

# Troubled Waters

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**Climate Change, Hydropolitics, and  
Transboundary Resources**

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# Climate Change in the Arab World: Threats and Responses

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**O**il and gas revenues in the Arab world, and especially in the Gulf countries, have enabled exceptional and accelerated development in all aspects of life. These countries have become a hub of intense activity in many spheres: geopolitical, military, economic, industrial, construction, and tourism. However, the scale of energy production and its use have also led to severe environmental problems, chief among them, climate change.

Arab countries have long had to deal with traditional environmental threats, such as desertification, biodiversity loss, pollution of marine and coastal areas, air pollution, and problems of water quality and scarcity. Climate change and additional problems have appeared in recent years, including those related to military conflicts and construction and demolition debris. Traditional and emerging environmental threats are often interlinked. For instance, desertification leads to biodiversity loss; livestock increase and overgrazing lead to desertification; waste-dumping releases methane, which adds to the global warming problem, which in turn leads to desertification, water scarcity, and many other ecological disasters.

## The Arab World's Vulnerability to Climate Change

The Arab World will be one of the regions most affected by global warming. According to the Climate Change Index (CCI) developed by Maplecroft, a British risk analysis consultancy, it is home to 5 of the top 10 countries most exposed to the impacts of climate change: Djibouti, Egypt, Iraq, Morocco, and Somalia.

Djibouti is ranked globally as the most exposed to the impacts of climate change, scoring 0.00 overall (CCI values closer to zero represent higher levels of exposure to the consequences of climate change). Djibouti's population is already regularly buffeted by tropical storms from the Indian Ocean. With 7.1 percent of the population living less than 5 meters above sea level, Djibouti will be increasingly vulnerable to inland flooding as sea levels rise. Djibouti, like other countries rated "extremely" affected by climate change, will also suffer public health impacts, including more severe heat waves. In many places around the

world, these dangers have already begun to take a significant toll. A World Health Organization study has estimated that the modest warming that has already occurred since the 1970s was responsible for 150,000 excess deaths by the year 2000.<sup>1</sup>

Egypt ranks as the second most exposed country. With the vast bulk of its population concentrated in the Nile Valley and Delta, it is at high risk of inland flooding; it also faces extreme risk of negative health effects. Iraq, fifth most vulnerable, is at high risk for coastal flooding, exposure to extreme temperatures, susceptibility to decreasing food availability, and the negative health problems these create. Morocco and Somalia, at 6th and 10th place respectively, are both expected to experience increased risk of inland flooding and extreme temperatures.

In the critical Persian Gulf, all six countries of the Gulf Cooperation Council (GCC)—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE)—are projected to suffer significant repercussions from global warming. Bahrain, 11th on the CCI, has a relatively small land mass that is in danger of being inundated as sea levels rise with climate change. Qatar is especially susceptible to inland flooding, with 18.2 percent of its land area and 13.7 percent of its population less than 5 meters above sea level. Bahrain and Qatar, together with Kuwait, figure among the countries exhibiting “extreme” vulnerability on the Maplecroft index. Oman, Saudi Arabia, and the UAE are all rated “highly” vulnerable. Many other countries in the region are also expected to be significantly affected by climate change. Yemen ranks among those “extremely” vulnerable, and Jordan, Lebanon, Libya, and Tunisia score “high” on the CCI.

### **Water Pressures**

Most of the Arab world falls under the classification of extreme water scarcity, defined by the United Nations as anything below 1,000 cubic meters per capita of average annual water supply. Many countries of the region already use more than 40 percent of their total available water resources, and more still are projected to do so in the next two decades (see annex 1).

Global warming will exert new pressures on water resources around the world. Shifting precipitation patterns will reduce freshwater supply in many regions, just as rising temperatures will increase demand for such uses as agricultural irrigation. As one expert stated: “There are two major and immediate consequences. First, rising sea levels will affect coastlines and marine life severely and could impact on desalination plants that are the source of water for the region. Second, rising temperatures mean increasing water demand and with falling freshwater levels and increasing salinity in sea water (which affects the efficiency of desalination plants), water scarcity is a fearsome prospect.”<sup>2</sup>

Indeed, so scarce are freshwater supplies in the Gulf region that the GCC states now rely on desalination for two-thirds of their water needs on average; Bahrain, Kuwait, Qatar, and

the UAE for more than 90 percent. In fact, 65 percent of all the world's desalination plants are found in GCC countries. Ironically, such plants are very energy intensive, such that greater reliance on desalination could increase the region's greenhouse emissions, adding to climate change. Yet desalination of seawater and brackish groundwater will continue to be a crucial water supply option for a large number of urban centers in GCC countries (see table 1).

**Table 1: Past and Present Desalination Schemes in GCC Countries**

Country	1990			2005		
	Desalination production (mcm)	Domestic demand (mcm)	Desalination-to-demand ratio (%)	Desalination production (mcm)	Domestic demand (mcm)	Desalination-to-demand ratio (%)
Bahrain	56	103	54	123	133	92
Kuwait	240	303	80	589	610	97
Oman	32	86	37	68	170	40
Qatar	83	85	98	250	252	99
Saudi Arabia	795	1,700	47	1,063	2,458	43
UAE	342	540	63	813	951	85
Total	1,548	2,817	55	2,906	4,574	64

Note: mcm = million cubic meters.

### ***Economic Pressures***

The ecological changes likely in the Arab region are relatively small compared to the potentially catastrophic hurricanes and floods anticipated in other parts of the world. But for many Arab countries, the economic impact of confronting climate change will be more severe. Their economies depend on revenues from oil and gas exports. Fossil fuel combustion, however, is the main source for emissions of carbon dioxide (CO<sub>2</sub>), the principal greenhouse gas (GHG). If the world shifts soon to renewable sources of energy, the Arab world, and especially the Gulf region, will suffer economically. According to one estimate, the Kyoto Protocol agreement to combat global warming by diminishing global fuel consumption could cut GNP some 3 percent in the GCC countries by 2010.<sup>3</sup>

Besides being the world's main petroleum exporters, the GCC countries have been under fire for carbon emissions from their own large-scale use of fossil fuels. Even though the region's total carbon emissions are very low (only 2.4 percent of the global total), per capita emissions are very high. Qatar, Kuwait, the UAE, and Bahrain, in that order, top

the list of the world's largest emitters of GHGs per capita, with Saudi Arabia close behind (see annex 2). There is thus no doubt that the Gulf countries share responsibility with the rest of the world for climate change, and must work to diversify their energy portfolio and find more environment-friendly energy sources. Yet, while countering global warming is a common responsibility, different obligations must be charted out for different countries.\* Those countries with the largest absolute emissions, for example, must shoulder more burdens.

Gulf countries recognize the problems created by their energy production and consumption profiles and are trying to come up with innovative solutions in the renewable energy field to offset this. This is clear in recent undertakings, including Abu Dhabi's Masdar, a carbon-neutral city due for completion in 2009. Indeed, mitigation initiatives have gained a lot of attention in the last several years, and many pioneering projects such as Masdar, and research efforts in the field of renewable energy, energy efficiency, and clean production and technology (especially under the Clean Development Mechanism [CDM]), have been launched. In November 2007, Gulf countries of the Organization of Petroleum Exporting Countries (OPEC) pledged a total of US\$750 million to a new fund to tackle global warming through research for a clean environment. Kuwait, Qatar, and the UAE pledged US\$150 million each for the fund. Saudi Arabia, the world's biggest oil exporter, will invest US\$300 million in the fund which is aimed at finding technological solutions to climate change, notably carbon capture and storage.

Adaptation to the various impacts of climate change, on the other hand, has been very low. The lack of arable land and water resources in much of the region prevents the development of carbon sinks, forests, and green areas. Information acquisition, public awareness, mainstreaming impacts into policies, monitoring, evaluation, and implementing measures have been almost nonexistent.

Most Arab countries still lack clear targets to reduce their GHG intensity. Much work needs to be done to establish, maintain, and improve emission-reduction registries as well as implement a comprehensive range of new and expanded domestic policies, such as tax incentives for renewable energy and clean technology. Finally, cross-sectoral policies

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\* In 2007, German chancellor Angela Merkel put forward a proposal, praised by a number of scientists around the world, to allow developing countries to increase their emissions per capita while industrialized countries cut theirs, until both sides reached the same level. This proposal, however, would not be very fair for countries such as those in the GCC, which are less populated and currently witnessing an economic boom, because it would entail slowing development. The proposal also does not take into account the expatriate population (especially labor, which moves to booming economies). Furthermore, it might provide a motive for countries to increase their population and in that way create another global problem which will end up increasing emissions instead of reducing them.

to fight climate change need to be developed and integrated with existing policies in the energy, agriculture, transportation, and related sectors.

## Climate Change Brings Water Troubles to a Boil

Water is at the heart of the problem of climate change. Accelerated glacier melt, rising sea levels, drought, and desertification are all water-related issues. Historically, civilizations rise near the banks of major rivers and are heavily dependent on their flow for water, agriculture, transportation, and trade. Water has always been both a blessing and a source of conflict. In fact, the English word “rivalry,” derived from the Latin *rivalis*, essentially means “one using the same river as another.”<sup>4</sup>

Water is also inextricably linked to the health of a population. Fresh water is required for drinking, sanitation, and irrigation of cropland. It has a direct influence on agriculture, which in turn affects harvests and livelihoods, particularly in subsistence farming areas. Changes in saltwater levels could result in saltwater intrusion into aquifers, rendering the groundwater unpotable. Water quality will also be affected by higher surface water temperatures which promote algal blooms and increase bacteria and fungi content.<sup>5</sup>

It is hardly surprising that some of the most parched regions of the world also suffer from perennial unrest. Extrinsic factors, such as rising food prices, can fan civil discord. Yet it is often the dependence of agriculture on scarce water supply that lies at the heart of the problem.

### Water Conflicts

Although seldom the trigger for war, the thirst and desperation created by water shortages or a threatened water supply can fuel existing tensions. Perhaps the most recent widely reported violence over water resources is that of the simmering conflict between farmers and nomads in Darfur, Sudan.<sup>6</sup> Drought and desertification in the northern parts of Darfur have spurred migration of the Arab nomads to southern Darfur, where they came into contact with black African farmers, which sparked disputes over land and scarce water resources. What seems to be a dispute caused by ethnic divide has its roots in water resource distribution.

The conflict in Darfur is by no means an isolated example. Table 2 lists several historical water conflicts to illustrate the grave consequences that can arise from threats to water resources. “Genuine water scarcity” refers to situations where there is a real natural shortage of water in the region that is not due to artificial restriction or control of water sources. “Water used as a political tool” refers to the intentional control or stoppage of water flows to extort or threaten neighboring states where water is otherwise sufficiently available.

**Table 2: Selected Conflicts Caused by Water Shortage**

<b>Date</b>	<b>Parties involved</b>	<b>Description</b>
<b>Caused by genuine water scarcity in region</b>		
1947–1960s	India, Pakistan	Partition leaves Indus Basin divided between India and Pakistan; disputes over irrigation water ensue, during which India stems flow of water into irrigation canals in Pakistan.
1951, 1953	Israel, Jordan, Syria	1951: Jordan makes public its plans to irrigate the Jordan Valley by tapping the Yarmouk River; Israel responds by commencing drainage of the Huleh swamps located in the demilitarized zone between Israel and Syria; border skirmishes ensue between Israel and Syria.  1953: Israel begins construction of its National Water Carrier to transfer water from the north of the Sea of Galilee out of the Jordan Basin to the Negev Desert for irrigation. Syrian military actions along the border and international disapproval lead Israel to move its intake to the Sea of Galilee.
2000	China	Civil unrest erupted over use and allocation of water from Baiyandian Lake, the largest natural lake in northern China.
2004–2006	Ethiopia, Somalia	At least 250 people were killed and many more injured in clashes over water wells and pastoral lands. A three-year drought led to extensive violence over limited water resources, worsened by the lack of effective government and central planning.
2007	Burkina Faso, Ghana, Côte d'Ivoire	Declining rainfall led to growing fights between animal herders and farmers with competing needs. In August 2007, people were forced to flee their homes by fighting in Zounweogo Province.
<b>Caused by use of water as a political tool</b>		
1978–on	Egypt, Ethiopia	Long-standing tensions over the Nile, especially the Blue Nile, originating in Ethiopia. Ethiopia's proposed construction of dams on the headwaters of the Blue Nile leads Egypt to repeatedly declare the vital importance of water, with Anwar Sadat noting in 1979, "The only matter that could take Egypt to war again is water."
1992	Czechoslovakia, Hungary	Hungary abrogates a 1977 treaty with Czechoslovakia concerning construction of the Gabčíkovo/Nagymaros project based on environmental concerns. Slovakia continues construction unilaterally, completes the dam, and diverts the Danube into a canal inside the Slovakian republic. Massive public protest and movement of military to the border ensue; issue taken to the International Court of Justice.
1997	Singapore, Malaysia	Malaysia supplies about half of Singapore's water; in 1997, it threatened to cut off that supply in retribution for Singapore's criticizing Malaysian policies.
2000	Kyrgyzstan, Kazakhstan, Uzbekistan	Kyrgyzstan cuts off water to Kazakhstan until coal is delivered; Uzbekistan cuts off water to Kazakhstan for nonpayment of debt.

Source: Adapted from Peter H. Gleick, "Water Conflict Chronology," Pacific Institute for Studies in Development, Environment, and Security, 2008, available at [www.worldwater.org/conflictchronology.pdf](http://www.worldwater.org/conflictchronology.pdf); accessed January 22, 2009.



Historically, warring states often made use of existing water resources to threaten the opposing country by poisoning wells or controlling access to water supplies that were not necessarily scarce. By contrast, recent conflicts over water have increasingly been triggered by genuine shortage more so than by accessibility. This is a worrying sign. No longer merely a tool of political or military advantage, the control of water supplies increasingly constitutes the spark or object of civil strife or open conflict.

## **Policy and Social and Institutional Responses**

In the most affected areas, a malfunctioning hydrological cycle could cause more serious water shortages and an unprecedented increase in water demand as drought, severe heat, land degradation, and desertification boost consumption for drinking and irrigation and lay waste to previously arable soils. As the freshwater sources dry up gradually over the next few decades, more conflict is likely. While resource management is important in preventing further deterioration, it is only half of the solution.

Effective climate change policy will not tolerate procrastination. GCC governments need to act right now to find ways to reduce their carbon footprint. This is necessary to stave off global warming and secure water needs in the short, medium, and long term for different sectors by using varied policy options, technologies, negotiations that can secure water supplies from friendly countries, and even political pressure.

### ***Water Pricing for Lower Wastage***

Consumers in the GCC countries typically do not bear the full costs of their water usage. Proper pricing would make people more conscious of using water efficiently and encourage high-usage customers to cut back. The Dubai Electricity and Water Authority took a step in the right direction in March 2008 by introducing a new system of rising tariffs. However, the tariff does not apply to UAE nationals. Rather than exclude nationals from the pricing system, it would be better to offer them a monetary allowance and charge all users water consumption according to the new tariff.

### ***Sensible Water Usage***

Agriculture accounts for about 6.5 percent of GDP in Saudi Arabia, just 3.3 percent in the UAE, and less than 1.0 percent in Kuwait. Yet agriculture continues to be the prime water-consuming sector in the GCC. In fact, agricultural water use has increased from about 73.5 billion cubic meters in 1990 to over 90 billion cubic meters in 2000, exerting immense pressure on the limited water resources.

Many corporations and environmental NGOs around the Gulf have embraced programs for greening the deserts. Yet this is an unwise solution in a water-scarce region, even if the

objective is to plant indigenous species. We have to accept and adapt to our surrounding ecosystem, which is a desert area with scattered indigenous species.

Growing reliance on desalinated water could be a risky policy, considering volatile prices for the oil that powers the plants and volatile revenues from the oil exports that finance them, not to mention the environmental problems these plants create. However, there is no doubt that desalination will remain an important component in the water budget of the GCC countries. More research should be devoted to reducing costs and finding environment-friendly desalination technologies. The sustainable use of groundwater resources should also be considered in the overall integrated water resource management policy of each country.

Striking a balance between self-sufficiency and water resource sustainability in the GCC countries will demand long and continuous struggle. Still, it is important to strive for better, environment-friendly solutions to reduce the effects of climate change and to collaborate on finding improved solutions in water management. The GCC states would be wise to seize the chance to use the Adaptation Fund that became available following the Bali climate negotiations in December 2007. They should also improve regional cooperation and joint project planning to ensure that the possible transnational consequences of water policies are examined and anticipated and that mutual interests are addressed.

## **Emissions Mitigation in GCC Countries**

The Kyoto Protocol established three so-called “flexible mechanisms” for the developed countries that are subject to mandatory GHG controls under the treaty. The mechanisms help them meet their national emissions reduction targets in cost-effective ways. The first of these is an Emissions Trading System: parties that emit less than their assigned levels can sell the extra amounts to parties that exceed their allotments. Second, Joint Implementation allows one developed country to help finance an emissions reduction project in another and receive an emissions credit to count against its own obligations. Finally, the Clean Development Mechanism allows parties in developed countries to finance GHG emissions reduction or removal projects in developing countries and thereby obtain allowances they can apply against their own emissions limits. Such credits can be bought and traded by companies and nations in the developed world and provide incentives for better environmental management and technological innovation that go beyond business as usual.

While India and China, as well as many countries in Latin America, were prepared to follow this path when the Kyoto Protocol was signed in 1997, the Arab states only started to think about emissions trading in 2006, and began implementing projects in 2007. Given that in 2006 the global emissions trading market was worth US\$30 billion and that this is

still a new market in the GCC countries, there is a huge potential for Gulf companies to reduce emissions and earn money from generated credits. Currently, there are many CDM projects in Bahrain, Egypt, Jordan, Morocco, and Tunisia.

In the Gulf, many companies and consulting firms have begun to explore this fast-developing field. The UK-based EcoSecurities, for example, has opened offices in Bahrain, Dubai, and Lebanon, and is planning branches in Qatar and Saudi Arabia, as well as intermediates in Egypt and Libya next year. Meanwhile, the Masdar Company of Abu Dhabi is the first local company in the region to pursue a CDM project. Projects are now moving quickly, as public and commercial awareness rises. Doha Bank is planning to launch the Arabian Gulf's first carbon credits exchange in 2009 to tap an emerging market for emissions trading. Moreover, CDM projects in the Gulf are being considered in fields such as renewable energy, waste, and cement. Current CDM projects include the following:

- *A landfill project in Sharjah in the UAE.* This project is in the very early stages but has received Designated National Authority approval.
- *The Dubal CDM Project.* Masdar (Abu Dhabi) will work with Dubai Aluminum Company Limited (Dubal) to develop and register a project to reduce GHGs from aluminum smelting, in order to claim credits of reduced GHGs at a Dubal smelter at Jebel Ali.
- *The Al-Shaheen Oilfield Gas Recovery and Utilization Project.* This Qatar project, registered on May 29, 2007, is aimed at recovery and utilization of natural gas from oil wells that would otherwise be flared. The project received Certified Emissions Reduction status in the second half of 2008.

The Al-Shaheen project is the first of its kind in the region and third CDM project in the petroleum industry worldwide. The Al-Shaheen oilfield has flared the associated gas since it began operations in 1994. Prior to the project activity, the facilities used 125 tons per day (t/day) of associated gas for power and heat generation, and the remaining 4,100 t/day was flared. Under the current project, total gas production after the completion of the project activity will be 5,000 t/day, with 2,800 to 3,400 t/day to be exported to Qatar Petroleum, 680 t/day for on-site consumption, and only 900 t/day still to be flared. The project activity will reduce GHG emissions by approximately 2.5 million t/CO<sub>2</sub> per year and approximately 17 million t/CO<sub>2</sub> during the initial seven-year crediting period.

Still, important questions need to be raised. Why did the region not witness registration of a CDM project until 2007, and why are there not more CDM projects in the oil and gas industry, the dominant industry in the region? The countries of the region will have to surmount several obstacles to make greater use of the CDM. These challenges include the following:

- Political will has been very weak.
- The region wants to develop as fully and rapidly as possible. Until recently, not much attention was given to environmental issues at the policy level; instead, the focus has been primarily on the economy and security.
- There is a lack of education and awareness regarding all aspects related to CDM projects (including how to tax CDM revenues).
- There is lack of infrastructure and capacity (expertise) in both private and public sectors for many environmental fields.
- CDM projects in the region are large scale and take time to plan and develop.
- Implementing CDM projects takes considerable time, especially in big oil companies.
- It is believed that CDM projects do not fit in well with the oil business.
- Petroleum companies do not need the relatively small additional revenue that would accrue out of the CDM.
- The petroleum industry cannot easily stop or change production to accommodate CDM projects, unlike industries such as cement, where swifter changes are possible.

Even so, while development in the Gulf region is rapid, political support and funds are increasingly available for environmental activities, and environmental awareness is growing. CDM projects are now considered an additional revenue source based on carbon credit sales. Potential CDM activities could thus be initiated in areas such as cement, landfills, industrial efficiency, waste management, industrial processes, the agricultural sector, land use change, and forestry inventory. Energy-efficiency projects in the Gulf, for instance, could save millions of dollars and reduce tons of CO<sub>2</sub> emissions while qualifying as CDM projects. In addition, renewable energy, in particular solar energy, holds great potential for the region, similar to biomass in Asia. In the long term, the region could potentially shift from exporting fossil fuel to exporting clean energy to the rest of the world.

In the meantime, while environmental laws exist, some executive regulations may be required to implement these laws and promote CDM projects in the Gulf. All concerned stakeholders should be involved. In Bahrain, for instance, a committee for climate change has been established that includes local NGOs. At the regional level, the GCC also has a multilateral committee on climate change to create a unified position.

Finally, it is worth noting that countries in the region are unlikely to embrace two potential greenhouse policies often advanced by developed country analysts. First, the GCC states will almost certainly not try to solve the carbon emission problem by imposing carbon taxes. These countries depend heavily on petroleum and gas as the main source of revenue for their development plans, and any carbon taxes might hamper this process. Similarly, despite being approved in 2007 by the Convention on the Prevention of Marine Pollution

by Dumping of Wastes and Other Matter (1972 London Convention), the potential for carbon capture and storage in underground or undersea reservoirs is also very limited as a safe way of disposal. From the environmental point of view, carbon capture and storage is not the best solution, as it will only postpone the problem, encouraging more emissions on the premise that the CO<sub>2</sub> produced can then simply be stored. Any leaks in the huge quantities of stored CO<sub>2</sub> could lead to environmental disasters. Small leaks could be fatal to local inhabitants; large leaks could rapidly return significant amounts of CO<sub>2</sub> to the atmosphere.

## **The Arab World's Growing Awareness of Climate Change**

The Council of Arab Ministers Responsible for the Environment is well aware of the possible repercussions of climate change on the Arab region and recognizes that dealing with climate change requires a collective international effort and solidarity of goals. At its 19th session on December 5–6, 2007, the council adopted the Arab Ministerial Declaration on Climate Change. The declaration announced the Arab countries' intention to include climate issues in all sectors of sustainable development policy and to adopt national and regional climate action plans.

Nevertheless, the governments in the region have been slow to formulate solid national action plans for the environment. States party to the UN Framework Convention on Climate Change (UNFCCC) are required to submit a national communication on their implementation of the accord. But the UNFCCC Secretariat has reported that no information is available about the status of the preparation of the national communications of Kuwait, Libya, Oman, Qatar, Somalia, or Syria.<sup>7</sup> Oil-rich Arab countries, particularly Saudi Arabia, have also been accused of actively hindering climate negotiations.

## **Institutional Developments**

On environmental issues, the Arab countries operate internationally and regionally through a number of bodies that coordinate activities and set the framework for regional efforts.

At the state level, environmental ministries, agencies, and councils, which are still fairly new, are struggling to play a significant role in the decision-making processes to address priority environmental challenges facing the region.

Due to the relative inexperience of the new environmental authorities and the lack of institutional capacity, many Arab countries first join international agreements and then seek solutions to fulfill commitments. Still, there have been several notable local developments:

- In November 2007, in recognition of the importance of the impact of climate change, Oman changed the name of the Ministry of Environment and Regional Municipalities to the Ministry of Environment and Climate Change.

- Due to the lack of reliable data on environmental affairs, the Environment Authority in Abu Dhabi (Abu Dhabi Global Environmental Data Initiative) launched an initiative with the World Wildlife Fund–UAE and Global Footprint network to collect and prepare the footprint for the UAE. The Al Basama Al Beeiya (Ecological Footprint) Initiative, launched on October 18, 2007, represents the UAE’s national effort to reduce its ecological footprint and ensure a sustainable future. Three key objectives were identified: raising awareness about the project and its mission, facilitating research on vital footprint components, and increasing institutional capacity building across the UAE. The project team is currently engaged in the challenging task of sourcing data on population and energy, which have been identified as priority areas in the project’s current phase.

## Civil Society

In the Gulf countries, civil society varies between the traditional type of organization that depends upon family and tribal networks, and newer forms, such as NGOs and community-based organizations. There are about 2,000 NGOs in the six GCC countries, a relatively high number in comparatively new societies. Civil society is more developed in Bahrain, Kuwait, and the UAE, as compared to Oman, Qatar, and Saudi Arabia. The activities of civil society organizations in the environment field are mainly centered on greening projects, cleanup campaigns, workshops and seminars, conferences, and training and public lectures. Many of the NGOs in the GCC region face problems, including lack of funds and volunteers, especially young volunteers. These obstacles hinder their abilities to carry out missions effectively and achieve their environmental goals. As such, environmental NGOs have not been very effective in lobbying for their causes.

NGOs can potentially play a very important role in new matters such as the CDM. In fact, supporting CDM programs can be one way NGOs can improve their image, spread their message, and attract funds and volunteers. This could include raising awareness (among individuals and in the public and private sectors); serving as watchdogs to monitor, foster, and propose CDM projects for different industries; and proposing ideas for clean projects to authorities and the private sector.

## Renewable Energy and Climate Change

Renewable energy projects and other clean technologies for mitigating climate change will enable GCC countries to align their GHG reduction and human development efforts, and promote mitigation activities that accelerate rather than slow socioeconomic progress. The Arab region not only has a considerable supply of oil and natural gas, but also an ideal geographic positioning to receive maximum exposure to sunlight and, in many areas, wind, which would provide endless renewable energy. According to one regional expert, “The

region is exposed to direct sunlight, as well as a reduction in the percentage of clouds. The usual Direct Natural Exposure...in the Gulf region is about 1800 kilowatt/hours per every square meter, and this makes the adoption of solar energy in the region technically and economically feasible. Statistics show that both the Middle East and North of Africa are equipped to deal with this technology...”<sup>8</sup>

Wind-generated energy is the least costly among all sources, and it is abundant in the region. For example, wind speeds reach 8 to 11 meters per second in Oman. However, renewable energy is almost nonexistent in the Arab region, representing only around 0.1 percent of energy supplies and producing less than 0.3 percent of electricity. The few renewable energy projects in GCC countries include the following:

- There is a mobile reverse osmosis desalination unit in Bahrain operated by solar power with a capacity of 200 gallons per day, and a mobile generator operated by solar and wind power with a capacity of 1.5 kilowatts.
- Saudi Arabia has several solar cooking, solar desalination, thermal and solar electricity, and photovoltaic systems projects ongoing. These projects were implemented through the American Cooperation Program which carried out many R&D programs in the last two decades of the 20th century.
- A desalination project in Oman uses thermal and solar power established to produce a limited amount of drinking water. Photovoltaic systems with a capacity of 352 kilowatts were built for pumping water, lighting, and communications.
- Prior to the Gulf War in 1990, R&D projects were carried out in Kuwait on solar lakes, air conditioning, and photovoltaic systems.
- Some mini-solar projects were implemented in the UAE for different purposes, such as phone cabins and traffic signals.

### ***The Masdar Initiative***

In April 2007, the government of Abu Dhabi began construction on the carbon-free city Masdar. The Masdar Company intends to build a unique, integrated “green community.” This green energy and technology campus will offer a sustainable living environment and state-of-the-art office and research facilities built with green construction that depends on desalination, biofuels, sustainable transport, water recycling, wastewater management, solar cooling, sustainable irrigation, and other renewable technologies.

Although difficult to measure precisely, the following direct results are expected from the project by 2015:

- 10,000 new high-quality jobs in the clean energy and sustainable technologies sector in Abu Dhabi

- 800 full-time master's degree and PhD students at the Masdar Institute specializing in clean energy and sustainable technologies
- A multibillion-dollar expansion of the Abu Dhabi non-oil economy
- The creation of a world-class scientific and research hub in the Gulf region, which can become the core of other knowledge-based activities and industries, in addition to clean energy

There is no doubt that the announcement of Masdar and the accompanying initiative is a step in the right direction. The most important direct benefit will be the ability to help cut emissions and therefore set an example. This will raise awareness and inspire others to follow up with similar initiatives.

## Conclusion

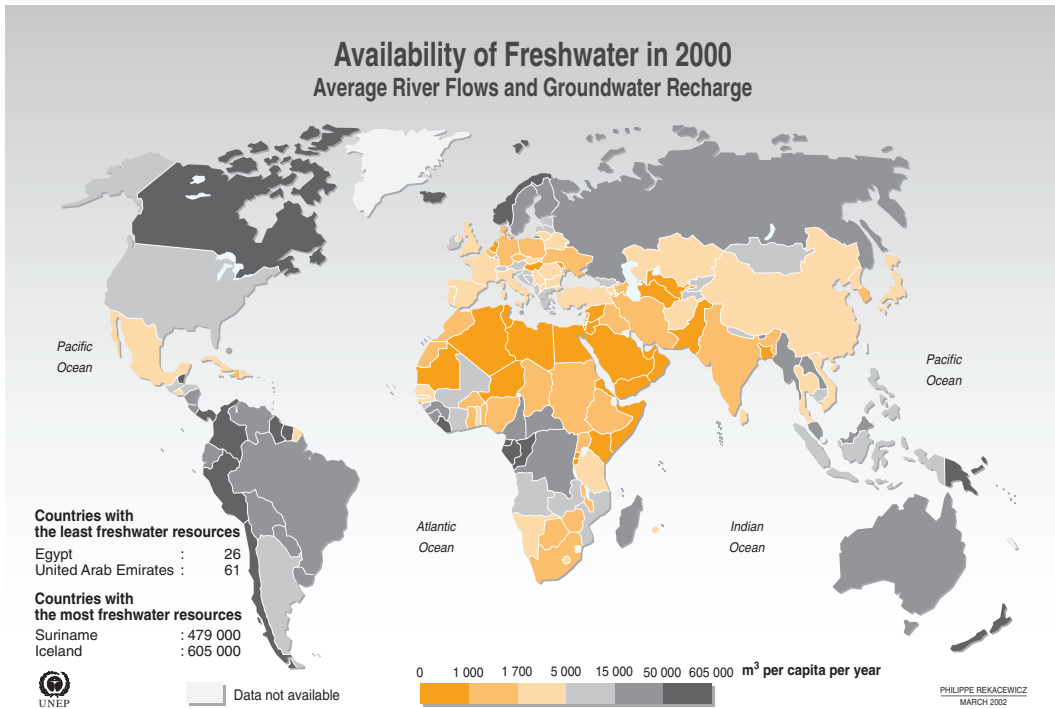
The Arab countries face numerous environmental challenges and have to reconcile many conflicting priorities, from promoting economic diversification, ensuring water supply and food security, and furthering environmental protection and conservation to adapting to the impacts of global warming.

These countries play an increasingly important role in the climate change arena: they are at once producers and exporters as well as victims of global warming. Thus, they must be fully backed and supported by the international community. There is no room for unilateral efforts that ignore other players. Over the next two years, as negotiations on the Bali roadmap progress, there are opportunities for Arab countries to garner financial and technical support from the industrialized world to help them combat the negative impacts of desertification and climate change as well as make advances in the areas of green and sustainable technologies.

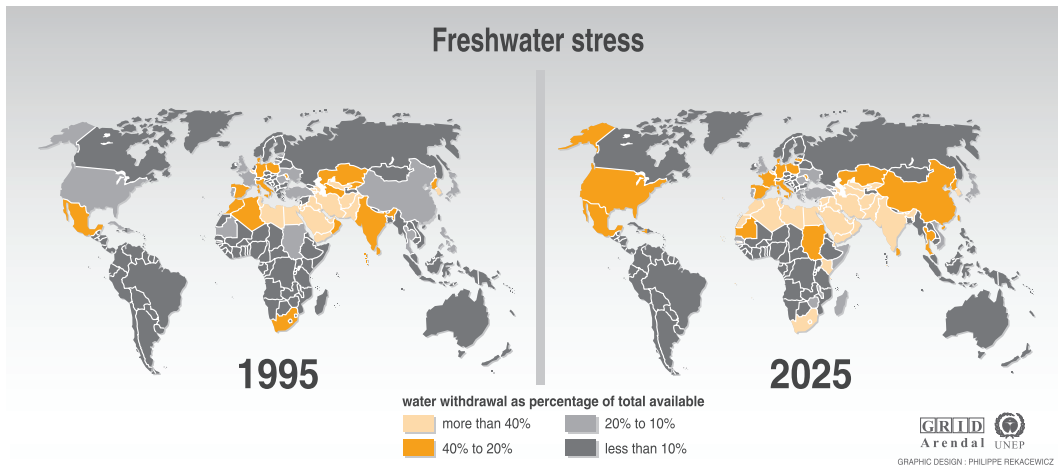
To be sure, the current policy engagement of the Arab countries is low. Cooperative projects and initiatives with the international community are few compared with other countries and regions. Inexperienced environmental authorities and lack of institutional capacity are a disadvantage. There is a definite need for better use of economic instruments in environmental policy to encourage environmental protection and promote clean technology that combats the negative effects of climate change. But many initiatives are in the pipeline to improve data and expertise, and to promote environmental awareness and protection. And there are many indicators that civil society will play an important role in general and especially in environmental issues in the near future. The Arab region's view of climate change, renewable energy, and traditional fossil energy sources has changed significantly in the last year. There is a shift toward energy diversification, with more research and initiatives in the field of renewable energy and a resolve to fight climate change and play a vital role in the emissions trading market. As one of the regions most vulnerable to global warming, the Arab countries will be increasingly likely to join the global effort to combat climate change.



## Annex 1: Water Pressures through 2005



Source: World Resources Institute (WRI), *World Resources 2000–2001, People and Ecosystems: The Fraying Web of Life* (Washington, DC: WRI, 2000); map © 2002 Philippe Rekacewicz, UNEP/GRID-Arendal.



Source: United Nations Environment Programme (UNEP), *Global Environmental Outlook 2000* (London: Earthscan, 1999); map © 2000 Philippe Rekacewicz, UNEP/GRID-Arendal.

## Annex 2: Per Capita Emissions Ranked by Country, 2000

Country	GHG(tCO <sub>2</sub> e)	Rank	CO <sub>2</sub> only	Rank
Qatar	67.9	1	60.0	1
United Arab Emirates	36.1	2	25.2	3
Kuwait	31.6	3	26.8	2
Australia	25.6	4	17.3	7
Bahrain	24.8	5	20.6	4
United States	24.5	6	20.4	5
Canada	22.1	7	17.1	8
Brunei	21.7	8	13.7	10
Luxembourg	21.0	9	19.2	6
Trinidad & Tobago	19.3	10	16.7	9
New Zealand	18.9	11	8.6	32
Antigua & Barbuda	18.5	12	4.9	62
Ireland	17.3	13	10.9	18
Estonia	16.6	14	11.3	17
Saudi Arabia	16.4	15	13.4	11
Belgium	14.5	16	12.2	14
Czech Republic	13.9	17	12.1	15
Singapore	13.9	18	13.1	12
Turkmenistan	13.8	19	7.8	40
Netherlands	13.5	20	10.9	19
Finland	13.3	21	10.9	20
Russia	13.2	22	10.6	21
Palau	12.9	23	12.7	13
Nauru	12.8	24	11.4	16
Denmark	12.5	25	9.7	27
Germany	12.3	27	10.4	22
United Kingdom	11.1	32	9.4	30
South Korea	11.1	33	9.9	26
EU-25	10.5	37	8.5	34
Japan	10.4	39	9.5	29
Poland	9.8	43	7.8	41
Ukraine	9.7	44	6.3	47
South Africa	9.5	46	7.9	39
Spain	9.4	47	7.5	44
Italy	9.2	48	7.7	42
France	8.7	50	6.2	48
Argentina	8.1	52	3.9	70
Iran	7.5	60	5.3	56
Turkey	5.3	75	3.3	78
Mexico	5.2	76	3.9	71
Brazil	5.0	83	2.0	100
China	3.9	99	2.7	88
Indonesia	2.4	122	1.4	111
Pakistan	2.1	131	0.8	132
India	1.9	140	1.0	120
Developed world	14.1		11.4	
Developing world	3.3		2.1	
TOTAL WORLD	5.6		4	

Source: World Resources Institute 2007.

Note: Figures exclude CO<sub>2</sub> from international bunker fuels and land use change and forestry.

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