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# A Green and Sustainable Vision for Basra



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### Dr. Broder Merkel

Broder Merkel is a German expert on water and environment. He worked for many years as Professor in TU Bergakademie Freiberg, as well as in many countries in the Middle East, Africa and South America. Today he works as a consultant, editor and author. He is convinced that supplying safe water for the still growing world population is the biggest challenge in the near future.

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### Dr. Sameh W. Al-Muqdad

Sameh is an expert on Water management, Water conflict and resolution, holding a PhD from TU Bergakademie Freiberg. He is the founder of Green Charter GC in Germany for Water and Environmental consultancy. Sameh has led several international projects in Europe and the Middle East. He firmly believes that water could be a source of cooperation and peace rather than a reason for conflict.

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## 1. Introduction to The Former ‘Venice of The Middle East’

The city of Basra was built in the beginning of the Islamic era in 636 AD. The harbor city was located in the north of the Arabian/Persian Gulf on the strategic location of the Silk Road. The population of the city of Basra peaked in 1977. During the 50s, 60s, and 70s, Basra was called the Venice of the Orient, just as Beirut was called the Paris of the East or the Pearl of the Orient. Today, one can only



Past and present view of Shatt al-Arab corniche

(Copyright Dr. Nawrast Abdalwahab)

imagine the beauty that once characterized this city with great imagination.

However, the population of Basra declined remarkably during the Iran-Iraq war (1980-1988); this, along with both the Gulf war (1990/91) and the US-Invasion of Iraq (2003), had major negative impacts on the city. The aftermath of these wars, together with the deliberate destruction of marshlands during the early 1990s, have another devastating impact on water quality and quantity, the ecosystem, and people. Furthermore, the restoration of the marshland after 2004 had further negative impacts on Basra, specifically due to the changes to the natural system of Shatt al-Arab, which consequently increased its salinity.

Everything in Basra has changed since then: flair, charm, smell, lifestyle, and architecture. The taste of the city as one of the most modern cities in Iraq has gone. Even the memories of people have been deeply affected. The progression of three wars has resulted in an obliterated identity of the city and its people. It is clear that Basra nowadays stands by the ruins of its glory during the 60s and the 70s of the last century.

Basra, like Baghdad and Mosul, has been well known for its diversity and plurality. But the population growth rate and demographic distribution have changed dramatically. Furthermore, the challenges of climate change, water shortage, desertification, and energy consumption, together with poor management, has complicated the current image of the city. The main outcome is an alienation of oneself from the city.

For the last 30 years, people in Basra have been buying water for drinking and cooking. All families engage in this activity, especially the youngest. Therefore, it is quite common to see a young boy or girl with a small jerrican crossing the street to buy water from the neighbor, who is the owner of the closest tank with reverse osmosis (RO) water. Only middle-class families have their own RO tank in their garden, which is refilled once a week by calling the vendor.



### **Dr. Nawrast S. Abdalwahab**

Nawrast is a Geologist and Lecturer at the University of Basrah. She earned her PhD degree of Geology in 2013, from University of Mosul- Iraq. Her research focused on the Basin Analysis of the under-discover Gas and Petroleum of Akkas Field, Western Iraq. Nawrast has a special interest in moving beyond scientific paradigms to philosophical inquiry. In addition to Geology, she lectures on Philosophy of Science and Environmental Geology. Since 2016, she has collaborated with artist Kelcy Davenport to create «From Basra to Cambridge and Back», an ongoing art-geology research project. Nawrast's research on the interdisciplinary of geology and art has led her current project into geology and art as a sustainable approach for complex areas.

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### **Zina Riadh Abdulla**

Zina is an architect and academic with a strong passion for environmentalism and sustainability. She has practical professional experience in working with international NGOs on themes such as youth engagement and leadership, entrepreneurship, and higher education development.

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### Scrap on Shatt al-Arab

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*(Copyright Dr. Nawrast Abdalwahab)*



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### Just like Venice, this photo shows the typical style of boats called “Ashari”.

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These boats were built of wood and used in the 19th century and the first half of the 20th century. Their structure is based on the millennia-old reed canoes called Mashhoof (Arabic: مشحوف), used in the marshes from the very beginning of civilization.

**The political and deliberate drying up of the marshes in the early 1990s has had huge effects on the environment, then and now.**



The crisis of Basra was exacerbated in 2018, when protests broke out in June with demands for the enhancement of public services, and again in July due to extensive electricity cuts. The crisis reached its peak during August 2018, when up to 118,000<sup>(1)</sup> people were poisoned by polluted drinking water. The largest wave of protests rose in September with riots and fires set at 12 local political parties' offices. Although waves of protest began in Basra after the 2003 US-invasion for various political, economic, and social reasons, the September 2018 demonstration was the first big protest that was primarily for health and environmental reasons. Women took part in this demonstration in large numbers. The water crisis can be considered a turning point in the nature of civic engagement and alienation from the local government and all political parties in Basra. Moreover, the call for autonomy

and independence from the central government in Baghdad was reactivated during November 2018.

#### **Interviewing Basrawis....**

Today Basra is an unsustainable city, in terms of water, waste, energy, and environment. To explore these issues, particularly the conditions of water services, we interviewed 46 of Basra's citizens. The questions in the survey were designed to investigate public awareness, consumption patterns, the government and water management performance, the non-governmental organizations' (NGOs) and private sector's roles, as well as other challenging knowledge amongst the respondents.

The results show that 97.8% of the respondents buy drinking water. Nearly half of these buy more than 1000 liters of water per month. Tap water is used for other domestic and personal usages,

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(1) Basra is Thirsty. Iraq's Failure to Manage the Water Crisis. 2019 Human Rights Watch

while groundwater and treated water are rarely utilized. A vast majority of Basra people need suction pumps in their houses to fill their rooftop tanks, due to a very low water pressure in the water network. Furthermore, 60% of the respondents do not receive a water bill, while the majority of the respondents would agree to installing a water meter in their houses. However, not only are technical problems in the water pipes common in most Basra districts, but water knowledge is also insufficient.

The lack of trust in the government's management, performance, regulation, cooperation, and negotiation is evident in most respondents' answers. Indeed, well over half of the respondents think that the local government is responsible for the water shortage in Basra. Moreover, the vast majority of people said that oil companies in Basra do not provide clear figures of the quantity of water used in oil production, and that oil companies do not follow environmental regulation, proper treatment, or remediation methods. Similarly, the majority of the respondents think that there is no clear regulation to govern and manage the water shares between the governorates; in addition, they think that the government does not negotiate well with upstream countries to manage the water shares, and that even the restoration of the marshland was not efficiently implemented.

Significantly, three-quarters of the surveyed citizens were unsatisfied with

water desalination and treatment by the private sector that already existed in Basra. However, the majority of Basrawis think that NGOs and the private sector could contribute positively in order to solve the water issues, and that the government should cooperate with both. On the other hand, although more than half of the respondents have never volunteered in any campaign related to water and environment, the majority of them are ready to volunteer in any type of these campaigns in the future.

The interviewees also think that agriculture patterns, irrigation systems, and power generation in Basra should be replaced by less water-consuming devices and sustainable and renewable power generation methods. More than half of the respondents agree with Basra's local government plan for seawater desalination, while more than three-quarters of the respondents think that the mitigation of climate change will decrease water scarcity.

## 2. What's Going Wrong?

Basra is a major metropolitan city suffering from urban heat island effect, with the city center being much hotter than the rural surrounding areas. This is caused by an increase of gas and fine dust emissions due to traffic and diesel-based electricity production, lack of green areas, and roads and sidewalks made from materials that trap heat during the day and release it during nighttime. Basra

is facing multidimensional deficits and challenges with respect to water, energy, and environmental and social issues; these include high unemployment rates, particularly of young people, as well as the city's infrastructure, and lifestyle in the city. Additionally, Basra and other cities in Iraq are facing problems with extreme population increase. These challenges will inhibit the development of the city in the future. Therefore, the deficits first need to be identified, then they need to be analyzed in-depth, followed by an investigation of causes, and finally a search for intelligent solutions.

## 2.1. Navigation in The Fog

Navigation in fog is difficult and dangerous because one can see nothing. The first step to solve such a miserable and disastrous situation is to gather data about the situation: where am I? What are the obstacles? Where do I want to go? In the case of the city of Basra, the problem already starts at this point, because the knowledge about natural and operating resources, regarding their quantity and quality, is anything but sufficient. This is true for almost all issues addressed in this report, and starts with the demand for energy and water needed because the number of inhabitants is uncertain. Insufficient data about existing power lines and the conditions (diameter, leakage rate, quality) of pipe networks for both tap water and wastewater make it difficult to estimate the current ability of the system in place. There is also insufficient data regarding

the actual number of residential houses and apartment buildings in the city, and no accurate information regarding the energy they need or power flow calculations. The same applies to most major facilities in the city, such as kindergartens, schools, hospitals, and other infrastructure.

## 2.2. Gifts Maintain Friendship

Gifts are important for human relationships; corruption is something else. Corruption can be defined as the illegitimate use of power to benefit a private interest. It occurs around the world on very different scales: from the policeman putting a fine of 10 dollars in his own pocket, to the politician transferring millions of dollars to the Cayman Islands or another tax haven. One important but not isolated factor is the lack of a sense of guilt, which is linked to tradition, socialization and education. Corruption occurs more or less everywhere, in the private sector, the public and private industry, and in NGOs as well. Not all institutions are interested in fighting active and passive corruption. This is true in particular for the private industry and the public sector in non-democratic states.

Corruption is a particularly chronic challenge to the “new democratic” system in post-2003 Iraq, and occurs at different levels and sectors. It is an acute threat to social harmony and to the government's stability and performance. According to Transparency International<sup>(2)</sup>, the

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(2) <https://www.transparency.org/en/countries/iraq>



corruption perceptions index for Iraq is ranked 162/180, which means Iraq is among the top 20 countries worldwide with regards to the prevalence of corruption. A field study shows that corruption in Iraq is systematic, with half a million Iraqi citizens having paid 1.9 million bribes in one year to civil servants<sup>(3)</sup>. One Iraqi government official estimates the total loss due to corruption to be as high as 300 billion USD from 2005 to 2018<sup>(4)</sup>. The lack of protection for reporting corruption by “whistleblowers”, as well as the lack of awareness of anti-corruption authorities, are major reasons for this.

A good example of water-related corruption is the Al-Faw Desalination plant, which was established back in 2009 in Basra city; the capacity for this plant is 400 m<sup>3</sup>/hour and cost ~ 13 million USD. The federal government signed the contract with a private company. In 2010, four hours after the grand opening, the project had already failed, for an unknown reason. Some references claimed that it was because the company did not conduct any ground engineering assessment; the plant was not fit for desalinating water in these areas, because of the high amount of mud in the water<sup>(5)</sup>. Despite the several official investigations, no results were

announced about the failure, but all of the media suspected the project had failed due to corruption<sup>(6)</sup>.

### 2.3. Education Has to Breed Confidence

Education is a complex process regarding the acquisition of knowledge, skills, beliefs, habits, and ethical and environmental awareness. Learning starts early in the family and is continued in school and during further education (university or vocational training). Ultimately, learning is a lifelong process, but early socialization is the most important factor. Furthermore, education at school depends on many factors, such as the quality of teachers and the purpose of learning, which can be somewhat related to the state’s political and/or religious goals. Poor education is often related to the fact that children and juveniles do not spend enough time at school, or to an inadequate curriculum. But even more importantly, poor education can be caused by a certain ideology forced by the state, or by cultural hegemony and socialization in dysfunctional families and clans that deny equal rights and the right of self-determination, in particular for women and girls. The Iraqi educational system was one of the best in the Arab world in the 1970s, but needless to say, it suffered from three wars and the sanctions<sup>(7)</sup>.

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(3) [https://www.unodc.org/documents/publications/2013\\_Report\\_on\\_Corruption\\_and\\_Integrity\\_Iraq.pdf](https://www.unodc.org/documents/publications/2013_Report_on_Corruption_and_Integrity_Iraq.pdf)

(4) <https://nationalinterest.org/feature/corruption-iraq-where-did-all-the-money-go-16279>

(5) <https://www.hrw.org/report/2019/07/22/basra-thirsty/iraqs-failure-manage-water-crisis>

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(6) <http://burathaneews.com/arabic/news/168762>

(7) <http://www.uruknet.info/?p=13605>

## 2.4. Old Is Gold

Iraq goes back to the civilization of ancient Mesopotamia. The name consists of two Greek words: meso, meaning between, and potamia, meaning rivers. Archaeological findings discovered golden art objects and remnants of high cultures in the ancient city of Ur and many other places. Since then, the country has had an eventful history. For the past five centuries, Iraq has struggled to find its own national identity. The country has gone through different political systems, starting with the Ottoman Empire. During that time, it was often a battle zone between the tribal alliances of Mosul, Baghdad, and Basra. As a result of World War I, immediately after the collapse of the Ottoman Empire, Iraq became a British mandate, and a monarchy was imposed. However, the monarchy faced unrest and many coups in a period of political instability. In 1958 the monarchy was overthrown by a military coup and a new order emerged, represented by the Republic of Iraq. In the period between 1958 and 2003, Iraq witnessed several significant events that influenced its national identity (i.e. nationalism, socialism, communism, and a dictatorship). Although the political systems mentioned above show differences, there is one commonality: all were centralistic. In 2003, the United States of America invaded Iraq and settled a new political order. Like the British did after WWI, the USA exported their federal political system to Iraq, which implied a rigid shift in the history of Iraq's political system, from centralization to

decentralization. These prominent events and the coexistence under several forging political orders have profoundly influenced the Iraqi identity.

The definition of identity has been a matter of ongoing discussion among scholars<sup>(8)</sup>; however, the definition of Kowert and Legro (1996), "Identities are... prescriptive representation of political actors themselves and of their relationships to each other"<sup>(9)</sup>, is truly close to the definition of the Iraqi National Identity statement in the constitution of 2005, which reflects the consensus among leaders of opposing Iraqi politics from even before the invasion of Iraq on April 2003, back to the early 1990s during their rounds of meetings in Vienna and Salah ad-Din<sup>(10)</sup>. Eventually, the final constitution sets the values of democracy, Islam, federalism, pluralism, and human rights - but most importantly, it "guarantees the Islamic identity of the majority of the people"<sup>(11)</sup>, and declares that "Islam is the official religion of the State and it is a fundamental source of legislation"<sup>(12)</sup>. Accordingly, dissonance in Iraqi society has arisen because the diversity of the Iraqi people was excluded

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(8) Fearon, J.D., 1999. What is Identity (As we now use the word)? <https://web.stanford.edu/group/fearon-research/cgi-bin/wordpress/wp-content/uploads/2013/10/What-is-Identity-as-we-now-use-the-word-.pdf>.

(9) Kowert, Paul and Jeffrey Legro. 1996. Norms, Identity, and Their Limits. In *The Culture of National Security*, ed. Peter Katzenstein. New York: Columbia University Press. pp. 451-497.

(10) Feldman, N. and Martinez, R. 2006. Constitutional Politics and Text in the New Iraq: An Experiment in Islamic Democracy, 75 *Fordham L. Rev.* 883

(11) Iraqi Constitution Article, 2(2).

(12) Iraqi Constitution Article, 2(1).

from the national identity<sup>(13)</sup>. Furthermore, the new constitution is clearly set on traditional constituents rather than those of modern states, which are legal, political, and economic constituents.

Indeed, what many Iraqis mean by lack of national identity is the lack of an imaginary national identity amongst Iraqi politician elites themselves, not Iraqi people. In October 2019, 14 years after ratification of the Iraqi constitution of 2005, Iraqi people held the slogan “We want homeland” reflecting their desire for sovereignty over their home, especially in regards to the distribution of resources and respecting the law. Such a slogan indicates the feeling of national identity and unity among the people in opposition to the government and political parties.

In fact, two years back in 2018, the water crisis in Basra contributed to unifying the people with one goal: the elimination of corruption and of the sovereignty of political parties. People realized that the successive governments since 2005 were not serious about solving the water, energy, and environmental problems, but

rather contributed to exacerbate them through corruption, poor management, and slackness. Besides, people were witnessing a radical change in the nature of Basra as modern, sustainable, and socially diverse, into an unsustainable, chaotic, and colorless city.

Ultimately, the water crisis in Basra is the environmental identity crisis of the city, which we could imagine to be a project for establishing a new identity for a green and sustainable Basra.

## 2.5. Again No Electricity...

Power failure is a rare event in many countries, but in Basra (and all of Iraq), it happens daily. Three wars, in addition to sanctions and mismanagement, left the city’s infrastructure in very poor conditions. The energy crisis has worsened in Basra and the country since 2003. In 2014, electric power plants in Iraq covered only 38% of the actual electricity demand<sup>(14)</sup>. Distribution of electrical power supply in Iraq in 2016 according to Ministry of Electricity (MOE) can be seen in the following table:

Type of plant	No. of plants	Installed capacity ((MW	(%) Percentage
Steam turbine	8	3,305	14.6
Gas turbine	36	15,000	66.2
Diesel	20	2,498	11.0
Hydro power	8	1,684	8.2
Total	72	22,667	100

(13) Hussein, M.T and Ali, R.M, 2020. Crisis of National Identity in The Iraqi Constitutional System. Centre of Strategic Studies, University of Karbala. [https://www.researchgate.net/publication/340978126\\_azmt\\_alhwynt\\_alwtnyt\\_fy\\_dstwr\\_alraq](https://www.researchgate.net/publication/340978126_azmt_alhwynt_alwtnyt_fy_dstwr_alraq).

(14) <https://openjicareport.jica.go.jp/pdf/12307146.pdf>

The table shows that 92% is thermal power from fossil fuel; hydropower in northern Iraq is the only alternative source of energy. No solar power systems are installed, although solar radiation exists in abundance in southern Iraq. Additionally, electrical power is imported from Turkey, Iran, and Kuwait. However, daily interruptions of power supply are common, and individuals and private enterprises, hotels, shops, authorities, and universities have their own power-backup system in place if they can afford it. Most of these are based on diesel.

There have been some attempts in the city of Basra to rebuild power plants in cooperation with international organizations, but the issue is still far from resolved, with the current power capacity covering approximately 67-75% of the demand. The Ministry of Energy has failed to meet the needs of the energy demands. This is incomprehensible in a country that is rich in oil and gas.

## 2.6. Not Enough Water?

Iraq is a country in an arid climate where water scarcity is common. On the other hand, Mesopotamia is blessed by two rivers, Euphrates and Tigris, which made southern Iraq with its marshes the cradle of modern civilization. However, an extreme growth in population in the last 50 years, the reduction of headwaters of Euphrates and Tigris as a result of dams in Turkey, Syria, and Iran, and mismanagement, are

all factors that placed Basra and the whole country in a critical situation.

One can distinguish eight sectors of water use: irrigation, industrial, cooling (mainly power plants), domestic (personal hygiene and laundry, cooking food, drinking), ecosystem services (e.g., maintaining the marshlands), recreational (fishery, boating, and swimming), gardening, and hydropower generation (dams). For the city of Basra, it is mostly industrial (oil-production and cooling in power plants) and domestic water supplies that are important. In the following, we focus mainly on tap water for the city of Basra, but a holistic view must also address the demand for the oil industry, which is situated in the direct vicinity of Basra. Rumaila, the biggest oil field of Iraq and one of the biggest in the world, is only 40 km to the west of Basra. It is important to know that the oil and gas industry consumes and produces water with different quality and in very different quantities. It is more or less impossible to give mean numbers for both because it depends on many parameters (geology, point in time, technology, etc.). Thus, a production well may result in up to 100 liters of water for 1 liter of oil, and may create a wastewater problem because the water is likely to be very salty. On the other hand, drilling a new well consumes water, and a production well in the third phase of production (enhanced oil production) consumes huge amounts of water (and carbon dioxide).



— The SWC carrying Euphrates water from Al Nasiriyah to Basra over a distance of 250 km —  
*[copyright Dr.Jassim Al-Maliky in 2018 - Basra]*

If one assumes 2.5 million inhabitants for Basra Governorate<sup>(15)</sup> with 200 L/person and day one ends up with a freshwater demand of 500,000 m<sup>3</sup>/day for the entire Basra Governorate for domestic water supply (including small business). However, due to the fact that the tap water network in Basra is rather old and not well maintained, it is very likely that more than 50% of tap water is lost in the network by means of leakage<sup>(16)</sup>. In consequence, more water has to be delivered into the network or less water is available for the consumers.

Tap water for Basra is supplied mainly by means of the open Sweet Water Canal (SWC), bringing water from the Tigris over a distance of about 250 km to Basra. Due to poor maintenance, the canal's state is very bad and an unknown amount of water is lost on its course due to leakage, evaporation, and illegal draw offs.

Water in the Euphrates (and Tigris) river is subject to elevated levels of sewage, agricultural and industrial pollution, oil spills, and increasing salinity in the vicinity of Basra. Thus, this water is anything but ideal, and fails to meet international drinking water criteria. However, the most dangerous pollutants are microbial germs from human and animal excreta, because

they can cause immediate and severe health impacts within hours and days. In August and September 2018, Basra experienced a severe health crisis with more than 118,000 persons hospitalized. It is remarkable that an explanation for this was never given, and that there were no warnings about drinking this water without boiling it for a sufficient amount of time<sup>(17)</sup>. In general, information about tap water quality and disinfection measures (e.g., chlorination of tap water) is not available to citizens. People in Basra, insofar as they have basic knowledge about water and can afford it, do not drink tap water or cook with it, but rather use bottled water and water from reverse osmosis tanks (TO). However, about 32% of the inhabitants have an income of less than 2.20 USD per day (the poverty threshold in 2010) and do not have access to safe drinking water. The real number may be even higher<sup>(18)</sup>.

**32% of the citizens live below poverty threshold and have no access to safe drinking water.**

With respect to water supply, it has to be mentioned that Basra receives an average of about 150 mm of rainfall in the winter; however, due to the sealing of soils by buildings, streets, and pavements, the

(15) <http://www.iau-iraq.org/documents/378/GP-Basrah2013.pdf>

(16) <https://www.eea.europa.eu/data-and-maps/indicators/water-use-efficiency-in-cities-leakage/water-use-efficiency-in-cities-leakag>

(17) Basra is Thirsty. Iraq's Failure to Manage the Water Crisis. 2019 Human Rights Watch

(18) Water and Sewage Sectors in Iraq — Sector Report: February 2013

majority of rainwater is lost as direct run off to ditches and to Shatt al-Arab, or is diverted to the canalization since no rainwater harvesting and water storing systems are in place.

As a general rule, water supply has to always be seen in unity with waste water management (sewer pipe system and waste water treatment plants). Therefore, it makes sense to handle this as one entity. If for some reason this is not possible or advisable, maintaining close communication between both entities is necessary.

## 2.7. Hey, Wastewater Is a Resource!

Because the amount of freshwater needed in Basra city does not account for agriculture irrigation, essentially, the total amount of freshwater (500,000 m<sup>3</sup>/d) can be treated and recycled for further use. Basra has about 40 water treatment plants in place. A report from 2013<sup>(19)</sup> shows that the Basra wastewater plant has a design capacity of 286,000 m<sup>3</sup>/d, but only 80,000 m<sup>3</sup>/d were actually treated in 2010. Actual numbers for 2020 are not available, but it is likely that the situation today is even worse in comparison to ten years ago.

The state of the sewage pipe net and the seepage rate due to leakages is unknown. Sewage leakage due to broken pipes can easily add up to 80% or more. Thus, a

huge amount of wastewater is seeping into the shallow groundwater or is spilled without treatment into the Shatt al-Arab. This pollution of surface water is not acceptable, but even more importantly, this water is irrecoverable and is a total loss for the arid area in question. Under humid climatic conditions it would be less important because excess rainwater is available, but in a water scarce region, the negative effects of this waste are twofold. No data is available with regards to wastewater constituents (solids, dissolved constituents including liquid industrial waste, and pathogen germs), the state of the plant itself, or the waste disposal of the treatment plant's left-overs.

## 2.8. The Trash Is All Over

According to a study from 2012, citizens in Basra produce 0.6 kg garbage per capita per day; other sources report that the amount is 1.4 kg per person per day. Both numbers are less than the USA statistics that show 2.4 kg per capita per day, but still, Basra numbers create big problems. The main components in the above-mentioned study were food (55%), plastic (25%) and paper (7%)<sup>(20)</sup>. But the biggest problem is that solid waste management in terms of organized waste collection, transportation of waste, waste separation (organic, paper, plastic, metals etc.), supervised waste disposal, and incineration, composting, or

(19) Water and Sewage Sectors in Iraq — Sector Report: February 2013

(20) [https://www.researchgate.net/publication/309592726\\_Integrated\\_Solid\\_Waste\\_Management\\_for\\_Urban\\_Area\\_in\\_Basra\\_District](https://www.researchgate.net/publication/309592726_Integrated_Solid_Waste_Management_for_Urban_Area_in_Basra_District)



*(Photos source: Dr. Nawrast Abdalwahab in 2020 - Basra)*

waste recycling, is not in place. The fact that citizens lack environmental awareness and follow a throwaway mentality worsens the situation. Thus, it is common that waste in Basra is thrown away and nobody cares.

Former city-canal and the Shatt al-Arab transformed to waste dump sites; yet again, nobody cares. If and when waste is dumped in non-controlled landfills, the groundwater would be jeopardized in the long term.



## 2.9. By The Ruins of Its Glory

Basra, an ancient city and the second largest one in Iraq, has suffered from three wars, urban growth, and negative transformation over time. Lacking prominent infrastructure and suffering from political and environmental issues, the city is no longer the “Venice of the Middle East”, as formerly known. The historical center has become an area of abandoned buildings that were once aesthetic landmarks in the region.

Random urban sprawl and growth have led to a city layout that lacks appropriate sociable and livable urban spaces for cultural and social activities. Besides, the absence of green areas has to be addressed. Population growth, air pollution, climate change and other factors have caused an urban heat island (UHI) effect. This is not an unexpected phenomenon for a metropolitan city; however, no steps have been taken to minimize the effects of this phenomenon. The high summer temperatures with tar covered roads and heavy traffic create a cruel micro-climate for the people of Basra. Walking along the once beautiful canals of the city has turned into a harsh experience with rubbish-strewn canals and polluted air. Multiple wars and urban maldevelopment have caused the green city areas to disappear, leading to dust storms which have sadly become a characteristic of the city.

The lack of modern building rules and regulations and a failure in implementing current laws have become serious matters of concern with a wide range of aspects,

aesthetic- and energy-wise. The population growth has led to higher demands for residential units, causing land owners to split up their lands into multiple cells. The increasing number of residencies in a certain area, which spiked the population density for that same area, is also an issue that contributed to maximizing the energy demand rates. There are also no rules or regulations regarding building materials and best practice advice to save energy. Many studies have been undertaken by researchers in optimizing housing design but no strategies have been implemented.

## 2.10. You Can Manage What You Measure

No matter how efficient manpower, technology and solid management are, without good governance and sophisticated policies, the system is likely to collapse. It is unclear in this context who is responsible for water governance and environmental policies in Basra. Is it the local or the federal government? Moreover, which authority is responsible for monitoring and updating these policies? This is a strategic shortage that needs to be bridged because such a deficit would influence the establishment and sustainability of any water- and energy-related projects.

## 2.11. Summary of Deficits

Living in Basra is anything but easy for a number of reasons: i) the electrical power supply is not stable without a private back-up system at home and in the office, ii) water from the tap is not drinkable without

elaborate treatment (cooking, reverse osmosis filtering), and iii) solid waste management does not exist and leads to the feeling of living in and on a waste dump site. In the summer, the city-climate is hot, humid, and difficult to endure without air-conditioning. Furthermore, the city does not have green areas with shade-giving trees, public transportation is not in place, and sandstorms are frequent. In addition to what every citizen of Basra endures on a daily basis, one has to consider that the missing or non-functioning solid-waste and waste-water management aggravates the water problems of Basra by contaminating soils, groundwater, and surface water in the city and its vicinity. Thus, the situation is constantly worsening and there is no hope in sight for recovery.

### 3. What Are The Reasons?

#### 3.1. Geography and Neighboring Countries

In general, Iraq is characterized by semi-arid to arid climate, but it is blessed by two rivers (Euphrates and Tigris) delivering huge amounts of water to the country, which led to the early development of high civilizations in the area of Mesopotamia<sup>(21)</sup>. However, both rivers arise from Turkey and therefore generate a common conflict that will be addressed below. Groundwater is recharged in mountain areas in the East

(21) Mithen, S. J., 2012. Thirst: water and power in the ancient world. s.l.: Harvard University Press.

of Iraq (Kurdistan) and in Saudi Arabia in the West. The latter is a classic case of transboundary groundwater, mainly in the Damam and Umm er Rum aquifer. However, these aquifers are rather deep (<400 m) in the Basra area and not well explored. For several reasons, the shallow Dibdibba aquifer contains water with increased salinity. Thus, Basra is mainly dependent on river water (Shatt Al-Arab).

All over the world, the last 10,000 years (Holocene) have been much warmer in comparison to the last glacial period. However, significant climate changes occurred during the Holocene, which affected temperatures but also rainfall (amount and distribution), both time-wise and area-wise. One interesting example is the change in the climate of the lower Tigris and Euphrates area (Mesopotamia), with wet periods during the mid-Holocene, which is apparent in sediment load and composition<sup>(22)</sup>. The West African monsoon dynamics in the mid-Holocene, which caused a greening of the Sahara<sup>(23)</sup>, is likely to be correlated with the wet period in the Tigris and Euphrates region. During the development of advanced civilization in Mesopotamia, irrigation technologies based on ditches and water harvesting,

(22) Aqrawi, A. A., 2001. Stratigraphic signatures of climatic change during the Holocene evolution of the Tigris–Euphrates delta, lower Mesopotamia. *Global and Planetary Change*, 1 2, 28(1-4), pp. 267-283.

(23) Gaetani, M. et al., 2017. Understanding the Mechanisms behind the Northward Extension of the West African Monsoon during the Mid-Holocene. *Journal of Climate*, 30 10, 30(19), pp. 7621-7642.

including water supply in houses (for the first time ever), were invented. People at that time learned to cope with severe climate change scenarios. Salt water intrusion in the south of Iraq (Basra region) and the development of the marshes were one of the most severe consequences.

In recent times, Shatt al-Arab was formed from four rivers: Euphrates (24%), Tigris (35%), Karkhe (8%), and Karun (33%). Both Karkhe and Karun rivers flowing from Iran have been completely cut off from the Shatt al-Arab by the construction of dams. Both upstream countries, Turkey and Syria, constructed several dams, which impacted the water quality and quantity and decreased the flow from Euphrates and Tigris by at least 40%. Furthermore, wastewater from agricultural irrigation canals in all big cities including Baghdad is spilled without treatment into the Euphrates and Tigris, leading to a diminishing of the water quality. Besides this, the Ministry of Water Resources decided to divert river water to the marshlands to restore them. This also decreased the quantity of water in the Shatt al-Arab in Basra. In consequence, nowadays Shatt al-Arab has only 65% of earlier flow (50,000 m<sup>3</sup>/sec), which leads to tremendous consequences on water quality due to pollution by wastewater and seawater intrusion.

### 3.2. History and Politics Matter!

Basra governorate is the last city with access

to fresh surface water, since Shatt al-Arab gets saltier the further it is from the gulf. The water resource stakeholder's map is rather complicated. Many stakeholders are involved in decision-making, such as the Ministry of Water Resources, the Ministry of Municipalities, the Governance Office, the agricultural, environmental, and health sectors, as well as a few NGOs working to increase awareness. This leads not only to quality concerns, but also to concerns regarding governance and regulation disordering of the water resources after passing through all Iraqi governorates. This governance aspect is considered as an internal political challenge that has affected the water supply sector, where the sharing responsibility makes it hard to recognize who is responsible for water regulations. Is it the federal government or the local administration within the governorates? The fuzzy boundaries of responsibilities have exacerbated the poor communication between the local authorities within Basra city. In addition, it has led to substantial distrust, escalating the tension between the governorates (Missan, Dhi Qar, and Basra).

Generally, in Iraq, the agriculture sector has the lion's share of water consumption (~70%)<sup>(24)</sup>, but in Basra we face a different situation. The national revenue is over 90% reliant on oil production, whereas the Basra region provides about 80% of Iraq's oil production. Water for oil production is

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(24) Frenken, K., 2009. Irrigation in the Middle East region in figures AQUASTAT Survey-2008. Water Reports, (34).

therefore a significant sector consuming water.

One of the fundamental deficits from a governance perspective is the unclear policy in terms of water regulations in the Iraqi constitution and the contradiction between the articles 110 and 114<sup>(25)</sup>. On the one hand, article 110 establishes the federal control of water resources, and on the other hand, article 114 indicates that management and control is on the regional and government level. This has led to a conflict of interest with the federal government.

From the water supply shortage, the challenge in Basra goes back to the 1990s of the last century; at that time, Iraq was under the United Nations sanctions. The previous administration suggests the Sweet Water Canal (SWC, or named as Albadaa canal), established in 1997, as a temporary solution to provide Basra city with high water quality. The idea is to get water from Tigris (Garraf stream) through an open canal from Nasiriyah city down to Basra. The canal ends with the R0 basin at Basra city that would eventually be linked to the tap water system to cover the demands of 2-3 million people. The minimum recharge capacity to the R0 basin should be 7.5 m<sup>3</sup>/sec to cope with the city's demands; in 2017 the recharge declined to 4 m<sup>3</sup>/sec due to the drought year, poor communication between the governorates,

and not least the lack of management and maintenance. The 20-year-old open canal has been suffering from actual damages where no maintenance has been conducted so far; aside from the high evaporation rate, a considerable amount of water leaks through the 230 km long journey. What adds insult to injury is that over 50% of water pumps that support the water flow through the canal have been defected to end with only half the water allocation reaching the R0 basin and therefore providing insufficient freshwater to the tap water system.

The 2018 water crisis in SWC revealed the poor communication between the authorities, where the Ministry of Water Resources announced that its responsibility is limited to secure the specific water share for each government. Once they do that, the responsibility moves to the local authority inside the governorate. The local municipality claimed that the Governor's office limits their authorities to manage the water shares within the Basra city. The Governor's office claimed that the Ministry of Water Resources does not control the governorates' water allocations, and insufficient water shares reached the Basra city. This endless blame-game model of communication leads nowhere, and never helps in finding sustainable solutions.

**The oil industry in Basra consumes 5 times more water than the drinking water supply.**

(25) [https://web.archive.org/web/20161128152712/http://www.iraqinationality.gov.iq/attach/iraqi\\_constitution.pdf](https://web.archive.org/web/20161128152712/http://www.iraqinationality.gov.iq/attach/iraqi_constitution.pdf)

Currently, the oil production sector in Basra is consuming ~ 5 barrels of freshwater to produce 1 barrel of crude oil<sup>(26)</sup>. The current average of oil production in Iraq is equal to 4.779 million barrels per day; this means 3,800,000 m<sup>3</sup>/day of water and 114 million m<sup>3</sup>/month respectively. That is nearly double the total capacity of the Duhok Dam (52 million m<sup>3</sup>) and 12% of the Mosul dam's total capacity (11 billion m<sup>3</sup>), used in one year. The amount of used water in this field will increase by more than 20% in the next two years<sup>(27)</sup> and the projection for oil production development in 2022 is 5.4 million a day. Collectively, this means Iraq is in a tradeoff between developing oil production as its main national revenue, versus reducing the water consumption in this sector, thus protecting the environment. In this context, Basra's water demand will be increasing due to population growth, climate change, and the acute demand of water needed to develop the oil sector and for the production to reach the planned goal of 10 million barrels per day.

The public awareness of energy deficiencies also seems problematic. Energy-saving equipment has only become available in local markets in the past five years. However, because of its higher prices compared to typical devices, citizens prefer the cheaper option. Besides, the use of best practice materials does not conform to the cultural norm. When hiring architects and

engineers to plan and construct buildings, people do not look for the best; rather, in most cases, they employ local staff. The result is poorly designed buildings and unsuitable building materials.

## 4. Ideas for Solving Problems

### 4.1. Reaching Out for a Holistic Approach

Issues such as power supply, tap water, irrigation water, industrial water, wastewater but also solid waste management, environmental issues, and social and socio-economic matters, are all handled in Iraq and Basra mainly as if they are separate issues. But Basra (and Iraq as a whole) needs a holistic approach. Holistic means to handle a bundle of things as a package. So, the very first question when applying a holistic approach is: how high is the general water demand (tap water, irrigation water, industry water, etc.) nowadays, and what will it be in the future? The second question is: what are the available resources (including wastewater and rainwater that could be harvested, and energy which could be used for treating seawater by reverse osmosis)? Only then can one start out with a plan: i) how to recycle water after a certain use, and ii) how to minimize the loss of water at any point of the utilization chain of water. Technologies that are implemented in Europe and the USA are often not applicable in our case due to climatic,

(26) [https://www.researchgate.net/publication/333389868\\_Water\\_Resources\\_in\\_Basra\\_And\\_its\\_Recent\\_problems\\_almward\\_almayyt\\_fy\\_albsrt\\_wmshklatha\\_almasrt](https://www.researchgate.net/publication/333389868_Water_Resources_in_Basra_And_its_Recent_problems_almward_almayyt_fy_albsrt_wmshklatha_almasrt)

(27) <https://www.bayancenter.org/wp-content/uploads/2018/06/9089765463.pdf>

cultural, and financial issues. Besides, the problem is so massive, that one cannot expect the state or city authorities to be capable of handling a holistic management tactic. Therefore, tailored and distributed solutions will be needed. A big hotel can take for example the responsibility for its energy, water, and solid waste management from A to Z; of course, not as an isolated island but rather in a sort of smart grid. On the other hand, citizens, private entities, and NGOs, have to be involved in sustainable solutions.

To develop policy and to practice good governance, the country needs to review the legislation by an expert committee, not only in order to oversee the conflict of interest on water resources, instead of identifying the shortages and gaps for the overall natural resources, but also to keep with the objective to mitigate the risk of tension between governorates, and to centralize water-related challenges as federal decisions. It is also highly recommended to implement a capacity building program for integrated water management, as well as for conservation practices for both the public and the state, in order to ensure effective and impactful awareness.

It is very important to centralize and consider water resources as a federal responsibility. The Ministry of Water Resources established, a couple years ago, the Higher Council for Water Resources (HCWR) which would take the lead for water responsibility for all of Iraq.

However, one of the disadvantages of the HCWR is that it is not yet recognized as an independent legal entity or authority; it needs to include permanent staff members such as advisors from the Prime Minister's office, academic members, members from national security authorities, and a member from the head of natural resources authorities of the Parliament. With such multidisciplinary members, this authority would secure flexible communication with the highest authority, raise concerns quickly, and foster practical solutions. Setting the HCWR only under part-time responsibility, even with the direct support from the Prime Minister, will not be sufficient, as it would be hard to gather all of these members when they are busy with other tasks - a situation we currently face. These facts limit the influence of the group commission and add to the struggle of achieving goals quickly. Consequently, such an authority needs to be established in parallel with amending the Iraqi constitution to reflect the centralization of water matters, conversely, to guarantee a smooth collaboration with governorates working under the authority of HCWR in water challenges. It is highly recommended that HCWR supports programs such as joint projects, capacity building, modern tools for water monitoring systems, information transparency and public awareness. Such programs and activities would enrich the knowledge, update the HCWR, and guarantee good local communication.

A multidimensional plan needs to be

developed by: i) encouraging negotiation rounds with Iran and Turkey to get more water shares, especially that a tight economic relationship exists with both countries where the annual economic exchange is over 20 million USD, ii) governing and implementing the wastewater treatment system to decrease the water pollution in Shatt al-Arab and enhance the quality, iii) having a strategic plan to develop the SWC by replacing the open canals with water pipes in order to reduce water loss through evaporation, and by updating the water pumps and implementing a systematic maintenance program, and iv) securing an annual federal budget for the strategic development of water desalination plants to meet water demands in Basra. This budget should be collected by setting a certain percentage for each oil barrel production.

The current water supply system needs to be replaced with modern and sophisticated technology, where intelligent monitoring technology is used to detect the leakage on the spot in order to avoid water loss, and to guarantee high efficiency. It needs to set a metering system and provide online services for payment or maintenance. It is also essential to set a decent tariff for each consumer and with it, provide incentives to guarantee conservative consumption for the end-user.

## 4.2. Intelligent Solutions

For decades, foreign aid has been characterized by advising developing

countries to adopt “western” technologies. Often, foreign aid does not consider aspects such as the local climate, environmental conditions and social boundaries, the local culture, and resource availability. It is unlikely that a water treatment plant designed and optimized for northern Europe will work properly in Basra, due to a rather different climate and the fact that a reuse of the treated water is not intended in northern Europe. However, in areas like Basra, it could be an option to separate wastewater types (rainwater, greywater, and blackwater) and apply different types of treatment, considering from the very beginning the reuse of the treated water for different purposes, such as irrigation of gardens and palm trees, as well as groundwater recharge.

One example of an intelligent solution is power supply, assuming that a person or entity has established a power supply with solar cells and a battery-based back-up system. In case this plant delivers more power than needed at a certain time, the electricity is fed in the grid and automatically accredited to the owner of the power plant. Similar approaches could be established for water supply and for treated wastewater being utilized for irrigation of green areas in the city, such as watering gardens and irrigating farms in the vicinity of the city. Introducing this kind of smart technology will need sensors, computers, software, and maintenance by skilled persons. A positive side effect of this would be the creation of jobs in particular for young people.

### 4.3. Rethinking Energy - Water - Waste

Generally, Iraq and Basra should seek unconventional sources for energy, considering more than only the most pressing question of how to cover the current demand of electricity in the city. Energy is needed for many other processes as well: modern water and wastewater treatment plants, recycling of waste, and industrial production of goods with high energy demand such as an aluminum plant or the production of hydrogen. Less challenging, but equally worth thinking about, is investing in waste to energy projects (incineration of waste).

Basra city might be a good place to implement a green energy masterplan to promote renewable energy such as biomass, biofuels, and solar energy. Enhancing the existing desalination plant in Faw is another task. The local government of Basra city needs to implement a strategic plan with a clear timeline for how to replace fossil fuel gradually with unconventional sources of energy for the next 10 to 20 years. Intelligent procedures have been developed at the local and international scales. One example is the dream farm concept (integrated, ‘zero-emission’, ‘zero-waste’, highly productive) using renewable energies and turning ‘wastes’ into food and energy resources, reducing the energy demand in the region by 14%<sup>(28)</sup>.

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(28) Matthew, R.A., 2018. Afterward: Closing Thoughts on the Water–Food–Energy–Climate Nexus. In *Water, Energy, Food and People Across the Global South* (pp. 325-332). Palgrave Macmillan, Cham, [https://doi.org/10.1007/978-3-319-64024-2\\_13](https://doi.org/10.1007/978-3-319-64024-2_13)

An integrated cropping system was tested for five years in the UK, saving about 8% energy compared with conventional cropping, while Italy saved ~30% energy using a crop rotation system<sup>(29)</sup>. The biomass for instance, carries several advantages such as saving ~35% of energy costs, decreasing the carbon footprint at the local level, providing an additional revenue stream for the local government in Basra city, and creating jobs<sup>(30)</sup>. However, energy-water-waste policies are among the gaps that need to be filled, implementing waste segregation and recycling. It is also essential to mandate sustainable development practices for all new projects, such as green building codes, low-water-consuming equipment, and waste segregation.

The governmental strategic plan should also include and implement a capacity building program for schools and universities, as well as conduct national awareness campaigns to educate the public on the advantages of conservation practices. Investing in schools and universities can eventually result in joint research projects with scientists of universities from foreign countries, developing tailored solutions with respect to the specific environmental and climatic conditions in Iraq. The foundation of spin-off enterprises would

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(29) O Di Nasso, N. B. (2011). Energy efficiency in long-term Mediterranean cropping systems with different management intensities. *Energy*, 36(4), pp.1924-1930, <https://doi.org/10.1016/j.energy.2010.06.026>

(30) Nunes, L.J.R., Godina, R. and Matias, J.C.D.O., 2019. Technological Innovation in Biomass Energy for the Sustainable Growth of Textile Industry. *Sustainability*, 11(2), p.528, <https://doi.org/10.3390/su11020528>



be the last and rather easy step, if venture capital is available from the oil industry.

#### 4.4. Rainwater Harvesting in Cities

Water harvesting in arid countries has a tradition of several thousands of years. This has included the construction of cisterns - water collection systems on rooftops in urban areas and in fortresses. In hilly and mountainous areas, the construction of terraces, drainage channels, and tunnels (canals) was developed to collect water for drinking, washing, farming, and cattle breeding<sup>(31)</sup>.

Harvesting roof water and water from sealed areas (e.g., streets, parking areas, etc.) is still a potential source of water for private and public uses in urban areas. The collected water can be stored in cisterns (tanks) or infiltrated into the underground (artificial groundwater recharge), if appropriate geological structures are available and known. Cisterns and storage in the subsurface have the advantage that evaporation does not occur. For artificial recharge, suspended matter has to be removed, because otherwise infiltration-wells might clog rather quickly. Another problem in Basra is that the shallow groundwater is likely polluted in many areas, for several reasons including leaking sewers, pit latrines, salt water intrusion,

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(31) Oweis, T., 2017. Rainwater harvesting for restoring degraded dry agro-pastoral ecosystems: A conceptual review of opportunities and constraints in a changing climate. *Environmental Reviews*, 25(2), pp. 135-149.

among others. Therefore, a thorough investigation of the Dibdibba aquifer with respect to storage suitability, groundwater quality, and self-purification potential is a necessity.

The management of urban catchments also has to consider soil and vegetation, since both have an important impact on runoff, infiltration, and recharge in the catchment. Any measure in terms of re-vegetation and afforestation requires a long-term approach and will take decades. Afforestation of small areas in cities may influence precipitation patterns locally and on regional scales due to surface-atmosphere transfers of heat and moisture<sup>(32)</sup>. Genetic differences in tree species show that some species (e.g., date-trees) can use a number of mechanisms to better cope with droughts and salty water than others<sup>(33)</sup>. By means of genetic technology, it is possible to develop species that cope better with droughts than natural species.

#### 4.5. Urban Development Rethought

Basra is a major metropolitan city suffering from the urban heat island effect, with the city center being much hotter than the rural surrounding areas. There are many ways to minimize the effect of this phenomenon;

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(32) van Dijk, A. & Keenan, R., 2007. Planted forests and water in perspective. *Forest Ecology and Management*, 251(1-2), pp. 1-9

(33) De Smedt, S. et al., 2012. Functional responses of baobab (*Adansonia digitata* L.) seedlings to drought conditions: Differences between western and south-eastern Africa. *Environmental and Experimental Botany*, Volume 75, pp. 181-187.

these mainly include enhancing the green areas throughout the city, in addition to reducing energy use and CO<sub>2</sub> emissions. The question now is how this can be done. People use energy in their everyday life, whether at home, for heating and cooling and appliances, or for transportation. It has been found in many studies<sup>28</sup> that in major cities, developing local mass transport has had a beneficial effect on reducing carbon dioxide emissions. By encouraging citizens to use means of local transport, we decrease the number of personal vehicles in use, resulting in less air pollution and better health benefits for the people. Active transport can especially help in enhancing the health of individuals on a general scale. For this to be effective, the pedestrian experience throughout the city needs redevelopment. Providing shading, for example, and walkable streets that are both entertaining and comfortable, encourage individuals to take on a healthier lifestyle. It is also a scientific fact that green areas are much cooler than urban areas; thus, developing green parks around Basra will help in both UHI effects and in increasing public health. Green areas can also help in reducing the amount and effects of dust storms, which is also an issue in Basra. Green belts surrounding and protecting the city can be a beneficial strategy to lower temperatures, protect from dust storms, and enhance air quality and purity in general.

Another strategy that can be used is energy-saving in buildings. Residential energy use is one of the most demanding sectors in Basra due to its extremely hot summers.

The cooling season extends for 9 months a year, causing high cooling demands. The lack of building regulations is a main factor in increasing these numbers even more. The use of highly demanding cooling devices is also an issue. Only recently have the local markets made environmentally-friendly cooling devices available, but as expected, with higher initial costs. The architectural design of individual houses and the used building materials play a vital role in the amount of energy needed for cooling and ventilating. Reducing glazing areas in houses means less solar gains, and therefore, less cooling demands. The use of horizontal shading on south facades, and perpendicular shading on east and west facades, are also recommended strategies for hot climates. Previous studies on house designs in Basra have shown that using insulation in addition to thermo-stone in residential buildings can reduce the cooling demands by approximately 30%<sup>(34)</sup>. If more building strategies are used, such as increasing airtightness, solar panels, solar chimneys, and green surfaces, savings can increase up to 45%. Using solar panels is also an extremely effective method in houses, as mentioned earlier.

Finally, when talking about sustainable urban development, including citizens in decision-making is always helpful. This way, we can raise awareness among people

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(34) Almodhaffar et al, (2014). "STANDARDIZING THE ANNUAL ELECTRIC ENERGY CONSUMPTION FOR A RESIDENTIAL BUILDING IN Basra CITY". Basra Journal for Engineering Sciences, vol. 14, no. 2, pp 162-175.

and encourage their sense of belonging and responsibility towards the city, which will affect their day-to-day life decisions.

#### 4.6. Urban Farming

Urban farming is a concept that leads communities to become more self-sustainable with respect to food supply, in particular for vegetables, fruits, and other fresh produce. Urban gardening and roof gardening are two simple and well-known concepts. These concepts are comparable to the private garden of a family's house. Another very simple and effective concept is integrating farms in town planning. The major requirement for this is a regulation of real estate prices by the state or city council. The easiest way to achieve this is for the land to be owned either by the state or the city, as with public city gardens and parks. NGOs could be the owners as well. The land may then be leased to a private person or an enterprise for farming. It is essential that the owner of the land is not authorized to sell or lease the land for purposes other than farming.

Vertical farming in vertical stacked layers is a rather new concept; one out of several possibilities is using hydroponics, a technique of growing plants without soil<sup>(35)</sup>. Some benefits of urban farming include its positive impact on city climate, the improvement of the employment

(35) Gericke, William F. (1937). «Hydroponics - crop production in liquid culture media». *Science*. 85 (2198): 177–178. Bibcode:1937Sci....85..177G. doi:10.1126/science.85.2198.177. PMID 17732930

situation, and the utilization of treated wastewater, rather than wasting this water to the Shatt al-Arab.

## 5. Conclusions and Visions

Converting Basra from its current miserable situation into a sustainable and amiable city is a huge challenge, but feasible in the long term. However, many things are needed to reach this goal: i) fighting corruption and population growth, ii) improving education and environmental awareness, iii) introducing the concept of waste and waste-recycling, iv) developing a holistic approach for the utilization of solar energy and water recycling, and v) developing architecture and infrastructure with green areas, urban farming, and rain water harvesting. This requires smart thinking, starting out with pilot projects at different scales, and the participation of citizens, particularly the young generation, and NGOs.

- The vision of green Basra can only come true through solidarity and the cooperation of the local and federal government with citizens, scientists, engineers, stakeholders, and NGOs. Developing the technical aspects is one thing, and the open dialogue with politicians and decision-makers is another. Providing advocacy training and encouraging women, kids, and juveniles to be active in this context is another important aspect that needs to be addressed. Hence, to promote

social engagement, NGOs, institutions, schools, universities, and professional unions should be empowered and supported in order to activate multidimensional initiatives such as:

- Initiate a Clean Stream Initiative (CSI) to prevent throwing waste such as plastic bags, bottles, and food waste into rivers and canals. The initiative is based on three pillars: i) setting up rubbish bins, ii) organizing rubbish transport and recycling, and iii) creating public awareness regarding waste sorting. The first pillar is realized by cooperating with gas stations, restaurants, and other entities, and by opening a dialogue with the municipalities' authority in order to provide waste container stations. The CSI would annually be rewarding the top 10 companies in the city that prove to be committed to environmental criteria. The second pillar is setting up startup business loans for waste collection and waste recycling entrepreneurs. The successful project will be funded either by state funding, loans with zero interest, or by fees collected from sellers and consumers. Such initiatives will target different challenges, including reducing waste volume and generating jobs and additional sources for energy through the reuse of waste. The third pillar is a motivational and educational campaign to change the behaviour of citizens regarding the handling of waste.
- Establish a Green Roof Campaign

(GRC) funded by special grants from the oil industry. This will encourage small businesses and researchers to create green roof areas, in addition to developing urban parks and planting palm trees along roads and canals. Such an initiative provides multiple benefits in terms of environmental, social, economic, and aesthetic perspectives. The GRC would serve to foster the sustainability of Basra city in different ways: reducing the amount of energy needed for cooling buildings during the hot summer mitigates heating up the city's micro climate, which acts as a natural filter for noxious emissions of traffic and oil production. It will further help reduce dust, noise, the production of smog, and particulate matter throughout Basra city. As a side effect, jobs will be created for planning, construction, and maintenance. Furthermore, schools and universities can be incorporated in the campaign through active participation and research by using pre-treated waste water.

- Establish a strategic project "palm tree for each Basrawi"<sup>(36)</sup> (PfeB). The project aims to farm massive palms in the outskirts of Basra to recover the loss of palm trees that Basra suffered from, and bring back the key symbol of the city. The PfeB project will be conducted on two levels: one, through

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(36) Is the nickname for citizens who were initially born and raised in Basra city.

civil society, where pupils and citizens cultivate trees carrying their names, and two, through the governor's office by cooperating with the oil companies and other enterprises to fund the massive cultivation for palms as a multi-purpose mission, including a positive impact on city climate, the introduction of modern irrigation techniques with waste water, public awareness, and the creation of job opportunities.

- Develop the marshlands to be attractive for tourism and scientific research activities. In this context, local authorities, along with NGOs and universities, will cooperate with the Centre for the Restoration of the Iraq Marshlands and Wetlands (CRIMW) at the Ministry of Water Resources. Such an initiative will help to create strong bonds between the citizens of Basra city and nature, as well as enrich the local community in different dimensions: i) increasing public environmental awareness of the wetlands' significant role in developing a productive ecosystem, ii) providing an economic opportunity by generating income and creating jobs through developing, for instance, a day trip for only small groups of visitors, and as such protecting the marshlands from massive tourism, and iii) using this unique ecosystem for research and education.
- Establish an “art agenda” with the aim of bridging a relationship between

human and nature. Such an agenda that focuses on shaping environmental consciousness has several goals: feeding the aesthetic vision of citizens, sustaining social memory, and forming a new identity for a modern and sustainable city. This agenda could be achieved by developing art programs for children, teenagers, and young people, and by providing funds for art galleries, workshops, and symposiums with the aim of filling the gap between generations and bridging the image of Basra from its past to the future, increasing artworks in the city, and reforming the spaces by sculptures.



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**The City, the Water and the Mud: A Memory\***

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The heavens used to cover our naked bodies, we, who stand on our tip toes at the noontide heat, celebrating with cold mud from the bottom of the river. Our flame-carved bodies become sculptures. We draw our wishes on our chests then throw ourselves into the cold water, to be caught by the hooks of wars.

We hurt a lot, we bleed dark mud, of which fishermen make a statue to stand under the blazing sky. We run dry like rivers.

*\*Artwork and text by Artist Hamid Saed, 2020. Translated by Dr. Amir Al-Azraki*