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1. General Considerations

ENTSOG is the European Network of Transmission System Operators for gas.

ENTSOG's TYNDP 2022 edition incorporates for the first time ever a dual gas system modelling approach considering hydrogen and methane network simultaneously, identifying infrastructure gaps and facilitating the assessment of hydrogen projects. TYNDP 2022 System Assessment Report defines the basis against which the project-specific cost-benefit analysis (PS-CBA) of PCI Project candidates is run.

In accordance with European Regulation (EU) 869/2022, ENTSOG had run within the TYNDP 2022 a project-specific cost-benefit assessment (PS-CBA) for all projects having applied to PCI under the first PCI selection process after the revised TEN-E. The results are published in this document in the form of Project Fiches.

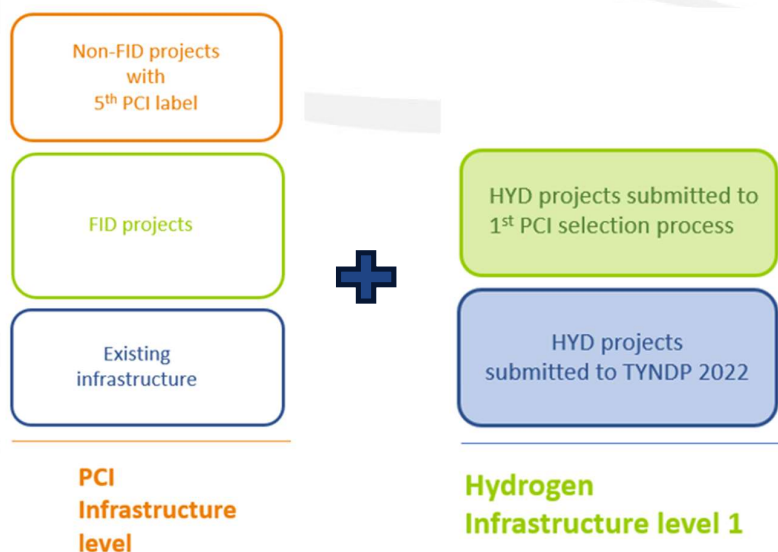
PS-CBA was performed considering legal requirements as set out in Regulation (EC) 869/2022 and should not be perceived as a complete assessment of PCI candidate projects.

The Project Fiches included in this document represent a summary of the relevant project(s) information and PS-CBA results in a harmonised, synthetic, and comparable manner. This allows to provide all the relevant information while ensuring a level-playing field and a transparent assessment towards all stakeholders.

2. Project-Specific Assessment (PS-CBA)

The PS-CBA assessment evaluates the impact of projects under a combined hydrogen and natural gas infrastructure level and two different demand and supply Scenarios, jointly developed by ENTSO-E and ENTSG¹:

> PCI Natural Gas Infrastructure Level (Existing infrastructure level + projects having FID status at the time of TYNDP project collection + non-FID projects included in the 5th PCI List
+ Hydrogen Infrastructure Level 1 (dedicated hydrogen infrastructure projects submitted to TYNDP 2022 and/or 1st PCI selection)



The infrastructure level is consistent across the different assessed projects. Often, a number of functionally related projects need to be implemented together for their benefit(s) to materialise (example: both sides of an interconnection). For such reason, the PS-CBAs have been performed by ENTSG at group level. The assessed project groups have been defined by the European Commission (EC) during the PCI selection process.

The impact of a project is therefore measured comparing the situations “with the project” and “without the project” (Incremental Approach) in the considered infrastructure level and per each demand scenario. Based on the composition of the infrastructure level, in some cases the calculated benefits are limited, as the infrastructure gaps might be already (partially) fulfilled by possible competing projects.

¹ For more details on TYNDP 2022 demand scenarios consult the TYNDP 2022 Scenario Report available [here](#).

3. Multi-Criteria analysis and how to read the Project Fiche

The Project Fiche offers a summary of the main information related to the projects forming a specific assessed group. Detailed information is available in TYNDP 2022 Annex A (Project Table) as well as TYNDP 2022 Annex Cs (Annex C1 and Annex C2).

The TYNDP 2022 Project Fiches include contribution/inputs by both ENTSOG and/or project promoters. Results have been calculated according to the methodology. Where relevant promoters were asked to provide further inputs directly inside the Project Fiches.

The first section of each project fiche includes all relevant technical details related to the projects forming the assessed project groups. This section reflects the information submitted by the concerned project promoters during the TYNDP 2022 and PCI project data collection.

Section B “Project Cost Information”, indicates the cost for the overall group and for each project forming this group. During project data collection, promoters were asked to indicate whether their costs are confidential or not. Section B displays the costs provided by the promoters (as of TYNDP 2022/PCI project collection), unless declared confidential. In case declared confidential, alternative costs have provided by the promoter. The cost values represented in Section B are not discounted/actualised.

In section C, “Project Benefits”, the main benefits stemming from the realisation of the project group are reported and described. Benefits are calculated for all TYNDP 2022 scenarios. Section C is composed of two different sub-sections:

> in C.1 “Summary of Project Benefits”, ENTSOG has described the sustainability and security of supply benefits stemming from the realisation of the project group as resulting from ENTSOG assessment based on different indicators as described in the methodology. More details on the indicators are available in Annex D of TYNDP 2022

> in C.2 “Quantitative Benefits”, ENTSOG has included all quantitative indicators results (more detailed in section 3.1).

3.1. Quantitative Benefits

PS CBA is a multi-criteria analysis with quantitative elements. Benefits have been calculated for the years: 2030, 2040 and 2050.

Section C.2 displays all quantitative benefits results.

The tables presented in this section show values from the CBA Methodology Quantitative Indicators with and without the project, as well as the project impact (or delta) for each indicator. PS-CBA analysis was performed following the TOOT² approach on TYNDP 2022 Hydrogen Infrastructure level 1³. Benefits are displayed according to the relevant sustainability and security of supply indicators.

Some indicators are expressed in percentage of demand of a given country and therefore the impact of a project must be understood accordingly (e.g. depending of the market size of the impacted country a 10% impact could be significantly different).

Results should be always carefully interpreted. In section C.1 ENTSG has provided a detailed summary of the relevant project benefits.

Indicator results are shown only for countries impacted by the assessed project group. Below is a short explanation on how to read the indicators and the associated quantitative benefits.

Sustainability - CO2 Emissions

The sustainability indicator “**CO2 Emissions**” shows the saved CO2 Emissions in Tonne enabled by the incremental project impact. A negative number in the Delta indicates that, thanks to the project CO2 emissions can be saved per year. The sustainability indicator is computed for both demand scenarios and different disruption cases:

- Distributed Energy (DE) and Global Ambition (GA) Scenarios
- supply disruption (disruption of H2-flows from LH2⁴/North Africa/Norway/Ukraine)

It should be noted that CO2 emissions reduction derived from ENTSG PS-CBA considers DE and GA demand and supply for H2 and NG in all European countries, therefore, sustainability benefits included in section C of the project fiche, reflect CO2 emissions reduction from the replacement of blue hydrogen supplies by green hydrogen supplies enabled by the projects. Nevertheless, additional GHG and non-GHG emissions reduction could stem from the project group implementation replacing other more polluting fuels.

Security of Supply

The indicator “**Curtailement rate Single Largest Capacity Disruption (SLCD)**” shows the results of the incremental projects impact on the avoided curtailed H2-demand (in %) in case of disruption of the single largest capacity per country. A negative value in the DELTA column

² Take Out One at a Time

³ Detail of H2 capacities in TYNDP 2022 Annex C.2 H2 Capacities per country

⁴ Disruption of liquified H2 or hydrogen embedded in other derivatives (e.g NH3) imported via terminals

indicates a positive impact of the project in reducing country(ies) risk of curtailed demand under single largest capacity disruption. A project may have positive impact in more than one single largest capacity (e.g. in SLCD-Country A and SLCD-Country B).

The indicator “**Curtailment rate Climatic Stress**” shows the results of the incremental projects impact on the avoided curtailed H2-demand (in %) in case of climatic stress cases:

- climatic stress (average 2-weeks, average 2-weeks Kalte Dunkelflaute⁵, design case =Peak day)
- supply disruption (disruption of H2-flows from LH2/North Africa/Norway/Ukraine)

A negative value in the DELTA column indicates a positive impact of the project in reducing country(ies) risk of curtailed demand under climatic stress.

3.2. Other Impacts and Benefits

Any hydrogen infrastructure has an impact on its surroundings. This impact is of particular relevance when crossing some environmentally sensitive areas. Mitigation measures are taken by the promoters to reduce this impact and comply with the EU and National regulations.

Section D “Environmental Impact” further elaborates on the mitigation measures taken by the project promoter. It is responsibility of the project promoter to submit such measures in form of qualitative and/or quantitative information.

In section E “Other Benefits”, promoters have indicated any benefit which may be not captured by the current application of CBA Methodology. It is responsibility of the project promoter to submit and substantiate such information.

Section F “Useful Link”, includes any weblink as provided by the promoters.

⁵ (cold) dark doldrums” expresses a climate case, where in addition to a 2-week cold spell, variable RES electricity generation is low due to the lack of wind and sunlight.