Introduction: The authorization procedure for PV plants

A number of different studies and documentation are required. These are:

- Documents that demonstrate the compatibility with the planning instruments;
- Documents regarding the type of crop and the land use capability (agronomy report);
- Documents regarding the geological, geomorphological, hydrogeological and seismic surveying;
- Documents regarding the impact on the landscape (landscape report).

The landscape report contains the description of the actual landscape conditions, the proximity to protected areas, a photographic survey, a representation of the natural and antropic barriers (orthoimages, cross sections).
Scope

An objective visual impact assessment to be used during the authorization of project developments of PV plants.

This is particularly important in case of proximity to historic sites, protected areas, hill territory or mountains, where the site of the PV installation can be seen from various different locations and may affect the landscape perception from some of the typical views.

Methods

Two different types of landscape impact assessment methodologies can be applied to renewable energy plants and to the PV plants in particular:

1) methodologies based on the calculation of visibility indexes of the plant over a large portion of land

2) methodologies based on the analyses of real photographic images or visual simulations;
Method 1) Calculation of visibility indexes

- Based on a discretization on land units (LU) of the territory potentially impacted and the calculation of index of impact based on visibility (3D models)
- The impact on each LU can be weighted as a function of different parameters

Method 2) Real photographic images or visual simulations

- Takes into account not only the visibility but also other aspects of the plant such as shape and colour, from a “static” point of view
- Visual simulation may be affected by the conditions of the picture (weather, focus, etc.)
Method 2) Real photographic images or visual simulations

Widely used for the assessment of the visual quality of the rural landscape (Arriaza et al., 2004) or of the wind turbine installations (Bishop, 2000).

Visual simulations of ground mounted PV plants are always requested by the Local Landscape Authorities but there is no uniformity on the way they should be done and analyzed.
Visibility indexes VS Visual simulations

- Complexity, information databases, time
- 3D models of terrain and buildings

- Landscape is still perceived from specific viewpoints or towards certain locations (a hill, etc.)
- Uses the same visual simulations that already are to be presented when authorizing a PV plant

Evaluation of visual simulations of ground mounted PV plants 1/2

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Step 2.2 Analysis of the visual simulation

$$OAI_{SPP} = 0.64 I_v + 0.19 I_{cl} + 0.09 I_f + 0.08 I_{cc}$$

- Visibility of the plant (sub-parameter $I_v$);
- Contrast colour with the surrounding (sub-parameter $I_{cl}$);
- Form (sub-parameter $I_f$);
- Form concurrency (sub-parameter $I_{cc}$);
Step 2.2 Analysis of the visual simulation

Sub-parameter: **form**

Sub-parameter: **colour**

![Image of visual simulation]

Determination of the colorimetric coordinates

Mean colour difference $\Delta E^*_{m}$

Sub-parameter

$\Delta E^* = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$

$\Delta E_{m,\text{min}} = 0 \rightarrow I_c = 0$

$\Delta E_{m,\text{max}} = 374 \rightarrow I_c = 1$

Colour difference $\Delta E^*$ calculation

Mean colour difference $\Delta E^*_{m}$

$\Delta E^*_{m}$ calculation

$I_c$
References