The European Association of Internal Combustion Engine Manufacturers

EUROMOT

STUDY ON ENVIRONMENTAL IMPACTS OF INDUSTRY DECARBONISATION UNDER THE INDUSTRIAL EMISSIONS DIRECTIVE:

EUROMOT'S SUGGESTIONS FOR LITERATURE AND PRELIMINARY COMMENTS

Brussels, 27 February 2020

1. Background

In February 2020 the European Commission launched a study on the potential wider environmental impacts of the transition of industry under the scope of the Directive 2010/75/EU on industrial emissions (IED) to a low carbon, circular economy. Industry decarbonisation options, in the context of the study, relate to technologies under development, covering the range of *Technology Readiness Levels (TRL).* Output of the study will be an inventory of possible decarbonisation options, with an assessment on their wider environmental impacts under the scope of IED. At this stage, the appointed contractor is looking for the most relevant information available on potential decarbonisation options.

- Primary aim of the study is to provide a clear picture of the potential wider environmental impacts of the transition of IED industry to a low carbon, circular economy.
- Secondary aim is to get a better understanding of the potential of IED plants to contribute to the emergency of a circular economy.

Euromot has during the last years actively participated in the EU LCP BREF (2011 – 2017) process as a member of the TWG (Technical Working Group). Recently (last autumn 2019), EUROMOT also gave feedback on the EU Taxonomy Technical Draft Report.

In the paragraphs below it is briefly described how the recent LCP BREF 2017 could be utilized when updating IED 2010/75/EU for the decarbonisation process topic. An option for a deep, fast, cost-effective and environmentally sound decarbonisation of the EU electricity grid is suggested.

A short feedback is given on an option on how the circular economy could be enhanced by using disposed car tyres as a replacement of virgin fossil fuels. Some ideas on how to improve the current structure of the IED are also addressed.

2. EU Green Deal

One of the key policy areas of the EU Green Deal is “Clean energy”. Source /1/ focuses on this aspect:

“ *Decarbonisation of the EU´s energy system is critical to reach our climate objectives*

Key Principles:

- *Prioritise energy efficiency and **develop a power sector based largely on renewable sources***
- ***Secure** and **affordable** EU energy supply*
- *… ”*

The EU Commission’s ambitions are further described in the “ ***EUROPEAN GREEN DEAL - RESETTING THE EU CLIMATE CHANGE AND ENVIRONMENTAL AGENDA*** “: paper /2/ quote:

” Supplying clean affordable and secure energy
*The EU Energy Union already seeks to achieve the three goals of clean, affordable and secure energy. The EGD reinforces these objectives **noting that energy efficiency needs to be prioritised with a power sector based largely upon renewable energy sources**. **Increasing offshore wind production is picked out as an essential element in this effort**. A new plan is also proposed for a competitive decarbonised gas market to help in the development of decarbonised gases.*

*Member States are already required to present their finalised Integrated National Energy and Climate plans to the Commission by the end of 2019 (based on pre-existing climate targets). Through the process of updating these plans, the EU will legislate by June 2021 to require Member States to align these plans to the new climate targets mentioned above in 2023. The EGD also recognises that **major development of supporting 'smart' infrastructure and technology will be required to secure these goals, and specific mention is made of smart grids, hydrogen networks, carbon capture, storage and utilisation (CCUS), and energy storage**. **The Commission will continue to review the regulatory framework to ensure that it will facilitate development in these areas.***

*A **review o**f the Commission's Environmental and Energy State Aid Guidelines in 2021 will also be undertaken with a view to facilitating the phase-out of fossil fuels.*”

In other words:

- Increased use of renewable “clean” energy sources such as intermittent (offshore) wind is an essential element of the “Clean Energy” policy.

- Energy supply needs to be secure and affordable.

3. European Investment Bank’s policy, EU Taxonomy:

The recent (November 2019) EIB’s (European Investment Bank) Climate Strategy /3/ and draft (June 2019) EU Taxonomy Technical Report /4/ recognize natural gas as a key fuel in the green transition process. Unfortunately, both these processes set the GHG (Green House Gas) threshold **on the individual generator level** and **not on the integrated power sector (grid) level** (e.g. see text in Annex 1). The set GHG limits/thresholds are so low that in practice no natural gas fired plant technology will be able to fulfil neither the Taxonomy first period threshold of 100 g CO2eq./kWhe nor the EIB threshold of 250 g CO2eq/kWhe (with the exception of the special case of a very efficient CHP plant) – se e.g. figure 1 in source /5/.

The "first" threshold set in the draft Taxonomy reports seems to rely on the CCS (Carbon Capture and Storage) technology, whereas the threshold set by the EIB seems to rely largely on "green fuel" availabilities. As highlighted in the Euromot Position Paper /5/: **CCS is today unfortunately far from being a commercially mature available technology** (" .. ***Still*** *a lot of R&D work, long term plant testing of the CCS is needed* before it *can be deemed to be proven, commercially available and safe enough* ..") **and "green" hydrogen is not available in sufficient quantities** (".. *This amount of renewable hydrogen is not available in coming decades*").

The "***individual generator***" level focus will thus amongst all ***slow down/hamper*** the following Green Deal "Clean energy" policy targets (quote from above) :

"***Key Principles***:

> *Prioritise energy efficiency and **develop a power sector based largely on renewable sources. Secure** and **affordable** EU energy supply*".

An integrated power sector (electrical grid) level approach would enable a faster and deeper introduction of intermittent renewables such as wind/solar power in a cost-effective way, while the grid stability would be secured by gas fired reciprocating engine plants. *In other words, clean, affordable and secure energy will be achieved by the introduction of an integrated power sector (grid) approach. This would also help the EU achieve its increased climate ambition of a 50 - 55 % GHG reduction by year 2030 and future further enhanced targets.*

In below chapter it is briefly suggested how to regulate the GHG emissions of a gas-fired grid stabilisation reciprocating engine plant.

4. BAT GHG limits of the gas-fired reciprocating engine plant

The relevant GHG gases for a gas fired reciprocating engine plant are CO_2 and CH_4.

In below text methane abatement methods are first described, and then the BAT-limits. The multifuel flexibility of the gas-fired (reciprocating) engine is also highlighted – to show that gas-fired reciprocating engines "will not be a stranded asset".

4.1. CH_4 abatement techniques:

- **Oxidation catalyst:**
  - Quote (LCP BREF /6/, BAT 45, **chapter 10** page 786) "*Oxidation catalysts are not effective at reducing the emissions of saturated hydrocarbons containing less than four carbon atoms.* "
  - LCP BREF **chapter 11 (Emerging Technologies)**: paragraph 11.6.1.2.1 (page 842) gives additional information about the **oxidation catalyst** option: "*Tests with oxidation catalysts in the context of lean-burn engines have shown that, due to methane's higher ignition temperature compared with CO or other*

hydrocarbons, the exhaust temperature in the order of 400–450 ºC is too low for effective CH4 abatement and should be raised by at least about 200 ºC. …

An additional challenge evidenced by the tests has been the fast degradation of catalyst activity, requiring the development of a regeneration scheme. The high costs of noble-metal-based oxidation catalysts also contribute to the remaining challenges to the commercial viability of the product. "

- **Recuperative oxidizer**:
  - paragraph 11.6.1.2.2 (page 843) /6/: ***"..*** *Recuperative reactors offer high THC and CH4 reductions, but are large in size and capital intensive. They also require constant operation and thus are* ***not suitable*** *for interrupted operation mode applications such as peak load plants.* **"**

- **Primary methods:** The reciprocating engine sector has worked intensively on reducing the CH_4-slip from the gas-fired lean burn engines since the 1990s: for more information please see the attached document "*Methaneslip abatement*", prepared by EUROMOT in April 2012 and included as a source in the final LCP BREF document (see reference n. 286 in source /6/ of this paper). In the attached 2012 document EUROMOT most notably underlines the following: " *Since the beginning of the 1990s, engine manufacturers have reduced the hydrocarbon (HC) emissions substantially (by up to 50 %)* …". Work to (further) reduce the HC-emissions from gas engines still intensively continues today.

In other words, primary methods are the <u>only viable abatement</u> options today for methane reductions.

4.2. <u>BAT GHG approach:</u>

In the 2017 LCP BREF (see source /6/), BAT-AEEL (BAT – associated energy efficiency levels) and methane BAT-AEL (BAT – associated emission levels) limits are set for spark ignited (SG) (reciprocating) gas engine. In chapter 10 of source /6/ the following information relevant for GHG emissions is provided:

- **CO_2 (efficiency is a proxy for fuel consumption and thus also for CO_2):**
  - Page 780, **BAT 40**, **table 10.23**: Natural gas fired engine BAT-AEEL (BAT – associated energy efficiency levels)
    - See also approved Dissenting View number no 62 (in chapter 12/6/)

  - Page 774, **BAT 31, table 10.17**: Liquid fired engines BAT-AEEL (BAT-associated energy efficiency levels)
    - See also approved Dissenting view number 53 (in chapter 12/6/).

- **CH_4**:
  - Page 786, **BAT 45, Table 10.26**: Spark ignited lean burn gas (SG) engine BAT-AEL (BAT – associated emission levels) for CH_4 (**calculated as C at full engine load**)

For further information (why the maximum CH_4-span limit is preferred, etc.) see chapter 6.2 of source /5/, providing examples on how to apply the above BAT-AEL and BAT-AEELs when setting the CO_2eq. limits.

Gas-fired (reciprocating) engines have a multifuel ability/flexibility. Indeed, we can have:

- Spark-ignited (SG) engine types:
    - Only gas mode: Gaseous fuels such as natural gas, biogas, landfill gas (only some engine types)

- Dual Fuel (DF) engine types:
    - Gas mode (primary fuel): natural gas or other gaseous fuel such as bio methane with liquid pilot fuel (for ignition) share of 1 .. 2 % of heat input.
    - Liquid mode fuel might be diesel oil, bio oil, methanol (in the future, engine development is needed), etc.

In other words, thanks to their multifuel capability, gas-fired (reciprocating) engines will still be a key asset in the future, that is when e.g. synthetic methane, liquid bio oils, methanol or other synthetic fuels become realistic options as commercially available in big quantities.

5. Circular Economy

Essential parts of sustainable energy and environment policies are:

- Alternative energy source development (replacement of (virgin) fossil fuels) ;
- Appropriate waste management strategies.

The pyrolysis process is an option of waste-to-energy technology to deliver alternatives to replace virgin fossil fuels. The advantage of the pyrolysis process is its ability to handle unsorted and dirty plastic or rubber. In order to enhance the sustainable energy and environment path development it should be investigated if plant burning products such as pyrolysis oil, produced from processes utilizing non-hazardous waste such as used tyres, could be subject to the same emission limits as specified for the liquid (oil)-fired plants (i.e. Chapter III and Annex V of IED).

Please see source /7/ for further information.

6. Other means to improve the flexibility of the IED 2010/75/EU

In source /8/ some ideas are listed to increase the flexibility and cost-effectiveness of the IED. E.g. a change of the limit setting approach for Annex V is proposed.

7. Conclusions

Electricity is a key factor to the success of decarbonisation processes of many different sectors (industry, transportation, etc.) in the EU. An effective climate policy shall be based on existing/flexible technologies in order to be cost-efficient and enable a faster transition to the green economy. The "**integrated power sector"** approach suggested in paragraph 3 would be a smart solution enabling a fast decarbonisation of the electrical grid during the transition period towards a wider development of renewable energy sources. Once "green" fuels become in the future widely commercially available, they can be introduced step by step in the grid, thus further accelerating the transition towards a CO_2-neutral electricity grid.

EUROMOT has also highlighted other important aspects (besides GHG emissions reduction) to be considered when updating the IED (Industrial Emissions Directive), such as the replacement of (virgin) fossil fuels (Circular Economy aspect) by usage of pyrolysis oil made from car tyres, as well as when setting Annex V emission limits, etc.. We believe that such adjustments will make the IED more cost-effective and fully in keeping up with technological & environmental trends.

Sources:

/1 / European Commission Green Deal: "Clean Energy"; December 2019; at web: https://ec.europa.eu/commission/presscorner/detail/en/fs_19_6723

/2/ Clifford & Chance: "***EUROPEAN GREEN DEAL - RESETTING THE EU CLIMATE CHANGE AND ENVIRONMENTAL AGENDA***" https://www.cliffordchance.com/content/dam/cliffordchance/briefings/2019/12/2019-European-Green-Deal.pdf

/3/ Press release "*EU Bank launches ambitious new climate strategy and Energy Lending Policy* "; November 2019 at web: https://www.eib.org/en/press/all/2019-313-eu-bank-launches-ambitious-new-climate-strategy-and-energy-lending-policy

/4/ EU Taxonomy Draft Report; June 2019 at web: https://ec.europa.eu/info/files/190618-sustainable-finance-teg-report-taxonomy_en

/5/ Euromot Position "Taxonomy .."; September 2019 at web: https://www.euromot.eu/wp-content/uploads/2019/09/Taxonomy-Report-June-2019_EUROMOT-Position_Stationary-engines_FINAL_2019-09-03.pdf

/6/ LCP BREF 2017 at web: https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/JRC_107769_LCPBref_2017.pdf

/7/ Euromot Position "*EUROMOT feedback on the Evaluation of the Industrial Emissions Directive*"; December 2018 at web: https://www.euromot.eu/wp-content/uploads/2019/06/EUROMOT-feedback-to-the-roadmap-on-the-IED-evaluation_FINAL.pdf

/8/Euromot Position " *New LCP BREF (2017) and Future Aspects of the Industrial Emissions Directive 2010/75/EU*", March 2018 at web: https://www.euromot.eu/wp-content/uploads/2018/07/LCP-BREF-EUROMOT-Position-Paper-2018-03-22.pdf

ANNEX 1:

Source /5/ quote:

*" .. The low and close to zero generating technologies (such as solar) are currently and in the near future only feasible with sufficient fuel-based balancing generation. The performance of the **integrated power sector** should be considered for the taxonomy approach, **not an individual generator** that has a renewable enabling function. In EU the grid average CO2 intensity today is 296 g CO2/kWh (year 2016) .. , in some EU countries the grid CO2 intensity is much above (Poland about 700 g CO2eq/kWhe) and in some well below (France about 70 CO2eq/kWhe) .. . Thus by introduction of grid balancing gas fired reciprocating engines enabling a fast penetration of renewables such as wind and solar and a fast decarbonisation of the electric grid should be achieved. .."*

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