

HIPCON Public summary progress report M1-18



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

Methodology

The first 6-month period of the project constituted a start and preparation phase with focus on developing a conceptual understanding of the industrial cases, steel manufacturing at SSAB Oxelösund AB and the Stockholm Vatten AB wastewater treatment plant (WWTP), and problems to approach as well as identifying and collecting the data necessary to carry out the technical work. During the first half year, the HIPCON project finished the work with describing and analysing the cases with respect to plant objectives, function and strategies for control options. The first historical data was also retrieved, which enabled starting “hands on” work through modelling real process data.

During the second half of 2004, environmental and economical modelling of the case studies started with development of KPIs. The research on social performance indicators has resulted in a report, which forms the basis of the remaining work in this field. Process modelling work started when data became available and 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. 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. User software requirements and internal software specifications were developed during the first 6 months. System design and prototyping was started during the second half of 2004. The software development has progressed successfully during the first 18 months and demonstration prototype have been developed and successfully used.

Steel plant

In the steel plant case study, the HIPCON project has already produced useful results for the steel making process, e.g. the so-called LD converter process. A key objective better understand the slopping phenomenon since it has both serious economic and environmental performance impact. The initial models can be used to estimate potential risk for slopping.

Process models describing the desulphurisation process have been developed. The models show good potential in saving carbide reagent (used for desulphurisation) which will lower the production costs substantially. Economical and environmental models are now being merged with the developed process models to fully more accurately evaluate proper process conditions. Work with developing a simulation model for the process chain from “coke to slab” has started.



The HIPCON researcher Sergey Shybayev from LSE during a rainy visit to SSAB site.

Wastewater treatment plant

The activities for the wastewater treatment plant case study have been intense during the first 18 months. To facilitate process modelling, several measurement campaigns have been carried out. The purposes of the campaigns have been to collect high quality data to develop empirical models and to calibrate the ASM1 model used for simulation of the activated sludge process.

The initial work started on using process models to predict phosphorus content in the wastewater for better control of the precipitation process. This work has been successful and is now close to an on-line application. The estimated savings of precipitation chemicals for the plant is more than 20 %. The calibration of the ASM1 model turned out to be more difficult than expected and this work is therefore delayed. However the model is expected to be ready during the autumn 2005. The model will be used for different control and optimisation purposes for the activated sludge part of the process. Economic and environmental key performance indicators have been developed for measuring plant performance.

Industrial interaction

During the year, a lot of work has been made to start up the Industrial Reference Group (IRG) by recruiting members and provide them with sufficient information about the project and the cases. This work has been successful; the group currently consists of representatives from 12 large companies from various industrial fields with a geographical spread over Europe. The consortium will use the IRG as an advisory agent that will feed back on the use of HIPCON results from an industrial point of view. A physical meeting with the IRG members was held in London in April. They received information about the project and the preliminary results. The HIPCON consortium also received useful feed back information. Initial meetings with two of the companies have also been held in order to discuss the possibilities to implement the HIPCON concept in their processes.

Contact information

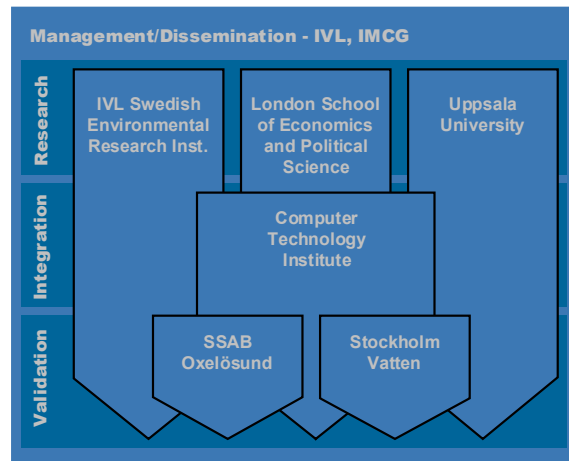
Visit the project web site www.hipcon.org for up-to date information about the project. For further information, contact the project manager at IVL, Jonas Röttorp (jonas.rottorp@ivl.se , +46-8-59856300)



The HIPCON consortium

The development of the holistic process management system requires close co-operation among experts in a variety of fields, e.g. economic, environmental and process modelling, multi-objective optimisation and model based control theory. Integration of the research is of paramount importance.

The consortium consists of 5 partners with expertise in these areas and two case study industries. Contact details and expertise of the partners are given below and the main roles of the partners in the figure.



IVL Swedish Environmental Research Institute, co-ordinator

IVL is Sweden's leading organisation for environmental research. In HIPCON, IVL works primarily with project management, environmental modelling and process modelling.



London School of Economics and Political Science

The activities of London School of Economics and Political Science in HIPCON are in the fields of econometrics and statistics.



Uppsala University, Division of Systems and Control

The division does research in such areas as system identification, signal processing, fault detection and automatic control. UU is responsible for model based control.



Computer Technology Institute (CTI)

CTI specialises in applied research related to computer science. In HIPCON, CTI works with decision support systems, process simulation and is responsible for integration and implementation of the HIPCON methodology in a software prototype.



IMCG Ltd

IMCG is an international management consulting company based in London. IMCG works with dissemination and commercialisation of the project results.



SSAB Oxelösund AB

SSAB is one of the medium-sized steel companies in Western Europe. The steel production facility in Oxelösund is one of the case studies in the project.



Stockholm Vatten AB

Stockholm Vatten produces drinking water and manages and treats wastewater from Stockholm and neighbouring municipalities. One of the company's wastewater treatment plants is a case study in HIPCON.