# Publishable Executive Summary


## *Introduction*

The HIPCON project is a 6th framework NMP priority STREP with contract number 505467-1 with 3 years duration from January 2004 to December 2006.

Process industries in today's highly competitive global market must reconsider their production control policies and strategies if they are to achieve sustainable production and increase their competitiveness. In order to attain sustainable and economically efficient production, it is necessary to take a holistic view of process control and management. This can only be accomplished by integrating consideration of product quality, process economy and environmental impact in the next generation process control and optimisation systems.

## *Objectives*

The HIPCON project aims at developing methodology and technology to facilitate transformation of the European industry to adapting holistic process management from a life-cycle perspective. In order to demonstrate the results and measure advantages a prototype software platform for multi-objective optimisation and control will be developed. In the end of the project the system will be implemented and demonstrated at the two case study industries.

The HIPCON project aims at developing methodology and technology for holistic process management from a life-cycle perspective. The project results will support long-term transformation of European industry and promote increased competitiveness and eco-efficiency of the industries. The specific aims of HIPCON are to:

- Develop new parameters for economic and environmental impact of the processes on company and societal level.
- Develop process control and modelling methods for industrial production processes covering product quality, economic and environmental impact of the processes.
- Integrate performance indicators from different disciplines for holistic process management.
- Identify conceptual models and control objectives for the industrial cases. Successful modelling for all industrial cases, linking process status together with economical, environmental and quality performance.
- Produce prototype computer code integrating mathematical models from different disciplines and control strategies for development of a holistic process management system
- Estimate performance improvements from a holistic viewpoint in all industrial cases.
- Disseminate the scientific results through scientific publications and conference presentations.
- Disseminate the results to relevant European industrial sectors through industrial take-up activities such as an industrial reference group, company visits and industrial seminars.

## *Progress*

This report describes the progress during the second and a half year of the three year HIPCON project. In the steel plant case study the HIPCON have been focusing on the steel making part of the process, e.g. the so-called LD converter process. A key objective is to reduce and predict slopping in the LD converter which is of relevance both economically and environmentally. In the WWTP the focus has been on chemical precipitation and the activated sludge process. One objective, among others, is to optimize the addition of precipitation chemicals, i.e. to minimize the dosage while maintaining a stable process with high quality on the effluent.

Environmental and economical modelling of the case studies started with development of KPI libraries capturing important aspects of the process' performance for each case study application. Economic modelling work is mainly based on cost modelling but work has also been devoted to establishing methods for indicating the economic risk of modifying the industrial process being monitored. Environmental modelling work is based on life-cycle inventories (LCI). The work with environmental modelling is now completed whilst some work on developing economical functions remains. The models will be used for monitoring process performance and in combination with simulation models for process performance simulation and optimization.

Process modelling work is progressing in several parallel tracks, aiming at process diagnostics, soft sensing and process simulation. Both empirical (multivariate statistics, artificial neural networks etc.), semi-physical (grey-box) and physical approaches are being used.

In the wastewater treatment case, soft sensor models have been developed that can be used in feed-forward control of the processes and simulation models that can be used for scenario based reasoning and optimization. Currently the models have been installed in the software demonstration at SVAB in real-time environment. In the steel plant case study, modelling methods have been successfully used to develop a dose optimization strategy can save large amounts of reagent if implemented in the plant, which leads to decreased environmental impact and lower operating costs. The reagent model has been validated with new data and is proven to work accurately. Several useful diagnostic models have also been developed for the LD converter process; especially the work on using sonic measurements for level detection in the LD converter looks promising. Some work on calibration and validation of these models remains though.

The work on process control methods and strategies has proceeded along different tracks, incorporating economical and environmental considerations. Several novel control strategies for both case studies are being evaluated using simulation models and historical plant data.

One project objective is the development of prototype computer code integrating mathematical models from different disciplines in a holistic process management system. A prototype with most of the functionality of the final software product has been developed during 2005. In the first half of 2006 the software has been debugged and all agents proven to function. It has functionality for monitoring, simulating and optimizing the process performance from environmental, economic and quality perspective. Along with the case demonstration the work on debugging and updating the software code will evolve.

During the first year, an Industrial Reference Group (IRG) was established by recruiting members from relevant industries. The group currently consists of representatives from 12 large companies from various industrial fields with a geographical spread over

Europe. Various partners of the IRG members have shown a great interest in the HIPCON results. Parallel projects have started to transfer parts of the HIPCON approach into their production.

## *Contact information*

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