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Studying Energy Transition and Net Zero Targets on Qatar Example

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Abstract. *This article looks at the trend of the new direction and emerging challenges to adhere to the UN SDGs in energy sector. Also, it considers how it is planned for incorporating energy transition in future visions and country plans of the hydrocarbon net exporting countries. Mainly it will be focusing on an example from the middle east that are classified as net hydrocarbon exporters, Qatar. "Is Qatar's approach comprehensive and agile enough to adapt to evolving guidelines post-Conference of the Parties?" is the core question behind the hypothesis investigated in this paper, through extensive review for publication studies and resources. A detailed look revealed that Qatar has an extensive, coupled with improvements based on regional context. Qatar's initiatives include development in renewable energy domain, investments in green technologies, and commitments to reduce carbon emissions. Adopting some of the neighboring countries' approaches could enhance outcomes and strengthen its role among GCC members. Nevertheless, geopolitical instability in the region demonstrates a great risk for such initiatives sustainability. Expanding the collaboration to be with more international bodies and private sector partnerships is crucial to ensure success for longer time. In conclusion, while Qatar is on a positive trajectory in achieving its energy transition, continued assessment and refinement of its strategies must be put in place. It is crucial to understand that political and economic stability will be vital for Qatar to meet its net-zero targets effectively. The dynamic nature of global guidelines demands a flexible and responsive approach from all stakeholders involved.*

Keywords: Strategy, Energy Transition, Net Zero, Climate Change, Policy, Sustainability, Decarbonizing.

Introduction

The current energy crisis underscores fossil fuel demand, creating significant obstacles for carbon-neutral goals outlined in the UN's 2030 Agenda. Since 2015, countries worldwide have been adjusting their strategies to align with these ambitious objectives. Major milestones in this journey include the 1992 Rio summit, the Millennium Development Goals, the 2012 Rio+20 conference, the Sendai Framework, the Addis Ababa agenda, and perhaps most significantly, the 2015 Paris Agreement. These initiatives, which began taking shape in the 1990s, gained considerable momentum after 2013, influencing long-term strategic planning for meeting the 2030 goals. Figure 1 shows the timeline for the UN SDG framework development (https://sdgs.un.org/goals).

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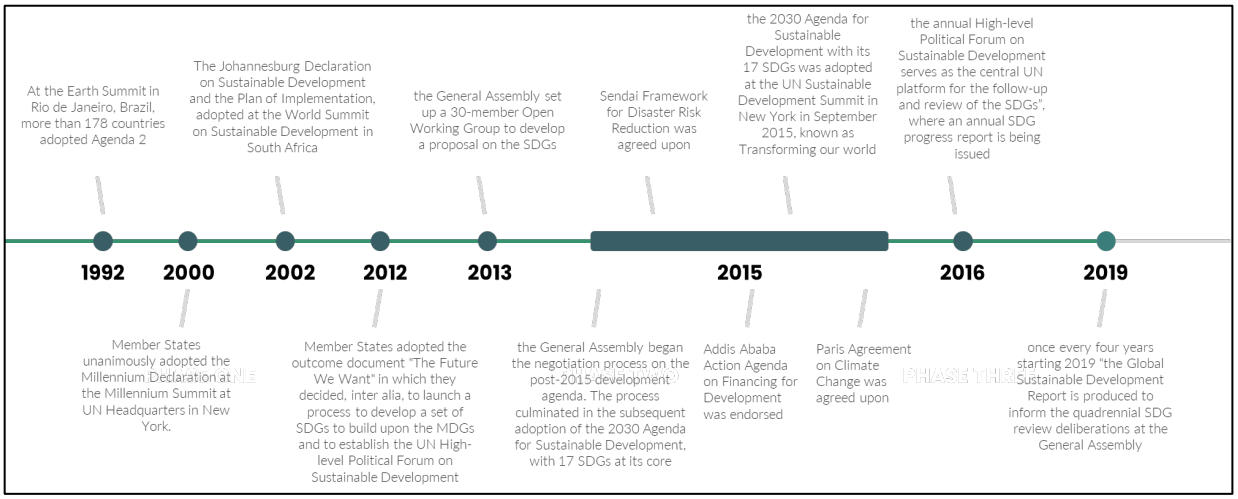

Figure 1. Timeline for the development of the UN SDG framework
Source: Murtada Ahmed, Proceeding of IBIMA 40th conference, Paper #543, 23.11.2022, Seville, Spain.

The Conference of the Parties (COP) meets annually under the UNFCCC since 2015, bringing together governments, NGOs, media representatives, and private sector stakeholders. The most recent sessions were hosted in the UAE (2023) and Baku, Azerbaijan (2024), where participants discussed climate strategies aiming to keep the 1.5°C goal within reach through concrete actions. Achieving this ambitious target requires widespread collaboration across civil society, governmental bodies, and various industries (https://cop28.com, https://cop29.az/en/home).

"Is Qatar's approach comprehensive and agile enough to accommodate the dynamic nature of evolving guidelines and requirements following each Conference of the Parties?" This serves as our primary research question, guiding our investigation into Qatar's efforts as a leading Middle Eastern hydrocarbon producer and exporter (primarily gas) in developing and implementing its energy transition commitments. Our paper exists within a broader study covering selected hydrocarbon net-exporter countries in the Middle East, including Saudi Arabia, UAE, Oman, Qatar, and Kuwait.

Qatar's approach to designing and implementing its energy transition strategy differs notably from other GCC states in several aspects. While all Gulf Cooperation Council countries depend heavily on hydrocarbon revenues, Qatar has distinctively focused on leveraging its vast natural gas reserves—particularly liquefied natural gas (LNG)—as a transitional fuel in the broader energy shift. Qatar has invested substantially in LNG infrastructure and technology, establishing itself as a global leader in natural gas exports, which many consider a cleaner alternative to oil and coal according to the International Energy Agency (IEA, 2022). In contrast, other Gulf states like Saudi Arabia and the UAE have diversified their energy transition strategies with substantial investments in renewable energy, especially solar power, as part of their Vision 2030 and UAE Energy Strategy 2050, respectively, as noted by the International Renewable Energy Agency (IRENA, 2023). Qatar's strategy emphasizes carbon capture and storage (CCS) technologies for mitigating emissions from gas operations, while other Gulf states focus more on direct renewable energy projects and hydrogen production initiatives.

Literature review

It's important to highlight how Conference of the Parties (COP) conventions shape global energy transition directions, which consequently influence countries worldwide to adapt their strategies and implementation plans. In this section, we'll summarize outcomes from the two most recent conventions, establishing context for Qatar's strategic planning and implementation efforts aligned with these global directives.

Outcomes of COP28 in UAE:

The latest COP28 outcomes addressed twelve topics through its thematic program, including dedicated days for nature, land-use and oceans, just transition, and indigenous peoples. UN estimates suggest global spending on ecosystem protection, conservation, and restoration amounts to roughly $145 billion annually—less than half the predicted funding needed by 2025 and just one-third of 2030 requirements (COP28 UAE Thematic Program, 2022). Figure 2 summarizes these outcomes.

The first significant outcome aimed to correct the course of climate action. The UN Global Stock take assesses worldwide progress on emissions reduction and Paris Agreement goals, guiding governments toward enhanced actions and cooperation. This process unfolds through three phases: collecting climate data (Information), reviewing progress (Assessment), and planning increased climate action (Political). Nations are encouraged to update their carbon-cutting strategies and climate plans before COP30.

The second outcome focused on fulfilling commitments to developing nations through Loss and Damage Funds, Global Goals on Adaptation, and Climate Finance commitments. These efforts include fund establishment, KPI development, and meeting financial targets. Phasing out fossil fuels represents another crucial aspect for addressing climate change, with targets for significantly reducing coal, oil, and gas usage by 2050. The IEA's 2023 scenario suggests an 80% reduction in fossil fuel demand, eliminating new coal, oil, and gas projects.

Another key outcome involves establishing foundations for renewable energy growth. Nations should commit to tripling global renewable capacity by 2030, improving energy efficiency, and eliminating methane emissions. This requires substantial infrastructure investments and financing for developing countries. Financial architecture reform aims to accelerate the transformation of financial systems supporting energy investments, with follow-up processes overseen by the UNFCCC or COP presidency.

Scaling accountability involves establishing mechanisms to monitor national NDC implementation and mobilize non-state entities like companies and cities. Key mechanisms include National Compliance, coordinated policy mandates, and expert guidelines on net-zero targets.

Delivering for nature and people encompasses thematic programs addressing nature, land use, oceans, just transition, and indigenous peoples. The estimated $145 billion annual spending on ecosystem actions falls significantly short of funding requirements projected for 2025 and 2030.

COP28 outcomes can be summarized as:

- Stimulating climate action course correction through the UN Global Stock take
- Fulfilling climate finance and adaptation promises to developing nations
- Phasing out fossil fuels with significant reductions targeted by 2050
- Expanding renewable energy capacity with goals to triple capacity by 2030
- Reforming financial systems to better support energy investments
- Increasing accountability mechanisms for national and non-state actions

- Supporting nature and people through targeted ecosystem programs

These comprehensive measures are vital for achieving long-term sustainability and effectively addressing climate challenges.

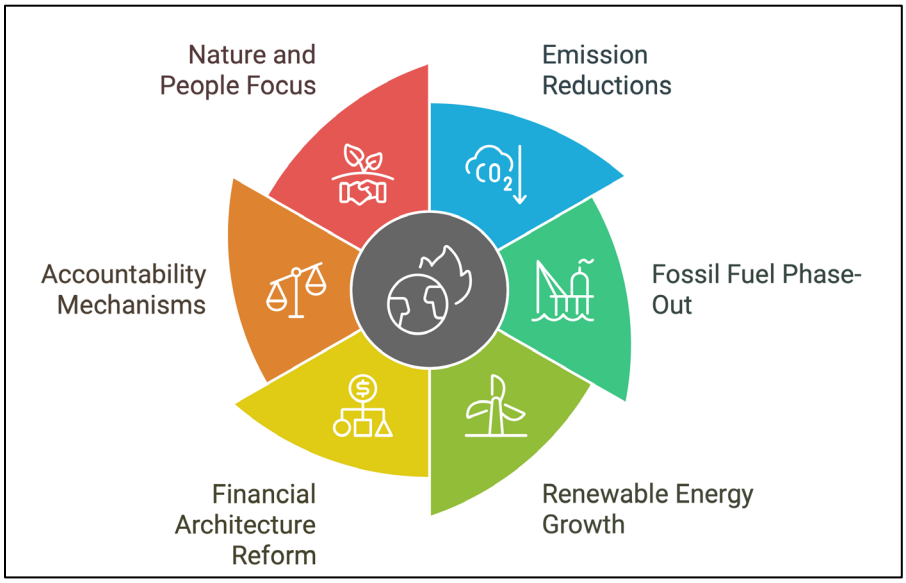

Figure 2. Outcomes of COP28 in UAE

Source: Authors' owns conception.

Outcomes of conference in Azerbaijan (COP 29):

The Conference of the Parties number 29 organized ```2024 in Baku, Azerbaijan last year, was one of the platforms to carry the evaluation for the progress toward Paris Agreement climate targets. Participating nations reiterated their commitment of limiting global warming to 1.5°C, this is combined with updated Nationally Determined Contributions (NDCs) targeting 45% greenhouse gas emissions reduction by 2030 compared to 2010 levels. It has been seen there is a large advancement from this conference, compared to the previous meeting two years before in UAE, it was decided to establish a new global financial mechanism aimed at mobilizing at least $100 billion annually to support developing countries' sustainable energy transition (UNFCCC, 2024), this sheds the light on the importance of climate finance's in promoting equitable climate action.

Additionally, for climate action framework transparency and accountability to be insured, an advanced monitoring and reporting systems were put in place. On another note, the meeting introduced initiatives based on nature-based solutions that emphasize biodiversity preservation as a climate change strategy. Finally, participants agreed on integrating climate resilience into national policies; in addition to recognize innovative solutions' role in sustainable development. Overall, Baku meeting emphasized global cooperation and fair resource distribution for achieving a sustainable future (IPCC, 2024).

Summary of comparison between outcomes of COP28 & COP29:

The table below summarizes and illustrates the advancements made at COP29 compared to the earlier conference at COP28, showcasing the increased ambition and concrete commitments toward global climate action (UNFCCC, 2024), (IPCC, 2024):

Table 1. Outcome advancement in COP 29 versus COP 28

Aspect	COP 28 Outcomes (2022)	COP 29 Outcomes (2024)
1. Emission Reduction Targets	Commitment to a *30%* reduction by 2030 from 2010 levels.	Enhanced commitments to a *45%* reduction by 2030 from 2010 levels.
2. Financial Mechanism	Discussions on climate finance with *no specific fund established.*	Established a new global financial mechanism *targeting $100 billion annually for developing countries.*
3. Nationally Determined Contributions (NDCs) Submission	Countries encouraged to submit *updated NDCs.*	Mandated *submission of updated and more ambitious NDCs with clear accountability* measures.
4. Nature-Based Solutions	*Limited* focus on nature-based *initiatives*.	Introduction of *comprehensive initiatives* focusing on nature-based solutions for biodiversity preservation.
5. Monitoring & Reporting Framework	*Basic monitoring framework* established.	*Robust framework for monitoring and reporting* climate actions, enhancing transparency and accountability.
6. International Cooperation	*General* calls for *cooperation; less structured.*	Strong emphasis on international collaboration with *clear partnership initiatives and support mechanisms*.
7. Adaptation Strategies	Emphasis on *adaptation* but *limited funding.*	Increased recognition of the *need for climate resilience integration into national policies*, with dedicated funding support.

Source: Authors' owns conception.

Areas of improvement for Qatar approach versus the GCC countries:

The literature review revealed several areas where Qatar's could improve its approach compared to other GCC countries. These challenges depend largely on Qatar's ability to address core differences in hydrocarbon exports as Qatar heavily depends on gas exports while other countries rely primarily on oil. This suggests that core adaptation approaches must consider hydrocarbon-specific technologies and their associated economic implications.

Methodology

Our methodology involved reviewing various scientific and non-scientific journal articles, papers, reports from international institutions (both non-profit and private, such as UN agencies), and government-published reports (including Qatari ministries and governmental bodies), policies, and strategies. We focused on energy transition efforts and renewable energy potential in Qatar—a global leader in gas production and export—as a case study among Gulf states, analyzing demand forecasting and energy policy research in the Gulf region. We thoroughly reviewed content to develop structured analysis leading to recommendations and improvement ideas for our case study.

Our central research question—"Is Qatar's approach comprehensive and agile enough to accommodate the dynamic nature of evolving guidelines and requirements following each Conference of the Parties?"—forms the crucial foundation for our hypothesis. As an outcome, we present recommendations and suggestions for improving Qatar's approach within the context of its need to adopt an energy transition strategy amid fragile regional and global geopolitical situations.

We contrast our findings with 19 dedicated papers on Qatar's energy transition and net zero carbon approach published in Logan Cochrane and Reem Al-Hababi's book "Sustainable Qatar – Social, Political and Environment Perspectives" (Cochrane L. and Al-Hababi R., 2023).

Results and discussions

This section begins by explaining our rationale for selecting Qatar as our case study, followed by an examination of Qatar's structured environmental sustainability efforts. We then discuss transition strategies, policies, and actions within Qatar's largest economic sector—energy—led by Qatar Energy. We briefly address key differences compared to other GCC countries' approaches before exploring economic impacts of these strategies on Qatar's economy, concluding with forward-looking discussion and recommendations.

Why Qatar Case Study:

Despite its modest physical size (11,521 sq. km) and population (2.7 million), Qatar plays an outsized role in global gas markets due to substantial hydrocarbon reserves. This has catalyzed domestic industrial development in sectors like steel, fertilizers, and petrochemicals, boosting exports of petroleum gas, crude oil, and refined products. These advancements have strengthened Qatar's global economic standing across diverse sectors including finance, construction, real estate, telecommunications, retail, healthcare, aviation, and notably petroleum, contributing to one of the world's largest sovereign wealth funds. Hosting FIFA 2022 further elevated Qatar's global profile.

Qatar now aims to diversify beyond hydrocarbons by emphasizing Islamic finance, tourism, sports, education, and healthcare. The government has introduced new strategies and policies to enhance non-hydrocarbon sectors, supporting broader sustainability initiatives through environmental policies, strategies, regulations, and institutions (L. Cochrane and R. Al-Hababi, 2023).

Qatar Structured effort for Environmental sustainability:

Qatar launched its National Vision 2030 (QNV 2030) in 2008, addressing environmental sustainability through governance, resilience, and an integrated framework. It balances social, economic, and ecological goals via four pillars: social development, human development, economic development, and environmental development. Key challenges include meeting current needs without compromising future generations, managing economic growth alongside population expansion, and environmental protection.

Three National Development Strategies support QNV 2030 implementation: NDS-1 (2011), NDS-2 (2018), and NDS-3 (2023), each with five-year focus periods addressing national goals. NDS-1 achieved two environmental targets by 2016, while NDS-2 (completed by 2022) improved integrated sustainability through initiatives reducing air pollutants, enhancing water quality, and raising public awareness about biodiversity (Al-Habibi, 2023). Figure 3 presents Qatar's Environmental Sustainability Pillars initiatives.

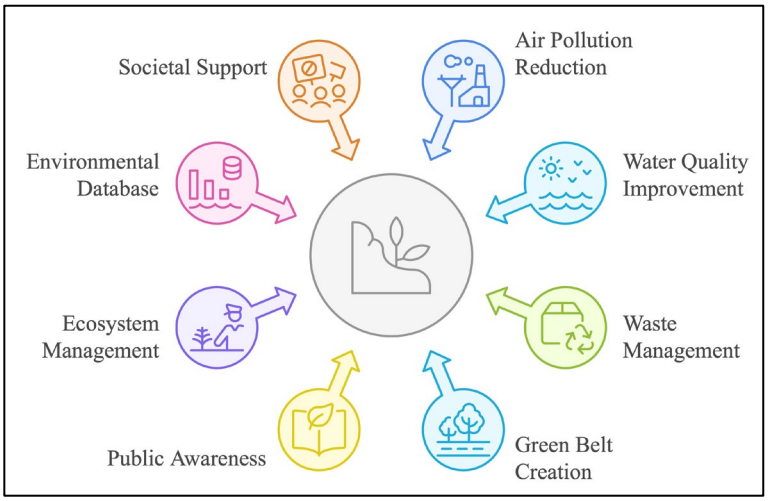

Figure 3. Initiatives for Environment Sustainability Pillars in Qatar

Source: Authors' owns conception.

In 2021, Qatar introduced both its National Environment and Climate Change Strategy 2030 (QNE) and National Climate Change Action Plan 2030 (NCCAP). QNE prioritizes greenhouse gas emissions, biodiversity, water resources, circular economy principles, and land use planning (Ministry of Municipality and Environment, 2021). NCCAP integrates adaptation and mitigation measures targeting 25% greenhouse gas emission reduction across oil and gas, power generation, water management, transportation, construction, and industrial sectors. Emission reduction strategies include carbon capture implementation, methane reduction initiatives, flare reduction programs, and energy efficiency improvements. Figure 4 highlights Oil and Gas Mitigation Measures for Emission Reduction.

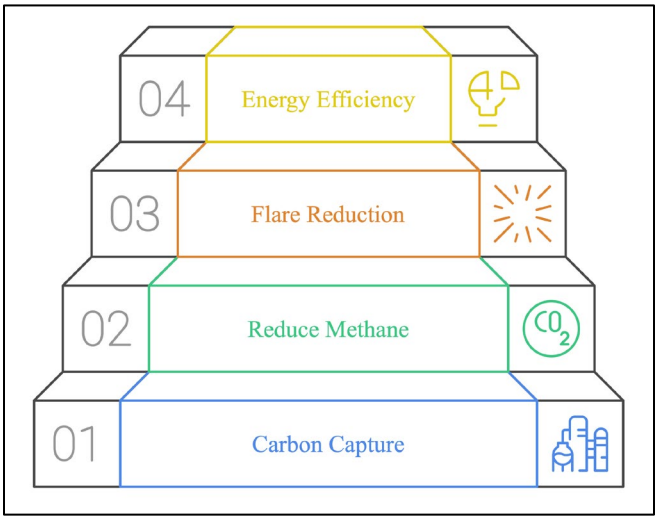

Figure 4. Oil and Gas Mitigation Measures for Emission Reduction

Source: Authors' owns conception.

The Ministry of Energy and its affiliated companies develop strategies for sustainability, sectoral adaptation measures, and community initiatives. This framework encompasses sectoral strategies, programs, and projects targeting environmental objectives, with clearly designated

responsible departments. While laws and regulations support environmental preservation, they require improved enforcement due to limited governmental capacity.

Qatar Energy Policy and Transition Strategies: Energy Sector Institutions actions

Building on its Environmental Sustainability structure, Qatar's energy sector has developed comprehensive Energy Policy and Transition Strategies—critical elements for navigating the global energy transition landscape. Qatar aims to achieve LNG export capacity of 126 million tons annually by 2027 while planning 11 million tons of carbon capture and storage (CCS) capacity by 2035. The nation also emphasizes hydrogen promotion and solar energy development. Economic diversification efforts have resulted in over two-thirds of GDP originating from non-energy sectors, though fluctuations in hydrocarbon demand continue impacting overall growth patterns. Reducing carbon footprint while fostering non-hydrocarbon private sector growth remains among Qatar's principal challenges (Wright, 2021).

Table 2. Qatar approach articulation for the Outcome in COP Aspects

Aspect	Qatar Actions
1. Emission Reduction Targets	Qatar has committed to reducing greenhouse gas emissions by 25% by 2030, as outlined in its updated Nationally Determined Contributions (NDCs) submitted in 2021. This commitment is reinforced by the Ministry of Environment and Climate Change's 2024-2030 strategy, which emphasizes achieving a sustainable and balanced environment alongside development goals.
2. Financial Mechanism	At COP29, Qatar called on developed countries to fulfill their commitments regarding climate change, including reforming international financing systems. This stance underscores Qatar's advocacy for equitable financial mechanisms to support global climate action.
3. Nationally Determined Contributions (NDCs) Submission	Qatar submitted its updated NDCs in 2021, detailing achievements and future plans to address climate change. The NDCs include measures to reduce emissions and adapt to climate impacts, reflecting Qatar's dedication to the Paris Agreement.
4. Nature-Based Solutions	Qatar's environmental strategies emphasize sustainability, one of the pillars of Qatar National Vision 2030. The country has launched initiatives to protect marine life, such as the establishment of the Regional Center for Whale Shark Conservation, highlighting its commitment to preserving biodiversity.
5. Monitoring & Reporting Framework	*Qatar operates an advanced national air quality monitoring network, ensuring compliance with environmental protection standards. This system enables the country to track progress in emission reductions and environmental quality effectively.*
6. International Cooperation	Qatar actively participates in international climate forums, such as COP28 and COP29, to showcase its environmental efforts and collaborate on global climate initiatives. The country's engagement in agreements concerning marine conservation and climate action initiatives underscores its commitment to international cooperation.
7. Adaptation Strategies	Qatar has launched its National Climate Change Action Plan, comprising numerous measures to mitigate emissions and adapt to climate change impacts. The plan is based on strict governance standards to monitor progress and address future challenges through 2030 and beyond

Source: Authors' owns conception, (QNA, 2023).

Difference between Qatar and other GCC countries approaches:

A distinguishing factor is Qatar's relatively smaller geographic footprint and population, allowing focused investment in high-impact, large-scale projects like the North Field Expansion—aimed at increasing LNG production capacity while incorporating sustainability measures (Gulf Times, 2023). By comparison, larger Gulf states like Saudi Arabia and UAE pursue broader economic diversification and energy transition goals, including extensive solar farms, green hydrogen initiatives, and innovative smart city projects like NEOM (Eljack & Kazi, 2021).

Qatar has integrated its energy transition strategy with National Vision 2030, emphasizing environmental sustainability alongside economic growth, though its focus remains more narrowly tailored to its gas industry compared to the broader renewable energy ambitions demonstrated by neighboring states (Qatar Ministry of Environment and Climate Change, 2023).

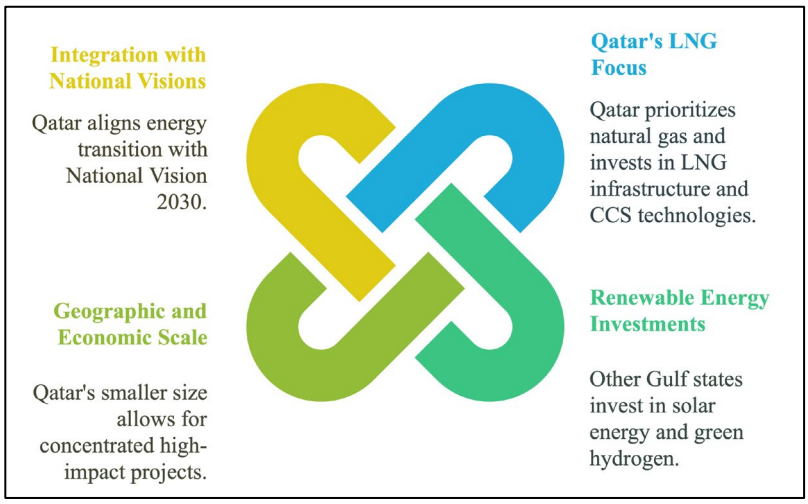

Figure 5. Key Difference Areas of Qatar approach to other GCC countries

Source: Authors' owns research.

Economic Impact of Qatar's Climate strategies

Qatar's climate strategies carry profound economic implications, reshaping the economy through enhanced energy efficiency, diversification efforts, job creation initiatives, and international investment attraction. Six key impact areas emerge:

(1) Renewable Energy Investments and Economic Diversification: Qatar's renewable energy investments, particularly in solar power projects like the Al Kharsaah Solar Power Plant (800 MW capacity), are contributing to economic diversification and cost savings. This facility is expected to reduce reliance on natural gas for electricity generation, potentially decreasing electricity production costs by 15% by 2030. These investments create new employment opportunities in renewable technology, engineering, and maintenance sectors, strengthening non-hydrocarbon employment.

(2) International Investment and Job Creation: Qatar has committed £1 billion ($1.3 billion) toward climate technology investments in the UK, aiming to establish climate technology hubs in both countries. This initiative should generate thousands of high-skilled positions in renewable energy, carbon capture, and green hydrogen sectors. This partnership enhances Qatar's global climate finance influence while enabling green technology transfer, strengthening its knowledge-based economy.

(3) Expansion of LNG Production and Sovereign Wealth Fund Growth: Qatar's planned 85% expansion of liquefied natural gas production is expected to significantly boost national revenues, potentially increasing GDP by 4-5% by 2035. The Qatar Investment Authority will benefit from increased LNG revenues, enabling greater investment across diversified sectors including technology, artificial intelligence, healthcare, and infrastructure, ensuring long-term economic sustainability.

(4) Carbon Capture and Storage (CCS) and Industrial Competitiveness: Qatar's CCS initiative targeting 11 million tons of CO_2 capture annually by 2035 should enhance Qatari LNG export competitiveness while attracting sustainable investment. These measures improve petrochemical and energy-intensive sector sustainability, ensuring long-term profitability while adhering to increasingly stringent global emissions regulations.

(5) Economic Growth from Renewable Energy Investments: Qatar's $14 billion renewable energy investment plan (2024-2035) should increase real non-hydrocarbon GDP growth by 0.53 to 0.67 percentage points in 2024, with continued gains thereafter. These investments stimulate job creation across solar and wind energy, energy storage, and smart grid technologies, expanding economic opportunities beyond traditional hydrocarbon sectors.

(6) Agricultural and Fertilizer Sector Expansion: Qatar Energy plans to double annual urea production to 12.4 million tons, responding to growing global fertilizer demand driven by population growth and food security challenges. This initiative increases export revenues, supports economic diversification efforts, and enhances regional food security initiatives. Qatar's climate strategies balance economic growth with environmental responsibility, positioning the country as a leader in green finance, sustainable energy development, and international climate cooperation, ensuring economic resilience in an emerging low-carbon future.

Recommendation & way forward:

Qatar could enhance its energy transition strategy by adopting successful approaches from other Gulf Cooperation Council (GCC) states. Learning from neighboring experiences, Qatar might strengthen its planning and implementation in several key areas:

- Renewable Energy Deployment
  Learning from UAE and Saudi Arabia: UAE's significant solar energy progress and Saudi Arabia's large-scale renewable projects under Vision 2030 offer valuable insights. Qatar might accelerate renewable energy deployment through increased utility-scale solar project investments and better integration into its energy mix (IRENA, 2023). Adopting Best Practices: Qatar could implement successful public-private partnerships (PPPs) and regulatory frameworks that have enabled UAE and Saudi Arabia to attract foreign renewable energy investment.
- Diversifying into Green Hydrogen
  Following Oman and Saudi Arabia's Lead: Both countries are emerging as green hydrogen production leaders. Qatar could leverage existing LNG infrastructure and gas expertise to develop green hydrogen export projects (IEA, 2023). Investing in Research and Development: Qatar might establish international partnerships and increase R&D investment to advance hydrogen technologies, similar to Saudi Arabia's NEOM Green Hydrogen Project.

- Enhancing Energy Efficiency and Smart Grids
  Emulating UAE's Smart City Initiatives: UAE has successfully implemented smart grid technologies and energy efficiency measures in Dubai and Abu Dhabi. Qatar could integrate similar solutions into urban planning, particularly for upcoming events. Promoting Energy Efficiency Standards: Qatar might introduce stricter building and industrial energy efficiency standards, following UAE's successful Estidama Pearl Rating System implementation.
- Expanding Carbon Capture, Utilization, and Storage (CCUS)
  Collaborating with Saudi Arabia and UAE: Qatar could expand CCUS capabilities through regional collaboration and technological expertise sharing (IEA, 2022). Scaling Up Pilot Projects: Qatar might scale existing CCUS pilot projects and integrate them into LNG production processes for further emissions reduction.
- Strengthening Regional Collaboration
  Joining GCC-wide Initiatives: Qatar could actively participate in initiatives like the Gulf Electricity Interconnection Grid, enhancing energy security and regional renewable energy integration. Sharing Knowledge and Resources: Through increased GCC state collaboration, Qatar might share knowledge, resources, and best practices to accelerate energy transition efforts.
- Focusing on Public Awareness and Education
  Learning from UAE's Public Campaigns: UAE has successfully raised sustainability awareness through public campaigns and educational programs. Qatar could launch similar initiatives engaging its population in energy conservation and sustainability efforts (UAE Ministry of Climate Change and Environment, 2023). Figure 6 illustrates areas for improving Qatar's strategy content and implementation based on neighboring countries' experiences and lessons learned.

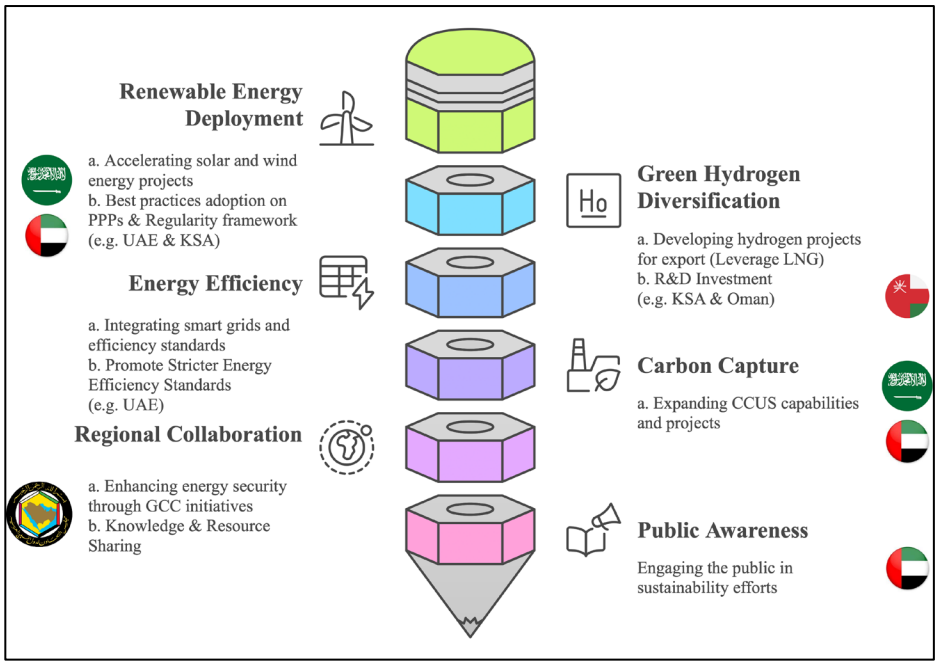

Figure 6. Areas to improve the strategy content and execution for Qatar based on neighboring countries experience and lesson learnt

Source: Authors' owns conception.

Implementation Strategy:
We've identified three implementation strategy themes requiring expansion into detailed playbooks and actions. Special effort is needed to identify touchpoints and synergies with existing approach elements to maximize added value. This includes developing a Comprehensive Roadmap with detailed timelines and targets. Qatar should also leverage International Partnerships with global organizations and institutions to access funding, technology, and expertise. Finally, regular Monitoring and Evaluation of energy transition initiatives will ensure continuous improvement and alignment with global best practices.

Conclusion

We must recognize that Qatar's initiatives form part of its strategy to maintain leadership status with innovative energy market presence while providing citizens with high living standards. Qatar should also aim to uphold its regional Gulf Cooperation Council (GCC) role. However, several potential barriers threaten this path to success. These include existing Middle Eastern geopolitical tensions, global economic conditions influenced by evolving US positions on energy transition and Paris Agreement support under the new administration, sluggish European Economic Area recovery following COVID-19 and the Russian-Ukrainian conflict, and China's emergence as a significant player in energy transition implementation technologies.

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