Industrial Energy-Related Technologies and Systems iets

An IEA Technology Collaboration Programme

IETS Annex XIV Extension

Energy efficiency in the iron- and steel industry

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Annex Manager

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Content

- This annex on energy efficiency in the steel industry is a continuation and a broadened approach on working on **Energy Efficiency in steel industry**.
- focus on applied studies for resource efficiency, training and dissemination and method development.

Partners in Annex XIV
Confirmed and potential partners

Sweden

Sweden will be managing the Annex for the duration of the Annex (**Swerea MEFOS)** previous partners *(**LTU**, **SSAB**, Höganäs)*

Finland

*(**SSAB**, Oulu University, **Åbo Academy**)*

France(ArcelorMittal, …)

Italy

(SSSA)

Belgium

New possible partners (University of Liege, CRM, …)

Japan

(Tohoku University, Nippon Steel and sumitomo Metals Corporation, JFE Steel Corporation, …)

Korea

(RIST, POSCO…)

Australia

(Bluescope Steel, University of Wollongong*,)*

China

(Baosteel…)

Subtasks in Annex XIV

Subtask A. Training and dissemination

Training and dissemination

Subtask B. Methodology development

Subtask C. Applied Process integration studies on Energy efficiency, resource efficiency and greenhouse gas mitigation

Deliverables

The deliverables in the project will be the following:

- Proceedings/summaries of yearly workshops (2 issued, one course also possible to have as a recorded course))
- Professional education material and course/workshop

Industrial Energy-Related Technologies and Systems iets

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IETS Annex XVI Extension

Energy efficiency in industrial SMEs

Annex Manager

Professor Patrik Thollander, Division of Energy Systems,

Linköping University,

Sweden

Annex XVI team

Germany

Ireland

Japan

Sweden

Norway

Italy

Colombia

Content

The objective of this Annex is to enhance practical and scientific knowledge of improved energy end-use in industrial SMEs, through specific studies of:

- Task V : Leader: Rohde, Clemens, Fraunhofer, Germany
  - Energy end-use efficiency policies with emphasis on energy efficiency networks towards industrial SMEs
    - Overview of energy end-use policies and programs
    - Feedback and outcomes
- Task VI: Leader: Osamu Kimura, Central Research Institute of Electric Power Industry, Japan
  - Review of scientific publications towards industrial SMEs
    - Literature review of policy programs
    - Literature review of barriers to and drivers for energy efficiency

Results

TASK V

Presented and published paper at the: 2019 ACEEE Summer Study on Energy Efficiency in Industry, Portland, August 12-14, 2019, s. 3-135-3-150: https://2019aceee.conferencespot.org/index.html#/paper/event-data/f036

TASK VI

Published paper in:

Energies, ISSN 1996-1073, E-ISSN 1996-1073, Vol. 12, nr 7, artikel-id 1338

https://www.mdpi.com/1996-1073/12/7/1338

Industrial Energy-Related Technologies and Systems iets

An IEA Technology Collaboration Programme

IETS Annex XVII Extension
Membrane processes in biorefineries

Frank Lipnizki

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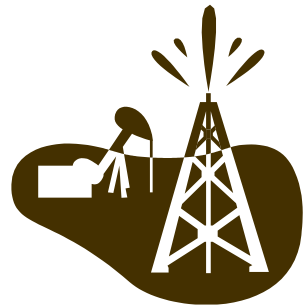
Background



Distillation is an established key separation process in **petrochemical refineries**

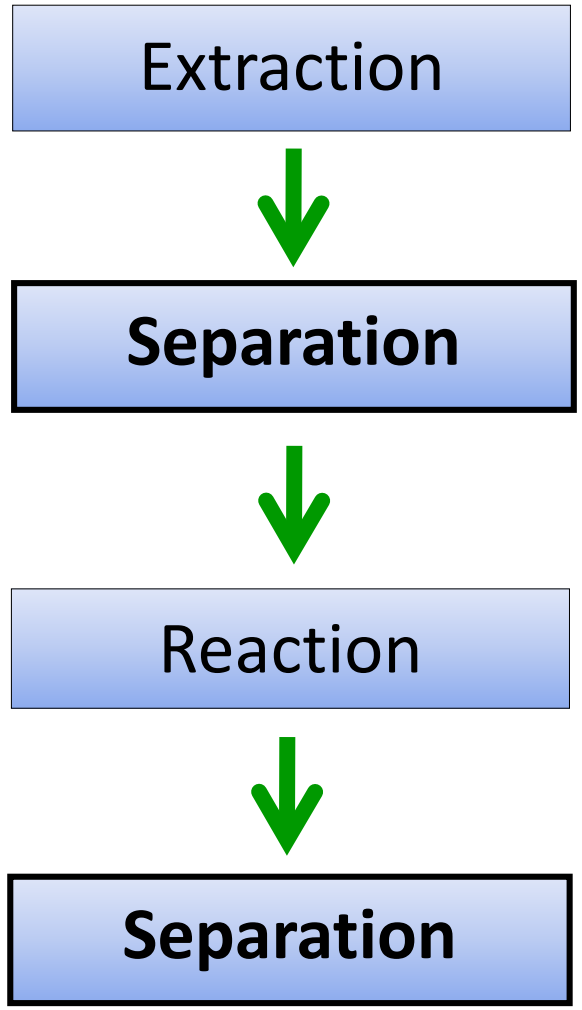
Membrane filtration is foreseen to get a similar role in **biorefineries**

However, membrane processes need to be adopted to biomass applications!

Separation accounts for

60 to 80%*

of the process cost of most mature chemical processes



* Ragauskas et al., *The path forward for biofuels and biomaterials*, Science, 311 (2006) 484

Partners in Annex XVII

Confirmed partners

Austria

- **AEE** (Insitute)

Denmark

- **Aalborg University** (Academia)
- **Technical Univ. of Denmark** (Academia)
- **University of Southern Denmark** (Academia)
- **Alfa Laval Nakskov A/S** (Industry)
- **LiqTech International A/S** (Industry)
- **Aquaporin** (Industry)
- **Novozymes** (Industry)
- **Kaffe Bueno** (Industry)

Germany

- **University of Applied Sciences Mittelhessen** (Academia)
- **Fraunhofer Institute of Ceramic Techniques and Systems** (Intitute)

Portugal

- **Instituto Superior Técnico** (Academia)
- **Universidade NOVA de Lisboa** (Academia)

Sweden

- **Chalmers University of Technology** (Academia)
- **Rise** (Institute)
- **Lund University** (Academia)
- **Ecohelix** (Industry)
- **Nordic Sugar AB** (Industry)
- **Umeå University** (Acafemia)

Italy

- **Nation Research Council of Italy – Institute on Membrane Technology** (Institute)

The Netherlands

- **Pentair** (Industry)
- **University of Twente** (Academia)

Tasks in the extended Annex XVII

Task A.	Separation in biorefineries
Task B.	Integration and optimization of membrane processes in biorefineries
Task C.	Fouling and cleaning of membranes in biorefineries
Task D.	Pretreatment of biomass process streams before membrane separation
Task E.	Emerging membrane processes (MD, FO, ED, VP, PV)
Task F.	Water and wastewater treatment in biorefineries

IETS Annex XVII Extension
Selected publications

2019

- D. Humpert, M. Ebrahimi, A. Stroh and P. Czermak: Recovery of lignosulfonates from spent sulfite liquor using ceramic hollow-fiber membranes, Membranes, DOI: 10.3390/membranes9040045. (**Task B -Integation & optimisation**)
- B. Al-Rudainy, M. Galbe, F. Lipnizki and O. Wallberg. Galactoglucomannan recovery with hydrophilic and hydrophobic membranes: Process performance and cost estimations. Membranes, DOI: 10.3390/membrane9080099. (**Task B Integation & optimisation**)
- G. Rudolph, T. Virtanen, M. Ferrando, C. Güell, F. Lipnizki and M. Kallioinen: A review of in situ real-time monitoring techniques for membrane fouling in the biotechnology, biorefinery and food sectors, Journal of Membrane Science, 588 (2019), Doi:10.1016/j.memsci.2019.117221. (**Task C – Fouling & Cleaning**)