Sanaa solar pv

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This study focuses on Sana"a Basin, where the shortage of water is among the most problematic. Of all global national capitals, Sana"a has often been identified as the one most likely to run out of water first.[3] It is important to remember that the hydrology of Yemen varies considerably and therefore findings about Sana"a cannot be assumed to be valid for other basins and regions. However, there are some principles and recommendations of a general nature that are valid across the country. Strategies and detailed policies must, of course, be specific to each basin and region.

None of the official authorities and their related policies/strategies, including the Ministry of Electricity and Energy (MEE), the Ministry of Water and Environment (MWE) and the Ministry of Agriculture, Irrigation and Fisheries (MAIF), have addressed the issues associated with the use of solar energy in Yemen.[4] There are a few studies about solar energy for domestic use,[5] but these have little bearing on the technology"s use for agricultural water extraction. A 2019 UNDP report, the only study so far to discuss the use of SPIS in Yemen, determined the positive advantages of SPIS and promoted its use, but said little about the possible impact of SPIS on groundwater sources.[6]

There are 29 million Yemenis, 70 percent of whom live in rural areas and more than 50 percent of whom depend on agriculture. Yemen has no lakes or permanent rivers: rainfall and groundwater are the main sources of water in the country. Agriculture is estimated to use 90 percent of groundwater resources in Yemen, even though it only generates less than 20 percent of GDP.[7]

Yemen suffers from extreme water scarcity. Per capita water availability has dropped steadily in past decades as known available resources have remained static or have diminished while the population has increased. The annual volume of renewable water per capita declined from 221 m3 in 1992 to 80 m3 in 2014 and to only 75 m3 in 2017;[8] the latter is just over one percent of the global per capita average (5,925 m3) and 14 percent of the Middle East and North Africa region per capita average (554 m3). Yemen"s trajectory over the past three decades suggests available renewable water per capita could drop to 55 m3 by 2030.

According to the internationally recognized Falkenmark indicator, absolute water scarcity occurs if per capita water availability falls below 500 m3 per annum. That is almost seven times the current water availability in Yemen. Since the beginning of this century, Yemen has been using annually one third more water than its renewable supply can support: in 2010, extraction was 3.5 billion cubic meters (bcm) while renewable supply was 2.1 bcm; the 1.4 bcm shortfall was met by water pumped with modern technology from non-renewable fossil aquifers.[9] The groundwater tables have dropped severely, leaving the country in a state of extreme scarcity. For example, in Sana"a Basin, the water table was at a depth of 30 m in the 1970s but had dropped to between 200 and 1200 m by 2012.

Water management policies and related national institutions have been weak. Farmers with extensive landholdings and powerful social connections have more, and unregulated, access to the resource than small landholders. Following years of benign neglect, the National Water Resources Authority (NWRA) was established in 1995. Officially, NWRA has full authority of water policy development and implementation but, so far, it has been unable to address the complex social and political issues involved in water management.

In July 2002, Law No. 33 of 2002 - known as the "Water Law" - was promulgated. It was amended by Law No. 41 of 2006, but its by-laws were only issued in 2011, demonstrating the intensity of the debate around its implementation. This delay took place despite the fact that the newly created MWE had lost control of agriculture, the most water-intensive sector, in 2003, when the irrigation sector was removed from its authority within weeks of the ministry"s creation and returned to MAIF, the institutional base for large landowners and foreign-financed irrigation development projects.

Lack of government action to solve the crisis of basic service provision in Yemen continued during the 2011-14 period while politicians were preoccupied with the political transition and short-term urgent priorities. After 2015, the main immediate impact of the conflict on the majority of urban residents was the interruption of electricity and water services. In rural areas, the main initial impact was the destruction of infrastructure, affecting the inward and outward transport of basic necessities, including agricultural inputs and food. The major fuel crisis that started early in the war decreased energy available for water pumping and, as a result, seriously affected the availability of water for urban households and for irrigated agriculture.

Now, while the war is ongoing, the public water network and electricity grid serve no more than 10 percent of families.[18] All sectors, including agricultural, industrial and services, experience significant increases in input costs for irrigation, transportation and marketing, resulting in lower production and exports.[19] Production has stalled, negatively impacting both public and private sectors. The delivery of public goods and services - including health, education and social security - has been affected throughout Yemen.[20] Fuel and cooking gas prices have become unstable; at times, the cost of these commodities has jumped to more than 1,000 percent from a pre-war baseline.

The war has affected water supply all over the country, in terms of availability, accessibility, quality and affordability. Decentralized, community-based water systems have shown more resilience than public, centralized systems; in many areas, people have gone back to using sustainable techniques, like rainwater harvesting. However, it is worth mentioning that the public water sector is one of very few sectors that have continued to provide services, even if these services are reduced, irregular and reach fewer Yemenis than before the crisis.[21]

This study conducted field surveys in December 2020 and January 2021 among a stratified sample of 88 farmers in Sana"a Basin, mainly from Bani Husheish, Bani Mater and Hamdan.[43] The study also undertook key informant interviews (KIIs) with water, irrigation and energy experts to ensure coherence between data at

the farmer level and professional- and administrative-level information. This approach facilitated a deeper understanding, from different perspectives, of the future of SPIS, its uses and proper management, in Yemen. After a quality check on the collected data, where needed, participants were contacted by phone to verify unclear or incomplete points.

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