

ENTSOs consistent and interlinked electricity and gas model in accordance with Article 11(8) of Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013

21 December 2016

This document is jointly submitted by ENTSO-E and ENTSG to the European Commission and the Agency for the Cooperation of Energy Regulators. It constitutes the “consistent and interlinked electricity and gas market and network model” (hereinafter referred to as the “Model”), in accordance with Article 11(8) of Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructures and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 (hereinafter referred to as the “Regulation 347/2013”).

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1. Introduction and objective

This document is ENTSO-E and ENTSG (hereinafter referred together as the “ENTSOs”) consistent and interlinked model, elaborated and jointly submitted by the ENTSOs in accordance with Article 11(8) of Regulation 347/2013 (hereinafter referred to as the “Model”).

Following opinion to be issued by the Agency for the Cooperation of Energy Regulators (hereinafter referred to as “ACER”) and approval by the European Commission, the Model will be included, as an annex, in the methodologies developed by each ENTSO for a harmonised energy system-wide cost-benefit analysis for projects of common interest (hereinafter referred as the “CBA Methodologies”). It shall then be applied by each ENTSO for their respective ten-year network development plans (hereinafter referred to as the “TYNDPs”).

In the current context, where the energy sector has to undergo tremendous changes to achieve the EU decarbonisation targets, the ENTSOs consider as key to ensure that the **assessment of the infrastructure needs in the frame of the TYNDP process is performed on a consistent and transparent basis, consulted with all relevant stakeholders**. This is the objective the ENTSOs see for the Model.

The Model, being applied to both ENTSOs TYNDP development processes, shall ensure consistent and interlinked TYNDPs outcomes, and as such that the European gas and electricity infrastructure planning is performed on a consistent basis.

This ensures that the implementation of the Model delivers consistency between both sectors’ TYNDP and projects of common interest (hereinafter referred to as “PCI”) selection processes.

This document is the ENTSOs Model. It is structured as follows. Chapter 2 presents the legal requirements applicable to the Model. Chapter 3 provides the Model itself. Chapter 4 highlights the role of the Model in the TYNDP assessment. Chapter 5 draws conclusion on the application of the Model. Finally, Annex 1 provides the overview of the Model and how it fits in ENTSOs TYNDPs.

The terms used in this document have the meaning of the definitions set out in Article 2 of Regulation 347/2013, Article 2 of Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchange of electricity and repealing Regulation (EC) No 1228/2003 (hereinafter referred to as “Regulation 714/2009”) and Article 2 of Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005 (hereinafter referred to as “Regulation 715/2009”).

2. Legal requirements

According to Article 8(3)(b) of Regulation 714/2009 and Article 8(3)(b) of Regulation 715/2009, ENTSO-E and ENTSG have to publish on a biennial basis their TYNDPs.

Article 11(8) of Regulation 347/2013 requires the ENTSGs to jointly submit to the European Commission and ACER the Model by 31 December 2016:

"By 31 December 2016, the ENTSG for Electricity and the ENTSG for Gas shall jointly submit to the Commission and the Agency a consistent and interlinked electricity and gas market and network model including both electricity and gas transmission infrastructure as well as storage and LNG facilities, covering the energy infrastructure priority corridors and areas and drawn up in line with the principles laid down in Annex V. After approval of this model by the Commission according to the procedure set out in paragraphs 2 to 4, it shall be included in the methodologies".

Annex V (13) of Regulation (EU) 347/2013 provides additional requirements to be fulfilled by the Model:

"For the common electricity and gas market and network model set out in paragraph 8 of Article 11, the input data set referred to in point (1) shall cover the years $n+10$, $n+20$ and $n+30$ and the model shall allow for a full assessment of economic, social and environmental impacts, notably including external costs such as those related to greenhouse gas and conventional air pollutant emissions or security of supply".

In accordance with abovementioned Article 11 of Regulation 347/2013, the Model, once approved by the European Commission, will be included in the CBA Methodologies which shall be applied for the preparation of each subsequent TYNDPs to be developed by the ENTSGs.

Inclusion of the Model in the CBA Methodologies developed by each ENTSG indicates that the Model is to be considered as an additional element of the CBA Methodologies, taking into account the regulatory frame already set for these methodologies.

3. The Model

3.1. Overview

The Model is part of the CBA Methodologies and is designed to ensure that the **assessment of the infrastructure needs is performed on a consistent and transparent basis, consulted with all relevant stakeholders.**

The Model is applicable to both ENTSOs TYNDP development processes and ensures consistent TYNDPs outcomes.

Both ENTSOs TYNDPs consist of the same steps: i) scenarios and related input data; ii) identification of needs; iii) project collection; and iv) cost-benefit analysis (hereinafter referred to as “CBA”) of the projects proposed to be included in the TYNDPs.

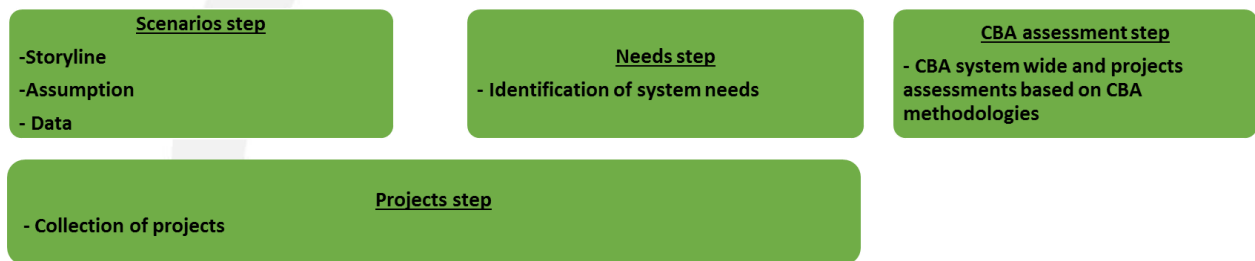


Figure 1 electricity and gas infrastructure planning steps

The Model aims at ensuring the consistency and interlinkage of both sectors TYNDP steps, in line with the requirements of Regulation 347/2013, the key element of the Model being the joint development of scenarios by both ENTSOs.

The overview of the Model is shown on the graph below and the following sections set out how it fits within the TYNDP exercise.

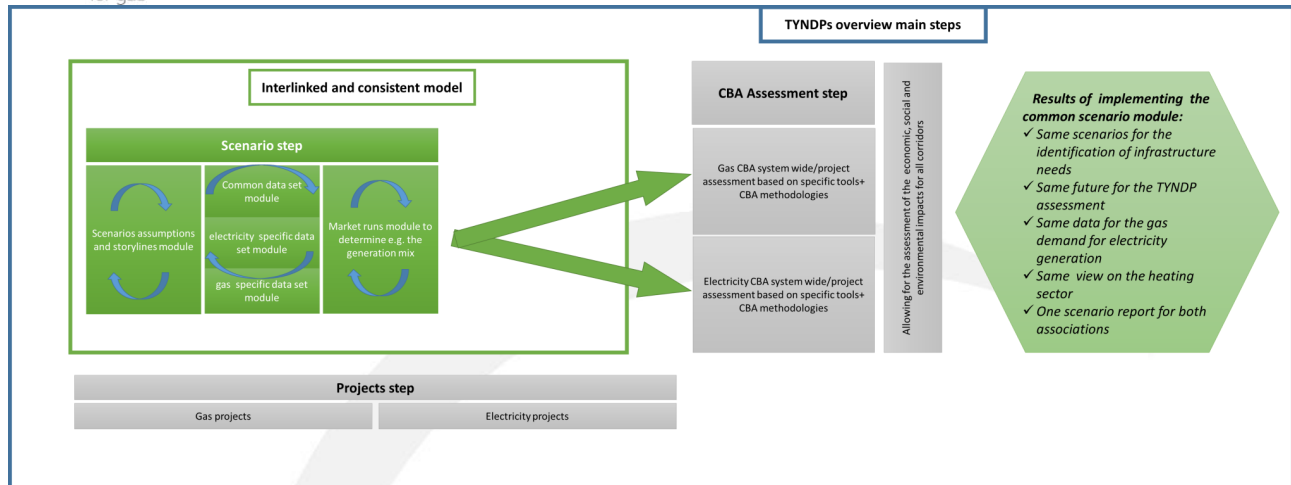


Figure 2 : Overview of the Model and how it fits in the TYNDPs (for a better resolution see annex 1)

As mentioned above, being included in the CBA Methodologies of both ENTSGOs and therefore being applied to the TYNDPs further developed by the ENTSGOs, the Model is considered in the broader framework of the TYNDPs processes to which the Model constitutes one of the elements.

3.2. Scope of the Model

The Model applying to the TYNDP processes has the same scope than the TYNDPs. It accordingly covers, in accordance with Article 11(8) of Regulation 347/2013:

- the electricity and gas transmission infrastructures, as well as storage and LNG facilities; and
- the infrastructures priority corridors and areas listed in Annex I(1) and (2) of Regulation 347/2013.

3.3. Timeframe for implementation of the Model

Each ENTSGO aims to already **implement the Model on an early basis for their respective 2018 TYNDPs**.

Following ACER opinion and the European Commission approval, the Model will be included into each ENTSGO respective CBA methodologies, and be applied for subsequent TYNDPs.

3.4. Scenarios and related input data

Scenarios development represents the first step in the gas and electricity planning exercise. These scenarios, biennially developed, set the frames under which both ENTSGOs identify in a consistent manner the gas and electricity infrastructure needs and later run project assessment.

The below sections present the joint ENTSGOs scenario development from the process and content-wise perspective.

3.4.1. Scenario Development process

The Model relies on a **joint ENTSOs Scenario Development process**, building on both ENTSOs expertise and in close cooperation with external stakeholders.

The below graph provides the overview of the scenario development process.

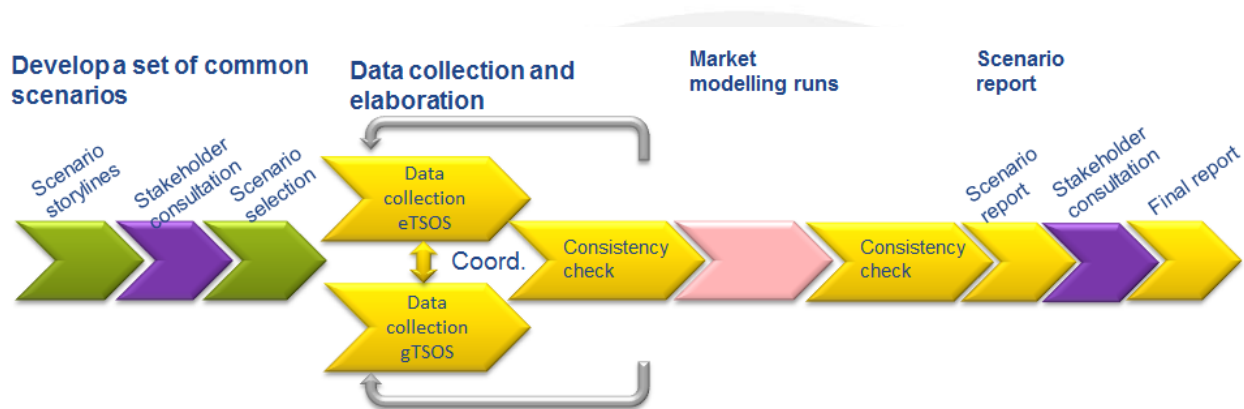


Figure 3 : Overview of the scenario development process

For developing and maintaining a consistent scenario data the two ENTSOs are currently and will continue working on two fronts:

- (i) strong cooperation and communication between the associations at all stage of the process. This is ensured by:
 - o regular meetings between the bodies responsible of the TYNDP planning and management;
 - o joint electricity and gas expert group responsible of creating the ENTSOs TYNDPs scenarios;
- (ii) alignment of the TYNDP processes especially on the scenario development phase which results in a common scenario report for both associations. This will be ensured by:
 - o joint work streams on scenario building, capitalising on both sectors members' expertise; and
 - o joint electricity and gas stakeholder engagement processes on creating the common scenarios.

The Scenario Development process is handled by a task force, composed of members and representatives of the two associations. The process ensures a strong involvement of the stakeholders of both sectors.

The process steps are described below, by chronological order:

Elaborate storylines: this consists in setting the time horizons for which scenarios are to be developed and drafting storylines for these scenarios described by a set of parameters covering the electricity and the gas sectors and where relevant more generally the energy sector. The time horizons and storylines are common to both associations. Regarding the time horizons, in order to both comply with the application of Annex V(1) and (13) of Regulation 347/2013 and ensure the proper consideration of the EU targets, the time horizons is set to round years. For the early implementation of the Model in the TYNDPs 2018, the ENTSOs plans the following joint time horizons: 2025, 2030 and 2040. In terms of parameters, the time

horizons and storylines cover in particular the compliance with the EU targets, the evolution of fuel prices, the evolution of both sectors' demand, the evolution of the generation portfolio and the evolution of European non-fossil gas sources.

Consult with stakeholders: the draft storylines are consulted with the stakeholders of both sectors at an early stage. The ENTSGs involve ACER and the European Commission in this consultation and request their support to ensure the involvement of national regulatory authorities (hereinafter referred to as "NRAs") and Member States.

Select the storylines: based on the stakeholders' inputs the ENTSGs amend the storylines and select the ones that will be developed into scenarios.

Collect the data: based on the selected storylines, the ENTSGs collect input data from their members. This data collection is framed by internal guidelines and is synchronised between both associations. Both associations require from their members that they concert at national level on relevant data (such as the installed capacities - as it relates to both grids - or each sector's demand – as the storylines define shared views on the contribution of each energy to the demand).

Check the data: the ENTSGs check the collected data to ensure their consistency with the storylines and between both sectors.

Run the market studies: based on the above input data, and for each of the scenarios, market studies will be run in order to optimise the generation mix (based on the assumed prices and efficiency of generation units).

The outcomes of this exercise are represented by the generation per fuel type (generation merit order) for each of the market nodes and the country balances for all the European countries. These outcomes are reviewed by both ENTSGs to check that the assumptions made on the generation level lead to the meaningful results.

In addition for the top down approach the electricity generation portfolio is further developed considering an optimization of the renewable energy sources (RES), thermal and hydro.

Issue the Scenario Report: the ENTSGs issue a scenario report which includes the storylines, as well as the data for each of the scenarios: commodity prices, electricity demand, installed capacities, generation, gas demand.

Consult the Scenario Report: the Scenario Report is put out for public consultation.

Finalisation and publication of the final report: based on the stakeholders' comments the ENTSGs update the report and publish the final outcomes.

3.4.2. Consistency and interlinked scenario data

The gas and electricity sectors interact in the following three ways:

1. the **electricity generation from gas** which depends on the installed generation portfolio as well as the CO₂ and commodity prices;
2. the competition between **gas and electricity on the end-user** side for a number of usages like e.g. in the **heating and transport sector**; and
3. **power-to-gas** where electric energy is transformed by chemical processes into gases and injected into the gas grid or into gas storages to serve multiple purposes.

All these three elements are part of the scenarios developed for the TYNDPs.

As the outcome of the joint scenario development, the ENTSOs publish a joint Scenario Report including all the common, consistent and sector-specific scenario data.

The structural changes in the electricity generation portfolio including the increase in renewable generation are drivers to the development of the electricity grid. This impacts the gas demand for power generation as well. The implementation of the Model ensures that these structural changes are reflected in the scenario data, and therefore considered when assessing the electricity and gas infrastructure needs and projects.

The potential of power-to-gas in supporting the integration of renewable generation is reflected in the scenario data as well and therefore considered when assessing the electricity and gas infrastructure needs and projects.

The implementation of the Model finally ensures consistent views on the electricity and gas demand in particular in regards to the heating and transport sector. Alignment with the European energy and climate targets is part of the scenario storylines, ensuring that the gas and electricity infrastructure needs properly account for the energy efficiency and RES targets.

3.4.3. Infrastructure data

Each ENTSO collects information about their respective infrastructure, including storage and LNG facilities. The transmission information focuses on the cross-border capacities.

The electricity grid capacities forming the reference grid capacities are used as an input to the market studies step of the scenario development process in order to derive the generation mix. The gas grid capacities are not needed as part of the scenario development process. The related data is collected at a stage of the TYNDP development process allowing collecting as up-to-date data as possible.

In both sectors TYNDP development process, the infrastructure data is used, together with the other scenario data, after the scenario development process, as input in the sector-specific market assessment steps forming the basis for the assessment of needs and projects.

The information on the infrastructure is transparently made available as part of each ENTSO TYNDP.

3.4.4. Overview of the input data

The graph below provides the overview of the input data in accordance with Annex V of Regulation (EU) 347/2013, highlighting the common and interlinked data (grey boxes), and link to the output data:

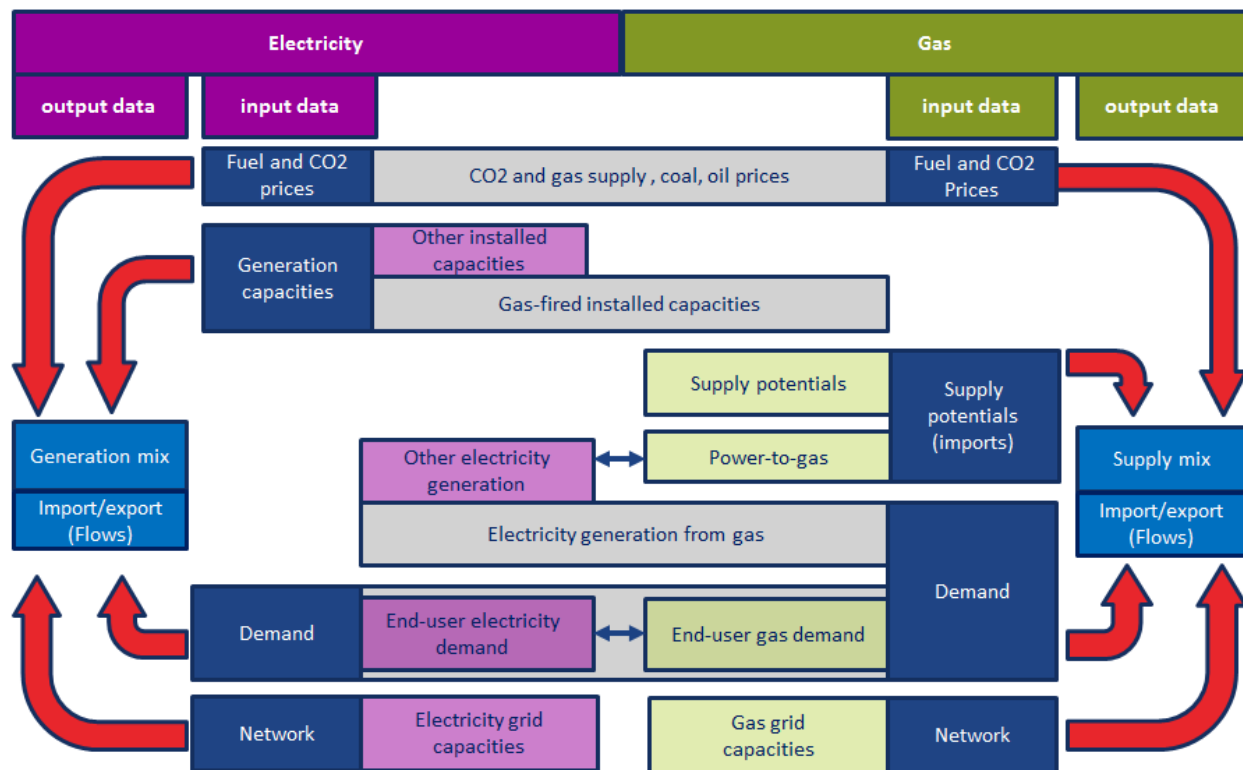


Figure 4 : Overview of the electricity and gas input data

4. Role of the Model in the sector-specific identification of infrastructure needs and CBA assessment steps

The identification of the infrastructure needs and the CBA assessment in each TYNDP is performed based on the latest CBA methodologies and the scenarios data stemming from the implementation of the Model. As such **the input and output data from the scenarios are directly used to perform each sector TYNDP identification of needs and CBA assessment.**

Fit for purpose sector-specific market and network simulation tools for TYNDP assessment

The TYNDP sector-specific identification of needs and CBA assessments build on the following tools:

- a gas market and network simulation tool, which includes:
 - o the grid infrastructure cross-border capacities between the EU countries and with the relevant neighbouring countries, transit capacities, internal capacities where relevant, as well as and the storage and LNG facilities;
 - o the supply potentials (including gases produced from power-to-gas);
 - o the fuel and CO₂ prices as resulting from the implementation of the Model; and
 - o the gas demand whose consistency with the electricity demand and with the electricity generation mix is ensured by the implementation of the Model;
- an electricity market simulation tool, which includes
 - o the grid infrastructure cross-border capacities between the EU countries as well as with the relevant neighbouring countries;
 - o generation portfolio as resulting from the implementation of the Model (including power-to-gas);
 - o fuel and CO₂ prices as resulting from the implementation of the Model; and
 - o the electricity demand, whose consistency with the gas demand is ensured by the implementation of the Model;
- an electricity network simulation tool, which includes the detailed grid infrastructure.

Each ENTSO has built a long experience in running its simulation tools, which have proven fit for purpose and reliable. Each ENTSO has additionally endeavoured to continuously improve and adapt its sector-specific tools to the particularities of the sector.

For all these reasons, and for the ENTSOs to best preserve their ability to further develop and improve their tools, each ENTSO makes use of its sector-specific simulation tool(s) when developing its TYNDP.

To ensure transparency towards stakeholders on the continuous improvements in applying each sector tool(s), from one TYNDP edition to the next, ENTSOs already today provide an up-to-date description of their simulation tool(s) in each new TYNDP edition, and will continue to do so.

The Model does not cover the actual tools that are used in the sector-specific assessments, as the tools can be improved for each new TYNDP edition, without affecting the CBA methodologies or the Model applied when developing the TYNDP. The ENTSOs recognise the importance of these tools for the project assessments. ENTSOs commit to be transparent on the tools used within the TYNDPs.

The Model: a key role in transparent and consistent gas and electricity assessments

The simulation tools, while sector-specific, show a high level of consistency. Both sectors market simulation tools represent each country over a consistent perimeter covering all the EU Member States along with the relevant neighbouring countries. This ensures that, for each sector, the Model covers the priority and areas corridors as listed in Annex I of Regulation 347/2013.

Both sectors market simulation tools also run on the basis of similar objective functions, aiming at covering demand while minimising the production costs of electricity, or respectively the gas supply costs.

The scenario data stemming from the implementation of the Model are directly used to perform each sector TYNDP assessment. This covers both the input and output data of the scenario development process, including common fuel and CO₂ prices (see Figure 4). The consistency between the simulation tools further ensures that the scenario data can easily and consistently be used in each tool.

For each sector, the assessments are run applying the CBA methodology including the Model, once approved by the Commission.

Application of the CBA Methodologies including the Model to the TYNDP assessments therefore:

- **allows for the full assessment of economic, social and environmental impacts as required by Regulation 347/2013; and**
- **ensures that the electricity and gas TYNDP assessments, and in particular the market-related assessment, are performed on a transparent and consistent basis for both sectors.**

Application of the CBA Methodologies including the Model benefits the PCI process, which is based on the TYNDPs including the CBA assessment:

- in ensuring that the process builds on the consistent and interlinked TYNDP scenario data stemming from the application of the Model; and
- in ensuring that the process builds on the TYNDP input and output data, derived from the application of the CBA Methodologies including the Model, which is transparently and publicly accessible on ENTSOs websites.

Application of the CBA Methodologies including the Model can benefit the Investment Requests, performed for mature projects under Art 12 of Regulation 347/2013, in ensuring access to overall consistent, interlinked and transparent TYNDP information.

5. Conclusions

The Model main purpose is to allow a consistent gas and electricity infrastructure need identification in a transparent and structured manner. The Model contains therefore information on the future and the associated data.

Although the Model does not incorporate the tools that are used in the next step namely the assessment of the projects, the ENTSOs recognise the importance of these tools for the project assessments. Therefore the ENTSOs commit to be transparent on the tools used within the TYNDPs, which are developed applying the CBA methodologies.

The Model represents the common ground for the electricity and gas sectors and completes the CBA methodologies of both ENTSOs. The Model guarantees a common perspective of the future allowing in the same time the flexibility to both sectors to go into sectorial details with regards to market and network studies.

ENTSOs already started implementing the Model to be used for the TYNDP 2018 and will continue, based on this experience to improve the implementation of the Model for every edition of the gas and electricity TYNDPs. For every edition the ENTSOs will make transparent all the data associated to the Model and the overall TYNDP input/outputs exercises.

6. Annex 1 - Overview of the Model and how it fits in the TYNDPs

