Support to Member States in the implementation of the Regulation on Governance of the Energy Union and Climate Action

TA Belgium - Note on methodological transparency, consistency and reporting gaps

31 May 2024

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TA Belgium - Note on methodological transparency, consistency and reporting gaps

A report submitted by ICF S.A.
in association with

Cambridge Econometrics, Rocco De Miglio

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1 Introduction and objectives

The ICF-led consortium supports DG ENER in providing technical assistance to Member States in the context of the update and reporting of their National Energy and Climate Plan (NECP), as part of the project "Support to the Energy Union Governance Process". The project team, led by Cambridge Econometrics, assists Belgium in its efforts to conduct an overall assessment of the Draft updated NECP on a 2030 horizon and beyond.

This technical assistance aims to review the current tools that Belgium has at its disposal and their appropriateness to assess the different impacts requested under section 5 of Annex I to the Governance Regulation[1] based on a comparative analysis of good practices in other Member States. It prescribes that NECP should include an assessment of the impact of planned Policies and Measures (PaMs) on the energy system, GHG emissions (including local air pollutants where relevant) and removals, as well as macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills, and social impacts, including just transition aspects. These need to be supported by an assessment of investment needs.

Belgium submitted its draft updated NECP on 30 November 2023. In its federal Parts the decision of the Council of Ministers of 8 October 2021 to develop and implement new or strengthened PaMs, was highlighted aimed at an additional emission reduction target in the non-ETS sector (including via tax instruments and climate-bonus and product standards, with a particular attention for transport and buildings). These PaMs should be subject to rigorous impact assessments and annual monitoring, in accordance with methodologies developed with the assistance of the Federal Planning Bureau (FPB) and validated by a panel of independent experts.[2]

The Draft updated NECP also refers to the development of an impact assessment in the period 2023-2024 to support the analysis of the investment needs[3].

This note provides a review of the methodological framework employed by the Belgian administrations, comprised by the Federal Planning Bureau (FPB), the Federal Energy and Climate Administrations, and three regional administrations (Brussels, Flanders, and Wallonia) for the National Energy and Climate Plan (NECP) impact assessment. The review was conducted by Cambridge Econometrics[4] and was based on documentation review and stakeholder interviews. All relevant documentation was made available to Cambridge Econometrics by the administrations. Stakeholder interviews took the form of 1-hour semi-structured interviews with staff of each administrative entity. Further details on the structure of these interviews are presented in Annex 1.

This note aims to achieve the following four objectives:

- Produce a visual representation of the methodological framework used for the NECP impact assessment.
- Identify reporting gaps and challenges currently faced, including any major reporting inconsistencies between the various impact evaluation methodologies used.
- Discuss the consistency between regional approaches to enable national aggregation.

[1] Regulation - 2018/1999 - EN - EUR-Lex (europa.eu)

[2] Belgium - Draft updated NECP 2021-2030, p.10.

[3] Belgium - Draft updated NECP 2021-2030, p.94.

[4] European Commission project. *Support to Member State in the implementation of the Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, TA Belgium.* Technical Assistance proposal available here: ENER_Energy Union Support_BE TA_Worplan_29-04-24.docx

- Comment on the overall methodological framework capacity to meet the reporting requirements of the NECP.

The objectives of the Technical Assistance request were:

By discussing these four points the note aims to support the Belgian administration with respect to the comprehensiveness and the consistency of the current and future NECP impact assessment exercises.

The note is organised as follow:

- Section 2 present an overview of the NECP reporting needs, together with challenges and recommendations.
- Section 3 presents the current NECP impact assessment methodological framework.

2 Review of NECP reporting challenges currently faced by Belgium

Belgium is actively addressing a range of challenges in reporting on its NECP, as identified by Cambridge Econometrics. These challenges are organised into three primary categories:

- Transparency;
- Methodological Consistency;
- Integrated impact assessment;
- Sectoral and NECP Criteria Reporting Needs.

2.1 Transparency

Challenges

Enhancing transparency will improve the quality of NECP reporting in Belgium without compromising the use of regional impact assessments and aggregation methods from regional to federal levels. Greater methodological transparency is crucial for fostering improvements in consistency across methodologies. As part of this technical assistance, efforts are being made to provide a clearer overview of impacts and investment needs across different government levels, from regional to federal. The technical assistance has yielded a detailed overview of the various tools available to both regional and federal administrations for NECP impact assessment. This includes essential information on each method, such as descriptions of the impact assessment methodologies employed, the outputs relevant to NECP criteria, and the ways in which these methodologies are integrated with other NECP impact assessment steps, including integrated impact assessments and the aggregation from regional to federal levels.

Currently, there is no explicit reporting of discrepancies between data sources and modelling assumptions of the different administrations. This may impair on the validity of reported impact estimates in one of the following ways:

- The same models being used for different impact assessments with different baseline assumptions and/or the same model being used for different impact assessments with different baseline assumptions.
- One or several impact assessments use several models used with overlapping assumptions.
- A model is used repeatedly over time with changing assumptions.

Recommendations

The implementation of a decentralised impact assessment methodological framework calls for the establishment of robust transparency practices. These practices include:

- The development and regular maintenance of documentation that outlines the methodologies used for impact assessment. This documentation should be readily accessible to the team involved in the compilation exercise. This note could serve as an initial step in this direction.
- The establishment of best practices concerning impact evaluation. For instance, although it's not a direct requirement of the NECP report, the use of a simplified Theory of Change (a sample template provided by Cambridge Econometrics as part

of the technical assistance)[5] or logic chains template can promote a common understanding among teams working on PaM impact assessment. This understanding pertains to estimation methods (whether quantitative or qualitative), implicit and explicit assumptions, and outcomes (including expected outcomes and unintended consequences). This approach will enhance the compilation exercise, ensuring that reported estimates at the regional level are coherent. At this stage, this level of detail is not communicated through the harmonised EC reporting templates, which are best suited for the final communication of impact estimates, where estimation consistency is implicitly assumed.

2.2 Methodological Consistency

Challenges

The limited formal coordination between governmental structures poses a significant challenge in ensuring consistent data aggregation and modelling assumptions from regional to national levels and in producing comparable results. Belgium employs a combination of regional and federal impact assessment exercises for NECP reporting. Ideally, this detailed approach should provide deeper insights into the impact of PaMs.

This review has highlighted that, although regional governments have made some progress in aligning their demographic assumptions, there remains a need for better consistency in the modelling assumptions across different administrative levels. Such consistency is crucial for generating comparable outputs that can be collectively assessed. Additionally, the tools and methods used for impact assessments vary across regions. There is a lack of a clear harmonisation process that would facilitate a consistent aggregation of impacts from the regional to the national level. This absence of standardisation complicates the integration of data and results and undermines the overall effectiveness of the reporting process.

Recommendations

- To maintain a decentralised impact assessment methodological framework, it is necessary to establish a clear harmonisation process that facilitates consistent aggregation of impacts from the regional to the national level.
    - The process will need to involve the harmonisation of both assumptions and approaches to estimation. Different methods can be used to complement each other if contextualised appropriately.

[5] During workshops with regional and federal administrations, a simplified Theory of Change (ToC) template was presented by Cambridge Econometrics. This tool is designed to potentially enhance methodological transparency for both NECP PaMs and policy packages, such as With Existing Measures (WEM) and With Additional Measures (WAM) impact assessments.

The ToC template aims to foster internal transparency by providing a standardised methodology for the internal reporting of the methods and assumptions used in PaMs impact assessment by each administration. The template can also serve as a useful framework that holds information which can then be consolidated and reported through effective contextualisation in a format that aligns with official EC reporting templates.

It's important to note that the custom ToC template is not intended to replace any official EC template proposed for NECP reporting, such as those used for the reporting of key parameters and variables. For more information on this, please refer to Annex 2.

- For this to be successful, close collaboration will be needed, if not throughout the duration of the impact assessment exercise, at least before and after. The first round of coordination is necessary to align on methods, assumptions, and data. The second round of coordination is necessary to align on the presentation of results to effective contextualisation, and if relevant, aggregation.
- Some concrete examples of this can be found in the summary of Member States interviews where the different approaches taken for promoting collaboration are ensuring consistency are explained. Spain, for instance, holds regular stakeholder engagement sessions to collect inputs from the different autonomous communities. Netherlands, has an appointed entity who is in charge of conducting an initial exercise which collects inputs and methods from different stakeholders, and aligns the assumptions and initial projections for the impact assessment. Please refer to the interview note for more details on this.
- To illustrate with a specific example for Belgium, the following measures could be implemented to foster collaboration within the scope of building stock impact assessments:
  - A central entity could be designated with the responsibility of ensuring collaboration across the entire NECP impact assessment. This entity could facilitate an initial coordination meeting, where all administrations convene to discuss their respective methodologies for assessing building stocks.
  - During this meeting, a dedicated focus could be placed on discussing the necessary steps for aligning modelling assumptions. This would also involve identifying common data sources and projections required for achieving this alignment. Once this meeting concludes, each administration can modify their building stock methodologies as agreed upon, and carry out the necessary estimations to obtain results at the regional or federal level.
  - Subsequently, the entity responsible for coordination would utilise these individual assessments and, with the support of the administration, aggregate the results in a consistent manner. Finally, the results, along with the implicit assumptions inherent in the methodologies and aggregation exercise, would be reported collectively. This comprehensive report would serve as a testament to the collaborative efforts and unified approach adopted in the assessment of building stocks.
- Belgium could revise and use the existing compilation exercise setting. The revised compilation framework could focus on fostering exchange between all relevant administrations on methodological issues. Once all facets of the impact evaluation methodologies are aligned and recorded, the aggregation exercise could be revised to consider them and report them together with final results.

2.3 Integrated impact assessment

Challenges

The current NECP impact assessment methodological framework used by Belgium lacks the capacity for integrated impact assessment.

- There is no explicit methodological framework that connects the results of energy system and emissions impact assessment to the macroeconomic modelling framework.
    - There is no feedback loop between the methodological modules that quantify impacts on the economy/society, energy, and the environment.
- There are many instances where energy system methodologies are not connected to one another, both within as well as between regions.

Recommendations

- A review of whether the existing methodological tools are fit for purpose with respect to the development of an integrated impact assessment methodological framework:
    - Can existing energy systems and GHG emissions/removals methods be connected to one another?
    - Can existing energy systems and GHG emissions/removals methods be connected to methodologies used for the estimation of the other criteria?
    - Can a connection be established between the macroeconomic and microeconomic models?
- If relevant, investment in the development of appropriate E3 models and integrated technoeconomic models.

2.4 Sectoral and NECP Criteria Reporting Needs

Challenges

A comprehensive NECP impact assessment, based on NECP reporting requirements, encompasses impacts on the energy system, greenhouse gas (GHG) emissions (including local air pollutants where relevant), and removals. It also covers macroeconomic impacts and, to the extent feasible, health, environmental, employment, education, skills, and social impacts, including aspects related to a just transition. These assessments need to be supported by an evaluation of investment needs, with a detailed breakdown of private and public investment requirements.

In terms of reporting requirements, the methodologies used for NECP impact reporting focus on the assessment of energy system impacts. GHG removals, macroeconomic and social indicators, including just transition and investment needs are not consistently captured by the methodologies available to the different administrative entities.

The FPB methodologies cover GHG emissions, and outcomes related to the macroeconomy, health, employment, skills, just transition and investment needs. However, the different methodologies are not consistently integrated nor connected to the methods used by Brussels, Flanders, and Wallonia. Currently, the FPB does not have capacities for the impact assessment of energy system impacts, GHG removals, Environmental impacts, and educations.

The methodologies used by the regional administrations in Belgium offer good coverage of energy system impacts. Most regional administrations do not have capacities for impact assessment with respect to non-energy system, GHG emissions impacts, public and private investment needs. Additionally:

- Brussels can quantify GHG removals and Environmental impacts.

- Wallonia can cover investment needs, social and just transition and employment.
- The FPB is expecting to expand capabilities with respect to investment needs and welfare costs quantification.

In terms of sectoral coverage, the various entities have described methodologies that allow the explicit estimation of PaMs impacts on key sectors. The FPB methodologies cover various sectors including transport, residential, and power generation. The Wallon methodologies cover a broad range of sectors such as residential, building sector, industry, tertiary, transport, and energy production. The Flemish methodologies focus on road transport, residential and non-residential buildings, and renewable energy production. Finally, the Brussels modelling excel tool is described as covering all sectors relevant to tracking changes in emissions.

Short term recommendations

- Based on the implementation of recommendations on challenges 1 to 3, explore the possibility of bridging gaps through closer collaboration on impact assessment methodologies across entities.
    - In concrete terms, based on the mapping of the different impact assessment methodologies in use, there is enough knowhow to bridge most if not all of the impact assessment gaps that each singular administrator faces. For this reason, a sensible starting point would be to hold a series of knowledge sharing workshops between the administrations that will result in the identification and adoption of best practices linked to: impact assessment methods, data needs, data collection methods. This can be followed by a strategic session on impact aggregation and reporting.
- Leverage on qualitative methods of analysis or relevant easy to implement quantitative methodologies to bridge reporting gaps. This has as a prerequisite appropriate use of contextualisation of results to safeguard consistency with other steps and methods of impact evaluation.

Long term recommendations

- Based on the implementation of recommendations on challenges 1 to 3:
    - Explore the possibility of collaboration and learning from other Member States, starting from those that were interviewed as part of this technical assistance.
    - Further develop in-house modelling capabilities. The need for in-house modelling capabilities is largely a function of the needs that can be already addressed through knowledge sharing. As such, it is difficult at this stage to outline models that would best fit the needs of the administration. However, the adoption of TIMES by the FPB seems like a step in the right direction. The model is already in use by one of the regional administrations, and its framework can bridge the energy system and investment needs gaps faced by FPB. For further inspiration on potential avenues for modelling expansion, please see the Summary of interviews note, produced as part of this technical assistance.[6]

[6] See. Summary of interviews_ICF first draft 24062024.docx

3 Mapping of the methods used for NECP impact assessment in Belgium

A comprehensive review of Belgium's modelling capabilities was conducted by Cambridge Econometrics, based on exchanges with the Federal Planning Bureau, Brussels region, Flanders region and Wallon region. In total, 13 methodologies used across the different regions and at federal level in NECP impact assessments were analysed as part of this Technical Assistance (see **Fout! Verwijzingsbron niet gevonden.** below).

Table 1 Overview of the methods used in Belgium for NECP impact assessments

Administrative entity	Methodology	Description
FPB	Euromod ITT	The tools can assess the budgetary consequences and equity implications of changes to both direct and indirect tax policies, as well as the social benefits system. This includes the analysis of the effects on purchasing power and other distributional impacts of common energy taxation. The tool can both impute and simulate expenditures. This is conducted at a nationwide level and for 10 EU countries.
FPB	E4BEL CGE	Currently under development
FPB	PLANET	The model establishes a relationship between the economy and transport. It can simulate the impact of transport policy measures, focusing on transport demand. It generates medium and long-term forecasts of transport demand in Belgium, encompassing both passenger and freight transport. The model's scope is macroeconomic, and geographical divisions align with institutional divisions for data collection. It also includes a welfare evaluation of policies.
FPB	CASMO	Car stock model which connects to Planet, providing detailed estimates of size and composition of the car stock. The model is used to assess the composition of the car stock and the associated average emissions per car kilometre driven in Planet.
FPB	ARTELYS	Bottom-up model used to quantify electricity sector outcomes. The model assesses the effect of capacity measures on electricity generation, prices, and emissions.
FPB	TIMES	To be developed - FPB is aiming to extend its modelling capacity also by using TIMES, based on information shared by the administration

Wallonia	TIMES	Provides estimates on the emissions, energy consumption, power capacity and (to some extent) investment needs of PAMs.
Wallonia	Qualitative tool: Macro impacts	The model conducts a qualitative analysis of greenhouse gas emissions and the evolution of the energy system. It evaluates the impact of policies on renewable electricity, heating, and transport.
Wallonia	Building Stock excel tool	The building stock excel tool is used to measure the impact of renovation strategies on energy consumption.
Flanders	Fasttrace	The tool forecasts emissions by analysing both the composition and characteristics of the vehicle fleet (vehicle park) and the total distance they travel (number of kilometres driven).
Flanders	Residential Building Stock Model	Energy based model for the residential sector
Flanders	Non-residential Building Stock Model	Energy based model for the non-residential sector.
Flanders	Renewable share tool	Inventarisation (a detailed inventory) of different sources of renewable energy
Flanders	OFFREM	Emission forecasting tool for not for the road vehicles

Source: Cambridge Econometrics through stakeholder interviews and internal methodological tools documentation review.

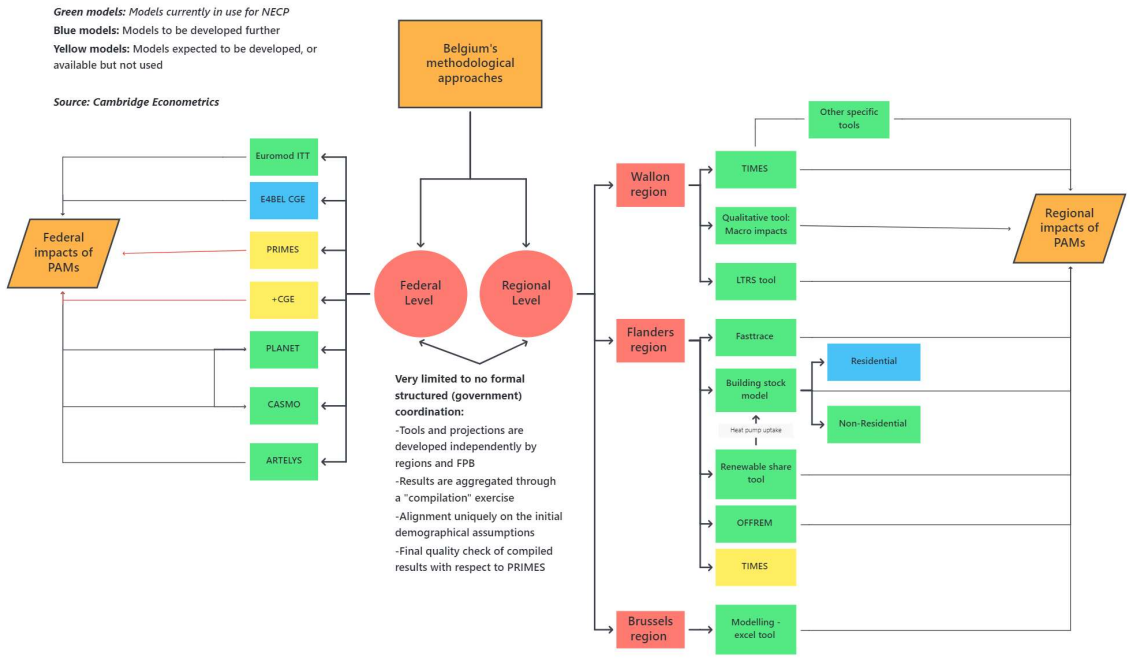
Table 2 Overview of NECP impact assessments gaps in Belgium

Methodology	Euromod ITT	E4BEL CGE	PLANET	CASMO	ARTELYS	Modelling excel tool	Fasttrace	Residential Building Stock Model	Non-residential Building Stock Model	Renewable share tool	OFFREM	TIMES	Qualitative tool: Macro impacts	LTRS tool
Administrative entity	FPB	FPB	FPB	FPB	FPB	Brussels	Flanders	Flanders	Flanders	Flanders	Flanders	Wallonia	Wallonia	Wallonia
Sectors covered	Transport (excluding freight),residential	All sectors, in principle	Transport (excluding aviation)	Transport (passenger cars)	Power generation	All sectors	Roads transport	Residential	Non-residential buildings	Renewable energy production	Offroad transport	Residential, building sector, industry, tertiary, transport, energy production,...	Tertiary, residential, industry, transport	Residential, Tertiary (Building stock)
Energy system impacts														
GHG emissions														
GHG removals														
Macroeconomy														
Health														
Environment														
Employment														
Education														
Skills														
Social and just transition														
Investment needs														

Note: Colour coding signifies estimate availability. Green indicates that impact estimates are available for this field. Yellow indicates that some partial estimates are available for this field. Red indicates that no impact estimates are available for this field.

Source: Federal Planning Bureau, Brussels administration, Flanders administration and Wallon administration

Figure 3.1 Overview of the Belgian methodological framework used for NECP impact assessment



Source: Cambridge Econometrics through stakeholder interviews and internal methodological tools documentation review.

Figure 3.1 presents the NECP methodological framework employed in Belgium to conduct impact assessments of the PaMs, is presented in the figure above. Five administrative entities participate in the framework: the FPB, the Climate and Energy administrations, and three regional administrations: Brussels, Flanders, and Wallonia. Each administration develops and implements their proprietary methodological tools independently based on the needs of the area/region they belong to.

There is limited formal coordination in terms of aligning assumptions, ensuring methodological consistency, and knowledge exchange of modelling capacities between the federal level, the Brussels region, the Flanders region, and then Wallon region. Once all administrations have conducted their respective impact assessments, the results are aggregated in a compilation exercise, to provide country-wide outcomes. This provides the aggregated reported results which feed into the NECP.

The impact evaluation of federal PaMs, to date, has been mostly based on contributions from ad-hoc analyses by the responsible federal administrations. These analyses are commonly conducted by consulting companies and do not provide an integrated assessment of policy packages (e.g. WEM or WAM). Instead, the analyses have a narrow scope on a single or a small number of PaMs. Their focus is on greenhouse gas reductions quantification compared to a scenario without the Pam.[7]

The FPB maintains a set of macro-economic models that can be used for impact evaluation of PaMs, however modelling developments are needed to assess policy packages. The FPB methodologies focus on the macro-economic outcomes. The FPB is one of the few administrations with the capacity to explicitly model distributional and welfare effects of

[7] For more information, please see https://klimaat.be/doc/2021-pams-finalreport.pdf and https://klimaat.be/doc/Evaluation_federal_PAMs_July_2017_corr.pdf .

PaMs. The modelling framework is comprised by a macro-economic (CGE) model, a micro-simulation model and three bottom-up models; all models broadly function independently. There is no feedback between the micro, macro, and bottom-up impact assessments, although there is scope for addressing this in the future through modelling expansion. Additionally, there are is feedback between the models of the FPB and that of other regions.

The Brussels region uses an excel tool for quantitative impact assessment, which models emissions at sectoral level. There is no feedback within this model and the rest of the methodological tools of other administrations.

The Flanders regions uses a variety of techno-economic models to conduct impact assessments. The tools focus on analysing emissions of the building and transport sector. There are some links across the tools, specially between the building stock model which provides heat pump uptake estimations for the renewable shares tool. There is no feedback between the models of Flanders and that of other administrations.

The Walloon region also uses a variety of techno-economic models to perform their impact assessments for NECP. These models include, TIMES, which models energy markets and can calculate investment needs, building stock renovation tool, micro-economic tools, and qualitative macro-economic analysis. The techno-economic assessment is not connected to the macro-economic analysis, however it can be expanded with TIMES. There are no linkages between the different methodological tools of the Wallon region, nor with the tools of other administrations.

For more details on the specific methodological tools used by each administration, please refer to the next section.

The European Commission sets out detailed guidelines for the methodological framework of the NECPs. The NECP reporting must ensure comparability, policy consistency, and should be grounded in a sound analysis, assessing the expected impacts of PaMs, and identifying gaps or investment needs[8]. The following types of inconsistency can arise within impact assessments[9].

1. The same model is used for different impact assessments with different baseline assumptions.
2. Different models are used for the same impact assessment with different data sources and parameter choices.
3. One or several impact assessments use several models with overlapping assumptions.
4. A model is used repeatedly over time with changing assumptions.

Consistency within impact assessments is essential to ensure horizontal, intertemporal, and conceptual comparison. In cases where this is not met, it is good practice to transparently disclose any types of inconsistencies.

The Belgian framework contains gaps and inconsistencies which do not meet the NECP reporting requirements. The independent impact assessments of each administration do not fit together and are set up in a way that there is no formal and

[8] *European Commission – Questions and answers. Questions and Answers on the assessment of the draft updated National Energy and Climate Plans. 18 December 2023. Available at:* https://ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_20_2348/QANDA_20_2348_EN.pdf

[9] Marques, Alexandra; Hradec, Jiri; Rosenbaum, Eckehard, Baseline Assumptions in EC Impact Assessments, EUR 28951 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-77153-8, doi:10.2760/982695, JRC109839

structured governance framework to coordinate their activities. As a result, different models are used for the same impact assessment, as well as different data sources, assumptions, and parameters are used – which according to the EC is defined as a methodological inconsistency. Additionally, there is no explicit reporting of discrepancies between data sources and modelling assumptions of the different administrations, which hampers transparency of the NECP report.

The aggregation exercise performed by Belgium, integrates the impact assessments of all administrations, and can result in methodological inconsistencies. The compilation exercise is conducted to aggregate results from all administrations and can be defined as the only official form of coordination. Within this exercise, a template of the EC, which records changes to energy and GHG emissions, is distributed for all the administrations to submit their estimates. Each administration uses its own independent tools to fill in the needed information. Once all administrations return their results, these are aggregated to obtain country wide impacts. The FPB further provides inputs to fill any gaps that remain, such as offshore wind, and energy production data. There is alignment at the start of this exercise to harmonize initial demographic inputs (e.g. population projections) across all administrations. Additionally, at the end of the exercise, results are compared against PRIMES EU reference to ensure there are no big inconsistencies.

Even though the compilation exercise aims to integrate results, consistency of the different methodological approaches is not met as per the EC definitions presented above. Different models are used for the same impact assessment with different data sources and parameter choices. When aggregating results, there is no disclosure of the discrepancies in assumptions and mechanisms of the different methodological tools used. Additionally, there is no prior formal coordination to ensure consistency within the independent impact assessments is maintained. This framework does not meet the NECP reporting needs relating to consistency, robustness, and transparency.

The methodological framework does not meet requirements on integrated impact assessments. NECP reporting requires a holistic approach, able to integrate various aspects of techno-economic and macro-economic assessments. The impact assessment needs to capture the impacts of the PaMs on the energy system, GHG emissions, and removals. Additionally, based on these first order effects, macroeconomic and social impacts, such as health, employment, education, and skills, need to be described to the extent possible. Finally, investment needs from the PaMs, broken down into public and private investment, also need to be estimated.

The current NECP impact assessment methodological framework used by Belgium lacks the capacity for integrated impact assessment. The techno-economic impact assessment models have limited link to micro- and macroeconomic analysis. Hence, PaMs economic and social impacts are not fully quantified. To meet the NECP reporting needs, a more holistic integration is needed. For some administrations, this integration is something that has been discussed and considered previously and was listed during workshops as implementable to some extent with a larger resource allocation.

The methodological framework contains many tools able to capture extensively energy system and greenhouse emission impacts. However, the micro- and macroeconomic impacts are limited to equity and labour market (wage distribution) assessments, which are only implemented by the FPB. Additionally, calculations of the investment needs from the private and public sector are missing, although current developments by the FPB aim to improve on this.

In conclusion, the NECP methodological framework of Belgium is performing well in terms of energy system impact quantification and has a well-functioning framework for micro and macro assessment, which could however benefit from further expansion. Most importantly,

Belgium would benefit from extensive coordination and consistency considerations, to ensure robust impact assessments. Additionally, there are several areas of improvement to expand the tools capabilities and cover all the needed impact evaluations. To reduce the identified gaps in the methodological framework of Belgium, the following areas of improvements are suggested:

- Improved methodological consistency through improved coordination.
- Improved transparency of methodological tools across administration.
- Expansion of micro and macro-economic modelling and integration with techno-economic impact assessment.
- Developing modelling capabilities for investment needs estimations.

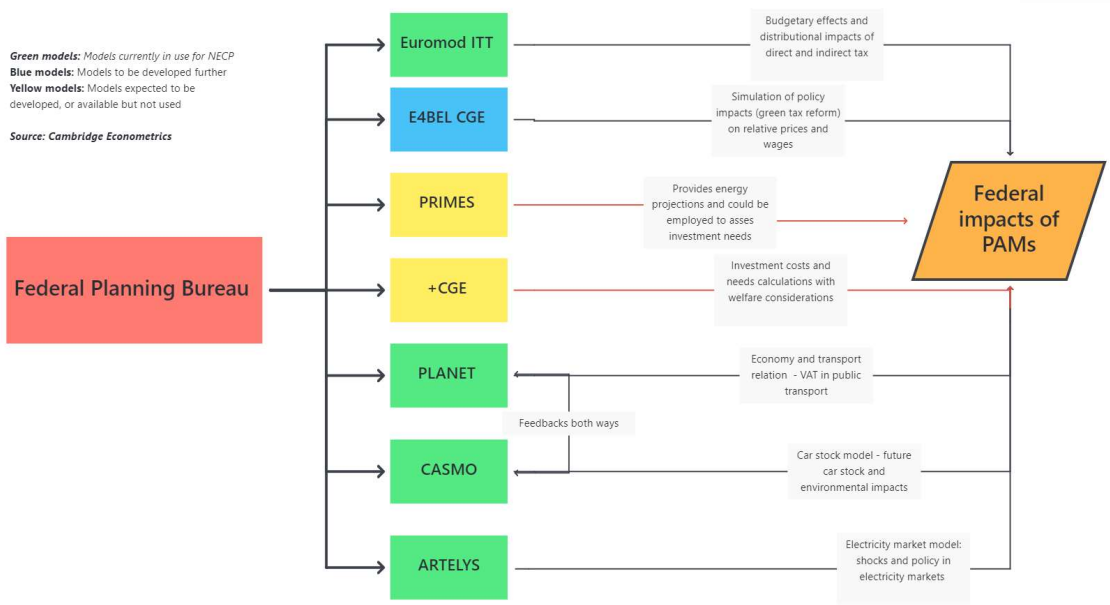
For more specific recommendation, please refer to the last section of this report.

Cambridge Econometrics conducted a further detailed analysis of the methodological frameworks of the following entities:

- the Federal Planning Bureau;
- the Brussels region;
- the Flanders region; and,
- the Wallon region.

3.1 Federal Planning Bureau

Figure 3.2 Overview of the Federal Planning Bureau methodological framework used for NECP impact assessment



Source: *Cambridge Econometrics through stakeholder interviews and internal methodological tools documentation review.*

Figure 3.2 presents the five different methodological approaches used by the FPB for their NECP impact assessment, including:

- Euromod Indirect Tax Tool (ITT);
- E4BEL CGE;

- PLANET;
- CASMO; and,
- ARTELYS.

The Euromod ITT is an EU micro-simulation model which allows for the evaluation of budgetary effects and equity impacts of reforms on direct and indirect tax. The FPB employs this tool to analyse the purchasing power effects of indirect taxes and pricing measures (i.e. VAT, excises, ETS2, etc) as well as energy price shocks. For example, an electricity price shock before taxes can be modelled, and the outputs will help draw insights on the distributional effects before and after taxes. The tool can provide granular results given that it has a detailed representation of different household income and commodity groups. It was developed at EU level and can model 18 EU countries facilitating cross-country comparison.

The E4BEL CGE is a static CGE designed to simulate the socio-economic effects of green tax reforms in conjunction with a micro-simulation model. The FPB employs this model to estimate the impact on relative prices and wages of reforms such as the ETS1, ETS2, and federal measures. It has a detailed sectoral breakdown, and disaggregation of labour demand and supply by skill types, which allow to model detailed impacts on prices and wages. The production functions, and therefor crucial labour demand elasticities, are based on most recent (German) empirical studies.

PLANET is a classic four-step model of the transport sector in Belgium. Within the NECP impact assessment, this model is used to model the effects of ETS2, VAT, excise, and company car measures in the transport sector, and understand the resulting impacts on travel demand, modal split, and corresponding emissions. Feedback from the economic to the transport sector are not modelled, meaning only the first order effects are captured. It is focused on transport demand, leading to restricted supply-side considerations within simulations, and produces medium as well as long-term projections.

CASMO is a car stock model which connects to PLANET and provides detailed estimations of the size and composition of the car stock. The FPB employs this model to assess the impacts of PAMs (related to car transport) on the composition of the car stock, and there for the average emissions per car kilometre driven in PLANET. The model was developed specifically for the context in Belgium, resulting in robust considerations for the Belgian car market and policy context.

ARTELYS is also a bottom-up model (optimal dispatch), focused on quantifying the impact of policies on the electricity sector. Within the Belgium's NECP impact assessments, this model is used to assess the effect of capacity measures on, electricity generation, prices, and emissions. It is a Europe-wide model, and as a result when a shock is modelled to a specific country's capacity, all electricity markets adjust.

The impact assessment of all the FPB methodological tools is strictly focused on a national analysis. Regional tools and the FPB tools are independent in their estimation, calibration and have no feedback in relations nor inputs. While some models, such as PLANET and CASMO could provide regional disaggregation of the emissions effects, these were not shown in the results of the federal measures.

Within their respective capabilities, all methodological tools, except PLANET and CASMO, are used in isolation to evaluate the impacts of PaMs or groups of PaMs (e.g. the modelling outputs from ARTELYS on changes in electricity generation capacities and prices were not fed into Euromod ITT to obtain the resulting distributional impacts). The only exception occurs with PLANET and CASMO, since they contain linkages both ways on transport demand and car stock.

Following this methodological framework, the technoeconomic impact assessments are disjoined and independent from the macroeconomic and social impact assessments. The

technoeconomic analysis (used for emission impacts by PAM) uses the ARTELYS, PLANET, and CASMO models. The macroeconomic and social analysis uses the Euromod ITT, and E4BEL CGE tools. In these models, the Federal part of the NECP entered as a group of PAMs. Models within each analysis function independently as they do not rely on outputs and assumptions from each other.

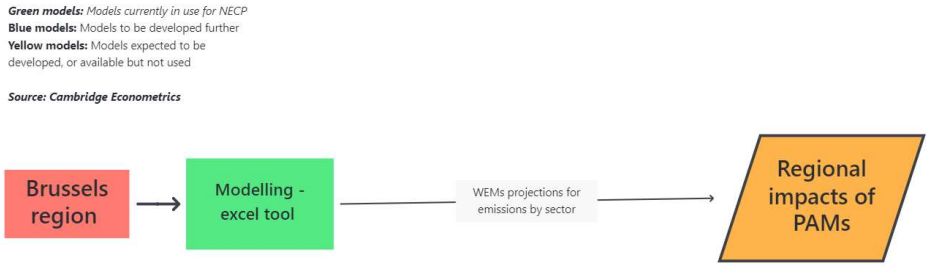
The FPB is planning to extent their modelling capabilities with the introduction of a new CGE model. This new CGE model is under development and is envisioned to be used in the NECP impact assessment for estimating investment needs and welfare costs of PAMs related to generating clean investment.

Additionally, E4BEL CGE is also intended to be developed further to extend it current application. An extension will include linking E4BEL CGE with Euromod ITT, to feed in changes to relative prices and wages.

The FPB is investigating the applicability of the TIMES model to generate normative, optimized pathways to decarbonisation, in complement to its current outlooks which use the PRIMES model. These typically generate positive, non-optimal pathways.

3.2 Brussels

Figure 3.3 Overview of the Brussels region methodological framework used for NECP impact assessment



Source: Cambridge Econometrics through stakeholder interviews and internal methodological tools documentation review.

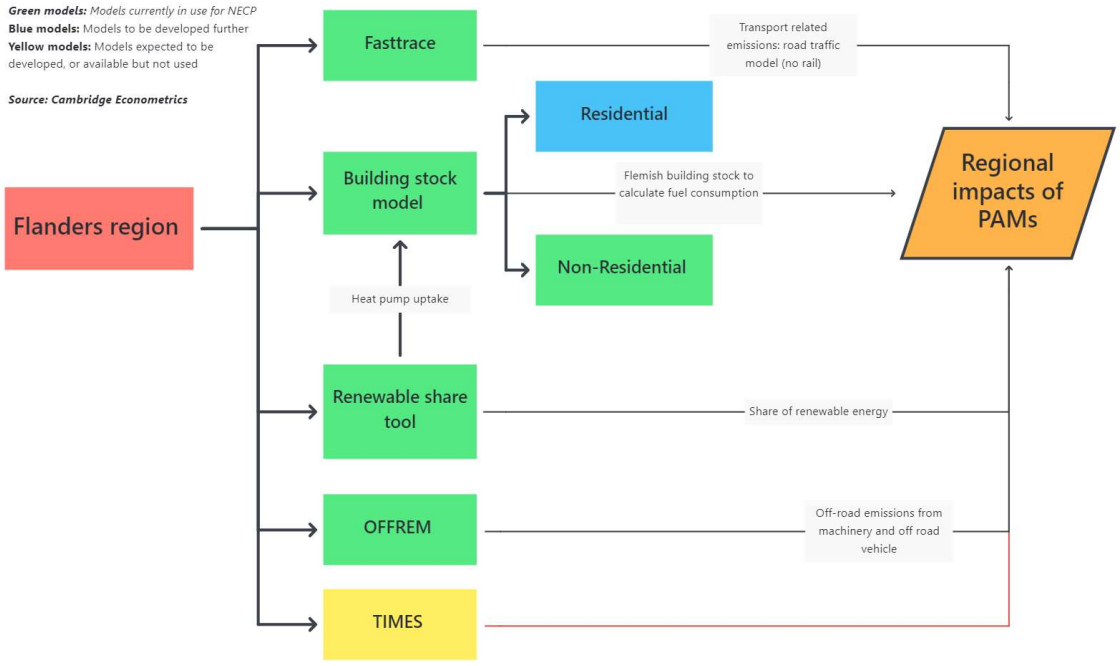
The Brussels region employs a unique methodological approach in the form of an excel tool aimed at providing emission projections (see Figure 3.3 above). This tool contains sector specific modules, with projections on the macro-economy and energy markets. The WAM package is inputted to the tool, and the resulting projections in emissions are used for the NECP reporting.

The methodological tool of the Brussels region is independent of all other tools at the FPB and other regions. The tool does not take inputs from other models, and it was developed independently to other regional techno-economic models. The resulting projections of this tool are employed within the compilation exercise, as an input for the Brussels region.

The modelling also is defined as techno-economic and has no projections of macro-economic indicators. As a result, the results of the impact assessment conducted in the Brussels region, do not feed into macro-economic impact assessments.

3.3 Flanders

Figure 3.4 Overview of the Flanders region methodological framework used for NECP impact assessment



Source: Cambridge Econometrics through stakeholder interviews and internal methodological tools documentation review.

Figure 3.4 presents the five different methodological tools used by the Flanders region within the NECP impact assessments:

- Fasttrace
- Residential building stock model
- Non-residential building stock model
- OFFREM; and,

Renewable share tool.

These models are all developed in-house, and targeted to analysing policies in the transport, building, and renewables sectors.

Fasttrace is a road traffic model for the region of the Flanders region. Within the NECP impact assessment it is used to estimate changes in transport related emissions attributed to the PAMs at Flanders regional level. The focus of this model is restricted to road traffics, and train rail is not considered.

The Flanders region also employs a Building stock model, which contains separate residential, and non-residential modules. Both these modules are used within the NECP to estimate energy efficiency levels and fuel consumption in buildings. These changes in fuel consumption are converted into emission impacts using oof-model calculations. The residential module is bottom-up, while the non-residential module is top-down and more developed.

OFFREM is used to complement the Fasttrace model, by providing off-road emissions from machinery and off-road vehicles. This includes construction machinery, agricultural and

farming machinery, railcars, and locomotives amongst others, providing a broader picture on transport related emissions extending past road traffic.

To calculate the growth and changes to renewable shares in power generation, the Flanders region employs an excel calculation tool.

The Flanders region specific methodological tools do not interact with other methodological tools of the FPB nor other regions. The road traffic model of Flanders is independent of the transport demand and car stock models used at federal level. Additionally, the Building stock models of the Flanders region are independent of the Wallon region's building stock models, and they are each developed separately without coordination on assumptions and model set ups. The renewable share tool is also developed in isolation of other regions and the FPB. However, the results of all parties come together in a compilation exercise which aggregates each individual result and provides an overview of the renewable share evolution.

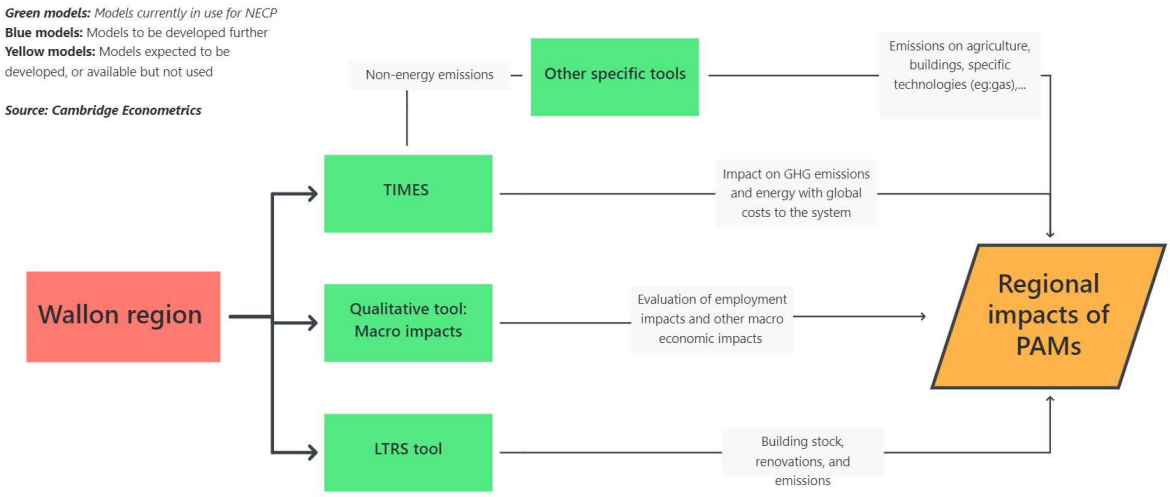
Models within the Flanders region also have limited feedback within themselves. Given that all methodological tools are techno-economic models focused on modelling emissions within a specific sector, there are no spillovers of outputs within the models. There is however one exception with both building stock models which provide heat pumps estimations for the renewable share tool.

The results from the Flanders region's techno-economic impact assessment do not feed into macroeconomic or social impacts assessments. All discussions relating to the NECP contributions of the Flanders region are focused on emissions estimation, and there is no connection yet to the macro-economic side.

The Flanders region's plans to improve its methodological framework in the future by implementing improvements to the Residential Building stock model.

3.4 Wallonia

Figure 3.5 Overview of the Wallon region methodological framework used for NECP impact assessment



Source: Cambridge Econometrics through stakeholder interviews and internal methodological tools documentation review.

Figure 3.5 presents the wide variety of methodological tools used by the Wallon region withing their NECP impact assessment:

- TIMES;

- Non-energy emissions tool;
- LTRS tool; and,
- Macroeconomic impact methodology.

TIMES is a bottom-up, integrated, optimisation model which captures the energy market dynamics and technologies. It is used for the NECP contributions of the Wallon region, to provide estimates on the emissions, energy consumption, power capacity and (to some extent) investment needs[10] of the PaMs. It requires inputs of energy and technology costs, as well as socio-economic variables. The model considers only combustion emissions of the main regional sectors (account for a sizeable percentage of total). Energy cost inputs are made consistent with PRIMES projections where possible.

Specific tools are also developed to expand the scope of TIMES and capture non-energy related emissions. These tools include, an agricultural specific excel tool which provides agricultural projections and GHG emissions, waste, and technology specific tools such as for gas markets. They attempt to maintain consistency with TIMES, but this is not always possible.

A building stock excel tool, called LTRS is also employed by the Wallon region, to measure the impact of renovation strategies on energy consumption.

The Wallon region also attempts to evaluate the macroeconomic impact of PaMs in the context of NECP reporting. For this purpose, it performs specific qualitative exercises per sector which produce estimations of expected impacts on employments and other socio-economic variables.

Except for the compilation exercise of energy projections, there are currently no other interactions between the Wallon region's methodological tools and those of the FPB and the two other regions. For instance, the TIMES model is independent from the design and outputs of ARTELYS (FPB) as well as from the Flanders region's renewable share calculations.

In addition, it should be noted that coordination and consistency across the Wallon region's various methodological tools are limited.

The results of the techno-economic impact assessments of the Wallon region do not feed into the macroeconomic social impact assessments. Although the Wallon region does perform separate macro-economic estimations, these remain at a qualitative level, and therefore do not employ projections and outputs from other methodological approaches which are targeted to focus on emissions.

Based on exchanges with the Wallon region, this note reports that there are several improvements to their methodological framework they would have been able and willing to implement but lacked resources to do so. One of these improvements involves expanding the outputs of TIMES to include macro-economic impacts as a first step for integrating techno-economic and macro-economic impact assessments. Additionally, the global cost to the system which TIMES provides, could be transformed into technology, and measure specific investment needs.

[10] The global costs of the system are provided as investment needs. A more top-down exercise to extract these investment needs per technology and PAM could be built for the future.

Annex 1 Structure of the stakeholder interviews:

To inform the content of this report, stakeholder interviews were conducted. The following stakeholders were involved during these interviews:

- The Federal Planning Bureau
- The Brussels region
- The Flanders region
- The Walloon region

During these interviews, the questionnaire presented below was used. Administrations were requested to fill any missing information after the interviews. Each interview lasted a minimum of one hour and was attended by one or more people from the administration. We had two rounds of interview with the FPB, that helped to obtain a first overview of the modelling framework. The second interview with the FPB took place after we have had the interview with each regional administration. Last information gaps were addressed through exchange during the drafting process of this note.

Question 1: From the scoped list of methodological tools sourced from the NECP of Belgium, which are the ones currently in used, and which other should be included?

Question 2: What is each methodological tool used for as part of the NECP work?

Question 3: How do the various methodological tools complement each other when evaluating impacts of a specific PAM (national and regional models, cross-regional models, techno-economic and macro-economic)?

Question 4: Do the results of technological impact assessments feed into macroeconomic or social impact assessments (as inputs)? If yes/no, please provide info.

Question 5: How does the regional and the national level fit together?

Question 6: How is impact aggregation done? Here impact aggregation refers to technoeconomic and the other impact criteria (macro, social, etc).

Question 7: What was the approach for disclosing the limitation of results?

Question 8: What is your/the teams experience with using the different methodological tools?

Question 9: Do you envision any future developments of the existing methodological tools?

Question 10: Is your administration currently working to develop specific methodological tools, which have not yet been discussed, for the NECP of Belgium?

Annex 2 Theory of Change template

As part of this assistance, CE provided the Belgian administration with a Theory of Change template. The different administrations were introduced to this template, with explanations on how best to use it, during their respective interview with the Cambridge Econometrics team. The aim of this template is to allow the administrations to collaborative outline what the assumed theory and methodological tools used for a specific impact assessment are. This should help improve transparency and consistency across administrations, as well as facilitate a structured and recorded impact assessment for each of the PAM.

This template is stored in the internal folders of the project team and the Belgian administrations. A summary of the template can be found in Figure A2.1 below:

Figure A2.1 Summary of the Theory of Change template

PaM description:
Start date:
End date:
Objective:
Description of causal chain:
Budget allocated:
Administrative team responsible:

		Environment relevant to the PaM: exogenous factors (events or other PaMs) expected to influence observed PaM-associated impacts	PaM delivery method	PaM implementation assumptions	Expected first degree impacts	Expected second degree impacts	Observed/Simulated outcomes (first degree)	Methodology employed: Observed/Simulated outcomes (first degree)	Observed/Simulated outcomes (second degree)	Methodology employed: Observed/Simulated outcomes (second degree)

	Approach description (short)	Indicator definition	Robustness	Possibility for integrated assessment (policy interaction considered)	Unit	Note	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
First degree effects																							
Δ (capacity)																							
uptake or penetration or usage																							
Δ (energy consumption)																							
Δ energy intensity																							
Macroecnomic impacts (including Aggregate, Industrial and residential dissagregation)																							
GDP																							
GVA																							
GHG																							
CO2																							
Imports																							
Exports																							
Import dependency																							
Energy consumption																							
Employment																							
Energy market developments by energy carrier																							
Energy prices																							
Energy consumption																							
Power generation																							
Power capacity																							
GHG																							
CO2																							
Investment needs																							
Private investment																							
Public investment																							
Energy Efficiency																							
Energy intensity																							
Social																							
Value of years of life lost																							
Air pollution damage costs																							
Quality-adjusted life years (QALYs)																							
Disability-Adjusted Life Years (DALYs)																							
Air quality																							
Water quality																							
Employment quality based on contract type (precarious employment)																							
Energy povery																							
Inequality																							
Disposable income by percentaile																							