CHALLENGES OF ATTAINING SUSTAINABLE DEVELOPMENT GOALS IN UZBEKISTAN: UNEQUAL DISTRIBUTION OF WATER

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Abstract

Uzbekistan, one of the most climate-vulnerable regions in the world, is facing some challenges in achieving Sustainable Development Goals as a result of increasing climate risks and underdeveloped water infrastructure that is causing unequal distribution of water resources between rural and urban areas. These problems block further development of several SDGs including good health and well-being, clear water and sanitation Industry, innovation and infrastructure, and climate action. This thesis examines challenges mentioned above and proposes possible solutions: managed aquifer recharge, efficient urban infrastructure.

Keywords: aquifer recharge, solar-powered water pumping system, infrastructure, Sustainable Development Goals

Introduction

Sustainable development goals call on all nations to take actions against critical problems like poverty, ecological crises, hunger, water scarcity. Uzbekistan, being an active member of the United Nations has taken several actions to achieve SDG goals, however there are still some barriers to overcome. One of these existing problems is unequal distribution of safe drinking water resources. According to data in 2025, 75% of the rural population had access to safe drinking water, against 89% in urban areas. In addition, only 32% of domestic wastewater undergo safety standards nationally [1]. This rate poses a huge health risk, especially as droughts concentrate pollutants in dwindling water sources. The situation is worsening with Uzbekistan's annual temperature has already risen by 1.6 ℃, nearly three times the global average of 0.6℃, with an increase of up to 2.5℃ in the Aral Sea region. Six dry years were recorded between 2019 and 2024, and river basin runoff is projected to decline by 25-50% in extreme years as glaciers retreat [2]. Climate change therefore is not a future threat to water access in rural areas of Uzbekistan but it is an active driver of deepening crises, making it difficult for countries to achieve Sustainable Development Goals. This thesis analyses all problems above and proposes possible solutions like managed aquifer recharge and rural water infrastructure development.

Structural Drivers of the rural-urban water inequality

Despite plentiful domestically available energy resources, the energy supply in Central Asia is very unevenly distributed between urban and rural areas. Almost half of the total population of Central Asia lives in rural areas and there is a lack of access to modern energy services to meet primary needs.The roots of rural-urban water gap go back to the Soviet period. The Soviet system prioritised water infrastructure in industrial and administrative centers, leaving rural areas with poorly maintained supply systems. Although many improvements have been made after independence, the system still can not provide equal distribution. The IISD

National State of the Environment Report (2024) notes that aging infrastructure and inadequate maintenance remain primary barriers to reliable rural water supply [3].

Climate change is worsening the rural water situation through three main processes. Firstly, more frequent droughts are reducing surface water availability and lowering the water table. This makes the shallow wells and springs unproductive that many rural households depend on. Uzbekistan is already one of the top 20 most drought-prone countries in the world [4], and the situation is made more complicated by the fact that around 90% of all surface water is already allocated to irrigated agriculture, leaving little in reserve for domestic use [5].

Secondly, floods and other natural disasters - which are becoming more common under a warming climate is also causing physical damage to rural water infrastructure.The UNDP Independent Country Programme Evaluation (2025) notes that climate-related disasters have created serious disruptions to water service delivery, with rural communities bearing a disproportionate share of the burden because they have the least capacity to repair or replace damaged systems.

In addition, rising temperatures increase evaporation from water sources and reservoirs, raise the concentration of salts and pollutants in remaining water bodies, and drive up demand for clean water supplies. In the Aral Sea region, these problems are compounded by the environmental legacy of the sea's desiccation: the Aralkum desert. It generates toxic dust and salt storms that contaminate both surface and ground water sources for millions of people in the Karakalpakstan autonomous republic [6].

Consequences for rural communities

The rural-urban water gap has serious and concrete consequences for health, livelihoods, and economic development. The most immediate concern is public health. With only 32% of domestic wastewater safely treated nationally, untreated sewage routinely contaminates the groundwater that rural communities use for drinking and cooking. In the Aral Sea basin, this is compounded by decades of accumulated pesticides, fertiliser, and heavy metal contamination left behind by the retreating sea, which has contributed to higher rates of respiratory disease, anaemia, and poor maternal outcomes in the surrounding nature.

Beyond health, unreliable water access has direct economic consequences. We can see it in the example of Muynak, which was once a thriving fishing city on the Aral Sea with nearly 30,000 people and an economy based on fishing and fish processing. As the Aral Sea dried up in the 1980s, fish disappeared and many people lost their jobs. The Soviet government temporarily kept the local cannery open by transporting fish from eastern Siberia, thousands of miles away, but after the Soviet Union collapsed in 1991, the factory closed. Today, Muynak has about 13,500 residents and is located far from the remaining water of the Aral Sea. Most people now earn money from salt harvesting or tourism, while many young residents move away in search of better opportunities [7].

The geographic distribution also plays a huge role as communities in Karakalpakstan - the region most directly affected by the Aral Sea disaster - face the combination of lower incomes and a degraded water environment. Kamalov and Juraeva (2024) describe the situation in this region as a compounding of climatic, ecological, and socioeconomic stressors that together constitute a distinct humanitarian emergency within Uzbekistan's broader development landscape. Addressing the rural–urban water divide therefore requires a targeted focus on the most marginalised communities, not only national-level averages.

Possible solutions

1.Managed aquifer recharge

One of the most effective ways to address rural groundwater depletion in Uzbekistan is developing managed aquifer recharge (MAR). It is a strategic approach to artificially replenishing groundwater supplies and has become an integral component of global water resource management [8]. MAR can make use of the higher river flows that occur in winter and spring from snowmelt in the mountains, storing that water underground as a buffer against the intense irrigation demand of summer months. And it can be utilized at different scales — from large basin-level schemes to small community ponds — making it adaptable to the varied conditions found across Uzbekistan's rural landscape. Implementation regarding this technology has already taken place. With the help of OPEC Fund for International Development, from the Fergana Valley to the foothills of northern Tajikistan, evaluated a potential of adapting advanced technologies of managed aquifer recharge in the Amudarya basin through modeling, on-farm testing of aquifer storage and recovery in the Amudarya River midstream [9]. However, we need further development of these projects in order to sustain an equal share of water resources throughout the country.

The World Bank Country Climate and Development Report (2024) identifies the modernisation of water storage and distribution infrastructure as one of the highest-priority adaptation investments for Uzbekistan. Managed aquifer recharge fits directly within this recommendation and has proven track record in comparable arid environments across the Middle East and South Asia. Financing can be accessed through partnership with international investment banks and international organizations like Asian Infrastructure Investment Bank.

2.Solar-powered submersible water pumping system

Solar-powered submersible water pumping systems are also promising considering Uzbekistan receives an average of 330 sunny days and between 2,850 and 3,050 hours of sunshine each year [10]. Besides, approximately 80% of its territory lies within a plain, characterized by an arid geographic zone and dry climate [11]. Agricultural production in these regions is possible only through artificial irrigation. Solar photovoltaic WPS can provide sustainable and climate-smart energy technologies for efficient irrigation systems in rural areas that are not connected to the national electric grid [12]. This can provide significant socioeconomic and environmental benefits.

Conclusion

This thesis has argued that Uzbekistan's rural–urban divide in access to safe drinking water is not simply a technical problem to be solved through engineering alone. It is the product of overlapping historical, institutional, and climatic pressures — Soviet-era infrastructure priorities, decades of underinvestment after independence, and an accelerating climate crisis that is reducing water availability and damaging the infrastructure that remains. The communities most severely affected — rural households in remote regions and the Aral Sea basin — bear costs that are far out of proportion to their contribution to climate change.

Possible solutions mentioned above - managed aquifer recharge and targeted rural infrastructure advancement with new technologies like solar-powered submersible water pumping systems are presented not as competing alternatives, but as complementary measures that jointly address the supply and distribution sides of the problem. Both require a

clear state commitment, reliable financing, and effective coordination among government agencies.

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