10 ASSESSING THE IMPACTS OF POTENTIAL INVESTMENTS IN RENEWABLES AND ENERGY EFFICIENCY

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This chapter is aiming to provide an overview about the impact that should be taken into consideration while policy makers or decision-makers are planning to increase the share of renewable energy use and energy efficiency. In this chapter – besides the new analysis – we are revisiting and evaluating the work that has been done in Pelin et al. (eds. 2014).

What we are aiming here is not a method or a tool to assess the potential impact of renewable energy use and energy efficiency but to give the reader a framework to further thinking what can be important in a rural, sometimes depressed area.

10.1 Theoretical frame for a sustainability assessment

As Gibson (2013) pointed out, the reason of sustainability assessment is quite obvious: what we are doing on Earth is wrecking the place (Gibson, 2013:3). Certainly, a sustainable assessment should not only take into consideration the negative effect but has to take on board the positive ones as well.

In his work, Gibson (2013) defined eight requirements for progress towards sustainability (Table 10.1) that can be a theoretical framework for sustainability assessment.

Table 10.1: Eight requirements for progress towards sustainability

Requirement	***Description***
Socio-ecological system integrity	Build human-ecological relations that establish and maintain the long-term integrity of socio-biophysical systems and protect the irreplaceable life support functions upon which human as well as ecological wellbeing depends.
Livelihood sufficiency and opportunity	Ensure that everyone and every community has enough for a decent life and opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity

Intragenerational equity	Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor.
Intergenerational equity	Favour present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.
Resource maintenance and efficiency	Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.
Socio-ecological civility and democratic governance	Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision-making bodies to apply sustainability principles through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary, collective and personal decision-making practices.
Precaution and adaptation	Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise and manage for adaption.
Immediate and long-term integration	Attempt to meet requirements for sustainability together as a set of interdependent parts, seeking mutually supportive benefits.

Source: Gibson et al. 2005: ch.5 in Gibson 2013: p.8.

In his cited work – besides referring (in its second requirement) to the classic sustainability definition provided by the Brundtland Committee (WCED 1987) – Gibson (2013) is focusing on the society (or sometimes socio-ecological system) as a core element of his theory. Taking into consideration the above mentioned framework in the forthcoming part we use the classical 3E (Equity, Economy, Environment) classification to take into consideration the different elements of the above mentioned principles of sustainability.

10.2 Social impacts

If social impacts of development projects are ignored (including positive and negative effects of a RES investment) the economic advantages often accrue only to a limited group of stakeholders leaving the wider impacts to be resolved by others (Balkau et

al. 2017). Therefore, when considering the impacts of renewable energy utilization, it becomes inevitable to also pay substantive attention to the assessment of its wider social impacts, even if it is positive or negative. More particularly, it is essential to examine investments in renewable or solar energy, to assess how their communication affects a given social group and in what ways such communication affects renewable/solar energy-related decisions made by that given group. (Social framework conditions for solar energy investments have been delineated in an earlier piece of work entitled "Napenergia és környezet" (Varjú (ed.) 2014"), i.e., Solar Energy and Environment.)

Transitioning to a low carbon energy system will require action at multiple levels (Britton 2018). As has been formulated by Csizmadia (2008), "The existence, lack, number, composition, applicability and value of social relationships exert a fundamental influence on the every-day life of an individual or that of a community" (Csizmadia 2008, p.27), by which these factors have important implications for the spread of environmentally conscious patterns including also the advance of renewable/solar energy investments (in addition to the economic and other framework conditions (Varjú (ed.) 2014). Consequently, where there are intense social relationships (e.g. typically the interaction between small groups or between small communities), solar energy investments by individual actors more significantly affect other actors' decisions.

Britton (2018) argued that the importance of municipalities in the energy sector may in fact be increasing rather than waning (Britton 2018: p.378). In the RURES project we explored motivations in our empirical investigations into the relationship among municipalities, local governments. Here what we would like to know is how individual organizations influence each other through the dissemination and exchange of their good practices. The main trait of the aforementioned relationships is its ad hoc nature. In case any news comes into the possession of local governments, they may decide to make inquiries about it, local governments in charge of implementation provide information but here active/relationship networking effects, which are present in the above referred business sphere, cannot be identified.

Local governments have a relatively significant effect on inhabitants. The development of a settlement is highly dependent on the personal competence of decision-makers, settlement leaders or on the interest-based network of local actors. "In relatively large settlements, there is always a complex organizational base present in the background of personal dominant influence." "The smaller a village is, the more dependent its success is on a given local government, on the capabilities of the mayor and his/her ambitions." "The lower the level of development, the more decisive the role of the individual is." (Varjú, 2014).

We thought the rural dwellers – or who work there or who have daily interaction – are able to speak about the main problems and the development possibilities of the

villages. The important local player (i.e. mayor) can determine the organization of rural population/rural society, whose attitude, qualification, decision and aspiration can influence the dweller's opinion (Ragadics 2010). For small villages the role and responsibility of the decision-makers is really important. The main characteristics of the rural society – especially in Baranya county – are the pessimism, the lack of motivation, the feeling of vulnerability and the self-care skills degradation (Bognár-Csizmady 2005). The population of the villages voted for the mayor, so we think s/he/ has the main local prestige, legitimacy.

One of the examples of a good practice where a local government took initiative about investments in renewable energy sources is Güssing town in Austria. According to (Tajmel, 2018) the district of Güssing was the poorest district in Austria with the following problems: small structured agriculture, bad traffic infrastructure, 45 years alongside the iron curtain, no industry, high rate of unemployment, 70% commuters and high rate of migration. To solve these problems, the following strategies were adapted: measures for increase of energy efficiency, energy generation from local renewable energy sources (biomass, solar energy), foundation of *Europäisches Zentrum für Erneuerbare Energie Güssing (EEE – European Centre for Renewable Energy Gussing) and foundation of Centre of technology.* The main idea of the previously mentioned strategies is a decentralized local energy production with the existing renewable resources of a region. *"The goal is to get independent from fossil energy in order to strengthen the regional added value! This strategy can be adapted individually wherever resources are available"* (Tajmel, 2018).

Since 1990 they started with the measures for increase of energy efficiency and beginning with production of heat out of biomass. From 2001 generation of the electricity from biomass and solar energy has been started. Beginning of the research and projects and foundation of new research institute started in 2008. Another good example is a district heating system of Güssing which started in 1996 and continuously develops heating grid (more than 35 km). Local inhabitants supply this system with their own biomass and part of the heating bill can be paid in biomass.

According to (Tajmel, 2018), in 2010 in Güssing total demand for the heating energy was 60 GWh, for electricity 50.2 GWh and for fuels 29 GWh, respectively. Total production in 2011 from local based renewable energy sources (4 biomass-district heating plants & 3 CHPs) was 72 GWh of heating energy which is 120 % of total demand in 2010. Production of electricity from local based renewable energy sources (3 CHPs and PV systems) was 100 GWh which is 200 % of total demand in 2010. In addition, in 2011 8.4 GWh of synthetic natural gas was produced which was 29 % of the total demand for fuels in 2010.

Summing up the above mentioned and using Pálvölgyi and colleagues' (2014) work, going through the set of criteria established by them (Pálvölgyi et al. 2014

p.191), based on our previous experience of and research into photovoltaic energy, we can assess the social impacts as follows:

Table: 10.2. Potential effects of PV use on the society

Designation of social indicator	Expected effect
Human health	Minimal effects (see detailed in life-cycle analysis)
Quality of life	Due to the sense of independence for the supply system, no or minimal effect
Education, qualification, knowledge	Positive effect, involvement of students into research tasks for the purpose of disseminating results
Public awareness, approach, presenting good examples	Positive
Mitigation of social disparities	Negative impact: Access to PV systems is possible mainly for wealthy people and savings resulting from the use of such systems also contribute to their cost-benefits, thus creating possibility for a further increase in social disparities
Enhancement of co-operation between social actors, strengthening cohesion	Positive impact: see e.g. outputs of current IPA
Prevention of migration (job creation)	Exerting no impact: job-creation effect of PV systems does not appear in a given region (see detailed in the chapter about regional impacts)
Energy poverty alleviation	Positive impact: renewable energy not exploited as yet becomes incorporated in the energy system

Source: Own edition based on indicators by Pálvölgyi et.al. (2014)

As in Pálvölgyi and colleagues' work can be seen, renewable energy has a positive effect on quality of life. Bailis (2011) further argued that energy plays a role in facilitating individual and collective well-being. The simple argumentation is that particular forms of energy are required for economic activity, and that such activity contributes to wealth (Bailis 2011). Continuing this perspective, those tools that can be used independently, especially making energy from renewable (and easily available) resources can especially help in poor rural areas. Such a tool can be a mobile phone charger using PV cells to create energy for charging (Figure 10.1).

Figure 10.1. Mobile phone charger with PV cells – promotional material for the project
Source: Photo made by the authors

The EU wants to promote the Smart Village scheme to provide resources for localities that do not have access, or have limited access, to infrastructure support.

The Smart Village programme aims to improve the quality of life of out-of-town settlements, mainly in the areas of the economy, education, energy management, digitization, mobility and health care, by promoting a high tech and social environment.

It is true that the smart village concept and practical examples have only one element in intensifying the use of renewable energy sources and turning to smart solutions in order to increase energy efficiency, but in the smart village programme the smart energy solutions take the biggest element. We think that the smart village programme's solutions can be very interesting for the RuRES project too, some useful solutions can be applicable, adaptable in the RuRES area.

The main question of energy management in the future is the way how we get to sustainability. There are two ways. Traditional solutions (low tech) and high tech approaches. There are several examples that show us that the technological solutions in themselves are not always useful, as they cannot be ignored by the human factor as well. See for example, the "Jevons paradox": the use of technical solutions does not occur with the expected degree of environmental impact reduction.

The concept of the smart village can be successful only if that the attitudes, and knowledge of the society develops considerably. This requires different programmes like RuRES.

10.3 Environmental impacts

The design of a power plant – regardless whether its resource is renewable or not – requires special emphasis to be placed on specific factors, such as the selection of the appropriate land used for the construction, the assessment of environmental impacts, e.g. landscape effects, visibility in terms of the local landscape and natural heritage, furthermore it becomes necessary to ensure that the local community can formulate its views on the installation of the intended power plant (Hartung 2014).

For property protection purposes a fence is installed around the boundary of the plot of land, which also has an impact on the environment, consequently attention should be paid to the height and tightness of the fence. Application of bright colours is unfeasible. In the connection to the network it is reasonable to take into account the visibility of high-voltage power lines and that of high-voltage poles (Hartung 2014).

In fact, there is evidence that the growth rate of atmospheric carbon dioxide is equal to the growth rate related to the burning and use of fossil fuels, which has reached high levels ever since industrialization. Due to the large-scale rainforest deforestation started in 1970, atmospheric carbon dioxide concentration continues to rise to a great extent (Canadell et al., 2007, Le Quéré et al., 2009). In the use of renewable energy, minimal or no carbon dioxide emissions can be expected. The widespread use of these technologies may mitigate escalation tendencies in carbon emissions (Hartung 2014).

10.4 Economic impact

No matter whether they supply households and/or business undertakings with energy complementary in nature or, by being in possession of business firms, they produce energy for sale, renewable energy systems (RES) are seen as important local energy sources and as such they can exert positive impact on the development of a specific region. Deployment of such systems and/or RES investments can take place in urban regions alongside motorways and in underdeveloped, peripheral rural regions.

Although the commissioning of such systems also in urban regions (and in developed rural regions or in areas having the potential to develop) can be justified, in certain aspects, innovative developments in economically backward rural areas have relatively higher marginal utility. In resource-deficient rural regions, any (sustainable) developments, with special regard to investments of innovative nature, are of utmost

significance, even though their job-creation capabilities are negligible. On the basis of urbanity and rurality, no difference can be revealed with regard to the currently available amounts of alternative energy including that of solar energy. Rural development must focus on the development of self-sufficiency in rural regions, an essential component of which is to accentuate the role of alternative energy production. There is a strong correlation between rural development and decentralized energy production. Decentralized energy production implies the use of local raw materials, local labour force and local investments and according to many, building a (green) country starts with villages.

In terms of energy utilization efficiency, the worst situation is to be found particularly in rural regions. It is an issue of great importance to supersede the approach to thinking solely in the context of large-scale supply systems. Instead, it is essential to create balance between small-scale power plants and large-scale supply systems. One aspect of the above balance is represented by the commissioning of RES, i.e. the emergence of local power stations in rural areas. Energy rationalization, while safeguarding environmental sustainability, also ensures sustainable economic development, therefore RES can certainly be regarded as developments congruent with community interests.

An outstandingly important aspect to be taken into account in relation with rural developments is to ensure that the deployment of RES should not result in land-use restrictions. In this context, a favourable situation is created by the fact that photovoltaic energy production can be combined with several other production methods (soil strength reinforcement, recultivation, pasturing, apiculture, viticulture, horticulture, etc.). The demand for land brought into use by investments may as well reach high levels but owing to the aforementioned particularity, such high demand does not pose any barriers to investments and in view of the rapid pace of innovations, the future is likely to see a significant decrease in specific land-use demand. It may be important to place special emphasis on the conscious design of RES sites where secondary land-use is also taken into account.

A solar RES established in a region is likely to offer opportunities to local businesses: an innovative environment may promote developments, ideally, synergy effects and positive externalities occur, entrepreneurial mindsets and entrepreneurial culture may develop in the neighbourhood of a successful and innovative business undertaking, and by all this, it indirectly creates potential for labour market recovery.

In parallel with opportunities, there are a number of problems to work on. Economic sustainability of local governments seems to be unstable, while at the same time settlements pay particular attention to local economic development (Mezei, 2008). Elements of sustainability do not carry equal weight in the task-orientation concepts of local governments. In the context of regional development, energy production-related

projects may typically become successful if they are viewed as elements constituting a part of a well-designed complex system of development and if no short-term high returns are expected. In view of the technology-intensity of innovative industries, also RES usually require only a low level of labour force participation while at the same time both the local governments and the national government's development policy often gives preference to the support produced by major employers.

The spread of renewable energy sources, including also the expansion of RES, depends predominantly on the changes in the pattern of fossil fuel energy markets, therefore, the success of a RES site and its impact on a region pose serious external risks in the short to medium-term.

Another issue of concern is that members of local communities do not seem to be ready for the adaption of alternative and innovative solutions, thus, not only the shaping of public perception of RES but also the development of assistance schemes may become necessary. After the use of energy generated by RES has become common among local governments, entrepreneurs and local residents, at the time of constructions, business undertakings engaged in the execution of the relevant work processes will see a temporary upswing. Another problem is that the aforementioned businesses are not necessarily (typically not) local undertakings either.