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Energy Self-sufficient Regions in the European Alps

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Not having to depend on energy imports: This vision holds great fascination for many regions in the European Alps. At the heart of the corresponding concepts are the ideas of meeting demand through regional renewable sources of energy, saving energy, and using energy more efficiently. Energy self-sufficiency can be seen as a regional "declaration of independence" with opportunities and challenges. It is a promising strategy for dealing with both climate change and energy crisis—to the benefit of the regional economy, society, and environment. Examples from the Alps prove that energy self-sufficient regions are not just a pipe dream, but a worthwhile alternative. Some major findings from a recent study conducted by the International Commission for the Protection of the Alps (CIPRA) are presented, as well as a political agenda to further advance the transformation process toward energy self-sufficiency. The long-term goal is to make the entire Alpine arc energy self-sufficient.

Keywords: *Energy self-sufficiency; energy autonomy; sustainable regional development; policy; European Alps.*

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Introduction

Increasing numbers of European regions are declaring themselves "energy regions." Although they differ in many ways, they all pursue a single, ambitious vision: to become independent of fossil energy imports. Pioneering areas include Güssing in Austria's Southern Burgenland, where the European Center for Renewable Energy has its headquarters, the German bioenergy village of Jühnde, and the Danish island of Samsø. These pioneer areas are leading the way. Many Alpine regions (for example, the region Murau in Styria/Austria, which wants to become energy self-sufficient by 2015) are seeking to follow their lead, and not merely to stop importing energy, but also to use energy economically and efficiently, meet their own demand as far as possible with renewable energies, and at the same time stimulate the regional economy (Energievision Murau 2011; www.energievision.at). Often, the objective of becoming a climate- and/or carbon-neutral region is closely linked with this economic goal.

Through its project "cc.alps—Climate Change: Thinking One Step Further!" the International Commission for the Protection of the Alps (CIPRA) is evaluating existing climate adaptation and mitigation measures in the European Alps (www.cipra.org/en/cc.alps). The aim is to identify measures that are in line with the principles of sustainable development. CIPRA has published a series of background reports, each of which explores one particular theme (such as energy, construction, transport, spatial planning, tourism, etc), but all of which take a critical look at climate adaptation and mitigation measures. One report covers the topic of regional energy self-sufficiency—a promising strategy for dealing with both the climate and energy crises. The present article refers to this report. First, the concept of energy self-sufficiency will be introduced. Second, the most common arguments in favor of creating energy self-sufficient regions will be reviewed. Third, the lessons learned from the Alpine experience will be summarized, and, fourth, a political agenda—from a nongovernmental organization (NGO) point of view—will be presented (see also Abegg [2010] for further reading, including examples of good practices from the Alps). Regional energy self-sufficiency, however, is not restricted to the Alps. A decentralized energy supply would be an interesting option for many regions given the potential, particularly in mountainous regions, to produce energy from renewable sources (eg biomass, solar radiation, water, and wind).

The idea of energy self-sufficiency

The *Oxford English Dictionary* defines self-sufficient as "able to provide enough of a commodity (as food, oil) to supply one's own needs, without obtaining goods from elsewhere; self-reliant, self-supporting, independent" (www.oed.com). Applied to an energy region, this means that the region's entire energy demand is produced locally.

In the Alps, several terms such as "energy autonomy," "energy revolution," and "energy self-sufficiency" are used. These terms are not necessarily meant in a scientific sense; the regions use them to describe their activities and to distinguish themselves. They are the result of a political decision-making process, not academic discourse.

However, several problems may arise in connection with such terms. Relativizations such as "as far as possible" or "largely" indicate that, in some cases, it is only possible to speak of partial self-sufficiency. Sometimes entire sectors, such as transport, are taken out of the equation. The question also arises as to whether self-sufficiency is an absolute goal or a numbers game. Based purely on mathematics, self-

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sufficiency would be achieved if the deficits in one form of energy, such as vehicle fuel, were cancelled out by surpluses in another form of energy, such as electricity, or, if deficits at certain times, such as midday, were offset against surpluses at other times, produced by strong winds at night, for example. Absolute energy self-sufficiency does not allow for this type of offsetting (Hoppenbrock and Albrecht 2010).

Self-sufficient also means that energy is produced autonomously. This is about finance and ownership in the broadest sense—two extremely important aspects if the economic effects of an energy revolution are to be achieved in practice, including, for example, a reduction in capital flowing out of the region and an increase in value added (Hirschl et al 2010).

Often, the definitions also go beyond the actual meaning of self-sufficiency: "An energy self-sufficient region exploits as far as possible the potentials for saving energy and increasing energy efficiency and meets the remaining average annual energy requirement in purely mathematical terms from regional sources of renewable energy." This definition by Saxony's energy agency (www.saena.de) highlights one important point: Energy self-sufficiency is not possible without energy saving and an increase in energy efficiency. After all, energy that is not consumed does not need to be generated. Furthermore, payback on investment in these 2 areas is rapid, releasing capital for other activities, such as expanding renewable energies.

Energy self-sufficiency can be found on different scales. There are energy self-sufficient farms, towns, and counties. Even the possibility of entire countries being energy self-sufficient is conceivable. So what is the most suitable size of a unit for achieving the goal of self-sufficiency? According to Tischer et al (2009), it is important to find a workable compromise between the necessary geographical proximity to the local people and the level of resources required in order to be effective. This would point to the region as the optimal spatial unit.

The system boundaries, however, produce another "dilemma": Strictly speaking, energy self-sufficiency requires a closed system, whereas regions are open systems. Consequently, a region would have to be seen as an "island," which is the case in many initiatives. Therefore, "island" or stand-alone solutions are sought. This seems positively anachronistic, if we consider the way in which each region is interconnected with its surroundings or, in other words, does not live an "insular existence" at all.

As shown here, the imprecise use of complex terms raises questions. In a number of initiatives, it is not clear what is precisely behind the terms being used—other than the general thrust. More sharply defined and clearly delineated terms would be welcome in order to establish a sound basis for formulating goals and measures.

Opportunities

Apart from the potential to produce renewable energy, there are many good reasons for mountainous regions to promote energy self-sufficiency. Next, I present a summary and critical appraisal of the most important arguments (see also Scheer 2006; Droege 2009):

Protecting the climate and the environment

The production and consumption of fossil energies cause serious environmental pollution. Burning of fossil fuels is also responsible for most greenhouse gas emissions and therefore for climate change. Using energy more economically and efficiently and switching to renewable energy sources will help to protect the environment and the climate. In addition, most national climate and energy policies assume that the renewable share of energy production must be massively increased. Since the potential for generating renewable energy is not equally distributed across a country, a national target of, for example, 40% of renewable energy means that some regions have to go far beyond this level—in other words, they need to work toward the target of a 100% renewable energy supply.

Stable prices, guaranteed supply

Numerous publications, including the *World Energy Outlook* (IEA 2010), point to the problems of the existing energy supply. How long the fossil energy sources needed to meet the steep rise in global demand will last is a moot question. It is clear, however, that prices will continue to rise. Tapping the remaining reserves will require significant investment. In addition, many of these reserves are in regions of political crisis. The existing supply uncertainties and political dependencies they engender are therefore likely to become even worse in the future. If we are to guarantee a secure supply and "stable" prices in the future, there is no alternative to reducing energy consumption and switching to renewable sources.

Attractive locations, new jobs

Establishing an energy self-sufficient region has a positive effect on the regional labor market: Agriculture and forestry can benefit from increased use of regional raw material (biomass). Existing companies working in energy technology, heat insulation, and construction will develop new fields of activity. Additional jobs will be created in the energy production industry itself. Renewable sources of energy are seen as future technologies with promising growth prospects. Connected with this, there is the hope that innovative companies will locate in the regions. Furthermore, a supply of energy from renewable sources at attractive prices promising long-term stability could add to the attractiveness of the

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entire region for businesses, making it appealing to companies working in a broad range of fields.

Increase in regional value added

Most energy systems are based on centralized supply. The energy is generated from fossil or nuclear sources; there is an outflow of capital for energy imports, control is beyond the sphere of influence of regional actors, and regions become dependent on urban centers. More efficient use of energy and a decentralized supply based on renewable sources could eliminate these disadvantages: Money and decision-making power would remain in the region. Furthermore, this would trigger economic multiplier effects and endogenous development processes. These developments and the value chains associated with them would strengthen rural areas. In a best-case scenario, energy policy can become the core of economic stimulus and a driver of economic and social development.

Sustainable development

Tischer et al (2009) view renewable energies as a "stroke of good fortune" for sustainable regional development. The effects on jobs, income, and climate protection are cited as reasons for this view. Moreover, material cycles and values chains can be regionally linked in a sustainable way. The expansion of renewable energies increases the chances of rural areas being able to participate in technological and economic development. Their relative significance increases, and it is anticipated that rural areas and urban centers will be able to interact as equals. In brief, energy self-sufficiency is conducive to sustainable regional development.

Stronger identity

The establishment of an energy self-sufficient region can only take place if there is a broad consensus of opinion. All stakeholders (households, businesses, towns and villages, etc) must agree on a common vision and approach. Commitment to a common cause has a bonding effect and strengthens social networks. Furthermore, a region can present itself as progressive and environmentally conscious and possibly even assume the function of a pioneer or a role model. A positive internal view and an image as an innovative location promote both regional cohesion and people's identification with the region.

Challenges

The increase in regional value added is a central argument for establishing an energy self-sufficient region. The prospect of positive economic development attracts a great deal of support from the general public and politicians alike. A closer look, however, reveals that there is very little verifiable information available about the potential economic impact of energy regions. In many concepts, the effects on the labor market and value creation are framed in a simplified and exaggerated way. It is therefore important to specify the conditions required for the economic effects to materialize (Hoppenbrock and Albrecht 2010).

High expectations, for example, will only be fulfilled if the potential of renewable energies is actually fully exploited (ie through full-scale expansion). A further requirement is that the renewable energy must be cheaper than imported fossil energy; this is definitely conceivable in the medium term. In addition, regional funding must be found that involves regional investors, community joint venture enterprises and the commitment of regional banks. Finally, it is important to move value chains into the region. Here, 3 levels of intensity can be distinguished:

1. Pure application of technology (eg installation of solar cells);
2. Exploitation of potentials such as above-average solar irradiation in mountain areas; and
3. Industrial production (eg development, production and sales/export of solar cells).

Whereas applications and exploitation of potentials are relatively simple, the step forward into production presents a major challenge. It is easier, for example, in the field of sustainable and energy-efficient construction, where use of regional building materials and heat sources (wood and timber) can constitute a very significant share of the value added to the region.

A certain degree of caution in assessing the potential effects on the labor market is therefore appropriate. In many areas, such as agriculture and forestry, but also the electrical trade and the building industry, it is primarily a question of safeguarding existing jobs. People may be given new job descriptions (eg a farmer may produce energy rather than agricultural goods), but additional jobs will not necessarily be created. New jobs will be available in the renewable energy production industry itself, but operation and maintenance of most facilities are not labor-intensive. New companies and research facilities would be of real interest, but flagship examples such as the Güssing model (were 1100 new jobs were created) are not easy to copy or replicate (Koch 2006).

If production of renewable energy is expanded, it is crucial that nature and landscape do not fall by the wayside. Ongoing discussions in the Alps (and elsewhere) show that 4 areas are particularly fraught with conflict:

1. Construction of large stand-alone installations, such as solar and wind power stations;
2. Further expansion of hydropower, which clashes with the wish to protect the last remaining natural bodies of flowing water;
3. Possible competition for land between the production of energy crops and food; and
4. Overuse of forestry resources from nonsustainable management

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practices and when "wood for energy" is grown in monocultures.

These problems can be defused to some extent by focusing very clearly on energy efficiency and energy saving. Every kilowatt hour that is not consumed does not need to be produced and consequently does not cause a conflict of aims around its production. Furthermore, biomass-fueled combined heat and power stations, for example, must be designed in a way that avoids unnecessary haulage and ensures that capacities can be fully utilized based on local and regional resources. This point, again, refers to the "system boundaries": Choosing too small a scale with small units can mean that inefficient measures are promoted and that installations such as wind farms are built, which could be operated more economically elsewhere. All this speaks in favor of concentrating on the most suitable locations, of cooperation between different regions, and of reconciling the interests of energy and environmental protection goals.

Lessons learnt from the Alpine experience

The achievements of the pioneers in the field of energy self-sufficiency to date are impressive. The successes are based on the perseverance with which the many different actors have pursued a common vision, and on a will to achieve an across-the-board conversion of the energy supply. They have proven that energy self-sufficient regions are not just a pipe dream, but a worthwhile alternative.

The strategy of responding to climate change and energy crisis by designing a proactive and target group-oriented resource and energy policy at regional level is extremely welcome—first, because it is an example of people accepting responsibility for the future. Second, creating an energy self-sufficient region can provide an important stimulus for the regional economy. This is particularly true in rural and structurally weak areas, where resources lie idle, and there is a lack of economic alternatives.

Regional economy, energy policy, and climate protection constitute a convincing combination of motives for taking action and encouraging the desired transformation. The regional value-added argument can be used to draw together the interests of all stakeholders. Energy self-sufficiency goes way beyond renewable sources of energy, energy saving, and efficiency programs. It also involves sustainable agriculture, energy-efficient building, climate-friendly transport, and much more. Ultimately, it is nothing short of a wholesale structural change: conversion of an entire region to sustainability.

A convincing vision will be required to achieve this task. It will also require clearly defined concepts. In many regions, the concepts are based on the principle of the "journey is the goal." While initially this may be perfectly adequate as a broadly defined goal, it must be made more precise and specific as the energy self-sufficiency process progresses. This is the only way to formulate effective goals and communicate realistic expectations.

A great deal of economic potential lies untapped in energy self-sufficient regions. It is crucial that this potential be fully exploited. However, a concept in itself is no guarantee of development and prosperity. The potential effects on the regional economy must be analyzed. Simplistic assumptions and overoptimistic projections are inadvisable. Justified hopes (and not exaggerated expectations) drive the process.

The stated motivation of most energy self-sufficient initiatives is sustainability. However, when it comes to implementation—as is always the case in politics and business—it is economic considerations that prevail, with ecological aspects often tending to be relegated to second place. This problem becomes particularly obvious when specific energy projects are about to be implemented, and—as happens quite frequently—conflicts of aims between energy policy and nature protection emerge. However, an energy self-sufficient region can only be classified as genuinely sustainable if it also integrates the interests of nature and landscape conservation.

Often, priority is given to the technical aspects of the energy self-sufficiency process. However, the social changes that go with energy self-sufficiency are equally, if not more, important. Ultimately, people must be decisive to ensure the success or failure of a project. This statement, which may on first glance seem rather banal, is of particular interest here, because we are talking about a radical structural and social change that can only be achieved with, and not in opposition to, the key stakeholders. This accords great importance to the social aspects—from an analysis of stakeholders to design of the processes of change and awareness building and communication (Neges and Schauer 2007; Tischer et al 2009; Kucharczak and Schäfer 2010).

There are now whole series of Alpine regions that are on the way to becoming energy self-sufficient. The basic thrust of their endeavors is comparable, but there are key differences with regard to their objectives, organizational forms, and level of resourcing. Having said this, it is important to take the different scales of the enterprises into account: It makes a difference whether it is a single municipality seeking to move toward energy self-sufficiency, or a cooperative venture between town and state or a large regional association.

The uneven distribution across the Alpine arc is also striking. In the German-speaking part (Austria, Bavaria, Switzerland, and South Tyrol), the concept of regional energy self-sufficiency is relatively well known. This is also where the most successful and advanced examples can

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be found; for example, the province of Vorarlberg, Austria (Amt der Vorarlberger Landesregierung 2010), Goms in Valais, Switzerland (Ernst Basler + Partner 2009), and the city of Bolzano in South Tyrol, Italy (Sparber et al 2010). Increased interest can be observed in the other regions, but to date only a handful of practical examples have progressed beyond the initial stage. We can only speculate about the reasons for this uneven distribution. On the one hand, it may be due to the different starting points and the speed of progress in terms of energy and climate policy, and, on the other hand, it may be due to the different national funding practices. The right enabling environment can trigger a very dynamic development, as the example of Austria illustrates (Österreichische Energieagentur 2011).

Political agenda

Based on the lessons learned, the International Commission for the Protection of the Alps (CIPRA) defined political requirements to further advance the energy self-sufficiency process in the European Alps. The long-term goal is the energy self-sufficiency of the entire Alpine arc—to the benefit of the Alpine economies, societies, and environments.

1. The Alps must become energy self-sufficient. There are examples that illustrate that this aim can be achieved regionally by 2050. It is crucial for all political levels to work toward this goal.
2. The vision of energy self-sufficiency is all-embracing. It includes not only opting for renewable sources of energy, but also efficient, economical, and innovative use of energy. Spatial planning and transport are core elements of this vision.
3. Financial support must be available. A boost from government funds is very helpful to get the self-sufficiency process started. Existing funding schemes must be adjusted to support this transformation.
4. An effort needs to be made to get everyone on board. A regional reorganization of this scale requires good governance: The general public and all key interest groups must be involved in the decision-making and implementation processes.
5. Interests of nature must be taken into account. Renewable energy is important and creates jobs, but energy self-sufficiency must not be misused as a pretext for building facilities that spoil Alpine nature and landscape.
6. Energy self-sufficiency research should be conducted. There is a lack of empirical data and scientific studies. The process must be accompanied by national and transnational research to ensure that implementation is constantly improved.

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