

## How to meet the increasing demands of water, food and energy in the future?

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Regarded as a driving force in water, food and energy demands, the world's population has been increasing rapidly since the beginning of the 20<sup>th</sup> century. According to the medium-growth projection scenario of the United Nations, the world's population will reach 9.5 billion by 2050. In response to the continuously growing population during this century, water, food and energy demands have also been increasing rapidly, and social problems (e.g., water, food, and energy shortages) will be most likely to occur, especially if no proper management strategies are adopted. Then, how to meet the increasing demands of water, food and energy in the future? This study focuses on the sustainable developments of population, water, food, energy and dams, and the significances of this study can be concluded as follows:

First, we reveal the close association between dams and social development through analysing the related data for the period 1960–2010, and argue that construction of additional large dams will have to be considered as one of the best available options to meet the increasing water, food and energy demands in the future. We conduct the projections of global water, food and energy consumptions and dam development for the period 2010–2050, and the results show that, compared to 2010, the total water, food and energy consumptions in 2050 will increase by 20%, 34% and 37%, respectively. Moreover, it is projected that additional 4,340 dams will be constructed by 2050 all over the world.

Second, we analyse the current situation of global water scarcity based on the related data representing water resources availability (per capita available water resources), dam development (the number of dams), and the level of economic development (per capita gross domestic product). At the global scale, water scarcity exists in more than 70% of the countries around the world, including 43 countries suffering from economic water scarcity and 129 countries suffering from physical water scarcity. At the continental scale, most countries of Africa, the south and west Asia, and the central Europe are suffering from water scarcity.

Third, with comprehensive consideration of population growth as the major driving force, water resources availability as the basic supporting factor, and topography as the important constraint, we address the question of future dam development and predict the locations of future large dams around the world. The results show that there will be 1,433 large dams built in the future, mainly in the Tibet Plateau and the Yunnan-Guizhou Plateau in Asia, the East African Plateau and the western part of Africa, the Andes Mountains and the Brazilian Plateau region in South America, the Rocky Mountains in North America, the Alps in Europe, and the Murray-Darling Basin in Oceania. Taking into account of the current situation of global water scarcity, these large dams are most likely to be constructed in countries that have abundant total available water resources or per capita available water resources, no matter whether they are experiencing "economic water scarcity" or have sufficient financial support.