# How a Climate Agreement Creating an International Carbon Market Could Reduce Stranded Asset Risk in GCC Countries and Qatar in Particular

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See footnotes at end of text.

In a stream of publications from a recent research project at Qatar University[1], the economic impact for GCC countries and Qatar in particular, of a worldwide policy aiming at achieving a 2°C global warming has been studied. The method is based on a game theoretical competition model calibrated on a CGEM[2] that describes decarbonization pathways for 15 coalitions of countries up to the end of our current century. In this forum, we discuss the main implications of the simulation results that were obtained and how they support the claim that a climate agreement creating an international carbon market, associated with a strong penetration of negative emissions could reduce stranded asset risks in GCC countries, and Qatar in particular.

## The concepts of Safety Cumulative Emission Budget (SCEB) and Carbon Dioxide Removal (CDR)

There is a consensus among scientists concerning the influence of cumulative emissions of GHGs on the average surface temperature increase at the end of the 21st century. In a nutshell, it is described by the SCEB of 1 trillion tons of carbon, since the beginning of the industrial era (around 1870), which gives a 60% probability of maintaining temperature increase below 2°C. Approximately, half of this safety budget has been already emitted, so it remains around 500 Gt of carbon to be emitted until one reaches a global zero-net emissions (ZNE) regime. In abatement pathways proposed in various reports based on different Integrated assessment models (e.g., MERGE, WHICH, TIAM, EPPA), attainment of Paris agreement goals necessitates reaching a ZNE regime before 2070 and even as early as 2050. For example, in the Sky scenario developed by Shell Corp[3], ZNE is reached by 2070 and is followed by a period of negative-net emissions to compensate for the overshooting of the cumulative emissions budget in the transition period 2020-2070. The CDR[4] technologies of choice to reach this goal are BECCS[5] to obtain negative emissions. In a transition to ZNE, GCC countries are exposed to stranded asset risk, sometimes described as "unburnable oil and gas".

## Stranded asset risks and possible diversification for GCC countries

For several decades, GCC countries have sustained their socio-economic development through a complete reliance on the revenues from oil and natural gas exports. Additionally, the wealth in hydrocarbon endowments have encouraged these resource-rich countries to invest in energy intensive industries[6]. Despite the economic growth achieved from the revenues of exporting hydrocarbons, population growth, energy demand increase, stricter pollution regulations and climate agreement have rendered such economic growth model unsustainable especially in a ZNE regime[7].

Reaching the 2°C objective may imply that a third of oil reserves and half of gas reserves could remain unused[8]. For the Middle East, respectively 38% and 61% of existing oil and natural gas reserves would be stranded. In a recent report, IRENA[9] has assessed the total value of stranded assets across upstream energy, power generation, industry and buildings and found to reach over USD 20 trillion, approximately 4% of global wealth. GCC countries face a paradox: they need to invest in the shorter time in oil and gas infrastructure to manage stranded assets risks but at the same time, they have to finance a new business model outside of oil and gas and to insert GCC countries and Qatar especially in the global economy of energy transition.

Historically energy transitions happened at various speeds from a decade to half a century or more[10]. The pace and scale of the current energy transition is driven by a convergence of political, digital or technological transformations that remains uncertain. As a consequence, demand for fossil fuels and even more for clean fossil fuels remains uncertain. GCC countries may have to develop approaches to manage the potential stranded assets risks. However, only very few projects on CCS including enhanced oil recovery have been implemented, e.g., the Emirates Steel plant in Musaffah or the Saudi Jubail's ethylene plant CCS project. Qatar have postponed the project to capture carbon at Ras Laffan to reinjected it in DuKhan oil field. Significant research on carbon removal technology and especially DAC has yet to be undertaken but GCC countries remain technologically dependent to

European or American research advances. A financing mechanism is needed to launch the deployment of DAC technologies in GCC countries.

Diversification is already at the top of the political agenda for most of the GCC countries although they suffer from deep-rooted reasoning and perceptions that prevent them from acting quickly on sound evidence of the forthcoming stranded asset risks. As such, further diversification of investment from their sovereign fund abroad should target industries resilient to the energy transition or benefiting from this transition[11].

GCC countries as well as all resource rich countries could be more proactive in the political processes associated to transition. As rational actors who look for preserving their country's economic development, they could leverage their association to harness resolutions in their favor. Understanding the future impact of carbon markets, carbon pricing and taxes is becoming a growing part of mainstream conversation in the energy industry when assessing the viability of future projects and the value of assets. The geopolitics of oil are now mixed with the geopolitics of climate change.

## GGC countries and climate policies

The GCC countries are among the major contributors to GHG emissions. The GCC countries rely heavily on large oil and gas industries in addition to their relatively small populations. The Gulf States account for 0.6% of the global population but ironically contributes 2.4% of the global GHG emissions per capita[12]. Carbon emissions from UAE are approximately 55 tons per capita, which is more than double the U.S. per capita footprint of 22 tons per year[13]. Added to this, in 2007 Qatar was singled out by the Human Development Report of the UN for the highest per capita carbon emissions in the world, estimated to be at 79.3 tonnes per capita. Such a bad record in relation to the issue of climate change has pushed many of the GCC countries to change their attitudes towards climate change and energy policies. Over the last few years, many of the GCC governments, including UAE, Qatar, and Saudi Arabia have announced plans to invest in new clean technologies in order to reduce the carbon footprints per capita. The focus is on diversifying energy sources and relying more on renewable energy in addition to designing and implementing sustainable energy systems based on effective energy efficiency measures. At the same time, a wide range of technological possibilities is available for the GCC countries including DAC[14].

The attitude of the GCC countries has dramatically changed in recent years on the issue of climate change and energy policy[15]. Many plans have been put forward in an attempt to reshape and reform energy policies in response to climate change challenges. Qatar for example was the first GCC country to join the World Bank's Global Gas Flaring Reduction project in order to show its commitment to reduce carbon dioxide emissions via controlling gas flaring. The Al-Shaheen project was the first of its kind in the region as a CDM project[16]. The Al-Shaheen oilfield has flared the associated gas since the oilfield began operations in 1994. The project activity will reduce GHG emissions by approximately 2.5 million t$CO_2$ per year and approximately 17 million t$CO_2$ during the initial seven-year crediting period. Further than this sample project, at the R&D level, many Gulf States have created research centres focusing on developing new technologies for reducing $CO_2$ emissions. In Saudi Arabia, the King Abdulaziz City for Science and Technology (KACST) was established as a hub for coordinating the efforts of the Saudi government and research institutes including the Technology Innovation Center on Carbon Capture and Sequestration[17]. In Qatar, the Carbonate and Carbon Storage Research Center (QCCSRC) was instituted[18]. Bahrain's Gulf Petrochemical Industries Company (GPIC) launched the first carbon dioxide recovery plant to reduce carbon dioxide emissions[19]. These efforts by the Gulf States among others indicate that the GCC countries have the determination to leverage new technologies and innovations into reducing the GHG emissions.

## International carbon market, DAC and fair burden sharing may alleviate stranded asset risks in GCC countries and Qatar in particular

Using the extended CGEM derived from GEMINI-E3, one can obtain an evaluation of the possible welfare cost for GCC countries if a worldwide carbon tax were implemented, in the absence of emissions trading and without deployment of CDR technologies. Qatar welfare cost is estimated to be 12.8% of discounted cumulative GDP (dcGDP), when compared to a Business as Usual scenario. This provides a proxy for estimating the stranded asset risk, since most of the cost is due to losses in the terms of trade, i.e., the collapse of the fossil fuel prices generated by a drastic reduction of fossil fuel use in all world regions. Qatar, exporting important volume of LNG and being the least cost producer is a little bit less exposed in the short term, but will be strongly impacted in a global ZNE regime. Natural gas is such an environment is a bridge fuel. The pace of energy transition is then determinant as gas producing countries may need to develop hedging strategies against a long-term downside risk for natural gas to optimize welfare.

One way to compensate energy exporting countries from loss of exporting revenue following deep decarbonization policy is to give allocations of $CO_2$ permits within an international emissions trading market[20]. The numerical simulations support such findings. We have simulated scenarios where an international emission trading system is implemented, DAC and CCS are available, and with an allocation of quotas of $CO_2$ emissions in such a way as to obtain equalization of welfare losses, expressed in percentage of dcGDP, across 15 coalitions of nations. In these simulations, it can be observed that a repartition of the emission rights corresponding to the remaining part of the SCEB among different groups or coalitions of countries, and letting these coalitions compete in supply on an international market of emission permits, could yield a fair burden sharing and alleviate the imbalance of welfare costs associated with a global climate policy.

The two types of CDR activities that one considers are BECCS and DAC with CCS. BECCS is not available in GCC countries, however DAC with CCS has an important development potential in these countries with important $CO_2$ storage capacities. All nations could compete in the introduction and exploitation of CDR technologies, but GCC countries could have a competitive advantage with DAC.

A scenario where CDR technologies are introduced leads to a substantial reduction of the global welfare loss, which is evaluated at 1.5% of dcGDP when no short selling of quotas is permitted and 1.3% of dcGDP when short selling is permitted. Short selling of quotas triggers an overshooting effect, where more emissions are permitted in the short-term, to be compensated by negative net emissions at the end of the planning period. In this scenario, the welfare loss is equalized among the 15 coalitions and represents 1.5% or 1.3% of dcGDP. To achieve that, GCC countries receive 8% or 6% of the SCEB and Qatar in particular receives 1.2% or 1.1%. The main gain for Qatar comes from quotas selling which contributes 9.4% or 10.1% of dcGDP to this decrease. Of course this requires significant $CO_2$ quotas that are equal to approximately 0.9% of the SCEB, while the Qatari inhabitants represent up to now less than 0.04% of the world population and 0.2% of global $CO_2$ emissions. Table-1 summarizes the simulations results, in terms of welfare losses, for the different scenarios studied.

In these scenarios, a factor plays an important role in reducing the stranded asset risks for GCC countries and Qatar in particular. It is the possibility to harness DAC with CCS. The DAC technology is a natural gas driven process[21], with a levelized cost of USD 300 t-1$CO_2$. Qatar as other GCC countries has an important potential for storage of captured $CO_2$. DAC activities generate negative emissions that increase the endowment in emission rights to supply on the carbon market. DAC technologies, coupled with solar driven hydrogen production could also be used to produce clean fossil fuels, with ZNEs. The simulations made with GEMINI-E3 indicate a carbon price (around USD 500t-1$CO_2$ in 2070 and 1100 t-1$CO_2$ in 2100) that would make these technologies highly competitive. In the long-term, Qatar could continue to exploit its natural gas endowment in two sustainable ways, producing clean fossil fuels that could be exported and, even more efficiently, generating new emission rights that will be exported via the carbon market, with a minimum logistical cost. The key role of DAC is confirmed by the results of the simulation with an international trading market without CDR that leads to a loss of 3.7% of dcGDP for all coalitions. In that simulation, the carbon price jumps to USD 4000 t-1$CO_2$ in 2100. It shows that DAC should be viewed as the backstop technology as indicated in the ICEF report[22].

| | | Cost decomposition | | |
|---|---|---|---|---|
| Scenario | Welfare cost in % of dcGDP | Abatement cost in % of dcGDP | Loss in terms of trade in % of dcGDP | Selling of Quotas in % of dcGDP |
| Uniform tax<br>No CDR activities<br>No carbon market | Qatar: 12.8%<br>GCC: 12.7%<br>World: 3.7% | Qatar: 4.2%<br>GCC: 6.2%<br>World: 3.7% | Qatar: 8.7%<br>GCC: 6.4%<br>World: - | -- |
| Uniform tax<br>with CDR activities<br>No carbon market | Qatar: 11.3%<br>GCC: 11.3%<br>World: 1.4% | Qatar: 5.4%<br>GCC: 6.9%<br>World: 1.4% | Qatar: 5.9%<br>GCC: 4.4%<br>World: - | -- |
| International emissions trading<br>No CDR activities<br>No short selling | Qatar: 3.7%<br>GCC: 3.7%<br>World: 3.7% | Qatar: 4.2%<br>GCC: 6.2%<br>World: 3.7% | Qatar: 8.7%<br>GCC: 6.4%<br>World: - | Qatar: 9.1%<br>GCC: 9.0%<br>World: - |
| International emissions trading with CDR activities<br>No short selling | Qatar: 1.5%<br>GCC: 1.5%<br>World: 1.5% | Qatar: 5.0%<br>GCC: 5.9%<br>World: 1.5% | Qatar: 6.0%<br>GCC: 4.5%<br>World: - | Qatar: 9.4%<br>GCC: 8.8%<br>World: - |
| International emissions trading with CDR activities<br>With short selling | Qatar: 1.3%<br>GCC: 1.3%<br>World: 1.3% | Qatar: 5.9%<br>GCC: 7%<br>World: 1.3% | Qatar: 5.4%<br>GCC: 4.1%<br>World: - | Qatar: 10.9%<br>GCC: 9.7%<br>World: - |

*Table 1: Welfare costs of 2°C global warming pathway*

## Conclusion and policy implications

Indeed the simulation results reported in this forum are still preliminary. Considerable uncertainty remains in the projections of key parameters in the CGEM and in the evaluation of potentials for CDR development and storage capacities. In these simulations, however it has been demonstrated that combining DAC, CCS and emission trading, coupled with generous allocations, one may expect a reduction of the welfare cost for GCC countries by limiting the cost of stranded assets. All other countries benefit also of this substantial cost reduction of the global climate policy. The policy implications are the following:

1 GCC countries should develop important R&D programs for DAC with CCS and clean fossil fuel production.
2 GCC countries should be proactive in the establishment of a global emissions-trading system.
3. GCC countries should negotiate a fair share of the remaining SCEB to compensate for the stranded asset risks.
4 The development of an important CDR activity in GCC countries could be a new source of industrial development and valorization of resources.
5 As DAC implementation reduces welfare cost for every country in the world, the cost of proof of

concept at scale close to storage capacities like GCC countries could be shared within an international financing mechanism.

## Footnotes

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