Student Contest Problem 2019

This contest problem is open to Bachelor/Master/PhD level students. The participants have approximately three months to prepare and submit solutions to the problem (see below) no later than **February 15 2020, 23:59 CET**. Solutions can be prepared by individuals or by teams.

The jury will select the best solution, based on technical excellence (i.e. process intensification, cost effectiveness, energy efficiency, environmental impact, social impact, operability, flexibility, etc.), quality of the report and originality. The jury will take also into account the size of the team and its academic level (Bachelor/Master/PhD).

The Award includes:

- First prize: One invitation to attend to the ESCAPE-30, to be held in Milan, Italy, 24– 27 May 2020 to get the award. First-prize award also includes a money transfer of 1000 EUR, after the ESCAPE event, to cover the travel and accommodation expenses.
- Second prize: One invitation to attend the CAPE Forum, to be held in Copenhagen, Denmark, in October or November 2020 (to be defined) to get the award. An oral communication slot will be granted to present the solution. Second-prize award also includes a money transfer of 750 EUR, after the CAPE-forum event, to cover the travel and accommodation expenses.
- Both first and second prizes: the publication of the selected solution on the EURECHA web site.

Submission procedure:

The written report should consist on a **pdf** file written in **English** and not exceeding **15 pages** (including figures).

This **written report**, any **other support file** (Annexes, Spread Sheets, Simulation Input files, etc.), and a support letter from an academic supervisor at your home university, should be packed (zip format) and sent, before the established deadline, as e-mail attachment to eurecha.secretariat@gmail.com.

In the body of this e-mail you **must** include the following information:

- Complete name (for all authors).
- Level (Degree/Master/PhD) and current year of your studies (**for all authors**). If available, please provide a link to a web page at your home institution related to one of the courses you are currently enrolled.
- Complete name and address of your home institution (School/Department/Research Center, etc.). Please provide a link to the web page of your home institution and an official contact to confirm eventually your affiliation/enrolment.
- Bank account data (account holder, IBAN, BIC) for money transfer in case of successful application

Transition to industrial production based on green hydrogen

Hydrogen can be produced from different feedstocks, from fossil fuels and renewable sources. Fossil fuels are limited resources, and their processing is responsible for the largest source of carbon dioxide (CO_2) emissions, having resulted in various concerns such as global warming and several environmental problems. Recently, a way to produce hydrogen from electricity (from the grid or renewable sources such as biomass, solar, or wind) has raised interest, but the competitiveness of this process must be better clarified. In particular, its application to conventional chemical industries is still questionable due to scale constraints.

In the present contest, the fictive European company Eurecha is looking for challenging industrial processes to invest in with the objective of making European industrial production more sustainable. As a consequence, the Eurecha Company asks a group of its employees (students that will take up the SCP) to perform a preliminary design of several industries that are already using or may use hydrogen in the future and to study the economic feasibility of switching the existing industrial process from fossil resources to green electrolytic hydrogen. The company managers want indeed to get a better technical view of the challenges stated in a report recently published by the European Joint Research Center (Dolci, 2018).

In particular, students are asked to simulate at least 2 case studies among those discussed in the European report and to evaluate their technical and financial viability in case of using green hydrogen only. Solutions to address the inherent variability of renewable hydrogen production should also be discussed. The solution should propose a grass-roots design with the new facility(ies) to be built up on a green field. Upon successful completion of the challenge, the candidates will submit the process flow diagrams, with all or some parts modelled using popular process simulators, such as Pro/II, Aspen, Hysys, or gProms, with closed mass and energy balances. Other information would also be included, but not limited to the following:

- Specification of the selected existing or conceptual industrial process. Problem introduction with the definition of the specific utilization of hydrogen and assumptions for the production of green electrolytic hydrogen;
- Literature review for processes and data available;
- A detailed description of the processes and their formulation;
- Clear identification of the design and modelling assumptions, including sizing of major equipment;
- Techno-economical and sustainability analysis. Considering intensified and more sustainable solutions is a bonus. Synergies and industrial symbiosis between different processes is encouraged if leading to significant gains;
- Applicants are encouraged to consider the sensibility of the solutions to face other processes/geographical areas.

Reference:

Dolci, F., Green hydrogen opportunities in selected industrial processes – Workshop summary report (26th of June 2018, Centre Albert Borschette, Brussels, Belgium), EUR 29637 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-99135-6, doi:10.2760/634063, JRC114766.