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Online Life Cycle Assessment: Case Vinyl Acetate Monomer Process

Extended Abstract: Life Cycle Assessment (LCA) is a "cradle-to-grave" analysis of the environmental costs associated with a given product [1]. Due to their association with large uncertainties, LCA models are used to predict the direct and indirect environmental impacts associated to the production of a product. They cover the whole life cycle of products, from raw materials acquisition to end use, recycling, or disposal. Such models are commonly used for supporting decisions of policymakers as well as for assessing impacts and costs of any production process.

Online LCA focuses on continuous LCA computation results based on real-time information collected from the equivalent system. This is possible by a direct communication between the model and the physical process. As a result, Key Performance Indicators (KPIs) of the related process can be continuously calculated for assessing environmental impact on the modeled system [2]. Online LCA significantly reduces the time required for gathering the information to support decision-making in product and technology development projects. It increases environmental awareness of process operators, policy makers and other actors involved in decision making.

Industrial process plants, such as chemical plants, could greatly benefit from applying the online LCA for taking short and long-term operation actions that would reduce their environmental impact. In these plants, online LCA systems could be implemented by connecting LCA tools and their models directly to the plant control system by directly embedding LCA models into the automation system of the plant. Thus, reduction of implementation costs, communication overheads and integration effort could be achieved. In this work, this approach is explored by embedding a Functional Mock-up Unit (FMU) of an LCA model into the control system of a Vinyl Acetate Monomer process [3].

The Functional Mock-up Interface (FMI) standard [4] targeted for model exchange and co-simulation of heterogenous models, can be utilized to implement the integration of LCA models. The LCA model, originally developed on the SULCA tool, is exported as an FMU and then embedded into the process control application of the plant, to continuously asses environmental impact of the modelled process, by adjusting the LCA values according to possible changes on the control process. In the paper, the architecture and case study including the description of the process and LCA model will be explained.

Keywords: Life Cycle Assessment, Online LCA, FMI, Vinyl Acetate Monomer, Control System

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