DEPARTMENT OF ECONOMICS AND BUSINESS ECONOMICS
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Defining, measuring and ranking energy vulnerability

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CREATES Research Paper 2019-1

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Defining, measuring and ranking energy vulnerability[1]

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Abstract

Vulnerability is reaching an increasing attention from both academia, international community and industry, being detected as a pillar of the development agenda. If the formal definition of overall vulnerability and resilience is still flawed in the economic literature, the measurement and mainstreaming of outlying characteristics and sound policies for energy vulnerability results almost uncovered, often overlapping with other energy issues. Energy vulnerability also results poorly enforced by regulatory, governmental, and legislative systems. After reviewing and furnishing a univocal ambient merging the multiple interpretations on such concepts, this work: i) defines energy vulnerability; ii) builds a composite indicator to measure energy vulnerability; and iii) analyzes and ranks OECD and non-OECD countries in terms of energy vulnerability. The regulatory framework, SDGs and the development agenda are examined, selected indicators from the WB's WDI are analyzed. The indicator is weighted by a multivariate analysis and its robustness is checked through different techniques.

JEL Classification: C38, C43, O13, Q48

Keywords: energy vulnerability, composite indicators, PCA

1. Introduction

1.1 The development agenda on energy policy

Energy is reputed a leading driver of economic growth, employment, and sustainable development. Energy policy aiming to ensure energy services for all is detected as a core strategy to tackle poverty and energy security itself. Affordable, reliable, sustainable and modern universal energy access is an essential pre-requisite for enabling virtuous economic cycles, alleviating poverty, protecting the environment, and building solid institutions (UN, 2015).

In September 2015, UN launched the Agenda 2030. Within the 17 Sustainable Development Goals (SDGs), it was attributed a leading role to vulnerability and resilience policies. Energy policy was object of a whole Goal: SDG 7 displays to "*ensure access to affordable, reliable, sustainable and modern energy for all*" (UN, 2015). As part of the SDG 7, they were detected 5 targets and 6 relative indicators with specific energy policy scopes to achieve by 2030. Target 7.1 proposes to "*ensure universal access to affordable, reliable and modern energy services*", measured as: 7.1.1) *proportion of population with access to electricity*; and 7.1.2) *proportion of population with primary reliance on clean fuels and technology*. Target 7.2 states to "*increase substantially the share of renewable energy in the global energy mix*", calculated by: 7.2.1) *renewable energy share in the total final energy consumption*. For target 7.3 it was agreed to "*double the global rate of improvement in energy efficiency*", gauged by: 7.3.1) *energy intensity measured in terms of primary energy and GDP*. For target 7.A, the consensus was based on "*enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology*", sketched by: 7.A.1) *mobilized amount of US$ per year starting in 2020 accountable towards the $100 billion commitment*. Last target, 7.B, focused on "*expand infrastructure and upgrade*

[1] The authors acknowledge the support of CREATES - Center for Research in Econometric Analysis of Time Series, Aarhus University, Denmark.

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technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programs of support", resumed by: 7.B.1) *investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services*.

1.2 Energy policy and vulnerability in the world

The economic literature does not clarify and perhaps overlaps the concepts of energy vulnerability, resilience, poverty, sustainability and security. The state-of-the-art on the subject appears to be still undefined. Some works analyzed the number of energy security indexes definitions, through a literature review (Winzer, 2011), and surveys (Ang & Choong, 2015). Some other works examined energy security, focusing on supply side (WEC, 2008; Kruyt & al., 2009). Analyzing the literature, it is clear the necessity to shape, by defining, measuring and ranking, energy vulnerability worldwide, as well as detecting energy resilience policies. Concerning the definition of energy vulnerability, holding the scarcity and preciseness of literature on the issue, for this work we based on the most representative definition, given by Gnansounou (2008). Thus, we address it to the energy system and implemented it. The measurement of energy vulnerability is dealt computing a composite indicator that considers the four dimensions of sustainability (economic, social, environmental, institutional), embedding them into seven pillars and twelve sub-pillars. For such scope, the 2017 WB's WDI dataset on Energy and Mining is exploited. A ranking of countries with respects to energy vulnerability is provided. The study is completed by a law & economics analysis of the energy regulation framework, especially concerning electricity sector, a SDGs analysis, and policy implications for the further research scope of shaping sound resilience energy policies.

Most of the studies related to energy security, poverty, sustainability, and vulnerability are addressed to LDCs or non-OECD countries. Regarding this group, features are impressive. One of the most astonishing data to be sketched is related to access to electricity. Despite improvements in the long-run shown by the trends, 1.06 billion people in the world are still lacking access to electricity, especially in rural areas, in Sub-Saharan Africa and Southern Asia. It is calculated that 20 countries accounts for 80 percent of the global access deficit in 2014 (IEA and WB, 2017; IBRD & WB, 2017). This figure turns the goal of universal access to modern energy services by 2030 as a prior, great development challenge. Another impressive data state that 3.04 billion people rely on solid fuels and kerosene for cooking and heating (IEA & World Bank, 2017). A controversial challenge comes from the necessity for modern society to cope access to modern energy systems with environmental and climate change pressures, that were decisively fostered in the last years, coming from the development agenda and particularly from recent COP21 and subsequent agreements. In this contest, energy efficiency, CO_2, GHG and emissions control, and energy transition policies become crucial.

Also industrialized countries must afford many problems related with energy vulnerability. Today's situation is paramount especially when dealing with natural gas and electricity markets, where in EU and in US regulation became a controversial issue. This was particularly clear after the electricity deregulation fiasco that led to the 2000-2001 Western electricity crisis and the Enron collapse caused by its market abuse, as well as the following re-regulation wave (Busato & Gatto, 2017 & 2017). With the scope to merge national markets into a unique European energy market, reforms were saluted from EC with the final aim to enhance supply security, environmental sustainability, production efficiency and market competitiveness (cfr. Gnansounou, 2008). On the regulatory framework, EU shown to be proactive in the last years in terms of energy security, implementing a series of directives and Green Papers through the EC (EC 2001a; 2001b; 2003; 2006). Among the last EU actions, one must report the package adopted on 2 December 2015 by EC to support the EU's transition to a circular economy. This industrial model foresees a new role for products and materials, passing from a linear to a circular life model. In circular economy, the role of energy turns fundamental, being waste and resource minimized and valorized with the sake of stimulating innovation, growth and occupation in a sustainable development optic (Ferrari, Gatto & Zada, 2017; Ghisellini, Cialani & Ulgiati, 2016).

1.3 Objectives of the paper

The paper attempt to contribute tackling the issues illustrated through the following scientific purposes: i) defining energy vulnerability in theoretical terms; ii) measuring energy vulnerability; iii) ranking energy vulnerability worldwide. Further contributions of the paper are the analysis of the regulatory framework on energy vulnerability, and the analysis of WB's WDI data on Energy from OECD and non-OECD countries.

2. Background literature: indicators on energy policy

Some studies explored grassroots vulnerability and resilience, energy poverty, sustainability and security, as well as energy vulnerability, especially for the supply side. Such analysis proposed a set of simple or composite indicators for the attempt of measuring phenomena, but both the definition and the calculation of energy vulnerability remains uncovered. In the most recent indexes, sustainability plays a crucial role. Some of the simple and composite indicators regarding energy security and vulnerability are synthesized by Badea (2010). Among the most used simple indicators, one should mention: i) energy intensity, given by the relationship among TPES and GDP; ii) energy dependency to specific energy sources, calculated as the percentage of import over gross inland energy; and iii) the energy prices of specific energy sources (Badea, 2010). With the scope of gauging and analyzing energy security in the medium and long run, Jansen & Seebreqts (2010), merged the exploration of diversity-based indices with the Supply/Demand Index, offering a wide analysis framework.

Concerning composite indicators dealing with energy vulnerability, the index that results to be more aligned with our purpose is the composite index of energy demand/supply weaknesses defined as a proxy of energy vulnerability (Gnansounou, 2008). Built on five indicators, the index explores the dimensions of energy policy sustainability to detect vulnerability drivers in EU and OECD countries. The weighting is based on a subjective interpretation. In terms of methodology, the energy vulnerability index that approaches the gauging technique that we adopted in our study is the Oil Vulnerability Index (Gupta, 2008). This Index is based on a set of seven indicators. It focuses on oil, and presents the strength of PCA weighting.

Among the other synthetic indicators connected with our study one can mention the World Energy Council's Energy Trilemma Index (WEC, 2016), exploring energy sustainability through the dimensions of energy security, energy equity (accessibility and affordability), and environmental sustainability; therefore, the Energy Trilemma Index ranks the national performances. Another composite indicator on the issues, focused on national energy regulation and policy, is the Regulatory Indicators for Sustainable Energy (RISE). RISE is implemented jointly by WBG, SE4A Project, ESAMP, and CIF, and analyzes 111 countries. It is based on three pillars regarding sustainable energy: i) access to modern energy; ii) energy efficiency; and iii) renewable energy. RISE is based on sample surveys, where data were collected in the 111 countries examined. Concerning energy resilience, one can mention the Energy Resilience Index (Drago & Gatto, 2018). This composite indicator, computed for OECD and non-OECD countries, exploits interval data to assess the sensitivity of the measure from different specifications.

3. Defining energy vulnerability

The definition and measurement of vulnerability and resilience are object of studies and policies, in particular from the International Community, addressed to both OECD and non-OECD countries. Moved from the most recent development agenda strategies, academia is focusing on creating more detailed and precise theories and metrics, attempting to address the different sides of the issue. Energy policy, devoted mainly to energy poverty, security and sustainability, becomes a focus of local governments and international institutions. The energy-development policy nexus did not lead to a clear definition of such issues, almost lacking when turning to energy vulnerability and resilience.

We pick the definition of vulnerability by Gnansounou (2008) as a baseline: "*the degree to which that system is unable to cope with selected adverse events*". The work states that attempts to give a formal definition of vulnerability and resilience for energy sector in the long run is reputed "*difficult to implement due to the number of possible harsh events and the epistemic nature of their uncertainty*", It also states that the construction of a composite indicator for energy vulnerability is not an easy exercise, due to multidimensionality, qualitative attributes of the subject, and the frequent correlation among its variables. It is also expressed the preference to resilience approach as a proxy to vulnerability for energy policy. On the other hand, the bridge between vulnerability and resilience policies is described in Frankenberger et al. (2012). Here sustainability assets play a leading role: in order to define resilience, they start from the economic, social, environmental and institutional drivers – and more specifically long-term trends in all the sustainability dimensions – that increase the state of vulnerability or adaptive capacity. Hence, the causes underlying livelihood security and exposure to risk are analyzed.

We apply the former definitions and statements to the energy sector, giving a focus on sustainability led from the development agenda. Energy vulnerability results as "*the degree to which an energy system is unable to cope with selected adverse events in economic, social, environmental and institutional terms*", holding the property of resilience to be used as a proxy of energy policy and that the drivers of long term sustainability trends, affecting livelihood security and exposure to risk and increasing vulnerability or adaptive capacity, turn fundamental to detect resilience measures.

4. Methods

4.1 Measuring energy vulnerability: the Energy Vulnerability Index

The index is based on 2017 WB's WDI data on Energy. The dataset consists of 264 country observations from 1960 to 2016. We consider the most recent year displaying consistent data, i.e. 2014. We select twelve sub-pillars, extracting for three of them a single indicator and for the other nine variables four pillars. After standardizing the values to make them comparable, we use a weighted sum to make a linear aggregation to compute the seven sub-pillars. Therefore, we use the Principal Component Analysis (PCA) as a multivariate analysis method to calculate the final index. To verify the robustness of our methodologies, we compute different weighting and aggregation methods. We run an equal weight estimate, a subjective weight based on the dimensions of sustainability, and a data aggregation through the Borda method. The work aims to complete the qualitative with the quantitative approach, giving a more rigorous and objective rationale to define and measure.

We use the PCA with the aim to reduce the number of variables in latent variables. Other possible choice might have been different techniques, i.e. Data Envelopment Analysis DEA as weighting method as remarked empirically (Agovino, Cerciello & Gatto, 2018) and methodologically (Nardo et al., 2005). Imputation with Markow chain for data imputation, while switching model for latent variables might be useful for future research to detect the changing regimes in the business cycles and the relationship between energy crises and business cycles turning points - more precisely, that oil shocks affect the likelihood to enter a recession – (Engemann, Kliesen & Owyang, 2011).

4.2 Data

Dataset: WB's WDI 2017

We selected some of the variables from the 2017 edition of World Development Indicators issued by the World Bank. Our choice was based on the variables from Energy & Extractives Open Data Platform, based on the nexus between energy, development and sustainability.

Data selection: the variables

The pillars detected for such a scope comes from WB's WDI 2017. From the WB's Energy & Mining featured development indicators, analyzing 15 variables related with energy policy on both economic, social, environmental and governance worldwide. Indicators come from different sources, i.e. internal (WB), external and mixed. Each indicator has different records, showing some divergences in data collection in terms of countries and time series. Variables were: i) Access to electricity (% of population); ii) Alternative and nuclear energy (% of total energy use); iii) Electric power consumption (kWh per capita); iv) Energy imports, net (% of energy use); v) Energy intensity level of primary energy (MJ/$2011 PPP GDP); vi) Energy use (kg of oil equivalent per capita); vii) Fossil fuel energy consumption (% of total); viii) Fuel exports (% of merchandise exports); ix) GDP per unit of energy use (constant 2011 PPP $ per kg of oil equivalent); x) Investment in energy with private participation (current US$); xi) Ores and metals exports (% of merchandise exports); xii) Renewable electricity output (% of total electricity output) xiii) Renewable energy consumption (% of total final energy consumption); xiv) Time required to get electricity (days); xv) Total natural resources rents (% of GDP). We dropped variables number x (investment in energy with private participation) and xi (ores and metals exports), since we reputed them not in line with our definition of energy vulnerability and not capable to add any information, hence not capable to match our indicator criteria. We dropped the variable xv as well (total natural resources rents) to avoid the risk of multicollinearity. We adopted the remaining twelve variables, composing some of them in different pillars. The final selection considers the following pillars and sub-pillars for the final index.

Fig. 1 – The Energy Vulnerability Index

Energy Vulnerability Index	A – Electricity access	A.1) Access to electricity
		A.2) Time to get electricity
	B – Energy Intensity	B.1) Energy Intensity
		B.2) GDP per energy use
	C – Energy imports	
	D – Renewable Energy Consumption	D.1) Renewable Energy Consumption
		D.2) Alternative and Nuclear Energy
		D.3) Fossil Fuel Energy Consumption
	E – Energy Consumption	E.1) Electric Power Consumption
		E.2) Energy Use
	F – Fuel Export	
	G – Renewable Electricity Output	

The variables give a good synthesis of energy vulnerability in all the four dimensions of sustainability. It results to be also in line with the precedent Energy Vulnerability Index, implementing it: out of five variables – Energy Intensity of the GDP, Energy Import Dependency, Energy related CO_2 emissions against TPES, Electricity supply vulnerability, and Non-diversity of transport fuels-, four results to be partially or completely covered, keeping only the last one of the group out of our analysis. A remark might be to detect a further institutional variable, that results to be the less covered sustainability dimension, but encompassed in most of the variables as a secondary dimension. We must also point out that some of the variables display different sign in terms of partial ranking, an important information to be considered in the following methodological steps.

Fig. 2 - Pillars Energy Vulnerability

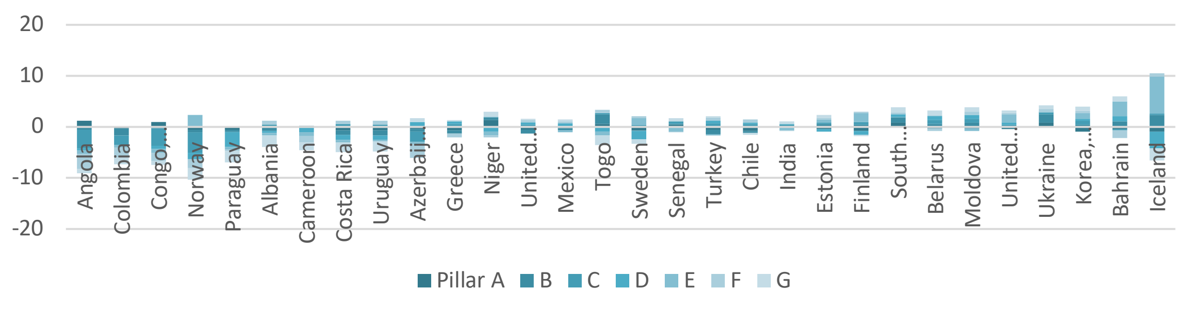
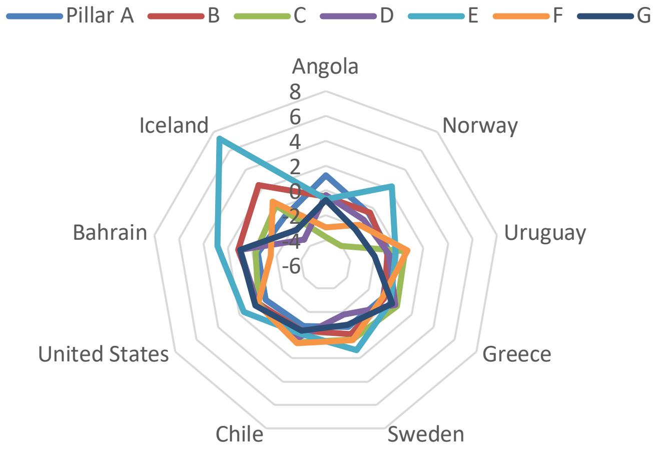


Fig. 3 - Spider diagram Energy Vulnerability



Data analysis

While other studies focused on developing countries (FAO, 2016), or on some industrialized countries (Gnansounou, 2008), we attempt to give a global representation of the phenomenon. The analysis on developing countries furnishes a precise overview of the concept of resilience, dealing mostly with the household component, interpreted as the center of decision-making associated to resilience. There, household is detected as the unit of analysis (FAO, 2016). This purpose is obtained through a survey using rotating panel for a number of Ugandan families. Though, the approach presents some risks. Above all, the years involved in the analysis are few (two years for the first sample of families, and two for the second sample). Another risk to be incurred is the potential misinterpretation of shocks is and how to cope with resilience measures. Studies focusing on a set of industrialized countries use IEA data to give a supply-side glance of energy vulnerability (Gnasounou, 2008). The observations that might be arisen are: i) the subjectivity of the choice in weighting the pillars composing the index; and ii) the number and variance of the set of countries selected (25, all OECD). The index has been applied in World Energy Council’s Europe’s Vulnerability to Energy Crises (2008). Compared to 2005 IEA Statistics, 2017 WDI energy data seems to display longer and more detailed time series, catching the main phenomenon within the energy-development nexus. As in Gupta (2008), we used a multivariate analysis, i.e. the PCA, to weigh the nine variables employed in the four pillars. The PCA merges the simple indicators, already aggregated into seven pillars, to form an energy vulnerability synthetic index, ensuring a robust and objective choice.

Normalization, linear weighting and PCA

The standardization of the indicators was necessary to make them comparable. Z-scores were run. After the standardization, we aggregated data through a weighted sum, using equal weights. After aggregating the twelve sub-pillars into seven pillars, we reduced the dimensions of the pillar into the synthetic index. Hence, we computed a PCA to reduce the dimensions of the pillar. We analyzed the correlation matrix among the pillar variables significance. We run KMO and Bartlett’s sphericity tests to evaluate the feasibility of the PCA. Since we aim to obtain factors that explain correlations among variables, they must display high correlations. We account for the values of eigenvalues and explained variance, fixing a threshold for the two factors for the explanation of the total variance. Each factor is weighted by each eigenvalue, that gives a ranking. The analyses suggest us to take into account four principal components. The results are confirmed by the scree plot.

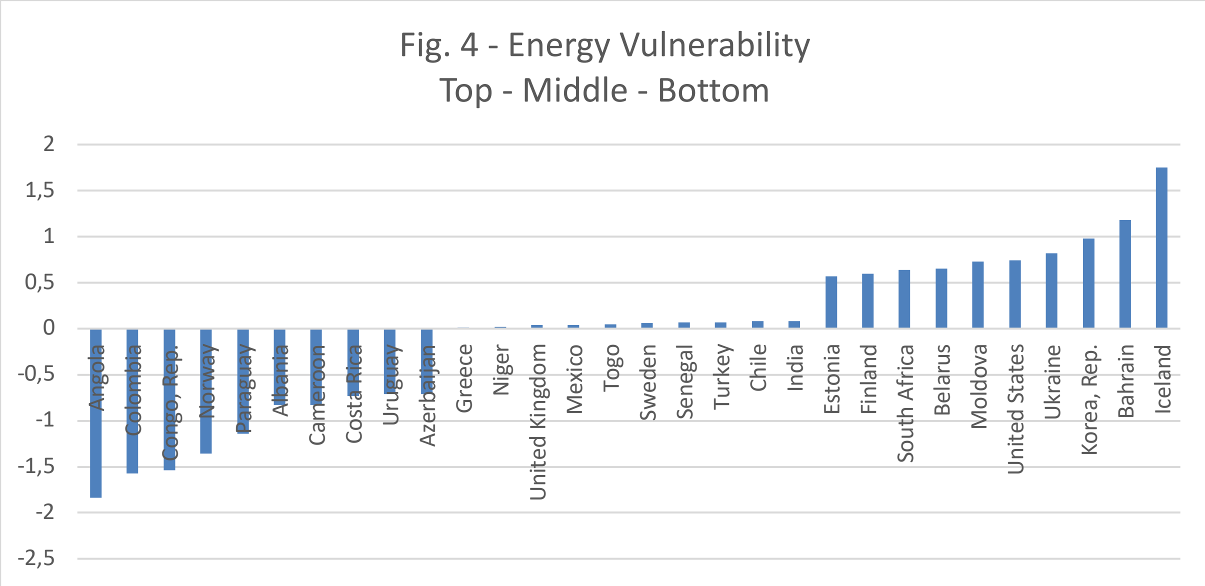
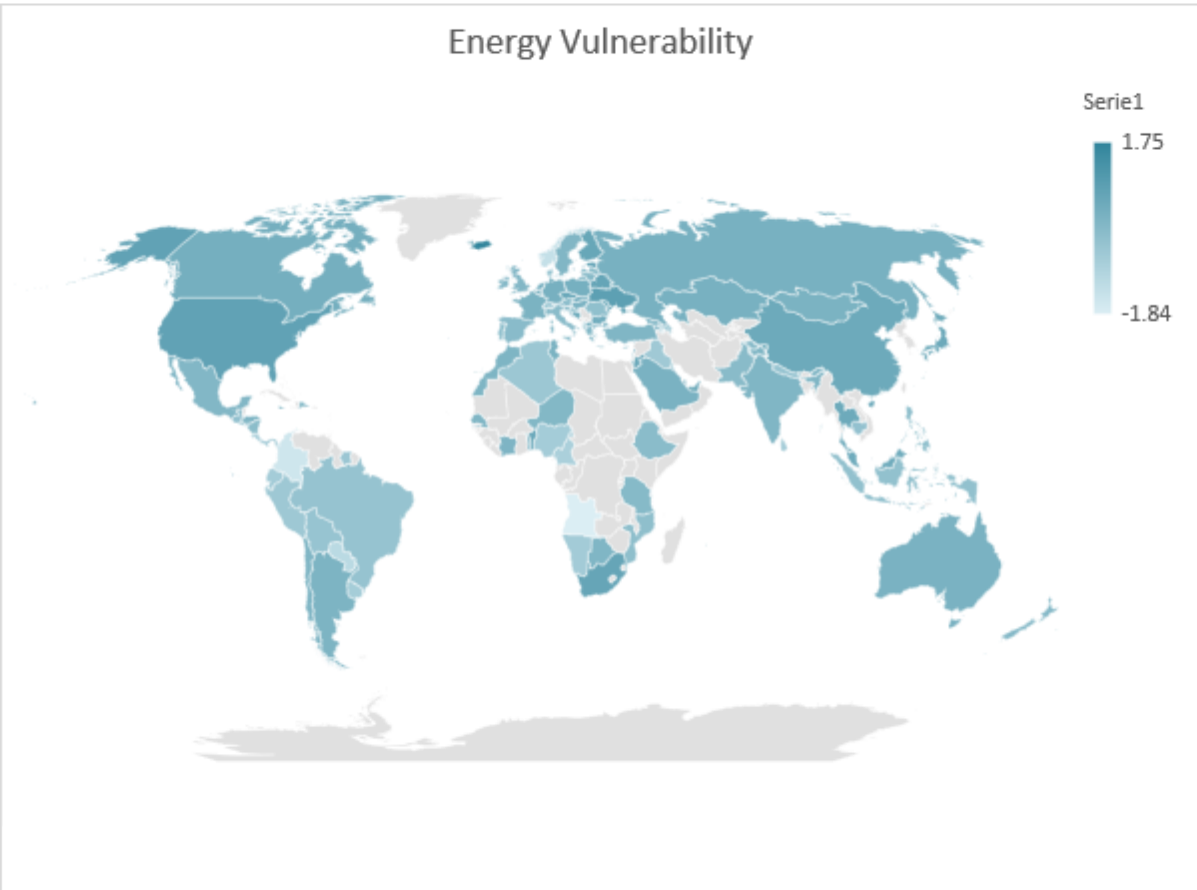


Fig. 5



5. Conclusion and policy implications

We defined, measured and ranked worldwide energy vulnerability. The work shows the first results on building a tailored composite indicator on the basis of 2017 WB's WDI on Energy and Mining, the Energy Vulnerability Index. In the index, we combined a linear aggregation with a Principal Component Analysis. We checked for robustness computing equal weights, subjective weights and

Borda aggregation. The final ranking accounts on the implementation of a clear and defined theoretical framework, from the starting choice of the variables, from the methodologies adopted for the calculation, and from the robustness of the analysis. Holding the standardization, subjective and objective weighting and aggregation, we run a correlation among the calculation methodology adopted and other aggregation methods to corroborate the results. The test displays correlations above 0.8, confirming the robustness of the index.

Concerning policy implications, a resilience approach seems to be strictly connected with energy vulnerability. Energy resilience measurement relies often on household as the center of decision-making. Resilience policies are becoming more and more popular in energy sector: we can mention remittances and microfinance tailored programs, often aiming to the encouragement of mini-grid and other energy access facilitations, showed to effectively decrease the vulnerability status, empowering energy resilience and security, fighting energy poverty. The final aim of the development agenda is in line with proposing resilience sound policies as powerful tools to smooth business cycle fluctuations, to forecast, mitigate, and monitor risk, volatility and shocks from the economic, social, environmental, and institutional sides.

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Appendix I - Factor Analysis

Correlation matrix[a]

		PillarAmezziCorrect	PillarBmezziCorrect	PillarCinteroCorrect	PillarDterziCorrect	PillarEmezziCorrect	PillarFinteroCorrect	PillarGinteroCorrect
Correlazione	PillarAmezziCorrect	1,000	,371	-,140	-,258	-,380	-,187	,007
	PillarBmezziCorrect	,371	1,000	-,115	-,259	,217	-,123	-,008
	PillarCinteroCorrect	-,140	-,115	1,000	-,049	-,203	,797	,008

	PillarDterziCorrect	-,258	-,259	-,049	1,000	-,042	-,190	,701
	PillarEmezziCorrect	-,380	,217	-,203	-,042	1,000	-,113	,028
	PillarFinteroCorrect	-,187	-,123	,797	-,190	-,113	1,000	-,217
	PillarGinteroCorrect	,007	-,008	,008	,701	,028	-,217	1,000
Sign. (a una coda)	PillarAmezziCorrect		,000	,046	,001	,000	,012	,469
	PillarBmezziCorrect	,000		,084	,001	,004	,070	,463
	PillarCinteroCorrect	,046	,084		,279	,007	,000	,462
	PillarDterziCorrect	,001	,001	,279		,309	,011	,000
	PillarEmezziCorrect	,000	,004	,007	,309		,088	,367
	PillarFinteroCorrect	,012	,070	,000	,011	,088		,004
	PillarGinteroCorrect	,469	,463	,462	,000	,367	,004	

a. Determinante = ,064

Correlation matrix inverse

	PillarAmezziCorrect	PillarBmezziCorrect	PillarCinteroCorrect	PillarDterziCorrect	PillarEmezziCorrect	PillarFinteroCorrect	PillarGinteroCorrect
PillarAmezziCorrect	1,921	-,666	,297	,825	1,006	,183	-,587
PillarBmezziCorrect	-,666	1,447	-,098	,307	-,559	,092	-,163
PillarCinteroCorrect	,297	-,098	3,221	,322	,534	-2,583	-,830
PillarDterziCorrect	,825	,307	,322	2,644	,485	,091	-1,853
PillarEmezziCorrect	1,006	-,559	,534	,485	1,630	-,123	-,428
PillarFinteroCorrect	,183	,092	-2,583	,091	-,123	3,253	,666
PillarGinteroCorrect	-,587	-,163	-,830	-1,853	-,428	,666	2,464

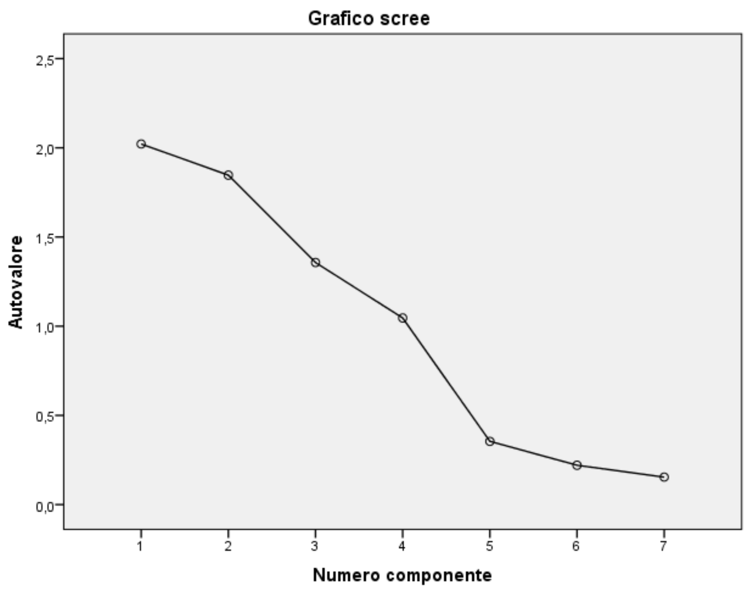
KMO and Bartlett's tests

Misura di Kaiser-Meyer-Olkin di adeguatezza del campionamento.		,435
Test della sfericità di Bartlett	Appross. Chi-quadrato	387,667
	gl	21
	Sign.	,000

Comunalities

	Iniziale	Estrazione
PillarAmezziCorrect	1,000	,872
PillarBmezziCorrect	1,000	,892
PillarCinteroCorrect	1,000	,920
PillarDterziCorrect	1,000	,878
PillarEmezziCorrect	1,000	,900
PillarFinteroCorrect	1,000	,906
PillarGinteroCorrect	1,000	,904

Metodo di estrazione: Analisi dei componenti principali.



Matrice dei componenti[a]

	Componente			
	1	2	3	4
PillarAmezziCorrect	-,133	-,593	,698	,127
PillarBmezziCorrect	-,175	-,591	,014	,715
PillarCinteroCorrect	,801	,353	,182	,347

PillarDterziCorrect	-,466	,785	,190	,091
PillarEmezziCorrect	-,241	-,019	-,834	,381
PillarFinteroCorrect	,892	,223	,002	,244
PillarGinteroCorrect	-,509	,596	,323	,430

Metodo di estrazione: Analisi dei componenti principali.

a. 4 componenti estratti.

Correlazioni riprodotte

		PillarAmezziCorrect	PillarBmezziCorrect	PillarCinteroCorrect	PillarDterziCorrect	PillarEmezziCorrect	PillarFinteroCorrect	PillarGinteroCorrect
Correlazione riprodotta	PillarAmezziCorrect	,872[a]	,474	-,145	-,259	-,491	-,219	-,006
	PillarBmezziCorrect	,474	,892[a]	-,098	-,314	,314	-,114	,049
	PillarCinteroCorrect	-,145	-,098	,920[a]	-,030	-,219	,879	,010
	PillarDterziCorrect	-,259	-,314	-,030	,878[a]	-,027	-,218	,806
	PillarEmezziCorrect	-,491	,314	-,219	-,027	,900[a]	-,128	,006
	PillarFinteroCorrect	-,219	-,114	,879	-,218	-,128	,906[a]	-,216
	PillarGinteroCorrect	-,006	,049	,010	,806	,006	-,216	,904[a]
Residuo[b]	PillarAmezziCorrect		-,103	,005	,001	,111	,032	,012
	PillarBmezziCorrect	-,103		-,016	,055	-,097	-,009	-,057
	PillarCinteroCorrect	,005	-,016		-,019	,016	-,081	-,002
	PillarDterziCorrect	,001	,055	-,019		-,015	,028	-,105
	PillarEmezziCorrect	,111	-,097	,016	-,015		,015	,022
	PillarFinteroCorrect	,032	-,009	-,081	,028	,015		-,001
	PillarGinteroCorrect	,012	-,057	-,002	-,105	,022	-,001	

Metodo di estrazione: Analisi dei componenti principali.

a. Comunalità riprodotte

b. I residui vengono calcolati tra le correlazioni osservate e riprodotte. Ci sono 7 (33,0%) residui non ridondanti con valori assoluti maggiori di 0,05.

Matrice dei componenti ruotati[a]

	Componente			
	1	2	3	4
PillarAmezziCorrect	-,184	-,093	-,716	,563
PillarBmezziCorrect	-,056	-,068	,097	,935
PillarCinteroCorrect	,954	,052	-,077	-,037
PillarDterziCorrect	-,087	,888	,047	-,281
PillarEmezziCorrect	-,146	-,019	,908	,232
PillarFinteroCorrect	,930	-,182	,026	-,082
PillarGinteroCorrect	-,037	,942	-,010	,120

Metodo di estrazione: Analisi dei componenti principali.
Metodo di rotazione: Varimax con normalizzazione Kaiser.
a. Convergenza per la rotazione eseguita in 5 iterazioni.

Matrice di trasformazione dei componenti

Componente	1	2	3	4
1	,852	-,488	-,097	-,162
2	,325	,722	,194	-,580
3	,103	,318	-,932	,141
4	,397	,375	,291	,786

Metodo di estrazione: Analisi dei componenti principali.
Metodo di rotazione: Varimax con normalizzazione Kaiser.

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