COPRO

COORDINATED PRODUCTION
FOR BETTER RESOURCE EFFICIENCY

D7.4 FIRST REPORT ON STANDARDIZATION ACTIVITIES

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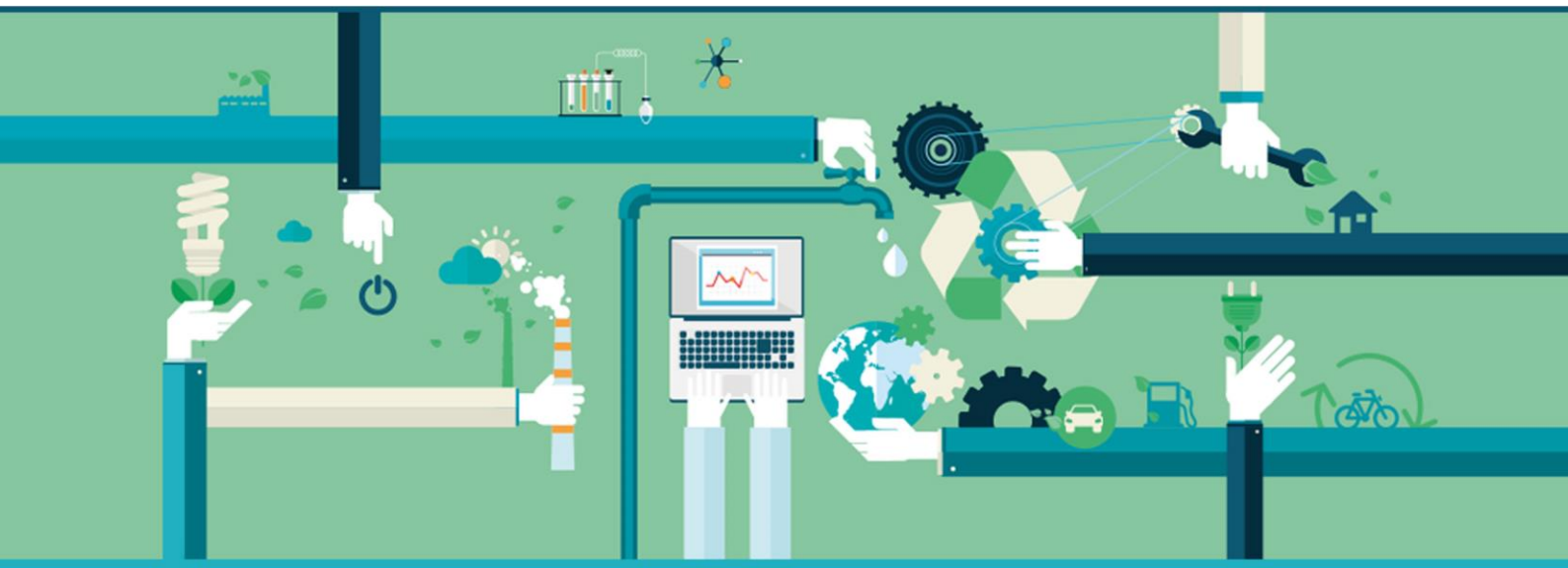

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Project Details

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THE COPRO PROJECT

The goal of CoPro is to develop and to demonstrate methods and tools for process monitoring and optimal dynamic planning, scheduling and control of plants, industrial sites and clusters under dynamic market conditions. CoPro pays special attention to the role of operators and managers in plant-wide control solutions and to the deployment of advanced solutions in industrial sites with a heterogeneous IT environment. As the effort required for the development and maintenance of accurate plant models is the bottleneck for the development and long-term operation of advanced control and scheduling solutions, CoPro will develop methods for efficient modelling and for model quality monitoring and model adaption.

The CoPro Consortium

Participant No	Participant organisation name	Country	Organisation
1 (Coordinator)	Technische Universität Dortmund (TUDO)	DE	HES
2	INEOS Köln GmbH (INEOS)	DE	IND
3	Covestro Deutschland AG (COV)	DE	IND
4	Procter & Gamble Services Company NV (P&G)	BE	IND
5	Lenzing Aktiengesellschaft (LENZING)	AU	IND
6	Frinsa del Noroeste S.A. (Frinsa)	ES	IND
7	Universidad de Valladolid (UVA)	ES	HES
8	École Polytechnique Féderale de Lausanne (EPFL)	CH	HES
9	Ethniko Kentro Erevnas Kai Technologikis Anaptyxis (CERTH)	GR	RES
10	IIM-CSIC (CSIC)	ES	RES
11	LeiKon GmbH (LEIKON)	DE	SME
12	Process Systems Enterprise LTD (PSE)	UK	SME
13	Divis Intelligent Solutions GmbH (divis)	DE	SME
14	Argent & Waugh Ltd. (Sabisu)	UK	SME
15	ASM Soft S.L (ASM)	ES	SME
16	ORSOFT GmbH (ORS)	DE	SME
17	Inno TSD (inno)	FR	SME

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Abstract

The goal of the standardization task of CoPro is to attract attention from national and international professional societies and standardization bodies to the results of CoPro which are – from the consortium point of view – worth to standardize. The purpose of this report is to describe the planned standardization strategy and to report the activities initiated by the partners during the first 18 months to reach the objectives of task 7.5.

REVISION HISTORY

The following table describes the main changes done in the document since it was created.

Revision	Date	Description	Author (Organisation)
V0.8	March2018	Creation	U. Enste (LeiKon)
V0.9	April 2018	Review and contribution	T.Butters (Sabisu)
V1.0	April 2018	Update	U. Enste (LeiKon)
V1.0	April2018	Final approval	S. Engell (TUDO)

Disclaimer

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List of Abbreviations

AENOR:	Spanish Association for Standardization and Certification
BSI:	British Standard Institution
CEN:	European Committee for Standardization
CENELEC:	European Committee for Standardization in the electrical field
DIN DKE:	German Institute for Standardization in the electrical field
EC:	European Commission
IEC:	International Electrotechnical Commission
ISP:	Industrial Stakeholder Panel
ISO:	International Organization for Standardization; International Standard
KPI:	Key Performance Indicator
MPC:	Model Predictive Controller
NAMUR:	International user association of automation technology in process industries
ProSTEP:	International association for standards in product data management
R&D :	Research and Development
TC:	Technical Committee
TR:	Technical Report
VDI:	Verein Deutscher Ingenieure (Association of German Engineers)
WA:	Workshop Agreement

1 Introduction

European Commission regards standardization as an important tool for promoting innovation, research and development (R&D) and contributing to the Union's competitiveness and the completion of the internal market. According to the Commission it is important to include 'relevance to standardization' amongst the evaluation criteria of EU-funded R&D projects, to promote projects related to standardization, and raise awareness about those projects via innovative means (European Parliament resolution 21.10.2010 2010/2051(INI)). Resource efficiency is one of seven flagship initiatives adopted by the European Union in its strategy for sustainable growth. In September 2011 the European Commission (EC) published its Roadmap to a Resource Efficient Europe defining medium and long term resource efficiency objectives and the means needed for achieving them.

The standardization bodies operate at national (AENOR, DIN, BSI etc.), regional (CEN, CENELEC) or international (ISO, IEC) level. ISO and CEN are general while IEC and CENELEC cover electrical sector including automation technologies which are mainly addressed in CoPro.

A strategic Group of IEC has developed 34 recommendations for future work. One of these recommendations is: "IEC should develop guidelines for the design and operation of energy efficient systems in the field of industrial automation and industrial process control". This implicitly includes the usage of these methods and guidelines for resource efficiency, of which energy efficiency is one part. CoPro will contribute especially to this recommendation.

This document introduces the first activities to incorporate the standardization issues into CoPro, as well as activities that have been found relevant for the CoPro project (existing standards or on-going standardization processes). The screening results of standards included in this report cover national standards developed by ProSTEP, NAMUR and VDI, European standards developed by the European Committees for Standardization (CEN and CENELEC) and International standards developed by the International Organizations for Standardization (ISO and IEC).

A first analysis showed that the best strategy is to introduce the results of CoPro into standardization activities by describing Best Practices and Guidelines in cooperation with standardization groups like NAMUR, VDI, AENOR or BSI. Based on this, new work item proposals e.g. for IEC TR or CEN WA can be initiated.

2 Standardization Objective

The main objective of the standardization task of CoPro is to attract attention from national and international professional societies and standardization bodies to the results of CoPro which are – from the consortium's point of view – worth standardizing. In detail the following objectives will be aspired to within the project:

- Stimulating pre-normative or standardization activities related to aspects such as information/knowledge exchange, data sharing, advanced model-based control technologies, scheduling and control integration, etc.
- Liaising with the appropriate standardization bodies and initiatives and ensure that CoPro is building upon emerging standards.

- Providing industry sector specific best practice solutions which can be described in recommendations or technical reports (like IEC TR, CEN WA, ISO WA (TR: Technical Report; WA: Workshop Agreement; both non-normative documents).

3 Potential Standardization issues in CoPro

The goal of CoPro is to develop and to demonstrate methods and tools for process monitoring and optimal dynamic planning, scheduling and control of plants, industrial sites and clusters under dynamic market conditions. CoPro will provide decision support to operators and managers and develop closed-loop solutions to achieve an optimally energy and resource efficient production. Further on, CoPro will provide decision support in plant-wide dynamic optimization and will develop integrated scheduling and control solutions. Advanced online data analytics will be developed for plant health and product quality monitoring. CoPro will also develop methods for efficient modelling and for model quality monitoring and model adaptation. In total a wide range of technology aspects.

3.1 Categories of standards and guidelines in the context of CoPro

From a standardization point of view the following categories of standards play a role in the context of the different tasks of CoPro:

- Standards and guidelines treating environmental Life Cycle Assessments (LCA)
- Standards and guidelines treating management activities to monitor, analyse and decrease resource and energy consumptions
- Standards and guidelines treating resource end energy performance indicators
- Standards and guidelines treating methods of
    - model based applications
    - dynamic optimization
    - advanced analytics
- Standards and guidelines treating methods of model description.

3.2 Links of CoPro topics to existing standards or ongoing standardization activities

The tables below show first results of a strategic analysis, which can be used further on to define the next steps and activities of task 7.5. The tables include a list of relevant existing standards for each defined category and a first evaluation to point out a possible link between the standard/guideline and CoPro activities.

Table 1: Standards and guidelines treating environmental Life Cycle Assessments (LCA)

Existing Standard / Guideline	Remark	Link to CoPro
ISO 14067-2013: "Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication"	Specifies principles, requirements and guidelines for the quantification and communication of the carbon footprint of a product (CFP), based on International Standards on life cycle assessment (ISO 14040 and ISO 14044) for quantification and on environmental labels and declarations (ISO 14020, ISO 14024 and ISO 14025) for communication. Can be used for retrospective analysis of environmental indicators.	Awareness inside CoPro. Relevant especially for Task 5.4 "Integration of LC assessment tools" and Task 6.4
ISO 14040-44:2006 Environmental management – Life Cycle Assessment – Requirements and guidelines exploitation goals	Addresses the environmental aspects and potential environmental impacts throughout a product's life cycle (cradle-to-grave)	Relevant especially for Task 5.4 "Integration of LC assessment tools" and Task 6.4 "Evaluation and sustainability, life cycle and economic impact assessment"
ISO 14045:2012 "Environmental management – Eco-efficiency assessment of product systems – Principles, requirements and guidelines"	Eco efficiency relates the environmental performance of a product system (based on LCA) to its product system value. It adds up economic and social indicators in comparison to the environmental standard.	Relevant especially for Task 5.4 "Integration of LC assessment tools" and Task 6.4 "Evaluation and sustainability, life cycle and economic impact assessment"
ISO 14052:2017 "Environmental management – Material flow cost accounting – guidance for practical implementation in a supply chain"	Provides a general approach for enhancing resource efficiency in the supply chain and addresses the significance of integrating MFCA between organizations.	Relevant especially for Task 5.4 "Integration of LC assessment tools" and Task 6.4 "Evaluation and sustainability, life cycle and economic impact assessment".
VDI 4600: "Kumulierter Energieaufwand"	German Guideline VDI 4600 "Accumulated Energy Consumption". Includes a framework to describe accumulated energy consumption	Possible starting point to introduce CoPro results into one pre-normative document of

	calculations for products within their Life Cycle.	the planned series of guidelines

Table 2: Standards and guidelines treating management activities to monitor, analyse and decrease resource and energy consumptions

Existing Standard / Guideline	Remark	Link to CoPro
EN ISO 14001:2015-11: "Environmental management systems - Requirements with guidance for use"	The requirements of ISO 14001 are an integral part of the European Union's Eco-Management and Audit Scheme (EMAS). The basic principles of ISO 14001 are based on the well-known Plan-Do-Check-Act (PDCA) cycle.	Further analyses necessary, which steps of ISO 14001 can be supported or simplified by CoPro methods and tools.
ISO 50001, 50002, 50003, 50004, 50015: "Energy Management Systems"	Worldwide relevant standard for energy management. Based also on Plan-Do-Check-Act (PDCA) cycle.	Further analyses necessary, which steps of ISO 50001 – 50015 can be supported or simplified by CoPro methods and tools.
ISO 14051:2011: "Environmental management – Material flow cost accounting – general framework with predominant scientific exploitation goals"	MFCA is a management tool that can assist organizations to better understand the potential environmental and financial consequences of their material and energy use practices. It is an environmental management accounting tool to understand material and energy uses and costs caused by material inefficiency.	Further analyses necessary, which steps of ISO 14051 can be supported or simplified by CoPro methods and tools.

Table 3: Standards and guidelines treating resource end energy performance indicators

Existing Standard / Guideline	Remark	Link to CoPro
ISO 50006:2014 "Energy management systems - Measuring energy performance using energy baselines (EnB) and energy performance indicators (EnPI) - General principles and guidance	Provides guidance to organizations on how to establish, use and maintain energy performance indicators (EnPIs) and energy baselines (EnBs) as part of the process of measuring energy performance.	Awareness inside CoPro. Relevant for Task 6.4 "Evaluation and sustainability, life cycle and economic impact assessment"
NAMUR recommendation	Provides a guideline to define and use	Potential to provide

NE162: "Resource Efficiency Indicators for monitoring and improving resource efficiency in processing plants"	suitable resource efficiency indicators for process industry. Result of EU-project MORE (Grant Agreement no. 604068)	CoPro results as enhancements in existing standard or as separate part of the standard.
Dansk Standard/ CEN Workshop Agreement DS/CWA 17185:2017: "Methodology to measure and improve the resource efficiency of resource intensive processes"	Provides a cross-sectorial methodology for identifying, characterizing and implementing a set of indicators whose purpose is to enable an organization to improve resource efficiency. Result of EU-project TOP-REF (Grant Agreement no. 604140)	The methodology is based on a chain of model based applications, sensitivity analysis and optimization without going into more detail of how these methods can be used best. Potential to provide CoPro results as enhancements in existing standard or as a separate part of the standard.

Table 4: Standards and guidelines treating methods of model based applications, dynamic optimization, scheduling and advanced analytics

Existing Standard / Guideline	Remark	Link to CoPro
IEC TR 62837 Energy efficiency through automation systems	Provides a framework for the development and adaption of documents in order to improve energy efficiency in manufacturing, process control and industrial facility management. The TR assigns energy functions to different plant levels according to IEC 62264 (ISA95).	Awareness inside CoPro.
VDI 4800: Resource efficiency – Methodical principles and strategies.	Series of (planed) guidelines concerning resource efficiency by the Association of German Engineers (VDI): Part 1 of the guidelines defines and explains general conditions, basic principles and functional aspects of resource efficiency. The guideline offers support to define KPIs for resource efficiency. It is planned, that in further parts specific	Potential to provide enhancements within this series of guidelines.

	methods and industry sector specific guidelines will be developed.	
NAMUR Worksheet NA140: "Procedure for Enhancing Energy Efficiency in Chemical Plants – Contribution of Automation Engineering"	Illustrates the contribution of automation engineering to energy efficiency. The procedure employed for the analysis of efficiency potential is universally valid and is supplemented by practical examples drawn from automation engineering	Potential to develop a new NAMUR Worksheet together with this group of experts.
VDI 2191 Part 1: "Advanced Process Control (APC) – Realisation of APC projects"	German Guideline developed by VDI (Association of German Engineers). Includes hints to plan and implement APC projects in a most efficient way. Focus is mainly on MPC and adaptive controller	Ongoing standardization activity by VDI. Potential to collaborate with experts of this group.
ISO 20140 –Part 5: "Automation systems and integration -- Evaluating energy efficiency and other factors of manufacturing systems that influence the environment"	Specifies types of environmental performance evaluation (EPE) data, which can be used for evaluating the environmental performance of manufacturing systems based on ISO 20140-1. It also provides recommendations for mapping the EPE data on to information models specified by IEC 62264.The evaluation method provides guidelines to analyse the usage of energy and the effects of a manufacturing system on the environment.	Awareness inside CoPro.

Table 5: Standards and guidelines treating methods of model description

Existing Standard / Guideline	Remark	Link to CoPro
ProSTEP iViP Recommendation PSI 11 – SmartSE: "Recommendation for Smart Systems Engineering:"	Prostep ivip is a leading, globally operating, and independent network of participants from the fields of industry, IT, and research. The goal is to define standards and interfaces, especially for the digitization of the entire product creation process. Base of the standard is the "Functional Mockup Interface (FMI)" which can be	Base of the standard is the "Functional Mockup Interface (FMI)" which can be used for a standardized Model exchange and model description. CopRo intends to use.

	used for a standardized Model exchange and model description. FMI is result of EU-project MODELISAR (Project no. 07006)	FMI in Task 5.2 (Data and IT System integration) and 5.3 (Model Management). Necessary enhancements will be reinforced to the FMI consortium

4 Standardization Strategy

4.1 General Strategy

Based on experiences gained in previous research projects the best way seems to be to initiate standardization activities within national or international standardization bodies like NAMUR, VDI in Germany, Danish Standard Association in Denmark; BSI in Great Britain or AENOR in Spain. With this strategy groups of experts beyond CoPro consortium members can be involved in an early stage of the research and evaluation activities. Further on, the standardization processes appear easier and faster. This strategy was already pursued successfully in several previous projects such as TOP-REF and MORE. Based on the non-normative standards or guidelines it can be proofed together with experts of IEC, ISO, CEN or CENELEC to determine which parts of the guidelines should be considered in ongoing international standardization activities.

4.2 Liaisons with standardization groups

Based on the analyses and categorisation of existing standards we initiated first meetings with standardization groups. In March 2018 Udo Enste (LeiKon) presented the objectives of the CoPro project to members of the NAMUR working group 2.4 (Manufacturing Execution Systems) in Mannheim, Germany. This group developed together with the NAMUR working group 4.17 (Energy Efficiency) the NAMUR recommendation NE162: “Resource Efficiency Indicators for monitoring and improving resource efficiency in processing plants” published in 2018 based on the MORE results. The NAMUR group 2.4 is interested in a frequent information exchange and expressed their preparedness to support the exploitation of CoPro results by defining a NAMUR Recommendation or a NAMUR Worksheet. In following meetings relevant issues of CoPro results will be discussed.

A second liaison was initiated with the German standardization organisation DIN DKE. Udo Enste (LeiKon) will join the next meetings of the DIN DKE working group K931 in June and in November 2018. He will use these opportunities to get in contact with IEC representatives. The DIN DKE working group K931 is a national mirror standardization group of the IEC Technical Committee 65 “Industrial-process measurement - control and automation”.

5 Conclusion

One important exploitation goal of CoPro is to stimulate pre-normative or standardization activities. A further aim is to liaise with the appropriate standardization bodies and initiatives and ensure that the project is building upon emerging standards and industry specifications for interoperability to enable quick market take-up.

To get a systematic approach to the different kinds of standardization fields, we identified 5 categories which play a role in the context of the different tasks of CoPro:

- standards and guidelines treating environmental Life Cycle Assessments (LCA).
- standards and guidelines treating management activities to monitor, analyse and decrease resource and energy consumptions.
- standards and guidelines treating resource end energy performance indicators
- standards and guidelines treating methods of model based applications, dynamic optimization and advanced analytics.
- standards and guidelines treating methods of model description.

For each category the most important standards and ongoing standardization activities were identified and possible links between the standards and the CoPro activities were elaborated. In parallel, first contacts and discussions with experts of standardization bodies were initiated.

CoPro will stimulate international standardization using a standardization path similar to the MORE project. In MORE, guidelines and a NAMUR recommendation were finalized. Activities are still in progress to initiate an IEC TR based on the NAMUR recommendation.

In CoPro we will continue the strategy of MORE, either in expanding the ongoing standardization activities or in initiating new standardization stimulations. Based on the systematic review of relevant standards and ongoing standardization activities (see chapter 3 above) the following strategy will be the red line for further activities within task 7.5:

1. Identify and condense CoPro results with relevance for potential crucial standardization input.
2. Stimulate a national pre-normative interest group like NAMUR, VDI, AENOR or BSI to pick up and enhance the ideas of CoPro in order to prepare at least one pre-normative guideline or recommendation preferably within the CoPro timeframe. Because NAMUR has the focus on automation technology strategies in process industry we already initiated first discussions with experts of this organization.
3. In parallel to the collaboration with pre-normative interest groups, contacts and discussions with normative standardization bodies will be initiated. First meetings are already arranged with DIN DKE and representatives of IEC TC65.