
Editorial: Clean energy and governance challenges

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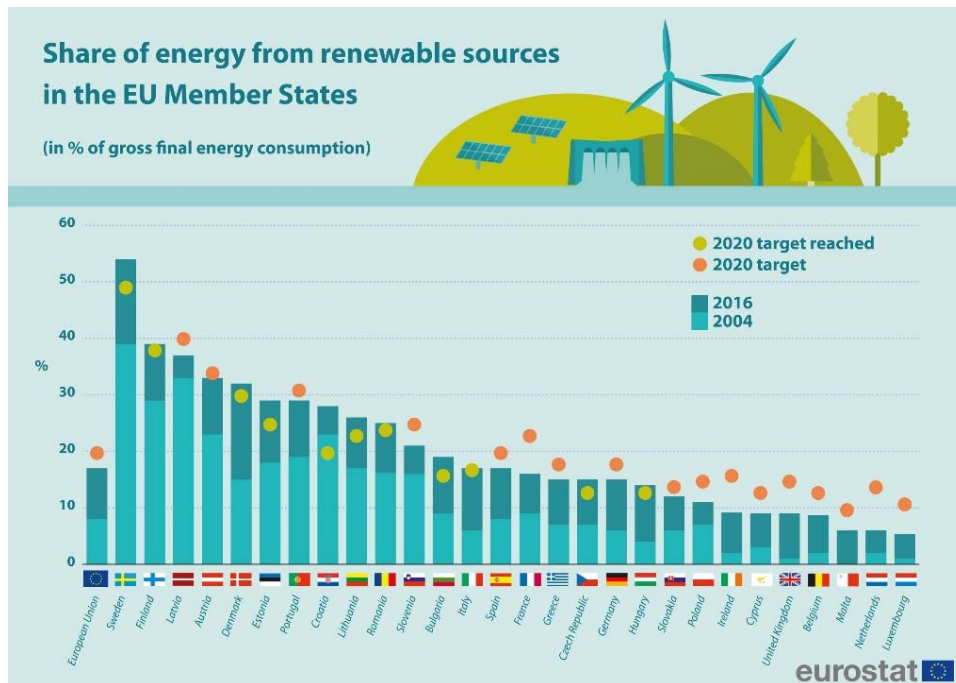
1 Introduction

Most countries across the globe are dependent on fossil fuels to meet their energy needs. Coal, gas and oil remain the most important energy sources in terms of their share in nations' energy mix, be it China, Germany or the USA. Fossil fuels also remain the principal sources of pollution and significant contributors to climate change. A need for clean, or green, energy, i.e., energy from renewable sources, is commonly acknowledged, although how this need materialises in policy and practice depends on a country's context. This leads to significantly varying approaches in the policies adopted by nations around the world (Ehrlich and Geller, 2017; Jaegersberg and Ure, 2017). Resource-rich countries, such as Brazil, Nigeria, Russia or Saudi Arabia, display limited interest toward developing policy on renewables and their progress in this field is yet to be seen. In contrast, resource-poor nations, particularly in Europe, are more active in adopting and

implementing policy aimed at increasing the utilisation of renewable energy sources (RES) (Solorio and Jörgens, 2017).

Figure 1 shows significant variation in the share of energy from RES across the European Union in 2016. Sweden, Finland, Latvia, Austria and Denmark are leading, with a high percentage of renewables in their energy mix; as high as approx. 53% (Sweden) and above 30% for all. Contrarily, Italy, Cyprus, the UK, Belgium, Malta, the Netherlands and Luxembourg are lagging behind, generating less than 10% of energy from RES. Figure 1 also shows that, as of 2016, 17 EU nations were yet to reach their 2020 target (for the share of clean energy in their energy mix) and the gap between stated targets and current level of RES utilisation remains significant.

Figure 1 Share of energy from renewable sources in the EU, 2004–2016 (see online version for colours)



Source: Eurostat (2018)

Lack of progress in developing renewables is further aggravated by a faster rate of utilisation of fossil fuels: in 2016, the volume of gas consumption in the EU increased twice as fast as that of renewables (Banja and Jégard, 2017). This suggests that significant impediments to expanding the utilisation of RES exist, necessitating their identification, conceptualisation and understanding of how best to address them.

To this end, the special issue of the *International Journal of Technology Intelligence and Planning* entitled 'Clean energy: innovation in policy, management and praxis' has been developed to share the results of recent research in the field, focusing on innovative approaches to the promotion of RES. This special issue aims to conceptualise how existing technology and technological advancements in clean energy generation are embedded in and inform policy goals, design and implementation at all levels. In view of

this, we sought contributions that drew on available and emergent technological solutions for clean energy and focused on a range of policy and governance issues related to the expansion of the utilisation of RES.

To ensure the fit with the journal's thematic scope, we selected papers that not only highlight technological developments in RES, but also look at a broader picture, particularly at the interplay between technological, policy and implementation aspects. This was a fundamental selection criterion given that governance issues, rather than technological limitations, appear at the forefront of issues impeding RES promotion. Technological advancements such as increased capacity of electrical storage batteries or cheaper wind turbines make renewable energy more cost effective and hence requiring smaller investment and attracting more households and businesses. However, issues beyond the scope of technology, its advancements and their impact on the levels of RES utilisation are increasingly drawing greater attention from stakeholders at all levels. For example, receiving a licence for launching a RES facility may be very difficult due to procedural ambiguity and/or tangled approval process; connection to the grid is often problematic for small producers of renewable energy owing to the same reasons; and feed-in tariffs do not always serve as an incentive for energy producers. Therefore, the special issue departs from a merely technological discussion of clean energy and, instead, adopts the policy and governance perspective.

2 Introducing the contents

The highlights of the special issue's articles begin with the paper on the governance of renewables in Kazakhstan. One might think that, as a resource-rich nation, Kazakhstan is not in need of a policy aimed at increasing the utilisation of RES. On the contrary, the nation has successfully put in place an elaborate policy, including a series of laws and regulations, and created a large number of institutions responsible for the promotion of RES. Nonetheless, the progress is slow, and the paper investigates the barriers to investment in renewables, a discussion likely to be of interest to other resource-rich economies. The paper draws insights into the governance of the renewables sector and identifies ways to facilitate investment in it.

The paper on wind energy focuses on the effectiveness of 11 policy instruments, such as feed-in tariffs, green certificates, grants and subsidies, loans and taxes, in 106 countries. Pursuing the goal of assessing the impact of different policy instruments on wind energy production, the paper argues that two policy instruments – tax incentives and strategic planning have a positive impact on wind energy production. This confirms the critical role of government in spearheading societal efforts to increase the utilisation of RES and elucidates the significance of certain governance instruments amongst those available. A robust quantitative study, this paper also suggests that the body of knowledge would benefit from cross-regional analyses that might group countries into regions and estimate the marginal effect of each policy instrument on renewable energy by each.

The paper on solar energy in the Global South (i.e., developing countries) emphasises an important governance aspect – contextualisation. Much like the paper on wind energy, this article analyses policy instruments available for solar energy, such as production tax credits, clean energy bonds and tradeable green certificates, among others. By looking at

qualitative data for Delhi, this case study investigates the outputs of the solar energy policy in the city and compares it to the potential that this urban area possesses. A considerable volume of unused and underutilised opportunities has led to the identification of barriers to residential solar PV deployment, which presents a challenging task for governance. Although the policy is in place and implementation is underway, much needs to be done on the city level to make sure that households can take advantage of a broad range of policy instruments and increase the production and consumption of solar energy. Yet another important element of this paper is its highlights of business models that could guide and inform energy producers' decision-making. The rationale is that a set of business models forms an enabling environment for policy, i.e., policy instruments do not work in a vacuum; rather, they should link clean energy generation capabilities with policy and with the urban context.

The paper focusing on the case of Australia investigates the economic and technological conditions surrounding *prosumers*, i.e., those consumers who also produce electricity. These are households that generate energy from renewables and consume part of it, storing and/or feeding the rest to the grid. Although the nation has achieved remarkable success with massive installation of rooftop solar PV systems, incentivised by subsidies, this also created problems for system stability and reliability. These include voltage fluctuations, frequency control issues and reverse power flow. Storing energy by using behind-the-meter batteries appears to be a solution to many of the system security concerns, which the paper discusses. Drawing on the technical benefits and limitations of batteries, the paper elucidates the efficacy of consumer subsidies for the deployment of batteries and makes policy recommendations. The paper is of particular significance as the storage of renewable energy is a critical issue for many nations, and the Australian experience, particularly from the governance perspective, could provide useful insights to be transposed to other nations.

The paper on community-led renewable projects is a much welcome contribution to this special issue. This is owing to the growing importance of stakeholder engagement at the local level, rather than the national or regional ones where policy-making typically takes place. The paper draws on theories underpinning institutional architectures (e.g., communitarianism, cultural theory) and examines schemes (a local development trust and a social enterprise) for generating renewable energy by communities. By comparing Scotland to other parts of the UK, the paper identifies different legal structures and business models for renewables. Community-led projects might be viewed as one of the promising avenues for the generation and consumption of renewable energy, particularly in rural areas, which explains the significance of this phenomenon for governance.

While summarising the special issue's contents is a challenging (and perhaps unnecessary) task, it brings to fore the principal benefit of it. Its principal benefit is in highlighting the models that might ensure the successful promotion of clean energy: their critical elements and associated policy decisions, financing mechanisms, governance arrangements, community involvement and implementation strategy.

3 Why publishing a special issue on clean energy governance was important?

This special issue has contributed to knowledge on clean energy by emphasising the need for a coherent and integrative approach to technology and technological advancements and policy development for and governance of the sector. Naturally, the range of themes related to clean energy is broad. In addition to technological and engineering aspects, it includes political, economic, regional, community, business, social and psychological dimensions. Although knowledge in the clean energy field is fast growing, many topics require further research, and the underpinning analytical frameworks require coherent, integrative consideration of both technology and governance. When one is separated from another, or linkages between them are weak or non-existent, the progress in expanding the utilisation of RES stalls. Future research needs to address how certain technologies and policy and governance tools (e.g., solar panels, energy storage solutions, community grids, financial incentives) could be effectively used, and what are the procedural and management arrangements that would ensure their effectiveness. Therefore, the lessons from this special issue go far beyond the community of academics interested in clean energy. They might also be useful to policy makers, governments, investors, businesses and local communities.

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