# Enhancement to Green Building Rating Systems for Industrial Facilities by Including the Assessment of Impact on the Landscape

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**Abstract :** The impact of industrial sites on people's living environment both involves detrimental effects on the ecosystem and perceptual-aesthetic interferences with the scenery. These, in turn, affect the economic and social value of the landscape, as well as the wellbeing of workers and local communities. Given the diffusion of the phenomenon and the relevance of its effects, it emerges the need for a joint approach to assess and thus mitigate the impact of factories on the landscape –being this latest assumed as the result of the action and interaction of natural and human factors. However, the impact assessment tools suitable for the purpose are quite heterogeneous and mostly monodisciplinary. On the one hand, green building rating systems (GBRSs) are increasingly used to evaluate the performance of manufacturing sites, mainly by quantitative indicators focused on environmental issues. On the other hand, methods to detect the visual and social impact of factories on the landscape are gradually emerging in the literature, but they generally adopt only qualitative gauges. The research addresses the integration of the environmental impact assessment and the perceptual-aesthetic interferences of factories on the landscape. The GBRSs model is assumed as a reference since it is adequate to simultaneously investigate different topics which affect sustainability, returning a global score. A critical analysis of GBRSs relevant to industrial facilities has led to select the U.S. GBC LEED protocol as the most suitable to the scope. A revision of LEED v4 Building Design+Construction has then been provided by including specific indicators to measure the interferences of manufacturing sites with the perceptual-aesthetic and social aspects of the territory. To this end, a new impact category was defined, namely 'PA - Perceptual-aesthetic aspects', comprising eight new credits which are specifically designed to assess how much the buildings are in harmony with their surroundings: these investigate, for example the morphological and chromatic harmonization of the facility with the scenery or the site receptiveness and attractiveness. The credits weighting table was consequently revised, according to the LEED points allocation system. As all LEED credits, each new PA credit is thoroughly described in a sheet setting its aim, requirements, and the available options to gauge the interference and get a score. Lastly, each credit is related to mitigation tactics, which are drawn from a catalogue of exemplary case studies, it also developed by the research. The result is a modified LEED scheme which includes compatibility with the landscape within the sustainability assessment of the industrial sites. The whole system consists of 10 evaluation categories, which contain in total 62 credits. Lastly, a test of the tool on an Italian factory was performed, allowing the comparison of three mitigation scenarios with increasing compatibility level. The study proposes a holistic and viable approach to the environmental impact assessment of factories by a tool which integrates the multiple involved aspects within a worldwide recognized rating protocol.

**Keywords :** environmental impact, GBRS, landscape, LEED, sustainable factory

**Conference Title :** ICEIAB 2021 : International Conference on Environmental Impact Assessment of Buildings

**Conference Location :** Venice, Italy

**Conference Dates :** April 12-13, 2021