Planning and Prioritizing Water Resources Investments: The Example of Kabul River Basin, Afghanistan

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Background: The urgent need for planning and prioritizing water projects in Afghanistan

Afghanistan currently has a very low level of development of its water resources, and correspondingly low levels of water-related services, including urban and rural water supplies, irrigation, hydropower, and other uses. The Government of Afghanistan is implementing a successful program of rehabilitation and small water resources projects, but investments in medium and large water projects are now critically needed to meet rapidly growing demands and support economic growth.

While a basin approach and integrated water resources management are the cornerstones of the Afghanistan's new water law, in practice most water resources projects continue to be conceived and planned within the sectoral perspective, i.e. as water supply, irrigation, or hydropower projects, and neither the inter-sectoral nor spatial location issues are adequately addressed. In addition, there does not exist any approach for prioritizing any of the numerous projects conceived in each basin, and there is a tendency to prepare all of the possible projects through pre-feasibility and feasibility studies. As a result, there is no list of priority projects agreed on a multi-sectoral basis, and the scarce financial and human resources of this post-conflict country are overstretched. Furthermore, there is a serious risk that a fragmented sector-based approach could result in very sub-optimal development in the basins, where some of the planned investments could severely impact the viability of other planned investments.

A DSS-based approach to planning and prioritizing investments

At the request of the Government of Afghanistan, the World Bank undertook in collaboration with the Ministry of Energy and Water the development of an integrated basin planning framework for analyzing and prioritizing water resources development options in Afghanistan, and to demonstrate its application in the Kabul River Basin (KRB).

The KRB is arguably the most important river basin of Afghanistan. It accounts for 35 percent of the country's population, including half of the urban population. About 80% of the currently installed hydropower capacity in Afghanistan is in this basin. While it encompasses just 12 percent of the area of Afghanistan, the basin's mean annual streamflow is about 26 percent of the country's total streamflow volume. Kabul, the largest city and capital of Afghanistan, had an estimated population of 3 million in 2005, and is one of Asia's fastest growing cities. The KRB is strategically located for agriculture and agribusiness development, with historically prime areas of high value horticulture. The KRB also has very advantageous topography for the development of water storage and hydropower projects. Eight to ten favorable dam sites with substantial storage and hydroelectric capacity have been identified and studied at reconnaissance and pre-feasibility levels.

The DSS is used to analyze and assess various development options in the KRB based on: (i) cost; (ii) water demands; (iii) water availability; (iv) economic impacts; (v) long-term consistency with development goals and trends in various sectors; and (vi) sustainable use of the water resource base. The DSS has two elements:

- A knowledge base that encompasses all available data that describes: (a) water demands and uses, namely, agriculture, domestic and industrial, mining, power generation, rural water supply, and the environment; (b) options for development and conveyance of water supply; and (c) the hydrological system.

- A mathematical model that enables the best possible combination of options to satisfy all demands by maximizing the total net economic benefit under a set of assumptions about: (a) water demands; (b) constraints; and (c) future scenarios.

The model maximizes the net economic benefits of water development, which are defined as the gross benefit from irrigated agriculture and hydropower generation minus: (i) the cost of storage, which includes the cost of the dam and electricity generation facilities; (ii) irrigation investment; and (iii) water conveyances including pumping. The economic benefits of urban, rural, industrial and mining water use are not determined; instead these water demands are estimated and set as constraints to be satisfied as part of the optimal solution. For a given scenario, or set of assumptions about the future including water and electricity demands, the model is designed to determine an optimal set of strategic options. Implicitly, the model finds the sequence of monthly water allocations in the Basin which result in the maximum net benefit and satisfies all specified constraints. This in turn allows the identification of a priority set of projects whose selection appears robust to repeated scenario and sensitivity analysis (to the many parameters where data is uncertain). This set of priority projects are ideally the ones where project preparation studies (e.g. pre-feasibility and feasibility studies) should be undertaken. In this regard, it is important to note that the process does not identify the project (or projects) to definitely be implemented; however, it does help to narrow down the large universe of choices for further preparation, but also to make such preparation be more cognizant of the role of the project in the basin setting with respect to other projects. The DSS demonstrates how, even with significant data challenges, it is still possible to initiate meaningful multi-sectoral analyses to assist in decision-making.

Key findings for the Kabul river basin

The modeling analysis identifies the priority investment options in the KRB, including 3-4 critical storage projects and one conveyance link to bring water from Panjshir sub-basin to the Kabul urban area. In addition, the results also indicate the likely extent of sustainable irrigation in the KRB, sustainable bulk water supply options for Kabul city, optimal energy production options, and trade-offs between sectors such as irrigation and urban water supply.

The priority projects identified though this analysis allow a focusing of preparation resources on key projects, and also ensure that the selected options are optimal from a multi-sectoral perspective. In addition, this analysis has strengthened the inter-ministerial dialogue and coordination, and developed policy dialogue at the highest levels in the Government, with the cabinet of Afghanistan endorsing this approach and seeking Bank assistance for applying it in other basins of the country as well.

Implications for Central Asia

The Central Asian countries of Amu and Syr Darya basins are endowed with a wealth of water resources, development of which for multiple sectors is a key element of fostering economic growth in the region. However, sectoral demands on these water resources can be conflicting, and adopting a multi-sectoral approach can help identify options that meet the sectoral needs in an optimal manner. Developing a common agreed model of the basin is also a critical step for identifying water resources development scenarios that increase the benefits for all countries, compared to a zero-sum scenario of tensions and conflict over water rights. Finally, a basin modeling system provides an ideal platform for bringing the various actors together to explore together the various water resources development scenarios, and could be critical for fostering cooperation between the countries.
