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ABSTRACT
The target article 'Risk communication, uncertainty and the Dutch energy transition' outlines a comprehensive list of major and minor recommendations that the Dutch Ministry for Economic Affairs and Climate Policy could follow. The aim of this commentary is to consider another aspect of risk communication that is often overlooked, the communication of risk amongst expert groups. Not only is there a need to carefully consider strategies, such as those mentioned in the target article regarding communicating risks to different publics, but also the ways risk is communicated amongst experts so as to inform successful policy decisions.

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Avoiding the temptation to hand wave

While much of what is going to be spelled out here is assumed to be common knowledge, it is nonetheless important to revisit the basics and the many auxiliary assumptions behind the topic of energy transition. The point of this is that without context, hands may often be waved about general missions for risk communication strategies such as being transparent and accountable. While everyone would agree that these are laudable, one is left often wondering what this actually means in practice. So, to avoid this, more concrete factors ought to be outlined regarding risk communication strategies and for a group that often gets ignored, namely the experts themselves.

Context

In the main, energy transition means a shift from fossil fuels (e.g. Coal, Oil, Natural Gas) as a dependent source of energy to alternative sources (e.g. renewables, nuclear). The motivating reason for doing this is that fossil fuels have been identified as one key climate tipping factor contributing to dramatic atmospheric changes; this is expect to have profound consequences on the habitability of the planet (Holme and Rocha 2023). There are of course other significant consequences besides, but in all cases, the forecasts trend towards a grim outlook if no adjustments are made to the current sources used to supply energy. Figure 1 is a useful characterisation of the dynamical elements that represent both natural processes and anthropogenic

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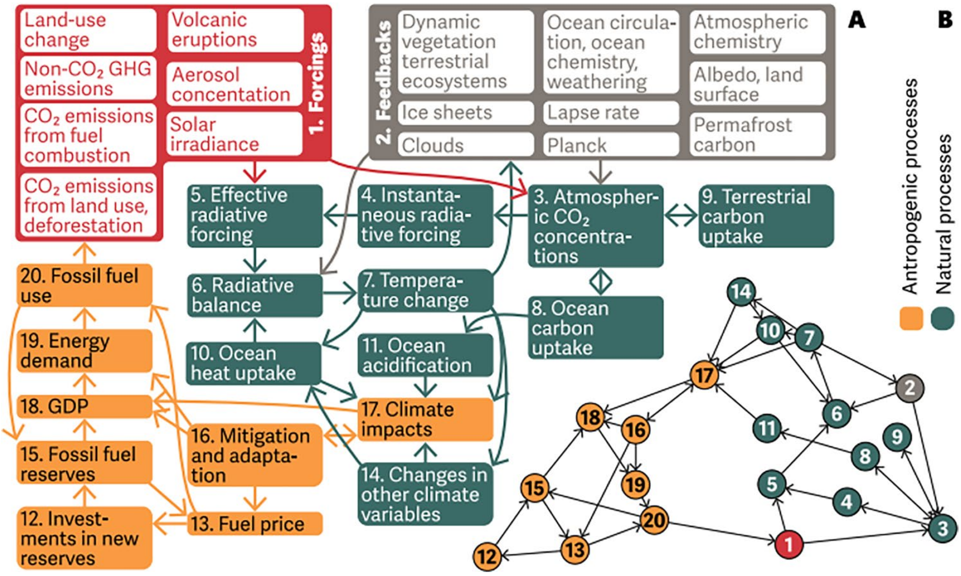

Figure 1. Holme and Rocha's (2023) Structured diagram of a climate model. Panel A illustrates key components and their interdependencies often used on large-scale climate simulation models. Panel B shows the same network as a causal directed graph.

processes that have climate impact. It helps bring some useful context and clarity to the loose way in which 'climate change' is referred to, often without distinguishing between the two processes. We will return to the value of this at the end of this commentary.

Crucially we can see the interdependencies that contribute to climate dynamics in context, and where there are critical points of entry for policy initiatives that show why they are being prioritised over other options. To inform decision-making, the quality of available information is important, but that in turn means finding the best way of representing information so it is accessible and has maximal utility. This in turn takes into account cognitive economy (Rescher 1989) – the effort gains and costs of mentally processing information. When details of risks concern complex topics, by necessity they invite a trade-off between the simplicity of the details presented against retaining accuracy of those details (Covello, Slovic, and Von Winterfeldt 1986). Figure 1 is illustrative of how the balance can be struck. It conveys in two different ways (Panel A, Panel B) the proximal and distal relationships between two different origins of climate change. To understand what energy transition means and the associated consequences that might follow, any intervention need to be considered in context, and graphical representations are essential to doing this well.

All current efforts directed towards energy transition have, by necessity, involved consideration of the pragmatics of shifting to fully renewable energy (e.g. wind, solar), and the timelines for when this can realistically happen; in fact this was recognised as an issue at least 20 years ago (Polatidis et al. 2003). As well as this, depending on the actual natural resources that any country has available, many policy makers have to entertain possible plans for a combination of renewables alongside nuclear energy, and the economic impacts of each (See Figure 2). Along with this, energy transitioning still has to contend with other options, such as more investment in technological innovations in fossil fuels; this has recently been viewed as a means of limiting the adverse economic impact experienced in the transition process (Macedo and Marques 2023).

Therefore, any discussion of risks concerns the many options for what types of actions are taken (e.g. full renewable energy, partially renewable energy) in terms of budgets, timelines, environmental impact, business impact, as well as public concerns (Figure 2). The delicate balance of these factors, along with the complex interplay between introducing measures to achieve energy transition also requires taking into account the interdependencies with natural processes of climate change (Figure 1).

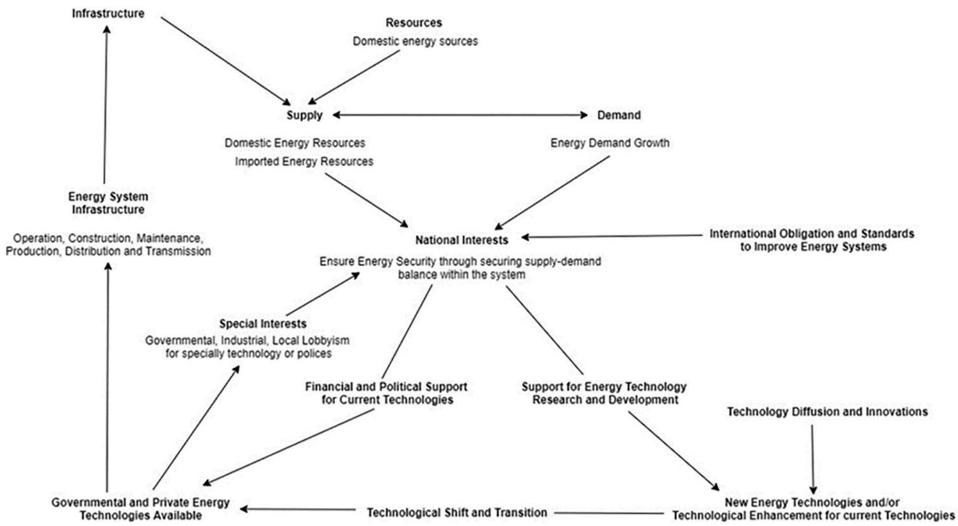

Figure 2. Gudlaugsson et al.'s (2022) Diagram of variables and interrelationships between factors informing energy transition policy making.

So, what risks are communicated across experts?

Eliciting perceptions, understanding, knowledge and concerns in the area of energy transition is often assumed to be of priority when it comes to the public (e.g. Linzenich, Zaunbrecher, and Ziefle 2020; Rafiq et al. 2022; Thomas et al. 2022). While less prominent, but no less intensively examined across combinations of expert groups, is the variability in the communication of, and interpretation of risks associated with energy transition policies (e.g. Kreuz and Ploß 2019; Meng et al. 2021; Perdana et al. 2023; Sivonen and Kivimaa 2024; Wiser et al. 2021). The wide spectrum of experts ranges across different stakeholders with their own particular expertise (e.g. academic, Industry, International organisations, NGOs). But even within a single government department specifically tasked with climate policy we see several specialisms, each with its own technical language and complexities (e.g. Energy Market analysis, Nuclear Energy Policy, Sustainable Industry, Decarbonisation, Digitisation, Economic Policy, Digital Economy).

The empirical work on expert elicitation and analysis of decision-making across different stakeholders provides two valuable insights worth highlighting. The first is the communication of risk depends on the questions being asked of experts. *What and by when?* In some cases the risks are attached to failure to implement policies by a certain time period, which takes the form of forecasts regarding the specific type of energy (e.g. nuclear energy, biofuel – substitutes for gasoline/diesel/jetfuel, wind energy-onshore/offshore) and technologies associated with its storage. *What and to whom?* Other work has examined risks in terms of national security regarding trade and cooperation with other countries and what proportion and type (e.g. fossil fuel, oil shale, natural gas, biofuel) of energy is imported and exported. This reflects a different set of interdependencies that broaden the scope of the risks considered in relation to national strategic energy, climate, security, and defence planning. *What and how much?* Another obvious consideration is cost and returns on investment. There are several factors that inform estimations of costs of research and development by energy planners. Whichever combination of non-fossil fuel energy technologies that could be utilised carries risks. The risks include costs in investment increasing above those estimated, variable rates of future expansion of technologies, and inaccuracies in estimation of when overall cost reduction to switching would be realised.

The second insight from recent work examining risk communication amongst and across different groups of experts is classic cognitive psychological phenomena. Examples of them can be found in a variety of domains such as food safety (e.g. Jenkins, Harris, and Osman 2020) and military planning (e.g. Edmunds, Harris, and Osman 2022). Variability in expert estimates of risk, when tested against formal model assumptions as a benchmark, reflect differences in the risk appetite of those making them, varying degrees of overconfidence, and differences in where uncertainties that impact the estimates are located (e.g. technological knowledge, economic knowledge, fiscal policies, legislation, socioeconomic factors).

The latter of the two is a fortuitous problem because there are basic common matters that cut across the different types of risks being communicated and the decisions on which they are based (Edmunds, Harris, and Osman 2022; Jenkins, Harris, and Osman 2020). Those same basic common issues have been the subject of considerable work in psychology, computer science, economics and management disciplines that offer viable solutions (Neil et al. 2021).

De-problematising communication of risk across expert groups

To avoid handwaving means being honest about the task at hand and exposing the major issues. This means acknowledging that efforts need to be dedicated to improve risk communication across experts, not just to the public. This isn't problematising matters, which academics are well known for, but rather a way to look for common themes to then expose appropriate solutions. While there are many more than the ones identified here, they all reduce to systematising knowledge on which risks are identified to communicate them accurately, and from which risks are prioritised to make decisions.

Systematising Knowledge: Several studies outline the need for diagrammatic representations of the problem space on which risk can be located, and on which policy decisions are required (Bolwig et al. 2019; Kreuz and Ploß 2019). As mentioned earlier, causal diagrams are an efficient way to capture complex interrelationships (Neil et al. 2021). Therefore, once an agreed representation of the problem space is in place, then this can be used to establish share knowledge. From the same representation of the problem everyone can work from it, and this canfacilitate better coordination of risk related details within and across groups of experts (Dolge et al. 2024). This representational system can also be used as a basis to identify which areas hold the most uncertainty across all expert groups. Recognising this is important so as to help make informed adjustments to the impact of the estimated risks for which ever questions is being posed.

Systematising risk prioritisation: Depending on how risks are communicated, some will be seen as requiring greater attention, or earlier action than others. This requires a shared language of risk, and a shared process on which decisions are made to act in accordance with the risks that have been identified. One solution, which has already been adopted by the European Commission for European energy and climate policy in 2014 in view of implementation in 2020, is multi-criteria decision analysis (MCDA) (for full details see, Steinhilber, Geldermann, and Wietschel 2016). Whichever method of coordination for group decision making is used, by necessity it requires establishing criteria for the hazards, the risk exposure, the trajectory of the risks over a given time period, the capacity to mitigate the risks, the opportunities afforded, the quality and reliability of the evidence on which risks are appraised, and the decision frame that each expert is operating under (i.e. their own risk appetite at the start). These are the necessary ingredients to standardise a process on which risks are identified, and communicated, from which decisions are then made.

Conclusion

There is no need to reinvent the wheel with respect to developing strategies that ensure risks are communicated well enough on which well justified policy decisions are taken. There are many tools available to support effective decision making based on communicated risks. But, for this to be done well, the foundations need to be established. The proposals here highlight the need to develop a basis on which those risks are derived, which requires a shared representation of the problem – which could be a causal model. What is also needed are the criteria on which policy decisions are made, which could be with recourse to a MCDA approach. MCDA not only systematises the process of decision-making, but also the language of risk and the critical risk factors that experts, with a wide range of knowledge and experience, can use to communicate amongst each other, as well as to the public.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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