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# **Investigating low-carbon pathways for hydrocarbon-dependent rentier states: Economic transition in Qatar**

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# Investigating low-carbon pathways for hydrocarbon-dependent rentier states: Economic transition in Qatar

## Abstract

For several decades oil-rich ‘hydrocarbon-dependent’ rentier states (countries) have been attempting to reduce their substantial economic reliance on oil, prompted by cyclical global commodity price volatility. Despite the sluggish economic diversification efforts, these states are now confronted with another structural challenge - an accelerating decline in global demand for fossil fuels as a part of climate change mitigation measures. With global economic agencies calling for rapid and unprecedented reductions in greenhouse gas emissions, there is an urgent need for these states to rapidly transition to a low carbon economy while minimizing adverse economic and social consequences. Addressing this imperative, the authors have sought to understand the ‘low-carbon pathways’ that could enable a rapid economic transition, using a two-stage Delphi study which used the hydrocarbon-dependent rentier state of Qatar as a case study. This paper presents the results of the Delphi study regarding the economic transition (part of the broader social change) from hydrocarbon-dependent to a low-carbon economy, investigating the key drivers and barriers and opportunities. The researchers propose a set of recommendations for facilitating economic transition away from the reliance on oil, to encourage the adoption of global and regional transition drivers, and overcome identified transition barriers. The study findings have implications for guiding public and private sector leaders to initiate and accelerate the transition in rentier state economies.

## Keywords

Hydrocarbon-dependent rentier state, Rapid economic transition, Decarbonization, diversification, Delphi study, Qatar

## Highlights

- Hydrocarbon-dependent rentier states are considering low-carbon economic transitions
- This study investigated low-carbon pathways for Qatar as a case study
- The Delphi study revealed clear drivers, barriers and opportunities for a transition
- Low-carbon economic transitions will require significant leadership
- Immediate commencement is required to minimize long-term economic hardship

## Abbreviations

GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GEA	Global Energy Assessment
GHG	Greenhouse gas emissions
GTL	Gas to Liquids
HDRS	Hydrocarbon dependent rentier states
Kboe	Thousand barrels of oil equivalent
LNG	Liquefied Natural Gas

LTS	long-term strategies
MDPS	Ministry of Development Planning and Statistics
NDC	Nationally Determined Contributions
QNB	Qatar National Bank
TM	Transitions Management
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change

## 1. Introduction

Following the Paris Agreement, many countries have committed and renewed their efforts to decarbonize their economies and societies by investing in low carbon transition (UNDP, 2020; World Bank, 2015). Transition pathways for each country vary depending on the geography, context, historical choices and path dependencies (Rosenbloom et al., 2019). Hydrocarbon export revenues (large share of energy-based products compared to the total merchandise exports) play a central role in the economies of more than a dozen energy-exporting countries worldwide, known as rentier states or HDRS (hydrocarbon-dependent rentier states) (Beblawi, 1987). However there has been relatively limited number of studies in relation to transitioning by rentier states (Hamedi, 2014; Osunmuyiwa and Kalfagianni, 2017; Sim, 2020). While some past studies have highlighted the future of hydrocarbon-dependent economies, most of the scenarios were imagined under different climate change scenarios and changing fossil fuel demand (Carbon Tracker, 2021; Chatham House, 2012; Fulop et al., 2017). These studies have failed to highlight path dependencies and some structural barriers that would contribute to accelerate or delay transition by rentier economies.

Responding to this knowledge gap, the authors sought to answer the question, “*What drivers encourage and inhibit hydrocarbon-dependent rentier states undertaking a low-carbon transition as soon as practicable?*”. Mohammed et al., argues that transition in HDRS is two-fold: a) structural changes in economic composition and less dependence on fossil fuels as national revenues or economic transition; b) decarbonizing socio-technical system and infrastructure, and the subsequent socio-cultural and institutional coevolution that would enable smooth transition without adverse consequences. This paper presents the results of the first part of the study – economic transition which investigated the key drivers, barriers and opportunities for transitioning away from a hydrocarbon-dependent economy. A two-stage, Delphi study was conducted, using the rentier State of Qatar as a case study to investigate current and emerging trends that would shape the low carbon pathway for HDRSs. The study builds on the previous research on developing low carbon transition narratives and scenarios (Mohammed, 2021, 2016; Mohammed et al., 2022).

With this in mind, the following discussion provide an overview of the context for investigating HDRS transition journey towards ‘low carbon economies’ in the context of existing research into decarbonizing energy-exporting economies. The rationale for focusing on Qatar as a case study is also presented. The paper begins with a brief description of the construct of a ‘low carbon economy’ and the impact of decarbonization of energy-exporting economies. The research method is then presented, followed by key results that emerged from the Delphi study. The findings are then discussed in relation to next step practicalities for HDRS for transitioning away from an economy dependent on supplying fossil fuels to others.

## 1.1 Literature Review

More than a decade ago, the Cancun Agreement encouraged both, developed and developing countries to create low carbon development strategies or plans in the context of sustainable development (UNFCCC, 2011). Amidst ongoing climate negotiations, the 2007 global economic crisis was broadly viewed as an opportunity to rethink progress and wellbeing and create a safe operating space for humanity by adhering to planetary boundaries (Rockström et al., 2009; Schleussner et al., 2016; UN, 2009; World Bank, 2010).

Many developed and developing countries are embracing the idea of a low carbon economy (and its variants; green economy, green growth) (UNEP, 2020), and the Paris Agreement has fueled this interest, with examples of nationwide transition strategies as summarised in **Table 1**. Some of the salient features include, long-term vision, pathways, and policies to achieve a low carbon transition, and some countries include economic recovery and job creation as a part of the strategy.

**Table 1.** Example nationwide transition strategies

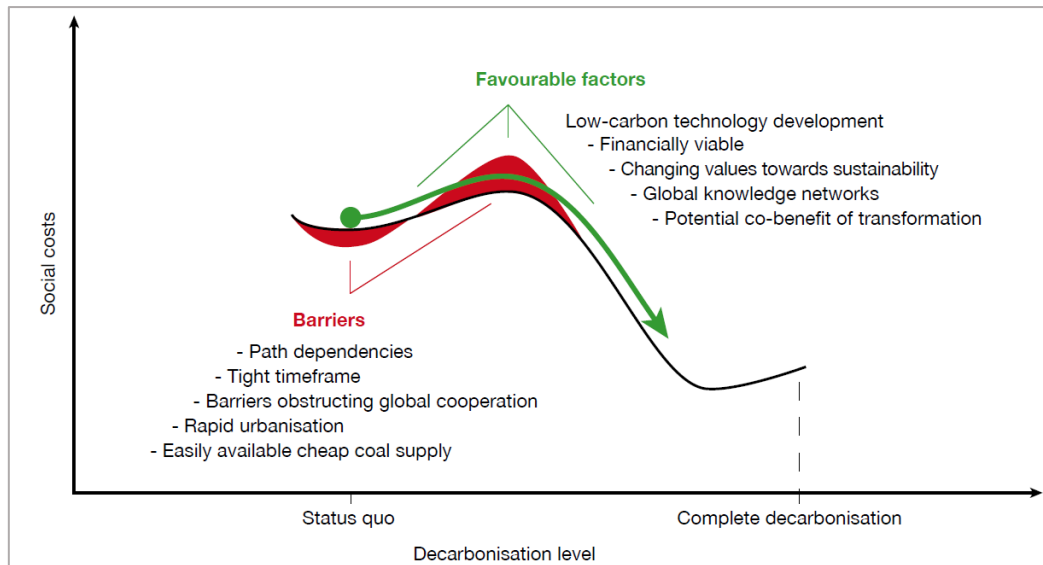
Country/Region	Transition Strategy
United Kingdom	Zero Carbon Britain 2030: A New Energy Strategy (HM Government, 2009)
European Union	European Commission Road: Roadmap 2050 (EU, 2011)
Australia	Low Carbon Growth Plan for Australia (ClimateWorks, 2010)
South Korea	National Strategy for Low Carbon, Green Growth (Government of South Korea, 2010)
India	National Action Plan on Climate Change, Interim Report on Low Carbon Growth (Government of India, 2008)
China	12th Five-Year Plan and Climate Change White Paper (Government of China, 2011)

Such a societal and technical transition – often referred to as a socio-technical transition – involves profound changes to existing production and consumption process, infrastructure, monitoring and regulation, lifestyle, and behaviour (Markard et al., 2012). It refers to large-scale transformation within a society or subsets of it, which fundamentally transforms the structure of the societal system. Transitions require structural and institutional changes and new socio-political realities, where local specificities such as resources (financial, human and geographical) and social acceptance and complexities matter (World Bank, 2015). How each country responds to these different factors depends on the state's financial and institutional capacity (Geels et al., 2017; Kern and Markard, 2016; Leach et al., 2012; Smith et al., 2005).

Major characteristics of low-carbon economic transitions include (Kainuma et al., 2013; Reilly, 2013; Skea and Nishioka, 2008):

1. The key role of future visioning, scenarios, and roadmaps, as well as adaptive governance.
2. The requirement for pluralistic pathways that capture changing circumstances.
3. Substantial timeframes spanning a generation or more, to overcome lock-ins of existing physical infrastructure and path-dependency of institutions and norms.
4. Coherent, long-term policy approaches and long-term funding to invest in the process.

Transitions also involve interactions between policy-power-politics, technology-economics-business-markets, and culture-norms-ethics-public opinion (Geels, 2002; Geels and Schot, 2007; WBGU, 2011). **Figure 1** provides a topography of the transformation and the nature of obstacles and barriers in the transition process. A concerted effort is required to overcome obstacles by internalizing costs and removing subsidies and incentives that pose barriers to transition.



**Figure 1.** Topography of the transformation (WBGU, 2011)

## 1.2 Hydrocarbon-dependent economies and transition challenges

The growth in fossil fuel demand has brought significant wealth to both, national economies and multinational corporations that export fossil fuels. Countries that are dependent on single commodities are frequently vulnerable to commodity shocks and low oil prices and many of these countries struggle to translate the riches of the resources into poverty reduction and sustainable development outcomes (Bleaney and Halland, 2014). Oil shocks have differential impacts on oil-exporting and oil-importing countries. The former with higher export concentration and less diversified economies are worst affected (Kilian et al., 2009). Economic performances of hydrocarbon-dependent economies (e.g., Algeria, Angola, Azerbaijan, Libya, Nigeria and Venezuela) have been volatile and despite their comparative advantage (cheaper energy sources) does not guarantee economic growth (Gozgor and Paramati, 2022).

To offset revenue volatility, governments in HDRS have tried to diversify revenue streams by developing a service sector such as real estate and construction, tourism and finance. The results of economic diversification efforts have been mixed across countries. Previous attempts to diversify the economy have been challenging and faced fiscal challenges during low-oil prices. There is a sizeable literature for understanding the poor economic performance and weak economic diversification efforts in hydrocarbon dependent economies. Corruption, weak governance, institutional instability, conflict/war, lack of skilled workforce and an authoritarian political structure are some of the factors contributing to weak economic diversification (Apergis and Payne, 2014; Bhattacharyya and Hodler, 2014; Matallah, 2022; Rafiq et al., 2016).

HDRSs face unique challenges and tensions in balancing near-term economic development and wealth accumulation as these countries are not only vulnerable to physical climate risks, but also global energy transition risks (Chatham House, 2012; Fulop et al., 2017; IEA, 2020a, 2018). Wealthier HDRSs such as Qatar, United Arab Emirates and Brunei, are considered to have time in the order of the next couple of decades, and options to restructure their carbon-intensive economic activities and fiscal regimes. However, given the high public spending by

many of the wealthier states (primarily in the GCC), the International Monetary Fund (IMF) has estimated, “*the region’s aggregate net financial wealth, estimated at \$2 trillion at present, would turn negative by 2034 as the region becomes a net borrower*” (IMF, 2020) unless strong fiscal measures are undertaken. Similarly in Latin America and the Caribbean, it is estimated that revenues will fall from \$2.7-6.8 trillion to \$1.3-2.6 trillion (Solano-Rodriguez et al., 2019).

Due to the rapid decline in energy demand because of the Covid lockdown and closure of industries, the oil prices plunged to near zero, and for a brief period the prices went negative (IEA, 2020b). The pandemic has also been cited as an opportunity for breaking with the past and imagining anew (Polychroniou, 2020; Roy, 2020), including state-led (i.e., country level) leadership to boost economies through strong fiscal packages that prioritize substantial emissions reductions (Hepburn et al., 2020). Countries across the world have implemented a wide array of measures for containing the immediate public health impact and economic slowdown and mid-term policy measures for economic recovery and restoring confidence in the market. There has been a mixed response regarding what the post-Covid recovery would look like. For some, the pandemic will alter the ongoing trend of decarbonization because policymakers will prioritize urgent healthcare and implement recovery packages to improve economy and create jobs (Goodell, 2020; Jiang et al., 2021). Whereas others are optimistic, and the recovery packages of most of the countries are emphasizing the role of renewables and investing in a green economy (Hepburn et al., 2020; Kuzemko et al., 2020). This would gather pace and accelerate the transition away from fossil fuels. Studies suggest that energy diversification has mixed impact on economic development. There is a negative impact on high-income countries for the short term and in the case of low-income economies, the negative impacts persist longer. Ultimately careful measures are warranted while diversifying the energy mix and resources (Gozgor and Paramati, 2022).

A considerable number of studies have examined the complexity and implications of low carbon transition in service-based economies in both, developed and developing countries (Berkhout et al., 2009, p.; Geels, 2012; Geels et al., 2017, p.; WBGU, 2011). Many transition studies have been sectoral such as food, energy, transport to a broader societal perspective (Ashina et al., 2012; Haas, 2019; Köhler et al., 2020). Scholarly interest in understanding transitioning to a ‘low carbon’ or ‘carbon neutral’ or ‘Net Zero’ is growing in both developed and developing countries, more so in Western Europe and North America (Bistline, 2021; Geroe, 2022; Ji et al., 2022; Shahbaz et al., 2020). Very little has been studied about the transition in the Persian/Arabian Gulf region and the following section justifies the reason for taking Qatar a case study to examine how these it will evolve and adapt to global changes such as climate change and energy decarbonization.

### 1.3 Rationale for Qatar as a case study

There are a number of reasons for choosing Qatar as a case study. First, it is one of the rentier states with excessive dependence on fossil fuels to sustain its economy and welfare. Second, though it has a small population and economic size, but holds one-fourth of global LNG market and has the third largest natural gas reserves. Third, rapid economic growth in a relatively short time making it one of the wealthiest countries, with the sovereign wealth fund exceeding \$300 billion. Fourth, unlike other fossil fuels, the demand for natural gas is expected to remain strong at least until 2040 as the emission intensity is relatively lower compared to coal and oil. Examining how this strong growth in natural gas demand will pose barriers to transition and also how the state is vulnerable to global decarbonization is of interest to researchers and



policymakers. Finally, the first author's familiarity with the country and ability to network with key policy and strategic experts in Qatar was also a key deciding factor.

Since the 1970s, oil exploration and exports has become one of the key sectors of the Qatari economic landscape. Two decades after the discovery of massive natural gas reserves, new technological developments have made LNG production and transportation economically and technically feasible. The growing gas demand has presented itself as an opportunity to convert natural gas into economic fortunes. Qatar currently supplies more than one-fifth (22% or 77.8 million tonnes) of LNG to the global market, positioning itself as a leading energy supplier, exporting 80% of its production (IGU, 2020). At the current natural gas production rate, reserves will last for another 138 years (BP, 2021). Owing to its small population (~2.7 million) makes Qatar having the highest oil and gas reserves per capita of 62.8 thousand barrels of oil equivalent (kboe) (QNB, 2018).

Besides gas, Qatar produces and exports crude oil, condensates, natural gas liquids and key refinery products. Due to cheap energy, Qatar has capitalized to monetize by producing energy-intensive downstream products ranging from petrochemicals, fertilizers, steel and aluminum. Cumulatively, the energy sector has contributed over half of the national GDP, more than two-thirds of national revenues, and 96% of export revenues between 2000 and 2019 (QCB, 2020). After years of moratorium, Qatar plans to expand its LNG production to 126 million tonnes per annum by 2026 from the 77 million tonnes in 2017, which would comprise one-third of the global LNG supply (QP, 2020). Qatari government maintains a 100% stake in oil and gas production through its national oil company – Qatar Energy, with assets exceeding \$125 billion in 2019 (QP, 2020).

The windfall profits from high oil prices and rising global energy demand throughout the last two decades (with a periodic drop in prices), Qatar's GDP grew to \$177 billion in 2019 from \$35 billion in 2000 (QCB, 2020). This rapid hydrocarbon wealth has made Qatar one of the richest countries in terms of per capita income, around \$92,479 in 2019 (QCB, 2020). The energy-led economic growth in the country has led to major infrastructural development, with spending of more than half a trillion dollars in the last two decades and investments in economic sectors such as tourism, finance, and other service industries.

Exposure to volatile commodity prices and structural dependence on oil and gas rents, the Qatar government has been diversifying its revenue streams by creating knowledge-based industries and a service-based economy. Some of these modest economic reforms have altered the GDP composition in the last two decades. The non-oil GDP has increased from 40 to 66% between 2000 and 2019 (QCB, 2020). Despite the change in GDP composition, Qatar's reliance on hydrocarbon revenues remains strong, and other sectors such as construction, and real estate are dependent on oil prices.

## **2. Research method**

This study adopted a qualitative approach using the Delphi method (Rowe and Wright, 1999) to elicit consensus on global, regional and domestic drivers, barriers and opportunities for transitioning to a low carbon economy and to identify potential transition pathways. This has included using a combination of 'classical' and 'policy' Delphi as these are pertinent in addressing complex subjects that transcend different disciplinary boundaries (economic, political, technological, social and environmental) such as low carbon transition and concurrently arriving at consensus on a wide range of issues related to transition (Turoff, 1970). Ethics approval was obtained for the study (Queensland University of Technology, Reference Number 1800000448).



Delphi study suited this research well for understanding emerging topics like low carbon transition given the fact that knowledge is restricted to a small pool of experts, it is highly contextual and lacking adequate 'historical or technical data and requiring human judgmental input'. Given the autocratic nature of the political system in Qatar, experts are reluctant to share views and opinions publicly to avoid backlash and the Delphi study provided a convincing methodological tool. Delphi technique assures anonymity and allows experts to exchange opinions, encourages a creative and unrestrained thinking process and avoids social, personal and political conflicts and limits potential biases and bandwagon effects. Delphi technique proved to be useful in carrying out a rigorous inquiry compared to traditional surveys in dealing with complex topics.

The research applied the Delphi method considering a range of 'scenarios' that drew from previous sustainability transition studies exploring topics such as transport, agriculture, renewable energy and forestry, and spanned city-wide, national, regional and global scale questions (Czaplicka et al., 2009; de Jesus et al., 2019; "EurEnDel Scenarios," 2007; Hurmekoski et al., 2019; Rikkonen et al., 2019; Wilenius and Tirkkonen, 1997). Within the energy resources sector, Al-Saleh (2009) used the Delphi method to investigate different renewable energy scenarios for oil-rich Saudi Arabia (Al-Saleh, 2009). In *Delphi Energy Future 2040*, the authors sought to understand the key drivers, actors and dynamics of an energy transition by 2040 (BDEW, 2015), synthesizing the knowledge contribution of over 350 energy experts from 40 countries, into priorities and recommendations.

## 2.1 Delphi study design

The Delphi study design comprised two categories: Category 1 *Low carbon economy* which investigated the key trends, challenges, and barriers in transitioning from a hydrocarbon to a low carbon economy in Qatar; and Category 2 *Low emission pathway* which investigated the key opportunities, challenges, and barriers for achieving a low emission pathway for Qatar. This paper presents the findings from Category 1. Category 2 findings are presented in a separate paper by the same authors, which also synthesizes the findings from both categories.

The Delphi study design was formulated to investigate further into the likelihood and consequences of four scenarios created during a workshop previously undertaken by the first author, considering global and regional drivers for low carbon transition, geopolitics, and domestic issues and policies in relation to Qatar (Mohammed et al., 2022). A full set of survey questions are provided in **Supplementary Information 1**.

Two rounds of the Delphi study was considered sufficient as the process achieved consensus on key items:

- In Round 1, the questionnaire comprised of 14 open-ended questions regarding: 1) global factors shaping the Country's energy transition; 2) risks of economic reliance on hydrocarbon revenues; 3) long-term economic and political implications and risks; and 4) policy and governance frameworks influencing the transition. Once the participants completed the first round, these results informed the development of the second round of questioning.
- In Round 2, the questionnaire comprised of closed questions, synthesised into themes for respondents to consider the degree of their agreement with statements made. The same panel of experts were asked to review the items summarized in the second round. Questions regarding the impacts of proposed solutions were based on a five-point Likert scale (from

Strongly Agree to Strongly Disagree; Highly likely to Highly unlikely; Very high impact to No impact). An open dialogue box was also included at the end in case participants wished to include additional information. As a result of the increasing consensus on most of the issues, it was decided to conclude after the second round.

Before launching the survey, a pilot questionnaire was prepared and disseminated to four senior professionals to review the content and the clarity. Experts for the Delphi study were contacted before the sending out the questionnaire to gauge their interest, motivation and willingness to participate and also to minimize dropouts. These experts are well known in the field of energy transition, the Gulf and energy politics. The survey was translated into Arabic by a professional translator for ease of responding and was reviewed by an independent bilingual expert to ensure the accuracy of the translation. The finalised questionnaire was administered using KeySurvey®.

## 2.2 Expert Selection

Past Delphi studies suggest a panel of 10-30 experts are ideal (Hasson et al., 2000; Hsu and Sandford, 2007), noting the expected response rate of around 30% (Gordon, 1994) and with no expectation for the sample to be representative or statistically significant. A diversity of local, regional and international panelists was selected based on their subject expertise and cognizance of regional politics and the domestic political system. Considerations were also made regarding the range of organization types represented (government, industry, academia) and sectors (energy/environment, oil and gas).

Experts were identified based on their presence in relevant publications, policy and corporate communities, and snowballing referencing by other experts. This included the ability to provide perspectives regarding the Qatar National Vision 2030 document (GSDP, 2008). Among the 40 experts invited to participate, 16 participated in the study (answering more than 90% of the questionnaire) and 13 (31%) in the first and second rounds respectively. Four participants partially completed the survey, and their responses were analyzed, but were not considered as part of the total number of expert participants.

All of the Delphi participants occupied significant positions within their own organizations, comprising senior members of government (11), private/ other (3) and academics (2). The number of participants living in Qatar (12) exceeded regional and international participants (4), and the number of non-Qatari participants (14) dominated the panel, with two Qataris. Participants ranged from various sectors, including energy and environment (6), economy and finance (7), oil and natural gas (2), politics and international relations (1). Participants' experience in the sector ranged from more than 20 years (11) to 11-20 years (4) and 5-10 years (1).

## 2.3 Data Analysis

Measuring consensus is one of the important components of the Delphi technique. However, there is no agreement in the literature on arriving at a consensus on Delphi responses (Birko et al., 2015; Hsu and Sandford, 2007). As the number of experts in the Delphi study was small and targeted, statistically significant tests were not conducted. For Round 1 Analysis (open-ended and qualitative survey), the questions were analyzed using NVivo software using a content analysis approach to identify major themes. The responses were coded into minor themes, and later these themes were grouped into broader categories. Finally, these categories were organized into themes to provide insight into broader areas.

For Round 2 Analysis (closed questions), Cronbach's alpha test was used to test the reliability and consistency of the data (Taber, 2018). Likert scale ratings were uploaded to SPSS and descriptive analyses such as frequencies, output percentages and statistical tests such as mean, standard deviation of each element and the whole survey, and tests for interquartile range (IQR) for each item were performed. The interquartile range (IQR) and collapsed categories were used to measure consensus (von der Gracht, 2012). According to De Vet, IQR represents the distance between the 25<sup>th</sup> and 75<sup>th</sup> percentile values in opinions, with smaller IQR indicating a larger consensus (De Vet et al., 2005) . If the IQR was 1 or less than 1 then consensus was deemed to be achieved. If the IQR was between 1 and 2, moderate consensus was assumed, and if it was more than 2, then no consensus had been achieved (Rayens and Hahn, 2016; von der Gracht, 2012). In the present study, for each item ratings were calculated to assess the extent to which respondents agree to an item.

### **3. Results: Case study findings**

Findings are presented for Qatar as the case study country of interest, considering the likelihood of the low-carbon transition scenarios, followed by drivers, barriers, opportunities and potential solutions. Statistical results of all the statements (Round 2) are provided in tables given below. Along with the statistical results (using interquartile range as a form of measuring consensus), qualitative comments from experts are included to support or negate the arguments.

#### **3.1 Perspectives on low-carbon economic transition scenarios**

When presented with the four low-carbon economic transition scenarios (Q8, in supplementary information), nearly half (40%) of the 16 participants believed that business as usual is likely to be the case, where the country will continue to accelerate natural gas extraction, and economic diversification will be limited, and reforms would be marginal and limited.

Some participants perceived an optimistic future about Qatar, where the country will diversify rapidly and invest in different low-carbon economic sectors and progressive labor and investment reforms will allow the country to tap into skilled professionals with foreign investment to create a clean-tech hub. Some participants believed that it is likely to be a combination of scenarios 1 and 2 wherein the public sector and welfare provisions will decline, reflecting on previously experienced episodes of cost overrun for military spending and past national expenditures.

#### **3.2 Perspectives on drivers for transitioning (Round 2)**

Delphi results are presented in Table 2, with participant consensus about 12 statements regarding potential drivers for Qatar to transition to a low-carbon economy. These are ordered in descending order of consensus, accompanied by the computed median, interquartile range (IQR) and the level of consensus (strong or moderate).

Table 2 Delphi results regarding consensus on key statements about drivers

<b>Round 2 Statements: Drivers for Transitioning</b>	<b>Median</b>	<b>IQR</b>	<b>Consensus*</b>
▪ Steady falling of natural gas prices	2.5	1	SC
▪ Growing competition from countries like Australia, USA, and others	2	1	SC
▪ Growing demand for natural gas in major economies to mitigate air pollution and rising energy demand	2	1	SC
▪ Disruption in maritime routes (Strait of Hormuz)	2	1	SC
▪ Expansion of LNG facilities in Qatar to maintain the LNG dominance	2	0.75	SC
▪ New discovery of gas reserves in several countries	2	0.75	SC
▪ Reliable and flexible suppliers in the market (long-term and spot-trade agreements)	1.5	1	SC
▪ Stronger climate agreements and policies in all major economies and across Europe	1	1	SC
▪ Comfortable profit margin because of the low production cost of natural gas products (LNG/GTL, etc.) in Qatar	1	1	SC
▪ Growing adoption of renewables in emerging economies and developed countries	1	2	MC
▪ Shift from long-term to short-term supply contracts	2	1.5	MC
▪ War and conflict in the Arabian/Persian Gulf will halt the supply of natural gas to the world	2	1	MC

\* SC: Strong Consensus; MC: Moderate Consensus

The top seven drivers are presented in Table 3 in relation to the impact timeframes perceived by participants from immediate to long-term. Participants' perspectives are summarized below, highlighting where consensus and/or variability was observed for each.

Table 3 Perceived drivers of a low-carbon economic transition\*

<b>Driver</b>	<b>Immediate</b>	<b>Medium Term</b>	<b>Long Term</b>
▪ Aggressive climate measures			
▪ Renewable energy, electric vehicles			
▪ Growing competition			
▪ Rising natural gas demand			
▪ Price volatility			
▪ Geopolitics			

\* Strong consensus: Thick line; Moderate consensus: Thin line.

### 3.3 Aggressive climate measures

There was moderate consensus (42%) that growing anthropogenic emissions and calls for aggressive climate ambition would reduce the demand for fossil fuels: for coal and oil in the short- to medium- term; and for natural gas in the long term. Seventeen per cent of the participants perceived that climate policies are not an immediate and direct threat because natural gas is considered as a 'clean fossil fuel' and helps to achieve the Paris Agreement (UNFCCC, 2015) targets. Sixty seven per cent of participants highlighted the likelihood that major energy consumers in developing countries such as China and India will replace coal with

gas to address the dual challenges of energy poverty and environmental sustainability (i.e., mitigating air pollution and carbon dioxide emissions).

### 3.4 Renewable energy and electric vehicles

There was strong consensus (75% of participants) that falling prices of renewable energy and disruptive innovations in battery technologies will have a profound impact on the global natural gas demand, in the medium-to-long term. Seventen per cent of participants highlighted the growing adoption of electric cars, *“the progression towards electric cars will take on greater momentum.”* One participant noted that crude oil exports constitute a significant economic value to the national GDP and export revenues, which will be hard hit because of the increasing uptake of electric cars in developed countries. Another participant emphasized the uncertainty of new technologies and the intermittent supply of renewable energy, which is a primary barrier to full-scale adoption.

### 3.5 Growing competition

There was strong consensus (75% of participants) that new entrants to the global natural gas market will reduce the country’s market share and eventually affect long-term revenues. This included commentary about increasing natural gas production in energy-consuming countries or finding secure suppliers that are geographically closer (Japan and Australia, for instance). Three participants suggested the shale gas revolution in the United States of America will affect all the Middle East energy producers, including Qatar. They commented that existing producers and the discovery of natural gas in several countries could pose a direct threat to Qatar’s natural gas market share. One participant highlighted growing liquid natural gas output.

### 3.6 Rising natural gas demand

There was strong consensus (92% of participants) that there is a strong demand for natural gas in emerging economies to meet rising population needs and strong economic growth. One participant noted that during the early days of Qatar’s LNG dominance, buyers secured their supply through premium pricing. For instance, the LNG price/MMBtu in 2012 was over \$16 dollars, and it nearly halved in mid-2017 (prices are based on Japan import values). One participant considered, *“the single largest factor that would help restore, sustain, and help boost Qatar economy is - global hunger for hydrocarbons”*. Another participant referred to the International Energy Agency reports of robust growth in natural gas even in carbon-constrained scenarios, noting that many countries are choosing gas-fired power generation over coal-fired because of declining natural gas prices and cost-effectiveness. Many participants referred a common state-level appreciation of natural gas as a transition fuel. One participant cited China’s coal-to-gas policy to mitigate air pollution in populous cities, reflecting that many other countries will follow suit, such as India, Bangladesh, Pakistan, and South Korea.

### 3.7 Price volatility

There was a varying consensus about price volatility driving efforts towards a low carbon economy. Fifty percent of participants predicted a low price environment for liquified natural gas in the coming years because of the supply glut in the market and growing alternatives. One participant commented, *“Price of gas may decline as alternative fuels become more economic. rising costs of production at danger as is the need to maintain a budget surplus.”* Another participant reflected, *“emergence of significant oil and gas deposits in major market areas predominantly in the Far East such as Japan, China, Korea, India etc. that would potentially drive down prices to level seen 3 or 4 years ago. US shale gas, Russian gas, development of Iran’s untapped resources all will play a part in the gas pricing mechanism in years to come.”* Another participant mentioned the negative impact of shifting from long-term supply contracts to spot pricing. In addition, one participant noted that as more liquid natural gas supply comes

into the market, Qatar's export revenue will decrease despite maintaining the same export volumes, reducing the budget surplus in the longer term.

However, all participants commented on Qatar's distinct advantages such as its massive natural gas reserves, and its status as one of the low-cost natural gas producers in the world, which would squeeze out higher-cost producers (possibly Australia and USA). Participants stressed that any rational actor would not abandon such valuable resources, especially when the production cost is one of the lowest in the world.

### 3.8 Geopolitics

There was varying consensus (45 per cent of participants in Round 2) that regional geopolitics, instability and rising tension would reduce the natural gas supply from Qatar, effective immediately and for the longer term. This included commentary that the region is currently volatile, mired with instability, civil war and regional conflict (direct or indirect). One participant commented that the narrow Strait of Hormuz in the Persian Gulf is the most important chokepoint for the world's oil supply. Although, in Round 1, one participant cited previous threats to close the Strait of Hormuz yielding no disruption in the supply of oil and gas from the region.

### 3.9 Perspectives on barriers to transitioning

Nearly all participants perceived that Qatar faces significant structural economic, financial, social and environmental challenges and barriers in transitioning to a low carbon economy. Actors supported a dominant regime because of direct economic benefits and persistence of institutions, i.e. 'rules of the game' The respondents wrote about a diverse set of challenges and barriers in Round 1, which were itemized for consideration in Round 2, as summarized in Table 4.



Table 4 Delphi results regarding consensus on key statements about barriers and transition risks

Round 2 Statements: Barriers and transition risks	Median	IQR	Consensus
▪ Unable to compete with international players (competitive disadvantage)	2	1	SC
▪ Lack of citizens' interest in focusing on innovation (entitlement to public sector jobs and focus on trading businesses)	2	1	SC
▪ Lack of incentives and ownership for expatriates resulting in stifling of research and innovation in low carbon technologies and services	2	1	SC
▪ Vested interest of current actors (business/bureaucrats) in maintaining the status quo	2	1	SC
▪ Reduced government expenditures in infrastructure projects	2	1	SC
▪ Growing unemployment among the youth	2	1	SC
▪ Afraid of making risky moves – focus on business-as-usual practices	2	0.75	SC
▪ Lack of skilled population in key sectors	2	1.5	MC
▪ Lack of political commitment and will at the highest level	3.5	1.75	MC
▪ Increasing austerity measures (reduction in social welfare schemes)	2	1.5	MC
▪ Growing social unrest as a consequence of declining income and falling lifestyle	3.5	1.75	MC
▪ Political legitimacy is threatened because of failing to maintain the affluent lifestyle	3	1.75	MC
▪ A large number of fossil fuel assets will become stranded as a result of declining demand for fossil-based products	2.5	2	MC

\* SC: Strong Consensus; MC: Moderate Consensus; IQR – Interquartile Range

In the following paragraphs participant perspectives on these 13 barrier and risk statements are summarized using three themes of economic/fiscal, political and social barriers. The temporal influence of each of these barriers and risks is summarized in Table 5.

Table 5. Perceived barriers and risks of a low-carbon economic transition\*

Barrier	Immediate	Medium Term	Long Term
▪ Fiscal/ Economic			
▪ Political			
▪ Social			

\* Strong consensus: Thick line; Moderate consensus: Thin line.

### 3.10 Fiscal and economic barriers

There was strong consensus among all participants that the government will reduce its expenditures on major capital-intensive infrastructure projects to maintain a healthy fiscal situation. A senior policymaker reflected on the challenge that the State confronts. *“If the revenues from gas decrease there would be many challenges and risks such as a reduction in the state budget as well as a decline in government infrastructure projects. However, the country will still be moving forward and exhibiting growth albeit a slower form of growth because it’s a relatively slow country with plenty of economic opportunities and space for reform.”* One participant suggested Qatar’s fiscal position will not be easily eroded because of its significant investment in foreign assets that would help in terms of price volatilities or other



fiscal crises (citing the recent economic blockade by other GCC states). Another participant reflected that the State has a quite successful long-term record of macroeconomic management.

There was moderate consensus among participants that Qatar would sustain a GDP growth rate to maintain economic and social well-being. Some participants pointed out that Qatar's rational and balancing policy act in investing in infrastructure would yield high economic returns in the coming years and some participants challenged this statement. A senior oil and gas participant based in Qatar made the observation, "*Diversification (both in Qatar and Internationally) away from reliance on energy is very important but will be difficult to achieve in quantity required to offset any significant reductions in energy revenues.*"

### 3.11 Political barriers

Most participants (83%) confirmed that the State had made significant strides in the last two decades to diversify the economy, but the reforms are not transformational to make any meaningful change in phasing out dependence on fossil fuels. One participant commented that it is against the State's interest for rapid transition, "*Qatar has a vested interest in slowing the progression to low carbon economy.*"

In the second round, participants could not agree on the following statement: *Political legitimacy is threatened because of failing to maintain the affluent lifestyle.* There was also no consensus among the panel of participants whether the decline in oil and gas revenues in Qatar will create unrest in society due to falling living standards.

Some participants made a sobering argument that there is a lackluster mood and impetus at the highest political level to shift from carbon-intensive to a low-carbon economy, and others said that it economically makes sense to retain the current status quo unless it is forced by international factors. As one participant reflected, "*Qatar has little economic impetus to transition to a low carbon economy, either in terms of its export model or for domestic power production (given plentiful cheap gas)*". Another participant remarked on citizenry challenges, "*There could be some social unrest among the locals and between the locals and non-locals. Also, an increasing portion of the private sector would be forced out of business. This should not be a problem; but, it can become like a chain reaction; then, it would be a serious problem.*"

There was a strong consensus among the participants on the following statement, *Vested interest of current actors (business/bureaucrats) to maintain the status quo.* Most participants concluded that the state would continue to rely on hydrocarbon revenues and shore up assets and investments in the foreign market to support domestic activities to maintain the affluent standard of living for their citizens. Their comments included remarks about it not only being the State that prefers to delay the transition, but also there is resistance by major stakeholders – big businesses and real estate conglomerates. Participants commented on government spending being directly proportional to higher hydrocarbon revenues, which benefits a wide section of the economy, like construction, real estate and service-based activities. Several participants concluded that the State's elite lack the willingness to initiate a new transition to a low carbon economy or might possibly delay transition reforms as long as possible.

### 3.12 Social barriers

In the first round, the participants highlighted that two decades of oil revenues and aggressive 'Qatarization' policies helped in creating thousands of well-paid public sector jobs with excessive benefits bringing unemployment to near-zero among the citizens. One participant reflected that the transition to a competitive low carbon economy will affect this model as, "*The existing model of employment for Qatari nationals will become unsustainable, meaning that living standards will be threatened.*" In a low-oil price scenario, the state has to maintain

fiscal stability by cutting costs, both in investment and public wages. However, participants believed that this would not be a near-term concern. They reflected that the state has a strong political incentive to protect local citizens by reducing foreign expatriates in public and private sectors, introducing taxes, and reducing social welfare schemes. In recent years, this has been the case as many oil-producing countries grappled with revenue losses because of low oil prices. This will intensify in the years of sustained low revenues and reduced fossil fuel demand.

Participants strongly agreed that youth unemployment will increase, and voluntary and forced exodus of skilled expatriate population, which forms the bulk of the workforce in the public and private sector will occur. The former poses a political threat, whereas the latter poses long-term macroeconomic risks. Several participants remarked that Qatar would no longer be attractive as it used to be in the past. One participant remarked that the current rentier state had created an “*entitlement culture among the local citizens resulting in low labor productivity*” which will remain a significant barrier in transitioning to a low carbon economy. Another participant commented that the government would forfeit productivity in exchange for political acquiescence. “*The rapid improvement in easy income and the quality of life over the past 20-30 years resulted in creating less reliable work culture among the locals. This happens all over the world and many called it the “curse of oil”. To move towards low carbon economy which depends on production not in natural resource extraction, there is a need for the locals to be more productive.*”

### 3.13 Perspectives on opportunities and solutions

A majority of the participants perceived that the conventional approaches will not propel new sectors, and a paradigm shift in economic thinking is imperative to realize a low carbon economy. The respondents highlighted several existing and emerging opportunities. They also noted about the impact of the dynamics of policy reforms and the challenges of implementing them. These were itemized for consideration in Round 2 as summarized in Table 6.

Table 6. Delphi results: Opportunities and solutions for a low-carbon economic transition

<b>Round 2 Statements: Opportunities and solutions</b>	<b>Median</b>	<b>IQR</b>	<b>Consensus</b>
▪ Efficient utilization of hydrocarbon rents – rationalization of spending on infrastructure projects	2	0.75	SC
▪ Opening up the market (Increasing the number of trading partners, international markets, international alliances and signing trade and investment agreements)	2	1	SC
▪ Diversifying Qatar’s foreign assets and portfolios	1.5	1	SC
▪ Increasing attention to other revenue-generating sectors (tourism, manufacturing)	2	1	SC
▪ Investment in knowledge-based businesses (advanced technology, services, etc.)	2	0.75	SC
▪ Financial capital to support niche low carbon technologies and services (LCTS)	2	1	SC
▪ Economic reforms (free trade zones, FDI laws, etc.) are underway, which will help in developing low carbon technologies and services (LCTS)	3	0.75	SC
▪ Providing economic, institutional, legislative, regulatory and financial support for the low-carbon economic sector	2	1	SC
▪ Withdrawing strategic and financial support for fossil fuel related projects	3	1	SC
▪ Promoting and incentivizing the private sector to participate in developing and manufacturing low carbon technologies and services	2	1	SC
▪ Building capacity of policymakers, bureaucrats, and academics to develop a range of enabling institutions to facilitate LCTS	3	1	SC
▪ Building skillsets for the workforce to focus on developing low carbon technologies and services	2.5	1	SC
▪ A national “green industrial policy and comprehensive strategy” for realizing a low carbon economy	2	2	MC
▪ Shifting the work culture from entitlement to meritocracy (based on merit and talent)	2.5	1.75	MC
▪ Radical labor reforms – ensuring job security for a highly skilled and skilled expatriate workforce that will boost competitiveness in low carbon economic sector	2	2	MC

\* SC: Strong Consensus; MC: Moderate Consensus

In the following paragraphs participant perspectives on these 15 opportunity and solution statements are summarized using five themes: existing initiatives, potential market reforms, policy opportunities, workforce innovation, and cultural opportunities.

### 3.14 Existing initiatives

There was strong consensus (88% of participants) that the convergence of plummeting oil prices in 2014 and the 2017 economic blockade by the neighboring Gulf states would lead the state to accelerate the reforms that were long under planning and review. Also, there was a new sense of awareness of being self-sufficient by developing home-grown products and value-added services. Sixty-nine per cent of participants perceived that progress would be made with existing initiatives, referring to *Qatar National Vision 2030*.

Participants reflected that this new interest in self-sufficiency and enthusiasm to promote local industries will boost economic diversification efforts. Consequently, these forces will restructure the economic composition and become less carbon intensive. Additionally, there was strong consensus that reforms such as the construction of free trade zones, foreign direct

investment laws in several non-oil and gas sectors are steps in the right direction. Participants referred to the nearly half a trillion dollars invested in modernizing the infrastructure (ports, highways, utilities, etc.) in the last decade. Fifty-nine per cent of participants perceived that the latest economic reforms and new infrastructure to attract private sector investment and foreign direct investment and support local manufacturing businesses are signaling a new direction.

One-third of participants expressed cautious optimism that the state would achieve the full benefits of these reforms despite administrative and institutional deficiencies. Participants agreed that the State must break away from investing in carbon-intensive sectors (oil, gas and petrochemical) and instead allocate resources and human capital to other revenue-generating sectors. Several participants argued that it is unlikely that the State will withdraw strategic support from one of its most lucrative and productive economic sectors, which underpins the entire economy. Respondents highlighted that the national oil company planned to increase liquid natural gas production by 126 million tons per year by the end of 2024. There was mixed opinion among participants whether this investment will be counterproductive to transition to a low carbon economy.

### 3.15 Additional market reforms

There was a strong agreement (88%) that opening up the market, such as increasing the number of trading partners, easing business and investment opportunities, will increase competition and drive the private sector to build better products and services. A few participants cautioned that full opening of the market in a small country like Qatar will diminish the local private sector because of inherent disadvantage and lack of adequate skills to compete with the international market. *“We must encourage a lot of international companies that we have a major stake in to open up in Qatar and be part of a knowledge transfer to domestic firms. We also must protect investors and give them the ideal business environment with which to invest their money. In some areas, Qatar cannot compete with London, Singapore, or Tokyo. But in other areas, Qatar can definitely offer a competitive alternative to these international business centers. One area for example in tax.”* Another reflected, *“Regulation must encourage foreign direct investment and must help the market and local companies grow. The trick has always to attain a balance between protecting local companies and helping them adapt to the more rapidly changing world markets and compete with global firms.”* One participant lamented, *“regulation has definitely been slowing transition as a lot of laws have not been passed such as the Public Private Partnership law that would spur innovation in public and private works”*, proposing fast-tracking reforms in order to minimize the damages.

### 3.16 Policy opportunities

Participants had divergent opinions regarding what policies would facilitate a low carbon economy in Qatar. One senior policymaker called for a fundamental change in the way rentier society works, and a new social contract is inevitable to realize the full benefits of the transition process. *“A new “bargain” between the state and the citizens about how to share hydrocarbon income. Root and branch modernization of government and an end to citizen’s entitlement to government jobs. ...competition and opening of markets (ending monopolies in the domestic market), and lots more besides. None of this is easy and changes will be resisted. Reforms will require a political commitment at the highest levels, which in turn will require persuading citizens that if the nation does not start to chart a new course the wellbeing of citizens and of future generations will be at risk (always a difficult argument to make given myopia and high rates of time preference).”*

There was moderate consensus among the participants whether a comprehensive ‘green industrial policy’ would facilitate the transition to new economic sectors. Participants provided examples where policies and strategies were developed, but were not fully implemented

because of various other challenges. One participant provided an alternative perspective, that *“the government task is clearer and practically easier than the private sector. The government shall set a vision for a low carbon economy and set a reasonable timeline. Then, it should regulate, facilitate, and manage what is needed to achieve a smooth transition. Being a clear task does not mean that it is easy to implement.”*

### 3.17 Workforce innovation and training

Some participants reflected that a lack of research and innovation culture in the private sector will lock into perpetual dependence on the international market. They reflected that the State must focus on encouraging the private sector to design, develop and manufacture new and cutting-edge low carbon technologies and services. One participant observed that the State *“needs to also legislate forcing it partially owned big companies, like Qatar Petroleum, Qatargas and others to support local industries and companies over external ones to help the local private sector to grow.”*

Participants strongly agreed that developing new skillsets are fundamental to navigate the low carbon pathway, and it is imperative to transform the current low productive human capital to innovative and skilled human capital. One participant called for *“education reforms which will equip citizens with skills and capabilities need for effective participation in the global economy in 21<sup>st</sup> Century.”* Given the small population and local workforce in critical sectors, participants suggested an open immigration system and policies conducive to skilled foreign workers. One participant noted, *“But above all, Government and private sector needs to attract skilled professionals to come to Qatar to settle and create new businesses”*. Another reflected, *“Mainly, policies that would make the local citizens more accepting to immigration and neutralization of highly skilled people coming to Qatar.”*

### 3.18 Cultural opportunities

Various participants reflected on cultural opportunities for enabling the transition to a low-carbon economy. One participant suggested a cultural reform that would enable a competitive economy, given that the rent-seeking private sector depends on the state largesse and primarily engages in construction, real estate and low value-added services. *“For the private sector, it is a clear matter of conflict of interest. The current economy allows them to make huge revenues with little effort (mostly as retailers or agents). To move toward low carbon economy, the scope is completely different and the culture must be changed. I believe that this will not happen naturally and there is a need for drastic measures from the government to force the private sector to take serious steps.”* Similar and supporting suggestions were apparent in another participant’s writing, *“And also, policies that encourage making Qatar work culture more based on merit and performance than other factors. Moving companies and government entities to Meritocracies.”* Another participant remarked, *“the social and institutional policies should be amended so that make people to study and work hard in order to gain income and they pay for whatever services they received from the public and private entities. they need to move from social welfare system to natural system.”*

## 4. Discussion

This study set out to contribute to the research literature concerning economic transition leading to a low carbon economy. The findings contain several important insights into the situation for Qatar, which could be considered for HDRS economies. The 16 Delphi study participants clearly agreed that small and open, energy-exporting states are highly vulnerable to external factors exerting pressure – in this case on Qatar, to undertake a low-carbon economic transition. Participants agreed about the sustained dominance of the LNG sector in HDRS including Qatar. However, they had differing viewpoints on the regional geopolitical issues. While there was

unanimous agreement on the need for bolder policy reforms to facilitate a smooth transition, the way forward remains uncertain, as experts disagreed on specific policy issues. In the following paragraphs, the implications of these findings are considered for Qatar and other HDRS economies, referencing additional 'extant' literature that assists in sense-making.

HDRS economies are tightly interlinked with global energy movements, regional politics and the global economy at large. The global demand for natural gas is rising in all developing economies, with China and India leading the way, as natural gas helps to meet their growing energy demand, meeting climate targets and addressing local air pollution concerns, and offset coal and oil demand. However, three factors are influencing this timeframe:

- New entrants are stepping up, including the United States of America and Australia. A natural gas surplus in the market may drive down the prices for a long period yielding lower returns (IGU, 2020).
- Increasing climate concerns putting sustained downward pressure on natural gas demand. Although natural gas is relatively cleaner than coal and oil, it is still a fossil fuel. Stringent climate actions by developed and developing countries may have a long-term impact on demand (Newell et al., 2019).
- Increasingly, growth in natural gas demand is offset by growth in renewable energy as prices for renewables and associated battery technologies are falling rapidly (Wood Mackenzie, 2017). Investment in renewables remain robust with the majority of the investments in the power sector leading up to 2040 with 72% allocated to renewables (Newell et al., 2019). Major energy-consuming nations such as China and India are increasingly investing and deploying renewables at a mass scale and making favourable policies for wider adoption by the private sector and citizens (IEA, 2019; IEEJ, 2020).

An additional factor that the experts did not discuss, but which is referenced in the literature, is the risk of stranded assets. Unanticipated or premature write-downs, evaluations and/or conversion into liabilities can leave assets 'stranded' (i.e., without value), including underground and unexplored reserves. This would cost the fossil fuel industry \$28 trillion in revenues in the coming two decades (Carbon Tracker, 2015; IEEFA, 2019; IRENA, 2017). In the Middle East alone, 38% and 61% of oil and gas, respectively, will be unburnable during the same period, costing future revenue losses to exporting economies (McGlade and Ekins, 2015). Over 112 major banks and insurers have formal coal exit policies to accelerate low carbon transition and to commit to the Paris Agreement (IEEFA, 2019)(Perkins and Lator, 2019)(Hook and Kynge, 2018). According to the International Renewable Energy Agency, the total value of stranded assets will rise to \$20 trillion under the Delayed Policy Action scenario compared to the Remap case scenario, which was 4% of global wealth in 2015 (IRENA, 2017). With the increase in investments in the hydrocarbon sector across all the HDRS, policy makers are betting on sustained demand for fossil fuels for the next three decades. However, the policymakers have failed to realize that lock-in and sunk investments would result in stranded assets worth billions of dollars.

Although not discussed explicitly by experts, the literature also discusses the growing momentum for divestment from fossil fuels. Volatile revenues, limited growth opportunities and declining demand will intensify and increase downward pressure on the industry, causing fossil fuel investments to be riskier. Since the oil and gas sector are capital-intensive, states and multinational companies depend on international financial institutions for oil and gas extraction (Dordi and Weber, 2019; Green and Newman, 2017; Hunt and Weber, 2019). Several studies report that the change in investor sentiment and growing stakeholder pressure against investment in fossil fuels are reshaping the fossil fuel industry. As at 2020, the value of



divestment had reached \$14.5 trillion, with more than 1300 institutions committed to divestment (Carlin, 2021).

In the case of Qatar, three implications of the rapidly changing marketplace are evident:

- Advantages include its relatively cheap production cost, huge reserves, and the ability to expand LNG facilities rapidly. Its geographical location also enables timely supply.
- Challenges include regional conflict and war, with only one sea route available for Qatar to supply being the Strait of Hormuz. However, the study findings suggest that closure of the Strait of Hormuz is currently not a chief concern for Qatari policymakers.
- Qatar's long-term relationship with many energy-consuming countries will retain its LNG dominance for some time. However, future Qatari policy and strategy will need to factor in the dynamics of renewables which is transforming the energy landscape globally, and it remains uncertain how far this will impact natural gas demand.

Economic diversification remains an eternal challenge for HDRS. Since the 1970s, HDRSs in the Middle East region have embarked on economic diversification. However, comparatively little has been achieved with the exception of Dubai (one of the emirates of UAE). Hydrocarbon revenues play a dominant role in national expenditures, including investment in physical and social infrastructure (Askari, 2006). For example, more than 90% of Qatar's export revenues and nearly half of national GDP comes from fossil fuel exports (QCB, 2020), wherein surplus revenues are reserved as a part of sovereign wealth funds and the accumulation of foreign assets. Other non-oil and gas sectors are dependent on the growth of the oil and gas industry, as the hydrocarbon revenues are directly invested in infrastructure development and other capital-intensive projects, which spurs the overall economy (Barma et al., 2012).

Key barriers impeding transition include, institutional inefficiency and lack of political will at the policymaking level, inadequate organizational innovation, and a lack of skilled workforce resulting in:

- Social contracts between the state and citizens to redistribute part of hydrocarbon wealth in the form of well-paid public sector jobs, generous social allowances, pensions, subsidized electricity, water and fuel (Beblawi, 1987; Gray, 2011). Currently fossil fuels remain central to maintain such social contracts with the citizens and being deeply embedded in governance and policymaking.
- Resistance by major stakeholders who have strong interdependency on hydrocarbon revenues, including private sector reliance on state funding. Economic and social tradeoffs are common when society transitions from one state to another (be it energy, transport, economic activity). Consequently the incumbent actors adopt various mechanisms to resist change (Geels, 2014; Hertog, 2013).
- Lock-in of carbon-intensive assets through accumulated wealth in the form of foreign assets and improved infrastructure domestically (Lazarus et al., 2015; Unruh, 2000). State institutions and policies contribute to perpetuating the established regime since any changes in existing rules and structures are likely to generate trade-offs across society that creates resistance (Geels, 2014).
- Absence of competitive advantage in any alternative low carbon technological and innovation frontiers. In HDRSs, the current evidence suggests that private and public sector research and development is weak despite heavy investment in recent years (Askari, 2006; Barma et al., 2012). In the Delphi study, one expert reflected that under closed innovative ecosystems, there is a limited potential for technological and service innovation in the low carbon sector. Where there are weak intellectual property rights and lack of ownership, will stifle innovation and expatriate workers cannot claim any ownership of the innovation.



Previous economic transformations in the region have been partly driven by technological developments, globalization, policies imposed by external organizations such as the International Monetary Fund (IMF) and the World Bank. External and internal factors influence and resist change, distributive conflicts of different actors and how the vested interests of the state poses barriers in implementing market-oriented policies (Haggard and Kaufman, 1992). Sovacool et al. (2019), argues that decarbonization comes with unintended consequences exacerbated by “*pre-existing structural drivers of injustice in energy markets and the wider socio-economy*” (Sovacool et al., 2019). Many researchers have pointed to various challenges and risks in the absence of diversification (Dafermos et al., 2018; Elgouacem et al., 2020; IMF, 2020; Jones et al., 2013; NGFS, 2019). In many countries, policymakers continue to support dying industries (carbon-intensive) because of distributive impacts such as job losses, voter backlash, and widespread protests (Prinz and Pegels, 2018).

Considering Qatar in relation to the Delphi findings discussed above:

- Experts agreed that the private sector is dependent mainly on state investment and focused on low value-added sectors, with a lack of appetite for research and technological innovation and characterized by inadequate skills and capabilities. This is consistent with the findings of the recent study conducted by the Qatar Development Bank (QDB, 2018). Previous studies confirmed that engaging the private sector will accelerate the transition process (OECD, 2016, 2013) and the policymakers in Qatar realizes the significance of creating a vibrant private sector and emphasize the role of creating wealth and jobs. However, the SME sector in Qatar is still considerably weak, facing many constraints. Modest reforms are insufficient and unless radical reforms are implemented at multiple scales, the private sector will continue to remain in the margins (Ennis, 2015; Hertog, 2013).
- Experts agreed that the state lacks an indigenous skilled workforce in vital sectors that would propel a low carbon economy and will continue to depend on foreign workers. Only 5% of the Qatari workforce contribute to the total workforce, both in the private and public sector in 2019 (PSA, 2020). The Qatari workforce and skilled workforce will always be in short supply and will continue to rely on expatriates. Therefore, a new set of technical and managerial skills and expertise are required to navigate the transition process.
- Experts agreed that the future of foreign labour is precarious in a ‘low carbon Qatar’ because of heightened job insecurity (shrinking hydrocarbon revenues resulting in increased layoffs of foreign workforce in the public and private sector), low wages, poor labour mobility, and inadequate intellectual property rights. Additionally, the education sector (including vocational skills) is nascent and considerably weak. A low carbon economy necessitates new occupations, skills and expertise to adapt to emerging new sectors and technologies, which requires anticipating needs, (re)skilling and facilitating mobility (Gençsü and Grayson, 2020; Jagger et al., 2013).
- Experts agreed that natural gas is seen in Qatar as a way to solve both, energy security challenges, air pollution and climate change. There is a clear material interest for policymakers to postpone transition and maximize revenues from exporting LNG and its derivatives. The recent announcement to expand LNG production is an emergent wealth accumulation strategy and to maintain dominance in the LNG market. Besides capitalizing on the growing demand for natural gas, this expansion indicates that diversification efforts are not yet achieving alternative revenue streams, instead perpetuating the oil and gas sector.
- Experts agreed on the importance of research and development expenditure. Despite several attempts to promote research and development in recent years, as one expert remarked, “*the results were dismal*”. In Qatar, the private sector has shown no interest in

developing new technologies and services and continues to rely on the international market despite the State pledge to become a knowledge economy. The State investment in research and development through funding public universities is yet to produce adequate knowledge capital. The local workforce has limited engagement in research, development and innovation, and most of the citizens prefer working in managerial positions.

The challenges associated with the transition to a low carbon economy necessitate active transition management policies. The Delphi study findings indicate that regardless of the timing of the decline, due to the complexities of the global marketplace discussed above, rentier states are already facing important macroeconomic and structural choices amidst shrinking account surpluses or widening deficits.

Further, sustained low oil prices are a major concern to HDRSs as this causes fiscal instability and reduced savings (El-Katiri, 2016; Krane et al., 2017). Fiscal surplus, welfare cuts, reducing expenditures, and sovereign wealth funds have been some of the common strategies used in the face of short-term business cycle fluctuations. However, whether these strategies can be successfully leveraged for long-term structural developments in the energy markets is uncertain and the global economy remains uncertain. Underpinning the success of such measures should be a local economy that is productive and resilient. The Delphi study results suggest that in the face of a low oil price environment, the government's ability to support its generous welfare state will erode rapidly. The recent episodes of low oil prices during the Covid19 pandemic have shown how quickly the State can roll back welfare schemes for non-Qataris and local citizens (Al Jazeera, 2020).

To mitigate long-term economic and fiscal risks, states can create productive, non-carbon intensive economic sectors to mitigate the risk of long-term downward pressure of lower oil prices and demand. In a recent report, Elgouacem et al. (2020) arrived at a similar finding, "*As fossil fuel exporters seek to adapt to climate change, they need to define and implement well-founded strategies for sustainable economic diversification and low-carbon growth.*"(Elgouacem et al., 2020). The rising risk of a 'hard landing' could be reduced if states are willing to take several 'supply-side' reforms and compromise with short-term risks, vested interests, and tradeoffs to avoid major economic hardships in the future.

Considering the future for Qatar, there are three factors evident from the Delphi study regarding market reforms to foster a desirable kind of structural reform:

- Qatar's bid for long-term pursuit of reducing its reliance on hydrocarbon revenues (Qatar National Vision 2030) is the main motivating factor.
- Alongside this existing initiative, a complementary vision is needed with a roadmap for the transition to a low carbon economy within the next two decades.
- The state needs a strong technical niche and competitive advantage that can compete in the international market.
- Alongside economic reforms (QCB, 2020), social and cultural reforms are prerequisites for the economy's structural transformation (Askari, 2006; Chaudhry, 1997).

## **5. Policy Implications**

We believe that our research is relevant to scholars and policy makers who are focusing on small, oil-producing economies to enable a deeper understanding of the drivers, barriers and risks of transitioning from a hydrocarbon-dependent to a diversified, low carbon economy. The findings primarily imply that the policy makers in HDRS confront stark uncertainties, rapidly evolving challenges and realities and complex choices to examine what kind of a future is

available in a carbon-constrained world. The fiscal impact of climate change on fossil fuel economies is increasingly concerning, but comprehensive studies on the financial implications from long-term structural factors is still lacking (Elgouacem et al., 2020; IMF, 2020; Jones et al., 2013). For wealthy HDRS, there is time to delay the transition, but it is imminent in the future. Although, it is desirable for the economies to transition to a low carbon economy, the policy makers face difficult challenges. This includes, the vulnerability of a small state, limited economic opportunities and lack of revenue from other sectors and the impact on the state-society relationship. The repercussions from a failing welfare state creates a strong political and economic incentive to maintain the hydrocarbon regime, resist and possibly delay or stall low carbon transition.

It is evident that technological and infrastructural development are insufficient for economic transformation. A wholesale and steady change in social and economic policies by minimizing distributional impacts on existing sectors is key for low carbon transition. Moreover, cultural shift is imperative – from an entitlement to meritocracy, private entrepreneurs should create an organizational culture that emphasizes long-term innovative capital instead of quick economic returns from low value-added sectors. The policy makers must realize that in the fast-changing and highly uncertain world, 20<sup>th</sup> century institutional policies of rentier states that protects a hydrocarbon regime and exclusionary policies would not work (Askari, 2013, 2006). A new social contract is inevitable to realize the full benefits of the transition process. As one expert argued that *“A new ‘bargain’ between the state and the citizens about how to share hydrocarbon income... not start to chart a new course the wellbeing of citizens and of future generations will be at risk.”*

Policy makers must allocate resources to the sectors that add value to the overall economy and improve labour productivity. Although, the recent economic blockade on Qatar by four neighboring Arab states catalyzed the much-needed economic reforms, the findings suggest that economic reforms are not matched with the social and cultural reforms which are prerequisite for structural transformation of the economy. Therefore, economic transition in HDRS remains a deeply structural and political problem and requires careful and long-term policies to avoid unintended and distributional consequences.

The lack of trust in ‘Green Industrial Policy’ by experts is understandable because many feel it is another policy/strategy document that has less relevance in the context of the local realities and as long as the structural problems remain unaddressed. At an operational level, the barriers to transitioning to a low carbon economy include organizational and logistical factors involving governance, and institutional failure such as poor coordination, policy gaps, lack of clear targets, and ambiguity over policy issues (Mohammed, 2016). Policymakers must overcome these institutional problems through radical public administration reforms at the highest level.

We recommend the implementation of a coherent policy with enforcement and independent evaluation which will enable transparency and accountability. A government must set a complementary vision (in line with Qatar National Vision 2030) and roadmap to achieve a low carbon economy within a reasonable timeline. The State must oversee, regulate, and facilitate to achieve a smooth transition. Experts argue that skills development to achieve transition has to be developed. Transforming from low productive human capital to innovative and skilled human capital is critical for the transition process.

## 6. Conclusions

The study confirmed that Qatar's journey to a low carbon economy is about a systematic shift in economic structure and composition in fostering new industries and enabling a safe decline and restructuring of redundant industries. Further to expert commentary through the Delphi study, it is proposed that the current lack of strong support for creating a coherent low carbon transition policy for Qatar follows several previous strategies that have not been implemented. Herein, the State needs to orchestrate and enforce existing and new reforms, providing oversight, regulation, and facilitation to achieve a smooth transition.

Transition to a low carbon economy demands sustained investment in low-carbon infrastructure and strategic sectors, and several experts in the Delphi study argued that the government could finance the transition using part of the hydrocarbon revenues. The unpredictable nature of hydrocarbon revenues may pose challenges unless the State mobilizes capital markets and institutional investors to scale up finance for a low carbon transition.

This Delphi study investigated the current and emerging trends that would shape the low carbon pathway for hydrocarbon-dependent rentier states. The literature lacks a holistic understanding of the drivers, barriers and opportunities for transitioning to a low carbon economy in rentier states. Against this background, we investigated factors influencing or inhibiting the transition process, providing initial academic insights and exploratory findings into this nascent topic for further academic discussions. In this two-stage Delphi study featuring national and international experts, this study found broad consensus, in that Qatar and other oil-exporting economies face a long-term decline in fossil fuel demand, aggressive climate policies and risk of stranded assets in addition to its age-old problems of revenue volatility and unpredictability (since the first oil price crash in the 1970s). Furthermore, experts agreed that global decarbonization will threaten the business-as-usual hydrocarbon-dependent fiscal revenues and economic security of HDRSs and the precipitous fall in export revenues will intensify in the coming years.

In this landscape, discussions have included marketplace, economic diversification and market reform factors that are likely to play a crucial role in influencing low carbon transitions of HDRSs. Despite global decarbonization, oil and gas sector revenues remain a critical driver of economic growth in HDRSs. These states will likely continue to exploit fossil resources for a considerable period of time. The current and at least short-term continued strong growth in natural gas demand (unlike slowing demand for coal and oil) (Arabella, 2017; Bos and Gupta, 2017; Carbon Tracker, 2015; IRENA, 2017) favors Qatar because of its abundant reserves, low-cost production and advantageous geographic position to supply other countries.

The above factors and the lack of revenue from other sectors creates a strong political and economic incentive for HDRSs to maintain the hydrocarbon regime, resist and possibly delay or stall low carbon transition. However, it is difficult to dismiss the reflections of the experts in this Delphi study who provided a clear narrative of a complex and uncertain future for Qatar, unless the state takes significant steps towards an accelerated economic transition away from the production and supply of fossil fuel. The findings imply that it is imperative to address some of the structural societal challenges such as entitlement to public sector jobs, rent-seeking private sector, low labour productivity, institutional instability, precarious job market and poor R&D culture in both, the private and public sector. Addressing these challenges are prerequisite for low carbon transition. Though, many of these structural challenges are partially recognized by the government, the experts believe that reforms are inadequate and there are political limits to reform as it will threaten the existing state-society relationship.

There are three key limitations in this study and further studies are warranted to obtain a holistic perspective. We aimed to obtain a heterogeneous sample to avoid sectoral bias and uniformity in responses. However, there was a lack of representation from the private sector in the panel of experts as this would have added another layer in understanding the challenges and barriers and perceived risks in transitioning to a low carbon economy. Second, difficulty in maintaining interest in the study among the experts because of the limitations posed by open-ended (first round) and closed-ended (second round) questionnaire. Experts had low interest in sharing insights during multiple rounds. Third, ranking different drivers, barriers and policy actions were beyond the scope of this study. It may be beneficial for future research to quantify such relationships offering further rigor and accuracy. Fourth, the results from the Delphi survey highlighted political economy challenges inherent in the reforms needed to accelerate low carbon transition, although, none of the Delphi experts went into detail about the kind of repercussions that could result as a consequence of the transition. Further studies are needed to engage the private sector and participants from diverse groups of society needs be included. There is a necessity to investigate the role the private sector can play for developing a low carbon economy. Although, the Delphi study was useful in deriving consensus on sensitive issues, it did not provide detailed and nuanced insights on the political economy of transition.

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### Author Contributions

**Sayed Mohammed:** Conceptualization, Writing- Original draft preparation, Investigation, Formal Analysis **Cheryl Desha:** Methodology, Writing- Reviewing and Editing, Validation, Supervision. **Ashantha Goonetilleke:** Writing- Reviewing and Editing, Supervision

### Conflict of Interest

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report.

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## Supplementary data

### Delphi Round 1

#### General Questions

Q1. Do you live in Qatar?

- Yes
- No

Q1a. If yes, are you

- Qatari
- Non-Qatari

Q1b. If non-Qatari, Number of years in Qatar

- a. <5 years
- b. 5-10 years
- c. 11-20 years
- d. >20 years

Q2. Education level

- a. Bachelors
- b. Masters
- c. PhD
- d. Others

Q3. Area of expertise

- a. Oil and gas
- b. Energy and environment
- c. Economy and finance
- d. Politics and international relations
- e. Others

Q4. Number of years of experience

- a. <5 years
- b. 5-10 years
- c. 11-20 years
- d. >20 years

Q5. Sector

- a. Government
- b. Semi-government
- c. Private sector
- d. Academia
- e. Civil Society

f. Others

## Theme one – Economic Diversification

(Open ended questions, word limit 1000 words)

1. In your view, what are the major global and regional factors that would threaten or sustain Qatar’s natural gas dominance and how it would affect the economy (fiscal, economic growth) if the revenues from oil and gas decline in the coming years?
2. What’s your take on the challenges and risks the state and society would face if the revenues from gas shrink in the coming years?
3. Based on your response to Question 9, whether these factors would facilitate or slow the transition to a low carbon economy?
4. Please share your views on various emerging domestic opportunities and synergies that would help achieve low carbon transition?
5. Based on your response to question 9, what are your thoughts on structural challenges and barriers (domestic) in slowing the transition?
6. What is your perspective on the responses the government and the private sector must do to sustain economic growth and development?
7. In your opinion, what are the social and institutional policy changes that are required to help the transition process?
8. What are the most likely scenarios to happen in Qatar when it comes to low carbon transition in the following years? Participants must select only one option. A separate box is given below to give their justification and any other comments for better understanding.

Scenarios	Description
<b>Scenario 1 – Business as Usual (BAU)</b>	<ul style="list-style-type: none"> <li>▪ The country will continue depending on natural gas, and natural gas production and petrochemical products for export.</li> <li>▪ Hydrocarbon revenues will be continuously spent on infrastructure projects and investment in international assets via sovereign wealth funds.</li> <li>▪ The population will gradually decline after the Football World Cup in 2022.</li> <li>▪ Economic diversification reforms will be limited, with continued growth in real-estate and tourism/sports.</li> </ul>
<b>Scenario 2 – Rocky Road</b>	<ul style="list-style-type: none"> <li>▪ The government will maintain the country’s dependence on natural gas sales.</li> <li>▪ Demand for natural gas will shrink, and/or new competitors will minimise Qatar’s share.</li> <li>▪ The government will scale down its welfare schemes, and subsidies will be greatly reduced.</li> <li>▪ The government will reduce the overall expatriate population to maintain jobs for Qataris.</li> </ul>
<b>Scenario 3 – Divest and Diversify</b>	<ul style="list-style-type: none"> <li>▪ The country will commit to managed decline in the extraction of natural gas.</li> </ul>



	<ul style="list-style-type: none"> <li>▪ The country will divest investment in companies that manufacture and export advanced green technologies.</li> <li>▪ There will be growth in eco-industrial zones and incentives to innovate.</li> <li>▪ There will be radical labour and investment reforms.</li> <li>▪ Growth in high-skilled labour and policies will be favourable for the expatriate population.</li> </ul>
<p><b>Scenario 4 – Wild card</b></p>	<ul style="list-style-type: none"> <li>▪ The global energy market will shift radically where: <ul style="list-style-type: none"> <li>- fossil-based products are no longer in use because of worsening climate change.</li> <li>- new energy and energy-based products will substitute for fossil-based products.</li> </ul> </li> <li>▪ Politicization of natural gas will limit the country’s natural gas share in the global market.</li> <li>▪ The country will experience a marked decline in natural gas consumption and sales.</li> </ul>

**Others (Text box)**

## Delphi Round 2

### Theme 1: Global, Regional and Domestic Factors

<b>Theme 1.1 Domestic factors</b> Please assess the following factors that will be in favour of sustaining Qatar's natural gas market. Please use the comment box if you would like to add extra information.					
	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly disagree
Comfortable profit margin because of the low production cost of natural gas products (LNG/GTL, etc.) in Qatar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Expansion of LNG facilities (in Qatar) to maintain the LNG dominance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliable and flexible supplier in the market (long-term and spot-trade agreements)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Theme 1.2 Regional and domestic factors**

Please assess the following factors that will deter (inhibit) Qatar’s natural gas market. Please use the comment box if you would like to add extra information.

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neither Agree or Disagree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
Growing competition from other markets like Australia, USA, and others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
New discovery of gas reserves in several countries	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Steady falling of natural gas prices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shift from long-term to short-term supply contracts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disruption in maritime routes (Strait of Hormuz)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
War and conflict in the Arabian/Persian Gulf will halt the supply of natural gas to the world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Growing adoption of renewables in emerging economies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stronger climate agreements and policies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Theme 2: Consequences of declining hydrocarbon wealth

<b>Sub theme 2.1 Positive Consequences of declining hydrocarbon wealth</b> Please assess the following positive consequences and the responses from the government happen as a result of declining hydrocarbon wealth? Please use the comment box if you would to add extra information.					
	Very likely	Moderately Likely	Neutral	Moderately Unlikely	Very unlikely
Acceleration of necessary physical and social infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Opening up the market (Increasing the number of trading partners, international markets, international alliances and signing trade and investment agreements)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Easing business and investment opportunities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diversifying its foreign assets and portfolios	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Growing investment in foreign firms (oil/gas and others)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing attention to other revenue-generating sectors (tourism, manufacturing)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Investment in knowledge-based businesses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Private sector stepping up their efforts in driving growth and investment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Efficient utilization of hydrocarbon rents – rationalization of spending on infrastructure projects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Sub theme 2.2 Negative consequences of declining hydrocarbon wealth**

Please assess the following negative consequences and the responses from the government will happen as a result of declining hydrocarbon wealth?

Please use the comment box if you would like to add extra information.

	<b>Very likely</b>	<b>Moderately Likely</b>	<b>Neutral</b>	<b>Moderately Unlikely</b>	<b>Very unlikely</b>
Unable to sustain a decent economic growth rate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reduced government expenditures in infrastructure projects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A large number of fossil assets will become stranded as a result of declining demand for fossil-based products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing austerity measures (reduction in social welfare schemes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Growing social unrest as a consequence of declining income and falling lifestyle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Growing unemployment among the youth	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Political legitimacy is threatened because of failing to maintain the affluent lifestyle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The departure of a large number of skilled expatriates from the country	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Theme 3: Low Carbon Economy – Fresh look on economic diversification**

**Sub theme 3.1.** Please assess the following factors that are in favour of facilitating low carbon economy  
 Please use the comment box if you would like to add extra information.

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neither Agree or Disagree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
Qatar has the capacity and potential to innovate, develop and export low carbon technologies and services (LCTS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic reforms (free trade zones, FDI laws, etc.) are underway, which will help in developing low carbon economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Economic diversification is high on the agenda because of sustained low oil prices and blockade	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial capital to support niche low carbon technologies and services (LCTS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**Sub theme 3.2 Barriers and resistance towards change**

Please assess the following factors that are limiting the development and growth of low carbon econ

Please use the comment box if you would like to add extra information.

	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neither Agree or Disagree</b>	<b>Disagree</b>	<b>Strongly disagree</b>
Lack of political commitment and will at the highest level	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Afraid of making risky moves – focus on business as usual practices	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vested interest of current actors (business/bureaucrats) in maintaining the status quo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unable to compete with international players (competitive disadvantage)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of skilled population in key sectors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of citizens’ interest in focusing on innovation (entitlement to public sector jobs and focus on trading businesses)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of incentives and ownership for expatriates resulting in stifling of research and innovation in LCTS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Theme 4. Policies/reforms towards a low carbon economy

Please assess the following <b>policies and reforms</b> in terms of their impacts in realizing low carbon economy in Qatar? Please use the comment box if you would like to add extra information.					
	Extremely Important	Very important	Moderately Important	Slightly Important	Least important
A national “green industrial policy and comprehensive strategy” towards a low carbon economy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing economic, institutional, legislative, regulatory and financial support for the low-carbon economic sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting and <u>incentivizing</u> the private sector to participate in developing and manufacturing low carbon technologies and services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Withdrawing strategic and financial support for fossil fuel related projects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building capacity of policymakers, bureaucrats, and academics to develop a range of enabling institutions to facilitate LCTS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shifting the work culture from entitlement to meritocracy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Building skillsets for the workforce to focus on developing low carbon technologies and services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Radical labour reforms – ensuring job security for a highly skilled and skilled expatriate workforce that will boost competitiveness in low carbon economic sector	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>