

Detailed Calculations of Energy Supply Levels in Almora District

1. *Number of Families and Population in Almora*

	Decennial Growth Rate (%)	Annual Growth Rate (%)*	Number		
			1981	1986	1987
Families	12.58	1.19	151,608	160,846	162,760
Population	16.77	1.56	757,373	818,320	831,086

Note: Decennial growth rate is converted into annual growth rate by assuming compound growth rate.

2. *Electricity Supply*

- a) Total domestic consumption of electricity = 12,831,000kWh
Assuming that entire domestic electricity consumption is for lighting'
the annual electricity consumption for lighting per household = 79.77kWh
- b) Annual consumption of electricity for drinking water supply = 9,089,549kWh
Annual consumption per capita = 10.9kWh
- c) Annual consumption of electricity for irrigation = 343.92kWh
Total irrigated area = 10,280 ha
Annual consumption per ha of irrigated land = 33.46kWh

3. *Firewood Supply*

Average family size = 5.1
Wood allotment per family per month = 200kg
Total fuelwood supply per month = 32,552 tons
Annual per capita supply = 470 kg
Energy per kg of wood = 4,500kcal
Annual energy consumption per capita from firewood = 2,116,800kcal

4. *Coal Supply*

Annual consumption of coal = 550 tons
Since coal is used for space heating during winter months (October-March), we can assume that this consumption is for six months only.

Coal Consumption per day = 3,005 kg
Energy per kg of coal = 4,000 kcal
Energy consumption per day from coal = 1.202×10^7 kcal

5. Kerosene Supply

Total annual kerosene sale = 5543.6 kl

In the State of Uttar Pradesh 88.7% of the total kerosene consumption is used for lighting and 11.3% is used for cooking. We assume that this consumption pattern holds for Almora District as well.

Total kerosene supply for lighting = $88.7\% \times 5543.6 = 4917.2 \text{kl}$

Total kerosene supply for cooking = $11.3\% \times 5543.6 = 626.4 \text{kl}$

Annual kerosene consumption per household for lighting = 30.2 lt

Energy consumption per household from kerosene used for lighting = $30.2 \times 9100 \text{kcal/kg} \times 0.83 \text{kg/lt} = 228,100 \text{ kcal}$

Annual kerosene consumption per capita for cooking = 0.753lt

Energy consumption per capita from kerosene used for cooking = $0.753 \text{lt/cap} \times 9,100 \text{kcal} \times 0.83 \text{kg/lt} = 5,687 \text{ kcal}$

Table 1: Selected Statistics of Almora District by Development Block

Block	Area (Km ²)	No. of Villages	Avg. Area Per Village (sq km)	Population (as in 1981)	Avg. Population Per Village	Population Density (Per sq.km)	Literate		Land Under Cultivation (in ha)		Irrigated Area (in ha)	Pump Sets	Fertiliser Consumption (kg/ha)	Cows No.	Buffaloes No.	Electrified Villages (%)
							Men (%)	Women (%)	Rabi	Kharif						
Takula	315	158	1.99	53971	342	171	56	23	4112	7452	11564	5	3.6	23818	10777	74
Dhaura Devi	323	242	0.75	52930	219	164	36	10	4376	6838	11214	-	3.4	21817	9872	36
Bhasiyachanna	376	90	4.20	29736	330	79	47	13	3541	5658	9199	-	4.1	11494	5281	43
Langara	213	207	1.03	39205	189	184	42	13	4281	6905	11186	-	5.8	15907	7198	51
Hwalbagh	204	234	0.87	50712	217	249	51	24	4562	6934	11396	14	2.9	21460	9711	91
Kapkot	1416	214	6.62	62301	291	44	51	11	5668	9141	14809	-	3.6	39102	14747	43
Garur	215	189	1.14	49585	262	231	58	17	5392	7007	12399	1	6.9	31827	12003	86
Bageshwar	440	395	1.11	58550	148	133	65	22	5339	7107	12446	5	8.4	38765	14617	37
Chankhuti	181	171	1.06	47863	280	264	61	24	4794	6927	11721	2	10	20791	8650	70
Tarikhet	234	267	0.88	58746	220	251	63	24	5798	7438	13236	5	3.3	25430	10579	47
Dharahat	307	212	1.45	57109	269	186	60	20	6378	8008	14386	5	3.1	26120	10866	69
Bhikiaren	167	202	0.83	40545	201	243	59	20	4851	7492	12343	4	1.8	19005	7906	69
Syaldeh	244	194	1.26	48369	249	198	58	17	5998	9014	15012	3	2.5	21487	8940	47
Sult	305	258	1.18	57481	223	188	51	13	7248	11014	18262	-	2.3	26943	11222	47

Table 2: Species and Growing Stock, East and West Almora Forest Division

Species (Local/English Name)	Botanical Name	Potential Increment (m ³)	Annual Number of Trees (1000)	Total Volume (1000 m ³)
Chir/Pine	<i>Pinus roxburghii</i>	175,020	21,105	13,490
Banj/Oak	<i>Quercus spp.</i>	3,570	451	238
Sarai/Himalayan or Bhutanese Cypress	<i>Cupressus torulosa</i>	844	65	132
Utis/Alder	<i>Alnus spp.</i>	649	97	33
Chamkharik	<i>Caspinus vimiensa</i>	643	285	64
Putti/Maple	<i>Aoer spp.</i>	388	338	86
Fir/Silver Fir	<i>Abis/Pindraw</i>	338	151	202
Pangar/Horse Chestnut	<i>Aesculus indica</i>	274	80	45
Kathbhoj/Alder Birch	<i>Batula alnoides</i>	128	50	31
Deodara/Himalayan Cedar	<i>Cedrus deodara</i>	108	36	23
Samroj/Cherry	<i>Prunus</i>	101	179	4
Others		< 100	255	24
Total		182,000	23,072	14,372

Source: Working Plans, East and West Almora Forest Division, 1981.

Table 3: Gross Energy Needs for Different Agroclimatic Zones

Agroclimatic Zone	Gross Energy Needs kcal/capita/day
1. Arid	1956 - 3260
2. Mountainous	11084 - 13040
3. Dry tropical	3912 - 6520
4. Permanent agriculture in humid tropical areas	5216 - 7824
5. Shifting cultivation in humid tropical areas with high population density	6520 - 9120
6. Shifting cultivation in humid tropical areas with low population density	6520 - 9120

Table 4: Energy Norms from Different Sources

Source	Energy Norms (kcal/capita/day)
NCAER ³	283
NCAER ⁴	265
NSS 32nd round ⁵	228
ITES ⁶	330
Bowonder ⁷	113-567
KVIC ⁸	650
Fuelwood study committee ⁹ of planning commission	685
ABE ¹⁰	620

³ NCAER, Domestic fuel survey, 1978/79

⁴ NCAER, Rural Energy Consumption in North India, 1980

⁵ NSS 32nd round, 1983

⁶ Institute of Techno-economic Studies (ITES), Rural Energy Consumption in South India, 1981

⁷ Dr. Bowonder of the Administrative Staff College of India, Hyderabad

⁸ KVIC, Gobar Gas: Why and How, 1975

⁹ Fuelwood study committee of the planning commission 1982

¹⁰ ABE, Towards a Perspective on Energy Demand and Supply in India in 2004/05, 1985.

Note: All above figures are quoted by ABE, 1985.

Table 5: Fuelwood Consumption Norms from Different Macro and Micro Studies for Hill Regions

S. No.	Study	Fuelwood (kg/capita/yr)	Equivalent Gross Energy (kcal/capita/day)
1.	NCAER - 1981 (Macro)	239	3111.8
2.	Satsangi - 1983 (Nainital District)	231-897	3006-11673
3.	Agarwal-1980a (Jagaria-H.P.)	2167	28200
4.	Agarwal-1980b (Dharmuchak-Garhwal)	462	6012
5.	Sagar 1981		
	- Chakrate	1116	14523
	- Harrawala	504	6558
	- Kanakundi (Garhwal)	224	2915
6.	Moendi-1985	970	12623
7.	NSS-18th round (Macro)	513	5676
8.	NCAER 1985 (Macro)	294	3831

Source: "Rural Energy Planning for the Indian Himalaya", Kumar and Ahuja; *In Energy Demand and Supply in the Indian Himalaya*. J.P. Painuly, 1986.

Note: Estimated by using a calorific value of 4,750 kcal/kg for fuelwood, same value is taken by ABE, 1985.

Table 6: Population in Electrified and Unelectrified Villages in Different Blocks of Almora District in 1987 and 2001

S.No.	Development Block	Population in Electrified Villages		Population in Unelectrified Villages	
		1987	2001	1987	2001
1.	Takula	53994	66920	5158	6392
2.	Dhaura Devi	56180	70909	2279	2877
3.	Bhasiyachanna	24434	30930	8447	10698
4.	Lamgara	30380	38387	12945	16358
5.	Hwalbagh	38974	50466	17666	22875
6.	Kapkot	48001	62561	21788	28397
7.	Garur	27973	36222	27409	35490
8.	Bageshwar	30739	39198	34194	43603
9.	Chaukhutia	24753	30789	27768	34539
10.	Tarikhet	30023	36830	34060	41783
11.	Dharahat	25805	28999	34206	38441
12.	Bhikiaren	17912	19590	24214	26483
13.	Syaldeh	19326	23474	33219	40349
14.	Sult	21962	25960	39746	46983

Table 7: Number of Households in Electrified and Unelectrified Villages of Almora District in 1987 and 2001

S.No.	Development Block	No. of Households in 1987		No. of Households in 2001	
		Electrified	Unelectrified	Electrified	Unelectrified
1.	Takula	11296	1079	13122	1253
2.	Dhaura Devi	11753	477	13904	564
3.	Bhasiyachanna	5112	1767	6065	2098
4.	Lamgara	6356	2708	7527	3207
5.	Hwalbagh	8154	3696	9895	4485
6.	Kapkot	10042	4558	12267	8397
7.	Garur	5852	5734	7102	5568
8.	Bageshwar	6431	7154	7686	6959
9.	Chaukhtia	5178	5809	6037	8550
10.	Tarikheth	6280	7126	7222	6772
11.	Dharahat	5399	7156	5686	8193
12.	Bhikiaren	3747	5066	3841	5193
13.	Syaldeh	4043	6950	4603	7912
14.	Sult	4595	8315	5090	9212

Table 8: Fuelwood Consumption in Cooking and Space Heating in Different Blocks of Almora District in 1987 and 2001

Block	Consumption in Cooking				Consumption in Space Heating	
	1987		2001		1987 (Tons)	2001 (Tons)
	Electrified (Thousand Tons)	Unelectrified (Thousand Tons)	Electrified (Thousand Tons)	Unelectrified (Thousand Tons)		
Takula	41.18	4.01	51.04	4.97	21.24	25.50
Dhaura Devi	42.85	1.77	54.09	2.23	19.45	25.66
Bhasiyachanna	18.84	6.57	23.59	8.32	10.25	14.48
Lamgara	23.17	10.07	29.28	12.72	14.18	19.04
Hawalbagh	29.73	13.74	38.49	17.8	19.13	25.51
Kapkot	36.61	16.95	47.72	22.09	22.21	31.63
Garur	21.33	21.32	27.63	27.61	18.08	24.94
Bageshwar	23.44	26.6	29.09	33.93	22.02	28.80
Chaukhutia	18.88	21.6	23.48	26.87	17.75	22.72
Tarikheth	22.9	26.5	28.09	32.51	21.71	27.34
Dharahat	19.68	26.61	22.12	29.91	22.30	23.45
Bhikiaren	13.66	18.84	14.94	20.6	16.22	16.02
Syaldeh	14.74	25.85	17.9	31.39	18.34	22.20
Sult	16.75	30.92	19.8	36.56	23.01	25.37
Total	343.56	251.35	427.26	307.51	242.88	332.66

Table 9: Kerosene Consumption in Lighting and Cooking in Different Blocks of Almora District in 1987 and 2001

Block	Consumption in Lighting				Consumption in Cooking	
	1987		2001		1987 (kl)	2001 (kl)
	Electrified Households (kl)	Unelectrified Households	Electrified Households (kl)	Unelectrified Households		
Takula	226.25	42.40	267.85	50.20	75.05	93.01
Dhaura Devi	211.34	30.70	250.26	36.39	78.09	98.56
Bhasiyachanna	88.86	60.32	105.23	71.40	33.96	42.99
Lamgara	116.06	97.04	137.40	114.91	42.22	53.35
Hawalbagh	153.65	136.68	181.93	161.83	54.17	70.14
Kapkot	178.33	158.82	211.16	188.07	66.72	86.95
Garur	106.58	204.92	126.22	242.66	38.88	50.34
Bageshwar	121.67	265.61	144.07	314.52	42.72	54.48
Chaukhutia	97.62	214.87	101.30	282.51	34.40	42.79
Tarikheth	118.69	264.23	140.53	312.89	41.73	51.19
Dharahat	111.98	291.04	132.50	344.66	35.86	40.30
Bhikiaren	80.50	213.57	95.32	252.90	24.89	27.23
Syaldeh	78.74	265.57	93.23	314.52	26.86	32.62
Sult	95.57	339.38	113.14	401.85	30.52	36.08

Table 10: Electricity Consumption in the Domestic Sector and for Water Supply in Different Blocks of Almora District in 1987 and 2001

Sl. No.	Development Block	Consumption in Domestic Sector		Consumption for Water Supply	
		1987 (Th.kWh)	2001 (Th.kWh)	1987 (Th.kWh)	2001 (Th.kWh)
1.	Takula	871.80	1032.22	587.45	728.08
2.	Dhaura Devi	814.45	964.41	611.23	771.48
3.	Bhasiyachanna	342.45	405.55	265.04	336.51
4.	Lamgara	447.27	529.5	330.53	417.65
5.	Hawalbagh	592.13	701.09	424.03	549.07
6.	Kapkot	687.21	813.73	522.25	680.66
7.	Garur	410.73	486.43	304.34	394.09
8.	Bageshwar	468.88	555.19	334.44	426.47
9.	Chaukhutia	376.19	390.39	269.31	334.98
10.	Tarikhhet	457.40	541.55	326.65	400.71
11.	Dharahat	431.15	510.60	280.75	315.50
12.	Bhikiaren	310.22	367.34	194.88	213.13
13.	Syaldeh	303.44	359.23	210.26	255.39
14.	Sult	368.29	436.02	238.94	282.44