INTRODUCTION

Background

The severity of the energy problem in the villages of the mountainous areas of Pakistan has increased over time, despite the Government's efforts to improve the availability of energy through numerous means. The extension of the grid to rural areas and the introduction of new technologies for both energy production and use has brought a new dimension to energy development in the mountains of Pakistan, but the benefits of the improved technologies have remained limited both in terms of the target population and area coverage. Further, with the increasing mountain population, the pressure on traditional forms of energy, particularly fuelwood, has assumed crisis proportions with major economic, social, and ecological consequences. The depletion of forests caused by reckless exploitation has led to an increase in the market prices of fuelwood and is causing greater hardships, forcing the village population to travel greater distances to obtain wood.

The realisation of the necessity for taking energy needs into account in rural development planning at national and international levels during the last few years. However, the importance of the planning and management of energy at regional or district level and its integration with rural development has emerged only recently. A pilot project to address these aspects was initiated by the International Centre for Integrated Mountain Development (ICIMOD) in April 1987. The project conducted case studies in five countries: China, India, Nepal, Bhutan, and Pakistan. This case study on Rural Energy Planning in the Swat District of Pakistan was a part of that project.

Objectives of the Study

The overall objectives of the study were to analyse the energy situation in the Swat District of Pakistan and to assess the extent of community participation in energy conservation and planning. The specific objectives are stated below.

- To assess the energy situation in Swat District.
- To analyse the consumption pattern of both traditional and commercial sources of energy.
- To determine the current demand and project future demand for different types of energy.
- To examine the supply situation under various scenarios.
- To analyse the importance of community participation in energy conservation and planning and identify measures to enhance the level of participation.
- To recommend an institutional framework for energy planning and development in light of the lessons learned in Swat District.

Methodology

Database Generation

A number of surveys were conducted during the course of this study to generate an energy data base. These surveys included the topics discussed below.

Union Council Energy Survey. A survey of all union councils (69), consisting of 537 electoral wards, was conducted with the help of the Department of Local Government of the North West Frontier Province

(NWFP) in Swat District to assess the energy supply pattern along with the potential for future development in each electoral ward. In addition to this survey, the energy supply potential of the district was also assessed from the data obtained from secondary sources such as the Department of Forests and from previous government reports on hydroelectric potential.

Household Energy Survey. A household energy survey was conducted in five villages located at three different altitudes, i.e., high altitude (above 9,000 ft), medium altitude (5,000 ft to 9,000 ft), and low altitude (below 5,000 ft). The five villages also had varied energy characteristics, i.e., two of these had no electricity connections and were not accessible by all-weather roads. Among the remaining three villages, two had grid electricity while the third had a micro-hydel plant. These three villages were accessible by all-weather roads.

The survey was conducted in two stages. During the first stage a rapid appraisal was made of the socioeconomic status of the households in these villages. The households were then classified into three groups, i.e., high income, medium income, and low income. From each of these three strata, 20 per cent of the households were selected by random sampling for administration of the questionnaire.

Electricity Consumption Data. Electricity consumption data in the district, by sector, was collected from the Water and Power Development Authority (WAPDA). The data on grid stations and villages electrified were also obtained from the same source. Similarly, the data on micro-hydels were obtained from relevant government organisations, including the Pakistan Council for Appropriate Technology (PCAT) and the Small Hydel Development Organisation (SHYDO).

Petrol/Diesel Consumption Data. A survey of filling stations was carried out in the district to find out the total petrol/diesel sale. The survey was deemed essential because this information could not be obtained from the household survey which had covered only the resident population and had omitted outside consumers passing through the district.

Survey of Energy Use in Small Industries. A rapid appraisal of small industries, which are major consumers of energy, was made to assess their energy consumption pattern in the district.

Energy Marketing Survey. A rapid appraisal was carried out to obtain details of the commercial energy supply system in the district, and this formed the basis for estimating the current demand as well as the present and future supply of energy sources in the district.

Survey of a Community's Felt Energy Needs. A community felt needs' survey was conducted in one of the local government units to demonstrate a methodology that could be used not only to assess the community's felt needs for the development of energy but also to involve the community in the energy planning and management process. The unit selected for the study was a union council (Charbagh Union Council), the lowest tier of local government in the district.

Application of an Econometric Model for Demand-Supply Balancing in the Energy Sector. An econometric model was applied to estimate energy needs, by sector, in the rural areas of Swat District. The following is the equation used:

$$Qj(t) = Qj(o) \times \left(1 + \frac{\text{Price variation}}{100}\right)^{P.E.} \times \left(1 + \frac{\text{Sectoral growth in GDP}}{100} \Big/ 1 + \frac{\text{Population growth}}{100}\right)^{I.E.}$$

Where, Qj(t) = The demand for fuel j at time t
Qj(o) = The demand for fuel j in the base year
P.E. = Price Elasticity
I.E. = Income Elasticity

The population growth rate, sectoral growth rates, and the increase in energy price are assumed to follow historical trends. In addition, government policies also affect energy price. Price and income elasticities in the future will reflect past trends. The software package used for the analysis was Lotus 123 on an IBM PC. The conceptual framework for the case study is shown in the flow chart in Figure 1.

Organisation of the Report

The study is divided into three main parts. The first part outlines the objectives and methodology of the study, describes the organisation of the report, and gives a description of the project area. The second part analyses the use pattern of energy resources which, for the purpose of discussion, has been classified into three major groups, i.e., biomass, electricity, and fossil fuel. The current energy demand as discerned from the use pattern, has then been projected for the next five years (Seventh Five Year Plan period: 1988-93) in the third part of this study. The projected demand thus obtained has been balanced against the various supply options. The account of the demand/supply scenario in the district has been followed by a section on demand/supply management. This section covers important aspects of community participation and institutional arrangements which play a crucial role in the development and management of energy at the district level.

Major Features of Charbagh Union Council (Swat)

Swat District is situated in Northern Pakistan, within the western-most reaches of the Himalayas. The district extends from 34° 10' to 35° 56' north latitude and from 72° 07' to 73° 0' east longitude. The total area of Swat District is 8,788 km^2.

The microclimate of the district varies considerably depending upon slope, altitude, aspect, and local winds. The district has cold winters which are more severe in the uplands. Summers range from hot in the lower southern portion of the district to cool at higher elevations.

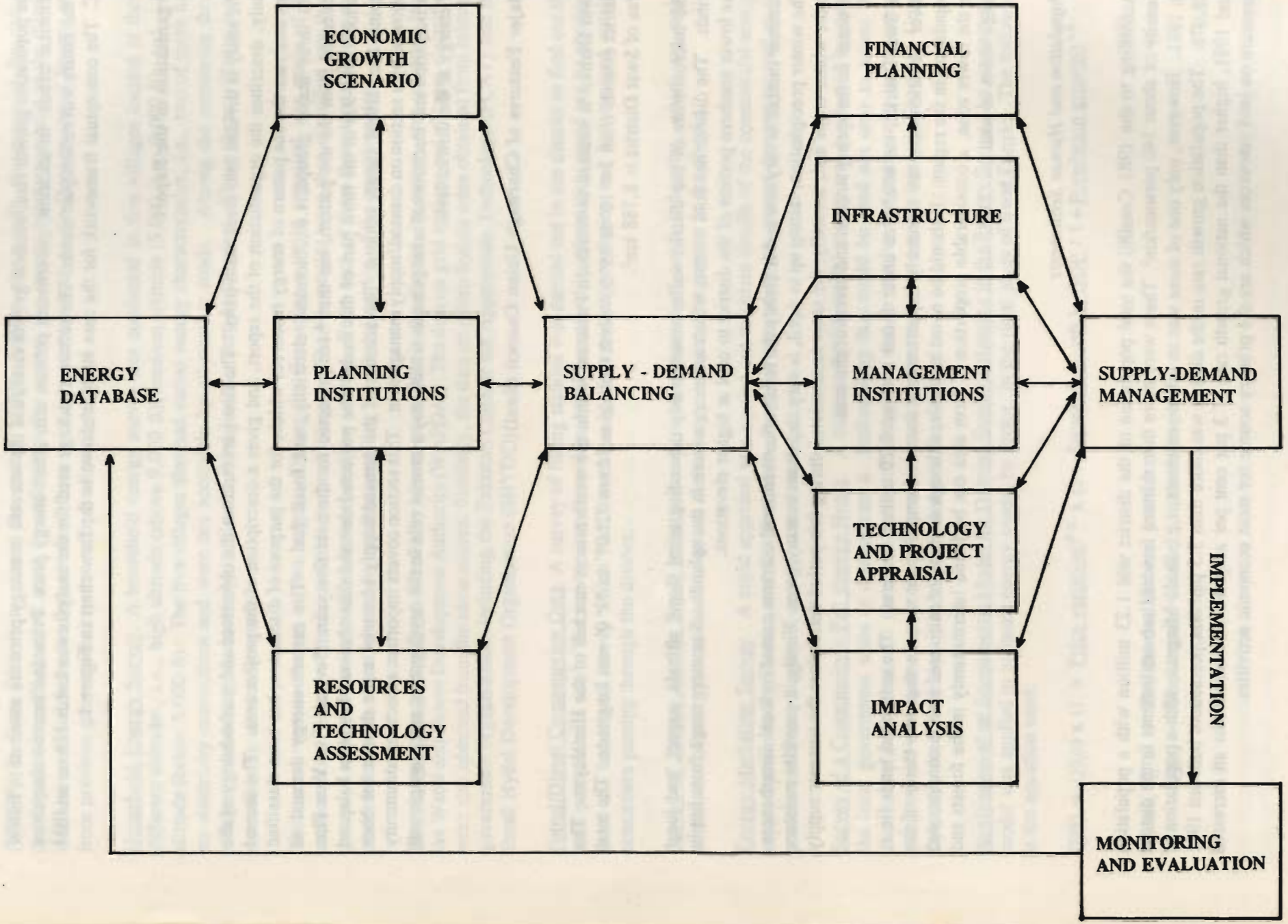
Summer rainfall is very low and is mainly the result of conventional currents caused by local disturbances. The winter precipitation, lasting up to April, is very important in many ways. Firstly, it provides moisture to the winter crops and, secondly, the snow accumulated during this period determines the summer supply of water in the spring streams and rivers of the area.

In Swat District, the total area under forest is about 0.20 million hectares. The cultivated lands lie at lower elevations and are extremely important as a source of employment to more than two-thirds of the population in the region. It should be noted here that, although the bulk of cultivated land is concentrated in the lower zone, a considerable proportion of farm area can be found intermittently in the forests and range zones as well.

Population and Human Settlements

According to the 1981 Census, the total population of the district was 1.23 million with a population density of about 140 persons/km^2. There were more than thirteen hundred sub-settlements in the district in 1981. However, only one of these was an urban settlement, i.e., Saidu-Mingora, with a population of 88,078. The population growth rate in the district was more than 3.5 per cent per annum between 1961 and 1981, higher than the national growth rate of 3 per cent per annum. The result was an increased pressure on land resources which are the primary source for most economic activities.

FIG. 1. DISTIRCT RURAL ENERGY PLANNING PROCESS



The growth rate of the urban population in the valley was extremely high. Saidu-Mingora reported a growth rate of almost 10 per cent per annum between 1972 and 1981. The rural population in the same period had grown at a rate of 3.26 per cent per annum. In 1981 it was 1.15 million and it is currently estimated at 1.39 million. The rural population is dispersed throughout 1,208 villages. Nineteen of these had a population of more than 5,000 each. However, the majority of these villages were small with more than half (624) having a population of less than 500. The district now has two urban settlements and 1,316 rural settlements.

Economy

According to the 1981 Census (GOP 1981), the labour force (both those working and looking for work) constituted 27.5 per cent of the total population in Swat District. The labour force participation rate was higher for rural areas (27.5%) than for urban areas (24.1%). The open unemployment rate was also low for the rural areas and was only 4.2 per cent as opposed to 9.6 per cent in the urban areas. More than 77 per cent of the working population of the district are engaged in agriculture, forestry, hunting, and fishing.

The other important economic activities are "community, social, and personal services", "wholesale and retail trade", and "restaurants and hotels", which employ 8.5 per cent and 4.7 per cent of the total working population of the district respectively. Manufacturing is another non-farm sector that offers employment to a large number of people.

The number of industrial units in Swat District are 46, out of which 2 are pharmaceutical units (NESPAK 1984), 39 are silk mills, and 5 are miscellaneous industrial units. These 46 industries constitute 20.08 per cent of the total number of registered units in the NWFP.

Bee-keeping is the biggest cottage industry in the district. More than 6,000 rural families are engaged in producing about 200,000 pounds of honey and beeswax annually.

Communication and Transportation

Swat has a very good network of roads. Even the remotest areas are connected by roads. The total length of the roads in the district is 542 miles, out of which these 242 miles of good quality roads and 300 miles of inferior quality roads (GOP 1981).

Telecommunication services are available in the important villages and towns. Currently, there are 83 post offices and 23 telegraph offices in the district. There is no railway network but a regular air service operates between Mingora and Peshawar.

Energy Sources for Domestic Use

According to the household census of 1980, three-quarters of the households used kerosene, one-fifth used electricity, and the remainder used unspecified sources for lighting. Within the urban areas, 71 per cent of the housing units used electricity and 29 per cent kerosene for lighting. In the rural areas, 78 per cent of the housing units used kerosene, 17 per cent electricity, while the remaining 5 per cent used unspecified sources for lighting. Regarding cooking fuels, wood/brushwood was used by 94 per cent of the housing units, 4 per cent used dungcakes, and only 1 per cent used kerosene. Among the rural dwellers, 95 per cent used wood/brushwood, 4 per cent depended upon electricity, and only 1 per cent on other fuels. In the urban areas, 71 per cent of the people used wood/brushwood; however, the percentage of urban dwellers using kerosene for fuel was comparatively high (21%).