



ANNUAL REPORT

2022



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ACCELERATING THE NECESSARY TRANSFORMATION OF INDUSTRY

Industry is one of the largest GHG (Greenhouse Gas) emitting sectors globally. The transformation of this sector for higher energy efficiency and GHG mitigation is crucial for industrial and societal economy and climate.

The need for industrial GHG mitigation has been highlighted by, e. g., IPCC (the UN Intergovernmental Panel on Climate Change) and IEA (the International Energy Agency), stating that efforts and implementation of novel industrial technologies and systems must be accelerated in near future in order to reach zero emissions by 2050.

Within the industry sector, a large number of competences, scientific disciplines and industry types must cooperate in order to achieve higher energy efficiency and deep decarbonization. For radical reduction of GHG emissions, a complex mix of measures and combinations between existing and novel technologies/systems will be necessary. According to IEA's net zero pathway, almost half of the reductions in 2050 must come from technologies that are currently only at the demonstration or prototype phase.

Analysis and dissemination of knowledge about opportunities and hurdles are crucial for achieving the transformation, both in a short-term and in a long-term perspective. Knowledge, experiences and future uncertainties regarding technical, economic and system aspects are of high importance.

During 2022, we have been focusing on organizing an open and international conference, addressing the need and means for radical reduction of GHG emissions. The conference will take place 9-11 May in Gothenburg, Sweden. Around 40 international experts will present the developments of major novel technologies and systems in industrial energy systems and opportunities and obstacles will be discussed.

Hope to see you there!

INTERNATIONAL ENERGY AGENCY, IEA

IEA - AT THE HEART OF GLOBAL DIALOGUE ON ENERGY

MISSION

The IEA works with governments and industry to shape a secure and sustainable energy future for all.

The IEA is at the heart of global dialogue on energy, providing authoritative analysis, data, policy recommendations, and real-world solutions to help countries provide secure and sustainable energy for all.

The IEA was created in 1974 to help co-ordinate a collective response to major disruptions in the supply of oil. While oil security this remains a key aspect of our work, the IEA has evolved and expanded significantly since its foundation.

Taking an all-fuels, all-technology approach, the IEA recommends policies that enhance the reliability, affordability and sustainability of energy. It examines the full spectrum issues including renewables, oil, gas and coal supply and demand, energy efficiency, clean energy technologies, electricity systems and markets, access to energy, demand-side management, and much more.

Since 2015, the IEA has opened its doors to major emerging countries to expand its global impact, and deepen cooperation in energy security, data and statistics, energy policy analysis, energy efficiency, and the growing use of clean energy technologies.

Source: <https://www.iea.org/about/mission>

AREAS OF WORK

IEA analysis is built upon a foundation of activities and focus areas including data and statistics, training, innovation and international cooperation.

Promoting energy efficiency

The IEA helps governments improve standards, advising them on developing, implementing, and measuring the impact of efficiency policies.

Ensuring energy security

IEA work on energy security ensures that markets remained well supplied, providing information to governments, and helping improve system resilience.

Programmes and partnerships

The IEA works with governments, organisations and agencies around the world to deliver programmes focused on countries, regions or topics.

International collaborations

The IEA works with a broad range of international organisations and forums to ensure secure, affordable and sustainable energy systems.

Promoting digital demand-driven electricity networks

IEA work on digital, demand-driven solutions offering significant benefits to cost reduction, emissions abatement and enhanced energy efficiency.

Data and statistics

Data collection has been at the heart of the IEA's work since the creation, with official energy statistics from more than 100 countries collected on a monthly or annual basis.

Training

For more than four decades, the IEA has carried out training activities around the world on energy statistics, modelling, technology, energy efficiency and renewable policies.

Technology collaboration

With about 40 research collaborations – including the IETS TCP - and about 6,000 experts, the technology programme provides the basis for international public and private research partnerships.

Global engagement

Since 2015, the IEA has opened our doors to eight major emerging economies for a new era of international energy co-operation.

Industry engagement

Meeting with various industry groups on a regular basis, the IEA gains precious insights on how policies shape real-world investments and actions.

Source: <https://www.iea.org/areas-of-work>

ABOUT THE IEA TECHNOLOGY COLLABORATION PROGRAMME (TCP)

Advancing the research, development and commercialization of energy technologies.

The Technology Collaboration Programme supports the work of independent, international groups of experts that enable governments and industries from around the world to lead programmes and projects on a wide range of energy technologies and related issues. The experts in these collaborations work to advance the research, development and commercialisation of energy technologies. The scope and strategy of each collaboration is in keeping with the IEA Shared Goals of energy security, environmental protection and economic growth, as well as engagement worldwide.

The breadth of the analytical expertise in the Technology Collaboration Programme is a unique asset to the global transition to a cleaner energy future.

These collaborations involve over 6 000 experts worldwide who represent nearly 300 public and private organisations located in 55 countries, including many from IEA Association countries such as China, India and Brazil.

Source: <https://www.iea.org/areas-of-work/technology-collaboration>

INDUSTRIAL ENERGY-RELATED TECHNOLOGIES AND SYSTEMS – THE IETS TCP

The IETS TCP is a Technology Collaboration Programme focusing on energy use in a broad range of industry sectors, uniting IEA activities in this area.

Industry offers a significant savings potential at low or even negative cost. The work included in IETS ranges from specific developments of process or energy technologies to overall system aspects, in which energy efficiency is an important part, for practically all types of industry types.

The Mission of the IETS TCP is to foster international co-operation for accelerated research and technology development of industrial energy-related technologies and systems.

BACKGROUND

The IETS program was established in 2005 as a result of a merger, revamping and extension of activities formerly carried out by separate individual programs. The former programs for Pulp & Paper and for Process Integration are now parts of the IETS TCP.

OBJECTIVE

The objective of IETS is to allow OECD Member countries and OECD non-Member countries to work together to foster international co-operation for accelerated research and technology development of industrial energy-related technologies and systems with main focus on end-use technologies, also taking into account other relevant IEA activities.

ACTIVITIES

Through its activities, IETS will increase awareness of technology and energy efficiency in industry, contribute to synergy between different systems and technologies, and enhance international cooperation related to sustainable development.

The Participants are implementing a wide range of co-operative activities in the fields of

- Scientific research,
- Technology and systems research and development,
- Demonstration and deployment,
- Technology and systems foresighting,
- Technology and systems assessment of policies and consequences, and
- Dissemination of information.

The work is organised in Tasks.

Additional information about the IETS TCP and its different activities can be found on the IETS website:

www.iea-industry.org

IETS WORK

The principal work of the IETS TCP is about identifying, observing, following and sharing work among countries and their organizations and industry clusters. This is done through defined projects, so called Tasks, in which experts from countries who choose to take part form a working group with a Task Manager in charge of coordinating.

As of December 2022, the IETS TCP had the following ongoing Tasks (read more about them and their specific activities later in this report):

- Task XI: Industry-based Biorefineries towards Sustainability
- Task XIV: Energy-efficiency in the Iron and Steel Industry (restarting)
- Annex XV: Industrial Excess Heat Recovery – Technologies and Applications
- Task XVII: Membrane Processes in Biorefineries
- Task XVIII: Digitalization, Artificial Intelligence and Related Technologies for Energy Efficiency and GHG Emissions Reduction in Industry
- Task XIX: Electrification in Industry
- Task XX: Knowledge sharing on Industry Transition Roadmaps
- Task XXI: Decarbonizing industrial systems in a circular economy framework

The work of IETS is continuously proceeding and new Tasks are developing in order to meet the arising needs of the IETS members.

IETS MEMBER COUNTRIES AND SPONSORS

As of December 2022, the IETS TCP Member Countries and Contracting Parties were the following:

- Austria: Climate and Energy Fund of the Austrian Federal Government
- Canada: Natural Resources Canada (NRCan)
- Denmark: Danish Energy Agency
- France: ADEME - Agence de l'Environnement et de la Maîtrise de l'Énergie
- Germany: Forschungszentrum Jülich GmbH
- Italy: ENEA – Italian National Agency for New Technologies, Energy and Sustainable Economic Development
- Netherlands: RVO Netherlands Enterprise Agency
- Norway: ENOVA SF
- Portugal: Instituto Superior Técnico, Technical University of Lisbon
- Sweden: Swedish Energy Agency

The following organizations are Sponsors to the IETS TCP, i.e., they can participate in Task work and ExCo meetings, but without the right to vote:

- Central Research Institute of Electric Power Industry, Japan

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- Limerick Institute of Technology, Ireland
 - Lucerne University of Applied Sciences and Arts, Switzerland
 - VTT Technical Research Centre of Finland, Finland
 - NREL – National Renewable Energy Laboratory, USA
 - Aalto University, Finland

WEBSITE: WWW.IEA-IDUSTRY.ORG

The IETS TCP website focuses on IETS projects, findings and collaboration activities. The website consists of an official layer containing background information about IETS, descriptions of Tasks, procedures for participation, lists of events, and publications for downloading.

The IETS website is also the forum for material being internally shared between participants within the TCP. There is a specific password protected section for the ExCo delegates through which meeting agendas, documents and minutes are shared. The IETS Secretariat acts as the webmaster, being responsible for general updates.

HIGHLIGHTS 2022

IETS is the only TCP exclusively for the industrial sector, and there is a big scope for further development. The industrial sector is one of the main sectors with enormous opportunities for energy efficiency, GHG abatement, sustainable power production, and more sustainable raw materials/products. It is well known that industrial energy savings are among the most cost-efficient ways to reduce GHG emissions.

ATTRACTING NEW MEMBERS

During 2021, National Renewable Energy Laboratory (NREL), i.e., the U.S. Department of Energy's primary national laboratory for renewable energy and energy efficiency research and development was invited to be an IETS TCP as sponsors. The application was approved by the CERT (Committee on Energy Research and Technology) early 2022. Also Aalto University, Finland was invited as a sponsor in March 2022 and approved by the CERT in June 2022.

THE IMPORTANCE OF NETWORKS

The visibility of the IETS TCP is also important in the member countries to enhance the cooperative aspect internally. As a TCP covering all kinds of industrial activities, implementing National Support Groups (NSGs) on the ExCo level provides delegates with a broader platform for discussions and dissemination nationally. In general, the idea with an NSG is its evaluating and advising function when it comes to assisting the country's ExCo representative in responding to inquiries of different character from the IETS Chair, Secretariat and the ExCo. The NSG network is also important for the future work of the IETS TCP as it can enhance and spread the knowledge about the TCP in relevant contexts in the IETS member countries and thus contribute to the concrete as well as overall strategic development of the IETS TCP.

In October 2021, the first meeting gathering representatives from all IETS National Support Groups was held. The aim is to have at least one meeting every year, but unfortunately, no NSG meeting was held in 2022.

THE MATRIX

Since 2013 the IETS TCP has been mapping areas of interest and industry initiatives in the IETS member countries respectively, resulting in a general picture of the sectors with most activities and the technology and system areas of highest interest. This compilation of these fields of interest, shared by several IETS member countries, is now referred to as the Matrix.

CHANGES IN MEMBERS AND DELEGATES

Elliot Mari, Ademe, is the new French delegate and Antoine Deswaziere, Ademe, is the new alternate delegate.

For a complete list of delegates and alternates, please refer to page 29.

COMMUNICATION

The IETS website is the main communication channel – in addition to personal meetings – and attracted about 7 000 visitors from all over the world during 2022. The website is continuously updated with current information, e.g., regarding activities in and status updates from Task work, seminars and conferences, news and new publications. Short summaries of the ExCo meeting minutes are also posted at the website.

In 2018, the EITS Secretariat started producing fact sheets on important and relevant topics, based on Task reports, workshop summaries etc. The following Topic Sheets were produced and published during 2022:

- **Topic sheet no 15**, October 2022: Decarbonizing Industrial Systems in a Circular Economy Framework. This fact sheet is based on the final report from the first Subtask of Task XXI, which aims to investigate the topic of Circular Carbon from an industry perspective, i.e., to describe industrial energy systems in the context of a sustainable, fossil-free economy, striving to meet the targets of both concepts, the circular economy and a sustainable energy system.
- **Topic sheet no 16**, October 2022: Industrial Excess Heat. This fact sheet is based on the final report from Annex XV – Industrial Excess Heat Recovery Task 3. The main background for Annex XV is the increasing awareness about industrial excess heat as a potential resource for contributing to an improved economy and sustainability in larger systems.
- **Topic sheet no 17**, October 2022: Consequences for Excess Heat Levels of Future Changes in Industrial Energy Systems. This fact sheet is based specifically on Subtask 2 in Annex XV – Industrial Excess Heat Recovery Task 3. Two issues of the IETS Newsletter were distributed online to about 150 subscribers and posted at the IETS website. The Secretariat also supplied an Annual Brief for the EUWP (Working Party on Energy End-Use Technologies – one of CERT's – the IEA Committee on Energy Research and Technology – four working parties).

To increase visibility and dissemination, news, reports etc. are also posted on Twitter and LinkedIn. A LinkedIn group for knowledge sharing is created in order for members to share information and experiences.

EVENTS 2022

EXECUTIVE COMMITTEE MEETINGS

- 34th IETS ExCo Meeting online, 24-25 May
- 35th IETS ExCo Meeting in Copenhagen 30 November- 1 December

In addition, two intermediate half-day meetings were held

- 2nd intermediate meeting online 10 March
- 3rd intermediate meeting online 29 September

WORKSHOPS & WEBINARS

Also in 2022, most events were digital, gathering quite a larger number of participants and giving more stakeholders the opportunity to engage in discussions. The following Task related but open webinars and workshops were held:

Workshop on CCUS Technologies in Industrial Systems (1 March)

This international online workshop was organized jointly by the IETS TCP and IEAGHG (IEA Greenhouse Gas R&D Programme).

The aims of this workshop were:

- To present experiences and important examples of ongoing projects in the planning, implementation and/or operational phases of CCUS/BECCS/DACCS technologies in industry, with emphasis on design, integration and role of these technologies from a systems perspective.
- To discuss the need for further work, including opportunities for international collaboration between the IETS and the IEAGHG TCPs in IEA.

Workshop on Circular Bioeconomy and Biomass Oriented Industrial Symbiosis (16 February)

The workshop was held online as part of the work performed in Task XI – Industry-Based Biorefineries towards Sustainability in order to explore the possibilities to start a new Subtask.

The objectives of the workshop were to:

- Review the emerging trends and challenges of industrial-based symbiosis systems to accelerate the growth of circular bioeconomy
- Identify optimized solutions based on circularity approaches
- Review methodologies to assess the potential for establishing industrial symbiosis involving biorefineries and other industrial systems using biomass
- Develop harmonized circularity metrics

Networking Workshop “Circular Carbon” (5 April)

This workshop was organized by IETS Task XXI “Decarbonizing industrial systems in a circular economy framework”, with speakers from several other TCPs. The exchange took the form of several elevator pitches and an accompanying discussion format.

Webinar on Digitalization Strategy Roadmapping (11 May)

Task XVIII, Digitalization, Artificial Intelligence and Related Technologies for Energy Efficiency and GHG Emissions Reduction in Industry, organized a webinar on roadmapping the implementation of digitalization in the energy-intensive process industries, with the perspective of Net Zero for 2050.

Workshop on Energy Efficiency in the Iron and Steel Industry (18 May)

In order to identify ways to restart Task XIV - Energy Efficiency in the Iron and Steel Industry, the IETS Secretariat organized this workshop.

During the workshop, the current R&D situation regarding energy efficiency in the iron and steel industry in the IETS member countries was presented. During the following discussion, the purpose was to identify areas where there could be an interest to cooperate. Thus, the aims of the workshop were to identify areas of common interest and identify possible collaboration activities in a new Subtask.

Workshop Task XIX Electrification in Industry Workshop – (onsite in Linz 22 October)

This workshop was organized together with the NEFI (New Energy For Industry). The aims were to give an overview about the broad topic of industrial electrification, its importance in the decarbonization innovation system, and its international context: technologies for direct and indirect electrification, country-specific perspectives from the Task XIX participants, energy resource demand from industries, demand for system and infrastructure services.

ONGOING TASKS 2022

TASK XI: INDUSTRY-BASED BIOREFINERIES TOWARDS SUSTAINABILITY

Responsible authors: Marzouk Benali, Natural Resources Canada/CanmetENERGY and Paul Stuart, Polytechnique Montréal and EnVertis Consulting (Canada)

Task Members: Austria, Canada, Portugal and Sweden

Projected ending date of Task XI: January 31st, 2025

SCOPE OF TASK XI

The main objective of Task XI is to promote systems analysis and decision support systems related to identifying sustainable industry-based biorefineries.

The reorientation of Task XI reaffirmed its initial mission considering the “biomass agnostic” bioeconomy perspective, with an increased emphasis on deep decarbonization of various industry sectors through the integration of different biorefinery pathways, to ultimately achieve net zero or negative GHG emissions. In addition, we will seek to collaborate with other Tasks in IETS and other TCPs, for all Task XI Subtasks that may be established.

As the bioeconomy continues to evolve, innovative solutions need to be found considering, for example:

1. Specific challenges of implicated sectors, and cross-sectoral value chains being created in the bioeconomy, considering near-term and longer-term policy landscapes;
2. Advanced energy analytical methods for sites transforming to the bioeconomy, especially in support of identifying long-term strategic approaches to achieving net zero GHG emissions;
3. Potential synergies between upstream and downstream stakeholders across bioeconomy value chains, and new forms of industrial symbiosis including through digitalization; and
4. Identification of opportunities for new circular bioeconomy value chains.

ON-GOING SUBTASKS

Subtask 5: Decision support tools and ex-ante research for evaluating bioeconomy transformation strategies.

Subtask 6: Technology pathways towards net-zero/negative emission biorefineries.

PROJECTED TASK XI DELIVERABLES

- Decision support tools and ex-ante methodologies to support the deployment of the bioeconomy, to be disseminated across IETS and IEA Bioenergy TCPs.
- Roadmaps for decision-making processes to support the transition of industry towards the bioeconomy, considering sustainability.
- Emerging biorefinery technologies emphasizing the potential to achieve net-zero or negative GHG emissions.

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- Guidelines and recommendations for future biorefinery scenarios analysis and key success factors to achieve the bioeconomy net-zero GHG emissions goals, to be disseminated across the IETS and IEA Bioenergy TCPs as well as industrial bioeconomy stakeholders.
 - Biorefinery case studies provided as technical factsheets.

MAIN ACTIVITIES DURING 2022

No information available.

WORK PLANNED FOR 2023

No information available.

CONTACT DETAILS

Task manager:

Paul Stuart, Chemical Engineering Department – Polytechnique Montreal

E-mail: paul.stuart@polymtl.ca

Task co-manager:

Marzouk Benali, CanmetENERGY – Natural Resources Canada

E-mail: marzouk.benali@nrcan-rncan.gc.ca

TASK XIV: ENERGY-EFFICIENCY IN THE IRON AND STEEL INDUSTRY

Responsible author: IETS Secretariat

Task Members: TBD

Time schedule, Tasks 1-3: 1 January 2011 – 31 May 2014

Time schedule, new Subtasks: TBD

DESCRIPTION OF CURRENT SUBTASKS

This Task was put on hold at the IETS ExCo meeting in May 2019.

ACTIVITIES DURING 2022

A workshop was organised 18 May with representatives from eight member countries and also from the IEA Secretariat. The aims with the workshop were to identify areas of common interest and possible collaboration activities in a new Task within IETS.

During the workshop the current R&D situation concerning energy efficiency in the iron and steel industry in our member countries was presented by the country representatives. In the following discussion, three main areas were identified for possible future collaboration and information exchange.

- Waste heat recovery
- Low carbon energy efficient solutions/systems
- Modelling

Furthermore, discussions have taken place to identify possible participating organisations in the Task.

WORK PLANNED FOR 2023

Identification of Task Manager and groups to participate in the Task.

CONTACT DETAILS

Task manager:

Vacant, please contact the IETS Secretariat for more information.

ANNEX*) XV: INDUSTRIAL EXCESS HEAT RECOVERY – TECHNOLOGIES AND APPLICATIONS

Responsible author: René Hofmann, TU Wien, Austria

Task member countries: Austria, Canada, France, Norway, Portugal, Sweden and Switzerland.

Time schedule, current term: May 2019 to March 2023 (originally started in 2011)

*) Annex XV didn't change from "Annex" to "Task" when the new Legal Text was implemented in 2022, but if granted a continuation in 2023 it will be for a new Subtask within Task XV.

BACKGROUND AND DESCRIPTION

This Annex (now Task XV) was originally suggested in 2008. Annex XV Task 1 was finalized in the spring 2015. From September 2016 to August 2018 Task 2 was successfully completed. Nevertheless, a number of further questions were identified which were tackled within the framework Task 3 (01.11.2019 to 31.10.2021). The Annex takes on a multi-disciplinary approach to the concept of excess heat recovery integrated in industrial complexes, aiming at the optimization of energy efficiency in global terms. The approach is based on industry needs and application, combining the knowledge of industrial technologies with energy efficiency and cost-effectiveness. The findings from Task 2 lead to a number of areas, which resulted in Task 3. Thus, the present Annex XV Task 3 (now Task XV Subtask 3) enabled to broaden the scope and included some new aspects, which may not be considered separately for changed framework conditions within an industrial environment.

Activity 1: The role of excess heat in industry and industrial symbiosis

Within the framework of this activity, approaches and experiences from industrial symbiosis projects as well as from scientific projects that highlight opportunities will be exchanged and discussed. Based on the experience and guidelines gathered, implementation strategies can be derived that address both short-term and long-term perspectives. The outcome of this activity is expected to be a compilation of methodologies to accurately assess system-wide excess heat potentials and key opportunities and risks of industrial symbiosis. In addition, recommendations for risk assessment and future regulatory changes to increase waste heat utilization in the context of industrial symbiosis will be developed.

Activity 2: Strategic process integration/intensification for future changes in industrial energy systems

To avoid dead-ends or "lock-in" in heat recovery, the following aspects and experiences as well as scientific projects identifying methods and guidelines should be shared and discussed in this activity:

- Importance of and approaches to process integration and consequences for the overall energy system in an industry when radical economic and technical changes are introduced.
- Optimization approaches and practical experiences in introducing new technologies/systems
- Methodical handling of uncertainty about policy instruments and their future development
- Consideration of informational and social, economic, financial, and technical risks
- Experience with strategic planning and "ex ante" evaluation, i.e., planning needs, including timing, of combinations of measures to achieve deep decarbonization
- Experience with commissioning and operation of demonstration plants and comparisons with expected performance

Activity 3: Ongoing projects at different TRL levels and systematical knowledge transfer

Large-scale implementation projects for waste heat utilization and the experience gained from them help to initiate new projects. During the previous Subtask activity, many participants expressed the need to include research and R&D projects at higher TRL levels in the Task evaluation and discussion.

The main goal of this activity is to build on the collected and compiled project information from Subtask 3 and continue work on an online database for excess heat projects. Proposals will be developed on what information should be included in the database, how it should be included, and how the database can be used effectively for future assessments. In this way, clear, repeatable policies and guidelines can be established. Data requirements can be collected through questionnaires to task participants. Methods and metrics for evaluating excess heat projects should be collected.

ACTIVITIES DURING 2022

The Annex work primarily focused on concluding the current Task and completing the Final Report.

PLANNED WORK

During 2023, focus will be on formalizing a proposal for continuation, secure funding and start the new Subtask. Proposed activities for Subtask 4 in Task XV:

- Workshops (Task XV, international/national)
- 3 Face-to-face Meetings
 - meeting early in the task spring 2024
 - midterm meeting - end 2024 / early 2025
 - final task meeting – 09.2025
- Quarterly Web meetings
- Contribution via pre-defined templates to organize the synthesis of the findings

CONTACT DETAILS

Task Manager:

René Hofmann, Head of the Institute of Energy Systems and Thermodynamics, TU Wien
Getreidemarkt 9/302, 1060 Vienna, Austria

E-mail: Rene.Hofmann@tuwien.ac.at

TASK XVII: MEMBRANE PROCESSES IN BIOREFINERIES

Responsible author: Frank Lipnizki, Lund University, Sweden

Task Members: Austria, Denmark, France, Germany, Italy, Netherlands, Portugal, and Sweden.

Time Schedule initial Tasks: 1 January 2014 – 30 June 2017

Time Schedule Current Subtasks: 1 April 2019 – 30 March 2022

DESCRIPTION OF TASK

The transition of our society from a society largely dependent on fossil-based materials to a climate-smart society based on biomass does not only mean a change in the raw material base, but it will also require that new production concepts in the form of biorefineries are developed.

Within the concept of biorefineries membrane processes have been identified as a key separation technology due to their high selectivity and low energy consumption. While the design and operation of membrane processes in other industrial sectors, e.g., the dairy industry, is well established, the design, integration and operation of membrane processes in biorefineries is largely empirical. The fact that process streams in biorefineries contain a large variety of components increases further the complexity.

The Task focused initially exclusively on biorefineries based on lignocellulosic biomass, while it then extended its scope to use membrane technology in the overall concept of biorefineries based on different renewable resources ranging from algae to agricultural residuals. The accessible knowledge will be mapped and structured and potential knowledge gaps will be identified together with the necessary actions to close those.

Thus the objectives of the extended IETS Task are the development of energy-efficient and sustainable concepts of biorefineries utilizing the opportunities of membrane technology to produce biochemical, biofuels and energy based on renewable resources by:

- Maintaining and extending the current Task network of industrial and academic experts by focusing on the integration and optimization of membrane processes, i.e., membrane reactors for chemical and biological reactions.
- Mapping and structuring the current knowledge and experience related to fouling and cleaning of membrane processes in biorefineries and investigate the potential use of advanced technologies, e.g., X-ray tomography for in-situ analysis and CFD for fouling modelling.
- Mapping of current membrane developments, i.e., Aquaporin, mixed matrix membranes, artificial water channels, and ceramic nanofiltration membranes and use dynamic membrane systems for energy-efficient concentration of viscous and/or high solid products.
- Extending the focus to emerging membrane processes to, e.g., electrodialysis and membrane adsorbers and mapping their potential in the concept of biorefineries.
- Investigating the use of membrane process for the recovery of water and resources in biorefineries, e.g., through the development of new membrane-based solutions for combined water and resource recovery, e.g., hemicellulose recovery for process water

The dissemination of the results will take place during Task meetings, seminars with industrial participation, presentations at conferences and publications for the general public and scientific community. Furthermore, the results will be publicly available on the webpage of the Task.

ACTIVITIES DURING 2022

The Task work primarily focused on concluding the current Task and completing the Final Report.

WORK PLANNED FOR 2023

- 8th – 11th of May, Workshops and sessions as part of the Energy Future in Industry conference, Gothenburg, Sweden.
- September 2023, Task Meeting (online).
- November 2023, Task Workshop (online)

CONTACT DETAILS

Task Manager:

Frank Lipnizki, Department of Chemical Engineering, Lund University, Sweden

E-mail: frank.lipnizki@chemeng.lth.se

TASK XVIII - DIGITALIZATION, ARTIFICIAL INTELLIGENCE AND RELATED TECHNOLOGIES FOR ENERGY EFFICIENCY AND GHG EMISSIONS REDUCTION IN INDUSTRY

Responsible author: Mouloud Amazouz, CanmetENERGY, Natural Resources Canada

Task Members: Austria, Canada, Denmark, France, Germany, Portugal, Netherlands, Italy and Sweden and sponsor organization in Finland (VTT).

Time Schedule Subtask 1: December 2018 – September 2021. (Final report approved and published)
Time Schedule current Subtasks: January 2021 – December 2023

SCOPE

Energy-intensive process industries - such as forestry, mining and smelting, oil and gas, energy production, chemical and fertilizers - increasingly have implemented sophisticated data management systems to capture process data across the supply chain for logistical decisions, as well as at the process level for quality, control and automation purposes. This dataset has potential to be at the foundation of the opportunity to identify new strategies for achieving radical GHG emissions reduction – related to significantly increased efficiency and improved competitiveness. Harnessing and analyzing a wide variety of data from different sources through Process Digitalization Technologies will allow energy-intensive process sectors to, amongst other things, improve product quality, increase manufacturing throughput, grow insight into the root causes of manufacturing issues, reduce machine failure and downtime, and render supply chains more efficient.

DESCRIPTION OF TASK XVIII

The main objective of task XVIII is to advance knowledge and development of digitalization, artificial intelligence and related technologies to improve the economic and environmental performance of targeted energy and GHG-intensive industries. The initiative would seek to assemble a network of academic, research labs, IT providers and process industry stakeholders to cooperate on the availability, quality and use of data (quality, quantity, location, operational, energy, etc.); to align capacity; and inform decision-making relevant to the targeted sectors.

To achieve this objective, the Task goals are:

- To create an international network and information infrastructure for stakeholders to exchange knowledge in the area of digitalization technologies.
- To facilitate joint development of new knowledge and expertise on Digitalization.
- To support and accelerate the deployment of digitalization practices in the energy-intensive process industries.

MAIN DELEVERABLES

- Proposals for subtasks submitted to the IETS Executive Committee
- Status reports presented to the IETS Executive Committee.
- Contributions to IETS Newsletter
- Reports and news from each Subtask to be published on webpages.

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- Articles in scientific reviewed journals.
 - Proceedings/summaries of workshops.

SUBTASKS

Subtask 1 – Needs and interests assessments

Subtask 1 started in 2019 and completed in 2021.

Subtask Manager: Paul Stuart, Polytechnique Montréal (Canada)

Subtask 2 – Methods and Applications of Digital Twins

Subtask managers: René Hofmann (TU Wien, Austria) and Lauri Kujanpää (VTT, Finland)

Time frame: 09 - 2021 to 12 - 2024.

Subtask 2 focuses on Methods and Applications of Digital Twins to promote the application of DTs in industry, in order to improve energy efficiency and reduce GHG emissions. Subtask 2 has the following sub objectives:

Overview of methods and applications of DTs and their requirements for different industry sectors

Analysis of the potential benefits of these methods, focusing on the impact on energy efficiency and GHG emissions reduction

Creation of an international, interdisciplinary network of research and industry

Subtask 3 – Lessons Learned and Created Values by Digitalization

Subtask Managers: Zheng (Grace) Ma (SDU, Denmark) and Michelle Levesque (NRCan, Canada)

Time frame: 09 - 2021 to 12 - 2024.

Subtask 3 will review and explore the barriers and incentives and existing business models. It will include:

Literature study to review the barriers and incentives and existing business models.

Qualitative and quantitative data collection from case studies.

Simulations (agent based modeling and discrete event simulation) to investigate the stakeholders' adoption of digitalization strategies

Subtask 4 – Roadmapping the implementation of digitalization in the energy-intensive process industries

Subtask Managers: Tom van der Velde (Tata Steel – NL) and Paul Stuart (Polytechnique Montréal – CA)

Time frame: Subtask 4 proposal is under development

Subtask 4 seeks to support the Task XVIII main objective's achievement by applying hands on measures to realize decarbonization by digitalization through road mapping its implementation in the large emitter industries based on practical objectives and constraints that must be faced by operating plants and corporations.

ACTIVITIES DURING 2022

At the task level, the following activities have been carried out.

- Preparation of the 2022 IETS annual report
- Presentation of the task overview at the ExCo meetings in May and November 2022

Subtask 1

- Final report approved and issued It can be found on the IETS website. <https://iea-industry.org/app/uploads/Task-XVIII-Subtask-1-Final-Report-20210915.pdf>

Subtask 2

- Finished the report on terms and definitions in the area of digital twins for industrial energy systems.
- Evaluated the questionnaire on the state-of-the-art of digital twins in industry and compiled the results into a report.
- Organized a second round of project presentation sessions with a focus on specific method and applications of digital twins in industrial energy systems.
- The reports and the recordings of the project presentation session are available in the Subtask 2 cloud storage.

Subtask 3

- Sub-task co-lead meetings for planning activities
- A scoping review to identify case studies from the mining sector was undertaken by Natural Resources Canada. A manuscript has been drafted and submitted for publication in the CIM Journal.
- Webinar held on October 26, 2022, titled “Digital technologies for energy efficiency and decarbonization in mining”. The event provided participants with an overview of some of the current digital technologies implemented in the mining sector and their benefits to highlight their potential impact on decarbonization in the industry.
- 2 additional case studies were added to the repository which now includes a total of 9 case studies:
 - KI4ETA - Artificial Intelligence for Energy Technology and Applications in Production Software AG | Energy Informatics
 - Structured data collection and analytics for reduced carbon footprint mobile HVACs Case-Christonik | Energy Informatics
- A paper which reviewed 207 energy informatics projects collected until the second quarter of 2022 was published: Howard, D. A., Ma, Z. G., & Jørgensen, B. N. (2022). Application of Energy Informatics in Danish Research Projects. *Energy Informatics*, 5(Suppl. 4.), [57]. <https://doi.org/10.1186/s42162-022-00245-0>

Subtask 4

- Webinar on digitalization strategy roadmapping on May 11, 2022 to initiate a working group

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- Started the organization of a first working group meeting entitled “Digitalization for an Energy Efficient and Resilient Industry: Strategic approaches”.

PLANNED WORK FOR 2023

Task XVIII

- Prepare and submit the annual report for 2023
- Hold an intra-task meeting to discuss the status of the subtasks in terms of achievements, end dates and future subtasks.
- Prepare and present the task overview to the IETS ExCo meetings.
- Organize a session on digitalization at the Energy Future in Industry conference, May 9-11, 2023
- Participate to the inter task meeting to explore concrete collaboration, May 11, 2023.
- Continue to explore collaborations with other tasks of IETS and other TCPs

Subtask 2:

- Organize one or two workshops to discuss and evaluate potential business models for further establishing digital twins in industry.
- Organize another batch of project presentation sessions with updated on ongoing projects and new insights.

Subtask 3:

- Webinars will be held to disseminate information on additional case studies as well as promote sub-task 3 for recruiting additional participants.
- Sub-Task 3 will continue to reach out more industry and technology providers to gather more case studies for the collection as featured on the website.
- Participation in Swedish Consortium Workshop on “Digitalization and AI in Industry for Energy Efficiency and GHG Mitigation”

Subtask 4

- Hold a face-to-face meeting to launch a new working group entitled “Digitalization for an Energy Efficient and Resilient Industry: Strategic Approaches.”
- Finalize Subtask 4 proposal and submit it for review and approval by IETS ExCo.
- Present the Subtask overview at IETS ExCo meetings.

CONTACT DETAILS

Task Manager:

Mouloud Amazouz, CanmetENERGY, Natural Resources Canada

Email: mouloud.amazouz@canada.ca

Subtask 2 - Methods and Applications of Digital Twins

René Hofmann, TU Wien, Austria

Email: Rene.Hofmann@tuwien.ac.at

Lauri Kujanpää , VTT, Finland

Email: lauri.kujanpaa@vtt.fi

Subtask 3 - Lessons Learned and Created Values by Digitalization

Zheng (Grace) Ma, SDU, Denmark

Email: zma@mmmi.sdu.dk

Michelle Levesque, CanmetENERGY, Canada

Email: michelle.levesque@canada.ca

Subtask 4 - Roadmapping the implementation of digitalization in the energy-intensive process industries

Tom van der Velde, Tata Steel, Netherlands

Email: T.van-der-Velde@tatasteelurope.com

Paul Stuart, Polytechnique Montréal, Canada

Email: paul.stuart@polymtl.ca

TASK XIX - ELECTRIFICATION IN INDUSTRY

Responsible author: Jonathan Moncada Botero, TNO, Netherlands

Task Members: Sweden, Austria, Denmark, Netherlands, Germany, France, Canada and sponsor organization from the US.

Time Schedule: September 2019 – June 2023

DESCRIPTION OF TASK

The Task aims to be a platform for enhancing collaboration between countries in the area of industrial electrification. The focus of the Task is on the system aspects of industrial electrification rather than on the technologies within each specific pathway or process. As such, the Task aims to foster the creation of “critical mass” in the area of industrial electrification. Early 2021, Subtask 2 started with drafting a more detailed workplan and identification of the final group of participants. The objective of the current Subtask, Enabling a shared view on system aspects of industrial electrification, is to build and strengthen the international ecosystem of industrial electrification with a focus on system impact. Subtask 2 aims at facilitating exchange of knowledge and lessons learned, increase awareness and international collaboration. It entails taking stock of technologies for electrification of industry, sharing and aligning insight and methodologies, identify best practices, broaden awareness by facilitating sharing.

ACTIVITIES COMPLETED DURING 2022

No information available.

WORK PLANNED FOR 2023

No information available.

CONTACT DETAILS

Task Manager:

Jonathan Moncada Botero, TNO, the Netherlands

Email: jonathan.moncadabotero@tno.nl

TASK XX KNOWLEDGE SHARING ON INDUSTRY TRANSITION ROADMAPS

Responsible author: Elliot Mari, ADEME

Task members: France, Germany, Netherlands, Italy, Norway, Sweden, Austria, Denmark, Canada

Time Schedule: May 2021 - November 2022

BACKGROUND

Growing concerns about climate change and the need for deep reduction in global greenhouse gas (GHG) emissions have prompted the development of public industry roadmaps to explore decarbonisation plans and demonstrate commitments. They have thus gained strong interest among governments and industry leaders to the point where industry roadmaps have become an object of study on their own upon which meta-analyses are conducted. The aim of the first year of activity was to capture an overview and to analyse industry roadmaps methodologies employed in different TCP member countries considering the national industry context.

DESCRIPTION

- Scope: National industry roadmaps
 - Main deliverables: One final report to be published in 2023.
 - Duration: 1 year
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ACTIVITIES DURING 2022

- Workshop in April 2022 “Industry roadmaps: managing the frontier between modelling and narratives.”
 - 12 bilateral interviews with national industry experts
 - Final report to be published in 2023.
-

PLANNED WORK FOR 2023

No future work planned to date.

CONTACT DETAILS

Task Manager:

Elliot Mari, Decarbonization Engineer at ADEME, France

Email: elliot.mari@ademe.fr

TASK XXI - DECARBONIZING INDUSTRIAL SYSTEMS IN A CIRCULAR ECONOMY FRAMEWORK

Responsible author: Simon Moser, Energieinstitut an der JKU Linz

Task members: Contributions from Austria, Sweden, Denmark, Portugal, Italy, (Norway, Netherlands)

Time Schedule: July 2022 – December 2024

BACKGROUND

Task XXI aims to investigate the topic of circular carbon from an industry perspective, i.e., to describe industrial energy systems in the context of a sustainable, fossil-free economy, striving to meet the targets of both concepts, the circular economy and a sustainable energy system.

In order to delimitate from the focus of the work done in other IEA TCPs, Subtask 2 Circular Carbon focuses the integration of carbon capture technologies and systems in industry and potential technical and techno-economic pathways for the reuse of the carbon through CCU.

Industrial symbiosis is an approach aiming to make industrial processes more efficient and circular through collaborations across organizational and sectorial boundaries. With Subtask 3 Industrial Symbiosis, industrial symbiosis is to receive a central place in the range of activities of the IETS. Due to the focus of the IETS, energy and greenhouse gas emissions are central, which explains the integration under the umbrella of a joint task with Circular Carbon.

DESCRIPTION

- Subtask 2 Circular Carbon & Subtask 3 Industrial Symbiosis
 - Final Report (December 2024)
 - 2022-07-01 until 2024-12-31
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ACTIVITIES DURING 2022

- Activities, meetings and workshops: Submit short descriptions of events, including e.g. main conclusions, participants, etc.
 - IETS Task 21 Networking workshop: on April 5th 2022, a networking workshop of IETS Task 21 with other IETS Tasks and IEA TCPs was arranged by WIVA P&G. Seventeen participants discussed on the issue of circular carbon, among others from the Bioenergy TCP, from Hydrogen TCP, from ETSAP TCP, etc. The participants supported the idea to continue the exchange among TCPs and Tasks.
 - Furthermore, IETS-21 participated in the Task-11 workshop on Circular Bioeconomy on February 16th 2022; IETS Chair Thore Berntsson represented Task-21 in a meeting with IEAGHG; furthermore, IETS-21 status was presented at the final online meeting of the ISO2CHEM EU-project.
- Reports (and their availability)
 - Final report of phase 1: <https://iea-industry.org/publications/final-report-task-xxi-subtask-1/>

WORK PLANNED FOR 2023

- Three interactive hands-on workshops with the participants of IETS Task 21
- IETS Task 21 session at the international IETS Conference in Gothenburg in May 2023
- Networking meeting beforehand the conference, organized by IETS Task 11
- Networking meeting organized by the IETS Task 21 subtask leaders in late 2023
- National and international surveys on the perception of carbon capture and best practices of Industrial Symbiosis.

CONTACT DETAILS

Task Management

Simon Moser, Energieinstitut an der JKU Linz, moser@energieinstitut-linz.at

Subtask 2 Circular Carbon

Hans Böhm / Simon Moser (Subtask 2 Circular Carbon), Energieinstitut an der JKU Linz, boehm@energieinstitut-linz.at

Subtask 3 Industrial Symbiosis

Rickard Fornell, RISE, rickard.fornell@ri.se

IETS EXECUTIVE COMMITTEE MEMBERS 2022

AUSTRIA

Delegate: Elvira Lutter, the Climate and Energy Fund of the Austrian Federal Government: elvira.lutter@klimafonds.gv.at

Alternate: Rene Hofmann, TU Wien: Rene.Hofmann@tuwien.ac.at

CANADA

Delegate: Eric Soucy, CanmetENERGY: eric.soucy@NRCan-RNCan.gc.ca

Alternate: Fiona Zuzarte, Office of Energy Research and Development: fiona.zuzarte@NRCan-RNCan.gc.ca

DENMARK

Delegate: Brian Elmegaard, DTU - Technical University of Denmark: be@mek.dtu.dk

Alternate: Jan Sandvig Nielsen, Weel & Sandvig Energy and Process Innovation: jsn@weel-sandvig.dk

FRANCE

Delegate: Elliot Mari, ADEME: elliott.mari@ademe.fr

Alternate: Antoine Deswaziere, ADEME: antoine.deswaziere@ademe.france

GERMANY

Delegate: Gordon Kaußen, Forschungszentrum Jülich GmbH: g.kaussen@fz-juelich.de

Alternate: Rene Gail, Forschungszentrum Jülich GmbH: r.gail@fz-juelich.de

ITALY

Delegate: Stefano Stendardo, ENEA: stefano.stendardo@enea.it

Alternate: Simone Maggiore, Ricerca sul Sistema Energetico – RSE SpA: simone.maggiore@rse-web.it

NORWAY

Delegate: Marit Sandbakk, ENOVA SF: marik.sandbakk@enova.no

Alternate: Anne Merethe Kristiansen, ENOVA SF: anne.merethe.kristiansen@enova.no

PORTUGAL

Delegate: Clemente Pedro Nunes, Technical University of Lisbon: pedronunes@gml.pt

Alternate: Isabel Cabrita, Institute for Higher Studies in Education and Sciences, ISEC Lisboa:
isabel.cabrita@iseclisboa.pt

SWEDEN

Delegate: Fredrik Backman, Swedish Energy Agency: fredrik.backman@energimyndigheten.se

Alternate: Thore Berntsson, CIT Industriell Energi: thore.berntsson@chalmersindustrietechnik.se

THE NETHERLANDS

Delegate: Maurits Clement, Netherlands Enterprise Agency: maurits.clement@rvo.nl

Alternate: Joop Bormans, RVO Netherlands Enterprise Agency: joop.bormans@rvo.nl

COORDINATORS 2022

IETS EXECUTIVE COMMITTEE CHAIR

Thore Berntsson, Sweden: thore.berntsson@chalmersindustriteknik.se

IETS EXECUTIVE COMMITTEE VICE CHAIRS

Clemente Pedro Nunes, Portugal: c.pedronunes@gml.pt

Eric Soucy, Canada: eric.soucy@canada.ca

IETS EXECUTIVE COMMITTEE SECRETARIAT

Heléne Johansson, Sweden: helene.johansson@chalmersindustriteknik.se

Per-Åke Franck, Sweden: per-ake.franck@chalmersindustriteknik.se

TASK MANAGERS (ACTIVE TASKS)

TASK XI: INDUSTRY-BASED BIOREFINERIES TOWARDS SUSTAINABILITY

Paul Stuart: paul.stuart@polymtl.ca
Polytechnique Montréal, Canada

TASK XIV: ENERGY-EFFICIENCY IN THE IRON AND STEEL INDUSTRY

Vacant – please contact Per-Åke Franck: per-ake.franck@chalmersindustrietechnik.se

ANNEX XV: INDUSTRIAL EXCESS HEAT RECOVERY

Rene Hofmann: Rene.Hofmann@ait.ac.at
Vienna University of Technology and AIT, Centre for Energy, Austria

TASK XVII: MEMBRANE PROCESSES IN BIOREFINERIES

Frank Lipnizki: frank.lipnizki@chemeng.lth.se
Department of Chemical Engineering, Lund University, Sweden

TASK XVIII: DIGITALIZATION, ARTIFICIAL INTELLIGENCE AND RELATED TECHNOLOGIES FOR ENERGY EFFICIENCY AND GHG EMISSIONS REDUCTION IN INDUSTRY

Mouloud Amazouz: mouloud.amazouz@canada.ca
CanmetENERGY, Natural Resources Canada

TASK XIX: ELECTRIFICATION IN INDUSTRY

Jonathan Moncada Botero, TNO, Netherlands
jonathan.moncadabotero@tno.nl

TASK XX: KNOWLEDGE SHARING ON INDUSTRY TRANSITION ROADMAPS

Elliot Mari, Ademe, France
Elliot.MARI@ademe.fr

TASK XXI: DECARBONIZING INDUSTRIAL SYSTEMS IN A CIRCULAR ECONOMY FRAMEWORK

Simon Moser, Energieinstitut an der JKU Linz, Austria
Moser@energieinstitut-linz.at

ABOUT THE IETS ANNUAL REPORT

This report has been prepared and published by the IETS Secretariat 2023. For further information, please contact helene.johansson@chalmersindustriteknik.se, or visit the IETS website at www.iea-industry.org.

The IETS TCP is part of a network of autonomous collaborative partnerships focused on a wide range of energy technologies known as Technology Collaboration Programmes or TCPs. The TCPs are organised under the auspices of the International Energy Agency (IEA), but the TCPs are functionally and legally autonomous. Views, findings and publications of the IET TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.





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