

SECTION I INTRODUCTION

AUTHORITY FOR STUDY

Wright Water Engineers has performed this study for the Office of Technology Assessment under Contract 133-2060.0.

GENERAL PURPOSE AND OBJECTIVES

Development of a major synfuel industry in the United States in order to reduce our dependence on imported oil is now a national goal. Achievement of this goal is dependent in part on water availability. Water availability for energy development has been the subject of a number of recent studies with conflicting conclusions and forecasts.

" In order to resolve some aspects of these conflicting studies, the Office of Technology Assessment commissioned the study herein to: (1) describe and analyze the hydrologic, institutional, legal and economic issues involved in assessing and interpreting estimates of water availability for synfuels development, and (2) evaluate the adequacy of currently used estimates of water availability as a basis for energy planning.

THE STUDY METHOD

Four major river basins were selected by OTA for this study: Upper Mississippi, Ohio/Tennessee, Upper Missouri, and the Upper Colorado. Major portions of the Nation's oil shale and coal reserves exist within these river basins, and conflicts over water availability for synfuel development can be expected to occur.

These five river basins are extensive, cover a major portion of the United States, and contain many complex water resources problems. Because of the extensive nature of these basins and their water resources problems, and the limited resources of this study, it was necessary to select priority areas within the basins for in-depth analysis and assessment. As a result, the

analysis and assessment herein generally focus on those subareas in each basin which: (1) are in proximity to major energy resources that could be used for synfuel development and (2) may experience increased competition for limited water resources.

Reports and other documents concerning water availability for synfuel development in each of the four basins were reviewed and analyzed with respect to their adequacy for decision-making purposes. In general, two types of reports were reviewed: (1) a site specific report concerning the adequacy of water resources at a specific location for development of a particular synfuel plant, and (2) a much more general report concerned with the adequacy of a region's or river basin's water resources for development of an extensive synfuel industry in the future.

The second category of reports is the major concern of the analyses herein. These reports and studies are intended to be of use for making policy and programmatic decisions concerning the synfuels industry by: (1) governors, their staffs, and state legislators; (2) Congress; (3) the White House and Federal agency officials; and (4) energy companies. Therefore, our review and analysis concentrates on the usefulness and effectiveness of the reports for programmatic and policy decisions by these categories of decision-makers.

Substantial differences in water availability exist among the four river basins studied. In addition, there is considerable disparity in the complexity of legal, institutional, political, and economic constraints among the basins. The volume of water available for synfuel development is much smaller in the Upper Colorado and Upper Missouri Basins than in the Upper Mississippi and Ohio/Tennessee Basins. In addition, there are more legal, institutional, political, and economic constraints affecting water availability in the Upper Colorado and Upper Missouri than in the eastern basins. Therefore, in addition to reviewing the major reports concerning water availability for synfuel development in the Upper Missouri and Upper Colorado basins, case studies of these two basins have been completed. The

purpose of these two case studies is to analyze and illustrate more thoroughly the ramifications of the legal, institutional, political, and economic constraints on water availability for synfuel development in these two western basins.

BACKGROUND

A major effort of the analyses herein is to assess the soundness of the data and forecasts concerning water availability for synfuel. Various areas of expertise are required for analyzing these data and forecasts: hydrology, water law, water resources planning, etc. Some familiarity with terms and concepts associated with these disciplines is necessary to understand the analyses and discussion presented herein. Brief discussions of water law and hydrology necessary for understanding water availability for synfuel development are presented elsewhere and will not be repeated herein. For example, the Office of Technology Assessment Report, "An Assessment of Oil Shale Technologies," presents an excellent discussion in Chapter 9 of the doctrine of prior appropriation, federal reserve rights, interstate compacts on the Colorado River, etc. The General Accounting Office report, "Water Supply Should Not be an Obstacle to Meeting Energy Development Goals" also presents a glossary of terms concerning water supply for synfuel development. Because of the availability of this general material elsewhere, an effort will not be made herein to include a complete introduction to terms and concepts necessary for understanding analyses of water supply availability for synfuel development. A few terms and concepts, however, are presented in order to provide a reader who may be unfamiliar with water resources and water law terms and concepts with a basic introduction necessary for understanding the analyses herein:

Annual Flows - The quantity of water (generally measured in acre-feet) to flow past a specific point in a river or stream during a period of one year. Annual flows are used frequently in assessing water availability for synfuel development but do not provide any indication of the variation in flow throughout the year, especially low flows.

Appropriation - The taking and applying of a specific amount of water for a specific use. Under the prior appropriation doctrine a state entity establishes dates for seniority rights for water use.

Consumption - That part of water diverted which is no longer available because it has been either evaporated, transpired, incorporated into products and crops, or otherwise removed from water the environment.

Depletion - Basically the same as consumption, i.e., that part of water diverted which is no longer available because it has been either evaporated, transpired, incorporated into products and crops, or otherwise removed from the water environment.

Diversion - A withdrawal of water from a natural source by artificial means. Irrigation, mining, municipal, and manufacturing needs for water all require diversions.

Mean Monthly Flows - The average amount of water to flow past a specific point in a stream or river during a particular month (generally measured in acre-feet). Mean monthly flows provide some indication of the variation that exists in flows throughout a year. Mean monthly flows do not, however, give an indication of minimum flows during critical periods--for example, the flow that could be expected to occur during the driest seven-day period in ten years.

Minimum Low Flow - Numerous statistical parameters are used to describe minimum low flows, e.g. the seven-day, ten-year low flow; the monthly flow which has an 80 percent chance of exceedance in any one year; etc. All of these-parameters are an effort to provide some indication of minimum low flows during critical dry periods.

Operational Hydrology - A statistical procedure to generate long stream flow records (e.g. 10,000 years of monthly flows) which will preserve important statistical parameters of the historic record while providing a number of

different sequences of flow not present in the historic record. Operational hydrology is used to evaluate proposed management, development, and projects in water resource systems.

Synthetic Fuel Plant Water Demand - This refers to the estimated consumptive use requirement of a synfuel plant. This requirement is estimated based on thermodynamic and production properties of a proposed plant. The demand is generally expressed in acre-feet per year and will be relatively constant throughout the year.

Transfer - A transfer of water rights involves the sale of those rights and a change of use (for example, irrigation to manufacturing), location of the use, or point of diversion.

Water Right - Legally established right to divert and use a given quantity of water.