The Water Resources Management Importance in the Sultanate of Oman

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Water in the GCC, Challenges and Innovative Solution

GENERAL SITUATION OF WATER RESOURCES

- Global water demand is increasing highly due to the rapid increase of population and development in different sectors.
- By 2025, about 1.8 billion people are expected to live in water scarce areas.
- By 2030, the world is expected to face a shortfall of about 40% between the predicted water demand and the available water supply.
- by 2050, the agricultural production, which is consuming about 70% of the current resources, will need to be increased by 60% to feed 9 billion people.
- Demands for food security has increased highly due to the increase in population, and accordingly, the irrigation water demand, which is expected to increase crop yields by 400% .

- Movement of considerably large number of people from countryside to the towns and cities have put enormous pressure on the infrastructure, especially in areas with limited infrastructures and resources. More than half of the global population currently live in towns and cities (expected to increase to two third by 2050).
- With the increase in population and the developments in different sectors, pollution in some areas has occurred, affecting the available water resources and making it unsafe to use.
- Untreated sewage and wastewater from factories can cause water pollution problems if not dealt properly, in save way. Pollutants can also travel down into the groundwater.
- Climate change expected to affect the hydrological cycle, increasing the floods and droughts frequencies and intensities.
- The regions failing to deliver sustainable water supply for their increasing population, especially in arid area due to increase in water demand with limited water resources.

IMPORTANCE OF WATER RESOURCES MANAGEMENT

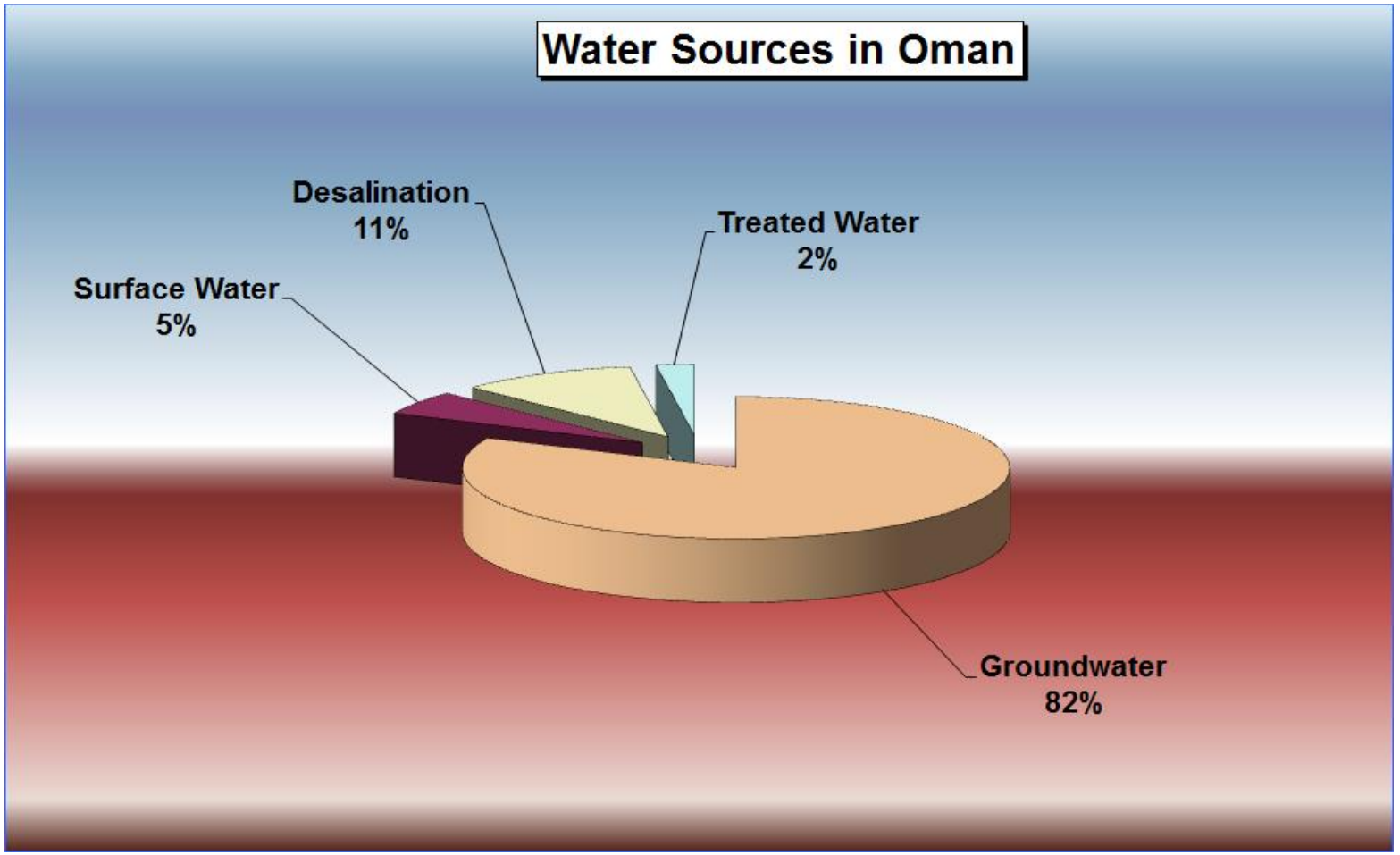
- Global water demand is increasing highly due to the rapid increase of population and development in different sectors with very limited resources.
- Adoption of an approach that seeks to harmonize the requirement of development and the available water resources and achieving sustainable development, necessarily.
- Comprehensive water resources management is needed to strengthen water security against increasing demand, water scarcity, growing uncertainty, high extremes, and other challenges

OVERVIEW ON WATER RESOURCES IN OMAN

- ***CONVENTIONAL WATER RESOURCES :*** Includes surface water resources and groundwater resources, represents 87% of available water resources. These resources are renewable resources and have been estimated at (1,318) Mm^3/year.
- **Surface water:** very limited, representing about 16% of the available conventional water resources, *includes:*
  - ***Rainfall:*** the total average annual amount of rainfall is estimated at about 15,841 Mm^3. About 79% of this quantity (12,553 Mm^3) is lost to evaporation.
  - ***Wadi flows:*** There are no permanent flowing rivers in the sultanate as it is the case in most arid areas. Most wadis flow after very intense rainfall for a few hours, only.
  - ***Ghaily aflaj:*** aflaj based on the perennial flow in a wadi. These type of aflaj represent 48% of the total number of aflaj in the sultanate.
  - ***Springs:*** most of these springs are located in the mountainous areas.

- **Groundwater** is the most important source of available water in Oman, representing about 94% of the available conventional water resources, and providing about 1,295 Mm^3/year of water.
  - It is the main source for agriculture and domestic water supply and mainly provided by wells and daoudi aflaj.
  - The renewable groundwater mainly exists in unconfined and shallow alluvial aquifers, and recharges from infiltration of surface water flow along wadis, whereas the non-renewable groundwater resources are found in relatively deep confined aquifers which receive little or no recharge.
  - The quality and quantity of the groundwater are different based on the geological characteristics of the aquifers.

- ***NON-CONVENTIONAL WATER RESOURCES :*** The over-abstraction from conventional water resources resulted in the decline of water level and increased sea water intrusion, especially in the coastal areas such as in Al Batinah and Salalah.
  - Seawater desalination plants, storage and recharge dams, and wastewater treatment facilities, have recently introduced as a major non-conventional contributor to water supplies, to overcome the increase of domestic demand and a shortage of conventional water resources.
  - To achieve a balance between the renewable resources and the increasing water demand, the augmentation to the non-conventional water resources became essential.

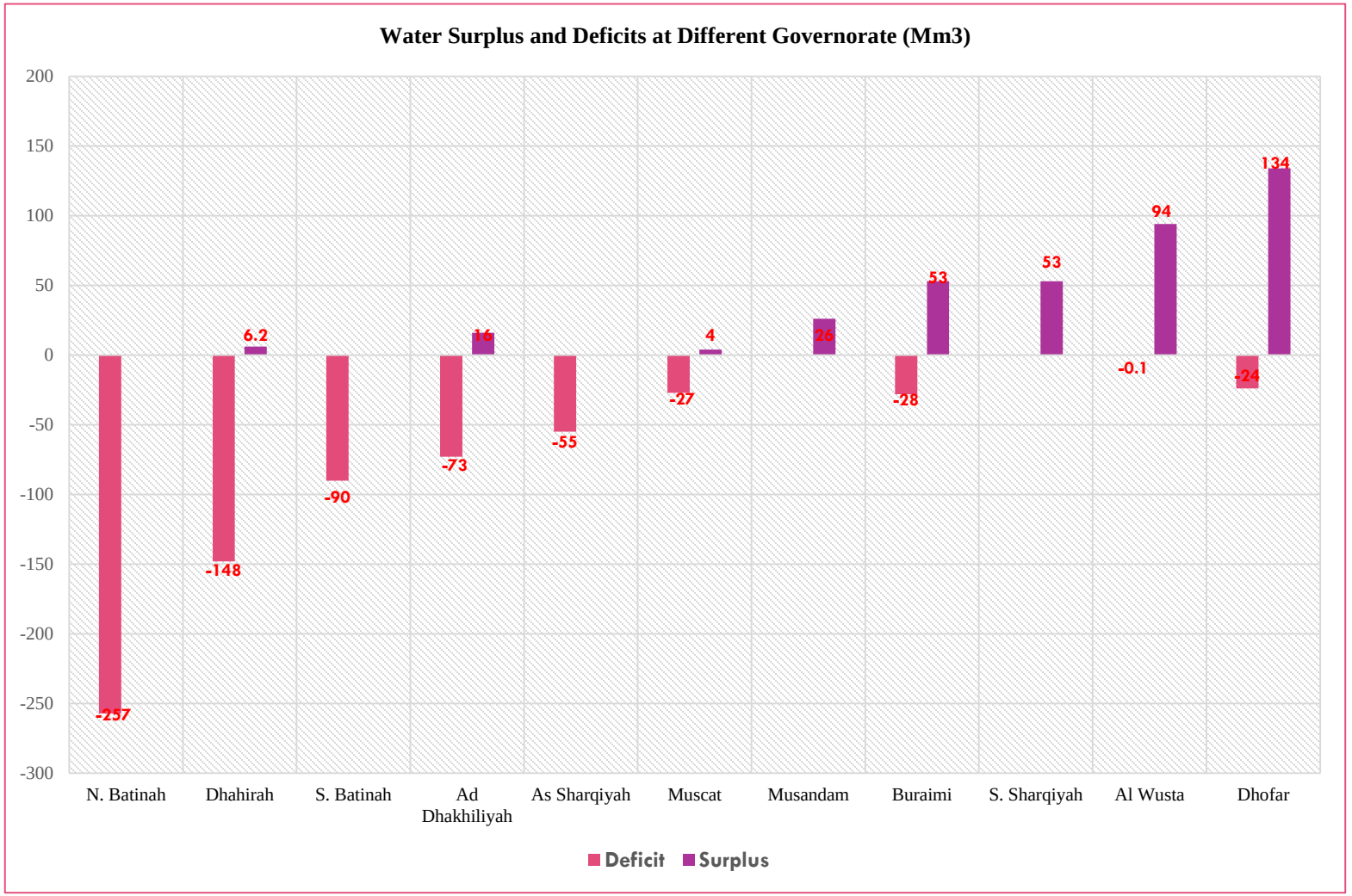


Percentage of Available Water by Category

Current Water Situation:

- Average water demands have increased by 35% (about 1649 Mm^3 compared to the 2000's), due to the growing economic activities in all sectors.
- Agricultural sector consumes about 83% of the total water resources (about 95% of the total abstractions from conventional water resources). The agricultural demand has increased with 36% compared to that of 2000 (1544 Mm^3 compared to 1131 Mm^3).
- Urban demands has increased 4 times more compared to that of 2000 (104 compared to 25 Mm^3).
- Consumption of water for industrial, commercial, municipal and tourism increased from (86 Mm^3) in 1998 to (399 Mm^3) in 2007, and to (1872 Mm^3) in 2010.

Available data indicate that the quantities of consumed water exceeds the available resources by about (316 Mm^3).



Water Surplus and deficits by Governorate

WATER RESOURCES MANAGEMENT STRATEGIES

- Setting water resources strategies and principles to be used as guides for integrated water resources management is very important.

The recommended principles should depend on three main piles, (ICWE, 1992):

- **(1)** water resources development and management should be based on a participatory approach, involving all relevant stakeholders,
- **(2)** Women play a central role in the provision, management, and safeguarding of water,
- **(3)** Water has an economic value and should be recognized as an economic good, considering affordability and equity criteria.

WATER RESOURCES MANAGEMENT IN OMAN

Oman has dealt with the challenge imposed by the continuing increase of demand on water resources from all sectors through the adoption of an approach that seeks to harmonize the requirement of development and the available water resources.

- ***Water supply management:*** initial emphasis was given through:
  - Development of the infrastructure and the water monitoring network
  - Execution of national water resources assessment programs to identify all possible resources
  - Regulation of water use

- ***Water demand management:*** scope has been broadened by:
  - Promoting all activities aimed at water resources conservation in all sectors
  - Increase of efficiency in water supply and water usage
  - Promotion of new non conventional water resources such as seawater desalination and wastewater treatment

Water Resources Development

Efforts are made by the government to develop water resources to meet the increasing water demands resulting from economic, industrial and social development at the various fields. Several programs related to water resources development have been implemented.

- ***Dams:***
  - ***Recharge dams***: the main purpose of these dams is to enhance groundwater storage through getting use of valleys flood water which is often wasted in sea and desert.
  - ***Flood protection dams***: that were constructed in Muscat and Musandam Governorate to protect occupants of downstream areas from flood risks. Most of these dams are also aiding in groundwater recharge beside the protection of downstream areas.
  - ***Surface storage dams:*** the purpose behind construction of small surface storage dams is to provide and develop water resources of village occupants and population spread near wadi channels, and remote mountain areas which suffer from lack of water resources.

- ***Desalination of seawater and brackish water :*** the domestic water supply in Oman relies on two main sources which are desalination of both sweater and brackish, and groundwater. Consequently, for the last few years new desalination plants were built and extension of existing desalination plants at Muscat and Barka was undertaken.
- ***Wastewater treatment and reuse:*** used at a large scale in Oman in beautification and groundwater recharge in some areas.
- ***Treatment and reuse of oil production water (OPW):*** associated with large volumes of water, where the water/oil ratio can be as high as 1:6 after preliminary separation. Only 40% of the OPW is used to maintain reservoir pressure by injection, while the remainder is disposed of into shallow and deep aquifers.
- ***Cloud seeding:*** preliminary study indicates that there is a possibility for the success of this method in Oman.

Protection of water supply sources:

Protection of water resources was a priority in Oman. All wellfields supplying water for domestic uses have been protected through the implementation of strict regulations in the protection zones which cover the whole catchment providing water to these wellfields.

Water Measures to promote activities aiming at water conversation

- ***Improvement of irrigation efficiency :*** introducing modern irrigation techniques is very important, but the traditional flood system remains the most common irrigation technique.
- ***Rehabilitation of water distribution networks :*** minimizing the non-revenue water resulting from, illegal connections, non-working meters, under registering of meters, errors in reading meters, damages to water lines and mainly leakage through the distribution networks.
- ***Water saving devices :*** recent study by the Government revealed, there is the possibility of water saving using the appropriate water saving devices in touristic facilities commercial, private and government buildings.
- ***Water reuse*** in Industries sector.
- ***Water quotas :*** recent studies revealed that water quotas could be established for all wells according to the type and size of cropped area.

CONCLUSIONS AND RECOMMENDATION

- Freshwater resources are limited, and the demand is increasing highly with over abstraction in some areas and pollution problems in others. Also, many do not have access to sufficient water resources.
- There is a big challenge for water resources management to balance the use of the water resource for the world's increasing population and the protection and conservation of the resource to sustain its functions.
- As there are about 60% of the global freshwater that are shared between different countries (about 2 billion people in 148 countries are sharing about 300 groundwater aquifer systems between them), the limited fresh water needs to be divided among the competing needs and demands of the different sectors and stakeholders.
- It is important to adopt an integrated water resources management which seeks to manage the water resources, considering the water resources from different perspectives and dimensions. Both the water cycle and the interests of the water users in the different sectors, need to be considered.

- Comprehensive water resources management is needed to strengthen water security against increasing demand, water scarcity, growing uncertainty, greater extremes.
- Investment in institutional strengthening, information management, and infrastructure development is essential.
- Information systems for resource monitoring, decision making under uncertainty, systems analyses, and hydro-meteorological forecast and warning is important.
- Institutional tools such as legal and regulatory frameworks, water pricing, and incentives are needed to better allocate, regulate, and conserve water resources for adequate and affordable water supply.
- Investments in innovative technologies for enhancing productivity, conserving and protecting resources, recycling stormwater and wastewater, and developing non-conventional water sources need to be explored for enhancing water storage, aquifer recharge, and recovery.
- Engineering, economic, social, ecological and legal aspects need to be considered.
- Planning, monitoring, operation & maintenance needs to be consistent

(Van Der Zaag, 2000, Gumbo and Van Der Zaag, 2001).

- **Supply actions, demand management actions, and quality control actions that are required includes :**
- Adopting improved irrigation techniques,
- Selecting appropriate crops to reduce agricultural water use,
- Managing water resources effectively and efficiently,
- Controlling urban water losses,
- Increasing the use of treated wastewater and desalinated water,
- Flood damages and drought consequences,
- Provision of sufficient water to spur and sustain economic.
- Minimizing water pollution, provision of access to safe water, hygiene and sanitation,
- Protecting the groundwater resources in qualitative and quantitative terms,
- Create and cultivate conservation awareness,
- Establishing an integrated program for the conservation and management of the resources at basin level.

THANK YOU

تقديري لكم جميعا ..

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الجمعية العمانية للمياه

سلطنة عمان