
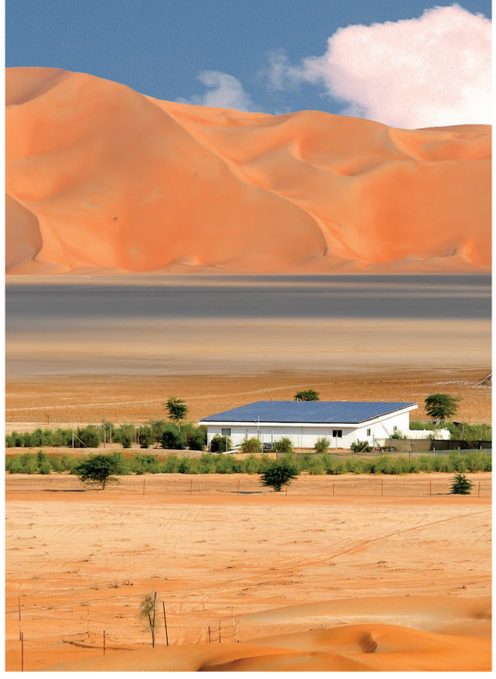

A Water Budget Approach for the Emirate of Abu Dhabi

POLICY BRIEF | **2015**



هـيـئـة الـبـيـئـة - أبـوظـبـي
Environment Agency - ABU DHABI

ABOUT THIS POLICY BRIEF

Policy briefs are published by the Environment Agency-Abu Dhabi (EAD) with the purpose of exchanging information and ideas about current and future public policies to pursue the Abu Dhabi Environment Policy Agenda and, in particular, to secure the preservation and enhancement of the natural heritage of the Emirate of Abu Dhabi, encourage a more efficient use of natural resources and provide a better quality of life for all.

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WE NEED TO ALIGN OUR WATER USE WITH OUR **WATER BUDGET**

"The demand for water is so high and the recharge rate so low that we know our use of groundwater is unsustainable. The issue of water scarcity and water security is only getting more urgent. Today we have less water in our aquifers than we did last year and we are therefore one year closer to running out. Throughout Abu Dhabi we are seeing groundwater aquifers declining at unsustainable rates and even at these elevated rates of extraction we are still failing to meet the full water needs of the Emirate.

If we continue to overuse our water now, our future water budgets will be smaller at the very time our populations and our economies are growing and, as a result, demanding more water.

Business as usual will not solve this looming crisis, we need to change the way we think about water, we must determine and define a fixed volume of water that we can supply sustainably within our economy over the long term. In other words we have a water budget. If we want to allocate more water to one sector of the economy we need to reduce consumption in another in the same way governments allocate funds across different sectors.

We must not continue to meet increasing demand, driven by economic and population growth by simply increasing supply, rather it means that we have to be more efficient, more productive and more competitive in the ways in which we use water".

H. E. Razan Al Mubarak, Secretary General of the Environment Agency-Abu Dhabi, International Water Summit 2014

WHAT YOU WILL FIND IN THIS BRIEF

1) Laying out the challenges

- **Under a business as usual scenario sectoral competition for water will intensify**
  - Groundwater withdrawal is 23 times the natural recharge rate
  - Abu Dhabi domestic water consumption is 3 times the world average
  - The return to sewer rate is lower than 28% and only 54% of recycled water is reused

2) Laying out the opportunities

- **Business as usual will not solve this looming crisis, we need to change the way we think about water:**
  - Define a sustainable water budget for the Emirate of Abu Dhabi
  - Study options for the efficient allocation of the water budget among competing sectors
  - Agree on a water allocation policy to optimise water use
  - Balance water use with the water budget
- **We need to produce and use water as efficiently and cleanly as possible**

A WATER BUDGET APPROACH TO PROMOTE THE SUSTAINABLE USE OF WATER RESOURCES IN ABU DHABI

The Emirate of Abu Dhabi is located in an arid region where access to renewable natural water resources, mainly groundwater, is limited and threatened by over abstraction.

Abu Dhabi has been able to overcome this limitation by increasing its reliance on non-conventional water resources. This approach requires significant investments in generation, transmission and distributions infrastructure and gas imports to desalinate and recycle water, and has a negative impact on the environment in terms of global warming, air pollution and marine pollution.

Although access to non-conventional water resources has enabled Abu Dhabi to achieve an impressive economic development and increase its population eleven fold since pre-oil times. However, currently groundwater withdrawal exceeds 23 times the aquifer's natural recharge rate and domestic water consumption per capita is one of the highest of the world. Maintaining the current patterns of water use will lead to the depletion of usable groundwater in a few decades and to tripling the volume of desalinated water to be produced by 2030. This is unsustainable.

Abu Dhabi needs to use water as efficiently as possible and plan to balance its water use with its water budget. A water budget is an accounting of the water resources within a geographical area. Like a financial budget, it includes the sources and quantities of water income (rain, groundwater, etc.); the water savings (storage) and the water expenses (water uses).

Adopting a water budget approach is essential to sustain the growing population, enable development, and support a healthy environment.

The planning assumption today is that Abu Dhabi will meet its future water demand by increasing supply. The water budget approach wants to change this. If currently our domestic consumption per capita is one of the highest in the world at three times the world average, if Abu Dhabi can reduce water consumption and achieve the world average, the Emirate will be able to triple its population and still produce the same volume of water for domestic consumption as it does today.

The water budget approach offers huge economic and environmental benefits in term of reducing investment in costly infrastructure, emissions of air pollutants and greenhouse gases and discharges of brine into the Gulf.

Adopting a water budget approach will require a four-pronged approach:

a | Define a volume of sustainable water budget for the Emirate of Abu Dhabi.

b | Study options for the efficient allocation of the water budget among sectors.

c | Agree on a water allocation policy to optimise water.

d | Balance water use with the water budget

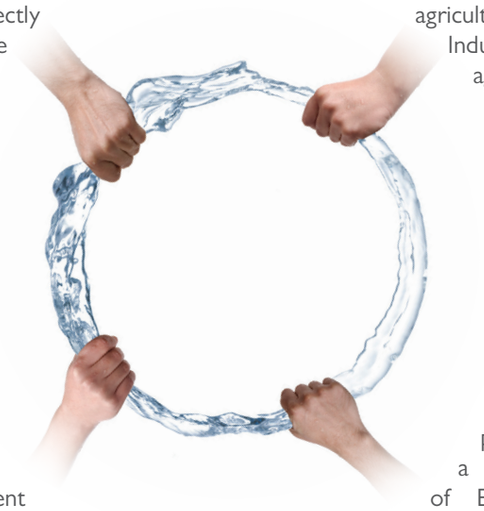
Currently, the Environment Agency – Abu Dhabi, in cooperation with other competent authorities, is exploring how to implement this approach.

UNDER A BUSINESS AS USUAL SCENARIO SECTORAL COMPETITION FOR WATER WILL INTENSIFY

Groundwater withdrawal exceeds 23 times the natural recharge rate

Abu Dhabi has an arid climate. Groundwater is the only renewable water source in the Emirate and accounts for 61% of the total water supply. It is consumed mainly for irrigation by the agriculture, forestry and public realm amenities sectors. Only 5% of what is used annually is naturally recharged.

Not all ground water is usable. Only 3% of groundwater is fresh, 18% is brackish and 79% is saline and cannot be directly used. Abu Dhabi has been able to overcome this limitation by increasing its reliance on non-conventional water resources such as desalinated and recycled water.



Abu Dhabi domestic water consumption is 3 times the world average

Desalinated water accounts for 31% of the total water supply. It is consumed mainly by the domestic and government sector, followed by the industrial and commercial sectors and the agriculture and forestry sector that use it only marginally. Abu Dhabi uses a large amount of water for domestic activities, exacerbated by excessive outdoor uses.

The return to sewer rate is lower than 28% and only 54% of recycled water is reused

Recycled water contributes to 8% of the total water supply. It is mainly used for irrigation purposes in some pilot farms.

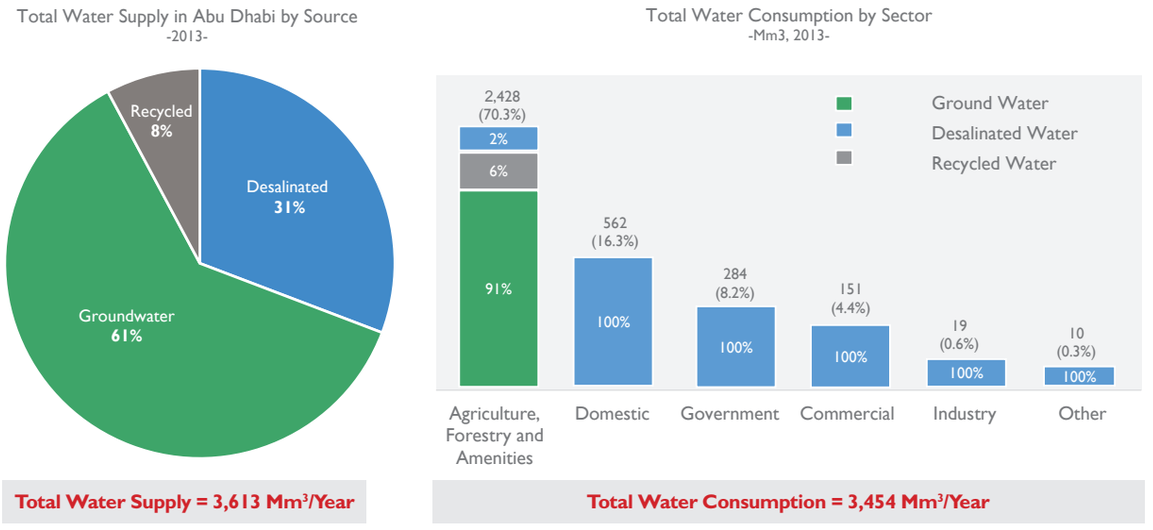
While Abu Dhabi has a well-developed sewerage network, about 72% of consumed water does not re-enter into the sewage system, leading to a low return-to-sewer relative to benchmarks. Additionally, only 54% of recycled water is reused, since infrastructure issues result in the discharge of the remaining 46% to the environment.

Under a business as usual scenario sectoral competition for water will intensify

There are five distinct areas of demand, agricultural, municipal, business, Industrial and domestic. The agriculture sector is the largest consumer of water (70.3% of total water consumption) followed by domestic (16.3%), government (8.2%), commerce (4.4%) and industry (0.6%).

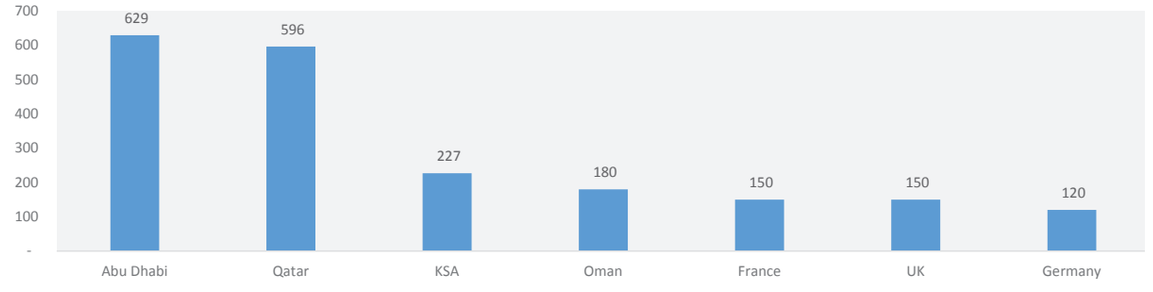
Although commercial and industrial uses are still relatively small, they are expected to grow at a faster pace in the coming decades as a result of the implementation of Economic Vision 2030 that expects tourism and manufacture to be part of the key sectors to contribute to diversify the economy. In a business as usual scenario, sectoral competition for water will intensify unless the government encourages the establishment of water efficient industries and buildings.

Figure 1: Total water supply by source & demand by sector



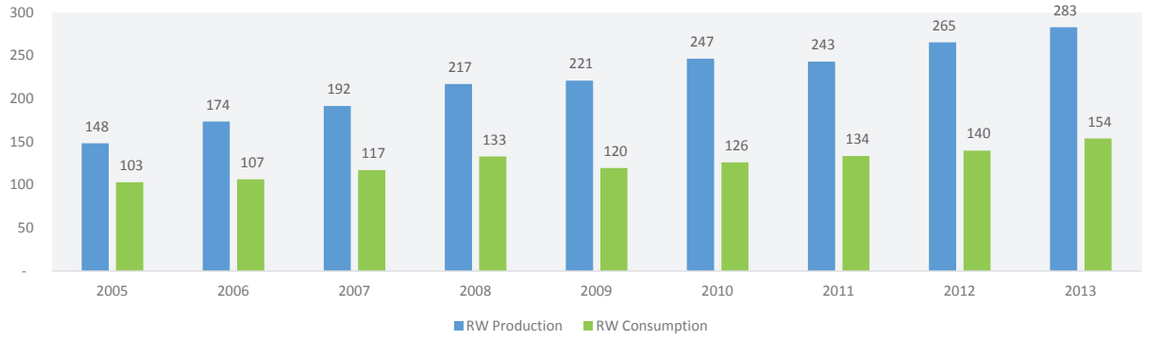
Source: SCAD, Abu Dhabi Statistical Yearbook 2014. ***Note****: Groundwater is estimated based on 2011 data*

Figure 2: Domestic Water Consumption (Liters/Person/Day)



Source: Abu Dhabi Environmental Policy Agenda (ADEPA) Team Analysis

Figure 3: Recycled Water (RW) Production & Consumption (Mm³ per Year)



Source: SCAD, Abu Dhabi Statistical Yearbook 2014

BUSINESS AS USUAL WILL NOT SOLVE THE LOOMING CRISIS, WE NEED TO CHANGE THE WAY WE THINK ABOUT WATER

To better manage and allocate its water resources, EAD has proposed the adoption of a water budget approach by the Emirate of Abu Dhabi.

The Water Budget

A Water budget is an accounting of the water resources within a geographical area. Like a financial budget, a water budget includes the sources and quantities of water income (rain, groundwater, etc.); the water savings (storage) and the water expenses (water uses).

Adopting a water budget approach is essential to meet the future demand of the domestic, industrial, commercial, government, agriculture, forestry and amenity sectors and sustain the growing population, enable development, and support a healthy environment.

Adopting a water budget approach will require a four-pronged approach:

a | Define a sustainable water budget for the Emirate of Abu Dhabi

b | Study options for an efficient allocation of the water budget among competing sectors

c | Agree on an allocation policy

d | Balance water use with the water budget

Define a sustainable water budget for the Emirate of Abu Dhabi

The water budget approach for Abu Dhabi will set a cap to the water available for consumption by different sectors at a sustainable level. Defining a water budget will require a thorough analysis of water supply and demand to develop a water budget model.

Calculating water supply includes an assessment of current supplies and potential availability of new water, within specific spatial and temporal boundaries. Current supplies will include groundwater, surface water and desalinated water. Additional supplies will look at the potential of sources such as, various types of reuse, bulk external supply, distributed rainwater harvesting and alternative technologies.

Calculating water demand includes an aggregation of water requirement by sectors. Current supplies will include five distinct areas of demand: agricultural, municipal, business, Industrial and domestic. The analysis will also take into account unaccounted for water including: i) transmission losses (leakage) of raw water and potable water in distribution, (II) operational use of water, (III) treatment losses, (Iv) meter and measurement inaccuracies (typically under-registration), (v) unmetered emergency use and (vi) water theft.

Study the options for the efficient allocation of the water budget

Once the water budget model is available it will be used to test the Impact of various interventions to ensure an efficient allocation of the water budget and use this information to make policy recommendations.

Agree on a water allocation policy to optimise water use

Once a range of possible scenarios have been envisaged a water allocation policy will need to be agreed amongst all the key stakeholders and approved by the Executive Council.

The water allocation policy for Abu Dhabi will need to consider economic, social, environmental regional, and technical factors such as network penetration as well as the social, cultural and operational risks associated with the use of different water types for different uses that require certain water quality.

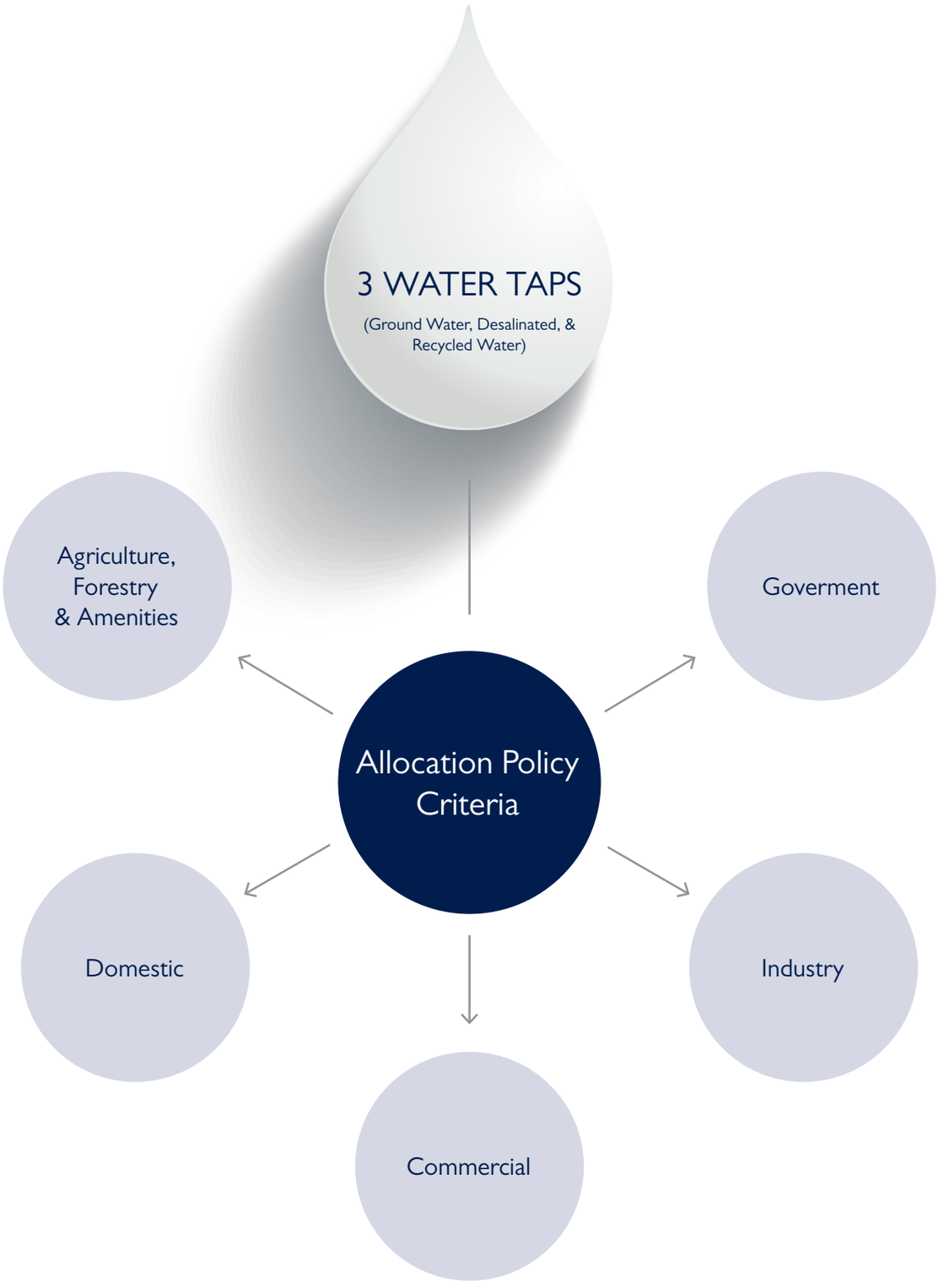


Figure 4: Three Taps Water Allocation among the five distinct areas of demand

TO BALANCE WATER USE WITH THE WATER BUDGET WE NEED TO PRODUCE AND USE WATER AS EFFICIENTLY AS POSSIBLE

The Emirate of Abu Dhabi is already adopting a number of initiatives to produce and use water more efficiently:

Develop a Dynamic Approach to Water Budgeting

The Environment Agency-Abu Dhabi has commissioned the UAE University and Leeds University to conduct a study to develop a Dynamic Approach to Water Budgeting for the Emirate of Abu Dhabi leading to realistic future water budget scenarios. The proposed study will comprise three stages; (1) develop a static baseline National Water Budget (NWB) model for the Emirate of Abu Dhabi by building on existing EAD work and cross-check with existing international budget studies, (2) Identify and engage data sources (supply and demand); populate and build a dynamic NWB Model and (3) interrogate NWB; test Interventions and develop future scenarios.

Conduct a well inventory and metering programme

The Environment Agency-Abu Dhabi is conducting a well inventory and metering programme that will provide essential inputs to better understand groundwater supply and demand and manage and regulate groundwater to reduce over abstraction.

Optimise the allocation of groundwater through the use of a crop calculator

The Environment Agency-Abu Dhabi in cooperation with the Abu Dhabi Food and Control Authority has developed a crop calculator to optimise the allocation of the groundwater used to irrigate crops. The model calculates the soil water balance by considering the inputs (rainfall and irrigation) and losses (plant uptake, evaporation, run-off and drainage) of water from the soil profile. The crop calculator is an initiative to promote optimum groundwater use in agriculture sector and to protect red zones where groundwater levels are falling rapidly. Currently groundwater withdrawal is 23 times the natural recharge rate. Through this and other initiatives it is expected to reduce groundwater abstraction by 20% by 2020.

Reduce the unaccounted for water

The Regulation and Supervision Bureau and the Abu Dhabi Water and the Electricity Authority are working toward reducing the unaccounted for water (UFW) resulting from network leakage and unmetered consumption. The reduction will be achieved through developing and overseeing a programme of metering, network refurbishment, leakage detection and remediation. Currently UFW is estimated to be around 20-30%, through the implementation of the programme it is expected to reduce it to less than 10% by 2030

Maximize the use of recycled water

The Abu Dhabi Sewerage and Services Company is working to maximise the use of recycled water. This will be achieved through an asset enhancement of the network and a rehabilitation of pumping stations. This is expected to increase the supply of water that is recaptured and as a result improving the return-to-sewer ratio and increasing the supply of recycled water as well as to expand distribution to end users. Currently the return to sewer rate is lower than 28% and only 54% of recycled water is reused. The target is to achieve full use of recycled water by 2018.

Revise the tariff structure to provide incentives to use water more efficiently

The Regulation and Supervision Bureau in cooperation with the distribution companies have published a revised tariff structure, effective, 1st January 2015, to provide incentives to large users to use water more efficiently.

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