FUELWOOD DEMAND AND SUPPLY IN THIMPU DISTRICT

Wood is the most commonly used fuel for domestic heating, cooking, and lighting in the district. Most villages in the temperate and sub-tropical zones are located near forests which meet the fuelwood needs of the people. Villagers own private woodlots called "*Sokshing*" and "*Jashing*" for collecting litter which is used as farm manure by mixing it with dung. Fuelwood in the form of twigs and small branches are also obtained from such woodlots. Villages in the alpine areas lie scattered high above the tree line and villagers have to walk more than 10 km to collect fuelwood from the forests. They rely on readily available scrub such as Rhododendron and Juniper for cooking their food and heating the rooms. Yak dung is also a commonly used fuel in these areas.

The supply of fuelwood to the rural and urban populations of Thimpu District comes from the government-owned forests and they are collected in one of four forms: dead trees and fallen branches, green trees by selective felling, lops and tops from logging areas, and saw log residues and offcuts.

Current Fuelwood Consumption

Table 4 shows the annual availability of residual volume from the logging areas in Thimpu District which can be used as firewood. The total annual volume of firewood available in the district is estimated to be approximately 165,000m^3 Assuming the present annual consumption rate to be 3.3m^3 per capita in the rural areas of Thimpu District, the total consumption of firewood in the district comes to 116,912m^3. This leaves a surplus of about 48,000m^3, which can be used to meet the demand of the urban population in Thimpu.

Annually a total of about 11,300m^3 of firewood is supplied to Thimpu township (Tables 5 and 6). With the urban population at 33,784, the present per capita consumption of firewood in Thimpu township works out to be 0.33m^3 per year. The low firewood consumption rate in Thimpu township reflects the use of other sources of energy such as electricity, LPG, and kerosene.

The demand for firewood is also met by felling oak and other broad-leaved trees from the forests. These trees are felled on a selective basis by first removing dead/dying and malformed trees. A total of 9606m^3 of firewood is supplied annually to urban areas by selective felling (Table 6) and 6,697m^3 of firewood is collected by villagers by felling green trees (Table 7).

Table 4: Forest Area, Total Growing Stock, and Annual Timber and Residual Yields in Thimphu District

Forest Type	Area (in ha)	Growing Stock Vol/ha (in m^3)	Total Growing Stock (in '000m^3)	Annual Yield (in '000m^3)	Log Volume (in '000m^3)	Residue Volume (in '000m^3)
Alpine forests	70,625	-	-	-	-	-
Temperate forests (mostly conifers)	84,100	428	36,017	857	429	150
Subtropical (mostly hard wood)	10,975	214	2,346	85	42	15
All	180,200	642	38,363	942	471	165

Note:

1. The areas of the vegetation types have been calculated from the report on Remote Sensing by Mr. Negi, UNDP Consultant, on the basis of the recently demarcated boundary of Thimphu District.

2. Growing stock per ha is taken from the following Management Plans.

   a) Temperate forest - Management plan for salvage areas of Thimphu, Paro and Haa.

   b) Subtropical forest - Lobesa Management Unit.

   Annual yield is calculated on the basis of pre-investment survey reports.

   a) Conifers 2.38 per cent of growing stock.

   b) Broad leaved 3.62 per cent of growing stock.

   Conversion loss to log volume is taken as 50 per cent.

3. Residual volume is calculated as follows:

   (1/10 of log volume + 25% of log volume).

4. Residual volume is assumed to be used as firewood.

Fuelwood Demand and Supply Projections

The present fuelwood consumption reveals that there is still an excess supply of 35,855 m^3. after meeting the urban and rural demand. It indicates that, at this stage, Thimpu District as a whole does not face any fuelwood shortage and there is sufficient fuelwood for its own use.

The volumes of growing stock, timber, and residual yield of fuelwood by block are shown in Table 8. The demand and supply situation for different blocks is presented in Table 9. This table shows that existing forests can meet the annual requirements of the rural population in all blocks except one. It also indicates that there are sufficient fuelwood resources even in alpine blocks. In reality, however, most forests in these blocks are far off from the habitations and the collection of fuelwood takes considerable time. The people in these areas turn to easily available sources such as scrub of rhododendron, juniper, and other shrubs for domestic cooking and heating. The alpine zones are ecologically fragile and indiscriminate removing of scrub and shrubs in these areas would ultimately bring about a variety of adverse effects such as soil erosion and desertification.

Table 5: Fuelwood* Supplied to Thimphu Township in 1986/87 (softwood and hardwood)

Month	Softwood (in m^3)	Hardwood (in m^3)
April'86	92.5	14.0 m
May	38.0	5.0 m
June	47.0	-
July	167.5	-
August	173.5	-
September	103.0	-
October	168.4	119.5
November	197.5	41.0
December	59.0	45.4
January'87	47.0	38.0
February	198.4	7.0
March	152.8	41.0
	1439.50	311.4
		Total:- 1750.9

Source: Bhutan Logging Corporation.

* Collected from the logging sites and supplied to Thimphu township from the firewood depot in Thimphu.

Table 6: Firewood* Supply to Thimphu Township in 1986/87

(Quantity in m^3)

Name of Organisation	Apr'86	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan'87	Feb	Mar	Total
Govt. Agencies (Various Departments)	810	-	-	888	804	258	126	-	1819	-	1549	-	6254
R.B.A.+R.B.G.+R.B.P. +IMTRAT	-	-	-	-	-	120	-	-	-	-	1549	-	1669
Private Parties	-	-	-	-	552	291	-	-	-	-	-	-	843
Contractors	-	-	-	-	-	390	-	-	270	-	180	-	840
											Grand Total:		10354
											Average Per Month:		780

* Green trees felled after paying royalty and converted to fuelwood and supplied to the urban population.

Table 7: Firewood Supply to the Villagers Around Thimphu Township in 1986/87

(Quantity in m^3)

Name of Organisation	Apr'86	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan'87	Feb	Mar	Apr	Total
Villagers	-	867.1	-	241.4	123.6	60	161.9	-	166.7	-	5076	-	-	6696.7
											Grand Total:			6696.7
											Average Per Month:			558

Source: Thimphu Forest Division.

Note:

a) Dead and fallen branches collected by villagers free of cost are not included in the calculation.

b) The above calculation reflects only the volume of green trees, usually of the oak species, extracted for fuelwood.

c) Villages near Thimphu Town are included and remote villages are not included.

Table 8: Blockwise Growing Stock, Timber, and Residual Yield in Thimphu District

Block	Growing Stock (in 1000T)	Annual Yield* (T)	Log Volume (T)	Residual Volume (T)
Naro	3490.6	83076.7	41538.4	14538.4
Teobesa	8188.3	194882.3	9744.1	3410.4
	2346.1	84929.8	42464.9	14862.7
Kawang	2510.5	597489.0	29874.5	10456.1
Chang	3099.3	73763.8	36881.9	12908.7
Barpa (Babisa)	3293.0	78350.4	39175.2	13711.3
Geyni	2189.3	52104.5	26502.3	9118.3
Mewang	4635.5	110324.6	55612.3	19306.8
Dagala	1361.4	32402.2	16201.1	5670.4
Babesa	738.7	17582.2	8791.2	3076.9
Lingshi	6595.2	156965.9	78482.9	27469.0

Source: Thimphu Forest Division.

Growing Stock	=	Total standing volume in forest
Annual Yield	=	Total annual timber (standing) to be removed (total annual increment)
Log Volume	=	Log (timber)
Residual Volume	=	Residue left after removing prime timber to be used for fuelwood

* Yield calculated on the basis of 2.38 per cent of the growing stock of conifers and 3.62 per cent of the growing stock of broad-leaved species.

Table 9: Blockwise Supply - Demand Projection for Fuelwood in Thimphu District

Block	Population 1987	Consumption Rate m^3	Total Consumption m^3	Fuelwood Availability m^3	Surplus/ Deficit (-) m^3
Babesa	2244	1.01	2486.0	13711.3	11225.4
Chang	3741	2.15	8043.2	12908.7	4865.5
Kawang	8346	1.88	15726.1	40800.4	25074.3
Mewang	8373	2.64	22104.7	19306.8	2797.9
Teobesa	6424	1.77	11370.5	18273.2	6902.7
Dagala	912	4.00	3648.0	5670.4	2022.4
Geyni	1144	4.00	4576.0	9118.3	4542.3
Lingshi	1113	4.00	4452.0	27469.0	23017.0
Naro	525	4.00	2100.0	14537.2	12437.2
Soy	476	4.00	1904.0	3076.9	1172.9

Source: Household Survey by the Author.

Note: Consumption rate of $4m^3$ per year assumed for Alpine *Gewogs*.

The demand for and supply of fuelwood have been projected in Table 10 for the years 1992, 2002, and 2012. Since the per capita fuelwood consumption rate and fuelwood availability are assumed to be constant for all these years in the future, the surplus is projected to decline over time for nine blocks and the deficit to continue to grow in one block. In the year 2012, five out of 10 blocks would have deficits in fuelwood supply.

Energy Supply in the Alpine Zone

The four blocks in the alpine zone are virtually cut off from the rest of the district because these blocks are inaccessible by motorable roads. The people living in these blocks are mostly nomadic and they depend on yaks to earn their living. Winters are very severe in this area and the people need a lot of fuelwood for room heating.

As stated earlier, forests in these blocks are far away from the villages, and this makes it difficult for the people to acquire sufficient fuelwood. The solution to the fuelwood problem in this area is to find alternative energy sources. Photovoltaic systems have been suggested as one of the alternatives for this area. However, the end use is mostly limited to lighting. Moreover, the cost of installing a photovoltaic system is estimated to be Nu. 13,000 which most local people cannot afford. Therefore, installing photovoltaic systems in these areas is not a feasible solution to the energy problem.

Creating village woodlots is another possible alternative for solving the energy problem. However, even this alternative is not very appropriate because villages are small in size and are scattered, the people are nomadic in nature, the number of yaks is high, which makes the protection of plantations difficult, and, since most areas lie above the natural tree line, it is difficult to find suitable tree species for the area.

Strategies to Improve the Fuelwood Supply in Thimpu

It will be hard to find a substitute to fuelwood in Thimpu District for many years to come. Thimpu has sufficient forest resources to meet the current demand for fuelwood. However, with an increase in population, the demand for energy will increase, thus putting more pressure on existing energy resources. Given this situation, the following strategies should be adopted so that the district does not face any energy problem.

Charcoal Production and Use

The best alternative for solving the energy problem in these areas would be to convert the wood into charcoal and distribute it to meet the energy needs for domestic cooking and heating. In addition, the villagers should be trained to use improved cooking-stoves to save energy.

There are large areas of forests in this zone which are located far away from the settlements. Transporting firewood from these forests would be time consuming and cumbersome. Charcoal is easy to handle and can be easily transported over long distances. It has high calorific value and can be stored for a long period. Trees felled on a selection basis and available tops can be converted into charcoal at the forest site. Charcoal can then be transported to the villages by mule. The production of charcoal should be done under the supervision of the forestry staff so that over-extraction of timber is avoided.

Table 10: Projection of Population, Fuelwood Consumption, and Fuelwood Availability in Different Blocks of Thimphu District in 1992, 2002, and 2012

Population	Consumption Rate	Total Consumption	Fuelwood Available	Surplus or Deficit (-)
Year: 1992				
2478	1.01	2503	13711	11208
4130	2.15	8880	12908	4029
9215	1.88	17324	40800	23476
9244	2.64	24401	19298	-5098
7093	1.77	12555	18273	5718
1007	4.00	4028	5670	1642
1262	4.00	5052	9118	4066
1226	4.00	4916	27469	22553
580	4.00	2320	14437	12217
526	4.00	2104	3076	972
Year: 2002				
3020	1.01	3050	13711	10661
5035	2.15	10825	12908	2083
11232	1.88	2116	40800	19684
11269	2.64	29750	19306	-10444
8646	1.77	15303	18273	2970
1227	4.00	4908	5670	762
1540	4.00	6160	9118	2958
1498	4.00	5992	27469	21477
707	4.00	2828	14537	11709
641	4.00	2564	3076	512
Year: 2012				
4488	1.01	4533	13711	9178
7482	2.15	16086	12908	-3178
16691	1.88	31379	40800	9421
16745	2.64	44207	19306	-24901
12847	1.77	22739	18273	-4466
1824	3.50	6384	5670	-714
2288	3.50	8008	9118	1110
2226	4.00	8904	27469	18565
1050	4.00	4200	14537	10337
952	3.50	3332	3076	-256

1. Population projection based on a flat 2 per cent per annum growth rate.

2. Fuelwood available (annual increment) assessment assumed to be equal to 1987 availability as the best of all possible supply scenarios.

Strategies Involved

Efficient Use of Existing Energy Resources. All existing forests should be brought under scientific management so that they can yield timber and fuelwood on a sustained basis. All residues that are not collected for fuelwood should be converted into charcoal and supplied to the users.

Improvement of Degraded Forests. An area of 2,575 ha of forests in various parts of the district is degraded because of the excessive felling of trees for timber and fuelwood in the past. These forests should be included in the afforestation programme.

Establishment of Woodlots on Wasteland. Available wasteland and unproductive land should be planted with fuelwood species in order to supplement the fuelwood supply from the forests. The creation of woodlots is particularly necessary in the fuelwood deficient blocks.

Promotion of Agroforestry and Farm Forestry. Rural households should be encouraged to plant trees on their farm land in order to supplement the fuelwood supply from the forests.

Promotion of Fuel-saving Devices. The average fuelwood consumption in the rural community of Thimpu is $3.3m^3$ per capita per year, and this is much higher than the average consumption of 0.45 m^3 per capita per head in the developing countries. Therefore, fuelwood saving methods and devices should be promoted particularly in the fuelwood scarce areas of the district.

Finding Substitutes for Fuelwood. It is difficult to find a perfect substitute for fuelwood. But efforts should be made so that the rural people can have access to electricity, solar power, and kerosene for lighting.

Improvement of the Fuelwood Distribution System. Fuelwood distribution centres are inadequate in Thimpu District. To improve fuelwood supply a fuelwood depot should be located centrally in each block so that the rural people do not have to spend much time in procuring fuelwood.