ENERGY SUPPLY ANALYSIS

Electricity

The main transmission line to Almora is a 132 kV line from Bhavani in Nainital District. There is a 132/66/33 kV substation in Almora. A 66 kV line from Almora is taken directly to Pithoragarh District. The district itself does not have any electricity generation capacity except for a 20 kW standby diesel generating set and a 55 kW micro-hydel plant in Bageshor which is non-functional at present. Of the 3,056 villages in the district, 1,682 (55%) are supplied with electricity. The extent of electrification in various development blocks in the district varies between 36 per cent and 93 per cent.

Table 2: Control of Forest Area by Different Agencies in Almora

Controlling Agency	Forest Area Hectares	Percentage of Total Forest Area	Estimated Cover (%)	Effective Area (ha)
1. Forest Department	149,481	38	40	59,792
2. District Administration (Civil and Soyam)	182,100	46	10	18,210
3. *Panchayat* Forest	62,799	16	50	31,400
4. Private Forest	52	-	-	-
Total	394,432	-	100	100,402

Source: Department of Forest, Almora District.

The electricity consumption in the district by different sectors is given in Table 3. The figures for 1985/86 are provisional and show the lower consumption level of electricity for water supply compared to earlier years. In 1984/85, domestic lighting and small electricity use accounted for 41 per cent of the total electricity consumption, followed by water lifting and water supply (37%), industries (16%), irrigation (3%), and commercial lighting (2%). Per capita electricity consumption in the district is around 31 kWh/year.

Table 3: Electricity Consumption in Almora by Sector

S. No.	Sector	Electricity Consumption ('000 kWh/yr)		
		1983/84	1984/85	1985/86
1.	Domestic lighting and small electricity consumption	8991 (37)	9686 (41)	12831 (60)
2.	Commercial lighting and small electricity consumption	390 (1.6)	395 (1.7)	549 (2.6)
3.	Industries	4153 (17.1)	3897 (16.4)	4766 (22.1)
4.	Irrigation	1513 (6.2)	752 (3.2)	811 (3.8)
5.	Water lifting and water supply	8969 (37)	8842 (37)	2451 (11.4)
	Total	24222	23756	21517
Per capita electricity consumption (kWh)		31.98	31.37	28.41

Source: *Sankhiyakia Patrika*, Almora District, 1986.
Note: Numbers in brackets indicate per cent of total.

Kerosene, Coal, and LPG

The annual average consumption of kerosene in the district is approximately 5,500 kilo litres. Kerosene is mostly used for domestic lighting and to some extent for cooking in urban areas. The monthly sales of kerosene from the four major dealers in the district are given in Table 4.

Table 4: Kerosene Sales by Major Dealers in 1987 (in '000 lt)

	January	February	March	April	May	June
1. Almora	223.2	220.8	196.8	212.8	232.2	188.8
2. Ranikhet	33.6	18.0	16.0	28.0	28.0	30.0
3. Ram Nagar	141.6	140.0	138.0	140.0	141.0	85.0
4. Pageshwar	80.0	72.0	70.0	76.0	79.0	141.0
Total	478.4	450.8	420.8	456.8	480.2	484.8

Source: Department of Supplies, Almora District.

Coal is supplied to the district only in the winter and is mostly used for space heating in the government departments. The annual coal consumption in the district is approximately 500 metric tons. The annual sale of LPG is approximately 1,050 thousand kg (65,700 cylinders)

Fuelwood

While the supplies of electricity, coal, kerosene, and LPG are from sources external to the district, fuelwood is available within the district. It is supplied through commercial as well as informal marketing systems. In rural areas it is also gathered for personal use. Hence, an accurate estimation of its supply is difficult. The commercial supply system is managed at the State level by the Forest Corporation of India (FCI) set up in 1974 to facilitate the scientific management of forest produce. The corporation pays royalty to the Forest Department to harvest the forest produce. The felling, processing, and transportation to its depots located in the foothill towns are managed by FCI. Wood is stacked in four categories: 1) softwood, 2) hardwood, 3)fuelwood, and 4) mixed wood. The wood is auctioned or sold through a private contract system. In 1981/82, a total of 111,462 m^3 (74308 tons dry weight) of fuelwood was harvested by FCI.

The informal system of fuelwood use is based on the right of the hill population to collect fallen dry twigs from the reserve forest area for their own consumption. The poor economic level of rural population and the scarcity of other fuel sources have prompted the rural poor to sell dry twigs to urban households and roadside eateries. Fuelwood collection is carried out exclusively by women and is restricted to reserved forest areas allotted to the villages. There are also dealers who purchase fuelwood from individual collectors and resell at higher prices.

Fuelwood is supplied to the users on the basis of ration cards. A family of up to 5 persons is allotted 100 kg of fuelwood per month and for a family with more than 5 persons the allotment is 200 kgs. However, shortage in supply is common.

Fuelwood is extensively used at the household level *khoya* (milk product used for preparing sweets) preparation industry in rural areas near the towns in Almora District. In some villages, where fuelwood is available at a close distance, about 40 per cent of the families are engaged in this activity.

Energy Supply Analysis

The level of energy supply is calculated on the basis of the total population of the district in the year under consideration. The annual growth rate of population is derived from the decennial growth rate by assuming a compound annual growth rate. Table 5 summarises the level of energy supplies by purpose in Almora District. The detailed calculations are shown in Annex 1.

The supply data analysed here were collected from various district offices. The analysis presented is a simplistic one but indicates the levels of energy consumption. The supply level of fuelwood is underestimated as the fuelwood collected by the rural households is not included.

Table 5: Energy Supply Levels by Source in Almora District

	Item	Unit	Number
1.	Electricity for lighting	kWh/hh/day	0.218
2.	Kerosene for lighting	kl/hh/day	8.27×10^{-5}
3.	Energy use for lighting	kcal/hh/day	813
4.	Kerosene for cooking	kl/cap/day	2.063×10^{-6}
5.	Fuelwood for cooking and space heating	kg/cap/day	1.3
6.	Energy use for cooking and space heating	kcal/cap/day	5815
7.	Water lifting	kWh/cap/day	0.03
8.	Irrigation	kWh/ha irr/annum	33.46

Source: Author's estimation based on the level of consumption of different energy items.

Biomass Resources

Biomass energy resources include forest fuelwood and crop residues useful for fuel and animal dung. Sewage and human excreta can also be included as energy resources in this group. However, because of the constraints in their immediate present use, these have not been discussed. Crop residues that contain rice husks are usually used as fuel. But considering the existing cropping patterns, rice husks may only be available on a limited scale in the district for energy purposes. Unlike in the plains, dungcakes are not used for fuel purposes in Almora District.

In 1981, the reserved forests had produced 36,349 m^3 of timber and 111,462 m^3 of fuelwood. The present demand for fodder and fuel is much higher than can be used in an environmentally sound manner. According to a Forest Department study, the fuelwood requirements of 900,000 residents at the rate of 0.65 ton per capita per annum will be 585,000 tons, i.e., 1,500,000 m^3 stacked (1 ton = 1.6 m^3 solid and 1 m^3 solid = 1.6 m^3 stacked). From Annex Table 2, assuming a conversion of 1 m^3 of fuelwood (stacked) for 1 m^3 round of timber, we can estimate a productivity of 2,60,000 m^3 stacked. This is only 16 per cent of the requirement. Thus, the forest cover is depleting at a very fast rate. According to the Forest Department, two thirds of the forest area (269,120 ha.) are suitable for grazing. This area is adequate to support 538,240 annual units of animals whereas the actual number of animals is five times higher. The data on deforestation caused by timber harvesting is not available. At present biomass resources for further exploitation on a commercial scale can be ruled out. The development of these resources has been attempted through social forestry and other afforestation programmes.

Wind Potential

The nearest station for which wind speed data is available is Mukteshwar in Nainital District. Since Almora does not have any wind station, this station is assumed to be representative for our analysis. The potential for wind electric generation in the district is estimated at 954 MkWh.

Solar Energy

In the hills the availability of solar radiation depends on the slope and the direction of settlement. Radiation data are available for one solar station in the district. Similar data can be collected and used for estimating the potential for using solar radiation for cooking, space heating, lighting, pumping,etc.