REPUBLIC OF TÜRKİYE
MINISTRY OF AGRICULTURE AND FORESTRY

Water Efficiency Campaign

WATER EFFICIENCY STRATEGY DOCUMENT AND ACTION PLAN IN THE FRAMEWORK OF ADAPTATION TO THE CHANGING CLIMATE (2023 – 2033)

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ABBREVIATIONS

WWTP	Wastewater Treatment Plant
EU	European Union
R&D	Research and Development
UN	United Nations
CPPCSP	Cleaner Production Practices in Certain Sectors Project
RDA	Regional Development Administrations
SBRD	Sector Based Reference Documents
GDCP	General Directorate of Crop Production
DGFA	Directorate General of Fisheries and Aquaculture
GIS	Geographic Information System
MLSS	The Ministry of Labor and Social Security
MEUCC	The Ministry of Environment, Urbanization and Climate Change
DMA	Measurement Zones/Isolated Subzones
GDSHW	General Directorate of State Hydraulic Works
ECO	Economic Cooperation Organization
IPPC	Integrated Pollution Prevention and Control
TPD	Training and Publication Department
FAO	Food and Agriculture Organization of the United Nations
NRW	Non-Revenue Water
GDAH	General Directorate of Animal Husbandry
ILI	Infrastructure Leakage Index
OIC	Organization of Islamic Cooperation
SPA	Special Provincial Administration
IPPCD	Integrated Pollution Prevention and Control Directive
MCT	The Ministry of Culture and Tourism
BAT	Best Available Techniques
VQA	Vocational Qualifications Authority
NACE	The Statistical Classification of Economic Activities in the European Community
RBMP	River Basin Management Plan
OECD	Organization for Economic Cooperation and Development
DCPPAIP	Determination of Cleaner Production Possibilities and Applicability in Industry Project
DREPIP	Determination of Resource Efficiency Potential in Industry Project
CSCDA	Centralized Supervisory Control and Data Acquisition
SEA	Strategic Environmental Assessment
SDG	Sustainable Development Goals
MIT	The Ministry of Industry and Technology
CSO	Civil Society Organization
TWI	Turkish Water Institute
WSA	Water and Sewerage Administration
GDARP	General Directorate of Agricultural Research and Policy
GDAE	General Directorate of Agricultural Enterprises
MAF	The Ministry of Agriculture and Forestry
TOBB	The Union of Chambers and Commodity Exchanges of Turkey
GDAR	General Directorate of Agricultural Reform
TURKSTAT	Turkish Statistical Institute
GWB	Groundwater body
SWB	Surface waters body
CoHE	The Council of Higher Education
WWF	World Wildlife Fund

MINISTER'S FOREWORD

Water, soil, air, and forests are the foundation of life, societies, and economies. The "value of water" encompasses various aspects, including ps cultural traditions, living standards, perception of the world, and economic considerations, as well as the cost of water. In addition, the value of water extends into cultural, ecological, social, spiritual (psychological) dimensions. In Africa, for example, this value of water transcends its essential role in drinking and daily use. For a child, it means sacrificing playtime and access to education. For a mother, it could entail giving up time for sacrifice of time for her children and herself; or facing health problems due to challenges in water transportation.

Water resources have played a pivotal role in the transition to settled life, cultural development, and the rise of civilizationsthroughout humanity's long history. It is no coincidence that Egyptian Civilizations were established alongthe banks of the Nile River, Mesopotamian Civilizations were flourished in the lands nourished by the Euphrates and Tigris, and many other civilizations around the world were established around important water resources. Disasters such as drought and famine, which threaten and eliminate water resources, bring with them significant consequences on a global scale.

Water resources, which are already under pressure due to the factors like population growth, rapid and unplanned urbanization, and overconsumption, are adversely being affected both in terms of quantity and quality all over the world with the impact of climate change. The effects of these pressures are expected to futher intensify in the future.

According to the principle of sustainable development, human and economic development should be achieved by considering environmental and ecological values. The main challenge in ensuring the sustainability of water resources is the increasing demand for wate, driven by factors such as a population growth, climate change, and rising living standards. This situation leads to significant public health problems and social risks in densely populated megacities.Consequently, it has become a necessity to create a road map for enhancing efficiency in water use, especially in sectors with high water consumption, by planning strategies focsed on efficiency and optimization in water use.

The first objective determined within the scope of the 1st Water Council held in 2021 was the Determination of National Strategies for Improving Water Efficiency. This Council Objective was reinforced through the preparation of the Water Efficiency Strategy Paper, as well as the creation and execution of basin-based water efficiency action plans for the key sectors (domestic, agricultural and industrial). Within the scope of the Climate Council, which was concluded in 2022, the efficient use of water resources was also evaluated under the work of the Climate Change Adaptation Commission.

I hope that **the Water Efficiency Strategy Document and Action Plan within the Framework of Adaptation to a Changing Climate**, which was prepared by considering all these collective efforts with a holistic approach, and evaluating them as a set of strategies, will serve as a guide for stakeholders in achieving the objectives of protecting and utilizing our water resources in an equitable and efficient manner, and I wish it proves to be beneficial for our country.

İbrahim YUMAKLI
Minister of Agriculture And Forestry

EXECUTIVE SUMMARY

Water is a vital requirementand an indispensable resource for all living organisms. The total amount of water in the world is 1.4 billion km³, with 97.5% being salt water in oceans and seas, and the remaining 2.5% classified as freshwater. Within this amount of fresh water suitable for human consumption, i.e. it possesses potable chemical/physical properties, 68.7% is located at the Earth's polar regions, while 30.1% is underground[1].

Accessible freshwater resources, constituting less than 1.2 percent of the world's total water supply, face numerous threats, including pollution, drought, climate change, population growth, water losses and unsustainable overuse. The availability and accessibility of water, both in terms of quality and quantity, is crucial for food security, energy supply, meeting environmental water requirements for ecosystems and other living organismssustainable development and sustainable prosperityand consequently, for the future of humanity.

According to the data announced by the General Directorate of State Hydraulic Works, the total annual usable water amount of our country is approximately 112 billion cubic meters. According to 2022 statistics, total annual water consumption is 57 billion cubic meters, of which 44 billion (77%) cubic meters is used as irrigation water and 13 billion cubic meters (23%) is allocated to meet the demands for drinking water and industrial use.

Our country is located in the Mediterranean climate zone, where the effects of global climate change are felt intensely. Itis considered to be among the regions that will be most affected by the negative effects of climate change. Projections concerning the future impact of climate change on water resources in our basins due to climate change indicate that our water resources may decrease by up to 25 percent in the next hundred years.

According to the international Falkenmark index, which is used to define water scarcity or stress, countries, or regions with an annual per capita water availability of 1,700 ~ 1,000 m³ are considered to be in "water shortage". For the year 2022, the annual amount of water available per capita in our country is 1,313 m3,and with the increasing population, the annual amount of water available per capita is expected to drop below 1,000 cubic meters after 2030.

If the necessary precautions are not taken, it is obvious that Türkiye will become a country suffering from water scarcity in the very near future, bringing with it many negative social and economic consequences. As indicated in the results of future projections, the risk of drought and water scarcity awaiting our country necessitates the efficient and sustainable use of our existing water resources.

[1] United States Geological Survey. https://www.usgs.gov/special-topics/water-science-school/science/where-earths-water.

The concept of water efficiency, which has gained prominencewith the risk of drought and water scarcity, can be defined as "using the least amount of water in the production of a product or service" or "producing more products or services with the same amount of water". The concepts of water efficiency and water conservation are often used interchangeably, but efficient use and conservation are differentiated in practice. While water saving can be expressed in terms of practices aimed at limitingwater use, water efficiency can be defined as practices that aim to prevent and reduce waste or maximize the benefits derivedfrom water use, rather than restricting water consumption.

The water efficiency approach is based on the rational, sharing, equitable, efficient, and effective use of water in all sectors, especially in agriculture, industry and households, in a way that conserves water in terms of quantity and quality. Ittakes into account not only the needs of humans but also the needs of all living things with ecosystem sensitivity.

Among the 17 Sustainable Development Goals (SDGs) set forth by the United Nations in 2000 to contribute to international development, SDG 6 (Clean Water and Sanitation) is directly related to water management. There are 8 sub-goals under SDG-6, and sub-goal 6.4. aims to "substantially increase water efficiency across all sectors". In addition, the Food and Agriculture Organization of the United Nations (FAO) has adopted the vision of "producing more food with less water" in agriculture, recognizing the growing demand for food and pressures on water resources.

With the European Green Deal announced on December 11, 2019, the European Union announced that it will adopt a new growth strategy that requires the transformation of its industry and reshape all its policies on the axis of climate change, while setting the goal of becoming the first climate-neutral continent in 2050. Within the scope of the European Green Deal, Türkiye has prepared the Türkiye Green Deal Action Plan consisting of nine main topics. Under the heading of "A Green and Circular Economy", which is one of these nine headings; the following targets have been set for water efficiency: (i) Reuse of treated wastewater, (ii) Preparation of a "Water Reuse National Master Plan", and (iii) Preparation of a "guidance document on water footprint" in the light of Sectoral Water Allocation Plans.

In our country, through the "Presidential Decree on the Organization of the Presidency" dated 10/7/2018 and numbered 1 (Official Gazette 10/7/2018-30474), the General Directorate of Water Management was assigned the duties of "conducting studies for the purpose of establishing policies on the protection and sustainable use of water resources" and "conducting studies on the impact of climate change on water resources".

In addition, the topic of Water Efficiency in Turkey was addressed as a main topic within the scope of the "Report of the Specialized Commission on Water Resources Management and Security" issued by the Presidency of the Republic of Türkiye, Department of Strategy and Budget, as part of the 11th Development Plan (2019-2023) Specialized Commissions Handbook.

On the other hand, the first objective determined within the scope of the I. Water Council organized by the Ministry of Agriculture and Forestry in 2021 was the Determination of National Strategies for Improving Water Efficiency. This Council Objective was supported by the preparation and implementation of the Water Efficiency Strategy Paper, and basin-based water efficiency action plans for key sectors (domestic, agricultural and industrial). Since water is a shared resource used across sectors, strategies for resource efficiency needed for each sector holds immense importance for the sustainable management of water resources.

In this direction, "Water Efficiency Strategy Document and Action Plan within the Framework of Adaptation to a Changing Climate" was prepared in which future targets and strategies were determined in order to expand water efficiency in all sectors in our country. Within the scope of the document, the current situation regarding water uses, national and international legislation, plans, programs and documents in force were analyzed, and water efficiency practices on a global scale were evaluated. As a result of the assessments, strategies and actions for the efficient use of water in all sectors, as well as the institutions and organizations that will assume responsibility and cooperate were identified.

In the preparation process of the document, active participation of stakeholders in the process and inclusiveness were prioritized. In the document, water efficiency targets, strategies and actions have been defined through the following main axes:

I. Urban Water Use Efficiency

II. Agricultural Water Use Efficiency

III. Industrial Water Use Efficiency

IV. Water Use Efficiency Affecting All Sectors

The urban water efficiency axis is analyzed through water supply and water uses at the urban scale and individual water uses in households. The urban water efficiency approach includes water efficiency in drinking and potable water systems and individual water efficiency; water use in institutions and organizations at the urban scale (tourism, public, service sector, etc.), water withdrawal from the source, treatment, transmission to the network, consumption by users, wastewater treatment, reuse of treated water and pricing to encourage efficient use of water. The basic principle in water supply is the timely delivery of quality and quantity of water to users. For this reason, it is extremely important to mitigate water losses, minimize failures, and ensure operational efficiency at every stage, from the source to the end user. Preventing and managing losses, especially in the networks of municipalities, will contribute to postponing the search for new resources and using existing resources more efficiently.

The average water loss rate in potable water supply and distribution systems in our country in 2021 was calculated as 33.54%. In all municipalities, it is aimed to reduce the water loss rate to 25% by 2033, and 10% by 2040, as required by legislation. Within the scope of this document, strategies and actions have been set out to carry out activities to increase the efficient use of water.

As in the rest of the world, the sector with the highest water use in Tükiye is the agriculture sector. Therefore, restricting access to reliable water resources will seriously affect the agricultural sector, jeopardizing the security of food supply. Efficient use of water in agricultural irrigation, which constitutes a significant portion of sectoral water usage, will result in significant water savings. Agricultural irrigation efficiency represents the ratio of total plant irrigation water requirement to the amount of water taken into the water supply network from the water source. According to 2021 data, the irrigation efficiency value in irrigation systems operated and transferred by the General Directorate of State Hydraulic Works was calculated as approximately 50.4%. The document aims to increase irrigation efficiency to 60% by 2030 and 65% by 2050. Based on these targets, strategies and actions have been identified for the dissemination of practices that increase agricultural irrigation efficiency.

On the other hand, industrial water efficiency practices have an increasing importance due to their environmental, economic, and public health benefits. In Türkiye, various studies focused on cleaner production techniques and resource efficiency are carried out within the scope of industrial water use efficiency. Within the scope of the document, it is aimed to achieve water savings of up to 50% by promoting cleaner production techniques in industry and implementing water efficiency measures. Strategies and actions have been determined to align with this target.

In addition to strategies and actions for sectors that use excessive water, strategies and actions related to legal, administrative, and technical regulations that cut horizontally across all sectors have also been identified, and an inclusive and participatory approach has been put forward. In this direction, measures have been determined for expanding the use of alternative water resources such as rainwater, gray water, used water, determining the size of the total water footprint and mitigation measures at the basin scale, virtual water transfers, monitoring water availability in basins, and making plans by taking into account efficiency measures at the basin scale according to projections on the effects of climate change on water resources.

Implementation of the prioritized short-medium-long term actions identified in the Water Efficiency Strategy Document and Action Plan within the Framework of Adaptation to a Changing Climate, which serves as a map on water efficiency, will make a significant contribution to the transfer of our water resources, which are one of the fundamental elements of sustainable development, to future generations in a clean and safe manner. In this direction, it is of great importance that the identified strategies and measures are implemented with sensitivity and a sense of national ownership by the relevant institutions and organizations.

1.INTRODUCTION

Water Efficiency

Water is a vital and an indispensable resource for all living creatures. The total amount of water in the world is 1.4 billion km³, with 97.5% being salt water in oceans and seas and,the remaining 2.5% is fresh water. Of this amount of fresh water suitable for human consumption, i.e. with potable chemical/physical properties, 68.7% is located at the Earth's polar regions, while30.1% is found underground.

Accessible freshwater resources, which account for less than 1.2 percent of the world's total water availability, face many threats such as pollution, drought, climate change, population growth, water losses, and unsustainable overuse. The availability and accessibility of water, both in terms of quality and quantity, are of utmost importance for food security, energy supply, environmental (ecosystems and other living organisms) water requirements, sustainable development, and sustainable prosperity, and consequently for the future of humanity.

While the world population was only 1 billion at the beginning of the 1900s, the world population has reached nearly 8 billion due to the developments in medicine after the industrial revolution. While there were only 2 metropolises in the world in 1800, 1187 metropolises have been identified in 2022. In addition to population growth, the rapid increase in population density greatly increases the pressure on natural resources, especially water resources.

On the other hand, Türkiye is situated in a high-risk region in terms of climate change-related risks. These risks affect the availability of water resources and cause negative impacts on water quality. As a result of climate impact assessments for the current century, it is projected that water potential in Türkiye will decrease compared to the reference period because of increasing temperatures and changing precipitation patterns. In addition to all these factors, which make access to reliable water resources more challenging, the gradual decrease in cultivable land poses a risk to food security. The Constraints and growing demands on agricultural land and water resources around the world require the development of new policies and measures at the global and regional levels.

Even if all greenhouse has emissions in the World are completely stopped today, climate change will continue to have an impact in the upcoming years due to the existing greenhose gases in the atmosphere. Therefore, adapting to a changing climate is necessary both to reduce the negative impacts of climate change and to turn some negative impacts into opportunities. Every step that ensures the efficient use of water resources will also facilitate adaptation to a changing climate.

The concept of water efficiency, which has been on the agenda worldwide with climate change, drought, and water stress, can be defined as "using the least amount of water in the production of a product or service" or "producing more products or services with the same amount of water".

[2] United States Geological Survey. https://www.usgs.gov/special-topics/water-science-school/science/where-earths-water.

The concepts of water efficiency and water conservation are often used interchangeably, but efficient use and conservation are differentiated in practice. While water saving can be expressed in terms of practices aimed at limited water use, water efficiency can be defined as practices that aim to prevent and reduce wastage or maximize the benefit obtained from water use, rather than restricting water (SYGM, 2021a).

In this context looking at international studies, SDG-6: Clean Water and Sanitation, one of the UN Sustainable Development Goals, is directly related to water management and includes "greatly increasing water efficiency in all sectors" as one of the targets.

Within the scope of the European Green Deal (EGD), which aims to be the first climate-neutral continent, Türkiye has prepared a Türkiye Green Deal Action Plan consisting of nine main topics. One of these nine chapters is 4. "A Green and Circular Economy", which aims to promote the use of efficient technologies, alternative water resources and clean production technologies.

The Water Framework Directive includes topics directly related to water efficiency, such as efficient use, reuse of used water, the establishment of the most appropriate pricing policies, and the use of technologies to increase efficiency.

"As emphasized in the 'Report of the Specialized Commission on Water Resources Management and Security' within the 11th Development Plan (2019-2023), published by the Strategy and Budget Directorate of the Turkish Republic Presidency, the significance of safeguarding water resources is underscored. The report highlights the importance of developing alternative water sources and promoting eco-friendly, water-efficient technologies. "Water" and "water efficiency", as one of the basic inputs of the sustainable development and human welfare, should be at the forefront of individual and collective agendas worldwide.

Both "ecological" and "economic" results will be achieved through the implementation of strategies for the efficient use of water and the measures to be implemented in this direction. With the rational, efficient, and sustainable use of water, along with positive environmental outcomes, the necessities such as treatment and development of alternative water resources, which require more costly and advanced technology, will be reduced and will bring positive economic results for consumers.

Purpose

It is essential to use existing water resources in terms of quantity and quality and by considering environmental needs (with ecosystem sensitivity), that is, by being sensitive to the water rights of all living things rather than being solely human-oriented. In this regard, the main purpose of the study is to determine the necessary strategies for the rational, collective, effective, efficient, and equitable use of water in all sectors, especially in urban, agricultural, and industrial areas, by taking into account all sectoral, institutional and individual shareholders.

Scope

Within the scope of this study, the current situation of water efficiency in Türkiye, national and international legislation; plans, programs and documents in force; bottlenecks encountered in this process considering water efficiency practices on a global scale; forward-looking targets, strategies and actions regarding water efficiency have been determined with the institutions and organizations that will be directly responsible and cooperated within the implementation of the practices.

The Strategy Document and Action Plan were developed on the main axes given below:

I. Urban Water Use Efficiency

II. Industrial Water Use Efficiency

III. Water Use Efficiency Affecting All Sectors

In the action plan, the works, and operations to be carried out in the short, medium and long term, the institutions/organizations that will be directly responsible for this process and the relevant stakeholder institutions/organizations are determined. Realizations regarding the action plan will be monitored and reported annually by the Ministry of Agriculture and Forestry (General Directorate of Water Management).

Legal Basis

With the “Presidential Decree on the Presidential Organization” dated 10/7/2018 and numbered 1 (Official Gazette 10/7/2018-30474), “to carry out studies for the purpose of establishing policies on the protection and sustainable use of water resources” and “the impact of climate change on water resources” duties are given to the Ministry of Agriculture and Forestry (General Directorate of Water Management).

Also, Water **Efficiency in Türkiye** has been addressed as the main topic within the scope of the “Water Resources Management and Security Special Expertise Commission Report” published in the 11th Development Plan (2019-2023) Special Expertise Commissions Handbook list by the T.R. Presidency’s Strategy and Budget Presidency. On the other hand, the first target determined within the scope of the I. Water Council studies organized by the Ministry of Agriculture and Forestry in 2021; **“Preparation of water efficiency strategy document”**.

General Principles

Studies were carried out by considering the principles of sustainability, participation, inclusiveness, scientificity, up-to-dateness and transparency.

2.CURRENT SITUATION

Water Availability and Sectoral Water Uses in Türkiye

Türkiye's surface area is 78 million hectares and the total annual usable water amount is nearly 112 billion m³. **Considering the population of our country in 2022, the annual amount of water per person is 1,313 m³**. According to the Falkenmark Indicator (water scarcity index), water potential per person should be more than 1,700 m³. It is stated that countries or regions with a per capita amount of water per year between 1,700 ~ 1,000 m³ are in "water shortage". In this respect, **Our Country is in the "water stress" class**. According to Turkish Statistical Institute (TUIK) population scenarios (only main scenarios were taken into account, low and high scenarios were not taken into account.) The population of Türkiye is expected to reach 93,328,574 people in 2030, 100,331,233 people in 2040, and 104,749,423 people in 2050. With the increasing population, the annual amount of usable water per person is expected to decrease to 1,200 cubic meters in 2030, 1,116 cubic meters in 2040, and 1,069 cubic meters in 2050. **It is obvious that in the very near future, Türkiye will come very close to the water scarcity limit and will subsequently become a country experiencing water scarcity**[3] (TUIK, 2018).

Table 1. Water Situation and Usage Areas in Türkiye

Total Annual Precipitation Amount	450 billion m³
Annual Average Areal Amount of Precipitation	574 mm
Annual Average Surface Flow Amount (Natural Flow)	185 billion m³
Annual Usable Amount of Surface Water	94 billion m³
Groundwater Safe Reserve Amount	18 billion m³
Annual Total Amount of Usable Water	112 billion m³
Total Sectoral Water Uses	57 billion m³
Agricultural Watering	44 billion m³
Surface Water	%75
Ground-water	%25
Drinking Usage and Industry	13 billion m³
Surface Water	%58
Ground-water	%42

Projection studies on the change in water availability in our basins due to climate change show that water availability **in Türkiye may decrease by up to 25 percent**. Since water is a resource shared across sectors, resource efficiency strategies for each sector are of great importance for the sustainable management of water resources.

[3] TURKSTAT Population Scenarios URL: https://data.tuik.gov.tr/Kategori/GetKategori?p=Nufus-ve-Demografi-109.

According to the results of 2022, 44 billion cubic meters (77%) of the total consumption of 57 billion cubic meters for various purposes is used as irrigation water, and 13 billion cubic meters (23%) is used to meet the needs for drinking purposes (12%) and industrial purposes (11%)4 (DSI, 2023). Approximately 71% of sectoral water usage is provided from surface water and 29% from groundwater. This value corresponds to 51% of the annual usable water potential.

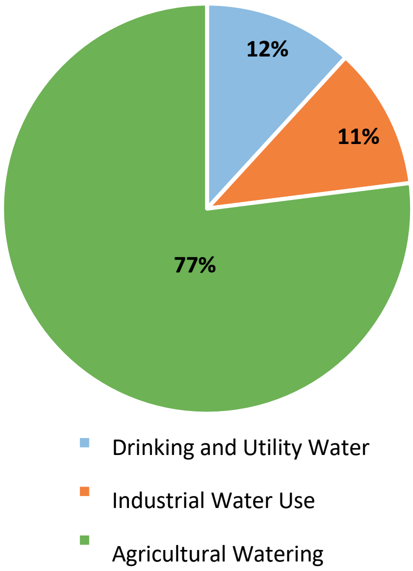

Figure 1. Sectoral Water Uses in Türkiye

When the current sectoral water uses in 25 river basins in our country are examined; approximately 81% of surface water resources are used for irrigation and 19% for drinking purposes and industry; it has been determined that approximately 67% of underground water resources are used for irrigation and 33% for drinking purposes and industry. In 78 million hectares of our country's, 51 million hectares of surface area have been surveyed and irrigable land availability has been determined as 26.5 million hectares.

The economically irrigable area has been determined as 8.5 million hectares, and irrigation services have been provided to 6.6 million hectares of this area with public investments and citizen opportunities. Considering the development situation in 2050, the irrigation area is expected to be 9.5 million hectares (DSI, 2020).

[4] Regulation on Control of Water Losses in Drinking Water Supply and Distribution Systems - Annual Reports of Water Losses and Inventory Forms.

The Impacts of Climate Change on Water Resources and Future Projections

With the industrial revolution, which began in the mid-19th century, human activities such as the excessive use of fossil fuels, changes in land use, deforestation, and industrialization ushered in a new era in world history. For the first time, human activities play a role alongside the natural change in climate. During this period, the multifaceted effects of climate change such as rise in sea level, increase in temperatures, decrease in glaciers, increase in the frequency and severity of disasters have been detected. These effects are expected to intensify and be seen in the coming periods.

Our country is located in the Mediterranean zone, where the effects of global climate change will be felt intensely, and is considered among the high-risk group countries in terms of the negative effects of climate change5. With climate change, more frequent, severe and long-term droughts, heat waves and forest fires are expected to occur in our country in the 21st century. In addition, with the increase in the number of days with short-term but heavy downpours, it is expected that there will be a significant increase in sudden floods.

It is inevitable that global climate change will affect many sectors due to temperature increase. Sectors such as health, forestry, biodiversity and tourism, especially water resources and agricultural production, are expected to be primarily affected. It is clear that climate change will alter the hydrological cycle and systems, altering water resources in terms of quantity and quality, and will also directly or indirectly affect socio-economic and environmental goods and services. The most important impact of climate change on the water cycle (hydrological cycle) will occur as changes in the availability, quantity and water quality of water resources.

[5] Ministry of Agriculture and Forestry, (2016), Impact of Climate Change on Water Resources Project.

As a result of studies conducted on the impact of climate change on water resources in our country; expected climate projections for the future until 2100 were obtained for 25 basins, and expected changes in surface and groundwater in the future for each basin were determined. The results obtained from the project are summarized as follows:

Potential Impacts of Climate Change on Water Resources

- Average temperatures in our country will increase significantly and the increase will be 1-2°C higher, especially in the eastern and southeastern regions of our country,
- The highest temperature increase in the southern and western regions will be experienced in the summer months,
- There will be a general decrease in total precipitation, mostly in the Aegean and Mediterranean coasts and in the southeastern and eastern regions.
- Rainfall increases of up to 150 mm will occur on the Black Sea coast,
- Precipitation decreases will be greatest in winter,
- The number of expected heat wave days in the east and southeast of our country will reach 200 days per year by the end of the century,
- The risk of forest fires will increase with the rapid increase in heat waves,
- According to the results of all models between 2015-2040, compared to the reference period of 1970-2000, the number of consecutive dry days will increase by 4-15 days,
- There will be an increase in the number of consecutive dry days in the Eastern Mediterranean, Konya Closed Basins and the Euphrates-Tigris Basin south of the Eastern Taurus Mountains.
- In the region from the Aegean coast to Central Anatolia, there will be an increase of 10 days in the number of dry days, in the Southeastern Anatolia Region, consecutive dry day index values will reach 140-160 days, and on the Black Sea coast, these values will be between 30-70 days,
- There will be a decrease in the total snow cover and the snow mass will melt faster in parallel with the increasing temperatures, which will increase water stress in the late spring and summer months.
- There will be a significant water deficit in the Euphrates-Tigris and Konya Closed Basins in all scenarios and projection periods,
- Considering the water supply investments, there will be a water surplus in the Eastern Black Sea and Çoruh Basins throughout all projection periods,
- It is estimated that water availability will generally be sufficient in the Marmara, Susurluk, Northern Aegean, Western Mediterranean, Western Black Sea, Yeşilırmak, Antalya, Aras and Van Lake Basins.

According to the 2013-2019 agricultural production data in the basins of our country, the results of the Impact of Climate Change on Water Resources Project and the water budget calculations made using the water footprint (WaterStat) of all agricultural products in our country, it has been determined that there is currently a water surplus of 14.6 km3/year for our country. However, according to the RCP 8.5 scenario, a water deficit of 57.3 km3/year is expected to occur in the 2071-2100 period. In our country, there is a water deficit risk in 15 river basins in the 2015-2040 period according to the RCP 4.5 scenario, and it is predicted that this risk will be valid in 18 basins in the 2041-2100 period according to the RCP 8.5 scenario. Compared to the results of the Impact of Climate Change on Water Resources Project, the water budgets calculated with the water footprint methodology reveal the risk of water deficit in more basins. This situation shows that the water need cannot be fully met and efficiency practices should be implemented as soon as possible (Pilevneli et al., 2023).

Efficiency Indicators

Efficiency, in broad terms, is an effective management indicator that reveals the effectiveness of resource utilization. To conduct efficiency studies, it is necessary to first obtain all kinds of water use information in a sufficient and realistic manner, assess the current state by interpreting this information, and determine realistic and reasonable future targets based on the current efficiency level. In this context, various indices and ratios used in water efficiency studies and measuring efficiency are as follows:

Various Indexes and Ratios Used in Water Efficiency Studies

- Household Specific Domestic Water Consumption: L/person.day
- Water Production Efficiency: Produced water/Withdrawn water (%)
- Drinking Water Networks: Infrastructure Leakage Index (ILI), Non-Revenue Water (NRW) Rate (%), Water Loss Rate (%)
- Agricultural Irrigation: Irrigation efficiency (%), irrigation per hectare (m^3/ha),
- Water Productivity: Product produced/Amount of water used (kg/m^3),
- Industry: Specific water consumption (m3/unit product), added value (TL/m^3)
- Water Footprint: m^3/unit (area/product/sector/person)
- Reuse of Used Water: Reuse rate (%)
- Water Use Index: annual total water withdrawal/long-term annual average availability (Water Exploitation Index – WEI)
- Falkenmark Index: annual amount of water per capita (usable water availability/total population) (m^3/person)

3. CURRENT SITUATION REGARDING SECTORAL WATER USE EFFICIENCY, TIGHTNESS AND STRATEGIES





3.1 URBAN WATER USAGE EFFICIENCY

https://media.istockphoto.com/id/542001932/tr/fotoğraf/atakule-tower.jpg?s=612x612&w=0&k=20&c=oLHSzptN5oE-y1bMJewGuMcHzvX0vyss5LrOUO-QazM=

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https://media.istockphoto.com/id/542001932/tr/fotoğraf/atakule-tower.jpg?s=612x612&w=0&k=20&c=oLHSzptN5oE-y1bMJewGuMcHzvX0vyss5LrOUO-QazM=

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3.1.1 Current Situation in Urban Water Usage

Water Usage Efficiency in Drinking Water Supply and Distribution Systems

Exploring new water sources, ensuring that the water taken from the source is treated to potable water quality and then making it available to consumers through transmission is both economically and technically demanding and costly. Considering these difficulties, as well as the decrease in the amount of water available due to climate change and rapid population growth, it is of great importance to prioritize efforts to reduce water losses in the existing network before starting the search for water resources. Within the scope of adaptation to the changing climate, water losses should be reduced to the lowest possible level in technical and economic terms while emphasizing efficient water usage.

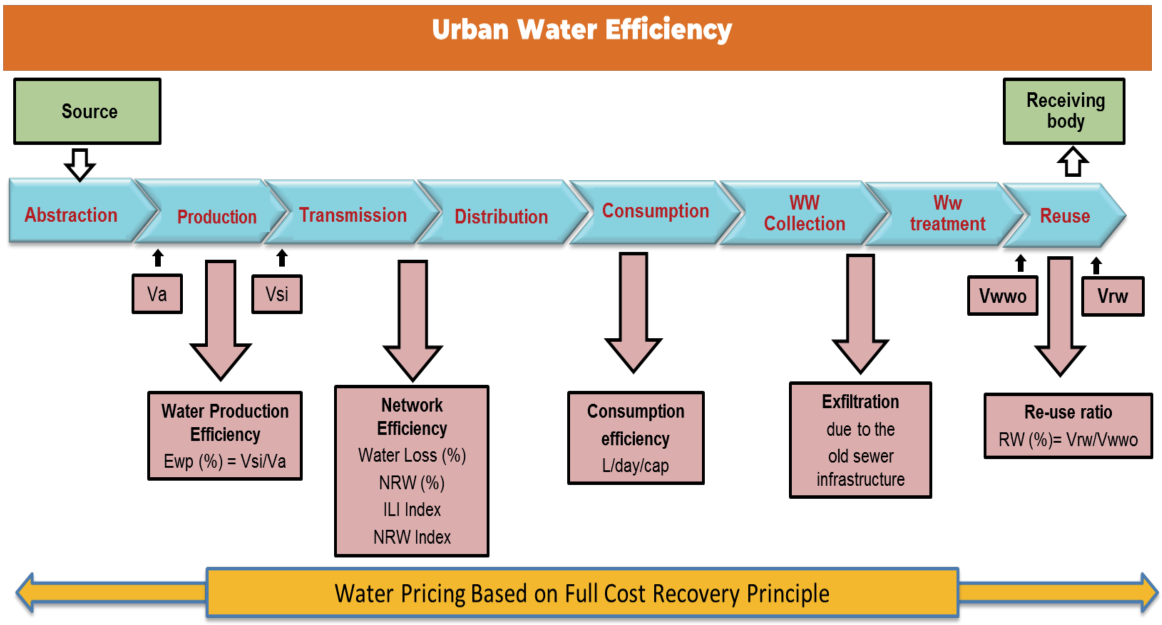


Figure 2. Urban Water Usage Cycle And Efficiency Approach

Water efficiency is a concept that includes **water withdrawal from the source, treatment, transmission to the network, consumption by users, treatment of wastewater, reuse of treated water and pricing that encourages the efficient usage of water.** The basic principle in water supply is the timely delivery of quality and desired quantity of water to users. For this reason, it is extremely important to prevent water losses, minimize failures and ensure operational efficiency at every stage from the source to the end consumer. In particular, preventing and controlling leakages and losses will contribute to postponing the search for new resources and using existing resources more efficiently.

Average water consumption in European countries is 124 liters per person per day. The average household composition is 2.3 persons and the average per household consumption is 105 m3/household/year.

Table 2 shows the annual withdrawal of drinking and potable water and the total amount of water withdrawn per capita in European countries (EurEau, 2021).

Tablo 2. Avrupa ülkelerinde su çekimi istatistikleri[6]

European Countries	Total Water Withdrawal Per Capita (m^3/year)	Drinking and potable water withdrawn annually (km^3/year)
Germany	342,6	-
Austria	392,8	0,72
Belgium	347,8	0,739
United Kingdom	125,4	6,227
Bulgaria	769,3	8,865
Czech Republic	149,1	0,654
Denmark	186,8	0,3917
Finland	507	0,4
France	415,6	5,391
Croatia	172,7	0,455
Netherlands	474,7	1,967
Ireland	296,1	-
Spain	668,6	4,89
Sweden	238,2	0,955
Italy	563,9	9,488
Iceland	826,5	0,08
Montenegro	256,3	0,0964
Hungary	769,3	0,6279
Norway	504,2	0,7753
Poland	264,5	2,129
Portugal	585	0,8838
Romania	328,9	1,085
Serbia	631,3	0,6539
Slovakia	112,2	0,2925
Slovenia	462,5	0,171
Greece	962	1,687

The Directive on the Quality of Water for Human Use (Drinking Water Directive), which is taken as a basis by the Member States of the European Union[7], sets the drinking water quality requirements for human health. Within the scope of water losses, Member States are obliged to assess the level of losses and the potential for improvement in reducing losses and leakages, using the Infrastructure Leakage Index (ILI) rating method or another appropriate method, and to communicate the results of the assessment to the Commission within 5 years.

[6] https://www.fao.org/aquastat/statistics/query/index.html
[7] 98/83/EC Directive.

Within 7 years, the Commission will set a threshold value for leakage and, based on the assessments of the Member States, establish a "European Union average leakage rate". will be drafted. Member States with loss/leakage rates exceeding the set threshold shall submit to the Commission an action plan with measures to reduce these rates.

In Türkiye, the Eleventh Development Plan includes measures related to water efficiency under the title of Urban Infrastructure, such as ensuring the integrity of planning within the scope of protection, **development and sustainable use of water resources, providing drinking water and wastewater services efficiently, adequately and in accordance with standards, and developing the SUKAP program to reduce physical losses.**

The By-Law on Control of Water Losses in Drinking Water Supply and Distribution Systems sets out the duties and responsibilities of water administrations to reduce water losses in water supply, transmission, distribution and consumption.

Water loss rates as per the By-Law;
Water loss rates as per the By-Law;
• Metropolitan and provincial municipalities:
- Maximum 30% until 2023,
- By 2028, to a maximum level of 25%,
• Other municipalities:
- Maximum 35% by 2023,
- Maximum 30% by 2028,
- By 2033, a maximum of 25%,
to the level of the level of the "minimum level".

Throughout our country, there are 30 metropolitan municipalities, 49 provincial municipalities and 216 municipalities whose data are considered reliable from the annual reports of water losses declared to the General Directorate of Water Management in accordance with the legislation[4] in 2021 (those with water losses less than 15% and greater than 85% were not taken into account). According to the calculation made from the data of the district/town municipality, the amount of water entering the drinking and usage network is approximately 6.22 billion m3/year.

Annually, 4.13 billion cubic meters of this water was distributed to users as permitted consumption. 2.09 billion cubic meters of water was lost before reaching the user. For this reason, the average water loss rate in drinking water supply and distribution systems in our country in 2021 is calculated as 33.54%. Approximately 24.09% of this rate consists of physical losses and 9.45% consists of administrative losses. In addition to the water loss rate, the non-income water rate, which includes authorized consumption without a bill, was determined as 38.67%. The average water loss rate of metropolitan municipalities is 32.45%, and the average water loss rate of provincial municipalities is 41.25%. The population of the municipalities whose data are used corresponds to approximately 88.7% of Türkiye's population.

[8] Regulation on Control of Water Losses in Drinking Water Supply and Distribution Systems (Official Gazette dated 08.05.2014 and numbered 28994).

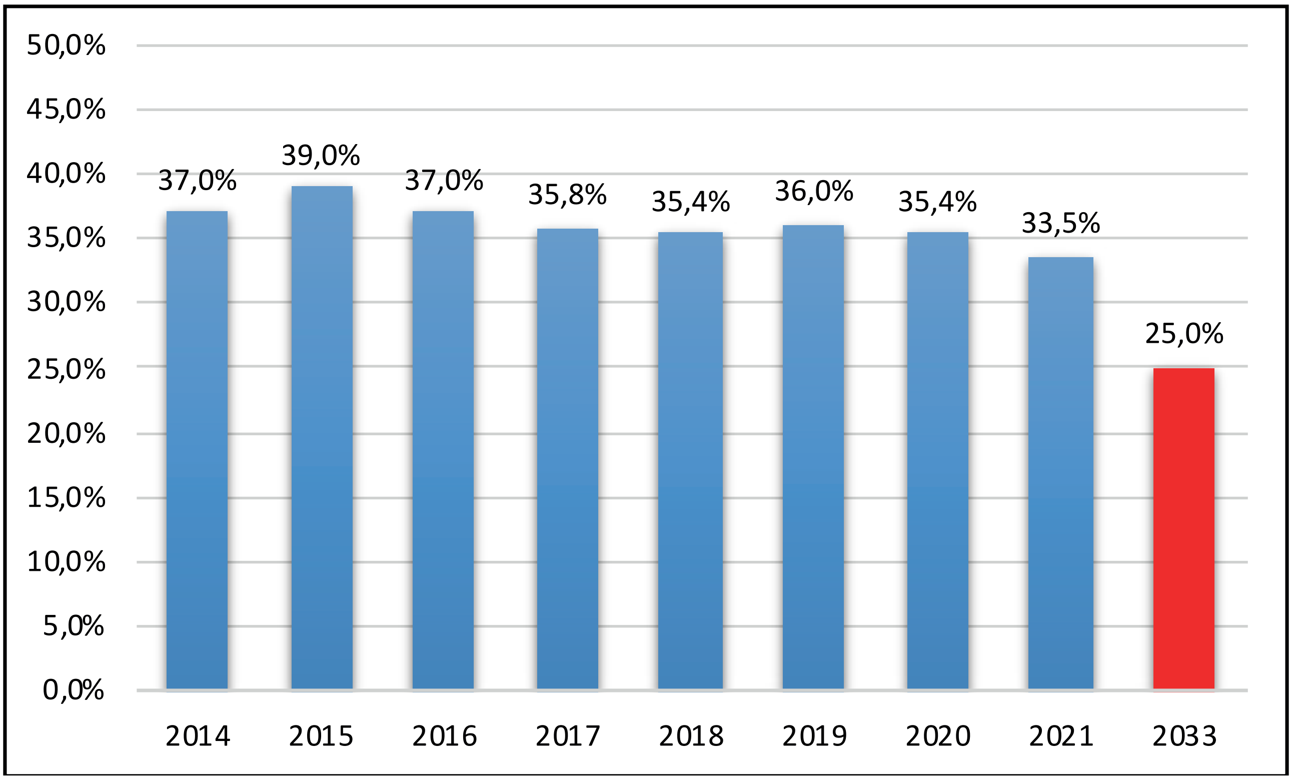


Figure 3. Water Loss Rates in Drinking Water Networks in Turkey Between 2014-2021

In urban water use, losses can occur at every stage (treatment plants, supply and distribution systems, building units, individual uses, wastewater treatment plants, recycling units, etc.) starting from the withdrawal of water from the source to its delivery to the end consumer. Especially in drinking water treatment plants, significant water losses occur due to the use of filter backwash water. In cases where the use of wash water is not optimized, a significant amount of water is lost due to backwashing during plant operation. In order to reduce this loss, backwash times should be optimized by placing turbidity sensors at the backwash water outlets of sand filters and controlling the inlet water quality. **Water loss data of 107 of 529 drinking water treatment facilities in Türkiye were examined, and while losses were 5% or less in 67 facilities, the number of facilities with a loss rate above 20% was 7. The loss rate in the remaining 40 facilities is between 5% and 20%.** (DGWM, 2017b).

In 2021, per capita water use, including losses, in the cities of our country is between 128-366 liters, and the average water consumption, **including losses, is 220L/person/day, while the net average water use, excluding losses, is 146 L/person/day.**

On average, the distribution of water uses according to subscriber groups is 68% residential, 10.6% other groups (water sales by tanker, agricultural water use, villages, neighborhood fountains, ports and different subscriptions specific to each municipality), 9.6% commercial/industrial, 5.3% public institutions/health institutions/schools, 3.2% parks, gardens and public toilets, 1.9% construction sites, 1.3% religious and charitable institutions[9].

[9] Regulation on Control of Water Losses in Drinking Water Supply and Distribution Systems - Annual Reports of Water Losses and Inventory Forms

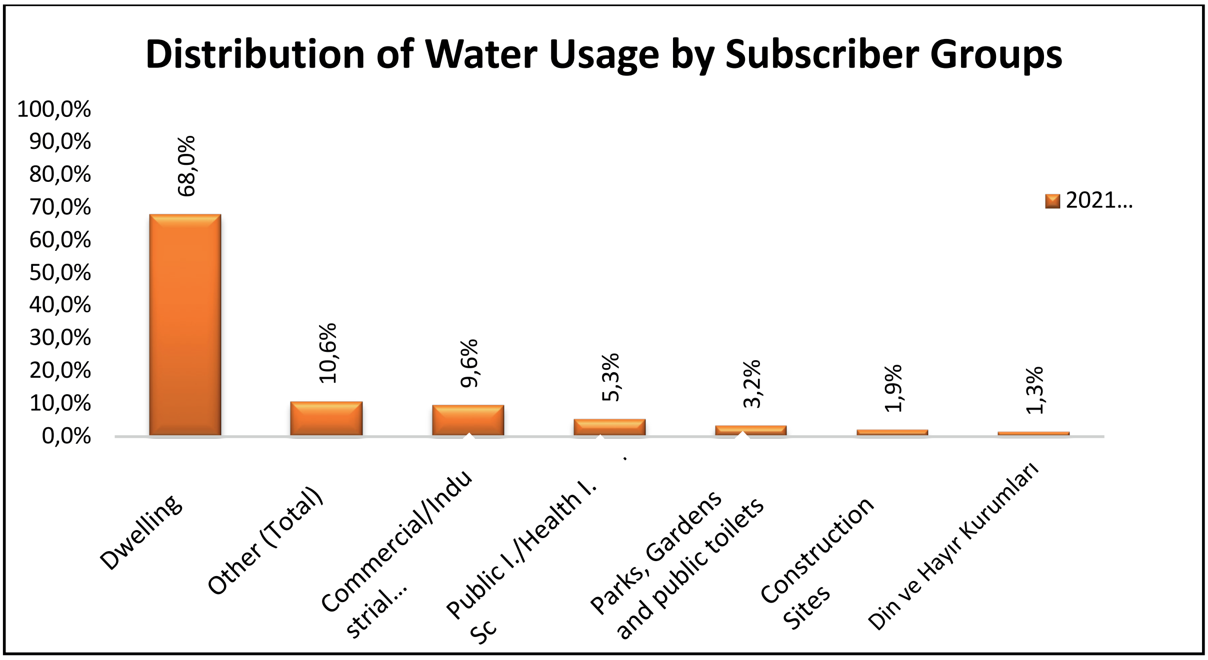


Figure 4. Water usage rates by subscriber groups

Measures to control and prevent water losses in drinking water supply and distribution systems are given below:

Measures to reduce physical losses

- Application of regional measuring areas
- Application of pressure management areas
- Implementation of pressure management control systems
- Rehabilitation of infrastructures

Measures to reduce administrative losses

- Improving meter reading and billing efficiency
- Application of meter testing & calibration tools
- Meter changes
- Unauthorized connection control

Measures to improve water systems management

- Implementation of remote control and intervention systems

Other complementary measures

- Capacity building for water system staff
- Public awareness campaigns on water efficiency
- Tariff related measures

Planned Areas Zoning Regulations[6] includes provisions on saving measures in buildings and climate change. With Article 57/A, practices that ensure the efficient use of water in central sanitary hot water systems, taps and batteries, and garden irrigation have gained legal ground. The following issues are stipulated in Article 57 of the Regulation;

(1) It is essential that central sanitary hot water systems are designed and implemented to include a hot water circulation (by-pass) installation in order to ensure readiness of hot water and water efficiency.

(2) In order to ensure water saving, it is essential to use taps or faucets not exceeding 6 L / min in sinks and sinks and 8 L / min in showers, and to show them in the plumbing project and site list.

(3) If an irrigation system is planned in parcel gardens, it is essential to design the system in accordance with drip irrigation, to select plants that require less water and suitable for drip irrigation system according to local and climatic conditions, and to use the water in the rainwater storage system first, if any. These issues are also taken into account in the landscaping projects requested by the administrations within the scope of subparagraph (b) of the second paragraph of Article 57.

Water Use Efficiency in Tourism Activities

Tourism is among the sectors where water use is intense. Water consumption in accommodation and daily facilities varies depending on the category of the facility, its physical characteristics and the management system of the facility.

Water Usage Areas in Tourism Facilities:

- Rooms, laundry and kitchen,
- General areas (gym, sauna, toilets in public areas, etc.),
- Garden irrigation, golf course irrigation,
- Swimming pools, ornamental pools and ponds,
- Air conditioning (in cooling towers and boilers).

The most important components that affect the amount of water used are the size of the facility, swimming pool, golf course and the management system of the business. However, the irrigation of green areas and golf courses and the amount of feed water for pools are not affected by the number of guests. As long as the operation is active, there will be a constant water consumption depending on the characteristics of the facility, and this consumption will increase in direct proportion depending on the occupancy. Landscape irrigation is one of the most important areas of water use, especially in hotels with large green areas. Although it varies depending on the size of the irrigated green area and other uses, **the share of water use in landscape irrigation in the total amount can reach 50-60%.** (TUBITAK MAM, 2014).

[10] Official Gazette dated 03.07.2017 and numbered 30113.

Approximately 45-50% of the total water in hotels is consumed in hotel rooms. 56% of the water used in a hotel room is used in the shower or bath, 25% in the toilet, 9% in the sink and 10% for cleaning (Çakır & Çakır, 2010). A study conducted to determine water usage habits and saving trends in water and energy use in Türkiye reveals that people tend to pay less attention to water saving when using water in public or semi-public places such as hotels and restaurants compared to the residential usage. **The study states that while individuals consume an average of 130 liters of water in their own homes, this rate varies between 300-600 liters in a hotel**[11]. Per capita water usage in hotels and accommodation facilities is higher than residential usage, and recycling of water used in the tourism sector is extremely important. Particularly, reusing the high amounts of gray water generated in the facilities for landscaping and agricultural irrigation, toilet reservoirs, ornamental pools, cooling water and vehicle washing, and laundry depending on treatment technology are among the solutions that will alleviate the burden on drinking and domestic water in the facilities.

[11] Water Use Research in Turkey conducted in collaboration with Grohe -TNS (URL: https://www.ekoyapidergisi.org/888-turkiyede-su-kullaniminda-tasarruf-bilinci.html).

Individual Water Use Efficiency

Within the scope of individual water efficiency practices, water efficiency to be achieved as a result of behavioural change through the water use behaviours of individuals in the process from the tap to the final consumption is addressed. However, achieving behavioral change in water use is related to many socio-economic and cultural factors such as household demographics.

The World Health Organization (WHO) states that the minimum daily water need of a person to meet basic daily needs is 25 liters. In the literature, it is stated that a person needs a minimum of 50 liters of water per day to meet basic needs such as drinking, eating, bathing and cleaning (Gleick, 2002).

Table 3. Daily basic drinking and domestic water needs

Need Type	L/person/day
Drinking water*	5
Cleaning-Hygiene	20
Bath	15
Meal Preparation and Cooking**	10
Total	50

*Temperate climate and average activity level
**Excluding water required to grow food

The amount of water used daily by households varies greatly depending on how far the water source is from the household. If the source is outside the house, at a distance of 1 kilometer or more (or the total supply time is more than 30 minutes in total), it can generally be considered as approximately 20 liters per person per day. However, in places where water is supplied from a single tap within the boundaries of the household's living space (or from a distance of 100 meters or within a 5-minute supply time), this value is approximately 50 liters per person per day. On the other hand, in conditions where water is accessed from more than one tap and without interruption, daily water consumption per person may be 100 liters or more (Howard et al ., (WHO), 2020).

With increasing population, socioeconomic changes, drought and climate change, the pressure on our water resources is also increasing. Preventing water waste becomes more important day by day in order to leave a better "water legacy" to future generations. Various reasons such as domestic use, especially unconscious consumption habits, and the lack of water and energy saving features of household appliances lead to serious amounts of water waste. Provided below are some selections.

Statistics on Water Waste in Households and Individual Water Uses

- Turning off a tap while brushing your teeth saves 11-12 liters per minute (Öztürk, 2018). Not turning off the tap while brushing causes water waste of approximately 25 liters per person per day, depending on brushing time Davis , 2014).
- A 5-minute pre-rinse performed before the dishwasher corresponds to approximately 45.4 liters of water usage, depending on the faucet feature (Portland Government , 2020). This value for a single wash corresponds to 11.4 liters per person, considering a family of 4.
- According to a modeling study carried out in 2009, it is stated that more than 10% of the hot water used is wasted while waiting for the hot water to arrive. For example, it is stated that the total American population takes 200 million showers daily and according to EPA estimates, 280 million gallons (1,233,367.16 m³) of water are wasted every day (Osann , 2014). Based on this, it is estimated that approximately 5.3 liters of water per person is wasted every day while waiting for hot water to arrive.
- In classical toilet systems, 9 liters of water are consumed per flush. However, in multistage devices, this value can be 3 liters/siphon. Based on this, it is possible to reduce water waste in toilets by 75%. In the calculations, assuming that a person uses it 4 times a day, water waste of up to 24 liters can occur.
- Assuming that, on average, hands are washed 9 times a day and turning off the taps for a 20-second soaping period, it is estimated that approximately 23 liters of water can be saved per day (Portland Government , 2020).
- It is possible to prevent a waste of 15 liters per wash by not using the pre-wash program unnecessarily (Derbyshire , 2008). This value for a single wash is taken into account as 3.75 liters per person, considering a family of 4 people.

In the calculations made based on the domestic usage data given above (for a house where a washing machine and dishwasher are operated daily), water waste per person per day reaches 93 liters. **By using water consciously and efficiently, it is possible to save more than 360 liters of water per day for a family of 4 people.**

On the other hand, eliminating leaks in indoor connection pipes or tap apparatus that need to be repaired in homes is among the issues that will increase domestic water efficiency.

Research Results on Individual Water Use in Our Country

According to the results of the research conducted by the Ministry of Agriculture and Forestry in 26 provinces in 2021 to determine water consumption habits in the society (TOB, 2021):

• 40% of the participants think that our country is water rich.

• Households are divided into three profiles according to their water consumption, with 38% of households consuming average, 38% below average and 24% above average water.

• There is a strong relationship between socio-economic status and the source of drinking water in households. As the socio-economic status increases, the use of tap water is replaced by bottled water.

• As household size increases, per capita water consumption decreases.

• 21% of the participants leave the water on while brushing their teeth and 52% while washing their hands.

• 30% of the participants rinse the dishes before placing the dishwasher and 33% run the machine without filling it completely.

• 67% of the participants use the pre-wash program in their washing machines, and 43% run the washing machine without filling it fully.

• In 4% of the households, flush water flows, and in 7%, there is a dripping tap.

• It is observed that one out of every four households with a toilet flush (%26) uses a water-saving flush.

• 31% of those who take a shower by taking a bath under running water use the running water until it heats up.

• 3% of the participants indicate that they have a system in their households for treating graywater and using it in toilet flushes.

• Approximately one in every twenty households (5%) states that there is a system for the use of rainwater in their building.

• 31% of the participants state that they are very careful about saving water.

• 96% of the participants support the view that “serious measures should be taken to avoid thirst in the future.”

Considering the subscriber groups in our country, the average water usage per person is 99 L/day in residential areas and 47 L/ day in other subscriber groups (all non-residential subscriptions)[12].

Approximately 12% of water use occurs through buildings (UNEP, 2012). A very small part of the drinking water used for household needs is used directly as drinking water. Almost all of the water used in residences turns into wastewater through kitchens, bathrooms and toilets and is discharged into the sewer line.

Structural regulations regarding water efficiency in households include measures that combine techniques to increase water efficiency in homes and household water use. This approach includes regulating the use of water inside the house, preventing the use of drinking water in places where it is not needed such as flush water, secondary use of wastewater created by reusing gray water, and using a combination of efficiency-oriented techniques, and devices. For example, it is possible to recover and reuse gray water through various methods. Domestic and/or industrial treated wastewater can be reused in accordance with circular economy principles in different areas specified in the Wastewater Treatment Facilities Technical Procedures Communiqué[13]. According to the Water Pollution Control Regulation, [14]it is essential to evaluate the reuse opportunities of gray water and rainwater.

[12] Regulation on Control of Water Losses in Drinking Water Supply and Distribution Systems - Annual Reports of Water Losses and Inventory Forms.
[13] Official Gazette dated 20.03.2010 and numbered 27527.
[14] Official Gazette dated 31.12.2004 and numbered 25687 .

3.1.2 Bottlenecks Encountered in Urban Water Use Efficiency

- Deficiencies in the structuring of municipalities and water and sewerage administrations (SUKİ).
- Lack of holistic planning regarding drinking and potable water management of municipalities.
- Lack of financial resources in drinking water services.
- Insufficient measurement, monitoring and control of water use.
- Lack of institutional and technical capacity (expert personnel, automation, etc.) in drinking water systems.
- Lack of up-to-date and holistic data on water and wastewater systems.
- Lack of awareness in local governments about water losses in drinking-use water supply and distribution systems, and instead of preventing losses, they are searching for new water sources.
- Although there are water loss targets in the legislation, there are no deterrent sanctions.
- Lack of regular and adequate reporting on water losses.
- Inadequate dissemination of applications such as isolated sub-regions, pressure management, hydraulic modelling, etc. to reduce losses in potable water distribution systems.
- Inadequacy of measurements and monitoring regarding free water use.
- Not using advanced performance indicators for infrastructures.
- Lack of systems such as Geographic Information Systems (GIS), automation, subscriber management system, asset management and fault notification and management in managing data.
- The existing infrastructures of most municipalities are outdated, inadequate and regular maintenance and repairs are not carried out, and water loss in water supply and distribution systems is very high.
- Illegal usage is high due to faulty measurements and unlicensed and/or unregistered well usage.
- Lack of awareness about efficient use of water.
- Insufficient incentives and legal regulations for the efficient use of water, especially the purification and reuse of used water.
- Insufficiency of education and awareness raising activities regarding the importance of water and its efficient use.
- Awareness-raising topics regarding individual water use are not included at a sufficient level in the compulsory education curriculum.
- Not allocating sufficient budget to awareness and training activities on individual water use.

- Lack of sufficient dialogue between public institutions and civil society organizations on water efficiency.
- The lack of widespread water-saving device classification system, the insufficiency of awareness raising activities that will enable manufacturers and consumers to choose devices in these classes, and the lack of incentives and legal regulations.
- Failure to monitor water use in accommodation and daily facilities in the tourism sector and failure to set permanent water efficiency targets.
- Insufficiency of guiding studies (guidance documents, etc.) on water efficiency for the tourism sector.
- Technologies, machinery, equipment, and devices that use water efficiently are not widespread enough.
- Due to the short season in marine tourism, both the water to be used and the wastewater to be generated vary seasonally, and this negatively affects the feasibility of reusing used water.

3.1.3 Goals, Targets and Strategies for Urban Water Efficiency

AIM: Increasing Urban Water Efficiency

Goal 1: By increasing water efficiency in local administrations, the water loss rate in all municipalities will be 25% by 2033; Reduced to 10% by 2040

Strategies:

1. Completion of legal, administrative, and technical studies that will increase the effectiveness of municipalities and water and sewerage administrations.
2. Developing the capacity of technical personnel in municipalities in effective management of water resources, especially in reducing water losses.
3. Transition to an integrated water and asset management system in drinking and utility water systems.
4. Establishing the necessary technological infrastructure for the detection and prevention of physical and administrative losses in drinking water systems and leaks in sewage systems and disseminating the use of automation/remote sensing systems.
5. Creating isolated sub-zones, pressure management, hydraulic modeling, etc. to reduce losses in drinking-use water supply and distribution systems. dissemination of applications.
6. In water allocations for municipalities, taking into account the achievement of water loss reduction targets determined by the legislation.
7. Prioritizing studies on reducing water losses in national and international financial resources (EU grant funds, Bank of Provinces, SUKAP, etc.).
8. Sharing good practices for reducing municipal water loss rates with other municipalities and disseminating the practices.

Goal 2: Ensuring water savings of up to 40% by increasing water use efficiency in the tourism sector

Strategies:

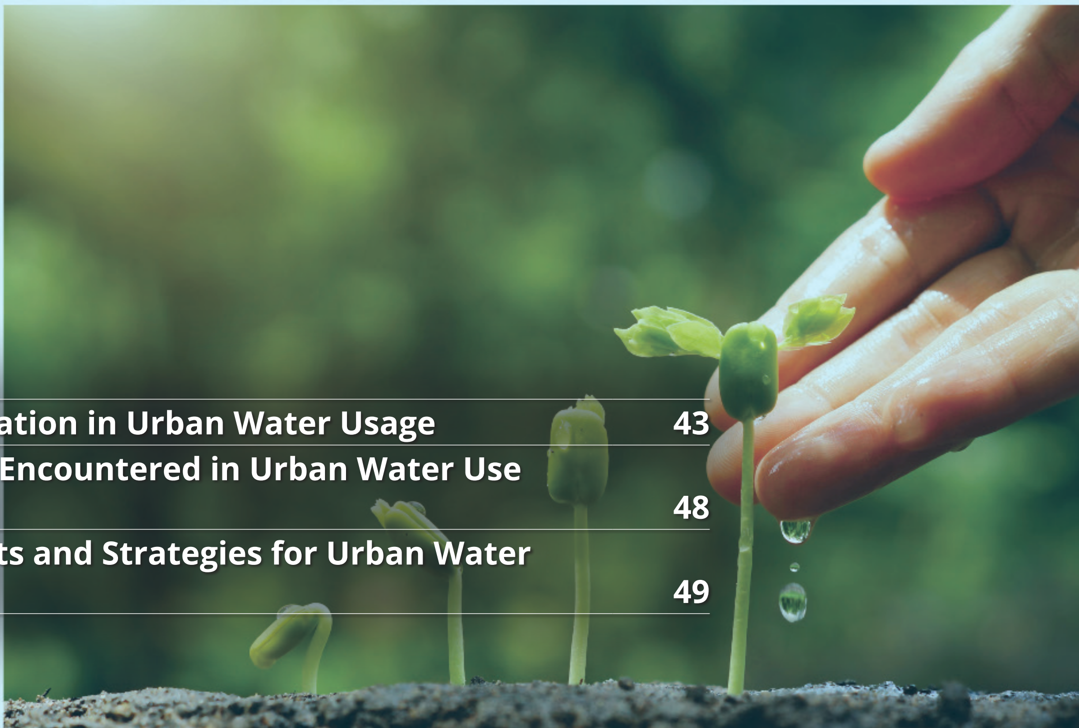
1. Developing social and economic supports and incentives (society encouraging practices, grants, incentives, R&D supports, etc. to support producers and industry) that will increase and popularize water efficiency in the tourism sector.
2. Expanding efforts to raise awareness about water efficiency in tourism, accommodation and entertainment facilities.
3. Conducting labeling studies showing the water usage level for devices, equipment and apparatus used in tourism facilities and disseminating the use of TSE certified water-saving products.

Goal 3: Reducing average daily water consumption per person to 120 liters by 2030 and 100 liters by 2050 by increasing efficiency in household and individual water use

Strategies:

1. Determining water efficiency targets in future water projections of local administrations based on per capita usage and the amount of water entering the system.
2. Establishing a water efficiency culture and increasing efforts to ensure individual behavior change, and developing capacity and financial resources for education, awareness and volunteering activities.
3. Ensuring cooperation between public institutions, universities, civil society organizations and the private sector in raising public awareness on the efficient use of water.
4. Creating incentive systems and programs to reduce individual water consumption.
5. Expanding the production and use of efficient household appliances, devices (faucets, shower heads, etc.) and cleaning products that will ensure efficient use of water.

3.2 AGRICULTURAL WATER USE EFFICIENCY



3.2.1 Current Situation in Agricultural Water Use

Water Use Efficiency in Agricultural Irrigation Activities

While agricultural water use in the world constitutes **approximately 70% of total sectoral water use**, this value is 25% for Europe and 81% for Africa and Asia (FAO, 2016). According to the projections made using socioeconomic and climate scenarios[15] for the world's irrigation area and irrigation amounts, it is predicted that there will be a slight increase in irrigation amounts if climate change is taken into account, and a slight decrease in usage if sustainable scenarios are preferred (Figure 5). In addition, water stress levels caused by agriculture around the world are given in Figure 6, where blue colored regions show the regions where water stress is lowest, and red colored regions show the regions where water stress is most severe. As can be seen from Figure 6, Türkiye is among the countries highly affected by the negative effects of climate change. The distribution of sectoral water uses also varies according to the development levels of countries. According to 2022 realizations, the share of agricultural irrigation in total water use in our country was 77% with 44 billion cubic meters (DSİ, 2023). Considering the share of water use in agriculture, the water gain from efficient irrigation practices will be quite high. It will be possible to irrigate more agricultural areas with the water gained through the use of modern irrigation systems and conscious agricultural practices.

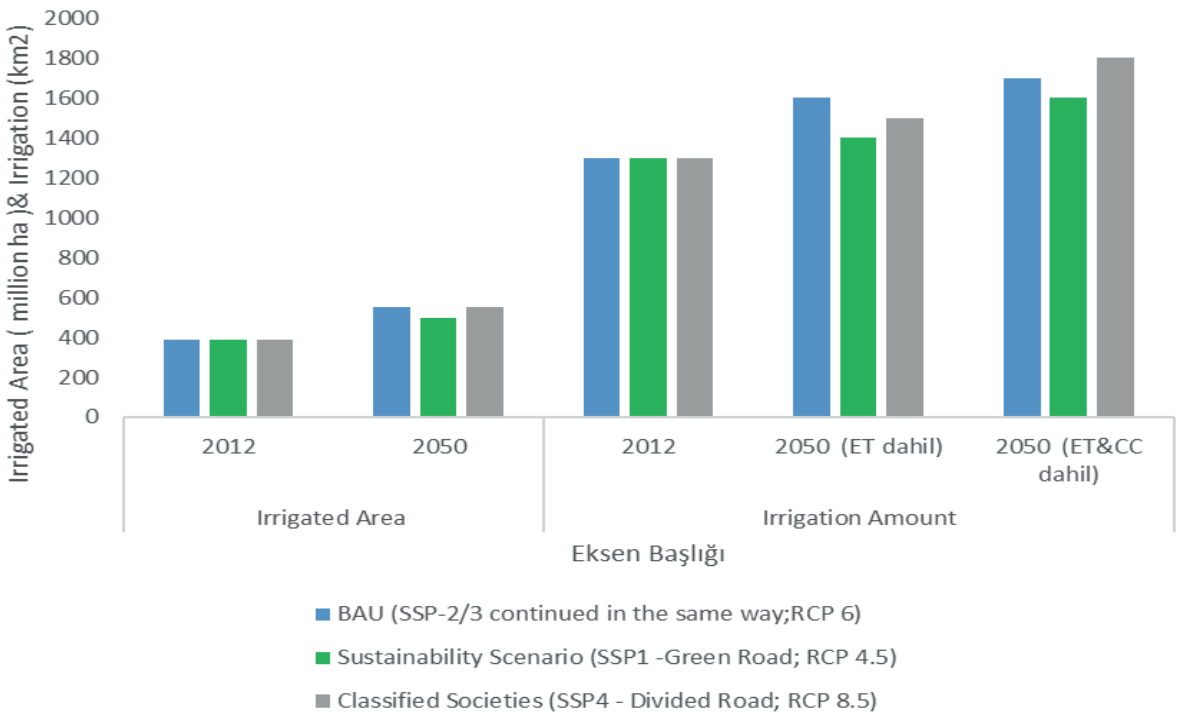


Figure 5. Global irrigated area and irrigation projections[16]

[15] Shared Socioeconomic Pathways (SSP), Representative Concentration Pathways (RCP) Senaryoları
[16] ET: Evapotranspirasyon,
CC: İklim Değişikliği (Climate Change)

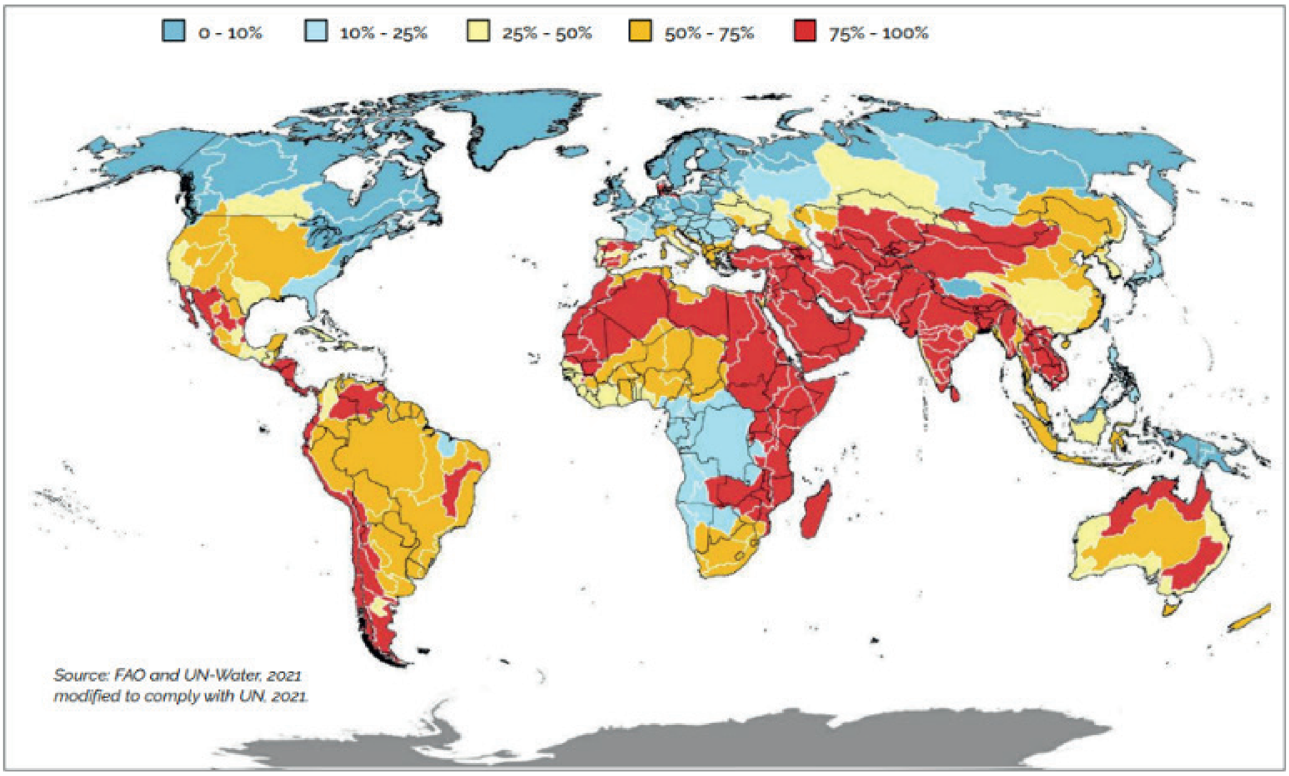


Figure 6. Water stress levels from the agricultural sector

Dissemination of pressurized irrigation systems is of great importance in terms of agricultural irrigation efficiency. According to the data of the International Irrigation and Drainage Commission, Israel and the United Kingdom realize almost all their irrigated agricultural areas, Brazil 77%, Spain 74% and the USA 57% with pressurized irrigation methods (ICID, 2018). Irrigation efficiencies in developed countries are at least 60-70% in surface irrigation, at least 70-75% in sprinkler irrigation and at least 80-90% in drip irrigation (Çevik et al., 2020).

In line with the vision of the international United Nations Food and Agriculture Organization (FAO) to "produce more food with less water" in agriculture;

- Modernization of irrigation systems **(Modernization of irrigation systems to be more efficient and less harmful to the environment in order to increase irrigation water efficiency),**

- Improving and diversifying the agricultural water supply system **(promoting investments in the treatment and reuse of urban wastewater for agriculture through decentralized rainwater collection and storage systems to increase the agricultural productivity and climate resilience of local communities),**

These issues are considered as policy tools that can be applied in the efficient use of water in agriculture.

In the FAO Aquastat portal, our country's agricultural water use efficiency value in 2018 is given as 0.29 US Dollars per cubic meter. Agricultural water use efficiency information of our country and various countries is given in Figure 7 (FAO, 2021).

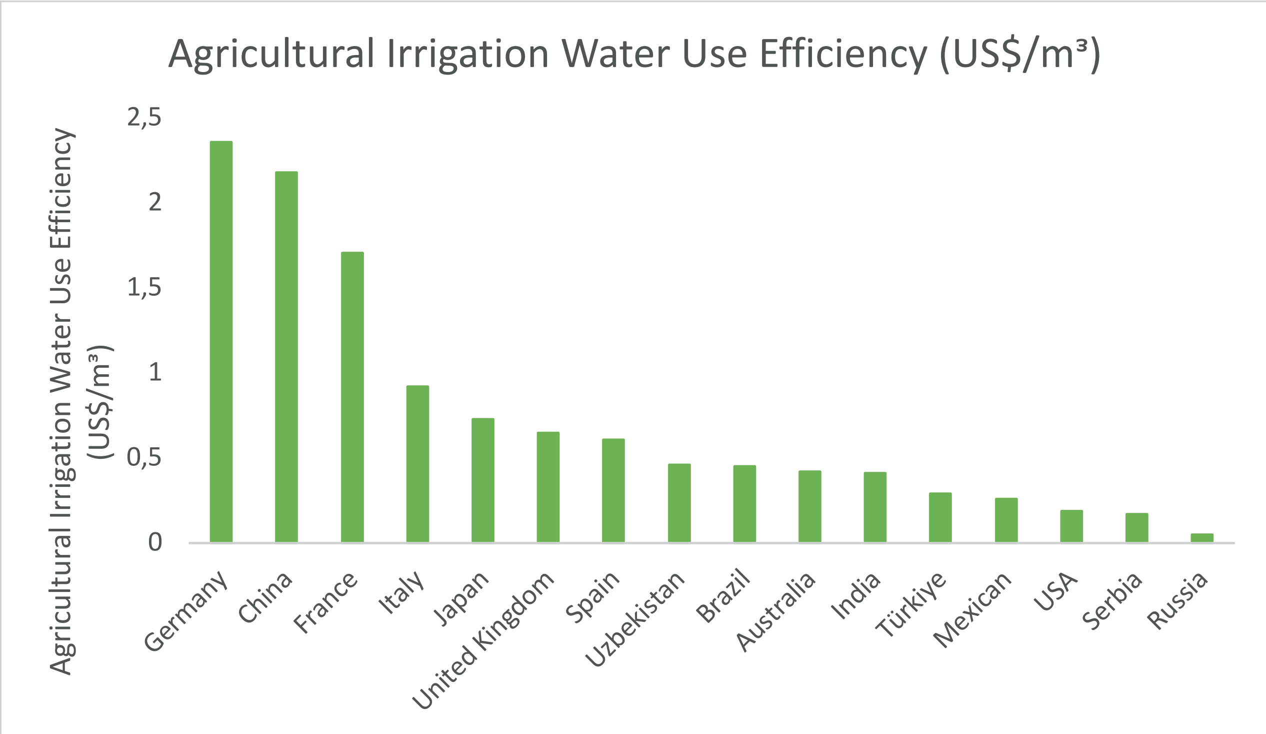


Figure 7. Irrigation-related productivity values in the agricultural sector

In addition, the policies of the Economic Cooperation Organization (ECO) include the policy of "Encouraging higher-yield agricultural production, more efficient agricultural water use and more sustainable cultivation of the land".

Within the scope of the goal of Combating Climate Change in Türkiye, Green Deal Action Plan highlights water efficiency practices in agriculture by mentioning "Training will be provided on sustainable agricultural techniques, carrying out R&D projects on this subject and disseminating the practices".

ccording to 2021 agricultural water use data in our country[17];

- The average total irrigation efficiency is 50.4% and water use per unit area is 9,515 m^3/ha,
- In irrigation facilities with meters, irrigation efficiency is 65% and water usage per unit area is 7,299 m^3/ha,
- In irrigation facilities where a water usage service fee tariff is applied on a volume-based (cubic meter, m^3) basis, the irrigation efficiency is 88% and the water usage per unit area is 5,173 m^3/ha.

[17] DSI General Directorate 2022 data

In accordance with the Regulation on Control of Water Use and Reduction of Water Losses in Irrigation Systems, **irrigation efficiency must be increased to 55+% by 2024.**

Among the studies carried out to increase agricultural irrigation efficiency are **the dissemination of closed systems, modern irrigation methods and agricultural techniques that will ensure the effective use of water; completion of land consolidation works; reuse of agricultural drainage and return water from irrigation; agriculture will be carried out in line with the water availability of the basins.**

- Measures related to efficiency in transmission and distribution lines
- Rehabilitation of irrigation areas
- Measures related to efficiency in in-field application systems
- Developing irrigation networks that feed the parcels and implementing high-efficiency irrigation systems and providing support to farmers
- Measures related to improving the management of water systems;
- Supervisory Control and Data Acquisition System
- Other complementary measures;
- Implementation of capacity building programs and efficiency-oriented irrigation tariffs for farmers

In order to achieve the irrigation efficiency rate targeted by the legislation, conscious and controlled irrigation practices must first be disseminated. In recent years, various activities have been carried out such as **closing open transmission lines, modernization of irrigation systems, new technologies and research and development studies for various crops, along with studies on the importance of land consolidation and controlled-conscious irrigation.**

Considering that inefficient surface irrigation systems are common in our country, another issue that affects efficiency in agricultural irrigation is **the management of return (drainage) water from irrigation.** Drainage in irrigated areas is of great importance in terms of protecting soil and water resources. Excessive use of irrigation water in irrigation networks where deliberate irrigation is not carried out and natural drainage is lacking causes the ground water level to decrease and resulting salinization threatens agricultural lands. Recovering and reusing water returned from irrigation will reduce the need for existing water resources and provide significant water savings. The management model proposed to solve drainage-related problems consists of structural and non-structural alternatives. Structural solution suggestions include improvement of irrigation systems, control of the quality of drainage water, management, and treatment of return water.

[18] DSI General Directorate 2022 data

Non-structural alternatives consist of legal and administrative solutions (carrying out water management by a central and single administrative structure), farmer training, water pricing that will encourage water efficiency, and irrigation management and operating systems alternatives. While fundamental solutions such as farmer training can provide permanent changes, if permanent solutions cannot be implemented, expensive engineering solution alternatives such as purification come to the fore (Karaaslan, 2019; SYGM, 2017a).

Another important issue regarding increasing irrigation efficiency is the organic matter content of the soil. The amount of organic matter in approximately 65% of Türkiye's soil is less than 2%, and in 23% it is between 2-3%. Increasing soil organic matter in these areas will contribute to increasing the amount of water in the soil and thus significant reductions in irrigation water needs can be achieved.

Water Use Efficiency in Livestock Activities

Another important area of water use in agricultural production is water consumption related to livestock activities. Water consumption in bovine, ovine and poultry farming occurs for animal drinking water purposes, facility, and equipment cleaning, backwashing of filters in water softening systems if available, regeneration of resins and green area irrigation processes.

In aquaculture, if river type production is carried out, the supplied water is taken into pools and then given back to the river. Therefore, a significant amount of water is used, but consumption does not occur at the source. In this type of facilities, water consumption for domestic purposes is the main use.

In cattle-raising, the use of float systems in integrated production facilities with high capacity, the creation of barn areas to reduce heat stress, and the use of pressure washing systems provide a water reduction potential of 9 - 25%. Other small-scale cattle-raising farms where sufficient action has not been taken on water management, it is possible to reduce water use by up to 50% and in ovine breeding facilities by up to 30%.

In livestock facilities, high-pressure cleaners should be employed to clean animal shelters and equipment. Equipment,such as spouted drinkers, round waterers and water troughs, should be used to meet the water needs of animals. These water facilities should be designed in accordance with the animal category, and should be designed in the appropriate size and standing angle. It is possible to reduce water use through practices such as using float shut-off systems in filling processes, gray water recycling, and rainwater harvesting[19].

[19] Ministry of Agriculture and Forestry, (2021-2023), Industrial Water Efficiency Project According to NACE Codes.

3.2.2 Problems Encountered in Agricultural Water Use Efficiency

- There is no legal regulation that will cover all agricultural water use organizations and bring them under one roof.
- Insufficient coordination and cooperation between institutions.
- Insufficient institutional and technical capacity in irrigation enterprises.
- Insufficiency of data reflecting the whole country regarding irrigation.
- Insufficient measurement, monitoring and control of agricultural water use, failure to control unregistered uses.
- Lack/insufficiency of holistic studies (guide, manual, application guide, etc.) regarding the principles of planning, project design, construction, operation and maintenance-repair of irrigation systems.
- Pressurized irrigation systems are not operated in accordance with standards, and farmers do not have sufficient knowledge and experience about modern irrigation methods.
- Insufficient water monitoring on a parcel basis.
- Deficiencies in operation, monitoring and evaluation in irrigation organizations, and difficulties in follow-up.
- Water use service fees (operation and maintenance) are area-based and do not encourage efficient use.
- Farmers need more financial support, and the scope and amount of financial support is limited.
- Supports related to crops and crop patterns are not determined by taking into account climate change and drought conditions.
- Supports related to crops and crop patterns are not in accordance with Sectoral Water Allocation Plans.
- Failure to determine real time crop water needs on a parcel basis. Irrigation not being done on time and according to need. Irrigation and drought assessments not being made at an adequate level due to lack of real-time data.
- Lack of widespread use of technological management tools such as automation and remote sensing in irrigation systems (taking into account parameters such as soil moisture, temperature, etc.).
- High water losses occur due to the prevalence of open (canal/sewer) systems and the inadequacy of existing infrastructures and the inability to effectively implement pressurized irrigation systems.
- The efficiency level is low in traditional gravity irrigation systems.
- R&D studies on the efficient use of water cannot be adequately reflected on the field.
- Reuse of water returned from irrigation (drainage) is not common.
- Low organic matter in our country's soil due to unconscious agricultural activities (lack of rotation, incorrect irrigation and fertilization techniques, etc.) causing water retention capacity and infiltration of the soil.
- The lands are very fragmented and scattered.

3.2.3 Goals, Targets and Strategies for Agricultural Water Efficiency

IM: Increasing Efficiency in Agricultural Water Use

Goal 1: Increasing irrigation efficiency to 60% by 2030 and 65% by 2050 by disseminating practices that increase agricultural water use efficiency

Strategies:

1. Completion of legal, administrative and technical studies that will increase the effectiveness of agricultural irrigation organizations.
2. Strengthening the institutional capacities of water user organizations (irrigation cooperatives, irrigation unions, etc.) to increase participation in irrigation management.
3. Disseminating controlled and sustainable agricultural practices (good agriculture, ecological agriculture, vertical farming, mulching, fertigation, etc.) that will contribute to increasing irrigation efficiency and effective use of water resources.
4. Regular measurement and monitoring in irrigation systems and widespread use of automation and high technology.
5. Determining the product pattern and product supports in accordance with sectoral allocation plans.
6. Making irrigation measurements on a parcel basis and determining plant water needs in real time.
7. Applying volume-based pricing for water use for irrigation purposes.
8. Expanding rainwater harvesting in agricultural irrigation and encouraging the reuse of water returning from irrigation and treated wastewater in agricultural irrigation.
9. Expanding farmer training on the effective use of water through public-oriented agricultural publication and demonstration studies.
10. In order to meet the required energy needs in modern irrigation systems, solar, wind, geothermal, etc. are used, dissemination of renewable energy sources.

3.3 INDUSTRIAL WATER USE EFFICIENCY

3.3.1 Current Situation in Industrial Water Use

Water Use Efficiency in Manufacturing and Service Sectors

One of the most important components of the European Union environmental legislation for industry is the "Industrial Emissions Directive[20] (IED)", published in 1996 under the name "Integrated Pollution Prevention Control Directive (IPPC)". By bringing a different approach to the prevention of industrial pollution, the Directive aims to concretize **the principle of preventing pollutants at the source, which is based on the characteristics of the receiving environment and the natural regeneration process,** as well as discharge standards.

The Directive in question includes the measures to be taken to control and prevent, or if not possible, to reduce, discharges/emissions resulting from industrial activities to the receiving environment, including air, water and soil, with an integrated approach. In the Directive, **Best Available Techniques (BAT/MET)** are presented in order to systematize the applicability of clean production processes and to eliminate the difficulties experienced in implementation. Considering their costs and benefits, BATs are the most effective application techniques for high level protection of the environment. In accordance with the Directive, Reference Documents (BREF) have been prepared for each sector, where BATs are explained in detail.

34 sectoral METs have been published within the scope of IPPC. There are no reference documents for all sectors in EU resources, **and national reference documents need to be prepared by taking into account the current successful water efficiency practices in our country.**

In our country, various studies are carried out regarding industrial water use efficiency, focusing on clean production techniques and resource efficiency. As examples of these studies; "Determination of Resource Efficiency Potential in Industry Project (SANVER)[21]", "Determination of Cleaner Production Possibilities and Applicability in Industry Project (SANTEM)22", "Cleaner Production Applications Project in Certain Sectors (BESTÜ)[23]" and

Evaluation of Metal Production and Processing Facilities within the Scope of EKÖK (EKÖK-METAL)[24]" projects and the "Determination of Turkey's Industrial Emission Strategy within the Scope of Integrated Pollution Prevention and Control (DIES)[25]" Project, which will be completed in 2023, come to the fore.

[20] Directive 2010/75/EU.
[21] Ministry of Industry and Technology, (2017).
[22] Ministry of Environment, Urbanization and Climate Change, (2017).
[23] Ministry of Environment, Urbanization and Climate Change, (2020).
[24] Ministry of Environment, Urbanization and Climate Change, (2020).

Work on the draft IPPC Regulation is being carried out within the scope of the Integrated Pollution Prevention and Control (IPPC) approach, which is the EU cleaner production perspective, and the harmonization of the Industrial Emissions Directive (IED), one of the EU Directives, with the national legislation. Along with the regulation, MET Result documents included in the EU documents will also be published for our country. On the other hand, the "Communiqué on Integrated Pollution Prevention and Control in the Textile Sector" came into force in 2011 as one of the first concrete steps of the Integrated Pollution Prevention and Control Application, which will provide significant gains in minimizing industrial pollution. In this context, *the Clean Production Practices Circular in the Textile Sector*[26] has been published in order to minimize the negative effects of textile sector activities on the environment, prevent air and water pollution, and implement clean production technologies to reduce water and energy consumption. With the circular approach?, clean production techniques have been made mandatory to reduce water pollution and water consumption by reusing purified wastewater in the process by solving the color and conductivity problems caused by dye bath water in the textile sector, where water consumption is intense and water pollution is quite high.

In addition, feasibility studies were carried out for 71 NACE codes selected within the scope of the "Technical Support Project for Economic Analyzes and Water Efficiency Studies within the Scope of River Basin Management Plans in 3 Pilot Basins[27]" (3 RBMP) and water efficiency proposal plans were prepared for the activities studied. As a continuation of this project, within the scope of the "Industrial Water Use Efficiency Project According to NACE Codes[28]", NACE Codes operating in our country and with high water consumption were determined and data were obtained on sectoral water usage, wastewater generation and water supply as a result of examining pilot facilities with different product types and features. and best available techniques (BAT) and sectoral reference documents (BREF) published by the European Union, water efficiency, cleaner production, water footprint, etc. Information was provided on the subjects. As a result of the study, specific water consumptions for the processes of enterprises were determined for 152 different 4-digit NACE codes that use water intensively, especially in the food, textile, chemical, basic metal and machinery sectors, taking into account the EU best available techniques (BAT) and other cleaner production techniques. Water efficiency guidance documents have been prepared.

The sector with the highest share of water consumption in our country, as in the world, is the food sector. In the food industry, water is used in processes such as washing and rinsing process lines, boiling, pasteurization, freezing, cooling, steam production, sanitation and disinfection (IPPC BREF, 2019).

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25 Ministry of Environment, Urbanization and Climate Change, (2020-2023).
26 Ministry of Environment, Urbanization and Climate Change Circular No. 2022/20.
27 Ministry of Agriculture and Forestry, (2017-2020).
28 Ministry of Agriculture and Forestry, (2021-2023).

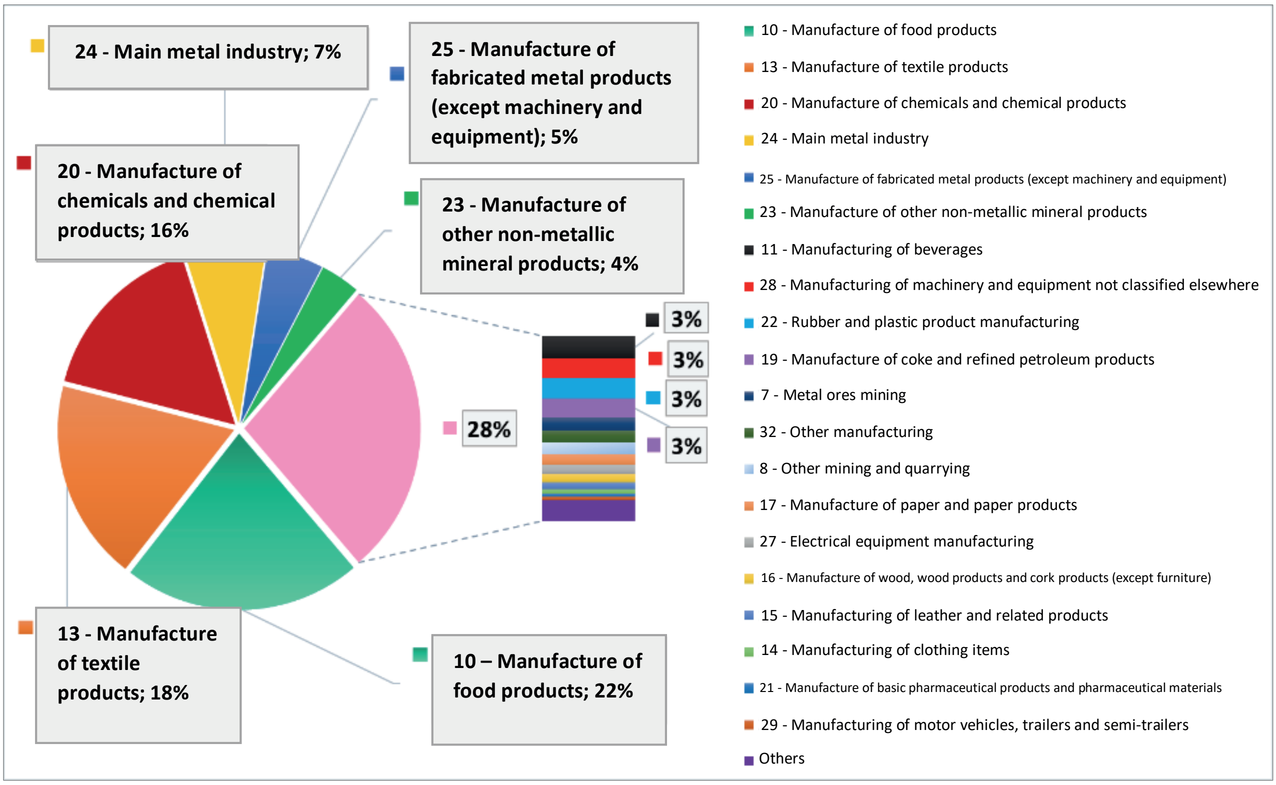


Figure 8. Distribution of water uses on a sectoral basis in industry in our country[29]

Water Use Efficiency in Mining Activities

According to 2020 statistics, 4.7% of the water drawn from fresh water resources was provided by mining enterprises and OIZs in 2020, and the total amount of water used in the mining sector in 2020 was 272,626,000 cubic meters30. In the mining industry, water is used at different stages, from the exploration/drilling process to the finished product. The final output is not included in the product content, but includes mining, sizing/ sorting (crushing/sifting), aqueous/non-aqueous cutting, ore enrichment, processing, shaping, washing, etc. Water is used at different stages.

There are generally two different water uses in mining activities:

- **Dust prevention:** Operations such as mining, crushing, screening, blasting, loading, transportation and unloading are processes that generate a lot of dust, and in order to prevent dust, wetting is done by spraying with water in accordance with the relevant regulations in the enterprises.
- **Process water:** Although most mining operations do not use water in the process, water is used in some mines and some process types. Most of them are recirculating processes, and such facilities require a certain amount of fresh water on a daily basis.

[29] Ministry of Agriculture and Forestry, (2021-2023), Industrial Water Use Efficiency Project According to NACE Codes.
[30] https://data.tuik.gov.tr/Bulten/Index?p=Su-ve-Atiksu-Istatistikleri-2020-37197

In order to meet the daily needs of the personnel who will work in almost all mining activities, drinking and potable water is used, and water is used for dust control during operations in the pit area, during blasting, in-mine access roads and during the transportation of materials. Apart from this, water is also used in some mining activities in processes such as crushing-screening, wire cutting, grinding, flotation and ore enrichment.

3.3.2 Bottlenecks Encountered in Industrial Water Use Efficiency

- Lack of inter-institutional coordination and cooperation in measurement, monitoring and control of industrial water use.
- Insufficiency/lack of legal regulations that enforce/encourage the efficient use of water.
- Inadequacies in providing up-to-date and reliable data that form the basis for planning in industrial water efficiency (water consumption on a sectoral basis or on a process basis).
- Long-term cumulative water use and water status in basins are not taken into account sufficiently when planning industrial investments.
- The costs of clean production technologies create reluctance among industrialists due to the lack of a pricing system that will encourage the efficient use of water, including the resource cost in industrial water use.
- Lack of BREF document translations (EU clean production reference documents) specific to each sector and sector stakeholders not being able to benefit from the documents effectively.
- Failure to sufficiently disseminate alternatives for the reuse of processed water.
- Purification and reuse of used water, rainwater, etc. Lack of technical knowledge, experience and awareness about the use of other alternative water resources.
- Reduction in the reuse potential of water from wastewater treatment plants due to the discharge of industrial wastewater into the general sewer system after pre-treatment.
- Difficulties encountered in the management of the concentrate resulting from advanced treatment in the water recovery process.
- Mining enrichment etc. Insufficiency of studies on efficient use of water in processes.
- Lack of awareness-raising and awareness-raising practices that prioritize water efficiency efforts in the use of products and services by consumers.

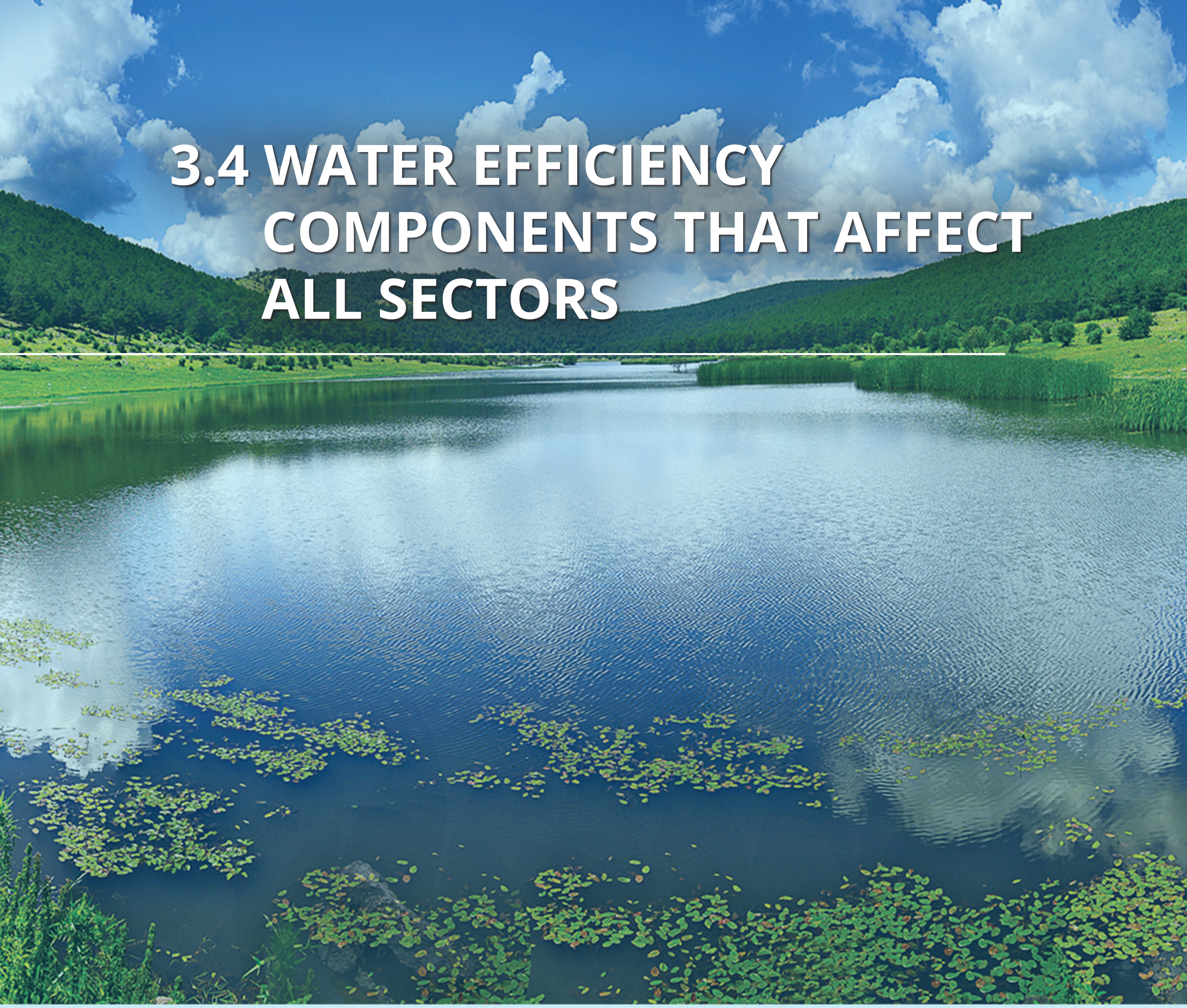
3.3.3 Goals, Targets and Strategies for Industrial Water Efficiency

PURPOSE: Increasing Efficiency in Industrial Water Use

Goal 1: Achieving water recovery of up to 50% by applying clean production techniques and water efficiency measures in industry

Strategies:

1. Strengthening the legal, administrative and technical infrastructure to increase water efficiency in the industrial sector.
2. Raising awareness within the scope of water efficiency practices in industry, disseminating good practices and ensuring cooperation between public institutions, universities, NGOs related to the industrial sector and the private sector.
3. Developing measurement and monitoring systems as well as creating up-to-date inventories.
4. Developing the institutional connection and cooperation structure between the institutional structure of basin water management and organized industrial zone managements, chambers of industry, and industrial non-governmental organizations for the control of efficient use of water.
5. Establishing regulations on water pricing that will encourage efficiency in industrial water use.



3.4 WATER EFFICIENCY COMPONENTS THAT AFFECT ALL SECTORS

3.4.1 Horizontal Components in Water Use Efficiency

Water Footprint

Water footprint is the amplest indicator that measures our water consumption, that is, the water use and pollution we cause. From this perspective, water footprint is not only the water coming from the tap, but the water also taken from the source to the field, or the visible use of water; on the contrary, it is clearly seen that all directly and indirectly and internal and external water consumption accounts for water footprint. Our water footprint includes not only our direct water consumption but also our "invisible water consumption" from production of domestic goods we purchase, importing goods from other geographies, and water footprint we create on other people's "fair water right" on a global scale through unnecessary use.

Water Footprint Components (Figure 9):

- Blue water footprint refers to the consumption of blue water (surface and groundwater) throughout the supply chain of a product, which is the water used/lost from existing surface and groundwater bodies in a basin.
- Green water footprint refers to the consumption of green water resources (rainwater).
- Grey water footprint refers to pollution and is defined as the volume of freshwater required for absorbing the pollution load to meet current ambient water quality standards. In other words, footprint for greywater is the amount of water required to bring the pollution-receiving environment back to good water condition.

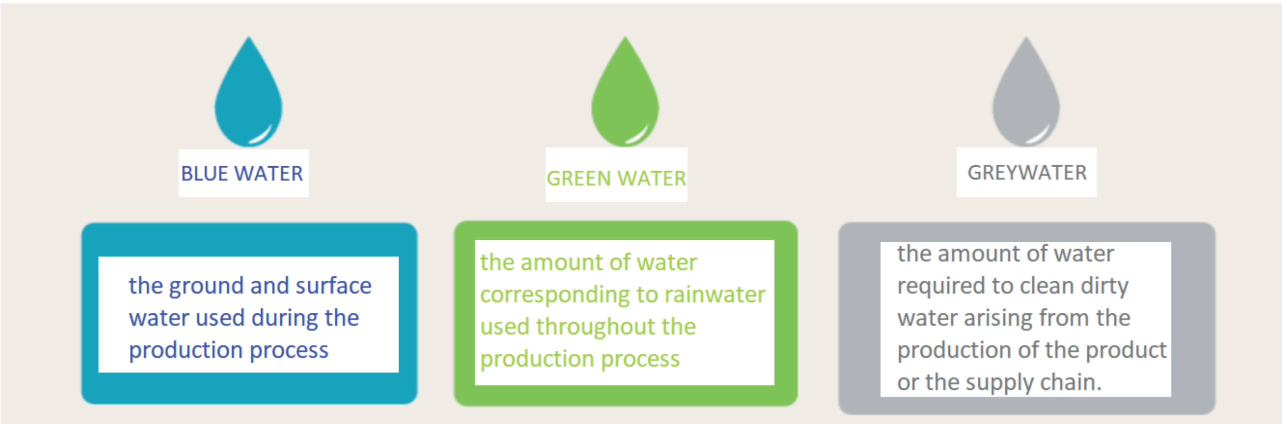


Figure 9. Water footprint components

Water footprint, as an indicator of water use, differs from common water withdrawal in three ways. Water footprint:

1. Does not include the use of blue water returning to where it originally came from.
2. Is not limited to using only blue water but also includes green and greywater.
3. Is not limited to direct water use but also includes indirect water use.

When the total blue water footprint amounts and average agricultural incomes of agricultural products were evaluated using the average agricultural production data between 2013 and 2019, it was determined that 30 agricultural products were better than other products in terms of total production, blue water footprint and agricultural income. Among these products, 12 (wheat, corn, tomato, alfalfa, grapes, potatoes, cotton, peppers, sugar beet, sunflower, apple, and vetch) stand out as the most substantial products in terms of their annual production, blue water footprint, and income generation, while corn, wheat, and alfalfa are at the top in all three categories (Pilevneli et al., 2023).

Water Footprint in Türkiye

According to Türkiye's Water Footprint Report[31];

- According to the water footprint results of production, the total amount of water consumed is 139.6 billion m³/year. 64% of this amount is green water footprint, 19% is blue water footprint and 17% is greywater footprint. At these amounts, agriculture consists of 89% of total water footprint (Figure 10).

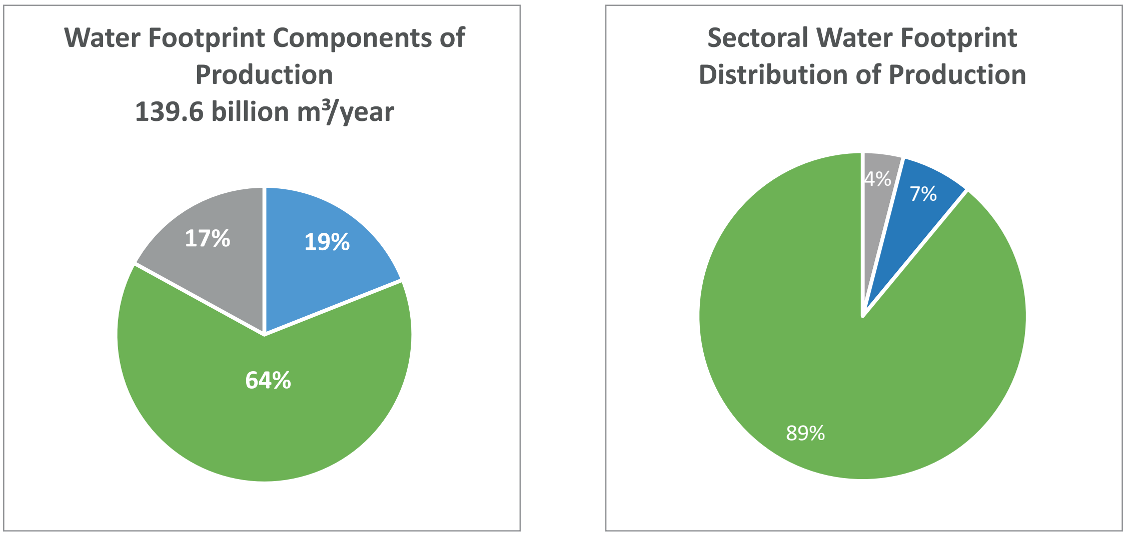
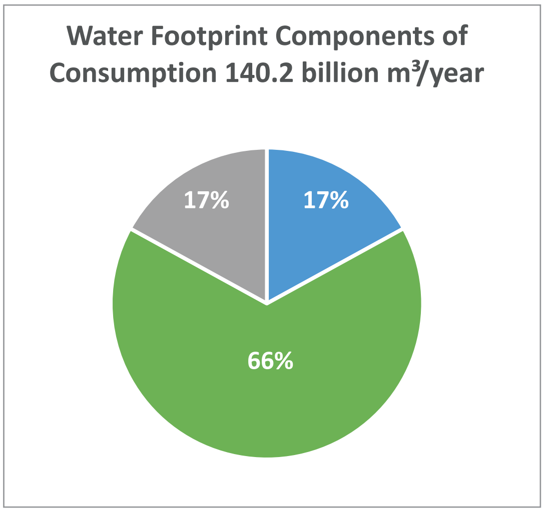


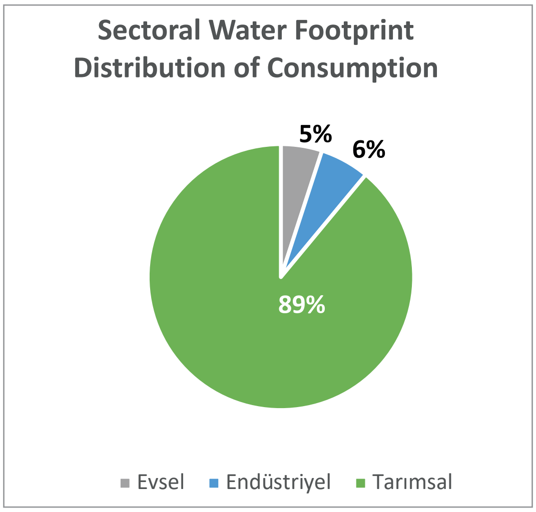
Figure 10. Water footprint components of production in Türkiye

- According to the water footprint results of consumption, the total amount of water consumed is 140.2 billion m³/year. 66% of this amount is green water footprint, 17% is blue water footprint and 17% is greywater footprint. In these amounts, agriculture consists of 89% of total water footprint (Figure 11).

- It has been calculated that our direct and indirect water consumption per person in our country, that is, our water footprint, is 5,416 liters. This amount includes the direct consumption as well as the amount of water consumed indirectly through goods and services.

[31] WWF-Türkiye and The Republic of Türkiye Ministry of Forestry and Water Affairs, (2014).





Şekil 11. Water footprint components of consumption in Türkiye

In the global economy, each consumer uses an average of 5,000 liters of water per day (1,500 to 10,000 liters/day), depending on the region they live in and the products they consume (Çapar, 2017). All the goods and services we use have a water footprint; this may sometimes be in the region we live in, in a distant river basin, or in a country on the other side of the world.

Until now, water has been seen as an unlimited and free consumption item/raw material. This perception is expected to change gradually with water footprint studies. It is necessary to ensure that the concept of water footprint and the environmental-social-economic impacts of our water footprint are correctly understood by all members of the society and disseminate practices to reduce water footprint.

Greywater Use

In domestic wastewater, the slightly polluted part of the wastewater that does not contain black water (water coming from toilets and containing septic tank waste), that is, coming from the shower, bathtub, sink, kitchen, dishwasher and washing machine, is defined as "greywater" (Akkurt, 2017). Greywater has a significant share (up to 80%) in domestic wastewater[32]. With the use of greywater, significant reduction can be achieved in domestic water use, and the consumption of drinking water supplied from the network can be reduced by half with the use of recycled greywater (Al-Jayyousi, 2003).

Compared to other systems, treating greywater is faster, easier and cheaper. With greywater recycling, drinking water use is reduced by using greywater in areas where drinking water quality is not required. In general, it is possible to use greywater in various areas such as landscaping and agricultural irrigation, toilet cisterns, ornamental pools, cooling water, vehicle washing, and, depending on the treatment technology, even laundry. With the use of greywater, wastewater production will decrease, and water consumption from the water network and, accordingly, water bills will also decrease.

[32] The Republic of Türkiye Ministry of Agriculture and Forestry, (2023), Greywater Use Guidance Document.

Rainwater Harvesting

Rain harvesting is the method of capturing rainwater and accumulating it on the ground, underground, in the soil or in tanks. This practice has different names in the literature such as water harvesting, water meadows, water retention gardens, rain gardens and micro-bioretention areas. Uses include livestock, farming, irrigation, domestic use with appropriate treatment, and indoor heating for homes. Harvested water can also be used for purposes such as drinking water, long-term storage, and groundwater enrichment.

Rainwater harvesting is one of the simple methods that dates back to ancient times, when waterproof lime plastered cisterns were built on the floors of houses. Rain harvesting, associated with the beginning of agriculture, is a method recommended within the scope of adaptation to climate change in the 6th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Today, rainwater harvesting practices are carried out in many countries such as Canada, Israel, the United Kingdom, Germany, Japan and Brazil for many purposes such as domestic use, irrigation, agriculture, environmental nourishment, flood prevention and drought fighting.

If we look at the examples in our country, in 2015, with the “rainwater recovery system application” projects undertaken by KTÜ Mechanical Engineering Department and Trabzon Metropolitan Municipality Technical Affairs Directorate, rainwater is harvested from the roof and used for domestic purposes (toilets, etc.) in various buildings. There is a “rainwater harvesting” project implemented by WWF in Aydın Haydarlı village. In this project, it was aimed to create a sustainable model by managing rainwater within the scope of combating desertification and drought in the Büyük Menderes Basin. In addition, with the “Local Solutions in Climate Change: Rain Harvesting” project jointly carried out by Landscape Research Association of Çankaya Municipality and the Humanitarian World Association from Portugal, landscape areas that retain rainwater were created and a pilot application was carried out in two parks belonging to the municipality (Yalçın Sever, 2020).

The most efficient rainwater harvesting method is to build structures near the main stream in order to feed aquifers with sub-basins with small water catchments and tributaries that reach the mainstream quickly during short and heavy rains. When rainwater harvesting is considered by regions, priority should be given to the Black Sea Region, Aegean and Marmara Region; and it is understood that the savings provided by the applications to be made especially in workplaces will reduce water consumption and the financial return will be high (Silkin, 2015).

If we look at the legislation on the subject, with the amendment made to the Planned Areas Zoning Regulation[33], it has become mandatory to install a “rainwater collection system” in new buildings in order to ensure that the rainwater collected on the roof is collected in a tank underground. With the regulation, it is stipulated that in buildings to be built on parcels larger than 2,000 square meters, roof surface rainwater will be collected in the rainwater collection tank to be established underground, and if necessary, rainwater will be collected for filtering and reuse.

[33] Official Gazette of the Republic of Türkiye dated 3 July 2017 and numbered 30113

On the other hand, water harvesting projects are currently carried out by the Ministry of Agriculture and Forestry, under the coordination of TAGEM, to store rainwater in the plant root zone in arid and semi-arid regions during periods when rainfall is insufficient. In Muğla Köyceğiz conditions, the effect of some practices that improve soil water retention capacity, together with the semi-circular (eyebrow type) dams technique, one of the microcatchment water harvesting methods, on olive cultivation was determined. As a result of the studies, it has been observed that organic material and polymer applications along with the water harvesting method are effective in preserving moisture by keeping rainwater in the soil. With Water Harvesting Projects, which are the best example of rainwater management, up to 85-90% of rainwater has been accumulated in the soil and in plant roots. The yield of rainwater harvested products was 3-4 times higher than that of dry (waterless) farming.

Reuse of Used Water

Used water is the water discharged as a result of water use in areas such as domestic, industrial and agricultural irrigation. Reusing the used water after treatment ensures the effective and efficient use of water resources in regions where drought occurs and water resources are scarce, as well as the sustainable use and protection of existing water resources.

Used water can be utilized in many areas such as agricultural irrigation, landscaping and recreation, industrial use, and groundwater recharge, after sufficient treatment is provided to meet the usage conditions. Utilizing used water, commonly used in agricultural irrigation, will contribute to the protection of clean water resources, as well as contributing to the economy by reducing wastewater disposal and fertilizer use due to high plant nutrient contents.

In order to transform used water into an important alternative water source in our country, a systematic integrated water management and reuse plan must be implemented. Suitability of water recovery depends on the evaluation of various factors such as financial dimension of use, public health protection approaches, discharge regulations, etc.

Although there are many benefits of reusing used water, the most important ones can be listed as follows:

- Fresh and saltwater resources are protected in quality and quantity and their sustainability is ensured.
- By reusing treated used water, pollution discharged to the receiving environment is reduced. By protecting the water quality of the receiving environments, tourism, fishing, agriculture, urban settlement, industry, etc. activities are also positively affected.
- There are initial investment and operating costs for the supply, transmission, treatment, and distribution of raw water from the source for drinking and domestic purposes. These costs are reduced by reusing treated used water.
- The places where water needs, uninterrupted water demand and water price are highest are generally major settlement areas and big cities. Treated used water is generally available in large cities (used water treatment plants) at high flow rates. Therefore, treated and reused wastewater makes significant contributions to meeting the water needs in metropolitan areas.
- Residual nutrients in treated used water that can be used in agricultural irrigation are an advantage, and the use of synthetic fertilizers can be reduced by informing farmers about the presence of nitrogen and phosphorus in the water.

Within the scope of EU Legislation, the Urban Wastewater Treatment Directive[34] also includes stipulations regarding the reuse of treated wastewater, provided that its negative effects on the environment are minimized. In this regard, by making wastewater reusable, water efficiency will be positively affected in water-scarce regions.

It is also expected to encourage water reuse in the EU with the Minimum Conditions for Water Reuse Regulation[35]. The regulation in question includes;

- Minimum water quality requirements for the safe reuse of treated urban wastewater for agricultural irrigation;
- Harmonized minimum monitoring requirements, in particular monitoring frequency and verification monitoring requirements for each quality parameter;
- Risk management requirements to assess and address potential additional health risks and possible environmental risks;
- Permit conditions;
- Transparency provisions whereby basic information regarding water reuse projects is made publicly available.

In Türkiye, with the amendment made in the third paragraph of Article 29 of the Environmental Law, numbered 2872, the incentive rate given to wastewater treatment plants for up to 50% of the electrical energy has been increased to 100% according to the reuse rate.

[34] 91/271/EEC Directive dated 21 May 1991.
[35] 05.06.2020 tarihli ve 2020/741 sayılı Tüzük.

In Article 28 of the Water Pollution Control Regulation[36], the procedures and principles regarding the Reuse of Treated Wastewater are determined. On the other hand, technical principles regarding the reuse of treated wastewater in different areas of use have been determined by the Wastewater Treatment Facilities Technical Procedures Report[37]. It is aimed to increase the reuse rate of treated wastewater in Türkiye, which is 4.75% by the end of 2022, to 5% in 2023 and to 15% in 2030.

Within the scope of "Project for the Evaluation of Used Water Reuse Alternatives", 601 wastewater treatment plants, 328 agricultural irrigation facilities, 4 rainwater networks collected with a split system and 12 cooling water users were examined as potential used water sources[38]. Within the scope of the project, 601 wastewater treatment plants, 328 agricultural irrigation facilities, , 4 rainwater networks collected with a split system and 12 cooling water users in Turkey were evaluated as potential used water sources and implementation projects for the reuse of wastewater treatment plant effluent water were prepared in Ankara, Malatya and Yalova. The investigations were supported by quality and quantity analyses, and a Pre-Feasibility Report and a Draft Action Plan were prepared for each basin. In these feasibility reports, the use of used water was evaluated as an alternative for agricultural irrigation water, landscape irrigation water, industrial water, environmental use, groundwater recharge and drinking water. It has been determined that 44% of treated wastewater can be reused in Türkiye. It was determined that 66% of the water returned from agricultural irrigation can be reused. By reusing the water returned from agricultural irrigation in the same sector, it was found out that approximately 500 million TL of fertilizer expenditure could be saved.

Establishing a green and circular economy is aimed within the scope of action of "the use of treated wastewater will be improved and made widespread" taking place in the literature of the Action Harmonization Action Plan for the European Green Deal. The growing gap between available natural water resources and water demand necessitates the treatment of wastewater using appropriate technologies and subsequently reuse in various fields such as agriculture, irrigation and energy. By treating water returned from agriculture in a way that does not pose a threat to the environment and human health and reusing it in agricultural irrigation, significant contributions are made to the efficient and sustainable use of irrigation water and to the country's economy.

[36] Official Gazette of the Republic of Türkiye dated 31 December 2004 and numbered 25687.
[37] Official Gazette of the Republic of Türkiye dated 20 March 2010 and numbered 27527.
[38] Ministry of Agriculture and Forestry, (2017-2019)

Incentive Pricing for Efficient Use of Water

Individuals and institutions have various responsibilities for the rational, equitable and efficient use of water, the healthy continuation of the water cycle and its safe return to ecosystems. First of all, the misconception that water is abundant, free or cheap needs to be changed in our country. For this purpose, the value of water will be correctly understood and its efficient use will be ensured by understanding how costly and laborious the process is from the source to reaching our homes and after use, returning to nature with treatment.

The economic value of water describes the benefits derived from certain water consumption. It is also defined as the amount that other goods and services or an individual is willing to sacrifice the amount of money for the water consumed. The economic price is usually what individuals pay for a good or service (Grafton et al., 2020). The water tariff is defined as the amount to be charged to the consumer (taking into account the ability of user groups to pay), which determines the prices that each user group will bear.

The Water Framework Directive (WFD)[39] is the first European Union (EU) environmental regulation to explicitly integrate economic principles into its approach to water management, with Article 9 addressing three closely related general concepts related to the pricing of water:

- Cost recovery principle
- Polluter-pays principle
- Incentive pricing

The main difference between the legislation in force in Türkiye and the WFD is that tariffs are established by considering only financial costs without including environmental and resource costs in tariff calculation. The cost incurred in this way does not reflect the full cost. Other differences include inadequate pricing mechanism to encourage efficient and rational use of water; insufficient subsidies for low-income groups to access water for their basic needs; lack of performance indicators to set national targets; and exposure to socio-political impacts.

In a study conducted by the United States Environmental Protection Agency (US EPA), cases where water costs exceed 2% of average household expenditures are categorized as "very costly" (United States Environmental Protection Agency, 2002). In Türkiye, with the Law No. 4736 on the Tariffs of Goods and Services Produced by Public Institutions and Organizations and Amendments to Certain Laws, it is stipulated that the water fee to be accrued by municipalities for disadvantaged groups (patriotic service, war and duty invalidity, widows and orphans) shall be charged on the tariff to be determined not less than 50% discount.

[39] DIRECTIVE 2000/60/EC

In addition, the beneficiaries of the free or discounted water tariffs with note that not exceeding one fifth of the total household use, to be determined by the municipalities and affiliated administrations within the scope of the "Human Right to Water", upon the decision to be taken by the municipal councils and general assemblies, are exempted from the provision of the first paragraph of Article 1 of the Law No. 4736 with the Presidential Decree[40].

Tariffs are generally divided into volume-based tiers. The first tier is the lowest priced tier, which corresponds to the amount sufficient to meet the basic needs of the average "low-income household". In the other tiers, the price per unit of consumption gradually increases. The idea behind this is that tiered pricing incentivizes water efficiency and ultimately creates an additional source of revenue to cover higher operating costs resulting from over-consumption. In this way, access to water will become more equal through cross-subsidy programs.

With some exceptions, similar types of drinking water and treatment plants are operated throughout the country and water supply structures are very similar. However, unit water prices in provinces and metropolitan municipalities vary. In 2021, the average water unit price in Türkiye (including wastewater and VAT) is calculated as 5.97 TL[41]. This amount is 6.19 TL on average in metropolitan municipalities and 3.82 TL on average in provincial municipalities. The main reasons for this are the type of water supply, the presence and type of wastewater treatment plant, households' unwillingness to pay water prices, no collection of wastewater fees by some municipalities, not including depreciation costs in prices, not prioritizing water management by water administrations, social and political reasons, failure to prioritize investment needs, insufficient knowledge on water supply and treatment by households, and accordingly, water prices diversify (SYGM, 2021c).

The issue of water use service charge in agricultural irrigation is complex and difficult as it involves many issues such as water management, operation, systems used and their efficiency, repayment of investments, protection and development of water resources. For the efficient use of water in agricultural irrigation, it is very important to set clear, acceptable and feasible prices. Water pricing methods may vary depending on the country, institutional and political structure, physical and social structure, and basin and sub-basin characteristics. There is no globally agreed methodology for agricultural irrigation tariffs. The price of water may vary according to the tariff-setting institution's understanding of water as a right, a need or an economic value. The price of water can also include various purposes such as reducing the amount of water use, providing a fund to the organization providing irrigation services, and reimbursement from the beneficiaries of irrigation investments.

[40] Decision No. 4920 dated 15.12.2021

[41] Regulation on Control of Water Losses in Drinking Water Supply and Distribution Systems - Water Losses Annual Reports and Inventory Forms.

Tariffs to be determined for agricultural irrigation services should be determined by taking into account the ability to pay, which includes various economic and social factors, and the willingness to pay, which is also a result of economic and social factors, and beyond these, the acceptance of payment. In Türkiye, area-based, product-based and volume-based various tariffs can be used for water use service charges in agricultural irrigation. In addition, the tariff applied for water service provided is the same regardless of the source of water (Groundwater or Surface water), although the obtaining cost is different. In addition, the same tariff is applied regardless of the added value of the production. It may be more reasonable to apply product-based and volume-based tariffs.

Current agricultural irrigation tariffs are mostly based on operation and maintenance costs in Türkiye. Resource cost and environmental cost are not taken into account in tariffs for agricultural irrigation services. The Organization for Economic Co-operation and Development (OECD) suggests that farmers should pay not only operation and maintenance costs for water, but also their share of the capital costs of water infrastructure. It should not be assumed that an increase in the price of water with such pricing in agricultural irrigation will reduce agricultural production; on the contrary, in Australia, where this policy has been implemented, agricultural production has not fallen while the price of agricultural water has increased, and the ratio of irrigation water use has been reduced by half without loss of production.

In Türkiye, agricultural irrigation infrastructures are executed as public investments. Irrigation infrastructures are largely subsidized by the state and no reimbursement is demanded from the users. The revenue collected through tariffs generally includes the operation, maintenance and repair costs of the investment. In Türkiye, full cost-based cost recovery rates for agricultural irrigation services are extremely low. For example, in Akarçay, Yeşilırmak and Western Mediterranean Basins, this rate is calculated as 0.5%, 1% and 2%, respectively (SYGM, 2021d).

In addition to all these, it should be carefully considered that the agricultural irrigation tariff should not exceed 10% of the difference between the farmer’s irrigated and dry farming income on a full cost basis determination. It is observed that tariffs exceeding this level might be beyond the farmer’s ability to pay even if the farmer is willing to pay. (SYGM, 2021e).

As for pricing in the industrial sector, only water fees are collected from industrialists according to the type of subscriber. In industrial sectors those who supply water with their own means and not collecting the resource cost, constitutes an important obstacle in the sustainable and efficient use of water.

3.4.2 Horizontal Axis Bottlenecks Affecting All Sectors

- Lack of a holistic, high-scale legal structure and regulation covering all areas of use, including the social, economic and technical dimensions of water and directly addressing the issue of efficiency.
- Lack of a single and centralized structure for water management.
- Lack of coordination in water efficiency actions.
- Lack of holistic strategies and practices targeting efficiency at every step of the water process, from sourcing, storage, treatment, distribution, use, post-consumption disposal and reuse opportunities.
- Lack of full cost-based pricing policies that support sustainable water services in all sectors and tariff practices that incentivize efficient use of water.
- Insufficient studies on social and economic incentives, supports, R&D studies, international best & successful practices, indigenous models to increase water efficiency from producer to consumer.
- Insufficiency of national-scale training and awareness raising activities for efficient water use in all sectors.
- Insufficient knowledge of water consumers on water efficiency, insufficient university-public-industry-private sector-NGO cooperation.
- Insufficient incentives, insufficient proliferation of alternative water resources such as reuse of used water due to and lack of standards/legislation, of rainwater harvesting, gray water use as alternative water resources.
- Inadequate practices to ensure that the water footprint is properly understood and reduced by all members of society.
- Not taking account the total / cumulative and long-term impacts on the water potential of the basins with high water use pressure, difficulties encountered in the implementation of Sectoral Water Allocation Plans.

3.4.3 Objectives, Targets and Strategies for Water Efficiency in All Sectors

OBJECTIVE: Mainstreaming Water Efficiency Practices Affecting All Sectors

Goal 1. Legal, administrative and technical regulations and planning to increase and promote water efficiency

Strategies:

1. Establish comprehensive legal arrangements that address all aspects of water efficiency and promote water efficiency.
2. Increasing the administrative and technical capacities of existing institutional structures.
3. Establishing effective water management structures at basin scale.
4. Establish legal infrastructure and implementation mechanisms for full cost-based pricing of water.
5. Increasing support for R&D, P&D and innovation projects to increase water use efficiency.
6. Ensuring the integration of drinking water, wastewater, treatment and solid waste facilities along with renewable energy projects.

Goal 2. Monitoring water availability in the basins, making plans by taking into account efficiency measures at the basin scale according to projections on the effects of climate change on water resources

Strategies:

1. In order to determine the impact of climate change on water resources and our current and future water potential, making basin-specific projections for basins in our country and determining basin-scale water efficiency measures by taking into account internationally accepted climate models and basin-scale water budget models.
2. Maximizing data sharing on water quantity and water quality among public institutions and organizations.
3. Promoting examples of "integrated urban water management" and "water sensitive urban design" at the city scale.
4. Retaining the water in basins and determining and implementing methods to leave the basin as late as possible.
5. Identifying and implementing methods to ensure that water leaves the basin as late as possible.

Goal 3. Expanding the use of alternative (non-conventional) water sources (rainwater, gray water, used water, sea water, brackish water, etc.)

Strategies:

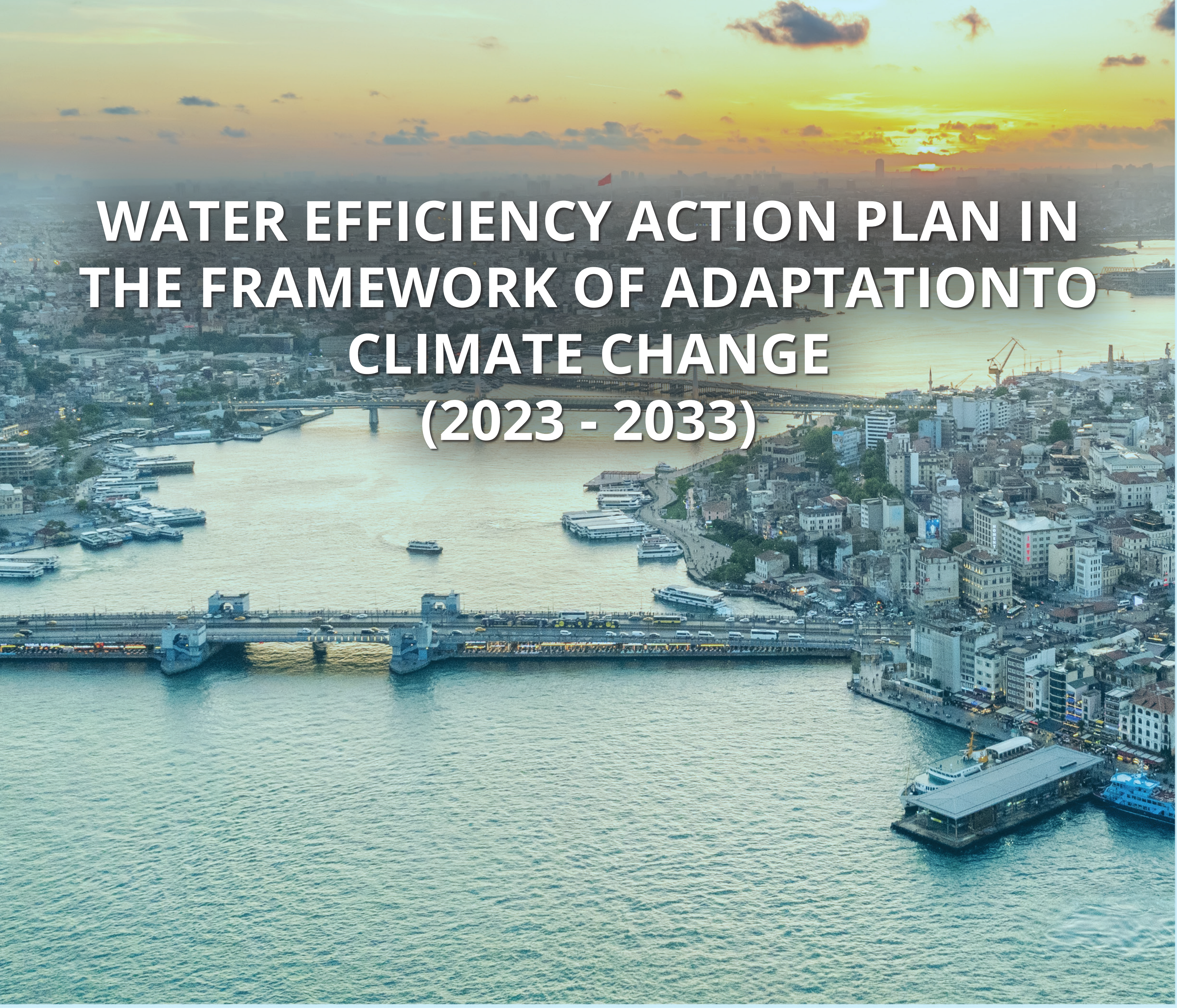
1. Develop legal regulations and create incentive mechanisms for the expansion of alternative (non-conventional) water sources.
2. Increase the rate of reuse of used water to 15% by 2030.
3. Scaling up rainwater harvesting in cities and rural areas.
4. Expand the use of gray water at the urban scale.
5. Increase training, incentives and implementation efforts to promote alternative water sources (rainwater, gray water, used water, seawater, brackish water, etc.).

Goal 4. Determination of total water footprint size and mitigation measures at basin scale

Strategies:

1. Determining the sustainability of the current situation regarding blue, green and gray water footprint and virtual water transfer on basin basis.
2. Calculating the size of the blue and gray water footprint in agriculture and industry, determining measures to reduce it, and establishing incentives and support mechanisms.
3. Carrying out studies to take virtual water content into account in international product trade.

WATER EFFICIENCY ACTION PLAN IN THE FRAMEWORK OF ADAPTATIONTO CLIMATE CHANGE (2023 - 2033)



4. WATER EFFICIENCY ACTION PLAN TABLES

Urban Water Efficiency Action Plan Aim:

Increasing Urban Water Efficiency

Objective 1: Reduce water loss rate in all municipalities to 25% by 2033 and 10% by 2040 by increasing water efficiency in local administrations

Number	ACTIONS	CALENDAR	RESPONSIBLE INSTITUTION(S)	RELEVANT INSTITUTION(S)
1.	Establishment of a fund to be used for water efficiency practices	2023 - 2027	MoAF	MoAF (SHW), Municipalities
2.	Basin-based water efficiency action plans for drinking and potable water preparation	2023 - 2030	MoAF (GDWM)	MoAF (SHW), Municipalities
3.	The future urban water supply planning should take into account water efficiency practices (reducing water losses, using alternative water sources, employing efficient technologies, changing individual habits) from source to tap.	2023 - 2027	MoAF (SHW, GDWM), BoM (İLBANK), Municipalities	MoEUCC
4.	Establishment of water and sewage administrations through a structure based on provincial boundaries, even in cities outside metropolitan areas.	2023 - 2027	MoEUCC (DGLA, BoM (İLBANK)), Municipalities, PSA	MoAF (GDWM), TMU
5.	The establishment of a legal framework for incentives and sanctions in compliance with the water loss rates determined by legislation and the submission of annual reports on water losses to the Ministry.	2023 - 2027	MoAF (GDWM)	MoAF (SHW), Municipalities
6.	Determining the financial resources for reducing water losses in municipalities and prioritizing investment needs.	2023 - 2033	MoAF (SHW), BoM (İLBANK), Municipalities	MoAF (GDWM), TMU
7.	Determining the necessary investment requirements for reducing water losses in municipalities and implementing these investments.	2023 - 2033	Municipalities	MoAF (GDWM)
8.	Evaluation of actions in the work termination plans prepared by local governments regarding water loss management through a performance monitoring system by the Central Administration.	2023 - 2033	MoAF (GDWM)	Municipalities
9.	Determining Infrastructure Leakage Index (ILI) and similar performance indicators in line with the 2040 goal and creating a database containing the necessary data for ILI calculations by all municipalities.	2023 - 2033	Municipalities	MoAF (GDWM)
10.	Implementing a legal regulation that establishes an upper limit by measuring the water consumption of subscribers falling under the unbilled authorized water consumption category for all water authorities; and ensuring that the unmetered unbilled authorized water consumption does not exceed 1% of the system input volume	2023 - 2025	MoAF (GDWM)	Municipalities
11.	The widespread implementation of legal regulations across the country to reduce physical and administrative water losses	2023 - 2028	MoEUCC, MoAF (GDWM)	Municipalities
12.	The establishment of monitoring and repair units/ teams for physical and administrative water losses in municipalities.	2023 - 2027	Municipalities	MoAF (GDWM)
13.	Providing vocational qualification training for drinking water and wastewater infrastructure and treatment facilities.	2023 - 2027	Municipalities, TMU	MoAF (GDWM), SHW), MoEUCC, PCI, BoM (İLBANK), TMU
14.	The use of systems such as Geographic Information Systems (GIS), automation, customer management system, asset management, and fault reporting and management.	2023 - 2027	Municipalities	MoAF (GDWM), MoEUCC

Hedef 1: Yerel idarelerde su verimliliğinin artırılmasıyla bütün belediyelerde su kayıp oranının 2033 yılına kadar %25; 2040 yılına kadar %10 seviyesine düşürülmesi

No	Eylem	Takvim	Sorumlu Kurum	İlgili Kurum
15.	Regular measurements conducted by municipalities at every stage of the drinking water systems, from the source to the consumer, including free water usage.	2023 - 2027	Municipalities	MoAF (GDWM)
16.	Recording unregistered water usage	2023 - 2027	Municipalities	MoAF (GDWM)
17.	Preparation of legal regulations for the implementation of deterrent sanctions to prevent the use of drinking and domestic water for garden/agricultural irrigation purposes.	2023 - 2025	MoAF (GDWM), SHW)	MoEUCC, PSA, Municipalities
18.	Creating isolated sub-regions that facilitate operation, monitoring, and maintenance in networks, easing flow and pressure management, and promoting applications such as pressure management and hydraulic modeling.	2023 - 2033	Municipalities	MoAF (GDWM)
19.	Consideration of regional measurement areas that provide control of drinking water networks in urban plans.	2023 - 2027	Municipalities	MoEUCC
20.	Establishing criteria for installing meters at the main entrances of high water consumption areas such as sites and campuses.	2023 - 2027	Municipalities	MoAF (GDWM)
21.	Ensuring the use of meters that offer high sensitivity, long lifespan, compatibility with remote reading, and reliable measurements in all positions, especially at low flow rates, with a preference for volumetric measurement principle meters.	2023 - 2027	MoEUCC, MoIT, Municipalities	MoAF (GDWM)
22.	Optimizing irrigation in municipal recreational areas, transitioning to drought-tolerant landscaping, and using alternative (non-conventional) water sources for landscaping irrigation.	2023 - 2030	Municipalities	MoAF (GDWM,GDARP)
23.	Promoting the sponge city model in urban areas, including the establishment of ecological infrastructure and drainage systems, covering surfaces like roadsides or sidewalks with materials that allow water passage, etc	2023 - 2025	Municipalities	MoAF (GDWM), MoEUCC

Adjective 2: Improving water use efficiency in the tourism sector to achieve water savings of up to 40%.

Number	ACTIONS	CALENDAR	RESPONSIBLE INSTITUTION(S)	RELEVANT INSTITUTION(S)
1.	Establishing a certification system to promote water efficiency in tourism facilities."	2023 - 2027	MoAF (GDWM)	MoCT
2.	Implementing projects, training, publications, and information campaigns aimed at promoting behavior change in terms of water efficiency in tourism and entertainment facilities	Continuous (enduring)	MoAF (GDWM),MoCT, MoNE	MoEUCC, Governorates, Municipalities
3.	Facilitating private sector-public-citizen dialogue and collaboration on water efficiency in the tourism sector, and implementing joint projects.	Continuous (enduring)	MoAF (GDWM),MoCT	CSO's, Members of Tourism Sector
4.	Expanding the criteria for efficient water use within the framework of the Tourist Accommodation Services Environmental Label and Environmentally Friendly Accommodation Facility Certificate."	2023 - 2025	MoEUCC, MoCT	MoAF (GDWM)

Objective 3: **Increasing efficiency in households and individual water use to reduce per capita daily average water consumption to 120 liters by 2030 and 100 liters by 2050.**

Number	ACTIONS	CALENDAR	RESPONSIBLE INSTITUTION(S)	RELEVANT INSTITUTION(S)
1.	Determining the national-scale household water use characterization and establishing regional water use profiles for individuals.	2023-2025	MoAF (GDWM), Municipalities	MoAF (SHW), MoEUCC
2.	Implementing projects, training programs, publications, and awareness activities that will ensure behavior change in individuals regarding water efficiency.	Continuous (enduring)	MoAF (GDWM), MoNE, The Presidency of Religious Affairs, Valilikler, Municipalities	MoEUCC, The Ministry of Interior, CSO's
3.	Carrying out research and development efforts to improve devices, equipment, and materials that will ensure efficient water use, and establishing standard specifications	Continuous (enduring)	MoIT, MoAF (GDWM)	STRCoF, TSI, CCEoT, Universities, Private Sector
4.	Publication of standards for devices, equipment, and materials developed for efficient water use.	2023 – 2028	TSI	MoIT, STRCoF
5.	Increasing R&D support programs for the production of efficient household appliances, devices, and cleaning products that promote efficient water use.	Continuous (enduring)	MoIT	STRCoF, TSI, CCEoT, Universities, Private Sector
6.	Promoting the use of devices, tools, equipment, and technologies that encourage end-users to use less water.	Continuous (enduring)	MoEUCC, Municipalities	MoAF (GDWM), CSO's
7.	Updating the primary and secondary school curriculum to include water literacy topics from a perspective of education for sustainable development.	2023 - 2024	MoNE	MoAF (GDWM)
8.	Expanding education and awareness activities on water efficiency in schools, Public Education Centers, municipal education and social support units, and places of worship.	Continuous (enduring)	MoAF (GDWM), MoNE, The Presidency of Religious Affairs, Municipalities	CSO's, Universities, Private Sector
9.	Promoting awareness practices on water efficiency practices in all public institutions.	2023 - 2030	All Public Institutions	MoAF (GDWM), MoEUCC, CSO's
10.	Including courses on sustainability, environmental management, and water efficiency in relevant departments at universities.	Continuous (enduring)	CoHE	MoAF (GDWM), MoEUCC
11.	Establishing digital platforms (websites, social media channels, etc.) with informative and guiding content on water efficiency, and effectively using written and visual communication tools.	2023 - 2024	MoAF (GDWM), RTSC	All stakeholders (Public Institutions, Universities, Media Organs, CSO's Private Sector, ec.)
12.	Facilitating dialogue and collaboration with CSOs and relevant government agencies as part of awareness and education activities on water efficiency, and implementing joint projects	Continuous (enduring)	MoAF (GDWM),Mone, CoHE, The Presidency of Religious Affairs	CSO'S, Universities, Schools, Public Education Units

Agricultural Water Efficiency Action Plan Aim:

Increasing Efficiency in Agricultural Water Use

Objective 1: **Increasing irrigation efficiency through the widespread adoption of practices that enhance agricultural water use efficiency, with the goal of reaching a irrigation efficiency 60% by 2030 and 65% by 2050.**

Number	ACTIONS	CALENDAR	RESPONSIBLE INSTITUTION(S)	RELEVANT INSTITUTION(S)
1.	Preparation of legislation to gather irrigation unions, irrigation cooperatives and public irrigation under a single roof.	2023 - 2028	MoAF (SHW, GDAR), PSA	MoAF, Municipalities
2.	Preparation of effective irrigation efficiency guide documents for irrigation management to strengthen the institutional capacities of irrigation organizations, and implementation of training and publication programs.	Continuous (enduring)	MoAF (EYDB, GDARP, DGWM)	MoAF (SHW, GDPR, GDAR)
3.	Transformation of open systems into closed systems in network transmission and distribution lines, renovation of aging closed systems, widespread implementation of automation, and establishment of measurement and monitoring systems.	2023 - 2033	MoAF (SHW), PSA, Municipalities	MoAF (GDAR, DGWM), Irrigation organizations
4.	Monitoring water usage in community irrigation systems and evaluating irrigation efficiency.	Continuous (enduring)	MoAF (SHW, GDAR)	MoAF (GDWM)
5.	Monitoring irrigation results and evaluating irrigation efficiency in irrigation cooperatives.	Continuous (enduring)	MoAF (GDAR)	MoAF (DGWM, SHW), Irrigation Cooperatives
6.	Monitoring irrigation results and evaluating irrigation efficiency in irrigation union.	Continuous (enduring)	MoAF (SHW)	MoAF (GDWM)
7.	Ensuring the integration of irrigation data into the National Water Information System.	2023 - 2033	MoAF (SHW, GDAR), İÖİ, Municipalities	TOB (SYGM)
8.	Expanding the scope of incentive mechanisms for increasing on-farm irrigation efficiency and prioritizing regions facing water scarcity.	2023 - 2028	MoAF (GDAR)	MoAF (GDWM, SHW)
9.	Completion of land consolidation works together with on-farm development works	2023 - 2030	MoAF (SHW)	MoAF (GDAR)
10.	Agriculture based on water resources - Implementation of the Sectoral Water Allocation Plan and determination of product patterns and product supports, taking into account Sectoral allocation plans within the framework of the Türkiye Agricultural Basins Production and Support Model.	2023 - 2027	MoAF (SHW, DGWM, GDARP, GDPR, GDAR)	PSA, Municipalities
11.	Creation of a certified irrigation consultancy system.	2023 - 2030	MoAF (GDAR)	MoAF (GDWM, GDARP , SHW), RDA
12.	Expanding the conversion of YAS irrigation areas to YÜS irrigation areas in regions where the YAS level is below the safe reserve.	Continuous (enduring)	MoAF (SHW, GDAR, GDAE),PYA, Municipalities	MoAF (GDWM)
13.	Controlling the compliance of the use of underground water resources with allocations and ensuring well peace	2023 - 2030	MoAF (SHW)	MoAF (GDWM, TRGM), İÖİ, Municipalities
14.	Benefitting farmers involved in well peace from modern irrigation system subsidies.	2023 - 2030	MoAF (GDAR)	MoAF (SHW)
15.	Conducting research on salinization due to the excessive withdrawal of groundwater for agriculture and landscape irrigation in coastal areas, determining preventive measures, and promoting agricultural irrigation using recycled water in these regions.	Continuous (enduring)	MoAF (SHW, GDARP), Municipalities	MoAF (GDWM), MoEUCC

Objective 1: Increasing irrigation efficiency through the widespread adoption of practices that enhance agricultural water use efficiency, with the goal of reaching a irrigation efficiency 60% by 2030 and 65% by 2050.				
Number	**ACTIONS**	**CALENDAR**	**RESPONSIBLE INSTITUTION(S)**	**RELEVANT INSTITUTION(S)**
16.	Expanding and supporting the use of organic (farmyard manure, compost + mycorrhiza, leonardite + mycorrhiza) and organo-mineral fertilizers, and green manure practices to increase the amount of soil organic matter in agricultural lands.	2023 - 2030	MoAF (GDAR)	MoAF (GDARP), RDA
17.	Toprağın su tutma özelliğini güçlendirecek toprak koruma tedbirlerinin yaygınlaştırılması	Continuous (enduring)	MoAF (GDAR, GDARP, EYDB)	MoAF (SHW), RDA, Irrigation Organizations
18.	Expanding the use of methods that prevent evaporation (mulching, surface soil tillage, etc.), night irrigation, awareness activities, and pilot practices.	Continuous (enduring)	MoAF (GDARP, GDAR, EYDB)	MoAF (GDWM), Universities
19.	Making irrigations based on plant water consumption needs and widespread use of technological management tools such as measurement systems (considering parameters like soil moisture, temperature, etc.), automation, and remote sensing in irrigation systems	2023 - 2030	MoAF (SHW, GDAR, GDARP, GDAE), PSA, Municipalities	MoAF (GDWM)
20.	Expansion of land practices for the collection of water returned from irrigation, treated wastewater and rainwater in micro-small scale areas for use in agricultural irrigation.	Continuous (enduring)	MoAF (GDARP, EYDB, , GDAR, SHW), BoM (İLBANK), PSA, Municipalities	MoAF (GDWM), MoEUCC, RDA, Universities
21.	Producing structural solutions for the reuse of water returning from irrigation, monitoring, quality control, and switching to alternative (compatible with returning water) plant patterns	Continuous (enduring)	MoAF (GDWM), SHW)	MoAF (EYDB, GDAR, GDARP), TWI, RDA
22.	Preventing eutrophication in dams for irrigation purposes	Continuous (enduring)	MoAF, MoEUCC	Municipalities
23.	Switching to closed circuit (recirculated) cultivation systems in aquaculture facilities and expanding hydroponic and aquaponic production systems to ensure water efficiency.	Continuous (enduring)	MoAF (BSÜGM)	MoAF (GDARP), Universities
24.	Supporting the use of alternative energy sources that will reduce irrigation prices in pumped irrigation	Continuous (enduring)	MoAF	MoAF (GDARP), TÜBİTAK, RDA, Universities
25.	Measuring the water used for irrigation purposes on a volume basis and collecting water usage service fees in appropriate areas on this basis.	Continuous (enduring)	MoAF (SHW, GDAR, GDAE), PSA, Municipalities, Irrigation Organizations	MoAF (GDWM)
26.	Determination of social and economic factors for effective water, pricing and determination of resource costs for water use in irrigation and livestock activities	2023 – 2033	MoAF (GDWM),TWI	MoAF (SHW, GDAR, GDARP), MoIT, RDA, Municipalities

Industrial Water Efficiency Action Plan Aim:

Increasing Efficiency in Industrial Water Use

Objective 1: **Ensuring water recovery of up to 50% by applying clean production techniques and water efficiency measures in industry**				
Number	**ACTIONS**	**CALENDAR**	**RESPONSIBLE INSTITUTION(S)**	**RELEVANT INSTITUTION(S)**
1.	Regulation of legislation on the management of emissions in industry	2023 - 2025	MoEUCC	MoAF (GDWM),MoIT
2.	Creating industrial water efficiency action plans on a sectoral basis	2023 - 2024	MoAF (GDWM)	MoEUCC, MoIT, TOBBCCEoT
3.	Taking into account the current and future water availability of the basin during the planning phase of new organized industrial zones to be established in the basins.	Continuous (enduring)	MoIT	MoAF (GDWM), MoEUCC
4.	Determining water efficiency practices and measures for production processes and other uses during the planning phase of industrial investments and requesting studies on water efficiency in permit/ approval processes (Strategic Environmental Assessment, Cumulative impact assessment, EIA, etc.).	Continuous (enduring)	MoEUCC	MoAF (GDWM)
5.	Organizing technical training programs and workshops on a sectoral basis, preparing water efficiency guidance documents	2023 - 2025	MoAF (GDWM)	MoEUCC, MoIT, TOBB
6.	Conducting studies to determine specific water usage ranges and water quality requirements on the basis of sub-sectors in the industry	2023 - 2030	MoAF (GDWM), MoEUCC	MoIT
7.	Evaluating used water recycling alternatives in cases where they are applicable in industry and creating an incentive mechanism to increase water recycling practices.	Continuous (enduring)	MoEUCC, MoAF (GDWM)	MoIT, TOBBCCEoT
8.	Making awareness-raising and encouraging arrangements for the separation of water in usage details (recycling, reuse, etc.) within the scope of the Green Deal Circular Economy Action Plan.	Continuous (enduring)	MoIT, MoEUCC	MoAF (GDWM),TOBB
9.	Within the scope of the Green Deal Circular Economy Action Plan, raising awareness and making encouraging arrangements for the separation of water in usage details (recycling, reuse, etc.).	2023 - 2028	MoEUCC, MoIT	MoAF (GDWM)
10.	Recording the YAS wells used in industry and integrating them into the National Water Information System by monitoring their water usage with the measurement system.	2023 - 2028	MoAF (GDWM), SHW), SUKİ'ler	MoEUCC, MoIT
11.	the use of meters with high measurement accuracy in industrial zones and the remote reading and monitoring of these meters and completion of related legal regulations	2023 - 2028	MoAF (GDWM),SHW)	MoIT, MoAF (GDWM)
12.	Determination of resource costs for water use in industry	Continuous (enduring)	MoAF (GDWM)	MoAF (SHW), MoEUCC, MoIT, SUEN, SUKIs, Universities

Water Efficiency Action Plan For All Sectorsaim:

Dissemination Of Water Efficiency Practices Affecting All Sectors

Objective 1. Making legal, administrative and technical regulations and plans that will increase and encourage water efficiency				
Number	**ACTIONS**	**CALENDAR**	**RESPONSIBLE INSTITUTION(S)**	**RELEVANT INSTITUTION(S)**
1.	The inclusion of provisions related to water efficiency in the Draft Water Law.	2023	MoAF (GDWM)	
2.	"Preparation of Water Efficiency Legislation."	2023	MoAF (GDWM)	Public Institutions and CSO'S
3.	The preparation of guides and similar documents for water efficiency practices in all sectors with the purpose of promoting sectoral water efficiency applications.	2023	MoAF (GDWM)	All Stakeholders (Government Agencies, Universities, Private Sector, etc.).
4.	The establishment of the Water Efficiency Coordination and Monitoring Commission, its linkage with Provincial, Basin, and National Water Boards, and the presentation of the Action Plan outcomes to Provincial, Basin, and National Water Boards	Continuous (enduring)	MoAF (GDWM)	Public Institutions and Organizations
5.	The establishment of water efficiency units in local administrations, agricultural and industrial sectors, etc.	2023 - 2027	MoAF, MoIT, MoEUCC, Local Authorities	MoAF (GDWM)
6.	Establishment of legislation for the Water Efficiency Certification System.	2023 - 2026	MoAF (GDWM)	Public Institutions and Organizations, Universities, Irrigation Organizations, Civil Society Organizations, Private Sector
7.	Prioritizing water efficiency practices in government-supported grant programs.	Continuous (enduring)	PoSB , All Ministries	MoAF (GDWM)
8.	In the grant support for local administrations under drinking and wastewater infrastructure, the requirement for water use efficiency practices in investments, local administrations adding extra points for the use of domestic and national products and services, and domestic and national solutions.	Continuous (enduring)	PoSB, Union of Turkish Municipalities , Development Agencies	MoAF (GDWM), MEUCC, Municipalities
9.	Conducting a water labeling program to indicate water usage levels in devices, equipment, and appliances, and promoting the production and use of TSE-certified and water-efficient products.	Continuous (enduring)	MoIT , CCEoT	STRCOF, SMIDO, Development Agencies, TSI, CSO's
10.	Planning the transition of all Public Institutions to efficient water consumption practices and the use of domestic and national products and solutions in the implementation."	2023 - 2033	MoAF, MoEUCC, BoM (İLBANK)	MoIT, STRCOF
11.	Establishment of a higher council that regulates the principles of full-cost-based water pricing, approves tariffs, and oversees implementations in all sectors.	2023 - 2028	MoAF (GDWM)	MoEUCC, MoAF (SHW), MoIT, Municipalities
12.	The implementation of a full-cost (financial, environmental, and resource) based water pricing mechanism that prioritizes water efficiency.	2023 - 2028	MoAF (GDWM)	MoEUCC, MoAF (SHW), MoIT, Municipalities
13.	Making the necessary regulations in the legislation to produce projects from renewable energy sources for achieving lower operating costs in agricultural irrigation, drinking water, and wastewater facilities.	2023 - 2025	MoAF (SHW, GDAFR)	MoENR, MoIT, PSA, Municipalities, SMIDO, Development Agencies
14.	Development of a quality control system for all materials and equipment used in network projects for drinking water and agricultural irrigation purposes.	Continuous (enduring)	MoAF (SHW), Municipalities	MoAF (GDWM, GDRP), MoIT
15	Determining and establishing financial resources (such as a water fund, etc.) for the implementation of the Strategy Document and Action Plan.	2023	MoAF (GDWM)	Presidency (PoSB), MoAF (SHW, GDARP, GDAR, GDAE), MEUCC, BoM (İLBANK), Municipalities
16	The tracking of progress related to the Strategy Document and Action Plan, through annual reports, and their submission to the National Water Council	Continuous (enduring)	MoAF (GDWM)	Public Institutions and Organizations

Objective 2. Monitoring the water availability in watersheds, and making plans at the watershed scale, taking into account efficiency measures, based on projections regarding the impact of climate change on water resources.				
Number	**ACTIONS**	**CALENDAR**	**RESPONSIBLE ENSTITUTION(S)**	**RELEVANT INSTITUON(S)**
1.	Completing water efficiency planning efforts for drinking water, agriculture, and industrial sectors in all watersheds; determining watershed-based measures and efficiency goals for the efficient, effective, and sustainable use of water.	2023 - 2030	MoAF (GDWM)	MoAF (SHW, GDRP, GDAR, TGDAE, GDPR), MoIT, PSA, Municipalities
2.	Implementing watershed-scale and comprehensive water allocation for drinking water, agriculture, and industry Instead of local solutions	2023 - 2030	MoAF (GDWM, SHW)	MoAF (GDRP, GDAR, GDAE, GDPR), MoIT, PSA, Municipalities
3.	Promoting the sponge city model for rainwater harvesting, flood management, ecological infrastructure, and drainage systems improvement in urban areas	2023 - 2030	MoEUCC, Municipalities	MoAF (GDWM, SHW)
4.	Expanding underground water storage facilities.	Continuous (enduring)	MoAF (SHW)	MoAF (GDWM)
5.	Transferring water from water-rich basins to regions facing water shortages and supporting underground aquifers, lakes, and reservoirs	2023 - 2030	MoAF (SHW)	MoAF (GDWM)
6.	Implementing measures (installation of solar panels and afforestation of the surrounding areas e.g.) to reduce evaporation losses from reservoirs, especially in regions experiencing water scarcity and those at risk, except for drinking water reservoirs	2023 - 2030	MoAF (SHW, GDF)	MoAF (GDWM)
7.	Increasing the storage capacity of water resources to compensate for the decrease in water stocks due to the effects of climate change, including reduced snowfall or early snowmelt.	2023 - 2030	MoAF (SHW)	MoAF (GDWM)

Objective 3. Expanding the use of alternative (non-traditional) water resources (rain water, gray water, used water, sea water, brackish water, etc.)				
No	**Eylem**	**Takvim**	**Sorumlu Kurum**	**İlgili Kurum**
1.	Preparation of the "Water Reuse National Master Plan"	2023 - 2025	MoAF (GDWM)	MoAF (SHW, GDARP, GDAR, GDAE), MoEUCC, BoM (İLBANK), Municipalities, Universities
2.	Determining the building (construction) criteria for mandatory greywater usage by making amendments to the Planned Areas Zoning Regulation	2023 - 2025	MoEUCC	MoAF (GDWM), MoCT, Municipalities,
3.	Making regulations to assign stormwater network manufacturing and operation duties to water and sewerage administrations	2023 - 2025	MoEUCC	MoAF (GDWM), Municipalities,
4.	Preparation of local-scale plans by water and sewerage administrations for the efficient utilization (use) of rainwater collected in the stormwater network	2023 - 2025	Municipalities	MoAF, MoEUCC
5.	Establishing the legal framework for the sector-specific use of reclaimed (used) water.	2023 - 2024	MoAF (GDWM)	MoEUCC, MoAF (SHW)
6.	Implementation of different reuse alternatives (such as agricultural irrigation, environmental replenishment, industrial use, landscape irrigation, consideration as drinking water, etc.) for reclaimed (used) water determined by taking into account local, regional and basin-based needs	Continuous (enduring)	MoAF (SHW, GDARP, GDAR, GDAE), MoEUCC, BoM (İLBANK), Municipalities	MoAF (GDWM)
7.	Dissemination of appropriate technologies for the reuse of water, treated in wastewater treatment plants, for different purposes	Continuous (enduring)	Municipalities	MoAF (GDWM), MoEUCC
8.	Making regulations aimed at providing individual users with incentives for the installation and operation of rainwater harvesting and greywater recycling systems through water bills or direct support	2023 - 2025	MoAF (GDWM)	Municipalities

Objective 3. Expanding the use of alternative (non-traditional) water resources (rain water, gray water, used water, sea water, brackish water, etc.)				
Number	**ACTIONS**	**CALENDAR**	**RESPONSIBLE INSTITUTION(S)**	**RELEVANT INSTITUTION(S)**
9.	Introducing regulations regarding prioritizing infrastructure works related to the use of rainwater and greywater in urban transformation areas, housing estates, mass housing, industrial zones, planning and permit processes	2023 - 2025	Municipalities	MoAF (GDWM), MoEUCC, MoIT, MoCT
10.	Preparation of technical support projects for the establishment of legislation within the scope of water efficiency and reuse of reclaimed water, especially in sectors with intensive water consumption.	2023 - 2030	MoAF (GDWM, SHW, GDARP, GDAR, GDAE)	İLBANK, Belediyeler
11.	Installation of cistern structures to expand rainwater harvesting in urban and rural areas, establishing systems that can respond especially to sudden floods and heavy rains, and integrating them into water collection systems.	2023 - 2033	Municipalities	MoAF (GDWM), MoEUCC

Objective 4: Determining the total water footprint size and mitigation measures at the basin scale				
Number	**ACTIONS**	**CALENDAR**	**RESPONSIBLE INSTITUTION(S)**	**RELEVANT INSTITUTION(S)**
1.	Calculation of blue, green and gray water footprint and virtual water contents at the basin scale and ensuring the sustainability of the water footprint in the basins	2023 - 2030	MoAF (GDWM), Municipalities	MoAF (SHW, GDARP, GDAR, GDAE), MoEUCC, BoM (İLBANK), TSI, Municipalities
2.	Conducting legislative studies for water footprint labeling	2023 - 2030	MoAF (GDWM)	MoEUCC, MoIT
3.	Determining the impact and magnitude of virtual water transfer in international product trade on water availability	2023 - 2030	MoAF (GDWM), TWI, Universities	MoAF (DSI, TAGEM, TRGM), MoEUCC, TSI, Municipalities

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APPENDICES

In the preparation of the Climate Change Adaptation Framework for Water Efficiency Strategy Document and Action Plan, summary information about the national and international studies, institutions, and regulations analyzed and utilized is presented in the appendices.

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NATIONAL-SCALE LEGAL REGULATIONS LEGISLATION, PLANS, PROGRAMS, DOCUMENTS ANALYSIS

NATIONAL LEGISLATION

The laws, regulations, and communiqués directly related to water efficiency are as follows:

LAWS:

- Law No. 6200 on the Services Conducted by the General Directorate of State Hydraulic Works (1953)
- Law No. 2560 on the Establishment and Duties of Istanbul Water and Sewerage Administration General Directorate (1981)
- Law No. 2872 on Environmental Law (1983)
- Presidential Decree No. 1 dated 10/7/2018 on the Presidency Organization

REGULATIONS:

- Regulation on the Preparation, Implementation, and Monitoring of Basin Management Plans
- Regulation on Control of Water Losses in Drinking Water Supply and Distribution Systems
- Regulation on Control of Water Use in Irrigation Systems and Reduction of Water Losses
- Regulation on the Protection of Drinking and Utility Water Basins
- Regulation on Rainwater Collection, Storage, and Discharge Systems
- Planned Areas Zoning Regulation
- Regulation on Water Allocations
- Urban Wastewater Treatment Regulation
- Water Pollution Control Regulation
- Regulation on the Principles and Procedures to be Followed in Determining Tariffs for Sewerage and Municipal Solid Waste Disposal Facilities
- Strategic Environmental Assessment (SEA) Regulation

COMMUNIQUÉS:

- Communiqué on Support for Individual Irrigation Systems under Rural Development Supports
- Technical Procedures Communiqué on the Regulation of Water Losses in Drinking Water Supply and Distribution Systems
- Technical Procedures Communiqué on Wastewater Treatment Plants (WWTP)
- Technical Procedures Communiqué on Drinking Water Treatment Plants

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DEVELOPMENT PLANS

Development Plans are documents that establish the development vision of our country, defining policies and measures to meet the fundamental values and expectations of our people, enhance our nation's international standing, and increase the well-being of our citizens. They provide guidance to institutions in setting priorities for the preparation of other policy documents and strategic plans.

In the Tenth and Eleventh Development Plans, under the headings of Urban Infrastructure, Environmental Protection, Soil and Water Resources, issues related to the efficient use and sustainable management of water resources are highlighted.

Under the Eleventh Development Plan, within the Urban Infrastructure heading, related to the water efficiency, there are measures on; integrity of plans on protection, development, and sustainable use of water resources, planning at the river basin level for the reuse of treated wastewater particularly for agricultural purposes, supply of efficient, adequate, and standards-compliant provision of drinking water and wastewater services and improvement of the SUKAP program aimed at reducing physical losses. In connection with the measures under this heading, the plan sets a target for the reuse rate of treated wastewater at 5% by the year 2023, and a target for a 25% reduction in drinking water losses by 2023.Under the Environmental Protection heading, and also within the framework of the Competitive Production and Productivity axis, measures related to water efficiency are considered.

NATIONAL WATER PLAN

The National Water Plan, prepared for the period 2019-2023, has been developed with a participatory and comprehensive approach to establish a roadmap for the "A Turkey with a Developed National Water Policy" objective. It outlines the general framework of our national water policy, taking into account the sustainable management of water resources in terms of quantity and quality, while also emphasizing the balance between conservation and utilization. The plan aims the completion of transition to basin-based water management is coordinated by the General Directorate of Water Management (SYGM), also, includes the Water Efficiency title which is one of the fundamental components of the water management cycle. Within the plan's content, an analysis of the current situation related to water efficiency in drinking-water, agricultural, and industrial sectors is provided, along with identified bottlenecks and ongoing policy measures.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

SECTORAL AND THEMATIC STRATEGY DOCUMENTS

The key sectoral and thematic strategy documents that provide the basis for water efficiency strategies and policies are as follows:.

- National Basin Management Strategy (2014-2023)
- National Drought Management Strategy Document and Action Plan (2017-2023)
- National Rural Development Strategy (2021-2023)
- Turkey’s Climate Change Adaptation Strategy Document (2011-2023)

INSTITUTIONAL STRATEGIC PLANS

Among the major institutional strategic plans that align with the national-scale water efficiency approach in terms of their goals and strategies are:

- Ministry of Agriculture and Forestry Strategic Plan (2019-2023)
- Ministry of Environment, Urbanization, and Climate Change Strategic Plan (2019-2023)
- General Directorate of State Hydraulic Works Strategic Plan (2019-2023)
- İLBANK Strategic Plan (2019-2023)

DECISIONS OF COUNCIL

Recommendations, strategies, and policies indicate the water efficiency were established within the framework of the Forestry and Water Council (2017), the Agriculture and Forestry Council (2019), the 1st Water Council (2021), and the Climate Council (2022). Being the primary basis of this study; within the context of the 1st Water Council, Water Efficiency Commission is constituted and the water efficiency topic is addressed in the Council’s decisions through 15 overarching objectives and 37 strategies. The first of these objectives focused on ***Determination of Strategies Intended for Improving Water Efficiency***: (i) Preparation of a water efficiency strategy document and (ii) Preparation and implementation of river basin based water efficiency action plans for sectors (domestic, agricultural, and industrial).

MANAGEMENT AND ACTION PLANS

Master plans prepared by the State Hydraulic Works (DSİ) and the General Directorate of Agricultural Research and Policies (TAGEM) are among the institutional documents that provide guidance for the effective and sustainable management of water resources. Additionally, River Basin Management Plans, Drought Management Plans, Sectoral Water Allocation Plans, Draft Action Plans for Reused Water, and Water Efficiency Action Plans in three pilot basins (Akarçay, Western Mediterranean, Yeşilırmak) encompass assessments at the basin scale regarding water efficiency include the current situation, needs, and analyses of the water required by each sector (domestic, environmental, livestock, agriculture, industry, energy, tourism, mining, aquaculture, etc.) from economic, social, and environmental perspectives and also address drought conditions (normal, mild, moderate, severe, and very severe drought), future projections, and the development of short, medium, and long-term measures to complement the water efficiency approach.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

INTERNATIONAL ORGANIZATIONS AND REGULATIONS

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

The Organization for Economic Co-operation and Development (OECD) advocates the adoption of pricing policies that balance financial, social, and environmental considerations in all sectors for efficient water use. It recommends the adoption of a water pricing policy that balances financial, social, and environmental goals to enhance efficiency in domestic and industrial water use, from an agricultural perspective, suggests that farmers should not only cover operating and maintenance costs for water but also bear the capital costs of the water infrastructure allocated to their use. It should not be thought to reduce agricultural production by the application of such pricing; on the contrary, in Australia, where this policy has been implemented, agricultural water prices increased without a decrease in agricultural production, and water use for irrigation was reduced by half without a loss in production.

UNITED NATIONS (UN)

The United Nations (UN) addresses issues related to water efficiency through the Sustainable Development Goals (SDGs) and initiatives under the Food and Agriculture Organization (FAO).

Sustainable Development Goals

The UN has established 17 Sustainable Development Goals (SDGs) under its auspices, with SDG 6 (Clean Water and Sanitation) being directly related to water management. Under **SDG 6**, there are eight specific targets, and target 6.4 aims to ***"substantially increase water efficiency in all sectors"*** The UN suggests various policy tools for water efficiency, emphasizing the promotion of cost-effective innovations and their adoption and also economic incentives, appropriate pricing, advanced technology, and public awareness are also highlighted to encourage improvements in water efficiency.

Food and Agriculture Organization (FAO)

The Food and Agriculture Organization (FAO) primarily focuses its water-related efforts on the management of agricultural water. In line with the vision of ***"producing more food with less water"*** in agriculture, the following policy tools can be considered for efficient water use in agriculture:

- Modernization of irrigation systems ***(modernization of irrigation systems to increase irrigation water efficiency and minimize environmental impact)***.
- Improvement and diversification of agricultural water supply systems ***(to enhance local community productivity and climate resilience; encouraging investments in decentralized rainwater collection and storage systems and wastewater treatment for reuse in agriculture)***.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

The European Union (EU)

European Green Deal and Circular Economy Action Plan

The European Union (EU) set its goal to become the world's first climate-neutral continent by 2050 with the announcement of the European Green Deal on December 11, 2019. Alongside this, it declared that it would adopt a new growth strategy requiring a transformation of its industries and a reshaping of all its policies with a focus on climate change. In response to the drawbacks of the traditional "take-make-use-dispose" growth model and the transition to sustainable development, the approach of the circular economy, which emphasizes efficient and sustainable resource management, longer product and material use, waste reduction, and the use of recycled materials in production, has become crucial in achieving the "climate-neutral" goal of the European Green Deal.

Within the scope of the European Green Deal (EGD), Turkey has prepared the Turkey Green Deal Action Plan, which consists of nine main headings. One of these headings is "Green and Circular Economy." Some of the goals related to water efficiency under this heading are as follows:

- Enhancing and promoting the use of treated wastewater.
- Preparing a "National Water Reuse Master Plan."
- Preparing a "guide document on water footprint" based on Sectoral Water Allocation Plans.
- Updating clean production regulations for the textile sector with high water consumption, creating clean production regulations for the leather sector, and organizing training programs on clean production practices in the textile and leather sectors.
- Preparing a National Sustainable Consumption and Production Action Plan.
- Researching the use, benefits, and potential developments of remote sensing, sensors, and information applications in water resource management.

First and foremost, reusing treated wastewater will directly contribute to water efficiency by providing an additional source of water. In addition, the "Water Footprint" assessment introduces a different perspective on water efficiency. Instead of creating a new water source, it calculates water usage for products with intensive water consumption, allowing water savings through the import of these products (virtual water transfer).
The National Sustainable Consumption and Production Action Plan and Water Reuse Master Plans will determine the current status of water efficiency and outline the necessary steps and responsible institutions and organizations. Transitioning to clean production in the textile sector aims to prioritize efficiency by reducing water and energy consumption in one of the sectors with the highest water usage.

Within the scope of the Climate Change Mitigation goal in the Turkey Green Deal Action Plan, the following activities related to water efficiency are planned:

- Preparation of the 2023-2030 Climate Change Action Plan and the 2050 Climate Change Strategy.
- Provision of training on sustainable agricultural techniques, conducting R&D projects in this regard, and promoting their adoption.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

Turkey Climate Change Adaptation Strategy and Action Plan document, covering the years 2011-2023, highlights the importance of water efficiency in water-intensive industries and agriculture-based industries. It includes actions to support water efficiency in these sectors and suggests revisions of documents like the Turkey Industrial Strategy Document from the perspective of water efficiency. The forthcoming action plan, which will cover the years 2023-2030, will also emphasize water efficiency in water resource management. Education and R&D efforts on sustainable agricultural techniques will make it easier to achieve the targeted productivity rates in the agricultural sector.

The Water Framework Directive

When considering the Water Framework Directive in the context of water efficiency, the following aspects stand out:

1. Calculation of ecological flow (the necessary amount of water for the sustainable survival of the aquatic ecosystem).
2. Development of allocation plans for the efficient distribution of water.
3. Treatment of used water for reuse in agriculture and industry.
4. Establishment of a policy for accurate measurement of water use and the reduction of losses and leaks.
5. Determination of the most suitable pricing policy for the efficient use of water.
6. Production of designs that enhance efficiency in the water distribution system (especially for drinking water, domestic use, and irrigation) and the promotion of their use.

These measures and considerations within the Water Framework Directive contribute significantly to water efficiency and the sustainable management of water resources.

Drinking Water Directive

The Council Directive 98/83/EC (Drinking Water Directive), adopted by the Member States of the European Union, establishes the quality requirements for water intended for human consumption, aiming to ensure human health. It applies to all waters intended for human consumption, with the exception of naturally mineral waters and medicinal products.

The Directive is based on the precautionary principle when setting pollution levels. For instance, the EU pollution levels for pesticides are 20 times lower than those specified in the World Health Organization (WHO) drinking water guidelines because the EU Directive aims to protect not only human health but also the environment.

In 2003, the European Commission initiated an extensive consultation process for the revision of the Directive. During this process, there was a departure from the end-of-pipe standard-setting approach. Instead, the entire water supply process from the catchment to the tap will be evaluated through water safety plans to identify and assess risks and the most effective control points.

The Directive, revised and put into effect in 2021, addresses issues directly or indirectly related to water efficiency within its scope.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

Access to Water for Human Consumption

Member States shall promote the use of tap water for human consumption by providing for the installation of indoor and outdoor facilities in public places wherever technically possible, in proportion to the need for such measures, taking into account specific local conditions such as climate and geography. Member States may also take the following measures to promote the use of tap water for human consumption:

- Creating awareness about the nearest outdoor or indoor facilities.
- Launching campaigns to inform citizens about the quality of such water.
- Encouraging the supply of such water in public administration and government buildings.
- Encouraging the provision of such water to customers in restaurants, canteens, and food services for free or at a low service fee.

Water Safety Plans

The new directive emphasizes the implementation of a comprehensive risk-based water safety approach that covers the entire supply chain from the source to the tap to maintain the quality of tap water. Member States are required to conduct risk assessments for drinking water catchments by July 12, 2027, risk assessments for drinking water supply and distribution systems by January 12, 2029, and to review them at regular intervals not exceeding 6 years.

Water Losses

Member States are obligated to assess the levels of losses and the potential for reducing losses and leaks using the Infrastructure Leakage Index (ILI) grading method or another appropriate method and provide the results of the assessment to the Commission within 5 years. Within 7 years, the Commission will establish a threshold for water loss and develop a draft "European Union average water loss rate" based on the assessments of Member States. Member States with water loss rates exceeding the threshold specified in the transferred savings will submit an action plan to the Commission to reduce these rates.

Information

In the context of consumer information, the revised regulation requests the preparation of summaries and statistics related to the overall performance of the water system, the ownership structure of the water source by the water supplier, information on the water tariff, and consumer complaints, in addition to the previous requirement for reports on drinking water quality.

Urban Wastewater Treatment Directive

The Urban Wastewater Treatment Directive, Directive 91/271/EEC dated May 21, 1991, addresses the collection, treatment, and discharge of urban wastewater, as well as the discharge of wastewater from certain industrial sectors. The directive aims to protect the environment from the adverse effects of wastewater discharges.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

Within the scope of the directive, member states are required to establish sewage systems for urban wastewater in all inhabited areas. The directive also includes provisions for the reuse of treated wastewater, with the goal of minimizing the adverse environmental impacts of treated wastewater. In this regard, the reusability of wastewater will positively impact water efficiency in regions facing water scarcity.

The Urban Wastewater Treatment Directive, a subdirective of the Water Framework Directive, was transposed into national legislation through the Urban Wastewater Treatment Regulation (Official Gazette, January 8, 2006; No. 26047), which came into effect in 2006, and the Urban Wastewater Treatment Regulation for Sensitive and Less Sensitive Water Areas Notice issued in 2009 (Official Gazette, June 27, 2009; No. 27271).

Regulation on Minimum Requirements for Water Reuse

The Regulation on Minimum Requirements for Water Reuse was published in the Official Journal of the European Commission on June 5, under Regulation 2020/741 (Official Journal of the European Union - L 177, Volume 63, page 32). These new rules are set to take effect from June 26, 2023, with the expectation of promoting and facilitating water reuse in the European Union. The regulation includes the following provisions:

- Minimum water quality requirements for the safe reuse of treated urban wastewater in agricultural irrigation.
- Harmonized minimum monitoring requirements, especially the monitoring frequency for each quality parameter and verification monitoring requirements.
- Risk management conditions for assessing and addressing potential additional health risks and potential environmental risks.
- Permit conditions.
- Transparency provisions making essential information regarding water reuse projects publicly available.

Article 5 of the regulation, titled “Risk Management,” states that competent authorities (agencies and/or organizations) will ensure the development of a water reuse risk management plan for the production, supply, and use of reclaimed water. The water reuse risk management plan will be prepared by the facility operator, responsible parties, and end-users. The responsible parties preparing the Risk Management Plan will consult with all other responsible parties and end-users.

The necessary elements for the Risk Management Plan are provided in the annex of the regulation. The Risk Management Plan should, in particular:

- Set out the requirements for the facility operator based on the conditions specified in the annex to further reduce any risks before the compliance point.
- Identify hazards, risks, and appropriate preventive and/or potential corrective measures.
- Specify additional barriers and requirements after the compliance point, including distribution, storage, and usage conditions in the water reuse system, to ensure the system’s safety and define responsible parties.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

Industrial Emissions Directive (EED)

The Industrial Emissions Directive (EED), originally published in 1996 under the former name "Integrated Pollution Prevention and Control Directive (IPPC 96/61/EC)," and later known as the "Industrial Emissions Directive (2010/75/EU)," is one of the most significant components of the European Union's environmental legislation with a focus on industry. This directive introduces a different approach to the prevention of industrial pollution, emphasizing the prevention of pollutants at their source, considering recipient environment characteristics and the natural renewal process, in addition to discharge standards.

The directive addresses the integrated control and prevention of discharges/emissions into the recipient environment, including air, water, and soil, originating from industrial activities. It also outlines measures to be taken in cases where prevention is not feasible, with the objective of reduction. In other words, the directive is based on the principle that the prevention of pollution from industrial activities in the EU involves the operation of relevant activities in accordance with the criteria specified in the directive by obtaining permits from competent authorities. According to the directive, integrated environmental permits for industrial facilities should be based on the emission limit values derived from the conclusions sections of the Best Available Techniques Reference Documents (BREF) based on Best Available Techniques (BAT) principles and should ensure compliance with the emission limit values for facility discharges.

BAT-BREF Documents

The directive defines the requirements for industrial facilities to obtain operating permits, systematically promoting the applicability of clean production processes and eliminating practical difficulties in implementation by presenting the Best Available Techniques (BAT/MET). METs are the most effective application techniques for the high-level protection of the environment, taking into account costs and benefits. According to the directive, Reference Documents (BAT Reference Documents-BREF) have been prepared, detailing METs for each sector. BREFs are the primary reference documents used by competent authorities in the Member States when issuing operating permits for facilities with a significant pollution potential in Europe.

Table 4 provides sectoral METs published under IPPC, and some documents are still undergoing revision and updates. Not all sectors have reference documents available in EU sources, and considering successful water efficiency practices in our country, the preparation of national reference documents is required.

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

Tablo 4. Existing EU BREF Documents[42]

	SECTOR	YEAR
1.	Ceramic Production Industry	2007*
2.	Waste Gas Treatment in the Chemical Sector	2019 (Draft)
3.	Wastewater and Waste Gas Treatment/Management Systems in the Chemical Sector	2016
4.	Economy and Cross-Media Effects	2006
5.	Emissions from Storage	2006
6.	Energy Efficiency	2009
7.	Iron and Steel Processing Sector	2001
8.	Food, Beverage, and Dairy Sectors	2019
9.	Industrial Cooling Systems	2001
10.	Intensive Poultry Farming and Pig Farming	2017
11.	Iron and Steel Production	2012
12.	Large Combustion Plants	2017
13.	Large Volume Inorganic Chemicals - Ammonia, Acids, and Fertilizers	2007
14.	Large Volume Inorganic Chemicals - Solids and Others in Industry	2007
15.	Glass Manufacturing	2012
16.	Production of Fine Organic Chemicals	2006
17.	Monitoring of Emissions to Air and Water from IED Installations	2018
18.	Non-Ferrous Metal Industries	2016
19.	Manufacture of Cement, Lime, and Magnesium Oxide	2013
20.	Chlor-Alkali Production	2013
21.	Large Volume Organic Chemicals Industry	2017
22.	Production of Polymers	2007
23.	Pulp, Paper, and Board Production	2014
24.	Production of Special Inorganic Chemicals	2007
25.	Mineral Oil and Gas Refining	2014
26.	Slaughterhouses and Animal By-Product Sectors	2005*
27.	Iron and Steel Processing Sector	2005*
28.	Surface Treatment of Metals and Plastics	2006
29.	Surface Treatment of Wood and Wood Products, Including the Use of Organic Solvents	2020
30.	Tanning of Hides and Skins	2013
31.	Textile Industry	2003*
32.	Waste Incineration	2019
33.	Waste Treatment	2018
34.	Wood Panel Production	2015

[42] European Union, URL: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/txt_bref_0703.pdf

Economic Cooperation Organization (ECO)

In the Economic Cooperation Organization (ECO), the focus on water management is particularly prominent in the areas of agricultural irrigation, the management and operation of water, irrigation systems, efficiency, pricing, and the protection and development of water resources. The main policies include:

- Encouraging cooperation among member countries for effective agricultural water management.
- Establishing an efficient management information system for information sharing.
- Increasing the efficient use of land and water resources through environmentally friendly policies, technology, and economic principles.
- Promoting higher-yield agricultural production, more efficient agricultural water use, and more sustainable land cultivation.
- Removing policy constraints aimed at improving water allocation efficiency.

Organization of Islamic Cooperation (OIC)

The Organization of Islamic Cooperation (OIC) Water Vision aims to minimize the destructive effects of water while maximizing efficient water use. The water-related policies are as follows:

- Connecting centers for water science, policy, management, and technology development within the OIC to build capacity, share knowledge, and enhance it.
- Finding solutions to water issues through increased dialogue, experience sharing, and the promotion of concrete actions.
- Encouraging OIC leaders to promote solutions to water security issues in their national and international agendas.
- Conducting joint activities for capacity development, innovative technological ideas, and educational programs between research and educational institutes of member states.

The Islamic Organization for Food Security provides technical expertise and knowledge in various aspects of sustainable agriculture, rural development, food security, and biotechnology to member states. It aims to facilitate the exchange and transfer of best practices, as well as the development and coordination of common agricultural policies among member states..

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Water Efficiency Campaign