESOURCE	200	2007	2008	2009	2010	2011	2012
Wind	0.7	0.7	0.7	0.7	0.7	1.1	1.1
Solar	0.4	0.4	0.5	0.5	0.6	0.8	0.8
Ocean	0.5	0.5	0.5	0.5	0.5	1.1	1.1
Biomass	87.4	89.5	91.8	94.1	96.9	100.7	101.1
Animal Waste	0.5	0.6	0.7	0.7	0.8	0.9	1.0
Municipal Solid Waste	0.4	0.4	0.4	0.5	0.5	1.3	1.3
Bagasse	12.4	12.7	13.0	13.3	13.6	13.9	14.1
Coconut Residue	13.4	13.7	14.1	14.4	14.8	15.1	15.5
Rice Residues	5.8	6.0	6.2	6.4	6.6	6.9	7.1
Fuelwood (Household)	42.8	43.6	44.3	45.1	45.9	46.7	47.5
Fuelwood (Industrial)	6.1	6.5	6.9	7.3	7.9	8.8	8.2
Charcoal	5.8	5.9	6.1	6.6	6.6	7.1	6.4
Total	**89.0**	**91.2**	**93.5**	**95.9**	**98.7**	**103.6**	**104.1**

The household sector will remain the largest user of these energy forms particularly fuelwood, comprising 66.9 percent of the total biomass consumption for the ten-year period. From a level of 57.6 MMBFOE in 2003, consumption of the sector will increase to 68.4 percent in 2012. While there is a growing trend in the consumption of fuelwood in the next ten-year period, the government shall institute measures and programs that would rationalize the utilization of this resource, with the view of reducing the negative impact on the environment. Such measures and programs to be instituted would include but not limited to the use of LPG and electricity for cooking and solar driers for crop drying, which would encourage rural households to shift to alternative fuels. Biomass will still be the most important fuel for rural households particularly in their cooking and agriculture activities such as crop drying.

Role of the Philippine Department of Energy in promoting renewable energy through biomass

It is the Philippine government's policy to facilitate the energy sector's transition to a sustainable system with Renewable Energy, particularly biomass, as an increasingly prominent, viable and competitive fuel option. The shift from fossil fuel sources to renewable forms of energy is a key strategy in ensuring the success of this transition. Moreover, current initiatives in the pursuit of this policy are directed towards creating a market-based environment that is conducive to private sector investment and participation and encourages technology transfer and research and development. Thus, current fiscal incentives provide for a preferential bias to RE technologies and projects which are environmentally sound. It is the specific objectives of the government to:

- To increase RE-based capacity by 100% by 2013
- To be the number one geothermal energy producer in the world
- To be the leading wind energy producer in Southeast Asia
- To double hydro capacity by 2013
- To increase non-power contribution of RE to energy mix by 10 MMBFOE in the next 10 years
- To become a regional solar manufacturing export hub
- Expand contribution of biomass, solar, micro-hydro and ocean by 250 MW
-

In view of the above, the Department of Energy has in fact, in collaboration with our legislators, passed and finally legislated the Biofuels Act that obligates all gasoline and diesel fuel sellers to blend in up to 10% ethanol and 2% Coco-Methyl Ester (CME) their products, respectively. On the other hand, the renewable energy bill (house bill 5563) is slated for final reading and approval by the bicameral committee. Once approved, it will pave the way to the following salient features:

- Renewable Energy Portfolio Standards (RPS) that will directly impose having a minimum amount of RE-based energy for all generators of electricity.
- RPS levels will be set on a grid to grid basis.
- Establish a Renewable Energy Market linked to the bigger Wholesale Electricity Spot Market to ensure compliance thru assigning a RE Registrar.
- Provides end users to choose clean, renewable and alternative energy as a concrete step towards RE promotion.
- Require the national power provider, NAPOCOR, and other new power providers in off grid areas (such as small island groups) to source a minimum percentage of their generation from available RE sources in their area, including biomass.
- Adopt net metering and distributed generation.
- Reduce government share in gross revenues.
- Provide fiscal incentives such as income tax holidays.
- Establishment of a trust fund for the research, development and promotion of RE.

As an aggressive move to promote RE development and use, the DOE has identified long-term goals, namely, to (1) increase RE-based capacity by 100 percent by 201 and (2) increase non-power contribution of RE to the energy mix by 10 million barrels of fuel oil equivalent (MMBFOE) in the next ten years. In support of these general goals, the government aims to (1) be the number one geothermal energy producer in the world, (2) be the number one wind energy producer in Southeast Asia, (3) double hydro capacity by 2013 and (4) expand contribution of biomass, solar and ocean by about 131 MW. These goals serve as concrete benchmarks for government to advance its vision of a sustainable energy system with RE taking a prominent role in the process. As mentioned earlier, aside from DOE, the Department of Environment and Natural Resources should also be a major government agency taking a stakeholders view in regard woodfuel production systems. Below is the discussion.

The Philippine set of criteria and indicators for sustainable forest management (SFM)

The Philippines has adopted the concept of Sustainable Forest Management as its major policy thrust in order to assure the long-term stability of its forest resources. In 2003, several consultations were done and later in the year, the DENR produced a document entitled "The Philippine Set of Criteria and Indicators for Sustainable Forest Management: A Manual and Reporting Framework."

In that document, DENR documented its experience in coming up with a set of criteria and indicators for SFM. The output of which will be elaborated in the succeeding sections of this report. A similar trajectory may be proposed for woodfuel production system inasmuch as during the course of data collection for this Paper, it was found out that in reference to the C&I, whatever is present at the national level, should also be felt at the Forest Management Unit (FMU) where woodfuel production take place.

According to this document (DENR, 2003), the policy of SFM is largely attributable to the implementation of measures embodied in the 1987 Constitution, the Philippine Strategy for Sustainable Development and the Philippine Agenda 21, the Master Plan for Forestry Development, and the adoption of the community-based forest management and watershed/ecosystem approaches as the main strategies for SFM. These key measures have been supported by various bilateral and multi-lateral funding agencies that supported various policy and institutional reforms and major forestry programs.

Further, the Manual on C&I comprehensively describes (full text from the DENR website: April 2007) the context of the efforts. For instance, to assess the current state of SFM in the Philippines, it is necessary to have a full understanding of the various components of SFM and their impacts on forest resources and ecosystems. These require a system of measurable criteria and indicators to evaluate the changes and conditions and management systems at national and forest management unit levels like timber concessions, industrial forest management areas, and community-based forest management areas. In this context, the DENR through the FMB is implementing the Project "PD 225/03 Rev. 1(F)" funded by the International Tropical Timber Organization. The project aims to adopt and implement an appropriate system of criteria and indicators based on the ITTO model. The adopted C&I will be applied as management tools for reporting progress towards SFM and enhancing capability of FMUs in managing their forest resources on a sustainable basis.

A pre-test was done for the Philippines. The Philippine C and I system, developed under a Pre-project [PPD 29/01 Rev. 1 (F)] also supported by the ITTO, was pre-tested in selected FMUs in the country and presented in a series of consultations and discussions with forest managers, non-governmental organizations, academic institutions, peoples' organizations, other government agencies and other civic society groups. The system will be used for national and FMU levels of reporting progress to SFM, identification of key factors hampering advancement, and proposing remedial measures to achieve goals and targets on SFM and Objective 2000. It was adopted in principle for implementation during a high-level meeting of DENR and other agencies' top officials held last November 2004. The results will be presented in the latter portion of this paper.

Among the objectives of the ongoing ITTO-FMB project aside from adoption of the C&I system, is the formulation and implementation of an appropriate audit system for the country using the C&I for SFM resulting from the pre-project. The system will be meaningless if not applied along with auditing of the adopted C&I to be used by various FMUs including CBFM areas as a tool for SFM reporting, control, verification, and monitoring.

The ITTO and the Philippine criteria and indicators

The International Tropical Timber Organization (ITTO) pioneered the development of criteria and indicators for SFM. It formulated an innovative forest management tool, one of the ongoing nine global processes, applicable mainly to Tropical forests. ITTO's Criteria and Indicators were originally formulated in 1991 as part of the Organization's pioneering policy work. The ITTO C&I were revised in 1998 to take account the numerous developments in ITTO and internationally after UNCED in 1992, including publication of a set of related policy guidelines by ITTO and the development of parallel C&I processes for temperate and boreal forests.

Back in 1998, ITTO has embarked on an unprecedented initiative to provide training to countries on the use of the C&I for monitoring, assessing and reporting on forest management, with the overall objective of promoting wide-scale implementation of the C&I in producer member countries. These countries now report to the Organization on the status of their forest management using the C&I via Reporting Formats (at the national and forest management unit – FMU – levels) developed and approved in 2001. ITTO's experiences in C&I training and reporting have provided valuable insights into the use of this tool. ITTO has also co-sponsored, with FAO and others, a series of international expert meetings on C&I to help to foster their uptake at a global level. In 2003, the International Tropical Timber Council [ITTC Decision (XXXVII)/17], taking into account all of these developments, decided to undertake further revisions of the ITTO Criteria and Indicators and Reporting Formats, simplifying the system and retaining the seven criteria with some modified language and the indicators were reduced from 63 to 56 and the reporting requirements from 89 to 56. This new C&I system was adopted by the 37th Session of the ITTC held last 13–18 December 2004 in Yokohama.

The objective of ITTO's Criteria and Indicators is to provide member countries with an improved tool for assessing and reporting on changes and trends in forest conditions and management systems at the national and forest management unit levels. By identifying the main elements of sustainable forest management, the criteria and indicators provide a means of assessing progress towards sustainable forest management that is "to enhance the capacity of members to implement a strategy for achieving exports of tropical timber and timber products from a sustainable management of their resources." The information generated through these Criteria and Indicators in assessing the state of the forest will help communicate the status of efforts towards sustainable forest management more effectively. It will also assist in developing strategies for sustainable forest management, in focusing research efforts where knowledge is still deficient and in identifying weaknesses.

When the indicators are made operational, a sound basis would be created for measuring sustainable forest management. The ITTO Criteria and Indicators should serve as a framework within which each country can develop its own system for determining sustainability at the national and forest management unit level. While the overall sustainability of the management of a nation's forests depends substantially upon actions taken at the national level (such as decisions on the balance of land use between forestry and other land uses and, within forestry, between production, conservation and protection), analysis at the forest management unit level is the key to monitoring and assessing sustainable forest management. Analysis at the national level for many indicators is carried out by aggregating the results of FMU level indicators. The wide variability of size and administrative/ownership structures of forest management unit's means that the level and nature of aggregation required will vary greatly between countries.

All the criteria are valid at both the national level and the level of the forest management unit. In the case of the indicators, some do not apply at the FMU level. A *criterion* is defined as an aspect that is considered important by which sustainable forest management may be assessed. A criterion is accompanied by a set of related indicators. A criterion describes a state or situation which should be met to comply with sustainable forest management. An *indicator* is defined as a quantitative, qualitative or descriptive attribute that, when periodically measured or monitored, indicated the direction of change.

Countries face a considerable burden in reporting to different international organizations. This load can be eased by ensuring that the nature of the data requested is as similar as possible. Indicators have, therefore, been chosen so as to be compatible with internationally agreed standards and definitions, as far as possible. If the indicators are to give an accurate picture of trends, it is important that comparable methods are used between one assessment and the next; and that there should be a means of estimating the degree of accuracy of any data presented. Ideally, countries should use the same methods of measurement and assessment over time. However, data collection and analysis techniques are dynamic. Countries in each report give a description of the methods used and an estimate of the accuracy of their figures and any difficulties encountered in their collection.

The Philippine C&I system is a systematic adaptation of the ITTO model refined under the country's forestry situation. The criteria and indicators in the country's context are a product of consultations among relevant government agencies and forest stakeholders. The purpose of the Philippine set of criteria and indicators is to provide the government through DENR and forest managers within the country an improved tool for assessing changes and trends in forest conditions and forest management systems. The criteria and indicators will also provide means of assessing progress towards the attainment of the objectives set under Executive Order 318 otherwise known as "Promoting Sustainable Forest Management in the Philippines" and towards to the commitment to ITTO Objective.

The use of the criteria and indicators as management tools will provide the forest managers a framework for understanding, planning and implementing improved forest management technique. They will have enhanced capacity to comprehensively assess the situations of their forest management units whether they are moving towards or away sustainable forest management. This will also help policy and decision makers in developing policies and necessary actions to further strengthen SFM, focusing on aspects where knowledge is still deficient and in identifying those areas which are in need of assistance.

The criteria identified by the ITTO were adopted as elements of sustainable forest management in the Philippines. Every criterion was accompanied with a full meaning and description as to what this particular criterion pertains.

Criterion 1. Enabling Conditions for Sustainable Forest Management covers the general institutional requirements for sustainable forest management to succeed.

Criterion 2. Extent and Condition of Forests, deals with Forest Resource Security relates to the extent to which the Philippines has a secure and stable forest state to meet the production, protection, and other social, cultural, economic and environmental needs of the present and future generations.

Criterion 3. Forest Ecosystem Health relates to the condition of the country's forests and the healthy biological functioning of its forest ecosystem and it deals with the forest conditions and health as affected by a variety of human actions and natural causes.

Criterion 4. Forest Production deals with the production of wood and non-wood forest products with perceptions that production can only be sustained in the long-term if it is economically and financially viable, environmentally sound and socially acceptable.

Criterion 5. Biological Diversity, relates to the conservation and maintenance of biological functioning of the forests.

Criterion 6. Soil and Water Protection, deals with the protection of soil and water in the forest.

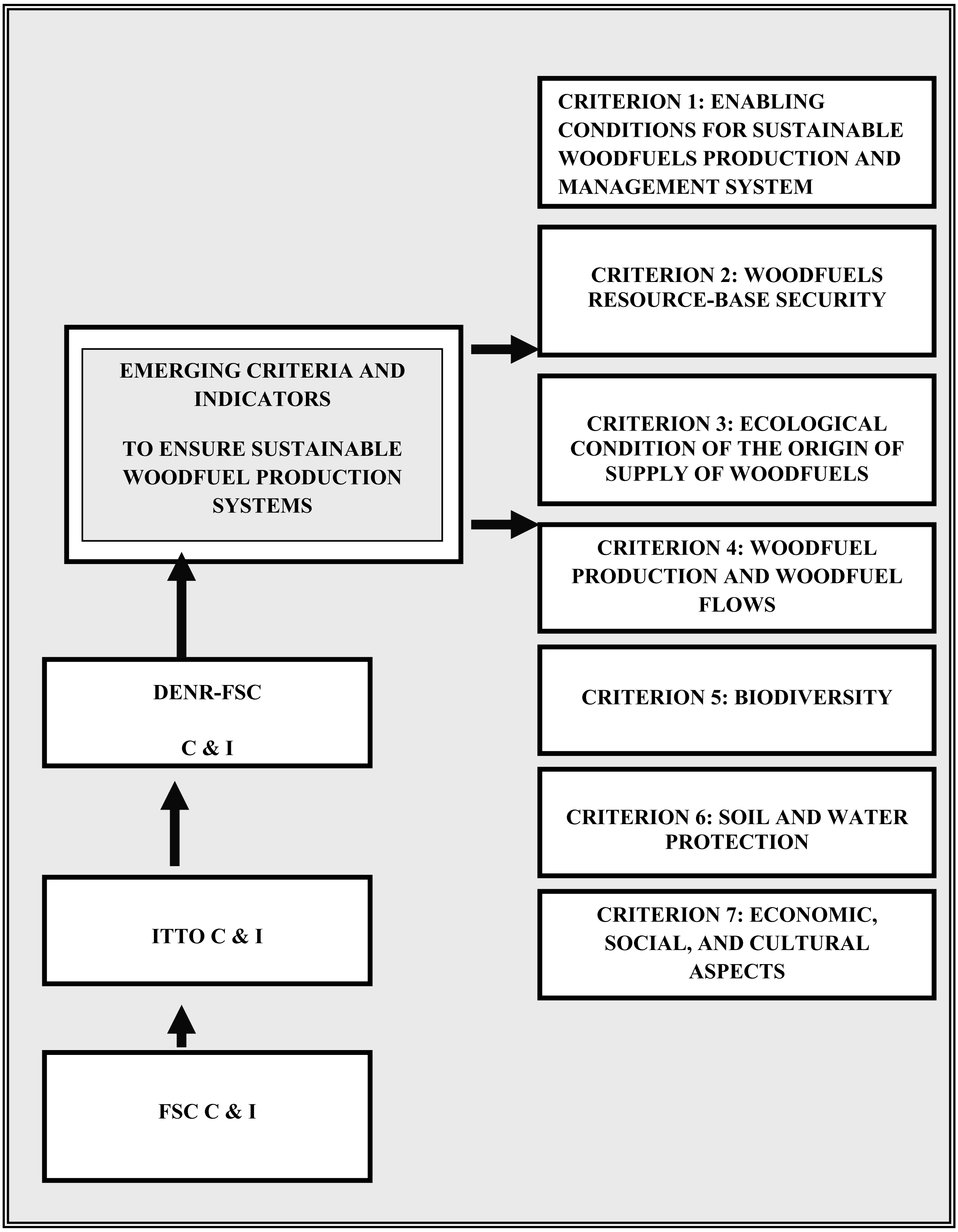
Criterion 7. Economic, Social, and Cultural Aspects, relates to the economic, social and cultural function of the forest.

The indicators have been carefully and comprehensively assessed and identified through a series of consultations with the different stakeholders to fit in the situation of the Philippine forestry setting.

Criterion 1 has a total of eleven (11) indicators and mainly descriptive in nature. Criterion 2 is composed of six (6) indicators. In Criterion 3, there are two (2) indicators identified. Criterion 4 has a total of ten (10) indicators that were designed relate to the flow of forest produce. There are a total of seven (7) indicators that were identified in Criterion 5. Criterion 6 is composed of five (5) indicators and a total of twelve (12) indicators identified for Criterion 7. A total of 53 indicators compose the Philippine C&I. These are all applicable at the national level. At the FMU level 47 indicators are considered appropriate for the Philippine forestry situation.

The Philippine C&I therefore is applicable to all forest conservation and forest products including NWFPs development efforts at the national and at the FMU level with the end view of sustainability using the SFM concept. Woodfuels that is fuelwood and charcoal are part of this framework. However, whenever woodfuels originate from private lands or are gathered for free from land uses such as private woodlots, or family woodlots, among others, the Philippine C&I can only be applicable when the country implements SFM through forest certification. The trading of certified charcoal and or certified fuelwood will have to be a public sector move otherwise, a more comprehensive monitoring of chain of custody for woodfuels, for instance at the transportation level, will suffice as the main recommendation. It is not possible to monitor fuelwood that is gathered for free among households. It is also not possible to monitor ultra small-scale charcoal production activities which are happening at a massive volume particularly if these are done at a subsistence level meant only for household consumption.

Figure 8. Criteria and Indicators for sustainable woodfuel production and management framework



Principles, criteria and indicators for sustainable woodfuel production and management framework

Below is an attempt at culling a criteria and indicator framework for woodfuel production. A criterion is defined as "an aspect that is considered important by which SFM may be assessed." A criterion describes a state or situation which should be met to comply with sustainable forest management, and in this case, a sustainable woodfuels production and management. Using the Philippine C&I for SFM (DENR Manual, 2007) as the main framework, below are 7 Principles, 7 Criteria, 53 Broad Indicators, and 183 Specific Indicators.

PRINCIPLE 1: **Enabling conditions for sustainable woodfuels production and management systems exist**

To ensure sustainable forest management vis-à-vis woodfuel production systems, it is important that the woodfuel resources, especially permanent forest estate are secured and protected and that they are managed in accordance with best management practices involving all stakeholders, in particular and local communities who are dependent upon the forest, in general.

CRITERION 1: Enabling conditions for sustainable woodfuels production (SWP)

Indicator 1.1 Existence and implementation of policies, laws and regulations to govern woodfuels production and management.

- *National objectives for forests vis-à-vis woodfuels management including production, conservation, protection and investment*
- *The establishment and security of woodfuel plantations*
- *Forest tenure and property rights in relation to forests*
- *Participation of local communities and other stakeholders in forest management*
- *Control of illegal activities in forest areas in relation to woodfuel production and trade*
- *Control of forest management vis-à-vis woodfuel production and trade*
- *The health and safety of forest workers in general and woodfuel producers in particular.*

Indicator 1.2 Extent of forest tenure and ownership of forest vis-à-vis woodfuel production.

Indicator 1.3 Amount of funding in woodfuel management, administration, research and human resource development.

- *Government sources (national, sub-national)*
- *International development partners (grant, loan)*
- *Private sources (domestic, foreign)*

Indicator 1.4 Existence and implementation of economic instruments and other incentives to encourage sustainable woodfuel production systems.

Indicator 1.5 The structure and staffing of institutions responsible for SFM vis-à-vis woodfuel production systems.

- *Primary government agency in-charge*
- *Nature of responsibilities*
- *Number of staff*

- *Website addresses*
- *Other institutions*
- *Nature of responsibilities*
- *Number of staff*
- *Website addresses*

Indicator 1.6 Number of professional and technical personnel at all levels to perform and support woodfuel management.

- *Government (professionals, trained forest/woodfuel workers/specialist, others - Full time or Part time, Number)*
- *Non-government (professionals, trained forest/woodfuel workers/specialists, others - Full time or Part time, Number)*

Indicator 1.7 Existence of communication strategies and feedback mechanism to increase awareness about SFM vis-à-vis woodfuel production and trade

- *Regular meetings among line agencies, LGUs, stakeholders*
- *Existence of multi-sectoral community organizations*
- *Various fora*
- *Various forms of interactions and feedback mechanisms*

Indicator 1.8 Existence of and ability to apply, appropriate technology to practice sustainable woodfuel production and efficient utilization and marketing of woodfuel products especially charcoal and fuelwood.

- *Description of technologies used to enhance woodfuel production (particularly charcoal) and the effects of using such technology*
- *Description of any recent changes in the technology used*
- *Description of what improvements are proposed*
- *Description of what constraints are present upon introducing the improvement*

Indicator 1.9 Capacity and mechanisms for planning sustainable woodfuel management and production systems and for periodic monitoring, evaluation and feedback on progress and status

- *Description of mechanisms used for planning SFM vis-à-vis woodfuel production including periodic monitoring, evaluation and feedback on progress*
- *Description of the capacity available and institutions responsible for these purposes*
- *A list of major constraints encountered in planning*

Indicator 1.10 Public participation in forest management planning relative to woodfuel production and management systems in terms of decision making, data collection, monitoring and assessment.

- *A list of institutions responsible for these processes*
- *Description of the processes of public participation, indicating the parties involved and their level of involvement*
- *Improvements proposed and constraints met during the interventions*

Indicator 1.11: Existence of forest management plans vis-à-vis Woodfuel Management and Production Plans

- *Number of management plans (i.e. in terms of hectares or area)*

- *Description of effectiveness of FMP and woodfuel management and production plans*
- *Improvements proposed and constraints in their introduction*

PRINCIPLE 2: **Woodfuels resource-base needs to be secure**

A sustainable woodfuel production and management system relative to SFM is a long-term enterprise and depends critically upon the stability of a nation's forest estate. Therefore, this criterion is founded on the basic premise that in order to achieve sustainable woodfuel production and management goals, there should be protection of forest and or woodfuel resources. It considers the extent and percentage of land under natural and planted forests, the needs for the conservation of biological diversity through the maintenance of a range of forest types and the integrity and condition of forest resources. There has to be a description of the resource base. An updated, overall land-use plan is important to ensure sustainable woodfuel production and management, relative to the other sectors of the economy. In this context, the external boundaries of the permanent forest estate should be clearly demarcated and changes in their extent should be regularly monitored.

CRITERION 2: Extent and condition of woodfuels resource-base security

Indicator 2.1 Extent in terms of area and the percentage of total land area under comprehensive land-use plans

Indicator 2.2 Extent of forests committed to production of woodfuels and protection against illegal use.

Indicator 2.3 Extent in terms of area and percentage of total land area under each forest type allocated to woodfuel production and trade

- *Description of forest type and classification used relative to SWP*
- *Classification of forest type based on species composition and so on relative to SWP*

Indicator 2.4 Percentage of Permanent Forest Estate with boundaries physically demarcated relative to woodfuel production and trade (and protected areas).

Indicator 2.5 Changes in Forested Area

- *Area at last reporting*
- *Areas formally converted to agriculture*
- *Areas converted to settlements, infrastructure development*
- *Areas converted to other purposes*
- *Areas formally added*
- *Areas converted illegally*

Indicator 2.6 Forest Condition relative to woodfuel production

- *Area of primary allotted to woodfuel production*
- *Managed primary forest vs. WP*
- *Area degraded primary forest vs. WP*
- *Area of secondary forest vs. WP*
- *Area of degraded forest lands vs. WP*

PRINCIPLE 3: There is a healthy biological functioning of forest ecosystem vis-à-vis sustainable woodfuel sources of supply

This principle relates to the healthy biological functioning of forest ecosystems as the proper environment for sustainable woodfuel sources of supply. This can be affected by a variety of human actions such as encroachment, illegal harvesting, human induced fire and pollution, grazing, mining, poaching and many others.

CRITERION 3: Ecological condition of the origin of supply of woodfuels

Indicator 3.1 The extent and nature of forest encroachment, degradation, and disturbance caused by humans that jeopardize sustainable woodfuel production and the control procedures applied (in this case woodfuel plantations and or similar set-ups).

- o *List of five major activities*
- o *A list of institutions responsible for implementing control procedures*
- o *List of constraints in implementing control procedures and any proposed improvements*

Indicator 3.2 The extent and nature of forest degradation and disturbance due to natural causes that jeopardize sustainable woodfuel production and the control procedures applied.

- o *List of five major activities*
- o *A list of institutions responsible for implementing control procedures*
- o *List of constraints in implementing control procedures and any proposed improvements*

PRINCIPLE 4: There is a sound and viable woodfuel production and woodfuel flow system

This principle is concerned with forest management for the production of wood and non-wood forest products transformed into fuelwood and charcoal. Such production can only be sustained in the long term if it is economically and financially viable, environmentally sound and socially acceptable. Trees earmarked for fuelwood and charcoal purposes are able to fulfil a number of other important functions such as environmental protection, carbon storage and the conservation of species and ecosystems. These multiple roles of forest and trees should be safeguarded by the application of sound management practices that maintain the potential of the forest resource to yield the full range of benefits of society.

CRITERION 4: Woodfuel production and woodfuel flows

Indicator 4.1 Extent and percentage of trees for which inventory and survey procedures have been used to define the quantity intended for woodfuel production.

- o *Exclusivity of rights and ownership over the area should be clarified/defined properly;*
- o *Public reservation areas includes military reservations*
- o *Other tenure arrangements such as TLA, IFMA, SIFMA, CBFM and others are under the state ownership*
- o *Source of forest products is either natural forest or plantation forest*
- o *Sources of information need to include date of inventory*

Indicator 4.2 Actual and sustainable harvest of wood for fuelwood and charcoal purposes

- *Type of forest product*
- *Units of measurement*
- *Volume by source (annual, total and average figures)*

Indicator 4.3 Composition of harvest

- *The most important species or species of groups harvested*
- *Average harvesting quantity (Permanent Forest Estate vs. Non-PFE) over the last 3-year period together with the source of data and the unit of measurement*

Indicator 4.4 Estimate of carbon stored in forests (Wood Plantations)

- *Description of methods of measurement; express in tones of elemental carbon*
- *Reference year*
- *Above ground carbon stock*
- *Soil carbon stock*

Indicator 4.5 Existence and implementation of woodfuel harvesting/operational plans (within woodfuel management plans) and other harvesting permits (small, medium and large scale permits without woodfuel management plans).

- *Description the procedures and processes for formulating plans and assessing of effectiveness of implementation of woodfuel harvesting/ operational plans*
- *Any other type of harvesting/ cutting permits within and outside PFE*

Indicator 4.6 Extent of compartments/ coupes harvested according to harvesting/ operational plans and any other harvesting/ cutting permits

- *Calculate average over most recent 3-year period*
- *Specify the different types of permits and report on their effects on woodfuel production sustainability*

Indicator 4.7 Existence of woodfuels e.g. charcoal and fuelwood tracking system of similar control mechanisms

- *Description of type of systems and its implementation*
- *Description of responsible parties*

Indicator 4.8 Long term projections, strategies and plans for woodfuel production

- *Description of projections, five years and beyond, or plans for production to bring current management of harvesting practices and patterns into alignment with sustainable woodfuel production and management*

Indicator 4.9 Availability of historical records on the extent, nature and management of woodfuel

- *Are historical records available about the extent, nature and management of woodfuels?*
- *Are there descriptions of the types of records?*

- *Do archives of woodfuel data, e.g. yield, uses, etc, exist and are they accessible for planning and management?*
- *Have such records been used?*
- *Have these records been proven useful in the past?*

Indicator 4.10 Availability of silvicultural procedures for timber and NWFP

- *Does the country have recommended silvicultural systems?*
- *What are they?*
- *Are they effectively monitored?*
- *At what geographical scale?*
- *Describe post-harvesting surveys to assess the effectiveness of the silvicultural activities*
- *Are monitoring data being archived to evaluate cumulative effects of silvicultural systems over time?*
- *Do silvicultural systems include the use of chemicals?*
- *If yes, specify and assess risks.*

PRINCIPLE 5: Ecosystem diversity and conservation can be accomplished if the establishment of a sound woodfuel production and management system co-existing with the establishment and management of protected areas through effective land-use policies and systems.

CRITERION 5: Biological diversity

This criterion relates to the conservation and maintenance of biological diversity, including ecosystems, species and genetic diversity. The general principles and definitions used here are those established by CBD and IUCN. The conservation of ecosystem diversity can best be accomplished by the establishment and management of a system of protected areas (combinations of IUCN Categories I and IV) containing representative samples of all forest types linked as far as possible by biological corridors or "stepping stones" relative to woodfuel production and management systems. This can be ensured by effective land-use policies and systems for choosing, establishing and maintaining the integrity of protected areas in consultation with and through the involvement of local communities.

Indicator 5.1 Protected areas containing forests with woodfuel plantations and or woodfuel production

- *Type of protection forest*
- *Location with FMU (extent/area of woodfuel production)*
- *Percentage of each forest type covered*
- *Percentage of boundaries or clearly defined*

Indicator 5.2 Protected areas connected by biological corridors or stepping stones

Indicator 5.3 Existence and implementation of procedures to identify and protect endangered, rare and threatened species of forest flora and fauna

- *Description of procedures to identify, list and protect endangered, rare and threatened species of forest flora and fauna vis-à-vis woodfuel production system*
- *List of institutions responsible*
- *Description of any recent change in the procedures*
- *Constraints in introducing improvements*

Indicator 5.4 Number of endangered, rare and threatened forest-dependent species

- *List of trees, flowering plants, ferns, birds, fresh water fish, amphibians, mammals, butterflies, others*

Indicator 5.5 Measures for in situ and or ex situ conservation of the generic variation within commercial, endangered, rare and threatened species of forest flora and fauna

- *Description of the measures applied to conserve genetic diversity*
- *Institutions responsible*
- *Description of recent changes*
- *Proposed improvements*
- *Possible constraints*

Indicator 5.6 Existence and implementation of procedures for protection and monitoring of biodiversity in production forests relative to woodfuel production in terms of:

- *Retaining undisturbed areas*
- *Protecting rare, threatened and endangered species*
- *Protecting features of special biological interest*
- *Assessing recent changes*
- *Description of any procedures being implemented*
- *Is the effectiveness being monitored?*
- *At what geographical scale?*
- *Description of procedures for assessing changes in production areas compared to control areas*
- *Are records kept over time?*

Indicator 5.7 Extent and percentage of production forest which has been set aside biodiversity conservation.

- *Area and percentage*

PRINCIPLE 6: Woodfuel production systems need to be sensitive to the requirements of soil and water protection in order to achieve a sustainably managed forest systems.

CRITERION 6: Soil and water protection in relation to woodfuel production

The importance of this criterion is two-fold. First, it has a bearing on maintaining the productivity and quality of soil and water within the forest and its related aquatic ecosystems (and therefore on the health and condition of the forest. Second, it also plays a crucial role outside the forest in maintaining downstream water quality and flow and in reducing flooding and sedimentation. Quantitative indicators of the effects of forest management on soil and water are therefore such measures as soil productivity within the forest and data on water quality and average and peak water flows for streams emerging from the forest. This information is difficult and expensive to obtain and is seldom available for more than a limited number of sites, as each site has its own characteristics in this respect (for example, slope, geological structure and the inherent erodibility of the soil type). The protection of soil and water is therefore best ensured by specific guidelines for different situations; these can only be based on experience and research.

Indicator 6.1 Extent and percentage of total forest area managed exclusively for the protection of soil and water and where woodfuel production is being managed sustainably.

- *Are there procedures to assure protection of downstream catchment values?*
- *Are they being implemented?*
- *Is their effectiveness being monitored?*
- *What are the geographical locations?*

Indicator 6.2 Procedures to protect soil productivity and water retention capacity within the production forest vis-à-vis woodfuel production units

- *Are there procedures to protect soil productivity and retain water within production forest in general and woodfuel production sites in particular?*
- *Are there provisions to prevent contamination of forest soil and water relative to woodfuel production areas?*
- *Are they being implemented?*
- *Is their effectiveness being monitored?*
- *At which geographical locations and scale?*

Indicator 6.3 Procedures for forest engineering includes several requirements

- *What are the drainage requirements?*
- *Conservation of buffer strips along streams and rivers.*
- *Protection of soils from compaction by harvesting machinery.*
- *Protection of soil from erosion during woodfuel harvesting operations.*
- *Are there recommended forest engineering procedures (woodfuel areas) in regard to the protection of soil and water?*
- *Are they implemented?*
- *Is their effectiveness being monitored?*
- *What geographical areas and scale?*

Indicator 6.4 Extent and percentage of areas of protected forest estates production which has been defined as environmentally sensitive (very steep or erodible) relative to woodfuel areas.

- *Which areas are defined as ecologically vulnerable hence woodfuel production is not recommended?*
- *What are the area characteristics?*
- *What is the area in hectare terms?*

PRINCIPLE 7: The economic, social and cultural characteristics of an area need to be respected and minimally disturbed since a sustainably managed forest and sustainably managed woodfuel production system has the potential to make a valuable contribution to the overall sustainable development of a country.

CRITERION 7: Economic, social and cultural aspects

This criterion deals with the economic, social and cultural aspects of the forest in general and woodfuel production in particular. A well-managed forest and well-managed woodfuel production system is a constantly self-renewing resource and it produces a host of benefits, ranging from high quality timber, fuelwood, and charcoal and this satisfies the basic needs of people living in and around the forest. It also contributes to the well-being and enhances the quality of life of the population in providing opportunities for recreation and ecotourism as well as providing livelihood and employment opportunities in fuelwood and charcoal production, trading and distribution. Likewise, in the case of fuelwood and charcoal, these resources form part of Filipino culture in terms of culinary preferences. If sustainably maintained, a sustainable woodfuel production system will also provide sustainable economic opportunities for communities.

Indicator 7.1 Value and percentage contribution of the woodfuel sector to GDP

- *Reference year*
- *GDP amount*
- *Description of the extent of the informal sector of woodfuel industry contributes to GDP*
- *Sources of data*

Indicator 7.2 Value of domestically-produced fuelwood and charcoal

- *Domestic market*
- *Export market*
- *Informal markets including marginal and illegal activities*
- *Annually/ seasonally*

Indicator 7.3 Woodfuel production capacities

- *Volume of woodfuel products processed*
- *Volume of woodfuel products produced*
- *Efficiency of the woodfuel industry*

Indicator 7.4 Existence of the implementation of mechanisms for the equitable sharing of woodfuel management costs and benefits

- *List mechanisms for the distribution of incentives*
- *Fair sharing of costs and benefits among parties*
- *Are they implemented?*
- *Are there obstacles?*
- *Are there improvements?*

Indicator 7.5 Number of people depending upon woodfuel production for their livelihoods

- *Number employed in formal woodfuel operations*
- *Number obtaining livelihood in informal woodfuel operations*
- *Other indirect employment*
- *Other subsistence activities*

Indicator 7.6 Training, capacity-building and manpower development programs for forest workers

- *Indicate the number and main focus of universities, technical institutions with formal SFM with SWP*
- *List short and medium term training programs for woodfuel managers for the last year*

Indicator 7.7 Existence and implementation of procedures to ensure the health and safety of woodfuel production workers

- *What mechanisms are in place for the health and safety of woodfuel workers?*
- *Are the mechanisms being implemented?*
- *What are the constraints?*
- *What is the number of serious accidents over the last 3 years?*
- *What are their causes?*

Indicator 7.8 Area of forest upon which people are dependent for woodfuel production either for subsistence uses, traditional and customary lifestyles

- *Specify types of forests used for woodfuel production either for subsistence, traditional or customary lifestyles*

Indicator 7.9 Number and extent of woodfuel sites available primarily for research and education

- *Number of sites*
- *Area in hectare*
- *Average number of users on an annual basis*

Indicator 7.10 Number of cultural factors leading to the use of woodfuels

- *Culinary practices requiring the use of woodfuels*
- *Seasonality of practices*
- *Use of multiple fuels*
- *Reasons for preference in woodfuels*
- *Fuel-switching incidence*
- *Patterns and trends*
- *What tenure rights are practiced?*
- *How is this practiced?*
- *What are the descriptions of constraints and proposals for improvements?*

Indicator 7.11 Extent of involvement of indigenous people, local communities and other forest dwellers in woodfuel management capacity building, consultation processes, decision making and implementation

- *Description of involvement from LGUs, NGOs, other community-based groups*
- *Frequency of regular meetings*
- *Documents to support level of interactions*
- *Community dynamics*
- *Local laws and ordinances*
- *Legal basis for this involvements*
- *Shortcomings and proposals for improvements*

CONCLUSIONS AND RECOMMENDATIONS

The study would like to close by reviewing and listing down the salient findings for policy consideration (Final Report DAP: Policies and Strategies toward Sustainable Development of Fuelwood Sector):

On fuelwood and charcoal:

a) Low-income households are the main users of fuelwood and charcoal.

b) Majority of households are dependent on fuelwood and charcoal as principal energy source or as secondary household energy source.
c) There are many industries as well who depend upon woodfuels as alternative source of energy.
d) Fuelwood and charcoal remain to be major alternative to imported energy.
e) Fuelwood and charcoal trading are important sources of income for many rural as well as urban households.
f) Fuelwood is generally gathered for free from local environment, particularly in the rural areas. Fuelwood is traditionally a free resource and generally gathered at no monetary cost. In the rural areas approximately 70 percent of the total households collect fuelwood for free.
g) Resistance to the adoption of improved cook stove technology is highly probable. Since fuelwood is gathered for free, users are not receptive to shifting towards the use of efficient and improved cookstoves.
h) The bulk of primary fuelwood supply is sourced from Alienable and Disposable private lands. Past studies reveal that 70 percent of the fuelwood users gather their supply from locations less than one kilometre from their residences. This suggests that a major portion of fuelwood supplies, particularly in the rural areas are sourced from A and D lands and some also from nearby public lands, mainly secondary forests and some protected areas.
i) There are no clear policies linking woodfuel requirements with the management and development of energy resources.
j) The national energy plans do not take into account the contribution of woodfuels to the country's energy economy.
k) There is no specific entity that is directly responsible for supervising and coordinating woodfuel related programs and projects.
l) There is a dearth of information and data base on supply and demand of indigenous energy resources particularly those on fuelwood and charcoal.
m) Aggregate demand and supply figures are irrelevant due to location specific situations, spatial distribution of supply and demand and the economic cost and benefits of transportation.
n) Fuelwood and charcoal sector policies must therefore recognize and build upon location specific characteristics e.g. spatial variation to woodfuel sector policies.
o) Provinces most likely to encounter problems over the short to medium-term are Category I, II, III provinces.
p) Probable over-exploitation of primary fuelwood resources due to preference for fuelwood over other biomass resources.
q) Many provinces have abundant primary and secondary fuelwood resources which are under-utilized.
r) Many rural areas possess surplus secondary biomass materials much of which remains underutilized.
s) There seems to be no constraint as far as the availability of commercial-ready biomass conversion technologies.
t) User conversion technologies which are currently used are inefficient.

u) Although there are a number of improved technologies for charcoal production, most of the charcoal is produced in underground pits or above ground mounds whose yields are very low. Unless conversion technologies are further improved, strategies to promote continued production and use of charcoal as a biomass fuel may lead to greater depletion of fuelwood resources. In this regard, there is a need to review present policies and programs on charcoal production.
v) User technologies are dictated by cost.

In conclusion, fuelwood and charcoal are important residential and commercial fuels. Most of the fuelwood comes from lands that are non-forest classification and most of the time fuelwood is gathered for free. Charcoal is an important fuel due to cultural preferences for certain types of food. Charcoal production technologies continue to be traditional and inefficient.

The Philippine C&I apply to all forest conservation and forest products that include NWFPs. The Philippine Forestry Sector is currently working out guidelines and schemes to implement such Criteria and Indicator system for Forest Certification. Accordingly in terms of products produced, whatever applies to the National, also applies to Forest Management Unit and Small forest management units. Woodfuel production usually takes place within small forest management units and also small farm management units. Therefore, criteria and indicators that apply to forest lands and affect woodfuel production is part of the certification of woodfuels only when the production take place in "forest" or public lands. Otherwise, there needs to be another set of criteria and indicators that include agricultural and non-forest lands where fuelwood is gathered and charcoal is produced.

It is important to note in conclusion six indicators that continue to be fall short of compliance within the framework of Philippine Criteria and Indicator System. In most cases, the indicators apply only at the National Level but not at the Forest Management Unit Levels (Philippine C&I Framework, 2007). These are:

1. Existence and implementation of policies, laws and regulations to govern forest management (only at the National level, FMU not yet).
2. The structure and staffing of institutions responsible for sustainable forest management (only at the National level, FMU not yet).
3. Protected areas connected by biological corridors or stepping stones (National level, FMU not yet).
4. Existence and implementation of procedures to identify and protect endangered, rare and threatened species of forest flora and fauna (only National level, FMU not yet).
5. Extent and percentage of total forest area managed exclusively for the protection of soil and water (only National level, FMU level not yet).
6. Value and percentage contribution of the forestry sector to the Gross Domestic Product (National level already considered, FMU level not yet).

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