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## Energy transition in the Austrian Climate and Energy model regions: a multi-risk participatory governance perspective on regional resilience

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### Abstract

The Austrian Climate and Energy (CEM) model regions are facing energy transition towards a greater share of renewable energy sources in the final electricity mix. To guarantee the resilience of the CEM socio-economic and regional systems, an integrated approach towards electricity generation and transmission is necessary. The changing architecture of electricity generation is causing new challenges to the transmission grids to adapt. The cascading risks of existing and emerging risks for electricity transmission grids can lead to power outages and even blackouts. This paper argues about the need of a multi-risk approach towards risk assessment and risk governance for resilience of CEM regional electricity systems. It also discusses a multi-risk governance perspective as a tool to strengthen resilience of urban socio-economic systems against electricity blackouts. Based on extensive dialogue with stakeholders from the CEM regions over the last two years the paper develops recommendations for inclusive and participatory risk governance process. The data collection included contributions of stakeholders from public and private sector, as well as academia and civil society. The analysis of data was done in light of possible stakeholders and public engagement into decision-making processes on risk mitigation measures and strengthening of electricity infrastructure of the CEM regions in Austria for resilience in the process of energy transition.

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## 1. Introduction

Austria, as other countries of the European Union, settled targets for reduction of its green house gas emissions through deployment of renewable energy sources (RES). This climate change mitigation policy targets have also synergies with energy security targets, namely, to reduce dependency of Austria on fossil fuel imports through domestically available RES. The National Renewable Energy Action Plan for Austria foresees an increase of the share of RES up to 78% in gross final energy consumption by 2050. The nationally developed goal to deploy RES is currently being implemented at the regional and local level in frames of the Climate and Energy Model (CEM) regions, which are covering 2.5 million inhabitants or 43% of the entire territory of Austria. Several CEMs are even planning even to become energy independent with domestically available RES by 2050.

The process of implementation of such targets will certainly lead to transition of the regional CEM electricity systems and caused by this transition further transformation of the CEM socio-economic systems, also including the urban systems. Policy interventions at such scale are also leading to the question about resilience of the electricity system of CEM regions to emerging risks caused by the process of transition but also to existing risks such as natural hazards and man-made activities. As CEM regional electricity systems are very complex and include several elements, those goals are to guarantee reliable electricity supply, the focus of this paper is on both, electricity generation and transmission, and the governance mechanism to guarantee resilience of CEM energy system in conditions of energy transition.

Electricity infrastructure is a critical infrastructure, which is vital for functioning of CEM regions and the disruption of this very complex system, which includes electricity generation, transmission and distribution, can lead to disruption of the vital societal functions, having negative impacts on all economic sectors and spheres of human activity. Worldwide, failures of electricity infrastructure leading to power outages and electricity blackouts are becoming a significant threat by affecting several million people. Electricity blackouts also have trans boundary nature, when they in frames of one country or region, and then spread to other regions. Only recently the electricity blackout, which started in Switzerland, affected 55 million of people in Italy in 2005. During the same year, electricity blackout in Norway also affected people in other Scandinavian countries. Two blackouts, which also happened recently, one in Turkey in 2015 and another one in Germany in 2006 were caused by energy transition and uncoordinated actions of responsible stakeholders.

Resilience of the CEM's electricity systems requires not only reliable electricity generation but also reliable transmission of the generated electricity from producers to consumers. This includes adaptation of electricity grids to the changing requirements of energy generation landscape caused by energy transition, such as the need to balance volatile RES supply, as well as protection of the grids from multiple natural and man-made risks. Protection of critical infrastructure includes all activities, which are needed to ensure functionality, continuity and integrity of critical infrastructure in order to deter, mitigate and neutralize a threat, risk or vulnerability [1].

One of the main questions for resilience of CEM regions is how electricity transmission system can balance the variable RES, which will require adequate infrastructure to integrate varying electricity produced by RES. As several CEMs are striving to reach high degree of RES in their electricity mix, the transmission system operators will have to adapt to the increasing share of RES, which might impact stability of electricity grids. While traditional variability of demand or load always required a certain level of flexibility, the so-called power ramps, caused the significant reduction of electricity coming from intermittent RES, can seriously affect electricity grids [2]. Moreover, electricity grids will need to react on demand – side changes and to integrate two-sides flow of electricity, not only from producer to consumer but also from consumer back to the grid, when consumers will become prosumers by generating their own electricity and feeding it back to the grids.

Even though the problem of resilience of CEM regional and urban systems in light of energy transition could be regarded as a technical or economic one, this paper argues, that this is also the problem of governance. Namely, there is a need of a multi-risk approach in risk assessment and development of risk mitigation strategies, which would address cascading and conjoint effects from existing risks but also emerging risks caused by energy transition. Such governance framework will require development of inclusive and legitimate solutions, based on co-production

of knowledge between experts and stakeholders in CEM regions. The theoretical framework of this paper is based on the assumption that participatory governance can improve results of decision-making processes of entire transitional process through combination of top-down and bottom-up decision-making processes. It is also based on the assumption that efforts required for participatory multi-risk governance will lead to a more sustainable energy transition process and resilience of CEM urban and regional systems.

## 2. Background

### 2.1. Theoretical background: concepts of resilience and of multi-risk approach

Multiple definitions of resilience exist and the engineering perspective is one of the most commonly used definitions such as the ability of a system to return to a steady-state after a disturbance [3], at the same time as ecological understanding goes beyond that and speaks about ability of a system to absorb changes [4]. Social and psychological understanding addresses abilities of individuals and communities to deal with changes [5]. Risk governance is integrating ways how community is mitigating existing risks, manages the emergency situation and recovery or following the risk governance circle. The risk governance circle goes from prevention, which includes risk evaluation, prioritization of risks and provision of resources, to risk treatment, which includes prevention, reduction, transfer and acceptance, adaptation emergency planning with early warning, to preparedness of responders and risk communication, and, finally, to response with crisis communication and recovery [6].

The definition of resilience corresponds with the definition of multi-risk approach as its main purpose is to establish a ranking of different types of risks, taking into account possible conjoint and cascading effects [7]. The need of a multi-risk approach to increase resilience of critical infrastructure was discussed starting from the early 1990s, with the Agenda 21 for sustainable development. The Agenda 21 discusses the need of a complete multi-hazard approach as a part of human settlement planning and disaster risk management [8]. In the international policy process, the need of multi-risk approach was outlined by the Hyogo Framework for Action (HFA) [9]. In its priority 3, indicator 3.3, HFA mentions that the methods for multi-risk assessment should be developed as well as the multi-hazard, inclusive and science-based risk decision-making. The need for multi-risk governance is further outlined in the recent Sendai Framework for Disaster Risk Reduction [10].

In Europe, the Internal Security strategy calls for all-hazard approach for risk assessment and development of guidelines for disaster management based on a multi-hazard and multi-risk approach [11]. Also in the European Community framework on disaster prevention there is a statement about the usefulness of a multi-hazard approach to a Community disaster prevention framework [12]. The European disaster risk reduction strategy calls for a comprehensive approach to disaster management. The European Union Energy 2020 Strategy identifies development of the grids as a key factor for further development of RES. The achievement of the goals of the EU Energy Roadmap 2050 require also changes in the quality of the grids, such as smart grid technologies to manage different energy supply options.

The multi-risk approach requires also a multi-risk governance, which covers different phases such as the process of communication of multi-risk assessment from science or private stakeholders to practice, the process of implementation of multi-risk assessment taken into reference existing institutional and regulatory structures as well as interests, influence and responsibilities of different stakeholders involved, and the process of implementation of risk mitigation measures, which requires support and acceptance from inhabitants of affected communities. The currently available scientific knowledge about multi-risk governance is limited. The most of existing words are focusing on multi-risk assessment [13; 14; 15]. However, the interest in the concept of risk governance increased significantly during the last years [16].

### 2.2. Participatory risk governance

The concept of risk governance includes various ways how stakeholders, including policy-makers, private sector stakeholders, academia and the general public, manage their common risk issues [17]. Evidence exists that a multi-risk approach allows comparison and ranking of different risks, taken into consideration interactions between different risks, which can influence their impacts and vulnerability of the region [18]. The multi-risk governance

could be understood as various ways in which stakeholders manage multi-risk and multi-hazard issues related to cascading disasters [19]. The concept of multi-risk governance goes beyond a sum of governance practices for different single risks, the profiling of key characteristics of governance in diverse risk sectors is only one aspect of multi-governance [20].

The implementation of multi-risk governance approach can benefit from participatory governance, based on a stakeholders' process, which includes design and selection of disaster risk reduction strategies', their implementation and evaluation. The participatory multi-risk governance approach allows taking into consideration of existing among stakeholders' knowledge and expertise in a two-ways communication process, which increases credibility and legitimacy of its outcome [21, 22]. Participatory risk governance is about stakeholders and inhabitants taking a more active position in shaping decision-making processes regarding risk mitigation and other measures improving resilience of their community [23]. Multi-risk governance can be a wicked problem because of the high number of interdependencies between natural and socio-economic systems, which have to be addressed by designing disaster risk reduction strategies, the large number of participating stakeholders and the need for interdisciplinary knowledge.

Resilience of CEM regions requires integration of interdisciplinary knowledge but also knowledge from different stakeholders and available local knowledge from inhabitants of CEM communities. This should be based on a certain level of social and public acceptance however also going beyond this level, by involving knowledge of people to make implementation of energy transition more sustainable. Acceptance as a basic level is necessary in light of several protests, which happen because of the deployment of electricity generation and transmission infrastructure. Acceptance is not only a necessary element of participatory governance but it is also closely connected with public participation. Public participation is understood as a democratic principle of inclusiveness and the right of people to participate in decision-making regarding infrastructure projects, which affect their lives [24]. This participation can take a form of providing input or comments to decision-making by inhabitants themselves or via organized stakeholders, who represent their interests, like NGOs, communities and associations [25].

Resilience of CEM regions based on participatory governance would require a better understanding of perspectives, interests and needs of different stakeholders from private and public sector. This understanding could be gained with the help of different methods of stakeholders dialogue such as semi-structured interviews or focus group discussions on the topics like risk interactions and "worst case" scenarios. The participatory stakeholders' process should start even prior to any decision-making process on multi-risk issues. Timely participatory process may also help to address possible conflicts, which might arise in different opinions among stakeholders on dealing with multi risk issues [26]. There is also evidence from practice that involvement of communities into disaster risk reduction and adoption of participatory approaches to risk management leads to more sustainable mechanism of reducing the risks.

### **3. Methodology and results**

The results of this paper are based on interviews with key stakeholders involved into the CEM process in three case study regions, Freistadt, Ebreichsdorf and Baden. The regions were selected as representative regions for suburban, semi-rural and rural regions. All of them are in the eastern part of Austria. The CEM Freistadt is a rural CEM located in the North of Upper Austria. The CEM Baden and Ebreichsdorf are sub-urban and semi-rural CEMs located in the Lower Austria, South of Vienna [27].

Altogether 22 stakeholders from policy-making process, private sector, academia and civil society participated in the period from June 2016 to April 2017. Each interview was in-depth qualitative expert interview, which lasted for over two hours and was fully transcribed. The interview protocol was developed based on available literature and media reports on energy transition in the CEM regions.

The results showed that several stakeholders are involved into decision-making process on energy transition at the national, regional and local governance levels. The needs for energy transition are identified at the national level. The discussion about implementation of energy transition takes place at the local level. At the local level the responsible stakeholders, such as the CEM manager and the local mayor, are playing the main role.

Even though inhabitants are well aware about impacts of climate change and there are several measures to raise their awareness about the CEM process and energy transition, their participation in the CEM decision-making processes remains limited. This is due to several factors such as the lack of capacity or knowledge but also due to the

lack of available possibility to participate and the perception that the voices of inhabitants will not change anything. Currently in all three regions the majority of participatory governance measures is focused on awareness raising process. These measures are sometimes targeted at specific groups of stakeholders but hardly involve them into decision-making processes.

At the same time, [28] identified examples of participatory governance measures, which allow stakeholders but also inhabitants to participate in decision-making process on energy transition. These are 16 energy groups, which give an opportunity for representatives, such as mayors, environmental committee offices, NGOs, civil society organizations and interested stakeholders, of 27 municipalities in the CEM region of Freistadt to provide feedback, recommendations and suggestions of the distribution of funds towards renewable energy projects. This is a unique practice and was not recorded in frames of two other CEMs, where decision-making process is mainly shaped by organized stakeholders from policy or CEM process.

#### **4. Discussion**

Our results showed that the majority of participatory governance measures on energy transition in three case study regions are concentrated at the level of informing inhabitants. There are different kinds of public information events such as climate cinemas, reports in local newspapers, public discussions, especially targeted information events for different groups of stakeholders etc. Currently inhabitants are hardly involved into discussion about energy transition in their region.

Evidence shows that engagement of inhabitants into decision-making at the local level can increase resilience of communities. An example is a free-year participatory process in Nocera Inferiore in Southern Italy [29]. The main difference of this process compared to other processes was elaboration of multiple stakeholders' worldviews on the goal of resilience as well as the measures to strengthen it. Instead of working towards consensus, this process developed compromise solutions, which were based on experts' elicitations but also on stakeholders' views.

The participatory process in France and Italy on possibilities for implementation of the multi-risk governance approach showed strengths and weaknesses of centralised and decentralised policy options. It did not only map involved stakeholders at the different levels of governance but also developed recommendations on multi-risk governance commissions being established at the local level to provide inclusive and multi-disciplinary discussion on resilience to multi-risk issues [30]. The process also led to an innovative approach in modelling and risk assessment by bringing stakeholders knowledge into development of modelling tools and shaping of these tools according to the stakeholders' feedback in a joint co-production process [31].

Another example is a participatory process in Germany, Belgium and France on highly contested infrastructure issues such as deployment of electricity transmission lines. The process brought together representatives from the transmission system operators and NGOs to develop joint plans on infrastructure deployment and addressing issues of public acceptance [32].

These projects show that stakeholders often have different views about the problem and the way to solve this problem. This is especially true with contentious and complex policy issues, such as resilience, which are frequently marked by disagreement about applicability of experts' analysis [33]. The participatory processes in these projects show that different views on problems and solutions can translate into different worldviews and conflicting interests among stakeholders involved. The participatory governance does not exclude experts participation, however, it gives to experts the role to frame policy options for deliberative discussions and co-production of knowledge together with stakeholders. These processes are showing that compromise solutions with respect to opinions of different stakeholders are possible and that instead of reaching a "best" solution in such complex policy problems such as resilience there are possibilities for many solutions, for a "clumsy" way forwards.

#### **5. Conclusion**

The stakeholders' process analyzed in frames of this paper showed that there is a high level of awareness about the need to mitigate climate change and, generally, positive perception of renewable energy sources. Across all

social groups inhabitants are ready to pay additional fee for electricity coming from renewable energy sources and additional fee for electricity coming from sources located in their region. Interested inhabitants as well as organized groups of stakeholders will be eager to contribute also to decision-making processes on energy transition in their region and to identification of measures which would help to adapt their region to this transition and to make the economy and infrastructure not only resilient to these changes but also will allow to benefit from these changes.

Also the results of analysis of participatory governance measures of energy transition in three case study CEM regions showed that even though the practice of co-production of knowledge between experts, local stakeholders and inhabitants of communities affected by energy transition is limited, however the first examples are already appearing. The energy groups in CEM Freistadt is an example where all interested in energy transition could provide their feedback and participate in decision-making regarding implementation of energy transition measures in their region.

These energy groups could provide a basis of participatory and inclusive discussion on energy transition. They could also create a platform to collect information about challenges, risks and benefits of energy transition from interdisciplinary perspective. As the deployment of infrastructure needed for energy transition mainly affects local communities where this infrastructure is settled such energy groups could also become a basis for implementation of an approach, which would allow strengthening resilience of the regions. Based on evidence of other realized projects, it might be easier to realize such approach at the local governance level rather than at the national level. This is mainly due to the fact that scientific knowledge on challenges, risks and benefits from energy transition is often context and case specific.

This research suggests enforcement of energy groups also in discussion of resilience issues at the local level. The members of the groups could include all interested inhabitants and representatives of organized stakeholders as well as experts with background in different sciences such as social or engineering disciplines. Energy groups might provide a frame for experts to work together with local authorities as well as practitioners and inhabitants who could share local experience and knowledge. Such energy groups could also help in discussion about responsibility sharing between private and public actors for energy transition in the region and to provide a divide between research and policy. Energy groups might also help to balance social views with technical evidence and provide a platform for discussion on institutional, legal, social and contextual factors of energy transition.

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