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Committee on Sustainable Energy

Group of Experts on Energy Efficiency

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Improving energy efficiency in industry

**Advancing energy resilience and decarbonization across the
United Nations Economic Commission for Europe region:
analysis of macro-level status quo and action points for the
industrial sector**

Note by the secretariat

Summary

Beyond the energy consumption that the industrial sector represents, it determines resource and emission consumption of other sectors by the way it sources, transports, designs, and delivers products. And besides embedded product emission footprints, it also determines to a large extent the energy consumption and emission profiles of the materials and equipment.

The present document contains an assessment of the current state and the development pathways that are available for the industrial sector for achieving energy resilience and identifies avenues of future research for the Task Force on Energy Efficiency in Industry.



I. Introduction

1. Approximately two thirds of the greenhouse gas (GHG) emissions of industry are caused by the energy it uses, and one third arises from processes (i.e., chemical reactions, mechanical movements, melting, etc.). While process-related emissions can only be addressed through finding alternative ways of processing goods to achieve the same outcomes (process decarbonization) while allowing the use of a non-fossil energy (i.e., from steel production with coke and coal, to steel produced with the help of green hydrogen; or from conventional to electro steam crackers in chemical industry), energy-related emissions can, particularly in case of electricity, be reduced through substitution. For about two thirds of industrial energy consumption, this requires more substantial interventions as they are process gases or process heat. This makes product design pivotal, as the energy- and emission performance can only be as good as the equipment allows.

II. Analysis and Discussion

2. For energy resilience and decarbonization, it is critical to understand that situations of supply shortage can trigger a collapse of complex supply chains across sectors. One of the most important processes in the chemical industry is the steam cracking that results in multiple by-products for other sectors (i.e., textiles, plastics, pharmaceuticals, rubber, fuels and additives, fertilizers). Switching the process or the form of energy while maintaining operations, therefore, is complex as well.

3. Parts of the United Nations Economic Commission for Europe (ECE) region experienced an energy crisis in 2022, when it became clear that increasing resilience of the non-electric energy demand needs to gain higher priorities as these – often fossil – energy carriers are less mobile than electricity and, therefore, are harder to feed through to areas of demand. Also, electrification of these processes takes time and significant investments, if electrification is at all possible and makes sense from a system efficiency standpoint. Where fuel switch from gas to hydrogen is technically feasible, there will still be the issue of price and sufficiency. Therefore, for all processes depending on process heat or cold, identifying and avoiding energy waste and making use of it is the most important short- to medium term action to increase energy resilience and reduce energy cost and emissions.

4. For companies to improve their energy resilience, it is therefore important to reduce cost risks and future proof their business model, operations and products to identify the mix of measures that facilitates achievement of these objectives and, ultimately, overall efficiency. Such systemic efficiency can be pursued focusing on minimizing the overall energy requirements and related emissions, or the associated energy costs, or a combination of both.

5. Industry, however, can only succeed with their decarbonization efforts and achieve energy resilience if enough clean energy (electricity or heat) is available at an affordable price, at any given point in time when the energy is needed.

6. Data suggests that about 60 per cent of the Scope 1 and 2 GHG emission savings are intended to be of an on-site nature, and more than 40 per cent of the envisaged measures build on self-generation or purchase of cleaner energies.

7. However, in many, if not most cases, the industrial sector alone requires more energy than clean energy is currently available on the market without increasing GHG intensity of energy for the rest of the economy.

III. Conclusions and Recommendations

8. It is, therefore, deemed advisable to assess the situation across the ECE region and beyond in the following dimensions, which could pave the way for future research by the Task Force on Energy Efficiency in Industry:

(a) What proportion of the overall energy, and specifically electricity, is consumed by industry and how large is the renewable or clean electricity gap to supply industry fully (in annual average) with net-zero emission electricity;

(b) In which geographies across the ECE region, the proportion of industrial energy use is largest, so, the impact of sector's decarbonization and subsequently the energy system resilience;

(c) What proportions of cleaner electricity and energy have been achieved, in order to understand where future expansions of cleaner generation would have the biggest relative positive impact on energy resilience and decarbonization efforts.
