

Presentation

How to ensure swift and inclusive energy transitions with young people across Norway: Searching for a proper approach

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Abstract: Environmental movements and climate strikes have underscored the exclusion of young people from the ongoing energy transformation process and emphasized the need for their engagement to achieve a swift and socially accepted transition. To address this issue, we have developed, implemented and assessed a multidisciplinary intervention tool for youth aged 15 -18, in the form of a workshop focused on the energy transition. The tool aims to help us and energy system planners gather and better understand perspectives and socio-techno-economic preferences of youth in Norway towards a net-zero energy system. The designed workshop consists of three segments: dissemination of common knowledge about energy and climate, interactive activities to explore and develop a shared understanding of various aspects of energy transition, and three rounds of questionnaires administered at distinct time intervals to assess changes in attitudes and preferences of young people.

Keywords:

inclusive energy transition, sustainability, Norwegian youth participation, climate change, multidisciplinary

1 Introduction

Nearly three decades ago, Donella Meadows (1994) emphasized the importance of establishing clear, feasible, and socially shared goals for those advocating for a green transition. She posed critical questions: What do we desire? What is our vision for the world we aim to create for ourselves, our children, and our grandchildren? Meadows cautioned that without such a vision, environmental policies would struggle to gain traction. Although her discourse inspired futurizing activities and vision workshops in academic and business contexts, the impact of engaging the affected population in setting shared goals for the future energy system remains unexplored.

In the Fridays for Future movement, youth engage in strikes due to their sense of responsibility and perceived threat from the climate crisis (Haugestad et al., 2021). Pathways such as meaning-making, connection to nature, and empowerment are potential means to alleviate climate anxiety among youth (Clayton, 2020). Empowerment through activism and identification with movements can enhance positive emotions, such as feeling moved (Landmann & Rohmann, 2020; Seibt et al., 2019). While youth generally exhibit more favorable attitudes towards for example wind power compared to older individuals (Coleby et al., 2009; Whalen, 2017), their overall perspectives on energy transitions remain insufficiently understood.

Energy system models guide policymakers on decarbonization strategies. Future scenarios, based on technology and economic assumptions, shape energy system analysis and policy implications. However, such analysis often lacks stakeholder engagement, especially from vulnerable groups like young people. While participatory energy system modeling (ESM) appears as one of the methods that could change it, it faces challenges related with providing relevant information or selecting effective engagement methods. So far, only few studies have engaged marginalized groups, and the results obtained indicate discrepancies between the stakeholder perceptions and traditional modeling scenarios. Participatory modeling is gaining attention, but issues like knowledge gaps and the validity of survey data persist. At the same time, young people, highly concerned about climate change, are underrepresented in policymaking despite their active involvement in social movements.

In a quest for searching a proper approach to overview and better understand preferences/ attitudes of younger generations towards climate change, we designed and held series of workshops with Norwegian high-school students to enhance their environmental literacy and gather their thoughts on energy transition. Norway's electricity demand is projected to rise by 30% by 2050, and the country could play a key role in Europe's net-zero targets. Understanding young people's views is crucial as they will live in a decarbonized future.

This work documents the executed engagement process and explores how young people perceive the information provided. It addresses two main research questions:

- 1) how to effectively engage youth in climate discussions,
- and
- 2) what future energy scenarios they envision.

2 Methodology

Our aim was to engage Norwegian school youth (15 -16 years old), introduce them to a structured educational workshop about climate change, green transition, and renewable energy, and understand their perspectives on:

- the choice of renewable energy technologies (RETs)
- their spatial allocation
- landscape choices for the RET installations
- ESM techno-economic preferences for projecting net-zero energy goals

This work bridges the existing knowledge gap by enhancing understanding of students' views and may contribute to shaping Norway's future energy policies. Thus, designing workshop activities is a thoughtful and valuable method for eliciting participants' preferred pathways in the energy transition process. Recognizing the significance of the details (e.g., what activities to include, how they should be conducted, and scheduled, etc.) during the workshop design phase, we engaged in the discussions with our multidisciplinary team of project's collaborators, i.e., academics: psychologists, technologists, energy system modelers, representatives from various public and private organizations. Apart from that, we also sought feedback from social science experts, including those in educational sciences, as well as teachers, high school and bachelor students.

2.1 *Workshops*

The presented work is a part of the “Energy for Future” research project, assessing youth perspectives on Norway's net-zero energy systems. Upper secondary school students participated in workshops integrated into their social science and geography classes. These real-life settings enhanced data validity and impacted attitudes and knowledge. Workshops were held in spring and winter 2024 across five schools in Eastern and South-Eastern Norway, involving 286 students in total. Three interactive sessions, each 90 minutes long, were conducted, with questionnaires administered at well-defined time intervals to ensure informed responses. Pilot sessions executed in Oslo helped in refining materials and activities based on student engagement and learning outcomes.

Key considerations for the workshops included:

- providing relevant information on energy transition
- highlighting climate crisis goals and trade-offs
- encouraging student's engagement and discussion
- designing collective learning activities
- following best practices for the stakeholder engagement
- combining social science with energy system modeling, natural sciences and technology to understand young people attitudes

The final structure of the workshops consisted of the following components:

Part 1: Establish a common knowledge base on the green energy transition and climate change

Part 2: Explore land-use conflicts through role-playing activities, concluding with a modeling questionnaire

Part 3: Focus on climate justice and international negotiations, ending with a post-social science questionnaire

2.2 Questionnaires

Two questionnaires were developed for students: a modeling questionnaire to capture socio-techno-economic preferences for energy modeling, and a social science-focused questionnaire to measure knowledge, empowerment, and attitudes towards renewable energy, sustainable energy technologies and climate change.

The modeling questionnaire was designed to align with the high spatio-temporal resolution requirements of the highRES energy model, which is utilized to design a future net-zero electricity system. This approach allowed to address model limitations and necessary assumptions. The questionnaire focused on the 'what' and 'how' of renewable energy technology installations and their impacts on people, considering both physical and social aspects. The rationale for including socially constructed aspects has been supported by several studies demonstrating that public engagement should consider not just the physical or technical attributes of a given technology, but also the affective and symbolic social aspects, such as visual disruption as well as the feelings and values that people associate with a technology.

The survey started with an open-ended question about important factors for RET installation, followed by discrete choice questions on technology preferences, with various question types to minimized biases. Following technology choices, students rated landscape preferences for the wind turbine installations. They also chose preferred

Norwegian counties for solar and wind installations, and answered questions on strategies for RET variability, electricity trading and transmission types.

Questionnaire drafts were refined with input from social scientists, political scientists, sociologists, RET scientists, and energy modelers to ensure accessibility and relevance. Brief modeling knowledge was shared with students before distributing the questionnaire.

2.3 *Facilitation*

The workshops were facilitated by master students and researchers involved in the project, with backgrounds in social or natural sciences, who also helped to design the workshop materials. All instructors were trained before the workshops, and the authors of this work participated in moderating sessions. Facilitators discussed with students how energy system modeling outcomes might be visualized on a map of Norway and used for policy guidance. Concise teaching sessions ensured that students had the knowledge to provide informed and unbiased responses. Their observations helped build guiding principles for designing and modeling emerging scenarios for ESM. Students were also provided with an explanation on how questionnaire results could influence modeling outcomes, illustrating how they could directly contribute to envisioning a future zero-carbon energy system and encouraging thoughtful responses.

The workshop design followed a functional dynamic approach, allocating different levels of control to stakeholders based on objectives. Trutnevyte et al. (2020) identified three modes of information flow during stakeholder involvement: communicating, consulting, and collaborating. In the workshop designed by us, teaching sessions served as communication, while the questionnaire activity involved consultation and collaboration. During the collaboration phase, the aim was to share model outcomes derived from student feedback, fostering meaningful integration of stakeholder preferences into ESM.

3 Results

Norwegian youth are divided on which renewable energy technologies to adopt and on their optimal locations. Based on the obtained results, they showed a strong preference for offshore wind solutions (68%). This aligns with Norway's goal to install 30 GW of offshore wind capacity by 2040. The main reasons for preferring this technology include protecting natural landscapes, minimizing environmental impacts, and addressing visual concerns. Approximately 32% favored onshore wind solutions, but concerns about installations near residential areas, forests, and agricultural areas were noted. Misconceptions about RETs, such as the toxicity of wind blade coatings, influenced their preferences.

Students also expressed preferences for specific regions for RET installations. They were asked to choose preferred Norwegian counties for solar and wind energy installations, considering factors like landscape types and proximity to demand centers. This regional approach helped to identify areas where youth support renewable energy projects, potentially guiding future policy decisions.

Regarding power transmission lines, pupils were divided between overhead and underground options, with minimal opposition to new installations. Their preferences aligned with the open-ended question responses, emphasizing self-sufficiency, zero-carbon emissions, and environmental protection.

Despite efforts to engage pupils through interactive activities and discussions, a significant percentage of indecisive responses have been also provided, which may stem from varied interpretations of questions or a lack of relevant knowledge. However, those who expressed clear preferences aligned well with their landscape and technology choices.

Energy models typically aim to minimize costs, while considering constraints like emission reductions and trading. However, cost-minimization was the least important factor for young people in Norway. To ensure an inclusive energy transition, models should consider public preferences and implement constrained or multi-objective optimization.

Youth engagement in decision-making processes about new RET installations can clarify doubts and provide updated information, especially in areas, where locals oppose potential installations of wind farms. Their active use of social media can further raise awareness about the characteristics and impacts of different RET.

Ongoing tasks involve simulating and analyzing scenarios based on students' responses, with plans to gather their feedback on model results. We expect that this iterative process will help to develop a mutual understanding of challenges and fosters shared ownership of policy decisions, facilitating a more inclusive energy transition.

Youth engagement in policy-shaping is crucial, as their preferences can guide future renewable energy projects and promote acceptance within their communities.

4 Conclusions

Despite the active participation of youth in climate change issues, they are often overlooked in participatory processes. To address this gap, we engaged Norwegian high school students, revealing their interest and capability for meaningful engagement in energy-related and environmental topics. Youth prioritize energy independence and environmental preservation over energy system costs. Offshore wind emerged as the

preferred option for meeting Norway's electricity needs, with minimal opposition to new power lines.

To achieve an inclusive and equitable transition, modelers and decision-makers should incorporate scenarios based on socio-techno-economic preferences of young people. This study provides a framework for integrating youth perspectives into energy system debates and optimizing future energy systems. Engaging youth during school hours is expected to help: 1) policymakers understand of and reflect on their perspectives, 2) in addressing youth's growing distrust, and 3) in fostering shared ownership of policy decisions.

5 Discussion topics

- I. How can we effectively engage young people across Norway in constructive, science-based discussions on climate change to facilitate an inclusive and swift energy transition?
- II. Can the proposed educational workshop framework, conducted during school hours, help address young people's distrust in the ongoing energy transformation process?
- III. Should normative energy system scenarios that reflect young people's perspectives be used in energy system planning?
- IV. How can we improve collective learning workshop activities to help project stakeholders and energy system planners make informed decisions?

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