that solar PV parks generally see their return within their 25-year useful life, which is also true for thermal water utilization. As for Bóly, we can calculate on a 40-year life-cycle and in the 11th year the power plant will be capable of generating a significant revenue.

Dombi (et al. 2012) investigated the sustainability of projects relying on renewable energy sources. In their model they considered air pollution-related values, land use requirements, the positive impacts of job vacancies and those of local income-generating capacity. They analyzed solar energy utilization for six different types of technologies, in the categories of solar modules, large-scale PV system, mirror and focusing technology; PV module for the supply of institutions; green-field solar installation and solar collectors. Land requirement by solar projects is 0.01 – 1.29 ha/GWh while values for carbon-dioxide emission range between 252.9 – 2857.2 t/GWh depending on the type of system applied. In the rank order of relevant technologies depicted by the study, projects targeting solar energy utilization are given great prominence: ranked in the 3rd, 7th, (and 11th, 16th, 20th,) places from among the 23 technologies analysed.

The most favourable sustainability value was ascribed to the Greenfield solar system (of 2200 modules): 0.241, which means a capacity of 0.5 MW and 0.62 MWh of generated energy at investment costs amounting to 330 million HUF.

The above investigations confirm the statements by Németh (2012) who points out that arenas for competition are constituted not only by the rivalry between the types of fossil and renewable energy utilization but also by the solutions to utilizing individual renewable energy sources (such as pellet burning, contemporary-style wood heating, heat pumps, solar-impulse landing gear - solar panels, wind generators and wind power plants etc.). Choice from among the alternatives and decisions made by consumers or investors are influenced by several factors relating to specific solutions: the measure of incidentally necessary investment, the trends in annual costs incurred, level of convenience associated with devices and availability of support schemes. In addition to all the above, investments are affected by several other factors which cannot be or can hardly be quantified.

In his study, Németh (2011) draws attention to the fact that for the purpose of managing resources more efficiently and in an economically more feasible manner, it is reasonable to adopt a complex systems approach to energy investments or carry out their implementation (preferably) in a number stages. The issue of energy saving implies a number of steps to be taken towards observing some factors, such as free arrangements, attention to the close environment (e.g. attention to the reasonable use of light sources, decreasing heating temperature by some degrees without causing any change in the sense of comfort, attention to reasonably reducing the number of events for opening windows). On grounds of expedience, energy efficiency measures are expected to precede modernization of installation technology. PV installation used as a replacement for the electricity supply of individual constructions is feasible to be combined with internal lighting upgrades as, in this way, the electricity requirement of certain constructions - in line with the necessary solar capacity requirement -may considerably become modified.

EN_13.2 Summary of social conditions

Preference for renewable energy sources is important not only because of the growing demand for energy but also because, according to the total life-cycle analysis of energy-producing installations, the environmental burden of the burning of fossil fuels is much heavier (air

pollution, acid rain, thereby indirectly causing the pollution of waters, high levels of carbon-dioxide emission, which lead to the increase of green-house effects and to global warming) than that posed by renewable energy sources.

The previously mentioned region is in a historically peripheral situation on both sides of the border and characterized by weak economic performance. Geopolitical events taking place in the 20th century did not create ideal conditions for the socio-economic growth of the region. Similarly, per capita GDP values also reflect the disadvantaged situation of the investigated region. According to the data provided by national statistical institutes, in these areas the ratio of GDP per capita relative to the national average is 73% in Croatia while in Hungary it is 71% (2011) (Varjú et al. 2013, KSH 2011, DZS 2011).

The Hungarian side of the region includes small village-type communities and the patterns in population distribution are uneven. The settlements are characterized by ageing demographic structures, population decreases dramatically and the level of education also shows a downward tendency (as a result of migration) thus diminishing adaptive capabilities. The high proportion of the Roma population, their distinct life-style and culture, high rates of unemployment, furthermore, gradually disappearing casual work opportunities all contribute to creating an even more vulnerable and disadvantaged situation in the region (Hajdú 2003, Virág 2010). The impacts of the EU 2007-2013 programming period is hardly measurable, the great majority of EU subsidies are concentrated in urban regions, and moreover, the ratio and the total volume of per capita subsidies at national level are among the lowest in Europe (Finta 2013). Similarly, towns play a more important role also in Croatia. In this region a major problem lies in the migration of (chiefly) young population.

With regard to environmental policy and the efficient utilization of renewable energy, a necessary but not sufficient condition is constituted by the existence of regulatory and legal framework. Efficient environmental policy requires a decision-making mechanism which may be framed in terms of a suitable system of methods and procedures, an extensive pool of knowledge, and mutual consultation. The facts concerning occasional delays in strategic planning, the unpredictable nature of opportunities opened for the submission of project applications and uncertainties about how long such opportunities are kept open or delayed approval of production permits indicate that in Hungary, for the past few years no real improvements have been made either in the field of environmental policy planning or in renewable energy planning (Varjú 2013).

It is a statement of fundamental fact that the development of a settlement substantially depends on the personal competence of decision-makers, settlement leaders and that of the actors present in social networks. “In relatively large settlements, there is always a complex organizational base present in the background of personal dominant influence.” (Pálné Kovács, 2008, p.93). “The smaller a village, the more dependent its success is on the local government, the capabilities of the mayor and his/her ambitions.” (Faludi, 1995, p. 380). The lower the level of development, the more decisive the role of the individual is. Consequently, from an environmental policy point of view, taking active and effective actions is regarded as an unavoidable responsibility to be assumed by local actors.

Within the framework of the research project we conducted interviews with settlement leaders for a study about settlements where investments into renewable energy took place. The interview questions were aimed at eliciting answers that reflected the types of motivation promoting these investments. The mayors of the investigated settlements are considered to have been key actors in municipal renewable energy investments since they succeeded in

getting municipal board representatives to accept the new trend. However, it can also be noted that decisions were guided by economic rationale and only little, if any consideration was given to the issue of environmental protection in decision-making which was based on merely competencies and the opinion of specific individuals. At a later stage, environmental issues were used as marketing tools. Nevertheless, we do not think that this a reprehensible approach since, in addition to economic rationale, also the factor related to the awareness-raising and educating function of environmental promotion manifesting itself in the form of a spin-off effect can be utilized.

The research has made it apparent that, in the majority of cases, investments are of an incidental nature and settlements have no renewable energy strategic plans which could provide the basis both for such investments moving towards renewable energy utilization and increasing the rate of energy efficiency. According to the interviewees, transparency level in terms of renewable energy is low while the institutional system seems to be rather politicized on both sides. There is only limited presence of objectivity and expert knowledge, which leaves a lot to be desired in this area. The public survey also concluded that factors underlying motivations to use renewable energy have their basis in conventions (especially on the Hungarian side) and in economic considerations. In the region the level of environmental awareness is lower than the EU or national average. Local photovoltaic investments hardly influence renewable energy utilization of a given community, for the time being such investments have no measurable impact on the population's environmental awareness. Public survey highlighted the socio-economic differences between the two settlements investigated. By relying on tourism (eco-type tourism) and on diversified industrial activities, Orahovica is capable of paying more attention to renewable energy investments and its population has started to move towards the development of small-scale solar power plants for home use, as a contrast, Sellye, a more disadvantaged settlement in the region of Ormánság, can be characterized rather by the use of conventional energy resources. However, it should be noted that in Hungary small-scale solar energy production for households is potentially more advantageous than conventional power generation.

EN_13.3. Module comparison based on standard test conditions (STC) and PVGIS

Table 23 presents the comparison of technical characteristics of modules at standard test conditions (STC) by which, as explained in chapter 3.2.3. sun radiation intensity of G=1000 W/m^2, with temperature on the cell surface of 25^{o}C is assumed. Manufacturers technical characteristics has described in chapter 5 has been used as well as the estimation of annual electricity production from photovoltaic (PV) systems with different technologies according to PVGIS which were used also in related techno-economical cost-benefit calculation whose specific investments and profit per kW of installed power were determined from calculations in the model described in a chapter 9 and represented in table 24.