EN_12.1. Potential impacts on land use

PV system installations can basically be divided into two major types. These are the ground-mounted systems and those mounted on roof structures. Static loading effects of roof-mounted systems are covered in the next chapter and subsequently the issues of visual impacts are discussed. In the present section we intend to present the locations offering opportunity for the installation of solar photovoltaic systems, furthermore, we also assess the nature of their potential future effects and the extent of territorial impacts exerted by these systems.

Based on the land cover dataset of CORINE 2006 available free of charge, for a start we selected land cover types which could be considered with a view to photovoltaic installations. In our query we excluded lands designated as special areas of conservation under particular international or national directives (e.g. NATURA 2000). We performed calculations and mapping for Baranya county, Hungary and for the county of Baranja-Osijek in Croatia.

According to the query, on the examined territory, the following areas were classified as eligible lands: continuous urban fabrics (27, 179 ha.), commercial and transport units (3,152 ha.). In Figure 56 the white/light spots indicate potential areas under consideration.

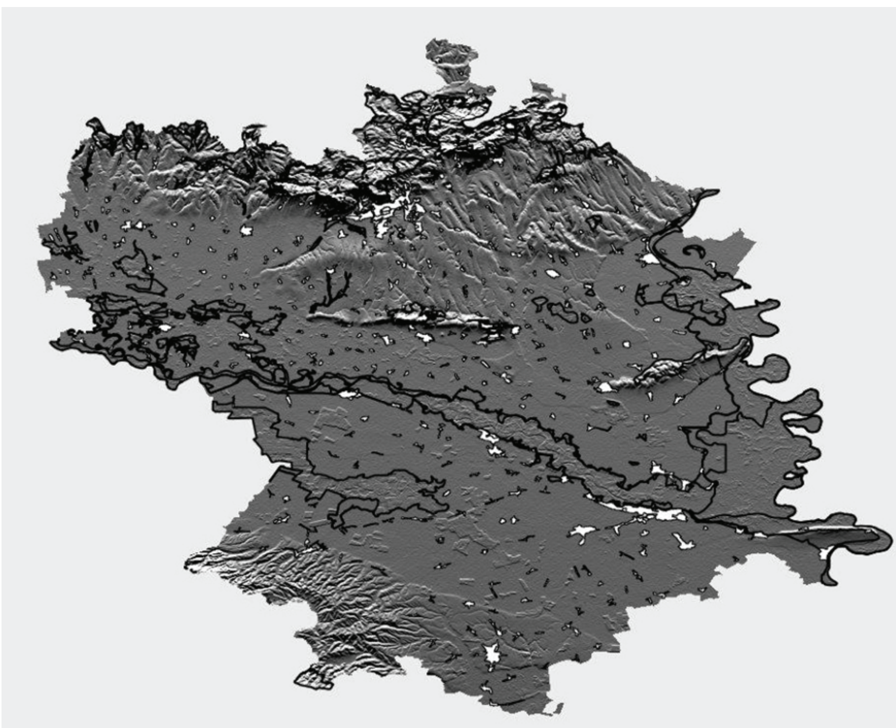

Figure 56: Potential built-up areas identified as suitable for the application of photovoltaic modules

Source: own edition

Map legend: White area: urban fabrics and commercial/transport units; thick, black frame: Natura 2000 areas.

Calculations by Kassai-Szoó (2014) reveal that energy absorbers can be installed in 2% of the urban fabric of Debrecen (also taking into consideration effects of shadowing on photovoltaic module performance). In the same way as in Debrecen, the type of thorough evaluation of roof surfaces can also be conducted in Pécs or in the county, which, at same time, is a process defining directions in future research. Provided we calculate with the above 2% for the meantime, in respect of the two built-up area types, we potentially arrive at 607 hectares in the region. Given the high-performance polycrystalline panels of BISOL 250 applied in the project, this means an installed capacity of 153 W per 1 m^2, which, on the basis of the above model calculations, leads us to the conclusion that this unit is capable of producing 201,566 kWh of energy per 1 m2 every year – a value amounting to 1, 223,505 62 MWh on annual basis. In 2010 the electricity consumption by Baranya county (Hungary) was 444,745 MWh, while according to data provided by Croatia, demand does not exceed 300,000 MWh (Hartung K. 2014). Thus, it is obvious that the available area, considering only the surface, is sufficiently large to satisfy the total electricity demand of the region.

EN_12.2. Potential impact of PV installation on the roof of buildings

In general, mounting solar PV systems on an already existing construction also means undertaking support structure-related tasks. In terms of design, the conformity of the structure pursuant to the standards currently in effect is to be verified. The following describes usual situations from different aspects.

Aspect 1: Solar panels are mounted on an already existing structure or on a new freestanding structure. In case solar panels are planned to be installed on a new freestanding structure, as appropriate, the design and implementation costs of such structure also constitute the financial responsibility of the given investment. As a contrast, if solar panels are installed on an already existing structure, in the design-control phase it may also become apparent whether there is a need for structural reinforcement and the extent to which the structure is to be reinforced is also to be determined. For one square meter of surface area, the unladen weight of the solar panels tested is between 12 and 21 kg, which, by being installed on a roof structure, may result in an increase of 10-130% relative to the unladen weight of the roof structure. Such great variations may be explained by the fact that there are many different types of roof structures including also the numerous types of shell roof structures in particular.

Aspect 2: What sort of roof geometry is involved? Traditional pitched roof or flat-roof structure? In case it is a flat-roof structure, panels to be adjusted at a fixed tilt require separate supports of their own, which adjust the panels in the right tilt angle while such supports may be omitted if the roof is parallel with the angle of inclination.

Aspect 3: refers to the orientation of the inclined roof since, in the event of inappropriate roof tilt, the application of separated panel supports is to be considered again or the option of a freestanding installation may be used, though this may take up valuable surface areas.

Aspect 4: refers to the condition of the existing frame intended to be used as a support structure. Experience shows that the year when the building was constructed and the purpose of the original builder represent are issues of great significance. As an example of this we can mention numerous old residential buildings which survived for well over 100 years in the city center of Pécs, where the elaboration, quality and condition of the roof structure (roof truss) are at a level much higher than those of roof structures aged 30-40 years or even younger, aged 5-15 years.

It needs to be recognized that any device or equipment is installed on the roof, whether a solar panel, solar collector or air-conditioning system, such device or equipment will be mounted on that particular structural unit of the building which has the least reserve capacity. This implies that even the seemingly inconsiderable weight increase of 12kg per square meter may result in the depletion of load-bearing reserve capacity when there is no option left but to reinforce the structure.

EN_12.3. Effects of visual pollution on the environment

The design of a PV park 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. In case there are nature conservation areas in the neighbourhood, landscape effect and the impact of visual pollution become of paramount importance in the development of a PV park. A PV park located in the vicinity of landscape or natural heritage areas is likely to be detrimental to landscape enjoyment. The solar park must be prevented from becoming a feature overpowering the landscape.

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.

Environmental impacts of visual pollution are highly dependent on the type of PV park to be installed, the selection of the site and on the environment of the power plant. Investigations into the visual pollution of landscapes and that of the environment lead us to the conclusion that, as a result of preliminary studies, visibility may be put at a value close to zero (NSC, 2013; BLM, 2013; Tsoutsos et al., 2005, LUC, 2013, Gracia-Garrido E et al., 2009).

EN_12.4. Solar power for carbon-dioxide emission avoidance

Atmospheric concentration of carbon dioxide is rapidly increasing with an annual growth rate amounting to 2 ppm (parts per million). In August, 2013 a concentration value of 395.15 ppm was measured in the atmosphere (SIO, 2013; NOA, 2013). We may face severe consequences unless such growth rate of atmospheric carbon dioxide is considerably reduced or virtually stopped. In technical literature several studies provide detailed analyses of this process (Hansen et al., 2008; Pachauri – Reisinger, 2007).

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 wide-spread use of these technologies may mitigate escalation tendencies in carbon emissions.

Consumption of a settlement and its CO2 emission depend on several factor. They are especially the climate, the type of buildings, the used energy carriers, the structure of economy, the population, the modes of transport, the leadership of the decision making of the