Project Overview
Individual units often are already automated and operated efficiently.

Inefficiencies result from lack of coordination.

Better coordination of production means improved energy and resource efficiency.
CoPro: Short fact sheet

- Full title: Improvement of Energy and Resource Efficiency by Better Coordination of Production in the Process Industries
- Contributing to circular economy and industrial symbiosis
- Builds on the results of FP7 projects
  - MORE: Real-Time Monitoring and Optimization of Resource Efficiency in Integrated Processing Plants
  - DYMASOS: Dynamic Management of Systems of Systems
- 17 partners from 8 countries
- Duration: 42 months
- EC contribution: 6 M€
## Consortium

Industry with 5 applications covering the complete value chain

<table>
<thead>
<tr>
<th>Technology providing SMEs</th>
<th>Universities</th>
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<tr>
<td>covestro</td>
<td>Lenzing</td>
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<td>P&amp;G</td>
<td>Innovative by nature</td>
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<td>Frinsa</td>
<td>INEOS</td>
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<td>Universidad de Valladolid</td>
<td>EPFL</td>
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<th>Dissemination and exploitation support</th>
<th>Research institutes</th>
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<td>LeiKon</td>
<td>CERTH</td>
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<td>PSE</td>
<td>Centre for Research &amp; Technology Hellas</td>
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<td>Université de Genève</td>
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<td>ORSOFT</td>
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Project Overview
Mission

Improved coordination is key to better energy and resource efficiency of the existing assets

CoPro addresses coordination in three dimensions:

- **Cross-layer process integration**, from basic process controls to the coordination of the complete supply chain
- **Cross-unit and cross-plant coordination**: Integrated management and control of heterogeneous units coupled by flows of energy and materials
- **Cross-functional coordination**: Coordination between different functions related to production, e.g. between maintenance and operations and between operations and the procurement of electricity
Goals

Provide and demonstrate tools for process monitoring, dynamic planning, and scheduling and control of plants, sites and industrial clusters under dynamic market conditions

- Improved energy and resource efficiency by coordinated optimization of production units
- Buffering the effects of fluctuating renewable energy production and distribution by integrating demand-side response with plant-wide scheduling and control
- Efficient plant and resource utilisation by integrated plant-wide scheduling and control
- Optimization of maintenance
### Plant and site operation efficiency largely determined by discrete events and decisions

- Plant and site operation efficiency largely determined by discrete events and decisions.

#### CoPro includes discrete decisions in plant-wide control and optimisation schemes

### Plant managers and operators have a crucial role in the operation of processing plants

- Plant managers and operators have a crucial role in the operation of processing plants.

#### CoPro develops intuitive forms of human-machine interaction and optimisation-based advanced decision support

### Suitable mathematical models in most cases are only available for some important plant or units

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#### CoPro develops techniques for coordination of production units that can employ models of different types

### Operation of plants of different companies in industrial parks that are connected by energy & material streams are not coordinated

- Operation of plants of different companies in industrial parks that are connected by energy & material streams are not coordinated.

#### CoPro develops technology for balancing and optimising networks, and for distributing the joint benefit in industrial parks
Project Overview

"We operate a petrochemical complex with interacting plants and produce a large number of base chemicals. We need to plan this production for at least the year ahead. With optimal planning of the site and optimisation of some of our units we can react quickly to changes in the market and save resources and energy."

Alexander Gammersbach
Team Leader of Site Optimisation
INEOS Köln GmbH
Cross-company coordination in chemical parks under confidentiality constraints

“In Chemical Parks and Industrial Clusters, chemicals and carriers of energy are exchanged across the boundaries of companies, usually based on long-term contracts. We want to coordinate the exchange of energy and materials in an agile and optimal manner while preserving confidentiality of business information. This will lead to better overall energy and resource efficiency and to a win-win situation for all parties involved.”

Lukas Maxeiner
Research Assistant
TU Dortmund
We strive to optimize the production and distribution of basic chemical gases required in the synthesis of our polymers. By means of advanced modelling, monitoring and optimization methods, we want to improve the energetic efficiency in the production of gases while respecting environmental and safety regulations.

Christine Maul
Team Lead of Advanced Process Control
Covestro Deutschland AG
Optimal process coordination for the recovery section of EU’s largest viscose fiber production plant

“The recovery of the spinbath is the key process step in the viscose fiber production with the highest energy demand. Especially the spinbath reconcentration by evaporation requires a huge amount of heat. In CoPro our goal is to improve our multi-unit evaporation process by focusing on load allocation, cleaning cycles, cooling water distribution and the heat recovery.”

Christian Jasch
Process Engineer
Recovery & Spinbath
Lenzing AG
“At FRINSA, we produce over 400 different products on shared production equipment. Our main challenge is to optimally plan, schedule and operate the equipment to minimize queues, idle times and consumption of energy. CoPro technology will replace manual scheduling methods and will improve the energy efficiency and reduce total costs.”

Jose Manuel García Lampón
FRINSA Production Manager
Frinsa del Noroeste, S.A.
Industrial use cases

Optimisation of production and packing of consumer goods products

“We produce a large number of similar products in the same plant and with the same equipment. The process of fitting all products in the daily schedule and the change from one product to the other makes it all quite complex and often not optimal. The main objective in this project is to increase the plant productivity by means of optimal planning and optimal and efficient utilization of assets, resources and energy.”

Francesc Corominas
Principal Engineer
Procter & Gamble
Outcomes: Technologies and tools

• **Plant-wide and site-wide optimisation** of operating points and discrete decisions including demand side response
• **Distributed optimization using market-like algorithms** to coordinate with minimum exchange of information
• **Technology for optimising changeovers**, reducing waste, rework and energy consumption and increasing throughput
• **Reactive scheduling** to maximize utilisation of the equipment and to minimize energy consumption
Outcomes: Technologies and tools

- **Online data analytics** for the detection of quality and equipment problems from available sensor information
- **New modelling techniques** to build models for advanced control and plant-wide optimisation efficiently
- **Novel forms of information presentation** to managers and operators that lead to a symbiosis of operators and computer-based optimization algorithms
- **Software platform** that connects to different IT systems and to visualization systems and facilitates the engineering and maintenance of integrated control and optimisation solutions
Expected impact

- 10% improvement of energy and resource efficiency if implemented fully and along the value chains across all applications and sectors
- Contribution to circular economy and industrial symbiosis
- Strategic partnership between the CoPro SMEs and large industrial companies
- High impact on the competitiveness of all individual partners by being first to the technology market; fast followers expected after dissemination and interaction with stakeholders
- Long term growth in employment (40 jobs 5 years after project end) at technology providing partner SMEs
- Economic leverage in the time of 3 years after the project end at least by a factor of 5
- Academic training and education via R&D and courses
## Key expected sustainability impacts

Estimated impacts for broad deployment by 2030 (relative to 2015)

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<tr>
<th>Indicator</th>
<th>Expected Impact</th>
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<tr>
<td>Reduction in greenhouse gas (GHG) emissions</td>
<td>4%</td>
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<td>Reduction of the use of energy from non-renewable sources</td>
<td>2-10%</td>
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<td>Waste minimization (in specific cases)</td>
<td>25%</td>
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<tr>
<td>Reduction of fresh water consumption (where applicable)</td>
<td>10%</td>
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**Valorisation**
- Definition of commercialization strategies
- Contribution to standards
- Support of start-ups
- Analysis of alliances

**Outreach**
- Publications
- Feasibility studies
- Exchange with industrial stakeholders
- Seminars, workshops, trade-fairs
Contacts

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- LinkedIn:
  https://www.linkedin.com/in/copro-2a5938138/
- ResearchGate:
  https://www.researchgate.net/project/CoPro-Coordinated-Production-for-Better-Resource-Efficiency