HOW SECURE IS EUROPE'S ENERGY SECTOR, AND HOW IT INTERACTS WITH WATER AND FOOD SECURITY?

Suwin Sandu, Centre for Energy Policy, University of Technology Sydney, Phone +6195142437, E-mail: suwin.sandu@uts.edu.au
Muyi Yang, Centre for Energy Policy, University of Technology Sydney

Overview

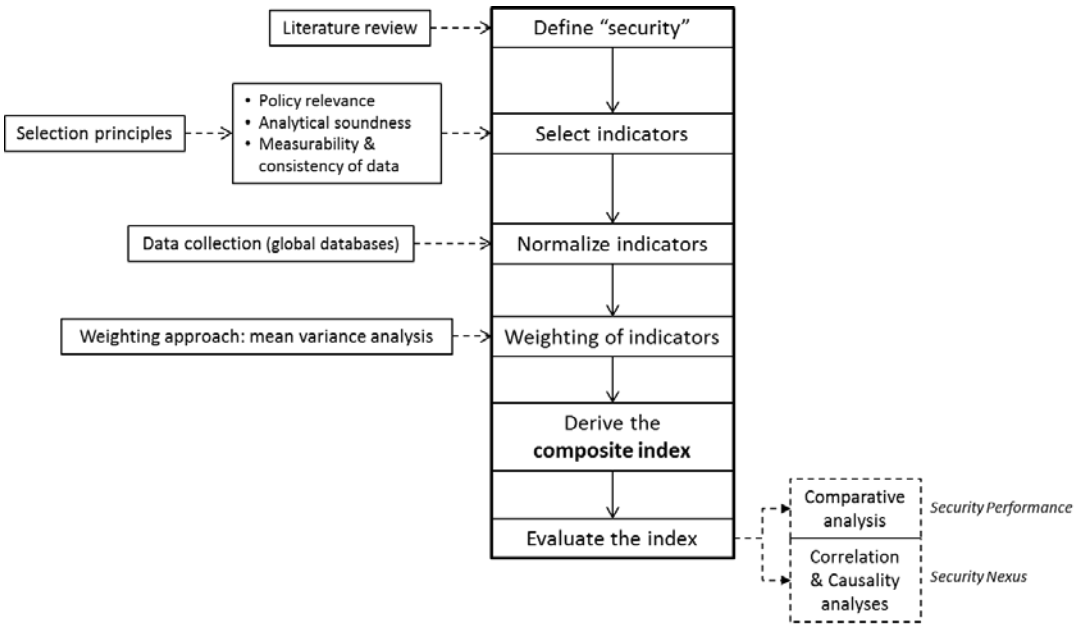
Meeting energy security challenge has lately emerged as a top policy priority for countries around the world, including those in the European Union. However, dealing with this challenge is not an easy task. This is because the concept of 'security' is complex. One of the complexities is that energy security is multidimensional in a sense that it encompasses a range of conflicting policy goals. For example, the current effort of the EU to reduce its reliance on energy imports (Hedberg , 2015) could lead to increased energy prices and thus results in overall deterioration of energy security. Second, the notion of 'security' is dynamic – it differs from country-to-country, and changes over time. This dynamism implies that the importance of each dimension of energy security changes over time, and it is crucial that this changing importance is recognized when conducting analyses of energy security. Third, energy security interacts with 'security' from other domains. This is particular true for water and food owing to increased recognition of energy-water-food nexus (Hoff, 2011). This means that actions to improve energy security is likely to impact water and food security (Rasul & Sharma, 2015).

Designing policies to redress energy security, without causing unintended consequences on water and food security, require holistic and quantitative measures to enable countries to track progress (performance) in response to policy endeavors aiming to improve security. Yet there is no consensus on the precise interpretation and measurement of energy, water and food security. This paper has two overarching objectives: 1) to develop composite indices for assessing the state of energy, water, food security of 17 countries in the EU between 2000 and 2010; and 2) to examine nature of interactions between energy, water, food security.

The paper is organised as follows: Section 2 provides some conceptual discussions on energy, water and food security. Key indicators are also identified for use in developing composite security indices. Section 3 describes the methodology employed to develop composite security indices and examine interactions between these indices. A discussion of results is given in Section 4. Finally, Section 5 presents the main conclusions.

Methods

The schematic diagram of the overall methodology is shown in the figure below. The methodologies comprise of literature review (to define security and select indicators), mean variance analysis (to develop weights of individual indicators for developing composite index), comparative analysis (to assess security performance across EU countries), and correlation and causality analyses (to assess security nexus; i.e., develop understanding of the interactions between energy, water and food securities).



Results

A comprehensive review of literature suggests that 'security' can be classified into three broad dimensions – physical availability and access to resources (*availability*), economic access to resources (*affordability*), and cleanliness and social acceptability in the way resources are used and produced in an economy (*acceptability*). Based on this definition of security, and availability of data, 21 indicators are used to develop composite energy security index. The overall results, presented in the table below, reveals the following key points.

	ENERGY				WATER	FOOD	Change in security index, from 2000 (%)					
	CESI	Av	Af	Ac	CWSI	CFSI	CESI	Av	Af	Ac	CWSI	CFSI
Austria	77.3	84.4	67.0	82.6	83.8	88.6	-10	-7	-24	5	-7	-3
Belgium	70.7	83.0	60.7	67.3	89.2	87.6	-8	-6	-28	19	0	-4
Denmark	73.5	85.1	61.2	74.8	94.3	87.8	-8	-4	-29	20	1	-4
Finland	74.6	89.6	61.0	72.9	87.1	87.8	-8	-2	-26	5	-3	-4
France	68.7	78.0	57.1	72.5	90.6	88.5	-12	-12	-31	16	0	-4
Germany	72.7	86.8	60.5	70.2	89.7	87.6	-6	-3	-28	20	0	-4
Greece	70.0	81.8	57.6	71.2	87.3		-7	-1	-29	20	2	na
Ireland	71.5	81.0	63.4	69.7	88.8		-9	-5	-28	20	-1	na
Italy	73.1	84.2	61.8	73.6	92.3	90.5	-7	-4	-26	18	0	-1
Luxembourg	67.1	66.1	72.0	60.9	87.3		-16	-20	-19	-7	-4	na
Netherlands	69.3	79.9	60.3	67.3	88.5	89.6	-10	-8	-29	17	-2	-2
Norway	68.7	70.3	55.1	88.0	82.3		-22	-19	-36	-3	-11	na
Portugal	76.8	86.4	64.1	81.8	86.8	88.1	-4	1	-25	21	3	-2
Spain	76.2	87.6	65.1	76.0	90.7		-2	1	-21	23	1	na
Sweden	74.5	84.4	59.3	83.3	87.2	87.4	-11	-5	-29	6	-4	na
Switzerland	75.7	82.1	65.2	82.5	86.2	89.0	-10	-6	-26	10	-7	-3
United Kingdom	70.1	84.6	56.7	68.6		87.3	-9	-5	-32	19	na	-5
World (average)	71.2	68.8	69.8	77.5	82.1	83.7						

Notes: CESI - Composite Energy Security Index; CWSI - Composite Water Security index; CFSI - Composite Food Security Index; Av - Availability; Af - Affordability; Ac - Acceptability.

- Most European countries are relatively energy secure, compared with other countries in the world. Austria, Portugal and Spain are among the most energy-secure countries (index values are higher than 75 in 2010), whereas France, Netherlands and Poland are slightly less secure (index values are lower than 70).
- The distinct feature of European energy sector is that they have sufficient access to energy resource to fulfill demand (i.e., energy availability index for all countries is greater than world average), but such access is costly (i.e., energy affordability index for all countries is lower than world average). Also, energy systems in most countries are relatively less clean, or less socially acceptable – Austria, Portugal and Sweden are the exceptions.
- Over the period between 2000 and 2010, most European countries experienced deterioration in energy security (i.e., CESI declined in all countries included in this paper). Decreased energy affordability is the main reason for reduced security in all countries, which offset significant gains in energy acceptability.
- There is a strong, and positive, correlation between energy, water and food security, implying that an improvement in one area is likely to improve security in other areas, and vice versa. The granger causality test (results not shown here) shows that increased food security is likely to result in increased energy security, but not the opposite. Further, improvement in energy security is conditioned upon an improvement in water security. However, increased energy security may not always lead to increased water security.

Conclusions

This paper demontrates that a simple tool such as a composite security index is an important first-step to develop an in-depth and a comprehensive understanding of energy security in order to deal with this challenge. The results in this paper provide insights into the state of energy security across the select EU countries, the factors that contribute to insecurity, and the effect that energy security may have on water and food security. These results can be used to enable monitoring of countries' security performance over time, convey policy messages that can help policy-makers to prioritise security concerns that are specific to their countries, and to support political dialogue aiming to improve energy-water-food security.

References

Hedberg, A. (2015), *EU's quest for energy security: What role for the Energy Union?*, Policy Brief, European Policy Centre, Brussels.

Hoff, J. (2011), *Understanding the Nexus*. In Proceedings of the Bonn 2011 Conference: The Water, Energy and Food Security Nexus, Bonn, Germany, 16–18 November.

Rasul, G. and Sharma, B. (2015), The nexus approach to water-energy-food security: an option for adaptation to climate change, *Climate Policy*, Vol. 16 Issue 6, pp. 682-702.