Impuls/Diskussionsbeitrag

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Would winter sports tourists produce energy for ski tourism? A winter sports destination may represent a specific case of smart grid acceptance

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Abstract: Winter sports tourism requires significant amounts of energy, which is a challenge for the environment. A sustainable solution could lie in the implementation of smart microgrids based on renewable energy and the active participation of the community. Winter destinations could differ in case of smart microgrids acceptance from other places due to their specific usage situation (leisure instead of everyday life) and thus have a higher acceptance for innovative energy systems.

Keywords: winter sports tourism; energy consumption; prosumer; microgrid acceptance

Zusammenfassung: Wintersporttourismus erfordert erhebliche Mengen an Energie, was eine Herausforderung für die Umwelt darstellt. Eine nachhaltige Lösung könnte in der Implementierung von intelligenten Mikronetzen auf der Grundlage erneuerbarer Energien und der aktiven Beteiligung der Gemeinde liegen. Winterdestinationen könnten sich bei der Akzeptanz von Smart Microgrids von anderen Orten aufgrund ihrer spezifischen Nutzungssituation (Freizeit statt Alltag) unterscheiden und somit eine höhere Akzeptanz für innovative Energiesysteme aufweisen.

Schlüsselwörter: Wintersporttourismus; Energieverbrauch; Prosumer; Microgrid Akzeptanz

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1. Context

Winter sports tourism consumes a substantial amount of energy. Considering solely the scope of the skiing activity itself (excluding transport to and from the destination or accommodation and food), significant energy consumption occurs – primarily for snow-making facilities and the operation of ski lifts. Sustainable Switzerland reports that one hectare of artificial snow requires 20'000 kilowatt hours (Sustainable Switzerland, 2023). "Energy use in tourism destinations is normally disproportionately greater than what is typically associated with other similar sized communities" (Kelly & Williams, 2007, p. 68).

For the sustainable operation of a ski resort, this energy usage should be reduced and sourced from renewable energy sources (Sustainable Switzerland, 2023). Certain destinations have already focused on renewable energy resources (Arosa Lenzerheide, 2024; KliK, 2024), and other projects have attempted to utilize winter sports infrastructure for further energy production (BergWind, 2024).

However, it is worth exploring the concept of a destination that not only harnesses renewable energy sources but also transcends this approach. Is it conceivable for a winter sports destination to operate as a self-contained, autonomous ecosystem, deriving its entire electrical supply from on-site generation?

2. Literature Review

Compared to traditional renewable energy approaches, intelligent micro grid systems can offer a more resilient solution due to their ability to adjust rapidly to changes in demand (Alvial-Palavicino et al., 2011). Such systems work on community level and rely on citizen involvement (Alvial-Palavicino et al., 2011; Gangale et al., 2013). The distinction between consumers and producers becomes less defined when for example private houses become little energy production centres through the installation of solar panels. Models introduce the concept of the *prosumer*, a consumer who simultaneously acts as a producer and thus get more implicated in the energy system (Ritzer et al., 2012; Zafar et al., 2018).

The Alps are an ideal environment to produce energy through photovoltaic systems, as demonstrated by various studies on the high energy production through PV systems in Alpine destinations (Beerli et al., 2021; ZHAW, 2023). Research shows, that compared to urban destinations, the energy production is up to four times higher in alpine regions (ZHAW, 2023).

A study by Fragniere et al. (2023) demonstrates that the social acceptance of smart grid technologies in Switzerland remains limited – and at the same time, would be one major success factor for the operation of such resilient energy systems. The research shows restraining forces for social smart grid acceptance being communication issues between various stakeholders, complicated administrative procedures, a lack of profitability as well as the high price for solar panels same as for batteries for electricity storage. Whereas driving forces include the eco-friendliness, self-sufficiency or knowledge gain according to the study (Fragnière et al., 2023).

3. Discussion

What role do communities of winter sport destinations play in this matter? Community behaviour – and with it the acceptance of new technologies such as micro grids – depend on the context and differ from environment to environment (Fragnière et al., 2023; Gangale et al., 2013). The social acceptance of smart grid technologies may thus differ in a ski resort environment, where prosumers would participate directly in the energy they would require for their leisure activities, as opposed to their everyday energy consumption in other situations. Thus, a winter sports destination might represent a specific case for a smart grid with a different social acceptance than that in other destinations.

Is it feasible to implement a micro grid concept in winter sport resorts to additionally take advantage of an increased visitor population on site? Microgrid systems incorporating renewable energy sources could potentially meet the energy demand and balance peak demand through intelligent control.

Energy self-sufficient winter sports destinations represent ambitious endeavours; however, they may become feasible and potentially even emerge as the necessary new paradigm for sustainable winter sports tourism. Research indicates that alpine regions are particularly well-suited for photovoltaic appications, which increases profitability (Beerli et al., 2021; ZHAW, 2023). Might technological advancements and innovative energy concepts render complete self-sufficiency achievable in the future?

The objective of a future study could be to investigate the social acceptance of microgrid networks in a tourism destination within the Swiss Alps and to determine whether it differs in terms of general acceptance within Switzerland, based on the research conducted by Fragniere et al (2023).

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