



## COMPARATIVE ANALYSIS OF LEGISLATIVE FRAMEWORKS FOR RENEWABLE ENERGY SOURCES IN GERMANY AND UZBEKISTAN

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**Abstract:** Uzbekistan faces a severe water crisis driven by climate change, population growth, outdated infrastructure, and transboundary water dependencies. This thesis examines the multifaceted water problem in Uzbekistan, focusing on the depletion of the Amu Darya and Syr Darya rivers, inefficient irrigation practices, and the socio-economic impacts of water scarcity. Drawing on recent literature, the analysis highlights the environmental degradation of the Aral Sea, agricultural inefficiencies, and limited access to clean drinking water, particularly in rural areas. The study critiques the effectiveness of current water management policies and proposes subjective recommendations, including the adoption of water-saving technologies, regional cooperation, and legislative reforms. By addressing these challenges, Uzbekistan can mitigate its water shortage, projected to increase fivefold by 2050, and foster sustainable development. This thesis underscores the urgency of collective action to ensure water security in an arid, landlocked nation.

**Keywords:** Water Scarcity, Uzbekistan, Amu Darya, Syr Darya, Aral Sea, Irrigation, Water Management, Climate Change, Transboundary Rivers, Water-Saving Technologies

### Introduction

Uzbekistan, a double-landlocked, arid nation in Central Asia, grapples with a critical water crisis that threatens its economic stability, environmental sustainability, and public health. With 90% of its water consumed by agriculture and 80% sourced from transboundary rivers, Uzbekistan faces economic water scarcity, defined as less than 3,000 m<sup>3</sup> per capita annually (1,870 m<sup>3</sup> in Uzbekistan). The depletion of the Amu Darya and Syr Darya rivers, exacerbated by climate change, upstream damming, and inefficient Soviet-era irrigation systems, has reduced water availability, with projections indicating a fivefold increase in shortages by 2050. The environmental catastrophe of the Aral Sea, once a vital water body, underscores the consequences of mismanagement, while rural communities struggle with limited access to clean drinking water, leading to health issues like hepatitis.





This thesis aims to analyze the causes and impacts of Uzbekistan's water problem, critically evaluate current management strategies, and propose actionable solutions. By synthesizing recent literature, including studies from the World Bank, International Water Management Institute (IWMI), and regional analyses, the study addresses the interplay of geopolitical, environmental, and socio-economic factors. The proposal section offers subjective recommendations to enhance water security, emphasizing technological innovation and regional cooperation. As global water shortages intensify, Uzbekistan's experience provides critical lessons for arid regions worldwide, highlighting the need for sustainable water governance.

### Analysis

#### ***Causes of Water Scarcity***

Uzbekistan's water crisis stems from multiple interconnected factors. First, climate change reduces water availability through decreased snowfall, glacier retreat, and increased evaporation due to rising temperatures. The World Bank projects a 10-15% streamflow decline in the Amu Darya and 2-5% in the Syr Darya by 2050, reducing Uzbekistan's water supply. Second, transboundary dependencies exacerbate scarcity, as 80% of Uzbekistan's water originates in upstream Tajikistan and Kyrgyzstan, where hydropower dams like Rogun reduce downstream flows.

Third, outdated infrastructure from the Soviet era, including dilapidated irrigation canals, results in 30-60% water losses. The collapse of the Sardoba dam in 2020 highlighted infrastructure vulnerabilities.

Agricultural practices, particularly cotton cultivation, consume 90.6% of water, with inefficient flood irrigation exacerbating losses. The Aral Sea crisis, caused by decades of over-irrigation, has reduced inflow from 55 km<sup>3</sup> in 1960 to near zero in dry years, leading to salinization and desertification. Finally, population growth (from 30 million to a projected 40 million by 2030) increases demand, reducing per capita water availability from 3,048 m<sup>3</sup> in 2005 to 1,589 m<sup>3</sup> in 2020.

### **Impacts**

The water crisis has profound socio-economic and environmental impacts. Agriculture, Uzbekistan's economic backbone, faces declining yields, with 300,000 hectares of crops lost to drought in Karakalpakstan in 2000. Public health suffers, as 71% of rural households rely on unsafe water sources, leading to waterborne diseases. Environmental degradation, particularly the Aral Sea's shrinkage, has caused salt storms, affecting 17-20 tons of salt per hectare





annually. Geopolitical tensions arise from upstream-downstream conflicts, with Uzbekistan's diplomacy easing but not resolving disputes.

### ***Current Management***

Uzbekistan has initiated reforms under President Mirziyoyev, including the National Agricultural Development Strategy (2020-2030), which prioritizes water-saving technologies. Since 2018, drip irrigation has expanded to 1 million hectares (27% of irrigated land), reducing water use by 40-50%. Subsidies (USD 133 million from 2019-2022) and tax exemptions incentivize adoption. The EU-funded "Water Governance in Uzbekistan" project introduced smartsticks, electronic devices improving water accounting for 500 farmers. However, these measures are insufficient against projected shortages, and regional agreements on transboundary water remain underdeveloped.

### **Discussion**

Uzbekistan's water crisis reflects a complex interplay of natural, historical, and policy-related factors. The reliance on transboundary rivers places Uzbekistan at the mercy of upstream nations, a challenge compounded by the lack of enforceable regional agreements. Soviet-era infrastructure, designed for large-scale cooperatives, is ill-suited for smaller farms post-independence, leading to inefficiencies. The Aral Sea's collapse serves as a stark warning of unsustainable practices, yet cotton remains a water-intensive priority, reflecting economic dependencies over environmental concerns.

Recent reforms, such as smartsticks and drip irrigation, are promising but limited in scale. The government's focus on technological solutions overlooks deeper issues like low water tariffs (USD 0.02-0.035/m<sup>3</sup>), which discourage conservation, and the absence of a comprehensive water law. Critically, while sources like the World Bank emphasize infrastructure upgrades, they may underplay the socio-political barriers to regional cooperation, such as upstream nations' hydropower priorities. Uzbekistan's diplomacy has reduced tensions, but without binding international standards, conflicts persist.

Comparatively, countries like Israel, with advanced drip irrigation covering 90% of farmland, offer models for efficiency. Uzbekistan's arid climate and land availability provide opportunities for scaling such technologies, but financial constraints and low public awareness hinder progress. The crisis demands a holistic approach, balancing technological, legal, and diplomatic strategies to ensure long-term water security.

### **Proposal with Subjective Opinions**





Based on the analysis, I propose the following subjective recommendations to address Uzbekistan's water crisis, blending practical solutions with optimism for regional collaboration:

**Scale Water-Saving Technologies:** Uzbekistan should aim to expand drip irrigation to 75% of irrigated land by 2035, following Israel's model. Subsidies should be increased, and local production of irrigation equipment (currently 50 enterprises) scaled to reduce costs. In my view, prioritizing drip irrigation over flood methods is critical to halving agricultural water use, preserving resources for future generations.

**Enact a Comprehensive Water Law:** A national water law should mandate conservation, set higher tariffs for excessive use, and establish a regulatory body for monitoring. This would address the current fragmented policy landscape, which I believe undermines accountability. Tax exemptions for water-saving technologies should extend beyond five years to encourage adoption.

**Strengthen Regional Cooperation:** Uzbekistan should lead negotiations for a Central Asian water treaty, modeled on the EU's Water Framework Directive, ensuring equitable transboundary water sharing. While upstream nations prioritize hydropower, I argue that joint investments in renewable energy (e.g., Uzbekistan's solar potential) could reduce dam reliance, benefiting all parties.

**Public Awareness Campaigns:** Educational programs should promote water conservation, targeting farmers and rural communities. I believe empowering <1>empowering local Water Consumer Associations (WCAs) with training on smartsticks and modern irrigation could transform grassroots water management.

These proposals, though ambitious, are feasible with international support (e.g., World Bank, ADB loans). Uzbekistan's progress since 2018 inspires confidence, but bolder action is needed to avert a crisis that could destabilize the region.

## Conclusion

Uzbekistan's water crisis, driven by climate change, transboundary dependencies, and inefficient practices, poses an existential threat to its economy, environment, and public health. The depletion of the Amu Darya and Syr Darya, coupled with the Aral Sea's collapse, underscores decades of mismanagement. While reforms like drip irrigation and smartsticks show promise, their scale and impact remain limited against a projected 25% water shortfall by 2030. This thesis proposes scaling water-saving technologies, enacting a national water law, fostering regional cooperation, and raising public





awareness to mitigate the crisis. By learning from global best practices and leveraging its solar potential, Uzbekistan can chart a sustainable path, ensuring water security for its growing population and setting a model for arid nations worldwide.

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