TWO LEVEL MULTI-OBJECTIVE RECONNAISSANCE SYSTEM STUDY OF A LARGE WATER RESOURCE SYSTEM

By

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CERTIFICATE

This is to certify that the thesis entitled, 'TWO LEVEL MULTI-OBJECTIVE RECONNAISSANCE SYSTEM STUDY OF A LARGE WATER RESOURCE SYSTEM' being submitted by Mr. Umesh C.Chaube to the Indian Institute of Technology, Delhi, India, for the award of the degree of DOCTOR OF PHILOSOPHY, is a record of bonafide research work carried out by him under my supervision and guidance. The thesis work, in my opinion, has reached the standard, fulfilling the requirements for DOCTOR OF PHILOSOPHY degree. The research report and the results presented in this thesis have not been submitted, in part or in full, to any other University or Institute, for the award of any degree or diploma.

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(Umesh C.Chaube)

ABSTRACT

Reconnaissance study of a large water resource system involves analysis of subsystem characteristics and subsystem interlinkages in terms of total system development objectives. Linear optimization models are developed to represent, (a) aggregate temporal and spatial characteristics of the system, (b) predominant policies namely irrigation and energy development and, (c) the related issues and technological options, in physical terms. A large system is viewed in terms of several constituent subsystems (natural and administrative planning regions) in which Level-I study relates to irrigation and energy development at subsystem level and Level-II study relates to irrigation and energy development at system level.

At Level-I, irrigation development in the tributary subsystems is analysed to study (a) implication of level of projects' development, (b) implication of resource conservation measures like canal lining, improving irrigation efficiency and reducing evaporation losses, (c) implication of conjunctive use of surface and ground water (natural and artificial aquifer recharge), (d) implication of crop water demand and (e) trade-off between irrigation under different crops.

Energy development in the tributary subsystems is analysed to study, (a) implication of energy demand distribution over different time periods, (b) effect of evaporation loss on energy generation and, (c) trade-off between energy and irrigation.

At Level-II, irrigation development in the system is analysed to study, (a) implication of water demand at the system boundary,

(b) implication of administrative constraints within system and, (c) implication of level of development in some planning regions within the system.

Energy development at system level is analysed to study, (a) coordinated energy generation when seasonal demand distribution is constrained at system level and, (b) its trade-off with irrigation and water demand at system boundary.

These Level-I and Level-II studies have been carried out in the context of developmental planning of Ganga basin which is a very large system (population 259.51 Million in the year 1971; land area 117 Million Sq. Km. and total annual runoff 549,930 MCM). There are several large natural and administrative planning subregions in the basin. The basin is characterised by predominant agriculture based economy and temporal and regional hetrogeneity in the resource availability and demand pattern. The study brings out relative impact of various issues on the irrigation and energy policies in planning subregions (natural and administrative) and trade-offs which would form the basis of further creative development and detailed systems analysis.