Table: 20: 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 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 we can see the potential social impacts in the Table 20, it is various. We can find factors where PV use has not or negative influence on the society, especially in the mitigation of social inequality, however it can positively effect on cooperation. In a widely social sense the use of PV combining a good cooperation among actors can become a good-examples, effecting on the settlement marketing.

EN_11. EFFECTS OF PHOTOVOLTAIC SYSTEMS ON REGION – RURAL DEVELOPMENT PERSPECTIVE

No matter whether they supply households and/or business undertakings with energy complementary in nature or, by being in possession of business firms (PV farms), they produce energy for sale, photovoltaic systems 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 PV farm investments can take place in urban regions (in the form of investments in brown-field developments in degrading industrial regions and in the area of opencast mines but also in industrial parks located in developing agglomerates or in the form of green-field investments) 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 PV systems, i.e. the emergence of local power stations in rural areas. Energy rationalization, while safeguarding environmental sustainability, also ensures sustainable economic development, therefore PV systems 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 PV systems 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, vine-culture, 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 PV parks where secondary land-use is also taken into account. A concrete example of this is the Sellyei Solar Power Plant where PV panels of a sunflower design have been located high enough for agricultural machines to pass under them. In their exploratory investigation into the possibilities of secondary land-use, they decided on pasturing (pasturing sheep).

The local social-economic benefits of the installation and spread of solar PV systems are generated, on the one hand, from economic processes giving rise to the relevant projects and from the capability of such processes to justify the existence of these projects and, on the other hand, the above benefits may be created by social needs (if there any at all). These systems exert their effects typically through the diversification of a specific region's economic activity while they can also enhance its prestige and offer further opportunities, such as:

- the emergence of renewable energy production locally, its development,
- partial or total replacement of local energy sources (energy consumption of business enterprises and residential energy consumption) with renewable energy,
- effective communication avenues to reach out to a given region's environmental consciousness and commitment to sustainability,
- involvement of local entrepreneurs in community developments based on local energy production,
- possibilities of setting up exhibition sites for events dedicated to renewable energy sources,
- modernization of energy utilization in a region, strengthening self-sufficiency,

- contribution to the demonstration of environmental education in a specific region and enhancing the efficiency of such education.

A solar PV system 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. The Sellye case sets an example for these processes, where the national news coverage of the solar power plant commissioned in the industrial park conveyed the message that fostering developments in the Ormánság is certainly worth the effort. As a consequence, a new company has been set up in the Sellye industrial park, which, even if at a low rate, has created job opportunities and generated tax revenues for the local government.

Local residents may need to consider providing support to solar energy utilization/production by offering special funds for this purpose. As a result, they could realize additional income (or more money is left in their pocket), which, in turn, will boost the region's internal demand. By the promotion of the local multiplication of the aforementioned case (equipped with a complex system of development tools), the revenue remaining with the region may increase. In this respect, small-scale, decentralized electricity production deserves special attention or, perhaps special assistance. Support may take the form of preferential rates made available by a PV farm to local business undertakings, local governments and to residents (thus, local energy producer's local market conditions improve). Due to the solar investment assistance provided by residents and by the local government, sales conditions of the local energy farm deteriorate, however, the appearance of solar PV cells becomes more accentuated, commitment to alternative energy sources gains broader perspective and market opportunities for solar PV cell producers/distributors become more enhanced. This is the reason why endeavours to develop a regional PV park should also incorporate the creation of related production capacitates as well as the establishment of small-scale electricity generating plants and/or electricity production plants. However, the aforementioned endeavours cannot possibly stand a realistic chance in the worldwide solar cell production trends.

Introduction to best-practices in solar PV parks may significantly enhance their spread and social acceptance and encourage both investors and governments providing space for installation to carry out partly similar developments. Unpredictable energy policy poses an increasingly serious obstacle to the expansion of photovoltaic parks in spite of all the positive examples of such developments throughout Europe.

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 solar PV systems require only a low level of labour force participation while at the same time both the local governments and the

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 photovoltaic systems, depends predominantly on the changes in the pattern of fossil fuel energy markets, therefore, the success of a PV park and its impact on a region pose serious external risks in the short to medium-term. The success of investments, their financial returns and regional benefits are difficult to convert into HUF while such developments can undoubtedly be listed among the break-through points for peripheral regions. It is primarily the indirect economic influence of projects that may carry great significance.

Successfully operating systems are capable of changing a region's energy consumption patterns and trends, furthermore, they may serve as models for neighbouring communities and regions.[30]

Another issue of concern is that members of local communities do not seem to be ready for the adoption of alternative and innovative solutions, thus, it is not only the shaping of public perception of PV systems but also the development of assistance schemes may become necessary. After the use of energy generated by PV systems 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.

The SWOT analysis below describes a collection of the most important factors which are considered relevant with regard to the impacts of PV systems on micro-regions.

[30] In one of the rural regions of France, a project has got the name "village-power plant", where the basis of energy production is formed by a PV system. An important element of the project is represented by the residents' active participation in it. They have recognized that the basis for economic development is formed by the expansion of renewable energy sources including also photovoltaic systems.

SWOT Analysis of Impacts Exerted by PV systems on Micro-Regions

Strengths • Multi-actor development, positive contribution by the majority of potential actors • The presence of innovative economic actor in the region, potential spin-off • Company mobilizing the capacities of R&D possesses broad relationship network. landscape (positive) • Future can be based only on local, small-scale, autonomous energy production and supply solutions as well as on renewable energy sources and energy-saving lifestyle. • The prerequisite for the long-term sustainable operation of rural local governments is represented by the use (exploration) of innovative solutions. • Cheaper local energy (savings on electricity bills).	**Opportunities** • Supply capacity development • Developments at local level, innovation incubation • Strengthening interest-articulation capabilities • Dynamically developing sector (Innovations happen at a fast pace.) • Favourable market opportunities provide development for businesses, which can exert positive influence on regions in a multiplicative manner. • Deployment of joint – usage generator plants in regions • Objectives of EU development policy • (Transitional) Development of the special segments of local construction industry • Diversification of the training structure in the broader region. • Creating the foundations of energy industry and that of broader regional vision • Setting up alternative-energy exhibition sites in the sector
Weaknesses • In fact, no plants or business undertakings, including potential suppliers, which are capable of joining the value chain, are present in the region. • Both international and domestic visibility is at a low level. • Cooperation and competition are weak. • R&D space and capacity are insufficient. • Impact on landscape (negative). • Covered market, nobody but suppliers operate in the region (spare part production). • Pending solution to energy storage • Barriers to E-on network connection.	**Threats** • Energy policy uncertainty • The power of European and Asian competitors may question the long-term success of regional developments. • There is no substantive receptiveness, which may be caused by insufficient income prevalent in regions or which may be attributed to lack of information and also to improper attitude to innovations. • Dynamically developing sector (Innovations happen at a fast pace) – very intensive price competition (small chance of acquiring competitive advantage).

EN_12. ENVIRONMENTAL IMPACTS

The aim of the present chapter is to provide a brief review of the potential environmental impacts of PV system applications. In this chapter, within the framework of environmental impacts and environmental protection effects, we consider the issues relating to land use, the effects exerted on building structures, furthermore, we take into account the implications of visual pollution on the environment, the reduction of carbon-dioxide emissions and also address the issue of photovoltaic materials and their integration into the waste chain.