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ECONOMIC AND FINANCIAL DEVELOPMENT IMPACTS ON ENERGY CONSUMPTION IN QATAR

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ABSTRACT

This study examines the short and long-run relationships among economic growth, financial development, investment, and electricity consumption during the period between 1975 and 2018 for Qatar. We conducted the Autoregressive Distributed Lag (ARDL) cointegration test and Vector Error Correction Model to propose comprehensive policy recommendations. The findings support the validity of the conservation hypothesis for energy-growth nexus, and thereby energy use reduction has an insignificant impact on the growth. We recommended policies aiming to reduce household energy use and country-wide AC usage. In this regard, financial subsidies in energy and water consumption should be reduced further, even abolished, to lower the waste use of energy and prevent extravagant water use distilled from seawater by natural gas-powered desalination plants. Policymakers should also consider proactive and incentivizing strategies for cooling electricity load control and demand-side management of cooling in summers. This might enable leveling out peaks in electricity use, and hence reduce redundant power generation and cost.

Keywords: *Energy-growth nexus; Energy-finance nexus; VECM model; ARDL model.*

Jel Codes: *C32, C52, Q43.*

1. INTRODUCTION

From an epistemological perspective, energy can be considered an underlying factor and input of growth along with labor, capital, and technology in modern times (Keen et al., 2019). Since the transition from hand production methods to machines, intense energy has been required to combustion engines for motion, and furnaces for heat to manufacture massive amounts of goods and commodities such as textile, steel, metals, ceramics, cars, appliances, planes, and so on, which would all require more energy to operate and function. Such a perpetuating vicious cycle of energy demand-and-supply has resulted in immoderate CO_2 emissions that are now stated a primary ingredient of greenhouse gases (GHGs) and consequent climate change, although initially conceived to be a harmless by-product of growth and

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modern trade. A significant portion of worldwide GHG emissions originated from energy use reported between 80 (WRI, 2021) and 90% (Gütschow et al., 2019). In this regard, after decades of relentless and careless exploitation of fossil fuels for energy, and energy for economic growth, the current generation of humankind is at the junction of making a major radical decision to balance the economic growth and social development enjoyed at the expense of environmental and health degradations as a consequence of emissions, generated by fossil fuels for both present and future generations (Ozturk, 2010).

Economic growth has a close relationship with energy consumption because further energy use usually leads to an increase in production and thus growth. However, energy consumption might be lowered after a certain economic growth threshold due to more efficient energy use and transition from energy-intense industries to energy-conservative sectors (i.e., high tech products, microelectronics, biotechnology etc.) instead of cement, steel, metals, and so on. In this regard, the causality between energy and growth is also broadly discussed in the literature since Kraft and Kraft(1978)'s seminal study. Manufacturing-based countries intensively requiring energy exploit fossil fuels to power their economic growth by omitting environmental, social, and indirect economic consequences. Due to the high demand for energy, fossil fuel supply, which also requires considerable energy for production and supply, increases enormously. The reason for this is that transporting fossil fuels from extraction places to locations in demand is accessible and thereby reachable everywhere with more affordable prices in general. Fossil fuels also enable continuous energy supply without interruption, which is the main disadvantage of renewable energy sources. In short, energy is vital for economic growth for both hydrocarbon-based rentier states and industrialized developed countries.

Hydrocarbon-based rentier states extract a considerable amount of these fuels to compensate for their lack of other natural resources such as water. For instance, rentier countries suffering water resources and located along the seacoast supply their water needs by desalinating seawater, which is an energy-intensive process, and it releases further emissions. In this regard, the Gulf Cooperation Council (GCC) countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE) hold approximately 30% of global oil reserves and 20% of natural gas reserves (BP, 2020), produce more than 50% of global hydrocarbon demand, and obtain almost 99% of their water needs through desalination plants. These numbers promote increasing oil and natural gas extraction without careful accounting of the environmental harm and cost on the people and society, in the long run, to gain substantial capital returns for the welfare of their nations in the short run. Although many of such nations started using their monetary resources to extensively improve their human capital through educational facilities, healthcare systems, and social inclusiveness, they continue increasingly relying on oil and gas revenues with insignificant economic diversification levels and vulnerability to oil price shocks, and thereby, fragile economies (Ari et al., 2019; Jolo et al., 2022).

Since the first oil extraction in the late 1940s, Qatar has shifted from a pearl, fishing, and agricultural-based economy to a hydrocarbon-based economy. Qatar is blessed with abundant natural gas resource and ranked third worldwide after Russia and Iran in terms of proven natural gas reserves (BP, 2020). Its purchasing power parity (PPP) per capita was US$142,000 in 2012, when Qatar was on top of the list. However, it went down to the fourth rank with around US$94,000 in 2019 (The World Bank, 2020a) mainly because of its high dependence on fluctuating oil and natural gas revenues, which constitutes more than 50% of GDP, 85% of export earnings, and 70% of government revenues (MDPS, 2020).

Since the 2010s, Qatar has been striving for substantial sectoral shifts, policymaking, and developing regulations to diversify its economy through various, mainly governmental, initiatives. In this regard, Qatar dramatically reduced financial subsidies in energy use, including seawater desalination, from 3.0% of GDP to 0.6% in 2014 and 2016, respectively, and thereby the overall reduction was equal to 77% in 2016 (Al-Saidi, 2020). It was an essential and beneficial step for reducing the waste of energy and water because the per capita energy consumption was about 198 thousand MWh in 2019, 11-fold higher than the global average of around 18 thousand MWh (BP, 2020). Besides, this reduction can reduce extravagant water use distilled from seawater, accounting for 100% of household water provision, in natural gas-powered desalination plants (Hussein & Lambert, 2020). Despite awareness campaigns and increasing tariffs for water use since 2016, Qatar's water consumption is one of the highest levels per capita globally, at 557 liters/day/inhabitant, and far from international averages (Hussein & Lambert, 2020). Excessive energy-water use negatively contributes to air quality and ranks Qatar first worldwide in CO_2 emissions per capita with around 39 tones, more than eightfold of the global average (BP, 2020).

This study examines the impacts of economic growth, financial development, and investment on energy consumption to understand the interrelations and recommend policies to contribute to Qatar's national vision. To this end, we conducted the Autoregressive Distributed Lag (ARDL) and Vector Error Correction Model to investigate the short- and long-run relationships.

2. LITERATURE REVIEW

There is extensive literature concentrating on energy-economic growth nexus by applying various econometric analyses and considering a multitude of perspectives. This study focuses on the economic and financial development impact on carbon emissions and energy consumption in Qatar. Therefore, we consider the literature reporting relevant results specifically for Qatar and related ones such as the MENA and GCC regions. In this respect, **Hata! Başvuru kaynağı bulunamadı.** tabulates a summary of such studies according to their focus, tested variables, period, methodology, and which of the following four hypotheses holds in the relationship of energy use, carbon emissions, and economic growth: (i) growth, (ii) conservation, (iii) feedback, and (iv) neutrality.

The "growth hypothesis" is a valid assumption when unidirectional causality exists from energy consumption to economic growth. In this case, energy use gives rise to economic development by utilizing it for production or services, and thereby the country becomes energy dependent for growth. In the opposite direction, unidirectional causality running from the growth to energy consumption justifies the "conservation hypothesis" that implies the growth is independent of the energy use. Hence conserving energy does not affect the growth. The "feedback hypothesis" is satisfied in the existence of bidirectional causality between the variables that implies triggering each other. The "neutrality hypothesis" is a valid assumption in the absence of causality between dependent and independent variables. It indicates that there is no relationship at all. Each hypothesis requires different policy treatments in energy use to promote growth. These four hypotheses are not only valid for energy-growth nexus, but also can be employed for environment-growth nexus by changing energy use in the definitions with carbon emissions. **Hata! Başvuru kaynağı bulunamadı.** presents the mentioned literature review for Qatar.

Table 1. The reported results of energy-environment-growth nexus for Qatar, and those including it, ordered by publication year

Author	Country	Variables[a]	Period	Methodology[b]	Hypothesis
Al-Iriani (2006)	GCC	Y↔E	1971-2002	GMM	Conservation
Al-mulali & Tang (2013)	GCC	Y↔E	1980-2009	PVECM	Feedback
	GCC	Y↔ CO_2	1980-2009	PVECM	Growth
Salahuddin et al. (2015)	GCC	Y↔E	1980-2012	PVECM	Growth
		Y↔ CO_2	1980-2012	VECM	Neutrality
Ozturk & Al-Mulali (2015)	GCC	Y↔NGE	1980-2012	PVECM	Feedback
Jammazi & Aloui (2015)	Qatar	Y↔E	1980–2013	WWCC	Feedback
Kahia et al. (2016)	GCC	Y↔NRE,	1980-2012	PVECM	Feedback
		Y↔RE	1980-2012	VECM	Conservation
Bekhet et al. (2017)	Qatar	Y↔E	1990-2011	VECM	Conservation
		Y↔ CO_2	1990-2011	VECM	Neutrality
Mrabet et al. (2017)	Qatar	Y↔EF	1980-2011	TY Granger	Feedback
Charfeddine (2017)	Qatar	Y↔EI, Y↔ CO_2	1970-2015	VECM	Feedback
Charfeddine et al. (2018)	Qatar	Y↔E	1970-2014	VECM	Growth
Salahuddin & Gow (2019)	Qatar	Y↔EI, Y↔ CO_2	1980-2016	TY Granger	Neutrality
Sadraoui et al. (2019)	MENA	Y↔E	2000-2018	VECM	Growth
Gorus & Aydin (2019)	MENA	Y↔E	1975-2014	SUR	Conservation[c]
Erdoğan et al. (2019)	MENA	Y↔E	1990-2014	SUR	Growth
Matar (2020)	GCC \ Qatar	Y↔E, FD↔E	1980-2017	WWCC	Feedback
Saadaoui (2022)	MENA	Y↔RE	1990-2018	PDH	Feedback

Notes: *(a) Y: Gross Domestic Product (Real GDP or constant prices), E: Energy use,* $\psi_1 = f(CO2, K, L)$*;* $\psi_2 = f(CO2, K, L, T, FD)$*;*$\psi_3 = f(E, U, T)$*; EF: Ecological footprint, NGE: Natural-gas energy consumption, RE: Renewable energy use, NRE: Non-renewable energy use, EI: Energy intensity, FD: Financial development. (b) GMM, PVECM, VECM, WWCC, TY Granger, SUR, and PDH stand for the generalized method of moments, panel vector error correction model, vector error correction model, wavelet windowed cross correlations, and Toda Yamamoto Granger causality, seemingly unrelated regression, and pairwise Dumitrescu–Hurlin panel causality, respectively. (c) Conservation is valid in short and middle term, but in the long term, growth hypothesis is valid.*

3. METHODOLOGY

The econometric analysis in this study initiates with determining the integration numbers for all variables by employing Augmented Dickey-Fuller (ADF) (1979) and Philips and Perron (1988) unit root tests. The results enable us to conduct the Autoregressive Distributed Lag (ARDL) (Pesaran et al., 2001) cointegration test to investigate the short- and long relationships among the variables in electricity use specification. Next, the causality direction is examined by performing Vector Error Correction Model (VECM) to ascertain short- and long-run directional impacts for each possible combination of independent and dependent variables and justify the ARDL findings. By employing VECM, we also investigate which of the following five hypotheses holds in the relationship of energy use and economic growth: (i) growth, (ii) conservation, (iii) feedback, and (iv) neutrality.

3.1. Data and descriptive statistics

This study investigates economic and financial development impacts on energy use. In this regard, we exploit following annual data: (i) electricity use as a proxy for energy use[1], (ii) real GDP as proxy for economic development, (iii) financial development that is proxied by domestic credit to private sector, (iv) foreign trade (the sum of exports and imports) as a proxy for openness and financial development, (v) investment that is gross fixed capital formation. All variables are gathered from World Development Indicators of the World Bank for the period of 1975-2018 (The World Bank, 2020b). Financial development, foreign trade, and investment are converted from the GDP shares to 2010 US dollars per capita by scaling them with the real GDP and population data to be consistent in the units and remove potential noise. The natural logarithmic forms are employed for all variables to reduce heteroscedasticity. Table 2 demonstrates descriptive statistics for the variables used in this study in levels and log-levels.

Table 2. Descriptive statistics

Variable	Definition	Mean	Min	Max	St. dev.
	Levels				
EU	Electricity use (kilowatt-hour per capita)	11819.67	3803.55	16390.73	3298.37
GDP	Real GDP (2010 US dollars per capita)	60421.46	39051.91	91455.24	14546.83
FD	Financial development (2010 US dollars per capita)	21854.44	9632.40	52804.29	11085.43
T	Foreign trade (2010 US dollars per capita)	29045.34	7408.30	77622.05	20260.80
INV	Investment (2010 US dollars per capita)	13326.25	2795.09	29566.82	8790.527
	Log Levels				
LEU	Log of Electricity use (kilowatt-hour per capita)	4.05	3.58	4.21	0.15
LGDP	Log of Real GDP (2010 US dollars per capita)	4.77	4.59	4.96	0.11
LFD	Log of Financial dev. (2010 US dollars per capita)	1.52	1.06	1.90	0.21
LT	Log of Foreign trade (2010 US dollars per capita)	4.36	3.87	4.89	0.30
LINV	Log of Investment (2010 US dollars per capita)	4.01	3.45	4.47	0.32

***Notes**: 1. The FD, FT, and INV are, first, gathered as a percentage of GDP, and then they are calculated as per capita measurements by the authors.*

3.2. The ARDL models

Many studies in the literature employ bivariate cointegration models to test a long-run relationship between two variables that might cause a shallow understanding of the nature of the process and incur missing underlying reasons for the relationship because of the multivariate impact of complex systems. Therefore, this study follows a multivariate cointegration test to gain more insights into economic and financial development impact on energy use. In this regard, we employ the ARDL bounds testing

[1] The last four years data (2015-2018, both inclusive) for electricity consumption is gathered from the Kahrama, Qatar General Electricity and Water Corporation (Kahrama, 2018).

approach developed by Pesaran and Shin (1999) . The ARDL test has several advantages against different cointegration approaches such as Engle and Granger (1987), Johansen and Juselius (1990), and Johansen (1992) procedures. These pros are that the ARDL model: (i) allows mixed integration numbers of order zero and one, whereas other cointegration approaches commonly impose that all variables must be integrated in the identical order; (ii) enables unbiased estimates when some or all explanatory variables are endogenous by involving the regressors' lags that form dynamic models (Pesaran et al., 2001); (iii) provide unbiased estimates without depending sample size; (iv) utilizes a single reduced-form equation for estimating the long-run relations; and (v) allows different optimal lags for the variables.

The ARDL approach consists of two steps for the long- and short-run estimates: (i) investigating whether there is a long-run relationship (see Eq.(1)); and (ii) if a long-run exists, then estimating long-run (see Eq.(2)) and short-run models (see Eq.(3)). In this respect, this study derives the log-linear functional model for energy (proxied by electricity) use specification.

3.2.1. Electricity (energy use) specification

Qatar's energy-growth-development nexus has stayed untouched in this study up until now. In this regard, this electricity specification (hereafter, interchangeable with energy specification) aims to reveal the relationships among energy use, real GDP, domestic credit to the private sector, foreign trade, and investment. We intentionally omit the CO_2 emission from the model because it might incur a noise and overfitting problem on electricity consumption in the hydrocarbon-based rentier states, such as Qatar. In contrast to many studies in the literature -in which commonly real GDP and energy use are selected a dependent and independent variable, respectively- we consider that electricity use is a dependent variable, and others are independent, to analyze economic and financial indicators effect on energy consumption in the integrated framework. To this end, the ARDL model of logarithmic-linear electricity (energy) specification for testing whether there is a cointegration among energy use, real GDP, financial development, foreign trade, and investment is given in Eq.(1).

$$\begin{aligned}\Delta(LEU_t) = \alpha_{31} &+ \sum_{i=1}^{a_{31}} \beta_{31i}\Delta(LEU_{t-i}) + \sum_{j=1}^{b_{31}} \gamma_{31j}\Delta\left(LGDP_{t-j}\right) + \sum_{k=1}^{c_{31}} \theta_{31k}\Delta(LFD_{t-k}) \\ &+ \sum_{l=1}^{d_{31}} \eta_{31l}\,\Delta(LT_{t-l}) + \sum_{m=1}^{e_{31}} \zeta_{31m}\Delta(LINV_{t-m}) + \delta_{32}LGDP_{t-1} + \delta_{33}LFD_{t-1} \\ &+ \delta_{34}LT_{t-1} + \delta_{35}LINV_{t-1} + \epsilon_{31t}\end{aligned} \tag{1}$$

In the existence of a cointegration, the long-run and short-run estimates are performed employing Eq.(2) and Eq.(3).

$$LEU_t = \alpha_{32} + \sum_{i=1}^{a_{32}} \beta_{32i}(LEU_{t-i}) + \sum_{j=1}^{b_{32}} \gamma_{32j}\left(LGDP_{t-j}\right) + \sum_{k=1}^{c_{32}} \theta_{32k}(LFD_{t-k}) + \sum_{l=1}^{d_{32}} \eta_{32l}\,(LT_{t-l}) + \sum_{m=1}^{e_{22}} \zeta_{32m}(LINV_{t-m}) + \epsilon_{32t} \quad (2)$$

$$\Delta(LEU_t) = \alpha_{33} + \sum_{i=1}^{a_{33}} \beta_{33i}\Delta(LEU_{t-i}) + \sum_{j=1}^{b_{33}} \gamma_{33j}\Delta\left(LGDP_{t-j}\right) + \sum_{k=1}^{c_{33}} \theta_{33k}\Delta(LFD_{t-k}) + \sum_{l=1}^{d_{33}} \eta_{33l}\,\Delta(LT_{t-l}) + \sum_{m=1}^{e_{33}} \zeta_{33m}\Delta(LINV_{t-m}) + \psi_3 ECT[3]_{t-1} + \epsilon_{33t} \quad (3)$$

3.3. The VECM for short and long run causality

ARDL cointegration test only indicates whether the long-run relationship exists and does not provide the causality direction. Therefore, this study employs the two-steps procedure in the Engle and Granger (1987) methodology to explore the causal relationship in the long- and short-run for the two sets of variables: economic and financial development impact on energy consumption. The first step is to estimate residuals from the long-run model for electricity specification (see Eq.(1)). The following step is to estimate Granger causality with vector-error-correction models (VECM) by integrating the first step's residuals into the model. In this regard, the VECM is superior to standard Granger causality in case of a cointegration existence. The VECM's equation set for estimating the electricity specification model is given in Eq.(4).

$$\begin{pmatrix} \Delta LEU_t \\ \Delta LGDP_t \\ \Delta LFD_t \\ \Delta LT_t \\ \Delta LINV_t \end{pmatrix} = \begin{pmatrix} \rho_1 \\ \rho_2 \\ \rho_3 \\ \rho_4 \\ \rho_5 \end{pmatrix} + \begin{pmatrix} \lambda_{11,1} & \lambda_{12,1} & \lambda_{13,1} & \lambda_{14,1} & \lambda_{15,1} \\ \lambda_{21,1} & \lambda_{22,1} & \lambda_{23,1} & \lambda_{24,1} & \lambda_{25,1} \\ \lambda_{31,1} & \lambda_{32,1} & \lambda_{33,1} & \lambda_{34,1} & \lambda_{35,1} \\ \lambda_{41,1} & \lambda_{42,1} & \lambda_{43,1} & \lambda_{44,1} & \lambda_{45,1} \\ \lambda_{51,1} & \lambda_{52,1} & \lambda_{53,1} & \lambda_{54,1} & \lambda_{55,1} \end{pmatrix} \begin{pmatrix} \Delta LEU_{t-p} \\ \Delta LGDP_{t-1} \\ \Delta LFD_{t-1} \\ \Delta LT_{t-1} \\ \Delta LINV_{t-1} \end{pmatrix} + \cdots + \begin{pmatrix} \lambda_{11,p} & \lambda_{12,p} & \lambda_{13,p} & \lambda_{14,p} & \lambda_{15,p} \\ \lambda_{21,p} & \lambda_{22,p} & \lambda_{23,p} & \lambda_{24,p} & \lambda_{25,p} \\ \lambda_{31,p} & \lambda_{32,p} & \lambda_{33,p} & \lambda_{34,p} & \lambda_{35,p} \\ \lambda_{41,p} & \lambda_{42,p} & \lambda_{43,p} & \lambda_{44,p} & \lambda_{45,p} \\ \lambda_{51,p} & \lambda_{52,p} & \lambda_{53,p} & \lambda_{54,p} & \lambda_{55,p} \end{pmatrix} \begin{pmatrix} \Delta LEU_{t-p} \\ \Delta LGDP_{t-p} \\ \Delta LFD_{t-p} \\ \Delta LT_{t-p} \\ \Delta LINV_{t-p} \end{pmatrix} + \begin{pmatrix} \psi_6 \\ \psi_7 \\ \psi_8 \\ \psi_9 \\ \psi_{10} \end{pmatrix} ECT_{t-1} + \begin{pmatrix} \epsilon_6 \\ \epsilon_7 \\ \epsilon_8 \\ \epsilon_9 \\ \epsilon_{10} \end{pmatrix} \quad (4)$$

The VECM for electricity specification allows us to test the following hypotheses for the energy-growth nexus mentioned at the beginning of the methodology section: growth, conservation, feedback, and neutrality hypotheses. Each hypothesis requires different policy applications and implications regarding energy consumption patterns that are considered by policymakers. For instance, the growth hypothesis indicates that increasing or decreasing energy use causes an increase or reduction, respectively, in economic growth. In this case, conservation policies targeted at energy use reduction might infer the growth inefficiencies. In this hypothesis, the growth has no influence on energy consumption. On the other hand, the conservation hypothesis suggests that increasing economic growth unidirectionally leads to an increase in energy use. In line with this, energy consumption has no impact on the growth, and thereby the conservation policies might mitigate air pollution and the depleting natural resources in hydrocarbon-based rentier states, particularly Qatar. The feedback hypothesis implies bidirectional causality between energy and growth. Last, the neutrality hypothesis states that there is no causality between them at all.

4. RESULTS AND DISCUSSION

In order to apply the ARDL test smoothly, a couple of pretests need to be conducted to avoid biased estimates and statistical flaws. This study proceeds to perform the ARDL model after passing several diagnostic tests. First, the Augmented-Dickey-Fuller (ADF), and Phillips and Perron (PP) unit root tests (Dickey & Fuller, 1979; Phillips & Perron, 1988) are employed to examine whether all the ARDL model variables are stationary in levels or the first integration order. This is because the ARDL critical bounds reported by Pesaran et al. (2001) and Narayan (2005) are valid only if the integration orders of the variables in the model are less than two, I(2). Table 3 presents the both ADF and PP results that energy use are stationary in levels, I(0), whereas real GDP, financial development, foreign trade, and investment data contain a unit root in their levels but are stationary in their first difference, I(1). In other words, the time series in the model have mixed integration orders in levels and the first difference, thereby satisfying an underlying assumption of the ARDL bounds test.

Table 3. Unit root test results

Variables	Levels		1st Difference		Conclusion
	ADF	PP	ADF	PP	I(order)
LEU	-4.9659 [0]***	-4.2371 (2)***	-2.5898 [1]	-3.0194 (3)**	I(0)
LGDP	-1.6877 [0]	-1.8469 (4)	-4.5245 [0]***	-4.7813 (4)***	I(1)
LFD	-1.7856 [0]	-1.7738 (2)	-6.0131 [0]***	-6.0308 (6)***	I(1)
LT	-0.9349 [0]	-1.1494 (3)	-5.0397 [0]***	-5.0397 (0)***	I(1)
LINV	-0.5363 [0]	-0.6839 (3)	-5.8063 [0]***	-5.8171 (3)***	I(1)

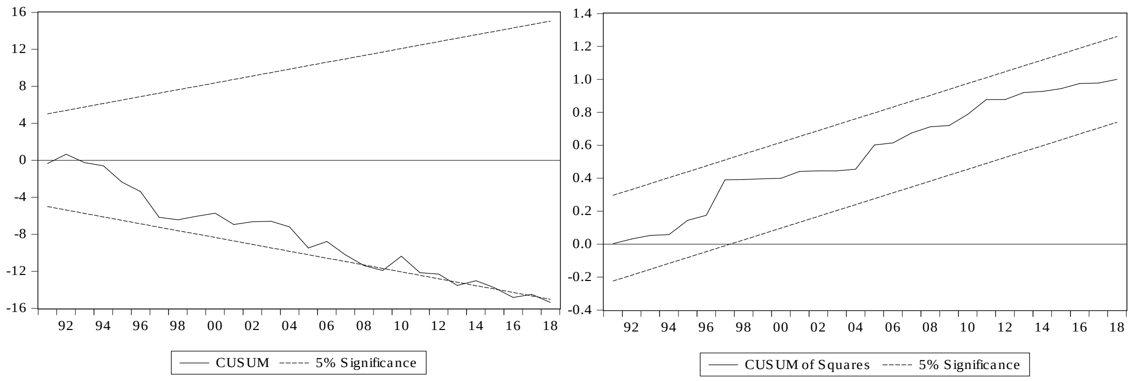
Notes*:1. *, ** and *** indicate significance level at the 10%, 5% and 1%, respectively. 2. The numbers in parentheses are the lag orders in ADF tests that are selected based on the AIC, and square brackets shows the optimal bandwidths for PP tests.*

Table 4 shows diagnostic test results for the electricity specifications. The findings confirm that the models are well-defined and enable the ARDL and VECM tests to make reliable and unbiased estimates for policy recommendations. In detail, the pretests indicate that the models hold the following conditions in their variables: (i) there exists no serial correlation, (ii) they have no heteroskedasticity problem, (iii) they have normal distribution stipulating zero mean and constant variance, and (iv) there is no misspecification regarding the Ramsey Regression Equation Specification Error Test (RESET) test (Ramsey, 1969). Macroeconomic and energy datasets are usually subjected to structural time breaks due to economic, financial, and energy crises such as the 1973 oil crisis worldwide. Therefore, this study investigates the structural time stability of the three model specifications by conducting the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests (Brown, Durbin, & Evans, 1975). Figure 1. illustrates the CUSUM and CUSUMSQ test statistics confined in the critical bounds of 5%

Table 4. Model diagnostic test results

Test	Electricity spec. Stat. (probability)
Breusch-Godfrey serial corr. LM test (F-statistic)	0.9741 (0.3909)
Heteroskedasticity: Breusch-Pagan-Godfrey (F)	1.6182 (0.1318)
Heteroskedasticity test: ARCH (F-statistic)	0.4211 (0.5200)
Normality test: Jarque-Bera test	0.7766 (0.6782)
Ramsey RESET test (F-statistics)	1.1042 (0.3027)
CUSUM	Stable
CUSUMsq	Stable

Figure 1. The CUSUM and CUSUM of squares for the electricity specifications



In this study, each sample size is limited to 44 between 1975-2018, which is relatively small. According to Burnham and Anderson (2004), the lag selection based on AIC provides unbiased estimates in the small samples and outperforms the alternative SCB approach. Therefore, we choose AIC in the ARDL and VECM models. Table 5 illustrates the F-statistics of the estimated ARDL model for (LEU|LGDP, LFD, LT, LINV) and the corresponding critical bounds at both 1% and 5% significance levels. The results confirm that the electricity specification has long-run relationships between the dependent variables and independent explanatory variables at a 1% significance level. Therefore, these findings enable us to estimate the ARDL long-run tests to make potential policy recommendations.

Table 5. Estimated ARDL models and bounds F-tests for cointegrations.

ARDL model	Model spec.	F-statistics	CV 1%		CV 5%	
			I(0)	I(1)	I(0)	I(1)
(LEU|LGDP,LFD,LT, LINV)	(1,2,0,4,4)	11.3807	4.394	5.914	3.178	4.45

Notes*:1. The optimal lag orders in the model specification are selected based on the AIC. 2. The CV represents the critical values for the lower I(0) and upper I(1) bounds that are obtained from the table of Case III in* Narayan (2005)*.*

The model has statistically significant regressors at a 1% significance level, except for foreign trade's energy elasticity (see **Hata! Yer işareti başvurusu geçersiz.**). The estimated log-linear long-run coefficients of real income per capita for the impact on electricity use is 1.938, implying that an increase in the income will increase the electricity consumption by 194%. In line with this, an increase in foreign trade will raise energy (electricity) consumption by 81%. However, an increase in investment will considerably reduce energy use. There is no long-run relationship between financial development and electricity use.

Table 6. ARDL long run estimates for electricity model specification.

Variables	Electricity specification	
	Coefficient	t-Statistics
LGDP	1.9386***	2.8015
LFD	-0.0893	-0.5629
LT	0.8090 ***	5.1281
LINV	-1.0850 ***	-3.8072
ECT_{t-1}	-0.2466***	-8.0643
R^2	0.9863	
Adjusted R^2	0.9789	

Notes*:1. *, ** and *** indicate significance level at the 10%, 5% and 1%, respectively.*

demonstrates the long-run cointegration estimates. The results show a strong and statistically significant long-run relationship at a 1% significance level between the dependent variable (i.e., electricity consumption) and the regressors corresponding to each model. The model has statistically significant regressors at a 1% significance level, except for foreign trade's energy elasticity (see **Hata! Yer işareti başvurusu geçersiz.**). The estimated log-linear long-run coefficients of real income per capita for the impact on electricity use is 1.938, implying that an increase in the income will increase the electricity consumption by 194%. In line with this, an increase in foreign trade will raise energy (electricity) consumption by 81%. However, an increase in investment will considerably reduce energy use. There is no long-run relationship between financial development and electricity use.

Table 6. ARDL long run estimates for electricity model specification.

Variables	Electricity specification	
	Coefficient	t-Statistics
LGDP	1.9386***	2.8015
LFD	-0.0893	-0.5629
LT	0.8090 ***	5.1281
LINV	-1.0850 ***	-3.8072
ECT_{t-1}	-0.2466***	-8.0643
R^2	0.9863	
Adjusted R^2	0.9789	

Notes*:1. *, ** and *** indicate significance level at the 10%, 5% and 1%, respectively.*

The estimated ECT coefficient is -25%, which is negative and statistically significant at a 1% significance level. This value confirms that the model performs a short-run adjustment to restore the long-run equilibrium when a shock arises. The speed of adjustment, which is computed by taking the inverse of absolute ECT values, is four years in electricity specification. Put differently, this adjustment speed implies that the model needs four years to return to the long-run equilibrium whenever it happens. In the meantime, the adjusted R^2 values are large enough, 0.98, confirming that the model statistically satisfies the goodness of fit.

It is worth reminding that the ARDL cointegration results depict a long-run relationship among a dependent variable and regressors but provide no evidence in relations' direction. In other words, the cointegration estimates reveal a causal relationship at least in one direction and only infer which variable moves upward or downward together with the dependent variable or drives in the opposite direction, without giving no clue which one causes to others. To shed light on causal relationships, this study conducts VECM causality tests but not conventional Granger causality tests because of cointegration. This method enables us to make more robust and unbiased policy recommendations to improve environmental conditions and electricity use effectiveness without retarding economic growth.

Table 7 illustrates the short and long-run causality relations between electricity consumption and other variables in the shaded areas; the remaining relations are out of scope. In this respect, we consider the estimated coefficients by taking electricity use as the dependent variable first and then the independent variable. There is a unidirectional causality running from economic growth to energy consumption in the short run. This finding supports the conservation hypothesis, and hence policy recommendations aiming to reduce energy consumption by increasing efficiency and preventing energy waste do not affect the growth. This result aligns with (Al-Iriani, 2006; Bekhet et al., 2017; Kahia et al., 2016) but differs from (Al-mulali & Foon Tang, 2013; Charfeddine et al., 2018; Mrabet et al., 2017; Omri, 2013; Ozturk & Al-Mulali, 2015; Salahuddin et al., 2015; Salahuddin & Gow, 2019).

Table 7. The short and long run VECM Granger causality analysis for electricity use specification.

	Short-run					Long-run
	ΔLEU_t	$\Delta LGDP_t$	ΔLFD_t	ΔLT_t	$\Delta LINV_t$	ECM_{t-1}
Dependent variable			χ^2 statistics [p-value]			Coefficient [t-statistics]
ΔLEU_t	–	3.7236* [0.0536]	0.0127 [0.9102]	0.4813 [0.4878]	2.8592* [0.0909]	-0.0900*** [0.0000]
$\Delta LGDP_t$	1.3937 [0.2378]	–	0.3275 [0.5671]	0.7982 [0.3716]	0.1193 [0.7298]	0.0510** [0.0181]
ΔLFD_t	8.0056*** [0.0047]	0.0447 [0.8325]	–	0.6392 [0.4240]	3.8719** [0.0491]	-0.1781*** [0.0053]
ΔLT_t	1.7592 [0.1847]	1.4174 [0.2338]	0.1220 [0.7269]	–	1.789492 [0.1810]	0.0768 [0.2894]
$\Delta LINV_t$	1.4908 [0.2221]	0.1010 [0.7507]	4.1713** [0.0411]	0.2092 [0.6474]	–	0.0083 [0.9082]

***Notes**: 1. The null hypothesis is that there is no causal relationship between variables. 2. Δ is the first difference operator. 3. *, ** and *** indicate significance level at the 10%, 5% and 1%, respectively.*

The resulting conservation hypothesis indicates that reducing financial subsidies in energy consumption will reduce the waste use of energy and not influence the growth. Indeed, Qatar has already lowered the subsidies, but there is still room for policy improvements because the per capita energy consumption was about 198 thousand MWh in 2019 that was 11-fold higher than the global average of around 18 thousand MWh (BP, 2020). This is mostly because of harsh and hot environmental conditions, air conditioning (AC) consumes an extreme level of energy between 30-40% of total installed electricity capacity in Qatar during summers (Bayram, Alrawi, Al-Naimi, & Koç, 2017). In this regard, policymakers should consider promising strategies for ACs' electricity load control and demand-side management of cooling (Bayram & Koç, 2017). In summers, the need for excessive electricity to cool buildings can be balanced with harvesting electricity from sunlight by developing large-scale solar powerplants. In the meantime, Qatar already signed an agreement to build the country's first large-scale (800MWp) solar farm in 2020, named Siraj 1 (Total, 2020). The transition from fossil fuels to renewable sources has two main advantages for Qatar as follows. First, it will reduce carbon emissions by replacing a certain degree of natural gas-powered electricity with clean energy that will raise air quality. Second, the unused natural gas due to solar harvesting will conceive an opportunity cost to trade this surplus gas in the international market. In other words, reducing the gas requirement for meeting its own need enables Qatar to export this surplus gas, and this will increase the income per capita. In this case, the citizens will demand better environmental quality because of the growing-welfare.

Table 7 also implies that investment (i.e., gross fixed capital formation) leads to electricity use, which in turn strongly triggers financial development in the short run. In the long-run, the rising investment will considerably diminish electricity consumption. In this regard, Qatar should (i) promote innovative and technology-intensive infrastructure investments, such as the combined cycle gas plant, that reduce energy consumption.

The policy recommendations can be summarized below and justified in the previous section while discussing the results.

- Policymakers can organize a campaign to raise public awareness for household energy-saving methods by utilizing social media posts. Social media is usually omitted in gaining skills and habits in sustainability actions, although the literature shows that social media has a significant impact on changing behaviors (Al-Mulla et al., 2022).
- Electricity production by solar farms, particularly in summers, can offset the excessive electricity requirement for space cooling in residences and businesses. Reducing carbon emissions by replacing a certain degree of electricity generated by natural gas-powered plants with clean energy will raise environmental quality. Therefore, building solar power plants should be placed on the country's development agenda. This will also conceive an opportunity cost because of surplus natural gas replaced by sunlight.

- Policymakers should consider proactive and incentivizing strategies for cooling electricity load control and demand-side management of cooling in summers. This might enable leveling out peaks in electricity use, and hence reduce redundant power generation and cost.
- Financial development should accompany the economic growth by mobilizing domestic capital into locally relevant and innovative technologies and investments as this would decrease energy consumption in the long run by upsizing the financial sector's share in the GDP versus existing reliance on natural gas-based economic growth.

5. CONCLUSION

This study examines the short and long-run relationships among economic growth, financial development, investment, and electricity consumption between 1975 and 2018 for Qatar. We conducted the Autoregressive Distributed Lag (ARDL) cointegration test and Vector Error Correction Model to propose comprehensive policy recommendations according to the dependency of energy use on economic and financial development. The findings support the validity of the conservation hypothesis for the energy-growth nexus, and thereby energy use reduction has an insignificant impact on the growth. This result implies that Qatar is still a rentier state instead of having a manufacturing economy that requires more energy proportioned to growth production. Another implication is that households and enterprise buildings primarily consume energy, and thus energy waste and extravagant AC usage, due to the harsh environmental conditions, become significant factors in increasing energy use. Therefore, we recommended policies to reduce household energy use and country-wide AC usage. In this regard, financial subsidies in energy and water consumption should be reduced further, even abolished, to lower the waste use of energy and prevent extravagant water use distilled from seawater by natural gas-powered desalination plants. Policymakers should also consider proactive and incentivizing strategies for cooling electricity load control and demand-side management of cooling in summers. This might enable leveling out electricity use peaks and hence reduce redundant power generation and cost. Besides, Qatar should promote innovation and technology-intensive infrastructure investments, such as the combined cycle gas plant, electric car charging stations, and clean public transportation in addition to country-wide strict energy and water efficiency policies, mechanisms, programs, incentives, and disincentives. These recommendations will not influence the growth because of supporting the conservation hypothesis. This manuscript distinguishes from the existing literature mainly as follows. First, all the variables are scaled with the real GDP and population to be consistent and remove potential noise. Second, electricity use is treated as dependent variable instead of independent, as in many studies of literature.

REFERENCES

Al-Iriani, M. A. (2006). Energy-GDP relationship revisited: An example from GCC countries using panel causality. *Energy Policy*, *34*(17), 3342–3350. https://doi.org/10.1016/j.enpol.2005.07.005

Al-mulali, U., & Foon Tang, C. (2013). Investigating the validity of pollution haven hypothesis in the gulf cooperation council (GCC) countries. *Energy Policy*, *60*, 813–819. https://doi.org/10.1016/j.enpol.2013.05.055

Al-Mulla, S., Ari, I., & Koç, M. (2022). Social media for sustainability education: gaining knowledge and skills into actions for sustainable living. *International Journal of Sustainable Development & World Ecology*, *00*(00), 1–17. https://doi.org/10.1080/13504509.2022.2036856

Al-Saidi, M. (2020). Instruments of energy subsidy reforms in Arab countries — The case of the Gulf Cooperation Council (GCC) countries. *Energy Reports*, *6*, 68–73. https://doi.org/10.1016/j.egyr.2019.08.020

Ari, I., Akkas, E., Asutay, M., & Koç, M. (2019). Public and private investment in the hydrocarbon-based rentier economies: A case study for the GCC countries. *Resources Policy*, *62*(September 2018), 165–175. https://doi.org/10.1016/j.resourpol.2019.03.016

Bayram, I. Ş., Alrawi, O., Al-Naimi, H., & Koç, M. (2017). Direct load control of air conditioners in Qatar: An empirical study. *2017 6th International Conference on Renewable Energy Research and Applications, ICRERA 2017*, *2017-Janua*, 1007–1012. https://doi.org/10.1109/ICRERA.2017.8191209

Bayram, İ. Ş., & Koç, M. (2017). Demand side management for peak reduction and PV integration in Qatar. *Proceedings of the 2017 IEEE 14th International Conference on Networking, Sensing and Control, ICNSC 2017*, 251–256. https://doi.org/10.1109/ICNSC.2017.8000100

Bekhet, H. A., Matar, A., & Yasmin, T. (2017). CO2 emissions, energy consumption, economic growth, and financial development in GCC countries: Dynamic simultaneous equation models. *Renewable and Sustainable Energy Reviews*, *70*(2017), 117–132. https://doi.org/10.1016/j.rser.2016.11.089

BP. (2020). *Statistical Review of World Energy, 2020 | 69th Edition* (Vol. 69). https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf

Burnham, K. P., & Anderson, D. R. (2004). Multimodel Inference: Understanding AIC and BIC in Model Selection. *Sociological Methods & Research*, *33*(2), 261–304. https://doi.org/10.1177/0049124104268644

Charfeddine, L. (2017). The impact of energy consumption and economic development on Ecological Footprint and CO2 emissions: Evidence from a Markov Switching Equilibrium Correction Model. *Energy Economics*, *65*, 355–374. https://doi.org/10.1016/j.eneco.2017.05.009

Charfeddine, L., Yousef Al-Malk, A., & Al Korbi, K. (2018). Is it possible to improve environmental quality without reducing economic growth: Evidence from the Qatar economy. *Renewable and Sustainable Energy Reviews*, *82*(September 2017), 25–39. https://doi.org/10.1016/j.rser.2017.09.001

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series With a Unit Root. *Journal of the American Statistical Association*, *74*(366), 427. https://doi.org/10.2307/2286348

Engle, R. F., & Granger, C. W. J. (1987). Co-Integration and Error Correction : Representation , Estimation , and Testing. *Econometrica*, *55*(2), 251–276.

Erdoğan, S., Gedikli, A., Yılmaz, A. D., Haider, A., & Zafar, M. W. (2019). Investigation of energy consumption–Economic growth nexus: A note on MENA sample. *Energy Reports*, *5*, 1281–1292. https://doi.org/10.1016/j.egyr.2019.08.034

Gorus, M. S., & Aydin, M. (2019). The relationship between energy consumption, economic growth, and CO2 emission in MENA countries: Causality analysis in the frequency domain. *Energy*, *168*, 815–822. https://doi.org/10.1016/j.energy.2018.11.139

Gütschow, J., Jeffery, L., Gieseke, R., & Günther, A. (2019). The PRIMAP-hist national historical emissions time series (1850-2017). In *GFZ Data Services*. https://doi.org/10.5880/pik.2019.018

Hussein, H., & Lambert, L. A. (2020). A Rentier state under blockade: Qatar's water-energy-food predicament from energy abundance and food insecurity to a silent water crisis. *Water (Switzerland)*, *12*(4). https://doi.org/10.3390/W12041051

Jammazi, R., & Aloui, C. (2015). On the interplay between energy consumption, economic growth and CO2 emission nexus in the GCC countries: A comparative analysis through wavelet approaches. *Renewable and Sustainable Energy Reviews*, *51*, 1737–1751. https://doi.org/10.1016/j.rser.2015.07.073

Johansen, Søren. (1992). Testing weak exogeneity and the order of cointegration in UK money demand data. *Journal of Policy Modeling*, *14*(3), 313–334. https://doi.org/10.1016/0161-8938(92)90003-U

Johansen, Soren, & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration - with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, *52*(2), 169–210. https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x

Jolo, A. M., Ari, I., & Koç, M. (2022). Driving Factors of Economic Diversification in Resource-Rich Countries via Panel Data Evidence. *Sustainability*, *14*(5), 2797. https://doi.org/10.3390/su14052797

Kahia, M., Ben Aïssa, M. S., & Charfeddine, L. (2016). Impact of renewable and non-renewable energy consumption on economic growth: New evidence from the MENA Net Oil Exporting Countries (NOECs). *Energy*, *116*, 102–115. https://doi.org/10.1016/j.energy.2016.07.126

KAHRAMA. (2018). *Annual Statistics Report 2018*. https://www.km.qa/MediaCenter/Publications/Statistics Report 2018-English.pdf

Keen, S., Ayres, R. U., & Standish, R. (2019). A Note on the Role of Energy in Production. *Ecological Economics*, *157*(August 2017), 40–46. https://doi.org/10.1016/j.ecolecon.2018.11.002

Kraft, J., & Kraft, A. (1978). On the Relationship Between Energy and GNP Author (s): John Kraft and Arthur Kraft Stable URL : http://www.jstor.org/stable/24806805 On the Relationship Between Energy and GNP. *The Journal of Energy and Development*, *3*(2), 401–403.

Matar, A. (2020). Does electricity consumption impacting financial development? Wavelet analysis. *Future Business Journal*, *6*(1), 1–9. https://doi.org/10.1186/s43093-020-00017-w

MDPS. (2020). Qatar Economic Outlook. *Ministry of Development Planning and Statistics*, *August*, 1–50. http://www.mdps.gov.qa/en/knowledge/Doc/QEO/Qatar_Economic_Outlook_2016_2018_EN.pdf

Mrabet, Z., AlSamara, M., & Hezam Jarallah, S. (2017). The impact of economic development on environmental degradation in Qatar. *Environmental and Ecological Statistics*, *24*(1), 7–38. https://doi.org/10.1007/s10651-016-0359-6

Narayan, P. K. (2005). The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics*, *37*(17), 1979–1990. https://doi.org/10.1080/00036840500278103

Omri, A. (2013). CO2 emissions, energy consumption and economic growth nexus in MENA countries: Evidence from simultaneous equations models. *Energy Economics*, *40*, 657–664. https://doi.org/10.1016/j.eneco.2013.09.003

Ozturk, I. (2010). A literature survey on energy-growth nexus. *Energy Policy*, *38*(1), 340–349. https://doi.org/10.1016/j.enpol.2009.09.024

Ozturk, I., & Al-Mulali, U. (2015). Natural gas consumption and economic growth nexus: Panel data analysis for GCC countries. *Renewable and Sustainable Energy Reviews*, *51*, 998–1003. https://doi.org/10.1016/j.rser.2015.07.005

Pesaran, M. H., & Shin, Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis. In S. Strom (Ed.), *Econometrics and Economic Theory in the 20th Century the Ragnar Frisch Centennial Symposium* (pp. 371–413). Cambridge University Press.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289–326. https://doi.org/10.1002/jae.616

Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, *75*(2), 335–346. https://doi.org/10.1093/biomet/75.2.335

Ramsey, J. B. (1969). Tests for Specification Errors in Classical Linear Least-Squares Regression Analysis. *Journal of the Royal Statistical Society. Series B (Methodological)*, *31*(2), 350–371.

Saadaoui, H. (2022). The impact of financial development on renewable energy development in the MENA region: the role of institutional and political factors. *Environmental Science and Pollution Research*, *0123456789*. https://doi.org/10.1007/s11356-022-18976-8

Sadraoui, T., Hamlaoui, H., Youness, Z., & Ben Sadok, I. (2019). A Dynamic Panel Data Analysis for Relationship between Energy Consumption, Financial Development and Economic Growth. *International Journal of Econometrics and Financial Management*, *7*(1), 20–26. https://doi.org/10.12691/ijefm-7-1-3

Salahuddin, M., & Gow, J. (2019). Effects of energy consumption and economic growth on environmental quality: evidence from Qatar. *Environmental Science and Pollution Research*, *26*(18), 18124–18142. https://doi.org/10.1007/s11356-019-05188-w

Salahuddin, M., Gow, J., & Ozturk, I. (2015). Is the long-run relationship between economic growth, electricity consumption, carbon dioxide emissions and financial development in Gulf Cooperation Council Countries robust? *Renewable and Sustainable Energy Reviews*, *51*, 317–326. https://doi.org/10.1016/j.rser.2015.06.005

The World Bank. (2020a). *World Development Indicators. GDP per capita PPP (current international $).* [Data]. https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?most_recent_value_desc=true&sort=desc&start=1990&view=chart

The World Bank. (2020b). *World Development Indicators*. [Data]. https://databank.worldbank.org/source/world-development-indicators

Total. (2020). *Al-Kharsaah Solar PV IPP Project*.

WRI. (2021). *Historical GHG Emissions: CAIT Data Source*. Available Online at: Https://Www.Climatewatchdata.Org.

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