Simulation of Power Plant Environmental Impacts within the Extended Marine Framework

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Abstract

This paper proposes the use of Modeling and Simulation to analyze the different Environmental Impacts of Industrial Facilities with special attention to Power Plant located within the Extended Maritime Framework. The approach proposed is based on combining different simulation approaches to be able to reproduce the phenomena affecting this context in a comprehensive way. The simulation experimental results are dynamically presented and updated within a Synthetic Environment, based on a Serious Game, in order to be able to augment the virtual representation with additional information. It is proposed a case study related to a Power Plant including different Gas Turbines located in front the coast and the scenario include the evaluation of the emissions on the Atmosphere, Sea Water and Ground, the inclusions on this domains as well as their impact on the flora, fauna and social layers.

The concept of sustainability is evolving along years therefore the related basic foundations are probably still valid: “the sustainability of ecosystems on which the global economy depends must be guaranteed and the economic partners must be satisfied that the basis of exchange is equitable”. So to address this point it is fundamental to evaluate in comprehensive way the whole ecosystems including human installations. The complexity due to the explosive nature of the context, the long term effects of the decisions overpassing human horizons and the presence of multiple interactions and stochastic factors make it evident the necessity to move out of qualitative approaches and to adopt quantitative methods. Obviously from this point of view Modeling and Simulation (M&S) result a strategic science to study these problems. Indeed Environmental Impacts (EIs) of industrial processes are very complex due to the fact that involve a myriad of factors and elements and often their interactions are still not very well known. Despite these facts, the possibility to model relationships between Environmental Impacts, the industrial plant characteristics and operational modes could strongly improve the understanding of these
phenomena; indeed dependency and combined effects could be estimated by designing a hierarchical relationship model. In the past, the authors developed these models focusing on Logistics as well as on Port Operations supporting the development of Green Solutions for these frameworks. Recently the evolution of policies on Greenhouse Gases had big impacts on industrial plants configuration, considering that several energy saving systems and policies, that are consolidated and already operational, have to be dismissed due to the change in tax policies; this situation leads sometime to strange solutions that are not really “energy saving”, but result effective in reducing taxes and fees.