

# **Climate change in the Persian Gulf – regional security, sustainability strategies and research needs**

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## **Introduction**

In recent years, most Western governments have integrated climate change in their national security agendas.<sup>1</sup> Also on an international level, these topics have become of key interest, as can be seen in the envisaged new NATO general strategy<sup>2</sup> and the 2007 climate change debate in the UN Security Council.<sup>3</sup> Only this summer, the UN General Assembly passed a resolution asking “the relevant organs of the United Nations (...), to intensify their efforts in considering and addressing climate change, including its possible security implications,” and requesting that the Secretary-General submit a comprehensive report to the next General Assembly on “the possible security implications of climate change”.<sup>4</sup>

That being said, the Arab states and particularly the Gulf region are yet to spell out these policies for their constituents. In light of the fact that these countries<sup>5</sup> are likely to witness strong direct and indirect impacts of climate change in the coming decades, it is even more urgent as Gulf governments have to prepare to deal with additional stress on their already fragile political systems.

In this article, I am going to sketch potential implications of climate change on the Gulf countries. I will link this to the changing security dynamics of the region, and examine the case-study of Yemen before analyzing sustainability pathways some Gulf States are currently exploring. The paper will conclude with a section identifying fields for future research.

## **Climate change and the Gulf region**

The impacts of anthropogenic climate change in the Lower Gulf are already noticeable. As Riegl’s research on coral reefs in Abu Dhabi, Dubai and Sharjah demonstrates, local marine ecosystems in the Arabian Gulf are substantially affected by climate change and must be placed amongst the “most stressed reef environments on earth” (Riegl, 2003, p. 434). In a local climate of increasingly frequent temperature anomalies,<sup>6</sup> unprecedented bleaching

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<sup>1</sup> Cf. the 2008 UK National Security Strategy or France’s national security white paper (July 2008). The Obama administration has not issued a comprehensive national strategy as of yet, but various US publications like the 2007 CNA report <http://securityandclimate.cna.org> recommend the immediate integration of climate change into the national security strategy.

<sup>2</sup> Cf. de Hoop Scheffer, 2008. The passing NATO Secretary General reiterated his position in a Chatham House talk on, July 20, 2009.

<sup>3</sup> UN SC S/PV.5663 and S/PV.5663 (Resumption), 17 April 2007.

<sup>4</sup> UN GA RES/63/281, 11 June 2009.

<sup>5</sup> In this article, the Gulf is defined as consisting of the Gulf Cooperation Council states (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) as well as Yemen.

<sup>6</sup> In 1998, average temperatures exceeded 37.3°C in central regions of the Gulf being more than 2°C above average. This was the largest temperature rise in the southern Gulf since 1870 and emphasizes the increase in sea surface temperature in the Gulf of at least 0.2 °C per decade for the last 50 years (Richer, 2008).

events and a heightened coral mortality rate could have been traced. In fact, some species of corals already began to adapt themselves to a continuously warmer climate (ibid.: 441). This, in addition to a projected sea level rise for the Lower Gulf between 0.09 and 0.88m until 2100, sets the argumentative framework for Riegl's statement that "the Arabian Gulf perhaps provides us with some aspects which might be described as a 'glimpse into the future.'" However, the author considers that these scenarios do not take into account potential climactic tipping points leading to major changes in ocean water chemistry or sea level rise.

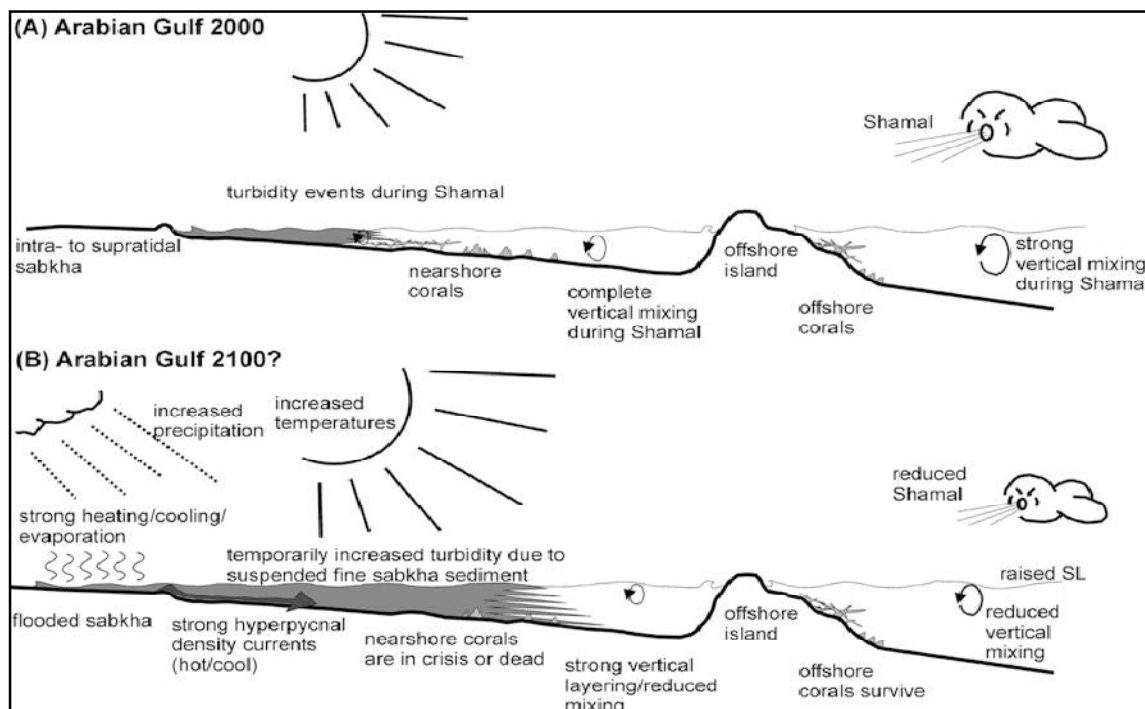


Figure 1: Anticipated effects of global change on Arabian Gulf corals (Riegl 2003: 443)

Other authors (Launay, 2006), (Richer, 2008) further discuss climate-related environmental risks for certain areas of the Gulf. Richer, for instance, predicts in her paper on environmental risks in Qatar major climate change related losses of regional flora and fauna. She states that "model predictions for temperature and humidity all show an increase for the Arabian Peninsula, the only question being how large of a temperature increase" (Richer, 2008).

Apart from potentially devastating effects on the non-human environment, in line with the IPCC's (IPCC) and other key meteorological models (UK Hadley Centre; Met Office) it is justified to predict that climate change will place additional stress on the regional political and economic systems in three ways:

Initially, a **decrease in precipitation in combination with a projected temperature rise** of 1.8°C by 2040 and 3.6° by 2070 (Met Office, 2009) will render even wider areas of the Gulf States unfit for agriculture and inhabitable for a non-nomad population. Richer's observation of the phenomenon "desertification in the desert" (Richer, 2008, p. 8) will undoubtedly be witnessed. This will raise the stakes for existing water supplies in the region, accelerating the depletion of non-renewable saline aquifers. Most fossil water resources on the Arabian Peninsula are between 10,000 and 30,000 years old. While currently, the domestic water use in the Gulf is about six times above the natural renewal rate, also in this case, the questions seems to be *when* rather than *if* aquifers deplete (Brook, Al Houqani, & Al Mugrin, 2006).<sup>7</sup>

<sup>7</sup> It should be noted that the fossil water reservoirs in the Gulf are significantly smaller than the North African ones. Thus, mega-projects like Libya's "Great Man-made River" tapping the world's largest fossil water reservoir in the Nubian sandstone aquifer system – a source that can supply Libya's urban centres with water in-

Already, their over-exploitation has resulted in an increase of salinity levels in ground water from saltwater intrusion and made desert springs disappear on the Peninsula. Water tables have dropped sharply as demand from rapidly urbanising and industrialising populations has outstripped supply from fossil water and local aquifers (Raouf, 2009a). Currently, more than half of the water used originates from desalination or wastewater treatment. However, in the mid-term perspective, the growing freshwater demand of the region cannot be sustained by the reliance on fossil water reserves, which is why both the relative and absolute amounts of desalinated water are going to rise. The 15 desalination plants that are currently operating in the GCC on the Arabian Gulf alone already have adverse environmental effects such as releasing gases, hot brine, treatment chemicals and other trace elements. Next to the production costs<sup>8</sup> and carbon emissions of this energy-intensive industry, their impact on marine life might become a liability. Abderrahman and Husain demonstrate in their study the devastating effects of hot water release by a power and a desalination plant in Kuwait (Abderrahman & Husain T., 2006).

**Table 1: Desalination Water Supply Share in 1990 and 2005**

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	122.7	133	92
Kuwait	240	303	80	589.1	610	96.5
Oman	32	86	37	67.932	170	40
Qatar	83	85	98	250.13	252	99
Saudi Arabia	795	1,700	47	1,063.28	2,458	43
UAE	342	540	63	812.61	951	85
Total	1,548	2,817	55	2,905.75	4,574	63.5

Source: World Bank (2005), Dawoud (2007)

Figure 2: Desalination Water Supply Share in 1990 & 2005 (Raouf, 2009b, p. 299)

A second likely climate change related impact, **sea level rise**, could threaten up to 15km of coastline in Bahrain (Raouf, 2008) and endanger the reclaimed islands and buildings in the coastal areas of the Lower Gulf, especially in the United Arab Emirates. This will put further stress on the already existing socio-economic and demographic fault lines. Increased and more dangerous river (*wadi*) flooding, a major problem in many parts of the world, is not of key concern to meteorologists. However, sudden, locally contained floods might still occur, particularly if the oceanic changes lead to more frequent and intensive storms in the coastal regions (Met Office, 2009).

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between 100 and 1000 of years – cannot be realized on the Peninsula. This does not suggest that the realization of such project would be particularly desirable. However, in the Gulf, this is not even possible from a resource perspective. For more information on Libya’s project cf. <http://www.water-technology.net/projects/gmr>.

<sup>8</sup> Until 2020, Saudi Arabia alone will invest US\$50bn in desalination projects, while an overall investment volume of US\$200bn has been earmarked for water and energy infrastructure projects. *Saudi Gazette*, 01 May, 2008.

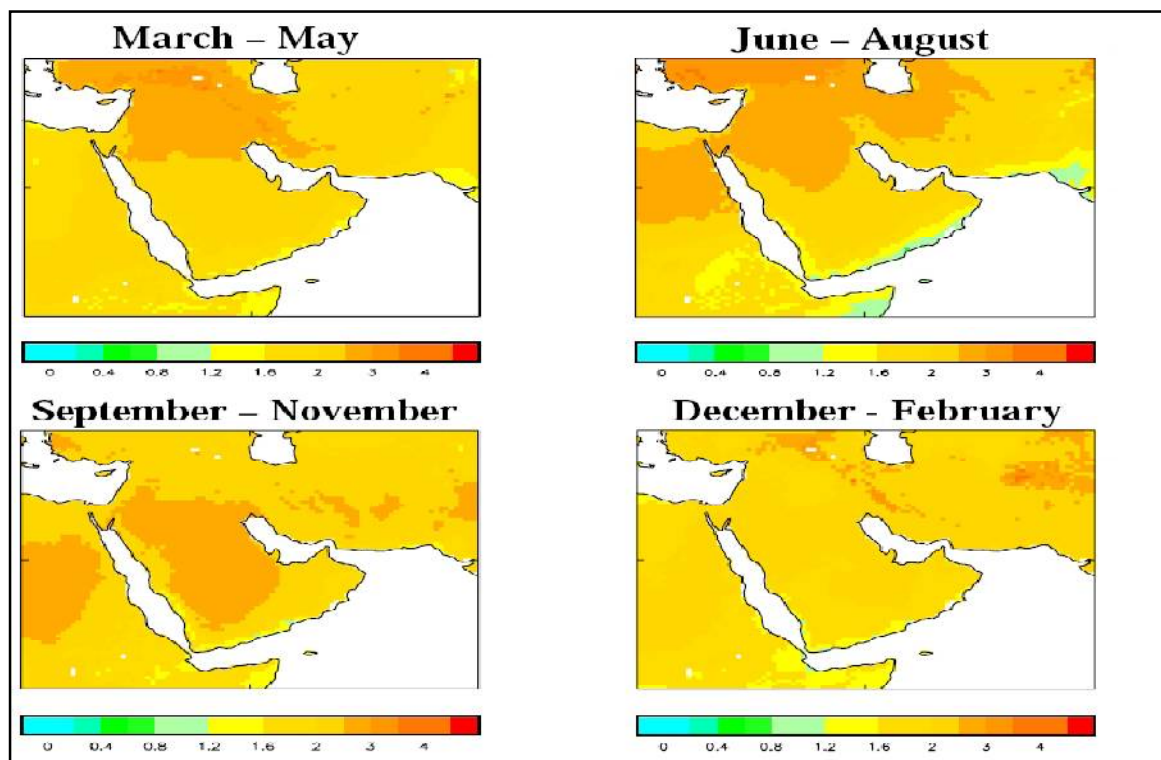


Figure 3: : Changes in Regional Climate Model projections of seasonal average temperature (°C) across the Gulf region for the 2040s relative to the 1990s (Met Office 2009)

Thirdly, next to these inner-systemic stress factors, the geographical position in of the Gulf needs to be taken into account. The densely populated, poorer and conflict-prone neighbouring regions of North and East Africa will face harsher consequences than the Gulf economies which might cause massive destabilization, potentially even violent conflict and mass migration. Additionally, weak governance structures and much less available funds will prevent the regional governments to develop robust adaptive capacities that could effectively cope with such situations. Admittedly, it is uncertain how far the GCC states are able to develop these capacities for their own states (Spiess, 2008), but chances are that the vastly more extensive funds of the GCC states will at least have an impact on the preparedness of worst-case events and resilience to worst-case scenarios.

Egypt can be quoted as a showcase scenario: a possible increase of the average temperature by 3 to 4 degrees would raise the sea level by approximately one metre, creating up to 6 million migrants from the densely populated Nile delta region. Even a sea level rise of 50 cm could lead to up to two million refugees and cause up to US\$35bn economic losses (UNDP, 2009, p. 49)<sup>9</sup>. In the Kordofan region in central Sudan, a temperature increase of 1.5 degrees between 2030 and 2060 would lead to a severe drop in agricultural production and a decrease in maize production by 70 percent of current levels (*ibid.*). Any such waves of migration and food shortages will form a major challenge to national, regional and human security regimes in North Africa and in the Horn. African urban centres could become ever more overwhelmed by both the immediate effects of climate change and a stream of refugees from regions that

<sup>9</sup> This figures seem to be more balanced than the numbers quoted in a recent study of CARE International , (CARE 2009, p. 17) based on Afifi, 2009. In this publication, it is claimed that an area of 518,000 ha and living space for 10.7 million lives would be inundated by sea level rise of two meters. This calculation may well be correct, but the likelihood that the sea level of the Mediterranean rises by a full two meters within this century is rather low. Above that, if this event would occur, it would have been preceded by a number of global climactic tipping points of a scale that comes close to a global worst case scenario. International pre-emptive and potentially adaptive measures to counter such events need to be discussed in a different framework than this paper can provide.

can no longer sustain people’s subsistence through agriculture (Brown & Crawford, 2009). As various other studies show (Refugee Studies Centre Oxford, 2008), (CARE International, 2009), the multi-faceted problem of climate change related human displacement (with the intricate legal question as to whether to classify these people on the move as mere economic migrants or refugees with rights to asylum and UNHCR support), with heightened stakes for local resources and increased probability of violent conflict has already begun with consequences that have yet to be mapped out.

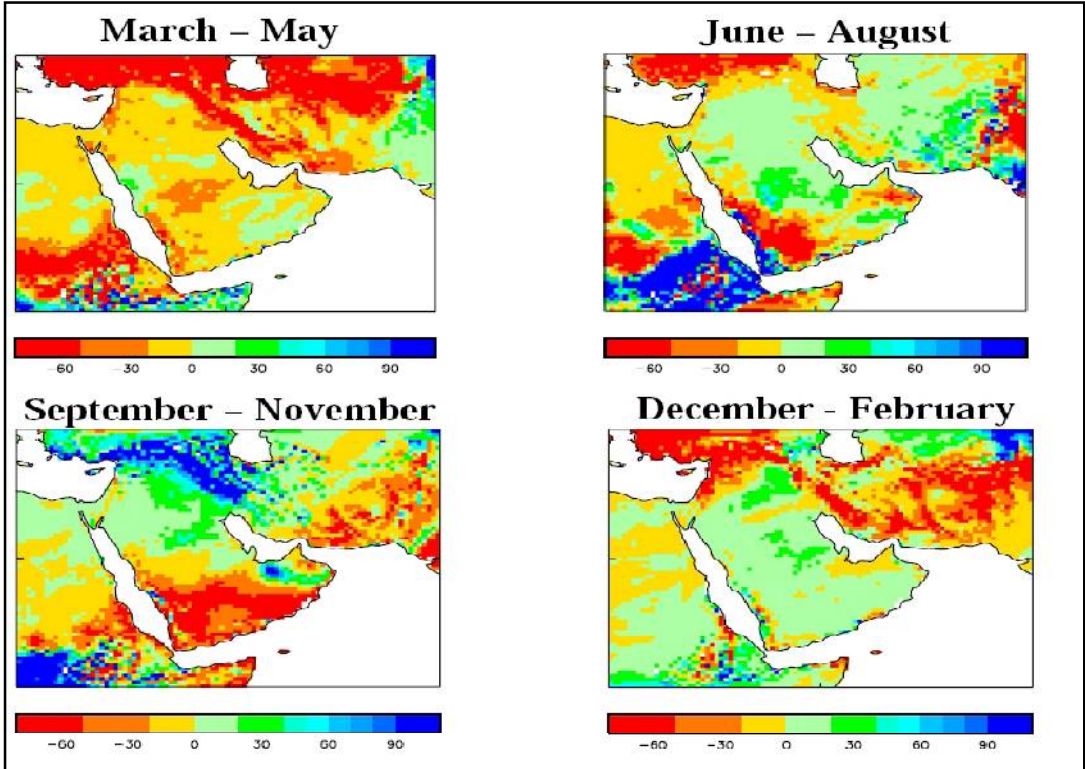


Figure 4: Changes in Regional Climate Model projections of seasonal precipitation (mm/season) across the Gulf region for the 2040s relative to the 1990s (Met Office 2009)

This potential influx of large groups of the population attempting to reach the oil states pose **extra-systemic stress factors to the Gulf region**. As is the case today with Yemen and Iraq, refugees may attempt to identify the weakest spot in the Gulf security umbrella to enter the Peninsula (Leghari, 2007). As in many other regions affected by potential mass movements of migrants, regional decision-makers might respond with a combination of civil and military response measures (Smith, 2007). One could argue that the European Union is in a similar situation today and its citizens live comfortable, stable lives despite the grim fact that substantial numbers of migrants die during their journeys to the EU at its very doorsteps. Thus, there should also be no reason for why a future military response of the GCC states necessarily results in related domestic unrest or economic hardship for the target countries. However, if the numbers of refugees attempting to enter the EU were of higher orders of magnitude, this would put countries under. The EU member states’ solidarity could be put to a test and national fault lines might break open again. In regard to the refugees, it remains uncertain what (violent) scenarios would actually be unimaginable. Sadly, there is no reason why such a scenario should not be applicable to the GCC states.

Lastly, it should be stressed that the projected impacts of climate change will begin to take effect in several decades. By this time, oil and gas rents for the Gulf States are likely to be on the decline either due to resource depletion or due to a post-fossil fuel world energy consumption induced by technological progress and international climate agreements.

## Strategic overseas investments in agro-industry

The concern about dwindling water reserves also has implications for agro-industry in the GCC. This has recently induced Saudi Arabia and the UAE to abandon their ambitious agricultural programmes launched in the 1970s and 1980s. These highly subsidized schemes having resulted in Saudi Arabia being a net wheat exporter in the 1980s have been rendered ecologically undesirable and economically unfeasible. While Saudi Arabia has announced that it will phase out domestic wheat production by 2016 (Woertz, 2009), this does not mean that the country will entirely abandon agro-industry. Instead, this must be seen as an attempt to move away from crops with a relatively high amount of water per unit of value added to higher value crops like fruits and vegetables in combination with upgraded greenhouse and irrigation facilities. This will result in a rising import quota for the staple food of the population.

Thus, GCC states actively seek measures to ensure their water and food security by negotiating strategic partnerships with countries in Africa and Southeast Asia.<sup>10</sup> The most important partners currently are Sudan and Pakistan, followed by numerous south-east Asian (Burma, Cambodia, Indonesia, Laos, Philippines, Thailand and Vietnam), and other countries, such as Turkey, Kazakhstan, Uganda, Ukraine, Georgia, Brazil (GRAIN, 2008).

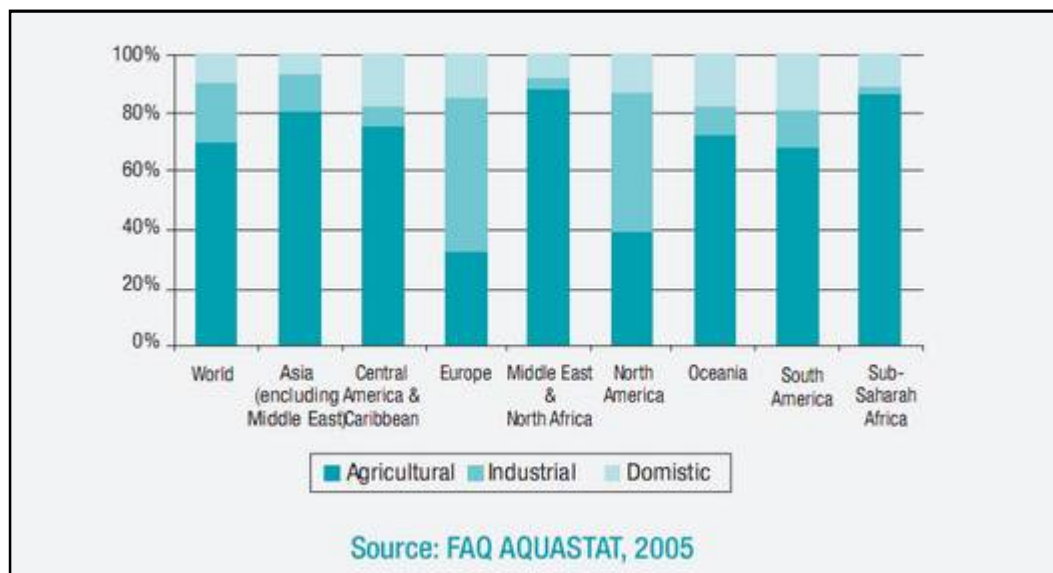


Figure 5: : Water withdrawals by Sector (Raouf, 2009b, p. 301)

One reason for the latest focus on food security is the recent food crisis which has led researchers to stress the future effects of climate change on global food security (Dupont & Thirlwell, 2009). Gulf States like the United Arab Emirates, which import 80 percent of their consumables, were strongly affected by the rise in prices on the world market, particularly since their Dollar-pegged currencies suffered greatly from the simultaneous weakness of the US-American currency. Approximately two thirds of the high GCC inflation is homemade, thus leaving around one third of the inflation to the weakening dollar and the rising commodity prices until summer 2008. Thus, the GCC food bill was inflated from US\$8bn to US\$20bn over the past five years (GRAIN, 2008).

<sup>10</sup> Javier Blas; Andrew England, 'Water Concerns Prompt Saudis to Cease Grain Production,' *Financial Times*, 27 February 2008; *Gulf Times*, 'Saudis Setting Up Fund to Buy Agricultural Land Abroad', 26 August 2008; *Saudi Gazette*, 'Pakistan offers farmland to Saudi Arabia, UAE', 4 September 2008.

Food inflation can turn into a source of major unrest. As witnessed globally in 2008<sup>11</sup>, a rise in basic food prices hits lower-income groups on the margin of subsistence particularly hard pushing many below the absolute poverty line as they have to spend a high proportion of their income on food. This could become a twofold liability for the Gulf States. Whereas the smaller Gulf States could have difficulties to cope with the underprivileged expatriate blue collar workforce forming the majority of these states' inhabitants, the larger Gulf States such as Saudi Arabia where significant pockets of poverty among Saudi nationals exist, could face social unrest from within the society, rendering all measures to quell potential food riots more sensitive.

Before the current crisis, GCC administrations have reacted defensively to price peaks. Using traditional measures such as food subsidies, price controls or wage bonuses to mitigate food price effects on the population. Analysts have viewed these remedies as temporary and potentially even accelerating national inflation. This phase, however, seems to have come to an end with Gulf leaders seemingly pursuing a more pro-active food policy by investing billions of dollars in the agricultural sector of the above-mentioned countries (Cotula & Vermeulen, 2009). While officials have not yet spelled out the guiding principles of this new direction of GCC food policy, related high-level working sessions have been scheduled for October 2008 and January 2009, when an official GCC food policy is to be expected.

In all likelihood, these policies will contain strong incentives for the respective partner countries to fulfil their part of the agreements as well as robust mechanisms in case they fail to do so. From a Gulf development perspective, ensuring food security and freeing scarce water resources for domestic and industrial consumption is a legitimate goal. However, it remains to be seen how mutually beneficial these "food for oil" programmes will turn out to be<sup>12</sup>. Although GCC and ASEAN have stepped up their bilateral relations in most business-related areas<sup>13</sup>, reports of domestic "special forces" that will be deployed in order to guard the farmland of the foreign investors sound particularly worrying.<sup>14</sup>

This trend has been received by international organizations and NGOs with great concern. Jacques Diouf, director of the United Nations Food and Agriculture Organisation (FAO) expressed: "I have no problem in Arabs doing the investment, but land is a political hot potato" (GRAIN, 2008, p. 4).

Some Gulf experts have deemed the investment of substantial funds in Europe and Latin America, which both boast more developed markets with greater safety of FDI, rule of law and world-leading agro-industrial technologies (Woertz, 2009, p. 240), a safer option and a

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<sup>11</sup> In the course of the 2008 global food crisis, food riots were reported from many countries, amongst them Haiti, Bangladesh, and Egypt. In the latter country, more than 200 people were arrested.

[http://blog.foreignpolicy.com/posts/2008/04/07/food\\_riot\\_watch\\_egypt\\_protests\\_spook\\_government](http://blog.foreignpolicy.com/posts/2008/04/07/food_riot_watch_egypt_protests_spook_government) and <http://www.cnn.com/2008/WORLD/americas/04/14/world.food.crisis>, both assessed 10 September, 2009.

<sup>12</sup> The question of how to develop national economies best is an open one and cannot be discussed in this context. It should, however, be noted that the success of Western models of development policy strongly connected to with the export of Western-style good governance models is debatable. A Gulf notion of development assistance might much rather be close to Chinese development concepts. These focus on China's interests on the one and infrastructure development and capital accumulation with no humanitarian strings attached on the other hand. Such models is also defended by Africa specialists closely analyzing the history of African oil policy like Clarke, 2008.

<sup>13</sup> On the first joint meeting of GCC and ASEAN foreign ministers in Bahrain (June 2009), ASEAN General Secretary Suring Pitsuan enthusiastically proclaimed: "You have what we don't have, and we have in plenty of what you don't have, so we need each other". *The Peninsula*, 01 July, 2009.

<sup>14</sup> The article "Saudi in talks to lease Pakistan farmland" notes succinctly: "In April, Pakistan said it would offer foreign investors one million acres of farmland for lease or sale and deploy special security forces to protect it." *Reuters*, 02 September, 2008, <http://in.reuters.com/article/southAsiaNews/idINIndia-42140420090901>, assessed 10 October, 2009.

diversification of investment risks. So far, however, nothing has materialized in that regard. If Gulf States were in fact to prepare large-scale agro-investments in developed countries, they would need to be extremely careful not to get entangled in the web of emotionalized national food security debates in the respective target country. Only this way, incidents like the 2006 Dubai Ports fiasco can be prevented.

### **Divergent trajectories and security paradigms<sup>15</sup>**

The GCC is by no means a monolithic bloc. Recognition of its diverse characteristics will be important in shaping strategies toward climate change and energy security. Although all six states remain reliant on revenues from hydrocarbons, they exhibit changing political economies and different pathways toward political liberalisation and economic diversification (Saif, 2009). Oil rents transformed the political economies of the GCC states and shaped their economic development over the past four decades. However, oil and natural gas reserves are not distributed evenly throughout the Gulf, and pockets of energy poverty and reliance on imported natural gas (primarily from Qatar) have already emerged. Even Abu Dhabi, which itself controls 3.4 percent of global natural gas reserves, faces long-term shortages of gas to meet rapidly-rising domestic consumption demands and is reliant on imported Qatari gas from the Dolphin project, alongside fellow net importers Dubai, Bahrain and Oman (Davidson, 2009).

The intra-regional distinction between energy-rich and energy-poor states will play a critical role in shaping future relations with external actors. At 2006 production rates, Bahrain and Oman, together with non-GCC member Yemen, are projected to exhaust existing oil reserves by 2025. They consequently face imminent transitions to post-oil states. Redistributive states are especially vulnerable to erosion of the ruling bargain and loss of regime legitimacy if mechanisms for co-opting support and depoliticising society begin to break down (Kaldor, Karl, & Said, 2007). In Bahrain, the existence of sectarian fault-lines further complicates state-society relations and sharpens the contestation of access to resources and services (Wright, 2008, p. 9). These countries' situation is thus very different from Qatar, the United Arab Emirates and Kuwait, which have projected reserves-production ratios of 62.8 years, 91.9 years and up to 110 years respectively from 2008.<sup>16</sup>

Saudi Arabia, by virtue of its size and large population, inhabits a third category. The kingdom is the linchpin of the GCC, but ossified state structures and fiercely competitive and overlapping bureaucratic fiefdoms act as a powerful brake on the processes of incremental reform currently underway (Hertog, 2007, p. 555). Existing power structures are less able to use oil rents to respond effectively to societal demands for a more equitable distribution of wealth. Per capita incomes more than halved between 1980 (US\$16,650) and 2000 (US\$7,239) and current levels of welfare redistribution are unsustainable in the longer-term (Dresch, 2005, p. 16). This reflects the scale of the demographic challenges facing the Kingdom as it confronts high population growth and unemployment, alongside a significant youth bulge entering the labour market.<sup>17</sup> The ageing leadership faces the task of addressing

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<sup>15</sup> I am extremely grateful for the collaboration with Dr. Kristian Coates Ulrichsen, LSE Kuwait Research Programme Fellow, and his extensive contributions to the parts on Gulf issues and on Yemen.

<sup>16</sup> Figures for reserve-production ratios are drawn from the BP Statistical Review British Petroleum, 2008, p. 6. Although no figures are given for Kuwait, a similar projection made by Christian Koch of the Gulf Research Centre in 2006 estimated it to be 110 years.

<sup>17</sup> N. Janardhan, 'Economic Diversification and Knowledge Economy in the Gulf', paper presented to the Gulf Studies Conference, University of Exeter, 3 July 2008.



the problems of incomplete modernisation as well as ensuring that change is incremental and progressive rather than sudden, violent and radical.

Moving beyond these differences, a number of underlying problems in all GCC states may increase their vulnerability to external shocks or stresses. These include bloated public and weak private sectors, severe deficiencies in local education systems that hinder the creation of knowledge economies, stratified labour markets and the presence of large numbers of migrant labourers (Coates Ulrichsen, 2009, p. 48). In November 2007, a study by McKinsey laid bare the scale of the challenges posed by mounting unemployment in the GCC as it estimated that the real unemployment rates in Bahrain, Oman and Saudi Arabia exceeded 15percent.<sup>18</sup> Since then, the double impact of falling oil prices and the global financial and economic crisis have jeopardised many of the development plans that formed the core of regional plans for economic diversification and job creation.<sup>19</sup>

These multiple sources of human insecurity may interact with growing resource scarcities and unequal patterns of resource distribution, of which access to water and food security are the most severe. Nevertheless, the systemic challenges posed by dwindling levels of, and unequal access to, resources will not be tackled so easily or effectively.

## **The case of Yemen**

Although not a member of the GCC, Yemen offers a stark example of how climate change can become an external variable that acts as a driver of conflict by placing additional stresses on existing points of weakness. The deteriorating internal situation is a cause and consequence of the contraction of state control and a symptom of the broader crisis of governance. Yemen is one of the poorest countries in the Middle East, with a population of 23 million and a GDP per capita of just US\$2,500 in 2007.<sup>20</sup> Its government faces a combination of armed rebellion, deep-seated socio-economic problems and mass opposition to government policies.<sup>21</sup> The cumulative impact of poor governance and endemic corruption, inadequate economic development, dwindling oil reserves, poverty and unemployment rates of over 40percent, and rapid population growth is a systemic social and economic crisis that has left Yemen perilously close to collapse (Day, 2008, p. 431).

The Yemeni example provides an illustration of how climate change and resource depletion can sharpen tensions and exacerbate conflict over access to scarce resources. Water tables are dropping by as much as six to ten feet each year as annual rains cannot keep up with demand for water and long-term declines in rates of precipitation.<sup>22</sup> However, growing scarcities have not resulted in better regulation of water management. Instead, individuals and groups have rushed to extract as much water as they can in order to translate it into short-term profit, primarily through the growth of qat. This mildly narcotic plant consumes more than two-

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<sup>18</sup> *Bahrain Tribune*, 'GCC Unemployment Rates Skyrocketing', 24 November 2007.

<sup>19</sup> *zawya.com*, 'Questions Surround Implementation of Saudi Arabia's Economic Cities', 14 January 2009; *Saudi Gazette*, 'Gulf markets plunge on disclosure worries', 14 July 2009; *The Peninsula*, 'UAE banks assess Saudi exposure', 17 July 2009; *24/7 Emirates Business*, 'Scrutiny turns to family firms' 17 July 2009.

<sup>20</sup> Figures taken from the CIA World Factbook 2008, <https://www.cia.gov/library/publications/the-world-factbook/geos/ym.html>, accessed 23 July 2009.

<sup>21</sup> Intissar Fakir, 'The ignored causes of Yemeni instability', *Daily Star*, 25 August, 2008.

<sup>22</sup> Borzou Daragahi, 'In Yemen, a Race for Profit is Hastening a Water Crisis,' *Los Angeles Times*, 3 August 2008

thirds of annual water consumption in Yemen and its cultivation causes rapid soil erosion in addition to depleting scarce water reserves.<sup>23</sup>

In December 2008, then-UK Secretary of State for Defence John Hutton visited Bahrain and pointedly listed climate change as one of the new threats to the GCC, along with the proliferation of weapons of mass destruction and the rise of terrorist havens in failed states.<sup>24</sup> Yemen currently meets all of these criteria and its failing political economy will be closely watched in the GCC as a barometer for the transitions to post-oil economies under conditions of possible climate stress. Saudi Arabia and Bahrain will especially monitor any fragmentation along tribal and sectarian lines for indications of possible societal fracturing in their own polities. However, a much greater identification of the threats and challenges posed by climate change and energy insecurity must first take place in every GCC state. There is currently an acute gap in the availability of information and public awareness of climate change in the region, and its mainstreaming into policymaking and implementation is virtually non-existent (Raouf, 2008).<sup>25</sup>

## **A sustainable future for the Gulf?**

The question that seems to pose itself is: Is there a realistic chance for sustainable future economies in the Gulf that will cope with internal and external pressures of climate change without exacerbating existing or future fault-lines? As widely known, definitions of sustainability differ substantially (Neumayer, 2003), consequently, so do proposed strategies to enhance it. Of the many possible dimensions of sustainability, I shall briefly present the countries' current role in the international climate regime, analyse educational and industry initiatives and examine selected renewable energy and energy efficiency programmes states as part of climate change mitigation efforts.

For the Gulf States, sustainability in relation to climate change protection begins with cutting their carbon emissions. As shown in Figure 6 and Figure 7, the GCC countries rank amongst the highest per capita CO<sub>2</sub> emitters in the world. In spite of much criticism towards it, a potential method to fund this reduction would be the UNFCCC's Clean Development Mechanism (CDM). However, Gulf States have so far failed to capitalize on the incentives given in the Kyoto protocol, which they have only ratified as non-Annex I countries recently.<sup>26</sup> So far, only Qatar has submitted a proposal for its al-Shaheen oil field gas recovery and utilization project in 2007.<sup>27</sup> Particularly Saudi Arabia has attempted to stall the current post-Kyoto negotiations mainly quoting existential economic concerns (Depledge, 2008). A stronger cooperative role from the Kingdom – and the region as a whole – would certainly be welcomed by the international community. The chances for the oil states to co-develop the post-Kyoto (and post-Copenhagen) climate regime are important and should not be easily dismissed.

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<sup>23</sup> Fakir, Ignored causes of Yemeni instability.

<sup>24</sup> 'Terrorism, Nuke Arms Spread, Climate Change Key Challenges in Gulf Region,' *Kuwait News Agency*, 14 December 2008.

<sup>25</sup> The recent attacks of Yemeni Houthi insurgents to Saudi military at the heavily fortified Saudi-Yemen barrier is not immediately climate change related. However, it clearly shows future military fault lines on the Peninsula.

'Offensive to continue till intruders retreat: Prince Khaled,' *Saudi Gazette*, 11 November, 2009.

<sup>26</sup> Qatar, the UAE, Saudi Arabia, Oman, Yemen and Kuwait in 2005; Bahrain in 2006. Cf.

[http://unfccc.int/files/kyoto\\_protocol/status\\_of\\_ratification/application/pdf/kp\\_ratification.pdf](http://unfccc.int/files/kyoto_protocol/status_of_ratification/application/pdf/kp_ratification.pdf)

<sup>27</sup> This CDM project is of a large size with a targeted reduction of 2,499,649 metric tonnes CO<sub>2</sub> equivalent per annum <http://cdm.unfccc.int/Projects/DB/DNV-CUK1162979371.3/view>

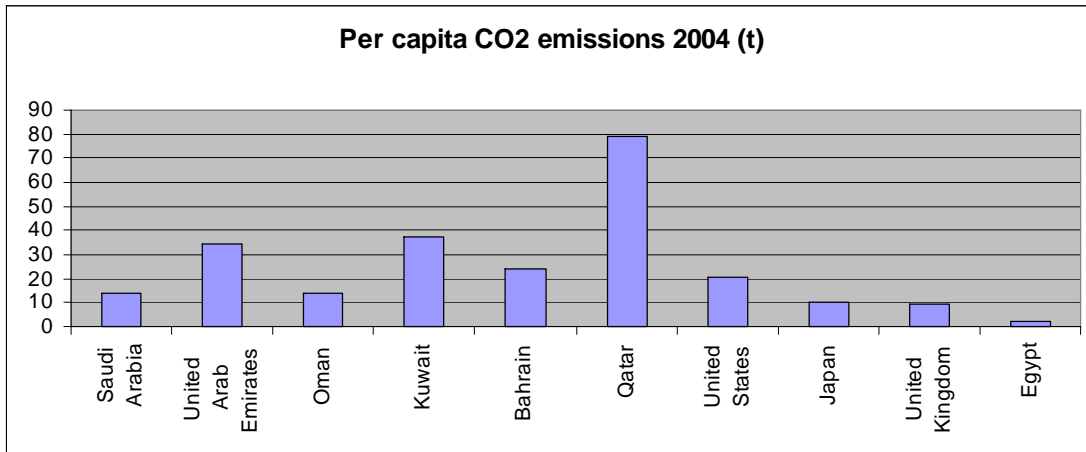


Figure 6: Per capita CO<sub>2</sub> emissions in 2004 (Hertog & Luciani, 2009)

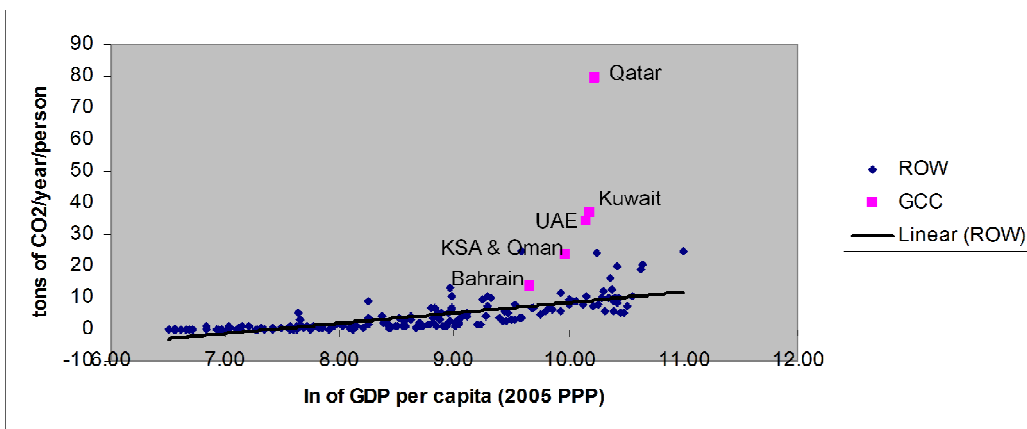


Figure 7: 2004 GCC CO<sub>2</sub> emissions relative to GDP (Hertog & Luciani, 2009)

Numerous initiatives for a more sustainable future of the Gulf States have emerged, the most comprehensive ones being the “future strategies” of Qatar and Oman (Qatar Vision 2030 or Oman Vision 2020).

More specifically, in terms of industry policy, Gulf rulers have not been idle and have announced various plans to diversify their economies. A special focus has been the attempt to rise in the value-chain of domestically produced petrochemical products (Shochat, 2008). In particular, Saudi Arabia has announced a multi-billion-Dollar infrastructure investment programme including the two newly founded industrial cities of Yanbu and Jubail, which are meant to become centres of Saudi Arabia’s trade and upgraded polymer production (Dill, 2009). In the field of research, the newly established King Abdullah University of Science and Technology (KAUST) attempts to set new standards in regional science education. This domestically much-loathed institution promotes coeducation and allows women to drive their vehicles on campus. It is a direct competitor to Qatar’s Education City and various UAE-based attempts to put the country on the map for world-class research and tertiary education.<sup>28</sup> Time will tell whether these institutions will generate sufficient research output and succeed in attracting a critical mass of high-calibre Arab students and faculty to compete with the American Universities in Beirut and Cairo and renowned institutions of higher learning worldwide.<sup>29</sup>

<sup>28</sup> For an in-depth discussion of higher education in the Gulf cf. Davidson & Smith, 2008.

<sup>29</sup> It has been noticeable that Gulf research institutions streamline science and technology research – arts and humanities are not nearly as high on the research funding agenda. Bearing in mind that the majority of modern

In theoretical terms, many Gulf innovation processes can be described by the concept of strategic niche management (Kemp, Schot, & Hoogma, 1998) attempting to induce socio-technological change bottom-up in order to prepare and instigate change on a technological regime level.

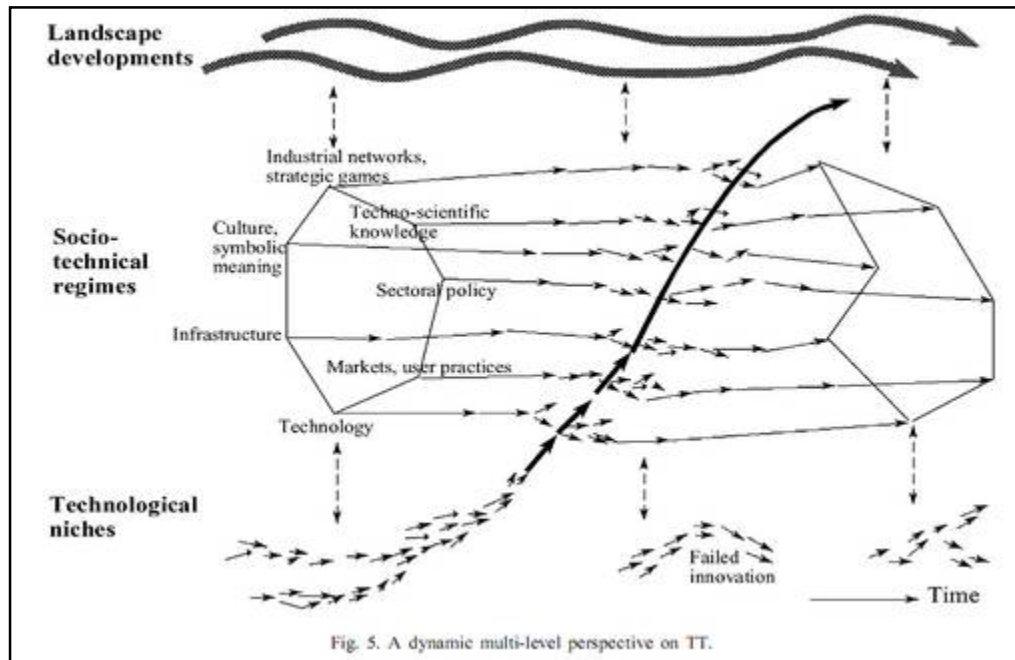


Figure 8: A dynamic multi-level perspective on technology transition (Geels, 2002)

This reading is parallel to Hertog/Luciani’s description that government-sponsored Gulf innovation typically takes place in protected environments, in specifically designed socio-political spaces in which hand-picked, often foreign researchers or executives are to register significant progress. This is often made possible by a strong personal support of a member of the ruling elite allowing the respective undertaking to become an “island of efficiency” (Hertog & Luciani, 2009). Under this special protection, shielded from competition and with a robust financial support, they are able to bypass inefficient administrative procedures and fast-track the development of their respective niche. However, what remains uncertain is whether these “islands of efficiency” have the power to feed their innovative dynamics back into the Gulf socio-technical regimes beyond the protected niches, inform policy processes and develop significant momentum for progress. If not, regrettably, O’Riordan’s dictum could still be valid today. He characterized innovation as the “handmaiden of control of the elites” (O’Riordan, 1981, p. 379), designed to contain rather than to trigger innovation.

A further way to reduce carbon footprints and to boost industrial innovation is the use of renewable energy sources. Oman and Saudi Arabia have recently begun to explore renewable energy power production.<sup>30</sup> In May 2008, the Authority for Electricity Regulation issued a major study on renewable energy in the country assessing technologies, locations and policy instruments suitable for the country (Authority for Electricity Regulation, Oman, 2008). Also, Saudi Aramco and Japan's Showa announced their intention to study the possibility of a solar

Muslim thinkers and politicians has a science education, would be a premature conclusion that this means we will not witness social change triggered by graduates of these institutions.

<sup>30</sup> Cf. *AME Info*, ‘Aramco, Show a to study solar power plan’, 25 June 2009, [www.ameinfo.com/201700.html](http://www.ameinfo.com/201700.html), accessed 19 July 2009.

power business in the Kingdom. Figure 9 gives an overview about ongoing solar activities in selected countries of the Middle East.

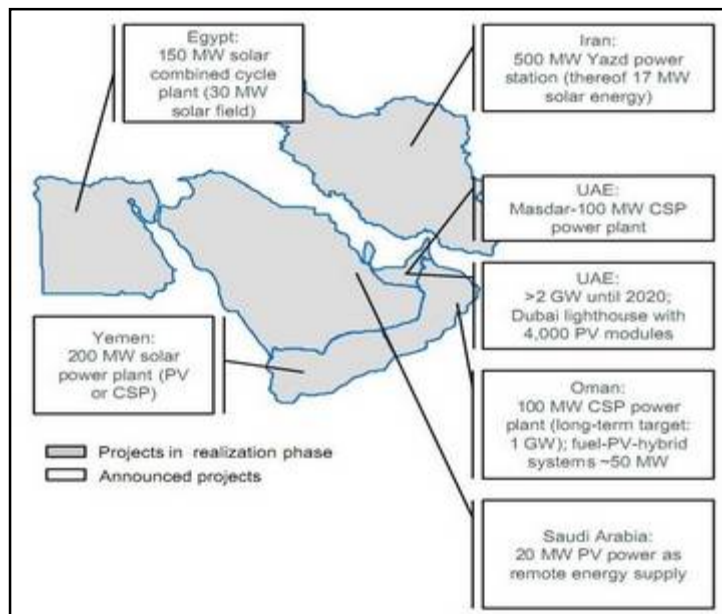


Figure 9: Ongoing solar activities in Middle East (Dill, 2009)

However, the best-known renewable energy initiative in the Gulf is undoubtedly Abu Dhabi's Masdar Initiative. It has been received very warmly by politicians, academics and industrialists, some researchers have even characterized it as a "new paradigm for environmental policy in high-income countries" (O'Brien, Keivan, & Glasson, 2007). Launched in 2008, its blend of industry initiative, research centre (MITE – Masdar Institute of Technology) and architectural novelty (the design of world's first entirely carbon-free city) (Reiche), housing the newly-founded International Renewable Energy Agency IRENA is truly exceptional. The projected overall investment volume for Masdar City is US\$22bn, in addition to US\$15bn for Masdar renewable energy projects, which the state hopes will lead to international joint ventures channelled through the Masdar Initiative, a company established to develop and commercialize clean energy technologies. In cooperation with Credit Suisse and Mubadala (Arabic for "exchange"), one of Abu Dhabi's smaller, dynamic Sovereign Wealth Funds, the Masdar Cleantech Fund also invests overseas: In the East German State of Thuringia, a PV plant has been constructed for US\$230m as part of a total of US\$2bn planned PV investments. At the same time, Masdar has announced a joint-venture with the Finnish wind-turbine producer WinWinD to set up its business in Abu Dhabi through a €120m investment in the company.

However, Masdar could become an example for the domestic containment of innovation rather than its spread. Albeit an initiative of impressive size and dimension, eventually, it could become extremely difficult to lastingly alter path dependencies in the power sector and the very structure of energy production in the UAE and the Gulf States as a whole. Spill over effects to the domestic system of power production are yet to be noted. Moreover, the fact that in line with the country's nuclear White Paper (Government of the United Arab Emirates, 2006), the UAE have commissioned three 1,500 MW nuclear reactors to be built until 2020 (Schneider, Steve, Froggatt, & Doug, 2009, p. 26), Masdar might become an asset for country marketing, yet just a fig leaf for renewable energy policy. The relationship between Masdar and nuclear energy is particularly challenging since the director general of IRENA, housed in

Masdar City, has explicitly excluded any promotion of nuclear power through this agency.<sup>31</sup> This should be seen in the context of the overall rise of civil nuclear programmes in the region (International Institute for Strategic Studies, 2008), (Jackson, 2009).

Regrettably, researchers have voiced criticism towards the Gulf's energy efficiency initiatives, undoubtedly one of the best and easiest form of carbon emissions mitigation. Supersberger et al. are rather pessimistic about the UAE (Supersberger, Tänzler, Kumetat, Fritzsche, Schwürer, & Vallentin, 2009) while others concede that "GCC countries face the quality/price trade-off dilemma in many areas...with the exception of industrial investment, the preference for cost minimization has almost always prevailed" (Hertog & Luciani, 2009).

Another potentially new method of energy-related income generation is Carbon Capture and Storage (CCS). Many regional oil-producers, particularly Saudi Arabia, promote CCS as part of a post-Kyoto climate agreement. Former or nearly depleted oil and gas formations are generally regarded as potential storage facilities, and geological research has found that Omani peridotite is particularly capable of absorbing large quantities of carbon (Kelemen & Matter, 2008). *Petroleum Development Oman*, the country's national oil champion, has expressed interest in an exploratory study.

Petrochemicals, trade, utilities, large-scale energy-related goods in combination with rather uncritical paradigms of growth and market performance – these areas have become the key vehicles of Gulf innovation and sustainability policies. Climate change in the Gulf ought not to have too many direct implications on these businesses. However, these models strongly capitalize on comparative advantages that can only be played out in a globalized economy where carbon intensity in production and transport processes plays but a little role. The Gulf would be truly hit should these product characteristics be priced into goods in the future – as indeed many scholars suggest.

## **Future Research Agendas**

The need for further research can be identified in literally all areas this paper has touched upon. The following is therefore merely a sketch of potential topics and by no means exhaustive.

With regards to **climate change research**: while, largely thanks to the IPCC and the multitude of in-depth studies it uses, the larger, global and continental effects of climate change are rather well-known, the question of downscaling remains to be an issue. In order to inform national policy – particularly in a world region where there are many doubts about the validity of climate change science as a whole – maps and climate model results of all kinds need to be as localized and as exact as possible.<sup>32</sup>

The vulnerability of infrastructure, investments and the man-made islands in the UAE and the smaller Gulf States should serve as an enticing incentive to study local and regional effects of climate change in greater depth. Moreover, the broader influence of climate change, a greater likelihood of extreme weather events and even less annual precipitation should trigger more research about climate changes impacts on Gulf economies, industries, urban centres and development plans as a whole. Innovative research in that field could serve as an excellent

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<sup>31</sup> 'IRENA will not support nuclear energy, says chief,' *Khaleej Times*, 30 July, 2009.

<sup>32</sup> Bearing in mind the probability issues of downscaling, for instance, last IPCC report's work in UN sub-regions and continents is undoubtedly of key importance, for policy-makers of small states at the Lower Gulf, this is simply not sufficient IPCC.

field for all the newly established Gulf institutions of higher learning to put themselves on the map. The financial backing for such projects should not be an issue in this region: next to Gulf governments who could brush up their profiles by Masdar-style climate related projects, an ambitious Sovereign Wealth Fund could use this opportunity to dedicate a minor part of its assets and fund an ambitious research project with a Stern Report-like impact on policies in the region.

A further very relevant field of research is on the potential numbers of climate change related migrants, their legal status and the sketch of an international agreement spelling out the rights of these groups and the duties of neighbouring states. So far, researchers differ greatly about the estimated numbers. As Morton et al. state:

“There are currently several million environmental migrants, and this number will rise to tens of millions within the next 20 years, or hundreds of millions within the next 50 years. These figures, however, are largely the result of ‘educated guesswork’, based on extrapolations from scattered case studies and a few highly speculative academic papers. Credible, evidence-based forecasts are needed to raise awareness, analyse impacts and direct corrective action but work has yet to start on targeted research to develop valid estimates of potential migration and to correlate them with climate models and predictions” (Morton, Boncour, & Laczko, 2008, p. 6)

In relation to the Gulf region, possible patterns of migration and human trafficking into the region in case of large-scale population movement North and East Africa will be of key interest to governments. In case that these movements will actually take place, governments might also quietly ask for designs of military response measures to keep unwanted “intruders” at bay.

Thirdly, a way to integrate the oil-wealthy Gulf States into a global climate deal incentivising them to abandon their obstinate positions and actively using their vast leverage in the region to help the rest of the Arab world agree on a post-Kyoto deal ought to be found.

Since the phenomenon of large-scale international **agricultural investments and land purchases** as parts of national food policy is rather new, research in all fields needs to progress quickly: at first, more needs to be found out on the material level since most details of these memoranda are not open to the general public. Research needs to play its role in enhancing accountability and transparency in global agro-investments ensuring that the mutual benefits investors often quote actually become reality. Apart from this, research about the legal status of these territories in relation to the foreign national investors needs to be conducted: are they part of the national territory? Who defends them in case of conflict? What happens in case of famines in the country in which the investments have been taken? Will these issues of Gulf food security trigger new conflicts because of newly-defined American-style “vital interests”? Agricultural investments also raise pertinent questions about the definition of national sovereignty over its territory since both rather well-defined terms are being deconstructed: what is territoriality in such a case, where is “the” national territory? If this ground has been bought by a foreign national government which sovereignty will have precedence and in which cases?

In the field of research on the **internal security and climate change dynamics in Yemen**, concepts need to be found for an upgrade of the relations between Yemen and the GCC. For a prosperous and secure Arabian Peninsula, the goal can only be to integrate Yemen into a comprehensive regional umbrella. However, GCC states have so far shown little interest in stabilizing this failing state knowing that such an undertaking would be a costly, long-term

commitment that could turn into a Gulf Afghanistan. On the other hand, if the GCC were able to stabilize its south-Eastern neighbour (and the same is true for the Horn of Africa), the organization would greatly enhance its role and reputation in issues of global governance as an organization ready to take up this role and aware of the fact that it is in its very own interest to invest into regional stability in neighbouring countries if not out of humanitarianism, then very much so for its own sake. Research concerned with developing patterns of how to empower the Gulf States to live up to such expectations would be of key relevance.

Finally, in the fields of broader **Gulf sustainability and renewable energy policy**, the key question is to develop strategies to undo barriers of contained innovation and transitions into sustainable Gulf futures. So far, only few policy models adapted to the GCC exist, such as Raouf's concept of economic instruments as an environmental policy tool for the GCC (Raouf, 2007). Many scholars have analyzed energy transition processes in European liberal democracies in order to identify and then remove structural barriers for the promotion of renewable energy in these countries (Reiche, 2004), (Lafferty & Ruud, 2008). In the Gulf States with their hierarchic governance structures, powerful energy ministries and national oil companies, changes of path dependencies might not be brought about with policy instruments developed for the West. In the Gulf, personal appeals to leading figures in the ruling elite might be a more successful starting point than attempting to create pressure via the barely-existing independent public sphere. In any case, the refinement of models of sustainability transitions needs to be streamlined.

On the material level, analysts should look into why the Gulf's SWFs are not more active in promoting regional development of any kind. With their major funds invested in carefully chosen projects they could spearhead technology innovations of a substantial kind and thus help bring about the much-needed changes in the era of climate change.

As a final remark, researchers should be careful not to overlook that they are dealing with the human victims of *collectively inflicted* global climate change. The securitization of the climate change migrants/refugees discourse and the militarization of the considered response measures is a dangerous path that should be avoided at all costs. The author has, at times, taken these possible development trajectories into account because these issues need to be appropriately addressed and dealt with beforehand in order to avoid them in case of emergency. It will be one of the most important tasks for researchers to monitor, and manage national discourses and make sure they do not lose the awareness of this fact.



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