

## ETSAP & IETS TCP WORKSHOP – INVITATION TO FOLLOW-UP

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You are invited to participate in three workshops on the topic of *Industrial sector modelling in energy system models* on November 17, November 21 and December 1, 2025. These follow a successful initial [Workshop](#) on April 10, similarly co-organized by two IEA Technology Collaboration Programs: the [Industrial Energy-Related Technologies and Systems \(IETS\)](#) and the [Energy Technology Analysis System Programme \(ETSAP\)](#).

**The follow-up workshops intend to foster dialogue between modelers and technologists** with respect to specific industrial decarbonization technologies and themes. This will provide modelers with an opportunity to review their modelling assumptions for the industrial sector, and technologists with an opportunity to better grasp the context affecting the evolving attractiveness of specific industrial decarbonization technologies.

The proposed workshop topics are:

- November 17: industrial decarbonization through carbon-free sources of process heat
- November 21: industrial decarbonization through bioenergy and CO<sub>2</sub> capture and storage
- December 1: industrial decarbonization through non-energy changes (process chemistry, material efficiency and innovative pathways)

Each workshop will be evenly divided between short presentations and roundtable discussions. All potential presenters are required to submit an abstract by Monday October 27, 2025. Very short abstracts related to a single area of expertise are welcomed. Further information is provided below.

Accepted abstracts and presentation material will be shared as PDF on the IETS and ETSAP websites. Presentation material is to be submitted the day before each workshop.

## **Agenda**

Date: November 17, November 21 and December 1, 2025

Time: 7h00-11h00 EST, 13h00-17h00 CET

Platform: MS TEAMS kindly provided by ESMIA Consultants Inc.

- 7h00 EST, 13h00 CET: General introduction
  - 5-10 minutes welcome address from an ExCo member at ETSAP and IETS
  - 10-15 minutes survey results and brief overview of industrial sector modelling in TIMES models.
- 7h30 EST, 13h30 CET: Very short presentations (maximum 10 minutes), alternating with question and discussion periods, including the prepared questions on each workshop topic (process heat, BECCS or non-energy).
- 8h45 EST, 14h45 CET: 10-15 minute break
- 9h00 EST, 15h00 CET: Continued presentations and discussions.
- 10h50 EST, 16h50 CET (at the latest): Concluding remarks
  - Workshop summary and identification of key takeaways
- 11h00 EST, 17h00 CET (at the latest): End of webinar

## **Call for abstracts**

- Participants interested to make a short presentation and/or to participate in a roundtable discussion are invited to submit a short abstract describing what they would like to present. Single-sentence abstracts are acceptable, for example: “My team has relevant expertise on oxycombustion systems and would like to present some data on how oxycombustion can make some industrial processes more efficient, facilitate carbon capture, and enable lower-cost decarbonization.”
- Participants are expected to put some emphasis on fostering modeler-technologist dialogue rather than only presenting research results. (Presentations from modelers are expected to try to answer technologist questions and presentations from technologists are expected to try to answer modeler questions, such as provided below.)
- Abstract submission deadline is Monday October 27, 2025. Please submit to [etienne.bernier@polymtl.ca](mailto:etienne.bernier@polymtl.ca) with [kathleen@esmia.ca](mailto:kathleen@esmia.ca) in copy.

November 17 workshop (process heat): example questions from modelers to technologists

- Looking at the fossil fuel usage for industrial process heat generation in a generic manner, how can that usage be split between what is likely 1) electrifiable with at least one technology with demand-response ability, 2) electrifiable with at least one technology but none with demand-response ability, and 3) not electrifiable at all or only indirectly through hydrogen?
- What practical hurdles limit the direct electrification of direct-fired industrial equipment (furnaces, ovens, kilns, dryers, reactors etc.)?
- What are the key available electrification technologies to decarbonize process heat, and how can we roughly characterize their cost and performance as a function of simple heat characteristics (load, temperature, direct vs indirect, etc.), independently of process specificities? Are they retrofittable on existing process equipment?
- What role can heat integration, heat recovery, heat pumping, heat storage, solar thermal and geothermal energy play to decarbonize process heat using less electricity, and how can the corresponding costs be modeled as a function of the same simple heat characteristics?

November 17 workshop (process heat): example questions from technologists to modelers

- In order for electrification technologies to compete against other industrial decarbonization technologies such as CCS, is it more important to decrease costs, to increase efficiency, or to accommodate intermittency?
- What is the expected variability of wholesale electricity prices (optimization marginals) in the 2030-2050 timeframe, and more specifically, what is the added value of making industrial electrification technologies capable of demand response on hourly to seasonal timescales?

November 17 workshop (process heat): other topics of interest

- The decarbonization of industrial combined heat and power (cogeneration) systems
- Decarbonization topics related to process heat in a specific industrial subsector (except when it better fits in the two other workshops)

November 21 workshop (BECCS): example questions from modelers to technologists

- The easiest way to model industrial CCS is to assume end-of-pipe capture using amines and a standalone heat source. How much does that overestimate costs and energy consumption relative to CO<sub>2</sub> capture methods that are more process-integrated?
- What is the flexibility of industrial combustion equipment to accommodate coal, oil and natural gas substitutes that are lower grade (less transformed) than drop-in fuels, such as raw biochar, raw pyrolytic oil or raw syngas? How can the compatibility between industrial fuels and their substitutes be estimated independently of process specificities?
- Which industries use syngas (reformed natural gas) as feedstock or reducing agent, and what are their prospects for direct substitution with bio-syngas?
- What are potential synergies between biomass transformation and industrial processes, which might favor co-locating new biomass transformation facilities with existing industrial facilities?
- What emerging bioenergy pathways could potentially outperform the established combustion and gasification pathways?

November 21 workshop (BECCS): example questions from technologists to modelers

- Many industries are enthusiastic to decarbonize using biomass without process modifications. If the resource is insufficient for everyone, which types of projects will have the best ability to pay for biomass? What characterizes a high merit bioenergy pathway in a net zero economy?
- Why would BECCS in industry ever become important, when bioenergy alone and CCS alone (and electrification) are already sufficient to fully decarbonize industry? What are the potential benefits for an industry to become a net negative emitter?
- If BECCS is to be used as a source of syngas feedstock, is it preferable to have only CO<sub>2</sub> to store (such as with gasification), or can there be a benefit to have liquid and solid byproducts for carbon storage (such as with pyrolysis)?
- What fraction of biomass can realistically be available long-term for industrial bioenergy projects, considering the competing demands for BECCS in other sectors, for carbon removal, and for nature-based solutions?

November 21 workshop (BECCS): other topics of interest

- Biological pathways to bioenergy
- Sector-specific considerations about implementing bioenergy and/or CCS in industry without major changes in production pathways

December 1 workshop (non-energy): example questions from modelers to technologists

- What disruptive process technologies can decarbonize industry at a lower cost than CO<sub>2</sub> capture? Are these technologies retrofittable on existing processes? How can their cost and their year of availability be estimated for modelling purposes?
- What role can product substitution, material efficiency and carbon circularity play for industrial decarbonization?
- What are some potentially underappreciated conversion routes for industrial CO<sub>2</sub>?
- For modelling purposes, what is important to know about the competing production routes (including upcoming) for primary steel, primary aluminum, cement, and basic chemicals?
- How can technology readiness, resource bottlenecks, adoption barriers, retrofittability, phased transitions and other factors affect the timing of decarbonization for existing industrial assets, considering their long life expectancy?

December 1 workshop (non-energy): example questions from technologists to modelers

- What do current modelling results show, in terms of whether innovations (disruptive process technologies, material efficiency, circularity and others) tend to be adopted or not when available in the model?
- Do current modelling results tend to show that CO<sub>2</sub> conversion is useful in general, or only in niche applications? Does that depend on geographic constraints limiting the transportation and storage of fuel, electricity and CO<sub>2</sub>? Which CO<sub>2</sub> conversion pathways tend to be prioritized?

December 1 workshop (non-energy): other topics of interest

- Decarbonization topics related to specific carbon-intensive processes such as cement, lime, iron ore pelletizing, steel, chemicals, chemical pulping, etc.
- Other innovations related to industrial decarbonization

**Additional Context**

- The industrial sector is often categorized as “hard to decarbonize”, but perhaps more accurately described as “hard to model”. Energy system models often lack the detail necessary to recommend optimal decarbonization strategies for industry, due to modelling challenges such as: technological diversity across subsectors and even individual sites, limited availability of non-confidential data, and absence of one-size-fits-all decarbonization solutions.
- Decarbonizing heavy industry could be less costly than would otherwise appear when considering energy system-level benefits, notably electrical grid balancing and carbon removal through bioenergy with carbon capture and storage (BECCS). This is not widely acknowledged, a misperception that can be reinforced when projections derived from energy system models (using TIMES and other platforms) miss those systemic benefits due to inadequately detailed industrial sector modelling. Such misperceptions can delay timely investment in industrial decarbonization, especially considering the longevity of the assets involved.
- Improving the energy system-level understanding of how the industrial sector can best contribute to Net Zero objectives is of high importance to policymakers worldwide; it is also recognized as a potential topic of collaboration between TCPs such as ETSAP, IETS, Bioenergy, HPT and others that are involved in industrial decarbonization modelling using different approaches.
- On September 26, 2024, IETS and ETSAP executive committees made commitments to co-organize a four-hour online workshop on the topic, which occurred on April 10 2025, with half the presenters drawn from each community. Follow-up collaborative workshops are organized on topics of interest identified in this first workshop.