A European comparison of electricity and gas prices for large industrial consumers

29 June 2016

Final report

PwC Enterprise Advisory cvba/scrl
Maatschappelijke zetel/Siège social: Woluwe Garden, Woluwedal 18, B-1932 Sint-Stevens-Woluwe
T: +32 (0)2 710 4211, F: +32 (0)2 710 4299, www.pwc.com
BTW/TVA BE 0415.622.333 / RPR Brussel - RPM Bruxelles / ING BE32 310138119602 - BIC BBRUBEBB /
RBS BE03 7205 4043 3084 - BIC ABNABEBR

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Executive Summary

1. Executive Summary

1.1. Executive Summary – English

In this report, energy prices for six industrial consumer profiles (four electricity, two gas) are compared between Belgium and four other countries: Germany, the Netherlands, France and the United Kingdom. When relevant, results are not presented on a countrywide basis but rather on a regional basis. The comparison looks at three components of the bill: commodity cost, network cost and all other costs: taxes, levies, certificate schemes.

In a **first phase** of the analysis, the industrial fabric of the Belgian regions is thoroughly analysed. Based upon the score on a few economic and energy-related variables, a ranking is constructed, identifying 5 industrial sectors most relevant for analysing energy costs: the chemical, basic metal, pharmaceutical, food & beverages and non-metallic mineral industries. Together with additional input from stakeholders within those sectors, six relevant theoretical consumption profiles are selected: E1, E2, E3 and E4 in the case of electricity and G1 and G2 in the case of gas.

Consumer profiles E1 and E2 represent industrial consumers with an annual consumption of respectively 10 and 25 GWh. Consumer profiles E3 and E4 represent very large industrial consumers, amounting to an annual consumption of respectively 100 GWh and 500 GWh. In the case of gas, a large industrial consumer (profile G1) with a consumption of 100 GWh a year and a very large industrial consumer (profile G2) with a consumption of 2,5 TWh a year are presented. Furthermore, the option that profile G2 uses gas as a raw material (feedstock), is presented in the study, while it has been excluded for profile G1.

The **second phase** of the analysis is dedicated to the build-up and comparison of prices and price components. General hypotheses are adopted and their application across different countries is carefully described in order to maximize the objectivity of the comparison. Energy costs are analysed from the bottom-up, and the different price components are described in a detailed way in order to offer a clear view of the origins of the observed results.

In terms of electricity, this report highlights a great deal of complexity as a consequence of government intervention aiming at reducing electricity costs for some categories of large industrial consumers. These interventions are specifically targeted at the second (network costs) and third component (taxes, levies, certificate schemes).

The lowest electricity cost for consumer profiles E1 and E2 can be found in the Netherlands, while Germany offers the lowest electricity cost for consumer profiles E3 and E4. The application of several tax and network cost reductions in the Netherlands, Germany and – to a lesser extent – France, depends on a host of very specific economic criteria, which obliges us to present the results in terms of a fairly large range of possibilities. The highest possible electricity cost for every profile under review can therefore be found in Germany, for consumers who cannot appeal to the reduction criteria, and to a lesser extent, in the United Kingdom.

Commodity cost makes up for a more important part of the gas bill than the electricity bill, but its impact on the differences between countries is larger for electricity than for gas. Germany has a sizeable competitive advantage on the other countries in terms of electricity commodity cost, while gas market prices are largely identical across the observed countries (except for the southern part of France).

For gas prices, the differences observed between countries are smaller than for electricity, as are the ranges of possibilities within countries. We observe considerably less complexity and although some reductions or exemptions on taxes for industrial consumers that use gas as a raw material (feedstock) apply, government intervention with regards to taxes and network costs is in general less common.

In terms of Belgian competitiveness, general conclusions are mixed. For all electricity consumption profiles, only one neighbouring country is certainly less competitive than Belgium: the United Kingdom. Similarly, for all consumption profiles and in all cases, the Netherlands are more competitive than Belgium. The differences between the Flemish and Walloon regions is most important for profiles E1 and E2, where the electricity cost is substantially higher in the Walloon region. For profiles E3 and E4, the picture is more nuanced, with the Walloon region slightly more competitive for E3, while the Flemish region is more competitive for E4. For industrial gas consumers, Belgium offers the lowest cost of all countries studied in this report, except when comparing to feedstock consumers in the Netherlands for profile G2.

In **a third phase**, sector and region specific electricity and gas prices are analysed in terms of their impact on the competitiveness of industrial consumers. It has to be noted that some competitors of Belgian industrial consumers benefit from important reductions on several price components. These are based on national criteria for electro-intensity, which can differ in severity and selectiveness in the neighbouring countries.

Nevertheless, a distinction between electro-intensive and non-electro-intensive consumers is very important as the situation for all important industrial sectors in Belgium is less beneficial when they compete with electro-intensive consumers in neighbouring countries, than when they compete with non-electro-intensive consumers. More specifically, industrial consumers in Belgium that compete with non-electro-intensive consumers in the neighbouring countries have a clear competitive advantage in terms of total energy cost. For industrial consumers that compete with their counterparts in neighbouring countries that benefit from reductions for electro-intensive consumers, the situation is totally opposite. Their total energy cost constitutes an important competitiveness problem, certainly when compared to Germany, France and the Netherlands.

Furthermore, the impact of the relatively low gas cost for Belgium is fairly limited. Although some sectors consume twice as much natural gas as electricity, the lower cost per energy unit of natural gas makes that electricity plays the determining role in the total energy cost competitiveness. Finally, the situation in the Walloon region is generally less favourable than in Flanders. This is most striking for industrial sectors with an important proportion of smaller industrial electricity consumers (E1 and E2).

To conclude, it can be stated that part of the tax revenues are directed toward protecting consumers that are not particularly affected by a lack of competitiveness of electricity prices, while more vulnerable consumers suffer from an important disadvantage compared to their electro-intensive competitors in neighbouring countries. It could be hence interesting to reflect upon the possible adaptations of the present tax reductions for industrial consumers that have been put in place by federal and regional governments. The general objective should be to generate an evolution toward more competitive total energy prices for electro-intensive industrial consumers, while preserving (part of) the present competitive advantage for non-electro intensive consumers.

1.2. Executive Summary – Nederlands

In deze studie worden de energieprijzen voor zes industriële verbruikers (vier in elektriciteit en twee in aardgas) vergeleken in België en vier andere landen: Duitsland, Nederland, Frankrijk en het Verenigd Koninkrijk. Wanneer dat relevant is, worden de resultaten niet op nationale basis gepresenteerd, maar wel in zones. De vergelijking behandelt de drie componenten van de eindfactuur: commodity, netwerk en alle andere kosten: belastingen, toeslagen en certificaatsystemen.

In een **eerste fase** van de studie wordt het industriële weefsel van de Belgische regio's grondig geanalyseerd. Gebaseerd op de score op een aantal economische en energie-gerelateerde variabelen wordt een ranking opgesteld, waarbij 5 industriële sectoren worden geïdentificeerd die het meest relevant zijn voor het analyseren van de impact van de energiekost: de vervaardiging van chemische stoffen, van metalen in primaire vorm, van farmaceutische producten, van voeding- en drankproducten, en van niet-metaalhoudende mineralen. Samen met aanvullende input van enkele belanghebbende partijen binnen de geïdentificeerde sectoren worden zes relevante theoretische consumptieprofielen voorgesteld: E1, E2, E3 en E4 in het geval van elektriciteit en G1 en G2 in het geval van gas.

Consumptieprofielen E1 en E2 vertegenwoordigen industriële verbruikers met een jaarlijkse consumptie van respectievelijk 10 en 25 GWh. Consumptieprofielen E3 en E4 daarentegen vertegenwoordigen industriële grootverbruikers met een jaarlijks verbruik van respectievelijk 100 en 500 GWh. In het geval van gas, zijn één industriële grootverbruiker (profiel G1) met een consumptie van 100 GWh per jaar en één met een jaarlijks verbruik van 2,5 TWh geselecteerd. Bovendien wordt voor het geval van profiel G2 de mogelijkheid voorzien dat deze gas gebruikt wordt als grondstof (feedstock), terwijl we deze mogelijkheid niet voorzien hebben in de studie voor profiel G1.

De **tweede fase** van de analyse is gewijd aan het opbouwen en vergelijken van prijzen en prijscomponenten. Om een zo objectief mogelijke vergelijking te realiseren worden een aantal algemene hypotheses aangenomen en de toepassing ervan wordt zorgvuldig beschreven. De totale energiekost wordt volledig opgebouwd van aan de basis, waarbij de verschillende componenten in detail beschreven worden om een duidelijk zicht te houden op de oorsprong van de eindresultaten.

Voor elektriciteit stelt dit rapport een grote complexiteit vast als gevolg van overheidsinterventies die erop gericht zijn de elektriciteitskost voor sommige categorieën grote industriële verbruikers te verminderen. Deze ingrepen zijn specifiek gericht op de tweede (netwerkkost) en derde prijscomponent (belastingen, toeslagen en certificaatsystemen).

We stellen vast dat Nederland de laagst mogelijke elektriciteitskost biedt voor consumptieprofielen E1 en E2, terwijl Duitsland de laagst mogelijke elektriciteitskost biedt voor E3 en E4. Het van toepassing zijn van de verschillende verminderingen op de netwerkkost en de belastingen in Nederland, Duitsland – en in beperkte mate – Frankrijk, hangt immers af van een hele reeks specifieke economische criteria, waardoor het resultaat een relatief breed spectrum beslaat. Hierdoor biedt Duitsland voor grootverbruikers die niet voldoen aan deze criteria ook de hoogst mogelijke elektriciteitskost voor alle profielen in deze studie, gevolgd door het Verenigd Koninkrijk.

De kost van de commodity heeft een groter aandeel in de eindprijs voor aardgas dan voor elektriciteit, maar speelt een meer bepalende rol voor elektriciteit. Duitsland heeft een substantieel competitief voordeel ten opzichte van de andere landen qua commoditykost voor elektriciteit, terwijl de marktprijzen voor aardgas grotendeels gelijklopen in de verschillende landen (met uitzondering van het zuidelijk deel van Frankrijk).

Voor wat betreft aardgas zijn de verschillen tussen de landen kleiner dan voor elektriciteit, en ook het bereik aan mogelijkheden binnen de landen is kleiner. In het algemeen is de prijssamenstelling minder complex en hoewel er enkele reducties en vrijstellingen bestaan op belastingen voor industriële grootverbruikers die gas gebruiken als een grondstof (feedstock), stellen we in het algemeen minder overheidsinterventie vast op gebied van transportkosten en belastingen.

Voor wat betreft de competitiviteit van België zijn de conclusies gemengd. Voor alle industriële elektriciteitsverbruikers is er slechts één buurland dat met zekerheid minder competitief is dan België: het Verenigd Koninkrijk. Voor alle elektriciteitsverbruikers en in alle gevallen heeft België een hogere elektriciteitskost dan Nederland. De verschillen tussen Vlaanderen en Wallonië zijn het grootst voor profielen E1 en E2, waarbij de elektriciteitskost substantieel hoger is in Wallonië. Voor profielen E3 en E4 is het besluit meer genuanceerd, waarbij de prijzen in Wallonië competitiever zijn voor profiel E3 en in Vlaanderen voor profiel E4. Voor industriële aardgasverbruikers is de conclusie wel erg duidelijk: de kost in België is de laagste van alle onderzochte landen, behalve wanneer prijzen vergeleken worden met feedstock consumenten in Nederland voor profiel G2.

In een **derde fase** worden sector- en regiospecifieke elektriciteits- en gasprijzen geanalyseerd in termen van hun impact op de competitiviteit van industriële grootverbruikers. Hierbij is het niet onbelangrijk te vermelden dat sommige concurrenten van Belgische industriële grootverbruikers kunnen profiteren van belangrijke reducties op verschillende prijscomponenten. Deze zijn gebaseerd op nationale criteria inzake elektro-intensiteit, die verschillen in gradatie en selectiviteit in de buurlanden.

Desondanks is een onderscheid tussen elektro-intensieve en niet-elektro-intensieve verbruikers zeer belangrijk aangezien de situatie voor alle belangrijke industriële sectoren in België minder gunstig is wanneer deze vergeleken worden met elektro-intensieve verbruikers in de buurlanden, dan wanneer deze vergeleken worden met niet-elektro-intensieve verbruikers. Industriële verbruikers in België die concurreren met niet-elektro-intensieve verbruikers in de buurlanden hebben immers een duidelijk competitief voordeel met betrekking tot hun totale energiekost. Voor industriële verbruikers die concurreren met elektro-intensieve verbruikers in de buurlanden, is de situatie compleet tegenovergesteld. Hun totale energiekost vormt een belangrijk concurrentieprobleem, zeker in vergelijking met Duitsland, Frankrijk en Nederland.

Verder is de impact van de relatief lage gasprijzen in België behoorlijk beperkt. Hoewel sommige sectoren tweemaal zo veel gas als elektriciteit verbruiken, zorgt een lagere kost per eenheid van energie van gas ervoor dat elektriciteit de meest doorslaggevende rol speelt in het bepalen van de totale energiekost en de competitiviteit. Tenslotte is de situatie over het algemeen wat minder gunstig in Wallonië dan in Vlaanderen. Dit is het meest markant voor industriële sectoren die gekenmerkt worden door een belangrijk aandeel van kleinere industriële verbruikers (E1 en E2).

Tot slot kan men stellen dat belastinginkomsten gebruikt worden voor het beschermen van verbruikers die niet in het bijzonder getroffen worden door een gebrek aan competitiviteit op het vlak van elektriciteitsprijzen, terwijl meer kwetsbare verbruikers benadeeld worden in vergelijking met hun elektro-intensieve concurrenten in de buurlanden. Vandaar kan het dus nuttig zijn om stil te staan bij een eventuele aanpassing van de huidige belastingvermindering voor industriële verbruikers in België en de gewesten. In het algemeen zou een evolutie naar een meer concurrentiële energieprijs voor elektro-intensieve verbruikers het doel moeten zijn, terwijl men (een deel van) het huidige concurrentievoordeel voor niet-elektro-intensieve verbruikers moet behouden.

1.3. Executive Summary – Français

Dans ce rapport, les prix de l'énergie pour six profils de consommateurs industriels (quatre en électricité, deux en gaz) sont comparés entre la Belgique et quatre autres pays : l'Allemagne, les Pays-Bas, la France et le Royaume-Uni. Lorsque cela est pertinent, les résultats sont présentés non pas sur une base nationale mais sur une base régionale. La comparaison traite des trois composantes de la facture finale: le coût de la commodité, les coûts de réseaux et l'ensemble des autres coûts: taxes, surcharges et systèmes de certificats verts.

Dans une **première phase d'analyse**, le tissu industriel des régions belges est analysé en profondeur. En se basant sur le score de quelques variables économiques et énergétiques, un classement est établi pour identifier 5 secteurs industriels clés pour l'analyse des coûts énergétiques : l'industrie chimique, l'industrie métallurgique, l'industrie pharmaceutique, l'industrie alimentaire et des boissons et l'industrie des minéraux non-métalliques. Grâce à l'apport d'informations complémentaires de parties prenantes de ces secteurs, six profils de consommation théoriques pertinents ont été sélectionnés : E1, E2, E3 et E4 pour l'électricité et G1 et G2 pour le gaz.

Les profils E1 et E2 représentent les consommateurs industriels ayant une consommation annuelle de respectivement 10 et 25 GWh. Les profils E3 et E4 représentent les consommateurs industriels dont la consommation est très importante, s'élevant sur une base annuelle à respectivement 100 GWh et 500 GWh. Dans le cas du gaz, un grand consommateur industriel (profil G1) avec une consommation de 100 GWh par an et un très grand consommateur industriel (profil G2) avec une consommation de 2,5 TWh par an sont présentés. En outre, le cas où le profil G2 utilise le gaz comme matière première (feedstock) est présenté dans l'étude, alors qu'il a été exclu pour le profil G1.

La **seconde phase d'analyse** est consacrée à la construction et à la comparaison des prix et de ses composantes. Des hypothèses générales ont été adoptées et leur application à travers différents pays est soigneusement décrite afin de maximiser l'objectivité de la comparaison. Le coût total de l'énergie est analysé et reconstruit à partir de zéro, tout en décrivant les différentes composantes de façon détaillée afin d'offrir une vue aussi claire que possible sur l'origine des résultats observés.

En ce qui concerne l'électricité, ce rapport met en exergue la grande complexité induite par des interventions gouvernementales visant à réduire le coût de l'électricité pour certaines catégories de grands consommateurs industriels. Ces interventions concernent surtout la deuxième (coûts de réseaux) et troisième composante (taxes, surcharges et systèmes de certificats).

Les Pays-Bas présentent les prix de l'électricité les plus faibles pour les profils E1 et E2 alors que l'Allemagne présente les prix les plus bas pour les profils E3 et E4. L'application des nombreuses réductions de taxes et surcharges et de coûts de réseaux aux Pays-Bas, en Allemagne et, dans une moindre mesure, en France, dépend d'une série de critères économiques et géographiques très détaillés qui nous oblige à présenter les résultats sous forme d'une gamme de possibilités relativement étendue. Les prix les plus élevés pour l'électricité peuvent dès lors être trouvés en Allemagne, pour les consommateurs ne pouvant satisfaire ces critères permettant de bénéficier des réductions, et dans une moindre mesure, au Royaume-Uni.

Le coût de la commodité représente une part plus importante de la facture pour le gaz que pour l'électricité, mais son impact sur les différences observées entre pays est cependant plus important pour l'électricité que pour le gaz. L'Allemagne a un avantage compétitif considérable par rapport aux autres pays en termes de coût de la commodité en électricité, alors que les prix sur les marchés du gaz sont généralement très similaires dans les pays de l'échantillon (hormis la partie méridionale de la France).

En ce qui concerne le gaz, les différences de prix finaux observées entre les pays ainsi que les gammes de résultats possibles au sein d'un même pays sont moins grandes que pour l'électricité. Nous observons sensiblement moins de complexité et l'intervention gouvernementale en matière fiscale ou sur les coûts de réseaux est généralement moins fréquente, même si certaines réductions ou exemptions fiscales pour les consommateurs industriels qui utilisent le gaz comme matières premières (feedstock) existent.

En ce qui concerne la compétitivité de la Belgique, les conclusions générales sont ambigües. Pour tous les profils de consommation d'électricité, le Royaume-Uni est le seul pays voisin qui est sensiblement moins compétitif que la Belgique. De façon similaire, pour tous les profils de consommation et dans tous les cas, les Pays-Bas sont plus compétitifs que la Belgique. La différence entre la Flandre et la Wallonie est plus importante pour les profils E1 et E2 pour lesquels le coût de l'électricité est sensiblement plus élevé en région wallonne. Pour les profils E3 et E4, le résultat est plus nuancé, la région wallonne étant légèrement plus compétitive pour le profil E3 alors que la région flamande est plus compétitive pour le profil E4. Pour les consommateurs industriels de gaz, la Belgique offre le coût le plus faible de l'ensemble des pays considérés dans ce rapport, à l'exception des consommateurs industriels utilisant le gaz comme matière première aux Pays-Bas pour le profil G2.

Dans une **troisième phase d'analyse**, les prix de l'électricité et les prix du gaz par secteur et par région sont analysés en termes d'impact sur la compétitivité des consommateurs industriels. Il est important de noter que quelques concurrents des consommateurs industriels belges bénéficient d'importantes réductions sur plusieurs composantes du prix. Celles-ci sont basées sur des critères nationaux d'intensité de consommation électrique, qui peuvent différer en niveau et en sélectivité dans les pays voisins.

Néanmoins, la distinction entre les consommateurs électro-intensifs et non-électro-intensifs est très importante car la situation pour tous les secteurs industriels importants en Belgique est moins avantageuse quand on les compare aux concurrents électro-intensifs que quand on les compare aux concurrents non-électro-intensifs dans les pays voisins. Plus spécifiquement, les consommateurs industriels en Belgique qui concurrencent les consommateurs non-électro-intensifs des pays voisins ont un net avantage concurrentiel en termes de coût énergétique total. Pour les consommateurs industriels qui concurrencent des acteurs dans les pays voisins qui bénéficient de réductions applicables aux consommateurs électro-intensifs, la situation est totalement inversée. Leur coût énergétique total représente un problème important de compétitivité, surtout comparé à l'Allemagne, la France et les Pays-Bas.

En outre, l'impact du coût du gaz relativement bas pour la Belgique est assez limité. Bien que quelques secteurs consomment deux fois plus de gaz naturel que d'électricité, le coût réduit par unité de gaz naturel fait que l'électricité joue un rôle déterminant dans la compétitivité du coût énergétique total. Enfin, la situation en région wallonne est généralement moins favorable qu'en Flandre. Cet effet est plus marqué pour les secteurs industriels composés d'une proportion importante de petits consommateurs industriels d'électricité (E1 et E2).

Pour conclure, on peut considérer que des recettes fiscales sont utilisées pour protéger des consommateurs qui ne sont pas particulièrement affectés par un manque de compétitivité des prix de l'électricité, alors que des consommateurs plus vulnérables souffrent d'un désavantage important comparé à leurs concurrents électro-intensifs localisés dans les pays voisins. Il pourrait dès lors être utile de réfléchir à la possibilité d'une adaptation des réductions d'impôts actuelles qui ont été mises en place par les gouvernements fédéraux et régionaux et dont bénéficient les consommateurs industriels. L'objectif général devrait être d'évoluer vers des prix de l'énergie totaux plus concurrentiels pour les consommateurs industriels électro-intensifs, tout en préservant (une partie de) l'actuel avantage concurrentiel pour les consommateurs non-électro-intensifs.

2. Introduction

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This report was commissioned by the CREG, the Belgian federal regulator for Energy and Gas, in October 2015. In the framework of the CREG's larger mission of supervising transparency and competition on the market, ensuring market conditions serve the public interest and safeguarding consumers' essential interests, PricewaterhouseCoopers was asked to conduct a study comparing industrial energy prices in Belgium and the neighbouring countries.

The purpose of this study is to compare the gas and electricity prices, in total as well as per component, billed to large industrial consumers in the three Belgian regions (Wallonia, Flanders, Brussels capital region) with those in Germany, France, the Netherlands and the United Kingdom. In addition to this price analysis, the purpose of this study is also to make an assessment of the impact of the observed price differences on Belgian industry.

This report was constructed in three different phases.

The **first phase** (described in section 3) consists in selecting the industrial consumer profiles that will be analysed during the price comparison. In order to maximise the relevance of the macro-economic impact analysis, the selection of these consumer profiles is based on a thorough analysis of the industrial fabric of the Belgian economy (in its three regions). Six consumer profiles were selected: four electricity consumption profiles and two gas consumption profiles.

The **second phase** (described in sections 4 to 8) consists in the actual price comparison. In terms of methodology, we built up the energy cost from the bottom up, identifying three main components: the commodity price, the network cost, and all other costs (taxes, levies and certificate schemes). In terms of structure, this report first describes the dataset and then the general assumptions in terms of consumer profiles and consumer behaviour, completed by an overview of the different zones identified in all five countries under review. We then move on to a detailed description of the deconstructed energy cost for gas and for electricity, carefully describing the observed regulatory framework.

In sections 7 and 8, we present the results per consumer profile, using a double analysis approach: how energy prices in Belgium compare to the other four countries, and how the three components of the energy price explain the observed final results. We also attach particular attention to the comparison of the second (network costs) and third (taxes, levies, certificate schemes) components. In a general conclusion, we give a first overview of the observed results in terms of competitiveness for Belgian industrial energy consumers.

The **third phase** of this report, described in section 9, consists in a detailed analysis of the impact of the results from the second phase on the competitiveness of industry in the three Belgian regions. We analyse the impact of the price differences with the neighbouring countries, paying particular attention to the total energy cost for industry on macro-economic basis where the combination of electricity and gas prices make up for the total energy cost. We analyse this total energy cost in the three regions for the most important industrial sectors, and describe the possible impact of these competitive advantages and disadvantages on the three regional economies in terms of added value and employment.

As a conclusion to this report, several general conclusions that can be drawn from this report are put forward, together with a host of recommendations based on these conclusions.

A preliminary version of phase 2 of this report was submitted for review to the energy regulators of France (CRE), Germany (Bundesnetzagentur), the Netherlands (ACM) and the United Kingdom (OFGEM). This final report integrates their remarks as well as those formulated by the CREG.

3. Selection of consumption profiles

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3.1. Identification of industrial sectors

The macro-economic analysis that will be conducted in this report aims describing the industrial fabric of the Belgian economy as a whole and the economy of the Flemish, Walloon and Brussels regions in particular. We will conduct this analysis in order to identify a number of industrial sectors for which a comparison of prices of gas and electricity is important.

We can identify two important objectives that justify this identification of industrial sectors for which energy price competitiveness is especially relevant. First, when selecting and describing the six consumer profiles that will be used for the price comparison in this study, it is important to assure that the chosen profiles are as relevant as possible for these sectors. Secondly, this macro-economic analysis as a whole will be useful when assessing the impact of the observed results in terms of gas and electricity prices on the Belgian economy and the economy of its regions.

Throughout this analysis, we will use a host of macro-economic data related to the manufacturing industry. The manufacturing industry can be identified through a certain amount of sectors described in the Statistical Classification of Economic Activities in the European Community, commonly described as the NACE classification.[1] The industrial fabric of a country can generally be regrouped in two different parts:

- **The manufacturing industry,** including the basic industries and all other industrial activities.
    - Basic industries

13-15 - Manufacture of textiles, wearing apparel, leather and related products
16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
17 - Manufacture of paper and paper products
18 - Printing and reproduction of recorded media
19 - Manufacture of coke and refined petroleum products
20 - Manufacture of chemicals and chemical products
21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations
22 - Manufacture of rubber and plastic products
23 - Manufacture of other non-metallic mineral products
24 - Manufacture of basic metals

    - Other sectors of the manufacturing industries :

[1] ***N**omenclature statistique des **A**ctivités économiques dans la **C**ommunauté **e**uropéenne*

10-12 - Manufacture of food products; beverages and tobacco products
25 - Manufacture of fabricated metal products, except machinery and equipment
26 - Manufacture of computer, electronic and optical products
27 - Manufacture of electrical equipment
28 - Manufacture of machinery and equipment n.e.c.
29 - Manufacture of motor vehicles, trailers and semi-trailers
30 - Manufacture of other transport equipment
31-32 - Manufacture of furniture; other manufacturing
33 - Repair and installation of machinery and equipment

- **The extractive industries**, which can be defined as the industries extracting minerals found in solid form (coal and mineral ores), liquid form (oil) or gaseous form (natural gas).

Throughout this analysis, we will only focus on the manufacturing industry, given the limited importance (in Belgium) and particular energy consumption profile of extractive industries.

We will first describe the industrial fabric of Belgium and its regions, focusing on employment, added value and specialisation. Secondly, we will analyse the energy-intensity of these industrial sectors in order to better understand the role energy cost plays in the total cost structure of the different industrial sectors. In the third analysis, results will be presented for export intensity that can indicate how exposed certain industrial activities are to international competition and a potential risk of delocalisation. The last analysis will build on the data in terms of energy intensity to present the potential in terms of consumption reduction (energy efficiency).

Main industrial sectors for the Belgian and regional economy

In this section, we describe the relative importance of each sub-sector of the Belgian manufacturing industry in terms of added value and employment. The analysis also looks at the degree of specialisation of the Belgian economy (and each of its sub-regions) compared to neighbouring countries. The analysis is carried out for the manufacturing sector (NACE categorisations 10-33) in Belgium and in each of its regions. The Eurostat dataset used in this analysis contains national account aggregates per industry with figures from 2013.

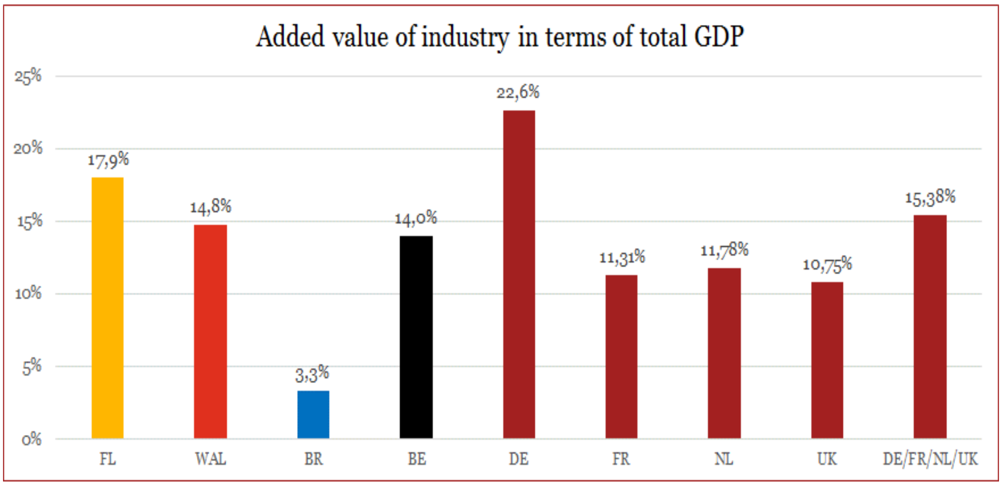
The first analysis aims to determine the relative importance of the Belgian manufacturing industry (NACE 10-33) in terms of added value. Hence, we compare the added value of the manufacturing sector to the total GDP of an economy (national or regional). The analysis is benchmarked with the relative importance of the manufacturing industry in each of the neighbouring countries (Germany, France, the Netherlands and the United Kingdom) and their weighted average[2].

Figure 1 shows that the relative importance of the manufacturing industry (NACE 10-33) is significantly higher for Germany than for other economies. It is also interesting to point out that the relative importance of the manufacturing industry

[2] The average is weighed with the size of the different economies.

in terms of added value is higher for Belgium than for each of the neighbouring countries, except for Germany. The same is true for the manufacturing industry in the Flemish and Walloon regions. Nonetheless, the manufacturing industry is less important in terms of added value for the Belgian economy than for the average of neighbouring countries – this is partly due to the weight of the German economy. At regional level, only the manufacturing industry of the Flemish region has a higher "added value to GDP ratio" than the average of neighbouring countries.

Figure 1 – Added value of industry in terms of total GDP

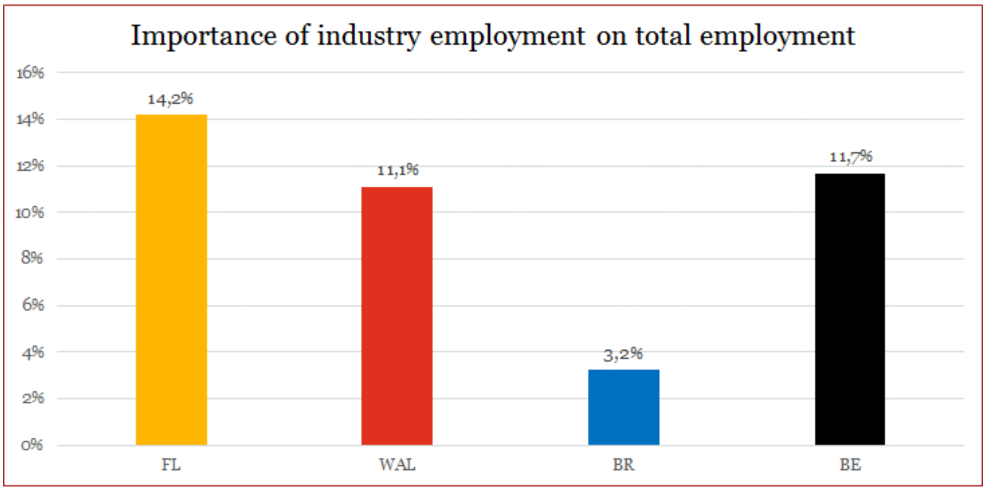


Source: Eurostat (2013), PwC calculations

The second analysis of this section aims to determine the relative importance of the Belgian manufacturing industry in terms of employment. Hence, we compare the employment generated by the manufacturing industry (NACE 10-33) to the total employment of the economy (national or regional). The analysis is carried out for Belgium and each of its regions.

When analysing the relative importance of industrial employment between regions, we come to similar results as the previous analysis looking at the relative importance of the manufacturing industry in terms of added value. The only difference lies in the fact that when looking at the manufacturing industry, the Walloon region ends up below the Belgian average in terms of relative employment (the Walloon region is above the Belgian average in terms of relative added value). All in all, the manufacturing industry is less important in terms of direct employment than in terms of added value to the entire Belgian economy (11,7% and 14,0% respectively).

Figure 2 – Importance of industry employment on total employment



Source: Eurostat (2013)

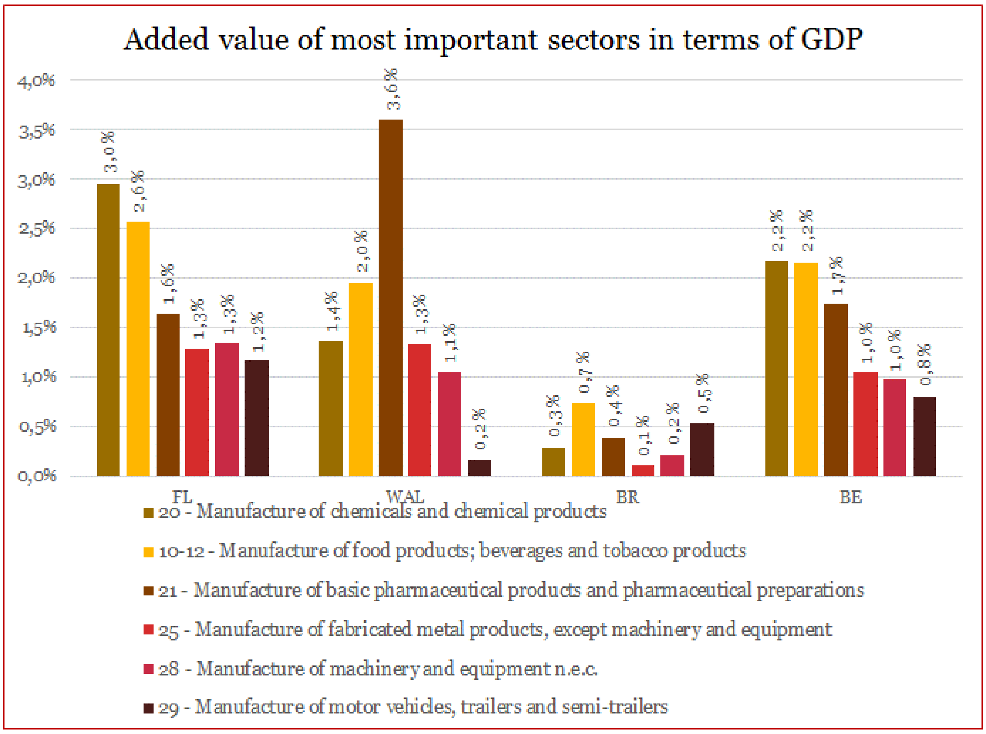
The third analysis aims to identify the most important industrial sectors in terms of relative added value. Hence, for each sub-sector (inside NACE codes 10-33), we compare the creation of added value to the total GDP of the economy (national or regional).

Figure 3 shows the top five sectors of the manufacturing industry (NACE 10-33) in terms of relative contribution to national or regional GDP. For the Belgian economy, they are: the chemical (NACE 20), food & beverages (NACE 10-12), pharmaceutical (NACE 21), fabricated metals (NACE 25), machinery and equipment (NACE 28) sectors. Interestingly enough, these top five sectors for Belgium are also the top five in the Flemish and Walloon regions.

Nonetheless, there are important regional differences that can be pointed out. First, the chemical sector is important for the Flemish region in terms of added value (3,0% of total GDP of Flanders). Secondly, the pharmaceutical industry is important for the Walloon region (3,6% of total GDP of Wallonia). It is also important to note that the automotive sector is nearly absent in the Walloon region. Third, the Walloon region also has a focus on non-metallic minerals (1,1% of total GDP of Wallonia).

It is also important to highlight that when basic metals (n°7 on Belgian level) and fabricated metals are added up, their importance equals that of the pharmaceutical sector on a Belgian level.

Figure 3 – Added value of most important sectors in terms of GDP



Source: Eurostat (2013)

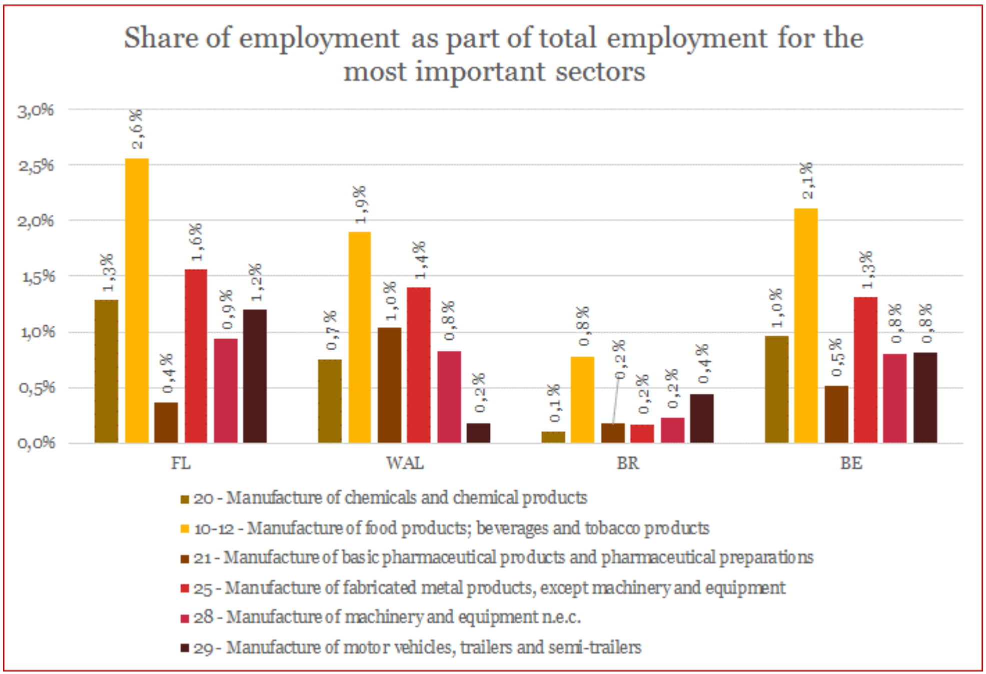
The fourth analysis of this section aims to identify the most important industrial sectors in terms of relative employment. Hence, for each sub-sector (inside NACE codes 10-33), we compare the creation of employment to the total employment of the Belgian economy. The same computation is done at the regional level.

Figure 4 highlights that amongst the manufacturing industries (NACE 10-33), the food sector (NACE 10-12) is the most important sector in terms of relative employment, followed by the fabricated metals sector (NACE 25). This is the case both at national and at regional level (except for Brussels).

It is also interesting to highlight that the pharmaceutical sector is not labour-intensive, whilst the food and fabricated metals industries are more labour intensive.

It can also be noted that both the predominance of the chemical sector in the Flemish region and of the pharmaceutical sector in the Walloon region is less outspoken when comparing with the previous analysis.

Figure 4 – Share of employment as part of total employment for the most important sectors



Source: Eurostat (2013)

The last analysis of this section deals with the specialisation indicator of the different sub-sectors in the manufacturing industry (NACE 10-33). The specialisation indicator is calculated by comparing the relative added value of each sector to that of the average of neighbouring economies. When a value for a specific industrial sector is positive, the importance of the added value created by this sector in Belgium (or one of its regions) lies above the average of the neighbouring countries. Inversely, when a value for a specific sector is negative, the added value created by this sector in Belgium (or one of its regions) lies below the average of the neighbouring countries. The specialisation indicator is calculated by the following formula:

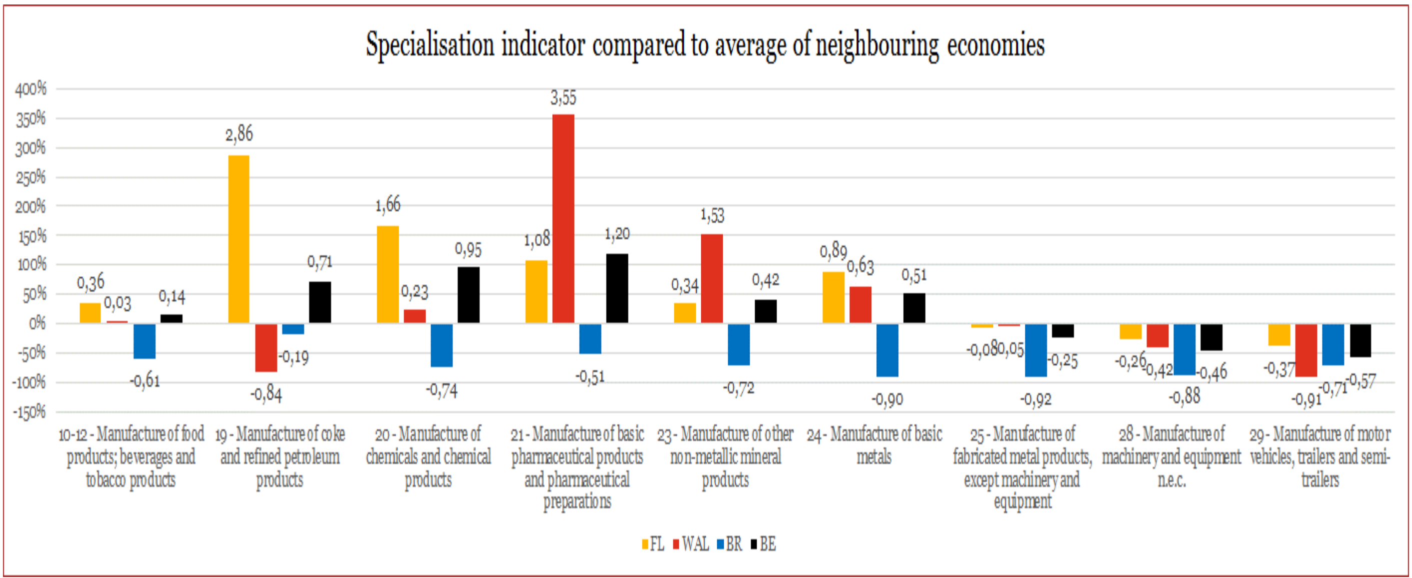
$$Specialisation\ indicator\ for\ Sector_i\ in\ Region_j = \left(\frac{Relative\ added\ value\ of\ Sector_i\ in\ Region_j}{European\ average\ of\ the\ relative\ added\ value\ of\ Sector_i} - 1\right)$$

Figure 5 shows that the pharmaceutical sector (NACE 21), the chemical sector (NACE 20) and the coke & refinery (NACE 19) sector are the three most important specialisations of the Belgian economy (specialisation indicator of 1,20 , 0,95 and 0,71 respectively).

Of the top six sectors in terms of relative added value, three are not specialised. These are the fabricated metals (NACE 25), machinery & equipment (NACE 28) and automotive (NACE 29) industries. It is interesting to note that the Belgian economy is more specialised in basic metals than in fabricated metal products, even though the latter is the larger sector in terms of GDP.

At regional level, the Walloon region is (besides the pharmaceutical industry) highly specialised in other non-metallic minerals (NACE 23), while the Flemish region is (besides the chemical sector) highly specialised in the coke & refinery industry (NACE 19).

Figure 5 – Specialisation indicator compared to average of neighbouring economies



Source: Eurostat (2013), PwC calculations

Sectors with the highest energy costs compared to total costs and energy intensity

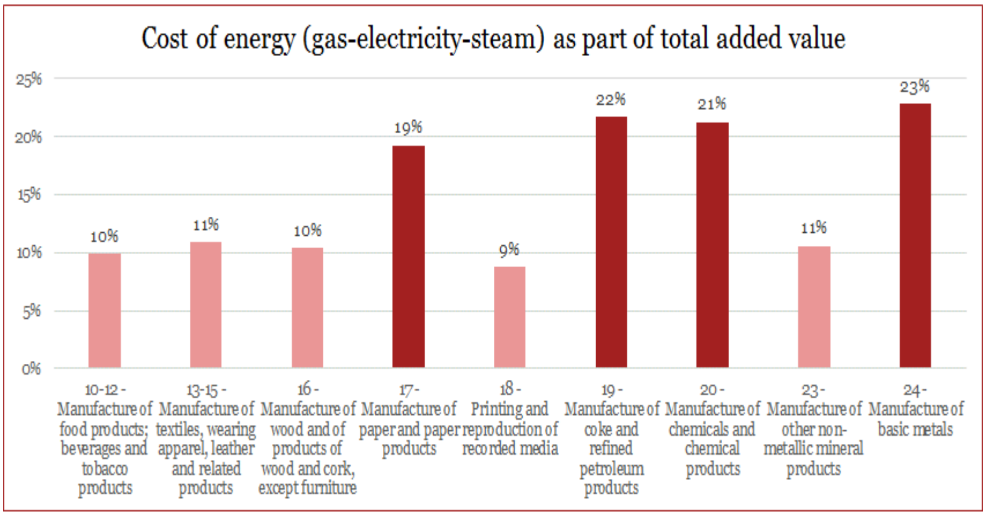
This section aims to identify sector in the manufacturing industry (NACE 10-33) with the highest energy costs. The first analysis is a cost approach which aims to identify the cost of energy (gas-electricity-steam) as part of total added value. The second approach is product based: we will analyse the gas and electricity consumption and compare it to the added value creation.

The first analysis compares the cost of energy (gas-electricity-steam) of each sector with the sector's added value creation. The analysis is based on input-output tables of the Federal Planning Bureau with figures from 2010. To do this, we identify the value of intermediary consumption of energy (NACE 35) for each sector of the manufacturing industry (NACE 10-33). We then divide this figure by the added value creation of the sector.

Figure 6 represents the sectors with a cost of energy (gas-electricity-steam) as part of total added value above 5%. It can be highlighted that for several of the most important sectors in terms of GDP the cost of energy (gas-electricity-steam) is relatively low and hence these sectors are not represented in the figure below. This is the case of the pharmaceutical (NACE 21), automotive (NACE 29), fabricated metals (NACE 25), and machinery & equipment (NACE 28) sectors.

Four sectors stand out as being sectors where the cost of energy constitutes a very important part of total added value. These are: the paper (NACE 17), coke & refinery (NACE 19), chemical (NACE 20) and basic metals (NACE 24) industries.

Figure 6 – Cost of energy (gas-electricity-steam) as part of total added value



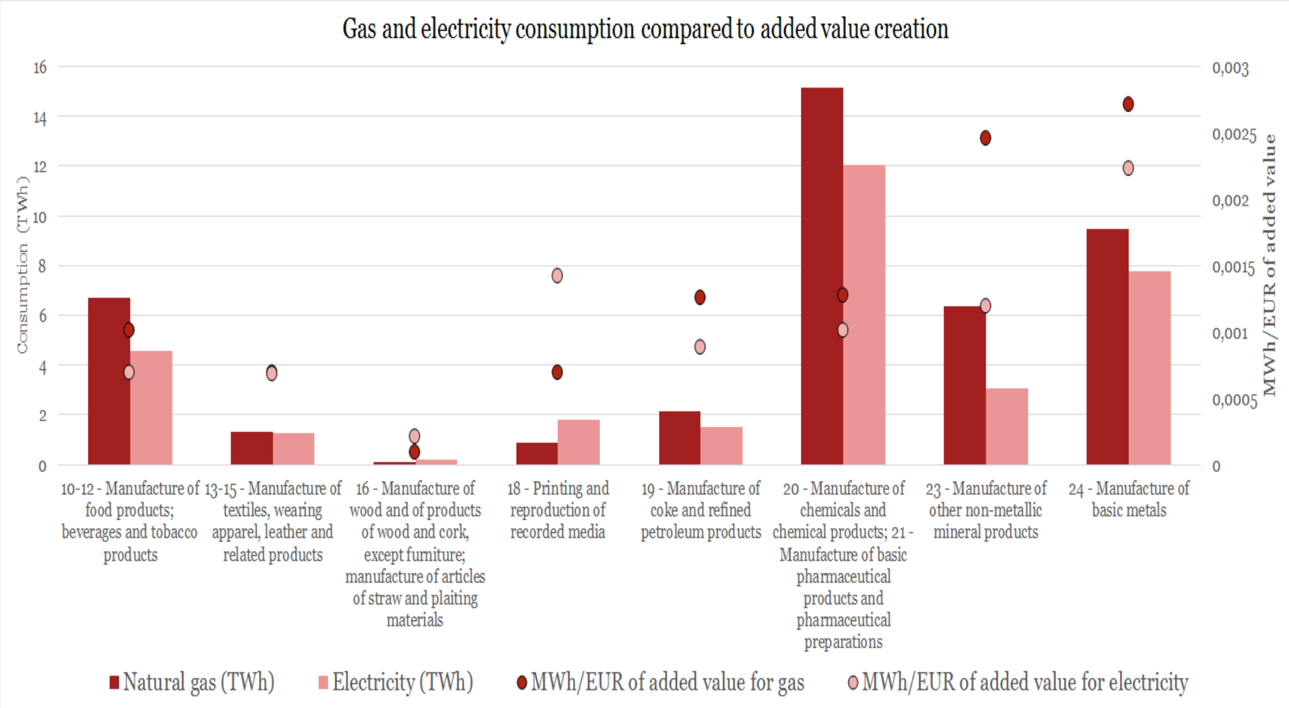
Source: Federal Planning Bureau (2010), PwC calculations

The second analysis aims to identify which sectors in the Belgian economy are the most energy intensive, based on a product approach. Energy intensity is computed by dividing the energy consumption (in MWh) of each sector with its added value creation (in EUR of added value). Added value data for each sector comes from Eurostat, whilst energy consumption accounts come from the Federal Planning Bureau. It is important to note that these energy consumption accounts being still based on old NACE-codes (2003), the data was converted to new NACE codes (2008) wherever possible. For example, there is no distinction between chemical and pharmaceutical sector (NACE 20-21).

The Belgian chemical/pharmaceutical sector (NACE 20-21) and the basic metals industry (NACE 24) are the sectors which show by far the highest gas and electricity consumption, while the textile (NACE 13-15), printing (NACE 18), wood (NACE 16) and coke/petroleum products (NACE 19) sectors are on average more modest consumers.

Figure 7 also shows that the two main Belgian energy-intensive sectors are the basic metals industry (NACE 24) and the other non-metallic fabricated products (NACE 23) – this is especially the case for energy-intensity of gas. The Belgian wood industry is the least energy-intensive sector shown in this figure.

Figure 7 – Gas and electricity consumption compared to added value creation



Source: Federal Planning Bureau, Eurostat, National Bank of Belgium (2013), PwC calculations

Interestingly, whilst the chemical/pharmaceutical sectors show large yearly electricity and gas consumption, they show an average energy-intensity compared to other manufacturing sectors.

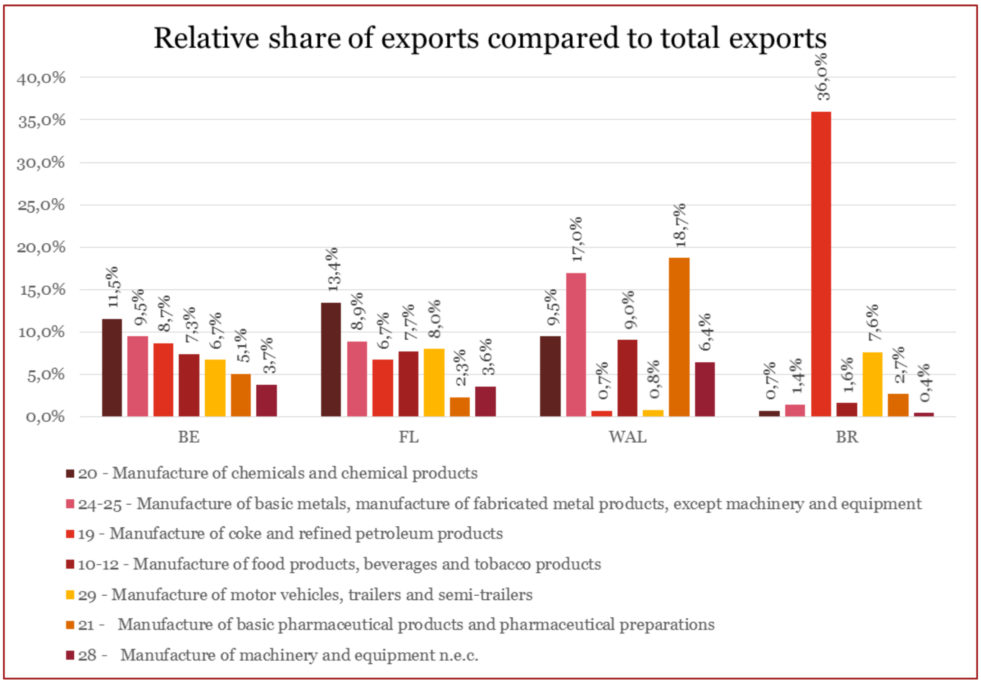
Most industrial sectors have a higher gas intensity than electricity intensity. The only exceptions to this observation are the woodworking (NACE 16) and printing (NACE 18) industries with a higher electricity intensity than gas.

Sectors with the biggest exposure to international competition (including risk of relocation)

In this section, we analyse which sectors have the biggest exposure to international competition. To do this, we analyse the relative share of exports compared to total exports for each industrial sector. Based on data published by the National Bank of Belgium, we determine the value of exports in each sector (per NACE 2008 category) and its relative importance in the total exports of an economy (regional or national).

The top 7 sectors of the manufacturing industry with the highest relative share of exports compared to the total exports of the Belgian economy are the chemical (NACE 20), basic and fabricated metals (NACE 24-25), coke & refinery (NACE 19), food & beverage (NACE 10 -12), automotive (NACE 29), pharmaceutical (NACE 21) and machinery & equipment (NACE 28) sectors. Hence, these sectors show the biggest exposure to international competition.

Figure 8 – Relative share of exports compared to total exports



Source: National Bank of Belgium (2012), PwC calculations

We analyse these seven most important sectors in terms of relative exports for each of the three regions. The top 5 sectors (each with a relative share of exports >5% of the total exports of the region) in Flanders and Wallonia are also amongst the top 7 sectors in terms of relative export share in Belgium. In Flanders, the chemical sector has the highest relative share of exports (13% of total exports of the region). Regarding Wallonia, the basic & fabricated metals (NACE 24-25) and pharmaceutical (NACE 21) sectors stand out as the sectors with the biggest relative share of exports (17% and 19% of total regional exports respectively). In the Brussels Capital region, the coke & refinery sector (NACE 19) is by far the sector with the biggest relative share of exports (36% of the total exports of the region).

Figure 9 aims to determine for which sectors of the Belgian economy there is a significant risk of relocation. To do this, we compare the export value of each sector (per NACE 2008 category) to the value of the gross output[3] for the sector. Indeed, the more an economic activity depends on exports, the more it is at risk of relocation (without taking into account other physical or geographical criteria). The production data for each sector comes from the Input-Output Tables of the Federal Planning Bureau. The last data available dates back from 2010.

The Figure below shows that the sectors in the Belgian manufacturing industry with the highest "exports on gross output" ratios are the automotive (NACE 29), chemical/pharmaceutical (NACE 20-21), textile (NACE 13-15), electronics (NACE 26), plastics (NACE 22), machinery and equipment (NACE 28). These sectors all show an "export on gross output" ratio of more than 70%. Hence, these sectors show the highest risk of relocation to third countries.

Amongst others, the food & beverages (NACE 10-12) and wood industries (NACE 16) are relatively less exposed to the risk of relocation. They each have an "export on gross output" ratio of less than 50%.

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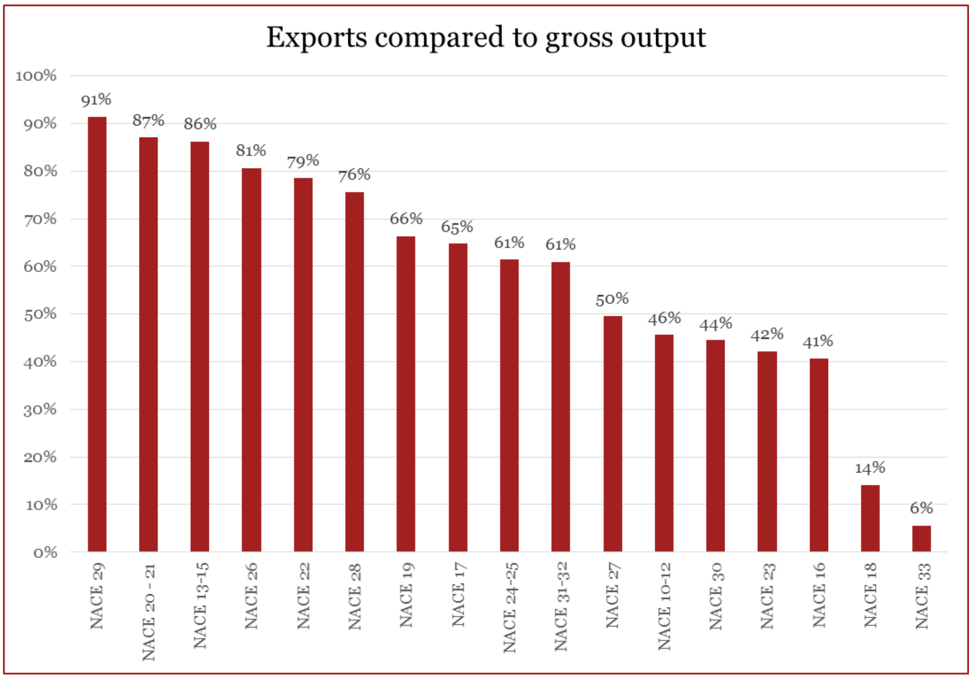
[3] According to the Bureau of Economic Analysis, gross output is a measure of an industry's sales or receipts, which can include sales to final users in the economy (GDP) or sales to other industries (intermediate inputs). Gross output can therefore be measured as the sum of an industry's value added and intermediate inputs.

Figure 9 – Exports compared to gross output



Source: National Bank of Belgium & Federal Planning Bureau (2010), PwC calculations

Sectors with the lowest potential in terms of consumption reduction (energy efficiency)

The aim of this section is to identify sectors in the Belgian economy that do or do not have the opportunity to significantly improve their short-term energy efficiency. For this, we compared the energy intensity of each sector of the Belgian manufacturing industry (based on 2008 NACE categorisation of industrial sectors) to that of the same sectors in neighbouring countries (Germany, the Netherlands and France). As highlighted in section 2, energy intensity is measured by energy consumption (in MWh) per EUR of added value created for each sector.

Added value data for each sector comes from Eurostat, whilst energy consumption accounts come from national statistic offices[4]. It should be noted that energy consumption data for the UK has not been found with a sufficient level of detail[5]. This analysis has been carried out separately for electricity and gas.

Energy efficiency analysis

The sector "i" of the Belgian economy (b) can be considered to have a potential for improvement in terms of energy efficiency, compared to the sector "i" of another country (p) if it consumes more energy to produce the same production unit.

Energy intensity of sector "i" of the Belgian economy > Energy intensity of sector "i" of country p

$$\frac{Energy\ consumption_b^i}{Added\ value_b^i} > \frac{Energy\ consumption_p^i}{Added\ value_p^i}$$

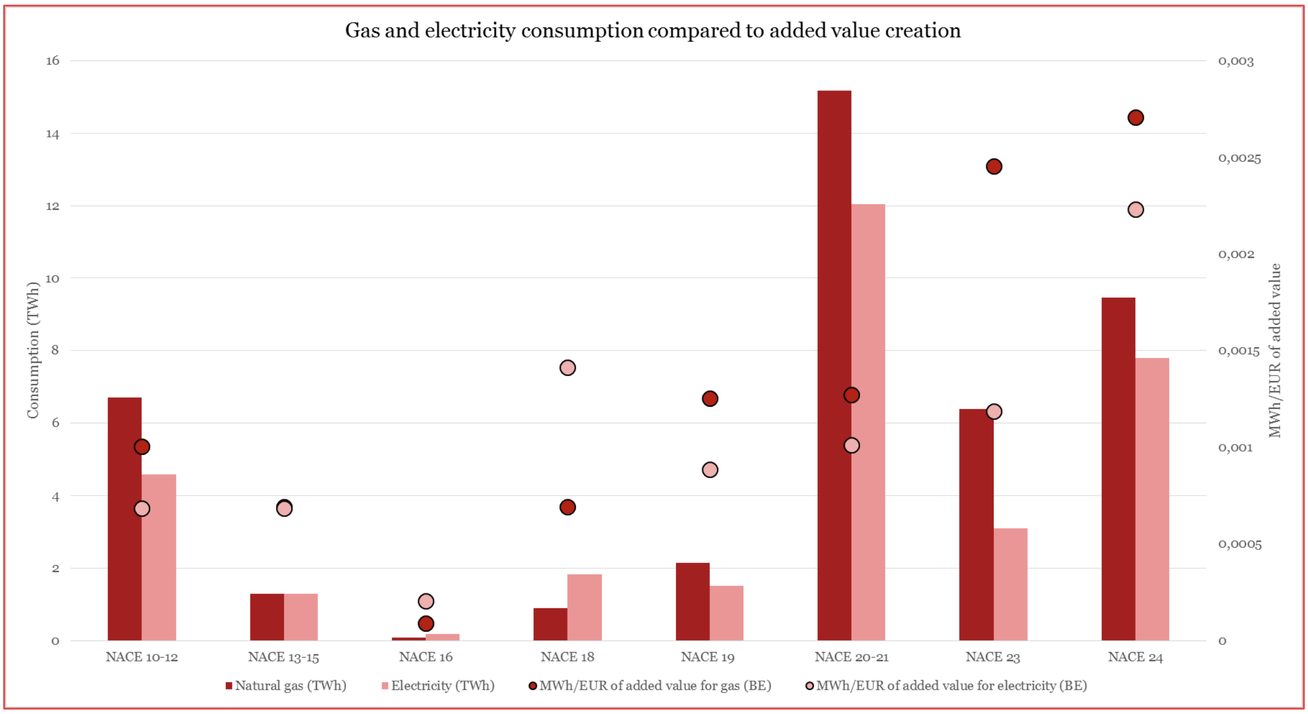
4 Federal Plan Bureau for Belgium, CBS Statline for the Netherlands, De Statis for Germany, and Insee for France

5 The energy intensity split between electricity and gas is not available.

It is important to note two caveats from a methodological point of view. Firstly, this analysis is based on very large-scale macro-economic data. Hence, it is not possible to draw precise conclusions on a micro-economic basis that relate to a specific economic process. Secondly, we cannot constitute a direct link between differences in energy efficiency on the macro level on the one hand, and the capacity to improve its energy efficiency on the other hand. Yet again, we have to take into account that within sectors and countries, important differences in terms of infrastructure and industrial process and productions exist that can explain these difference.

As a reminder, Figure 10 also presented in section 2, shows that the two main Belgian energy-intensive sectors are the basic metals industry (NACE 24) and the other non-metallic fabricated products (NACE 23) – this is especially the case for energy-intensity of gas. The Belgian wood industry is the least energy-intensive sector shown in this figure.

Figure 10 – Gas and electricity consumption compared to added value creation



Source: National Bank of Belgium (2013), PwC calculations

On Figure 11 and Figure 12[6], we observe that most Belgian sectors have a potential for improvement in terms of energy efficiency (electricity and gas) if we compare them with that of the weighted average of neighbouring countries (Germany, the Netherlands and France). This is the case for food & beverage (NACE 10 -12), textile (NACE 13-15), printing (NACE 18) and non-metallic fabricated products (NACE 23) industries. Hence, these sectors could potentially adapt to non-competitive electricity and gas prices with increased energy efficiency.

However, some Belgian sectors do not have the opportunity to significantly improve their energy efficiency. This is the case for NACE codes 20-21[7] combining the

[6] Comparison data for category NACE 19 (coke and refined products) is unavailable for France.
[7] The two sectors have been analysed together, as the 2003 NACE codes for Belgium do not allow to analyse them separately.

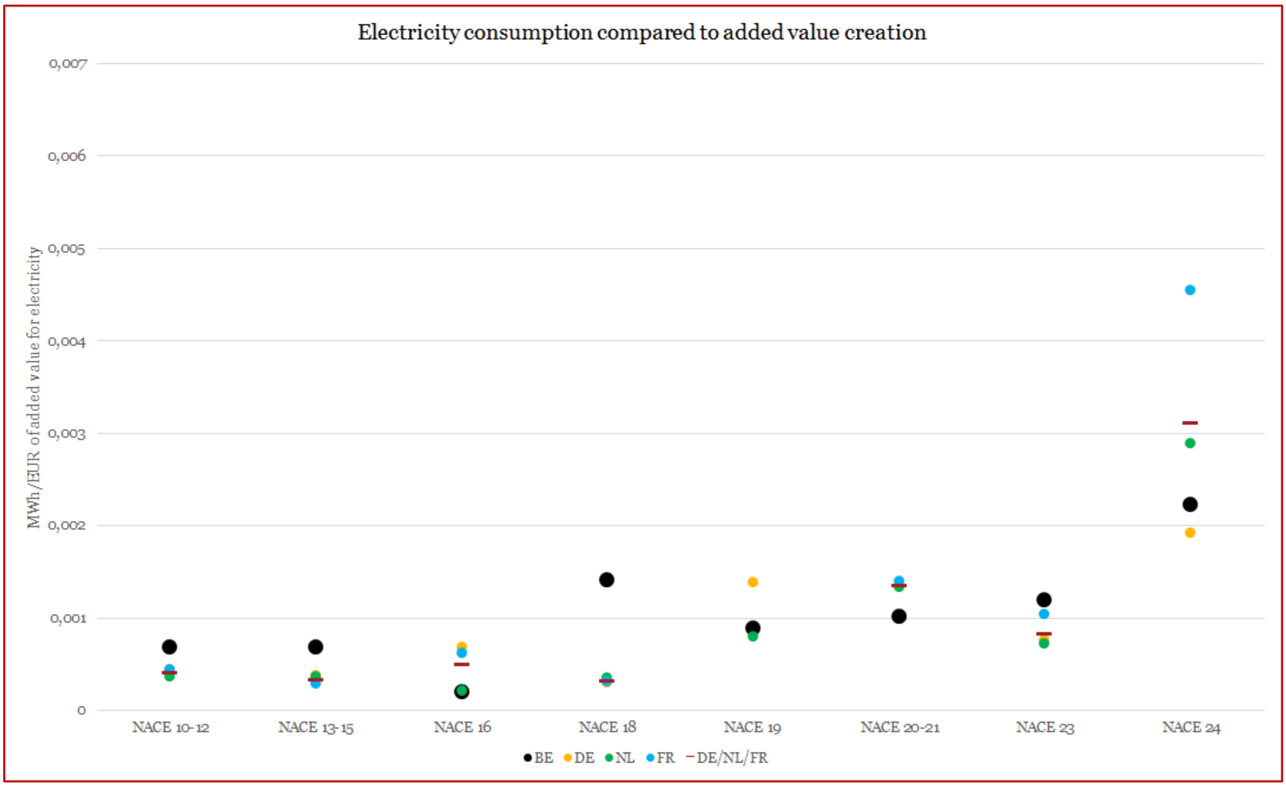
chemical & pharmaceutical industries. For NACE 20-21, both electricity and gas is more efficiently consumed in Belgium than in the neighbouring countries. As shown on Figure 12, the energy efficiency gap is particularly significant for gas. The high gas average for neighbouring countries is mainly impacted by the high gas intensity in the Dutch chemical sector. Nonetheless, Belgium is also below Germany and France in terms of gas efficiency (Figure 12). This means that with uncompetitive prices, these sectors would be unable to adapt by increasing their energy efficiency significantly in the short term. This is particularly important as these sectors also have the biggest added value compared to GDP in Belgium.

Another sector where the potential for improvement of energy efficiency is limited in the short term is the wood industry (NACE 16). For this industry, Belgium is below the average of neighbouring countries in terms of electricity intensity (at the same level as the Netherlands) (Figure 11). Belgium is also below the average of neighbouring countries in terms of gas efficiency (Figure 12).

A third example is the Belgian basic metals industry (NACE 24) which has an electricity intensity below the average of neighbouring countries (Figure 11), but a gas intensity above the average of neighbouring countries (Figure 12). The high electricity average for neighbouring countries is mainly impacted by the French basic metals industry. In other words, this sector has a potential for improvement in the short term in terms of gas efficiency but not electricity efficiency. This is also interesting as Figure 10 shows that the Belgian basic metals industry is an important gas consumer.

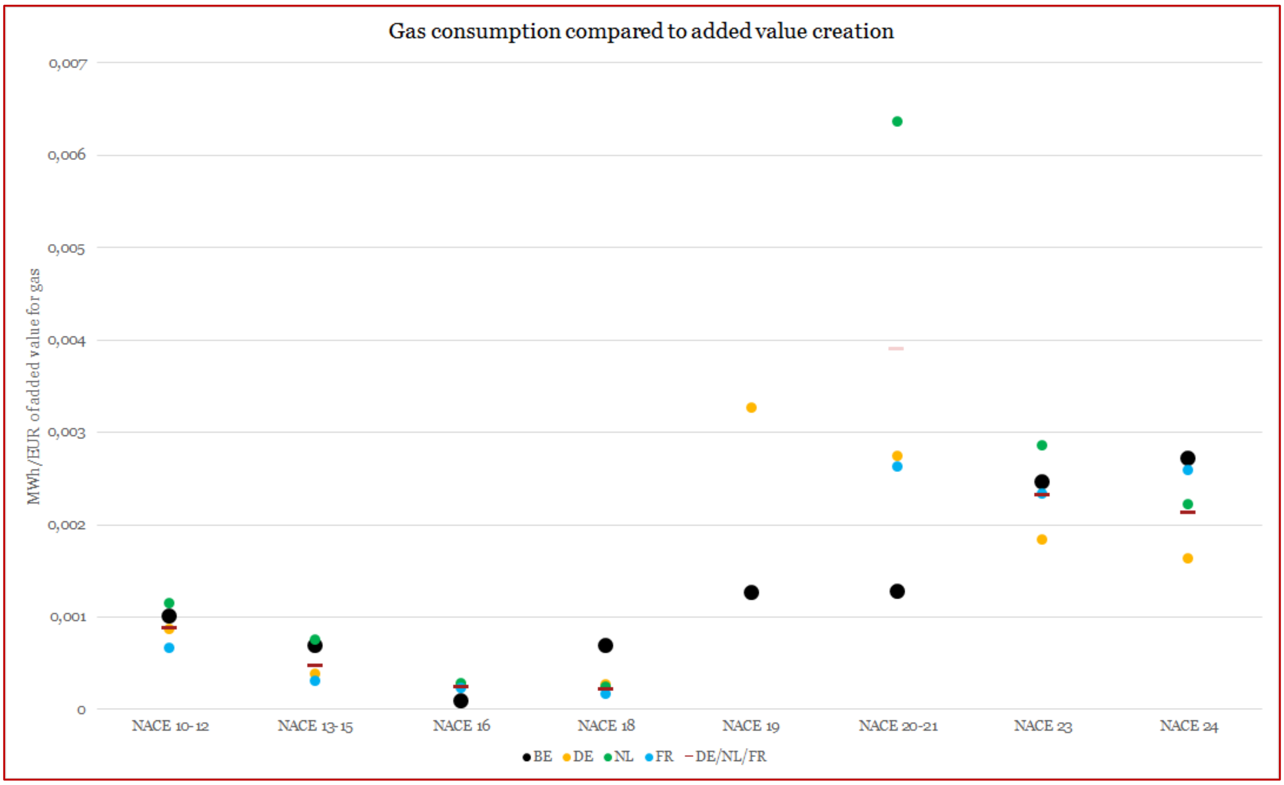
It should be noted that data is missing for the coke & refinery (NACE 19) sector as is observed on Figure 11 and Figure 12. Energy intensity data for this sector was not available for France. Moreover, the gas intensity of the Dutch sector is extremely high (0,018 MWh per EUR of added value) and was not presented on Figure 12.

Figure 11 – Electricity consumption compared to added value creation



Source: National Bank of Belgium (2013), Destatis (2013), CBS Statline (2013), Insee (2013), PwC calculations

Figure 12 – Gas consumption compared to added value creation



Source: National Bank of Belgium (2013), Destatis (2013), CBS Statline (2013), Insee (2013), PwC calculations

Selection of most important sectors for our analysis

This section concludes our economic analysis by presenting a selection of the most important sectors for calculating electricity and gas prices of large industrial consumers.

The methodology we use to select the most important sectors is the following. First, we rank the sectors for each analysis by importance. In Table 1, the smaller the number, the higher the sector is ranked for the analysis. Second, we calculate for each sector the average score obtained across all analyses. It is on this basis that we calculate the final ranking of each sector.

To illustrate this, we take a couple of examples. The second column represents the analysis we present in section 1 which concerns the added value of each sector compared to the total GDP of the economy. We find that the biggest sector in terms of relative added value is the chemical sector (NACE 20), which receives a score of 1 in Table 1, followed by the food & beverages industry (NACE 10-12), receiving a score of 2.

Another example concerns the comparison with neighbouring countries in terms of potential for improvement in energy efficiency. For this analysis, we consider that the more a sector is energy efficient compared to the average of neighbouring countries, the less it has a potential for improvement of energy efficiency.

This approach has several caveats which are important to highlight. Firstly, for some analyses, the ranking of some sectors are not available. This is mostly the case for analyses which depend on data based on Belgian energy consumption accounts from the Federal Planning Bureau. These energy consumption accounts being still based on old NACE-codes (2003), the data was converted to new NACE codes (2008) wherever possible.

Secondly, for some analyses, some sectors benefit from the ranking position of another sector. This is especially the case for the pharmaceutical industry (NACE 21) which often piggy backs on the chemical industry (NACE 20). This is due to the fact that for some analyses only combined data for NACE 20-21 codes is available. This is also the case for the basic and fabricated metals (NACE 24-25) industries that are sometimes analysed together for lack of available data.

Thirdly, only the analyses linked to national data were taken into account. In other words, all ranking of sectors based on regional approaches were excluded from this matrix.

Lastly, the calculation of the average score across all analyses is based on a simple average. No particular weight was given to an analysis as we considered all analyses as important in determining the most important sectors.

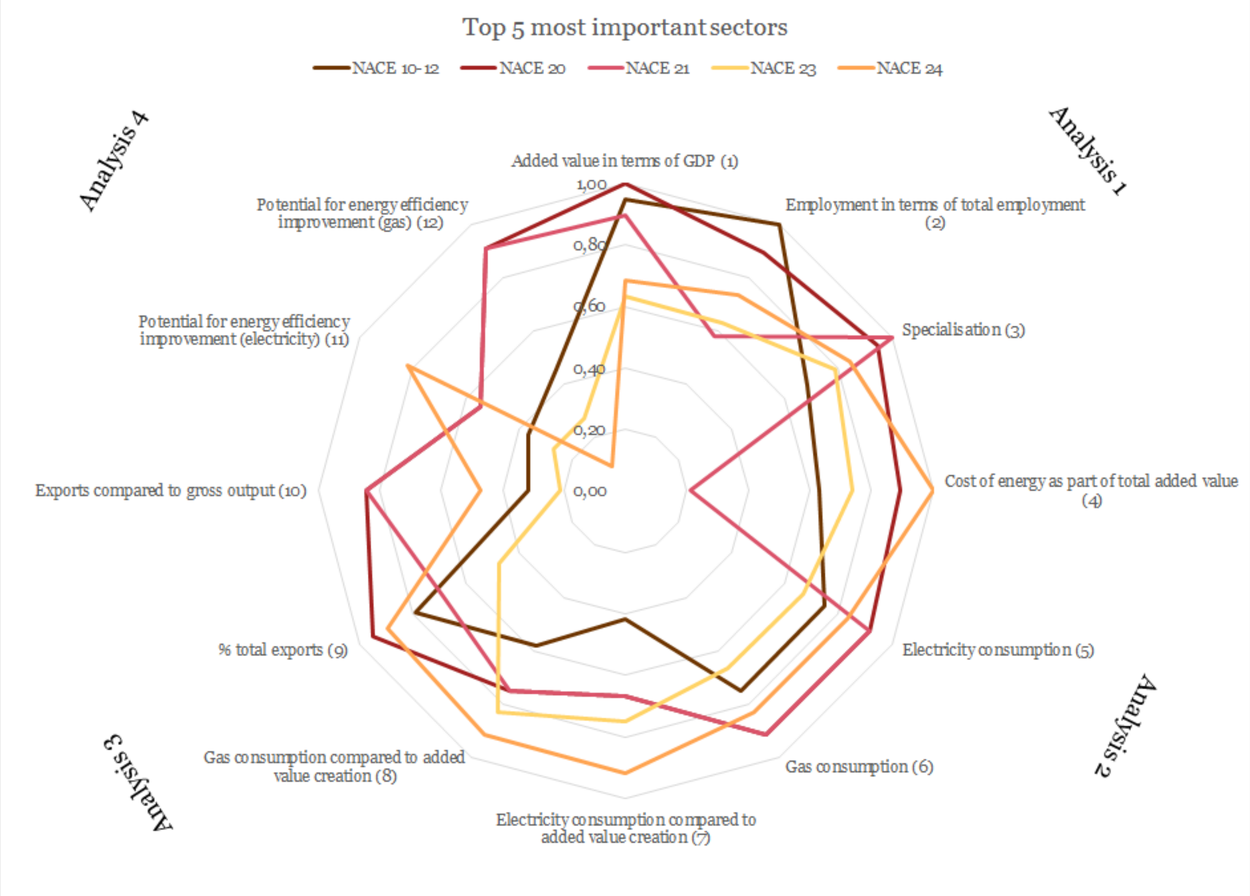
Table 1 – Ranking of sectors

NACE code	Sector ranking	Added value in terms of GDP	Employment in terms of total employment	Specialisation	Cost of energy as part of total added value	Electricity consumption	Gas consumption	Electricity consumption compared to added value creation	Gas consumption compared to added value creation	% total exports	Exports compared to gross output	Potential for energy efficiency improvement (electricity)	Potential for energy efficiency improvement (gas)	Average score
NACE 20	1	1	3	2	3	1	1	4	3	1	2	4	1	2,17
NACE 24	2	7	6	4	1	2	2	1	1	2	9	1	10	3,83
NACE 21	3	3	9	1	16	1	1	4	3	6	2	4	1	4,25
NACE 10-12	4	2	1	7	8	3	3	7	5	4	12	7	6	5,42
NACE 23	5	8	8	5	6	4	4	3	2	10	14	9	7	6,67
NACE 13-15	6	12	7	6	5	7	6	8	7	8	3	8	8	7,08
NACE 19	7	17	19	3	2	6	5	5	4	3	7	N/A	N/A	7,10
NACE 29	8	6	4	17	10	N/A	N/A	N/A	N/A	5	1	N/A	N/A	7,17
NACE 25	9	4	2	11	14	8	8	9	9	2	9	6	5	7,25
NACE 17	10	16	17	10	4	9	9	6	8	11	8	2	2	8,50
NACE 22	11	9	11	12	17	10	10	11	11	9	5	3	3	9,25
NACE 28	12	5	5	15	18	N/A	N/A	N/A	N/A	7	6	N/A	N/A	9,33
NACE 18	13	15	13	9	9	5	7	2	6	17	16	10	9	9,83
NACE 16	14	19	16	8	7	11	11	10	10	15	15	5	4	10,92
NACE 31-32	15	13	10	14	13	N/A	N/A	N/A	N/A	12	10	N/A	N/A	12,00
NACE 26	16	14	15	18	11	N/A	N/A	N/A	N/A	14	4	N/A	N/A	12,67
NACE 27	17	11	14	16	12	N/A	N/A	N/A	N/A	13	11	N/A	N/A	12,83
NACE 33	18	10	12	13	19	N/A	N/A	N/A	N/A	18	17	N/A	N/A	14,83
NACE 30	19	18	18	19	15	N/A	N/A	N/A	N/A	16	13	N/A	N/A	16,50

Source: PwC calculations

Keeping this in mind, we can conclude that the top 5 most important sectors for our analysis are: the chemical (NACE 20), basic metal (NACE 24), pharmaceutical (NACE 21), food & beverages (NACE 10-12) and non-metallic mineral (NACE 23) industries. These top five sectors are visually represented in Figure 13. The larger the area covered by the sector, the more the sector ranks high in each of the analyses we performed in this chapter.

Figure 13 – Spider diagram for top five most important sectors



3.2. Selection of consumption profiles

The mission we received from the CREG for this report was to compare 2016 prices for **six different consumer profiles**, without specifying how many electricity and gas consumer profiles.

In the report "A European comparison of gas and electricity prices for large industrial consumers" published in early **2015, only four consumer profiles** had been defined to compare the situation between the five countries under review. These profiles are described in the following table, and were provided by the CREG. The power sector comprises three profiles (E1, E2, E3) while the gas sector had only one profile (G1).

Profiles 2015 report	E1 (Electricity 1)	E2 (Electricity 2)	E3 (Electricity 3)	G1 (Gas 1)
Annual consumption	25.000 MWh	25.000 MWh	250.000 MWh	100.000 MWh
Load profile	Stable, 8am-6pm, work days only	Stable, 8am-6pm, work days only	Flat throughout the year (baseload)	Stable
Consumption hours/year	2.527	2.527	8.760	8.000
Connection	30-70 kV	≥ 150 kV	≥ 150 kV	
Maximum capacity	9.893 kW	9.893 kW	28.539 kW	15.000 kW

For this new report, that aims to compare prices for the year 2016, the six consumer profiles will be gradually defined analysing each of the abovementioned criteria: consumption, load profile and consumption hours, connection level and maximum capacity.

All considered profiles will be built on the basis of simplifying hypotheses. The emphasis is put on the energy consumption, the load profile with a maximum capacity, and the level of the grid connection.

In determining the load profiles and maximum capacity contracted by the consumption profiles G1-G2 and E1-E2-E3-E4, two sources were used. First of all, stakeholders were informed and consulted about the general scope of the report. [8] Based on this information, they were asked to provide input on load profiles for certain sectors. Secondly, we were provided insight in a confidential analysis of consumption and transmission-grid offtake data analysed by the CREG.

Gas – Electricity

The first decision to be made in terms of construction of the consumer profiles is how to spread out the six possible consumer profiles over the two energy sources.

We choose to define two consumer profiles for gas, and four consumer profiles for electricity. This choice, that adds one consumer profile for each energy source compared to the previous report, is largely based on the higher level of complexity that is to be found on the electricity market in terms of pricing, grids and taxes.

[8] FEB/VBO, UWE, VOKA, BECI, FEBELIEC, Essenscia, FEVIA, Agoria, ABVV/FGTB, ACV/CSC, ACLVB/CGSLB, BNB/NBB.

In terms of commodity pricing, we observe commodity prices for electricity that vary in function of the load profile (baseload – peakload) of the consumer. For natural gas, pricing is based on one single market index and more simplified.

In terms of grids and grid fees, the picture for electricity is again more varied than for gas. With a distribution grid, a local transport grid and a transmission grid, Belgium counts three different grids with separate tariff structures for electricity. For gas, the choice is more straight-forward, with a transport grid and a distribution grid. To conclude, we can also add that generally, a greater complexity is observed in terms of taxes, levies and surcharges (and the possible reductions and exemptions) on electricity than on natural gas.

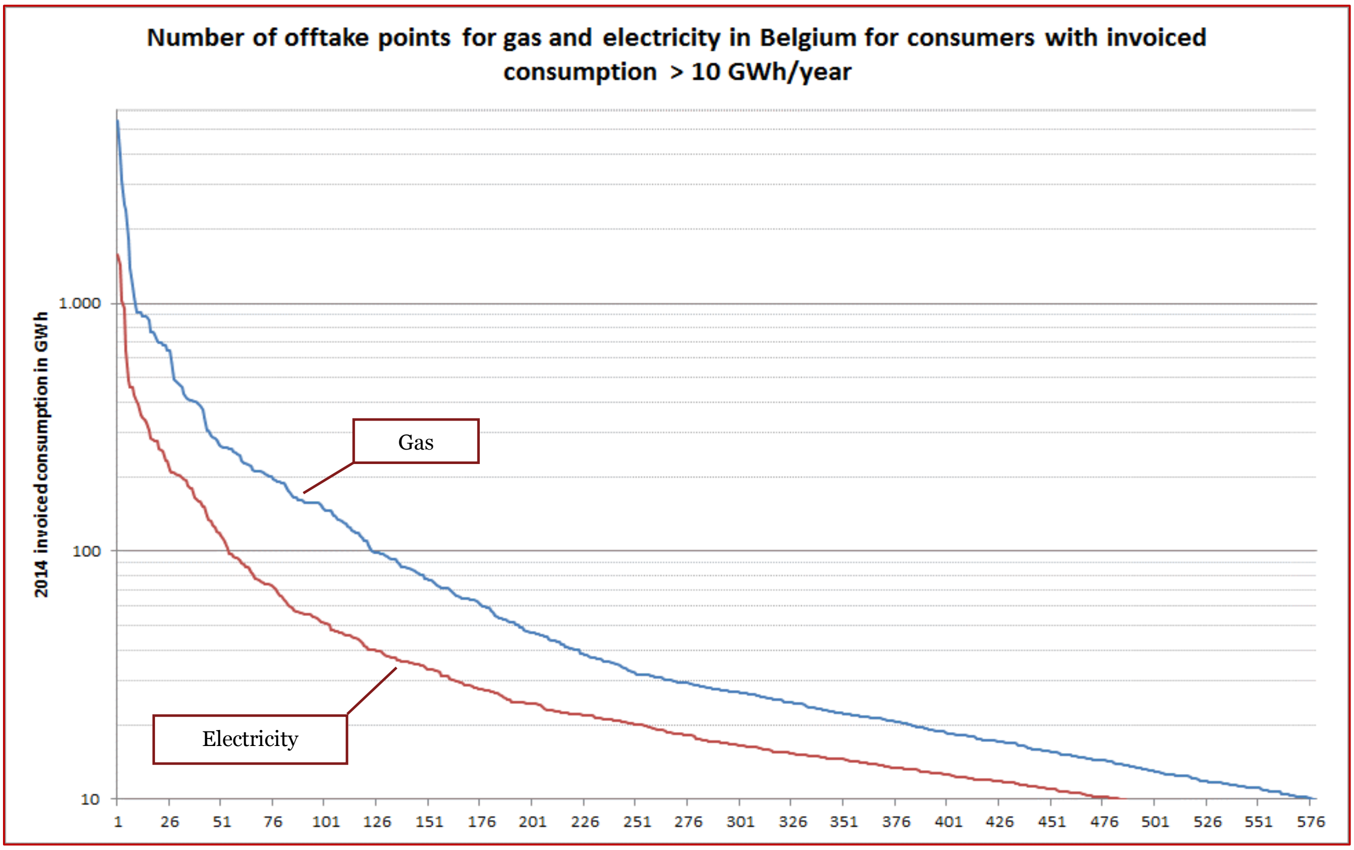
	Electricity	Gas
Number of profiles	4	2

Annual consumption

In terms of annual consumption, the objective is to find a set of four electricity profiles and two gas profiles that are as representative as possible for industrial consumers in Belgium and its regions. As stated above, to retrieve the annual consumption by the consumption profiles G1-G2 and E1-E2-E3-E4, two sources were used. First of all, stakeholders provided input on load profiles for certain sectors. Secondly, we were provided insight in a confidential analysis of consumption data analysed by the CREG.

We will first look at the general distribution of the annual consumption of consumers that we qualify as 'industrial', consuming more than 10 GWh a year of gas and/or electricity. The figure below shows all invoiced amounts of gas (blue) and electricity (red) in the year 2014 of consumers being invoiced more than 10 GWh/year. These figures have been retrieved from the CREG and are based on invoicing data of industrial consumers in Belgium. For electricity, these data are different from 'offtake-data', which take into account direct market purchase and auto-production as well. Given the lack of consistent and complete offtake-data, however, invoicing data have been used for this report.

Figure 14 – Number of offtake points for gas and electricity in Belgium for consumers with invoiced consumption > 10 GWh/year



Source: CREG (2014)

We can clearly observe a thin set of extremely large consumers for both electricity and natural gas. Nevertheless, we see a difference between gas and electricity consumers in terms of size of this set: 9 gas consumers are being invoiced for over 1 TWh of natural gas a year, while only 3 electricity consumers are in the same case. Because of the fact that we are dealing with invoicing data, we know that for electricity offtake data can slightly differ. While this is the case for several individual electricity consumers, the distribution of the population is largely the same. Interestingly, based on offtake data we observe only 2 electricity consumers above 1 TWh/year.

In terms of energy, industrial gas consumption as a whole is higher than industrial electricity consumption. We observe about 580 consumers being invoiced over 10 GWh/year of natural gas, while for electricity this number lies around 485.

Electricity

For electricity, the distribution along the curve shown in the figure above guides us toward the following choice of annual consumption.

Profile name	E1	E2	E3	E4
Annual electricity consumption	10 GWh	25 GWh	100 GWh	500 GWh

First and foremost, as we see a large number of consumers being invoiced for a consumption between 10 and 17,5 GWh/year, we assume a continuation of this population trend below 10 GWh/year, which makes us opt for an E1 consumption profile that finds itself at this 10 GWh/year border.

Secondly, we opt for one 25 GWh/year consumer profile, which - apart from representing a considerate amount of electricity consumers - also allows for a comparison with the data found in the 2015 report (where two 25 GWh/year – consumer profiles were present).

The third and fourth profile are larger consumers. E3 shows an annual consumption of 100 GWh, while E4 shows an annual consumption of 500 GWh. E3 would be the 53th largest consumer (based on invoicing) in Belgium, while E4 would be the 6th largest consumer and represents the few very large (+300 GWh/year) electricity consumers.

In order to test the representativeness of this choice of consumption profiles as well as to test the relevance of the five top sectors that were identified as being key to this analysis, we have analysed the electricity invoicing data based on NACE-codes. Then, by attributing each of the industrial (NACE 10-33) consumers to one of the 'representativeness ranges' around each consumer profile, we evaluate the relevance of a consumption profile for the entire industrial fabric, and for each of the most important sectors in particular.

The table below shows very clearly that the top 5 sectors that we have identified in section 3.1 are indeed very relevant when comparing energy prices for large industrial consumers and eventually assessing the impact of energy price differences on the economy. 60% of consumers in the E1-range belong to these 5 key sectors, and this number increases for the E2-range (69%) and the E3-range (77%). The lower representation of the 5 key sectors in the very small group of E4-consumers (12 consumers with an annual consumption of >300 GWh) is entirely caused by the presence of consumers from the coke and refinery sector (NACE 19) in this consumptions range, a sector which is not part of these 5 key sectors.

Code NACE-Sector	E1 (10-17,5 GWh/yr) (1)[9]	 (2)[10]	E2 (17,5-62,5 GWh/yr) (1)	 (2)	E3 (62,5-300 GWh/yr) (1)	 (2)	E4 (>300 GWh/yr) (1)	 (2)
10-12 Food products, beverages and tobacco products	51	**23%**	52	**59%**	4	**18%**	-	**0%**
20 Chemicals and chemical products	20	**6%**	25	**18%**	16	**47%**	2	**29%**
21 Basic pharmaceutical products and pharmaceutical preparations	1	**2%**	7	**36%**	3	**62%**	-	**0%**
23 Other non-metallic mineral products	11	**10%**	13	**29%**	7	**62%**	-	**0%**
24 Basic metals and fabricated metal products	10	**3%**	15	**10%**	14	**36%**	4	**52%**

Source: CREG (2014), PwC calculations

	E1	E2	E3	E4
Count of all industrial consumers (NACE 10-33)	155	163	57	12
Count of consumers of 5 focus sectors	93	112	44	6
% top 5 on total	**60%**	**69%**	**77%**	**50%**

A second set of conclusions can be drawn when looking at the top 5 sectors separately. Profiles E1 and E2 seem to be very relevant for the Food, beverage and tobacco sector (NACE 10-12) that represents a third of the industrial consumers in both consumption ranges. The chemical sector (NACE 20) is quite evenly distributed among consumption ranges E1, E2 and E3, and accounts for 28% of industrial consumers in the E3-range. The pharmaceutical sector (NACE 21) counts a relatively low number of large industrial consumers, mostly present in the E2 and E3-ranges. As stated before, its presence in the top 5 sectors is in part due to its large importance in terms of added value. The non-ferrous sector (NACE 23) is best represented by profile E3 (12% of the industrial consumers in the consumption range) while the

[9] The figures in column 1 refer to the absolute frequencies of each consumption profile per sector within their respective consumption range. For example, there are 51 cases of consumer profile E1 (with a consumption between 10 and 17,5 GWh/year) within the NACE 10-12 sector.

[10] The figures in column 2 refer to the relative frequencies or the ratio between the total consumption of each consumer profile (absolute frequency multiplied by 10, 25, 100 or 500 GWh) and the consumption of all consumer profiles within that sector (absolute frequency of E1*10 GWh + absolute frequency of E2*25 GWh + …). Per sector (horizontal summation), the relative frequencies add up to 100%, except for NACE 23 and 24, because they are presented as rounded figures.

metallurgy sector (NACE 24-25) is most present in the consumption ranges around profiles E3 (one out of 4 consumers) and E4 (one out of 3 consumers in this ranges).

Gas

For natural gas, the distribution along the curve shown in the Figure 14 above guides us toward the following choice of annual consumption, taking into account that only 2 natural gas profiles will be treated.

Profile name	G1	G2
Annual electricity consumption	100 GWh	2.500 GWh

First and foremost, we define the G1 profile as a 100 GWh/year consumer, which allows for a comparison with the date found in the 2015 report (where one 100 GWh/year profile was present).

Secondly, we opt for a very large consumer of 2,5 TWh/year. The main motivation behind this choice is the clear presence of a group of very large natural gas consumers that use natural gas not only for heating but also clearly as a feedstock for their industrial process. We count 9 industrial consumers that consume between 1 and 6 TWh of natural gas per year, representing over 22 TWh of annual consumption.

In order to test the representativeness of this choice of consumption profiles as well as to test the relevance of the five top sectors that were identified as being key to this analysis, we have analysed the natural gas invoicing data based on NACE-codes. Then, by attributing each of the industrial (NACE 10-33) consumers to one of the 'representativeness ranges' around each consumer profile, we evaluate the relevance of a consumption profile for the entire industrial fabric, and for each of the most important sectors in particular.

The table below shows very clearly that the top 5 sectors that we have identified in section 3.1 are indeed very relevant when comparing energy prices for large industrial consumers and eventually assessing the impact of energy price differences on the economy. 78% of consumers in the G1-range belong to these 5 key sectors, as do 78% of consumers in the G2-range. We can hence state that more than four out of five industrial consumers consuming more than 10 GWh/year of natural gas (based on invoicing data, 2014) belongs to the five top sectors that we had identified in section 3.1

Code	NACE-sector	G1 (10-1.000 GWh/year)		G2 (> 1.000 GWh/year)	
		(1)[11]	(2)[12]	(1)	(2)
10-12	Food products, beverages and tobacco products	181	**100%**	-	**0%**
20	Chemicals and chemical products	71	**36%**	5	**64%**
21	Basic pharmaceutical products and pharmaceutical preparations	12	**100%**	-	**0%**
23	Other non-metallic mineral products	33	**57%**	1	**43%**
24	Basic metals and fabricated metal products	32	**56%**	1	**44%**

Source: CREG (2014), PwC calculations

	G1	G2
Count of **all industrial consumers** (NACE 10-33)	423	9
Count of consumers of **5 focus sectors**	329	7
% top 5 on total	**78%**	**78%**

A second set of conclusions can be drawn when looking at the top 5 sectors separately. Profile G1 is very relevant for the Food, beverage and tobacco sector (NACE 10-12) that represents over 40% of the industrial consumers between 10 and 1000 GWh/year. The chemical sector (NACE 20) is the most important sector represented among the very large gas consumers (>1 TWh/year) with 5 out of 9 consumers, but is also very present among the G1-range. The pharmaceutical (NACE 21), non-ferro (NACE 23) and metallurgy (NACE 24) sectors are mainly present within the G1-range.

[11] The figures in column 1 refer to the absolute frequencies of each consumer profile per sector within the respective consumption range. For example, there are 181 cases of consumer profile E1 (with a consumption between 10 and 1.000 GWh/year) within the NACE 10-12 sector.

[12] The figures in column 2 refer to the relative frequencies or the ratio between the total consumption of each consumer profile (absolute frequency times 100 or 2.500 GWh) and the consumption of all consumer profiles within that sector (absolute frequency of G1 times 100GWh + absolute frequency of G2 times 2.500 GWh). Per sector (horizontal summation), the relative frequencies add up to 100%.

Load profile and capacity

Electricity

In order to further construct the electricity consumption profiles, stakeholder input was collected on two main factors:

1. Consumption hours (day/night – week/week-end)
2. Maximum capacity contracted: the percentage above the average power level that is contracted during consumption hours

Detailed proposals were made by Agoria, Voka and FEVIA; combined with the CREG-data, the most important conclusion was that for industrial consumers, a pure peakload profile (8am-8pm only on week days) is rarely ever observed.

A second conclusion was that in general variations between the average and the contracted maximum capacity are more outspoken for the smaller consumption profiles than for the larger consumption profiles.

Based on this input, we defined an amount of consumption hours for E1 and E2 that corresponds to a constant consumption (24h/24h), but only during week days, which amounts to 6250 hours per year.

Annual consumption (MWh)	Consumption hours	Average capacity (MW)	Average capacity +20% (MW)
10.000 (E1)	6.250	1,6	1,9
25.000 (E2)	6.250	4,0	4,8

Based on sector input, we observed that the maximum contracted capacity is generally situated around 20% above the average capacity (annual consumption divided by 6.250 hours). This means that for E1, we propose a contracted maximum capacity of 2 MW while for E2 we propose a maximum capacity of 5MW.

For E3 and E4, the situation is somewhat different as we observe an increase of pure baseload profiles which brings down the variation level between the average (based on 8760 hours/year) and contracted maximum capacity.

Annual consumption (MWh)	Consumption hours	Average capacity (MW)	Average capacity +10% (MW)	Average capacity +15% (MW)
100.000 (E3)	8.760	11,4	12,6	**13,1**
500.000 (E4)	8.760	57,1	**62,8**	65,6

Based on the assumption that these profiles are consuming on week-ends and weekdays alike (8760 hours), we propose a contracted maximum capacity of 13 MW for profile E3 (average capacity +15%) and of 62,5 MW for profile E4 (+10%). This reflects the general tendency toward even more baseload profiles for larger consumers.

Gas

In order to further construct the natural gas consumption profiles, stakeholder input was collected on two main factors:

1. Consumption hours (day/night – week/week-end)
2. Maximum capacity contracted: the percentage above the average reserved grid capacity that is contracted as a security margin

Based on these inputs, we defined an amount of consumption hours for profile G1 and G2 that corresponds to permanent baseload consumption. For profile G1, we propose to maintain the load profile that was used in the previous report[13] (with a 20% margin above the average capacity). For profile G2 on the other hand, representing a very large consumer, we limit the margin above average capacity to 5%, corresponding to the reality for several of these consumers.

Annual consumption (MWh)	Consumption hours	Average capacity (MW)	Average capacity +5% (MW)	Average capacity +20% (MW)
100.000 (G1)	8.000	13		**15**
2.500.000 (G2)	8.760	285	**300**	

As a consequence, we propose a maximum contracted capacity of 15 MW for profile G1 and 300 MW for profile G2. We have excluded the option that profile G1 uses gas as a raw material (feedstock consumer), while we have included it for profile G2.

Grid connection

Electricity

In terms of electricity grid connection, the existence of four different consumer profiles allows us to cover a wider range of the Belgian electricity grid. Partly based on consumer input, we hence propose the following distribution of consumer profiles along the electricity grid.

Profile E1 (10 GWh/year) is connected to the distribution grid (Trans HS) at a connection level of 26-36 kV. Profile E2 is connected to the local transport grid at a connection level of 30-70 kV, while profiles E3 and E4 are directly connected to the transport grid at 150kV or higher.

Gas

The existence of two different gas consumption profiles equally gives us the opportunity to distribute both profiles over the Belgian gas network. As the G1 consumer represents a wide range of consumers, and given the fact that direct connection to the transport network in Belgium is rather rare (about 230 connections), the choice is to connect client G1 to the distribution grid as a T6 client (>10 GWh/year). Consumer profile G2 (2,5 TWh/year) is connected to the transport grid.

[13] See "A European comparison of electricity and gas prices for large industrial consumers" by PwC, 28th of April 2015, http://www.creg.info/pdf/Studies/F20150428EN.pdf .

Summary

Taking into account the elements brought forward in this section, we can summarize the chosen consumer profiles as follows in the table below.

Profile	Annual consumption (GWh)	Maximum capacity (MW)	Connection level	Grid
E1	10	2,0	26-36 kV	DSO (Trans HS)
E2	25	5,0	30/36/70 kV	LTSO
E3	100	13,0	>150kV	TSO
E4	500	62,5	>150kV	TSO

Profile	Annual Consumption (GWh)	Maximum capacity (MW)	Connection level	Grid
G1	100	15		DSO (T6)
G2	2500	300		TSO

4. Description of the dataset

4. Description of the dataset

4.1. General Assumptions

The general assumptions, applicable to all compared consumer profiles and countries, are outlined below.

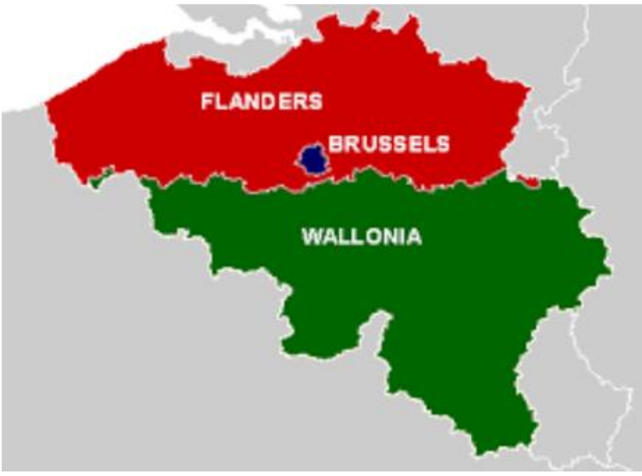
1. *January 2016*. This study gives an overview of the price levels in January 2016.
2. *Economically rational actors*. We assume that our six profiles are economically rational actors who optimise their energy cost where possible. We assume for instance that British industrial consumers are part of a Climate Change Agreement: they focus on energy efficiency and emission reduction, and obtain tax reductions at the same time.
3. *Exemptions and reductions*. In many cases, we observe the existence of (often progressive) reductions or exemptions on taxes, levies, certificate schemes or network costs. Whenever economic criteria - such as exercising a well-defined industrial activity, or paying a certain part of your company revenue as energy cost - are used to determine the eligibility for those exemptions and reductions, we do not present one single value but a range of possibilities as result with a minimum and a maximum case.
4. *Commodity prices*. All market data in terms of commodity was provided by the CREG and – where necessary – completed by PwC based on Bloomberg market indices.
5. *Sales margin (electricity and gas)*. No sales margin is added for gas and electricity commodity prices, in order to assure maximum objectivity when comparing different countries and consumer profiles.
6. *Transportation cost and contractual formulas*. Whenever different tariff options are available for a client, we assume that the client always opts for the most advantageous formula. Given the predictable consumption profiles of the cases under investigation, this assumption is, according to PwC, the most realistic one.
7. *Gas pressure level and caloric value*. Industrial gas consumers directly connected to the transport grid are not connected to the same gas pressure level in every country. We will consider the most plausible pressure level in every country, given the nature of the gas network and the size of the considered client profile. We also take into account the caloric value of the gas in every country.
8. *Exchange rate*. For the UK comparison, we have always used the January 2016 average exchange rate to convert from Pound Sterling to Euro (0,7546 GBP/EUR).[14] The commodity cost formula was calculated entirely in Pound Sterling, and the final result converted to Euro at the January 2016 exchange rate.
9. *VAT*. Following the terms of reference provided by the CREG, we do not take into account Value Added Tax (which is tax deductible for industrial clients) in this study.
10. *UK*. Wherever this study mentions the UK, Northern Ireland is not taken into account.
11. *Auto-production*. We did not take into account any possibility of on-site electricity production. This implies that for the consumer profiles under review, we assume that electricity consumption (and invoicing) equals offtake.

[14] Source: *National Bank of Belgium*.

4.2. Electricity: Countries/zone(s) identified

Belgium

Belgium is divided in three regions, respectively Flanders, Wallonia and the Brussels Region as mapped below.



Even though transport and commodity cost for industrial electricity consumers is assumed to be identical for the entire territory of Belgium, it is logical to analyse the three regions separately because of the existence of (i) differing distribution charges (for E1) and (ii) a double regional impact on the third price component: taxes, levies and certificate schemes (for all profiles).

DSO tariffs

The list below gives an overview of all Flemish DSOs that all have TRANS HS as maximal tension level and their market share in 2014. The Flemish region has 11 DSOs for electricity, mainly operated by Eandis (Gaselwest, Imea, Imewo, Intergem, Iveka, Iverlek, Sibelgas) and Infrax (Infrax west, Inter-energa, Iveg, PBE).[15] For network costs - distribution tariffs for profile E1 - we will hence present a weighted average values for all 11 DSOs.

DSOs of the Flemish region	Electricity distributed MWh (2014)[16]	Market share
Gaselwest	5.601.115	17,40%
Imewo	5.183.063	16,10%
Iverlek	4.877.707	15,15%
Iveka	4.232.896	13,15%
Inter-energa	4.118.835	12,79%
Intergem	2.563.823	7,96%
Imea	2.217.613	6,89%
Infrax west	1.119.264	3,48%
Iveg	999.082	3,10%
Sibelgas	655.382	2,04%
PBE	625.515	1,94%
Total	**32.194.295**	**100%**

[15] ORES Voeren, ex-Intermosane, was not taken into account.
[16] Figures from VREG

The Walloon region has 13 DSOs mainly operated by ORES (ORES Brabant wallon, ORES Est, ORES Hainaut, ORES Luxembourg, ORES Mouscron, ORES Namur, ORES Verviers) and RESA. For network costs - transmission and distribution tariffs for profile E1 - we will hence present a weighted average of the values for all DSOs. For simplification reasons (similar tariff structures), only DSO tariffs for Wallonia from ORES and RESA were taken into account (amounting to 94% of all distributed electricity in Wallonia in 2014). In other words, 5 smaller independent or 'cross-regional' DSO's were not taken into account in our weighted average: AIEG, AIESH, Gaselwest, Régie de Wavre and PBE. It should be noted that TRANS MT (instead of TRANS HT) is the highest tension level for RESA in Wallonia.

DSOs of the Walloon region	Electricity distributed MWh (2014)[17]	Market share
Ores Hainaut	4.386.000	29,87%
RESA	3.429.000	23,35%
Ores Namur	1.707.000	11,62%
Ores Brabant wallon	1.375.000	9,36%
Ores Luxembourg	1.167.000	7,95%
Ores Verviers	665.000	4,53%
Ores Mouscron	561.000	3,82%
Ores Est	495.000	3,37%
Gaselwest	261.000	1,78%
AIEG	213.000	1,45%
AIESH	182.000	1,24%
Régie de Wavre	148.000	1,01%
PBE	96.000	0,65%
Total	**14.685.000**	**100%**

The DSO for electricity in the Brussels region is Sibelga. It should be noted that TRANS MT is the highest tension level for Sibelga in the Brussels region.

Taxes, levies and certificate schemes

The first impact is caused by regional public service obligations that are a consequence of the grid connection levels that are summarised in the table below. The regions can impose public service obligations on grid operators below or equal to 70 kV located on their territory (impacts profile E1 and E2).

Voltage	Operator in charge	Operator in Belgium
< 30kV	Distribution System Operator (DSO)	Several
30 kV< x < 70 kV	Local Transmission System Operator (LTSO)	Elia in the 3 regions
> 70kV	Transmission System operator (TSO)	Elia (federal)

The second regional impact within Belgium is caused by the certificate schemes that stem from the regional competence in terms of renewable energy obligations on their territory. Flanders, Wallonia and the Brussels Capital region each impose their

[17] Figures from CWAPE

own green certificate scheme on all electricity consumers within their region (all profiles under review).

Apart from looking at the Belgian case through the three regional cases, we also make several other assumptions: the four electricity consumers under review are part of an energy efficiency agreement and belong to the sectoral NACE-BEL classification codes 5-33 (all industry).

Germany

Within the German territory, consumers can take part in one single electricity market and we therefore assume that the commodity cost is equal for the whole of Germany. As to taxes, levies and certificate schemes, we observe no regional differences for electricity consumers, not even for the local taxes[18].

On the German territory, four different TSO's are active; their corresponding geographical coverage is depicted below.

1. The *West region* which is made of Nordrhein-Westfalen, Rheinland-Pfalz and Saarland, where Amprion is the TSO.
2. The *South-West region* which is made of Baden-Württemberg where Transnet BW is the TSO.
3. The *Central region* which is made of Niedersachsen, Hessen, Bayern, Schleswig-Holstein and where Tennet operates the transmission grid.
4. The *East region* which is made of former East-Germany and Hamburg; 50 Hertz operates the transmission grid in this region.

Given the geographical and economic importance of these four zones (even the smallest one has as many inhabitants as the whole of Belgium), it is logical to treat these four zones the same way as we treat the three Belgian regions. They will hence be analysed separately.

As is the case in Belgium, profiles E1 and E2 will also pay a distribution cost (explained in further detail in section 5.2). As Germany counts about 870

[18] The Konzessionsabgabe is a local tax that applies to all electricity consumers connected to the distribution grid, but it is fixed on a national level and capped at one single rate for industrial consumers (*Konzessionsabgabenverordnung, § 1-2).*

distribution system operators[19], and as distribution and transmission tariffs are integrated (two layers presented in one single tariff), the four transmission zones remain the most relevant way of presenting the results for Germany. For profile E1 and E2, we will therefore present an average of the distribution tariffs of two large (one rural and one urban) DSOs from each of the four transmission zones, similar to what has been done for the gas market.

France

In terms of electricity market, France will be treated as one single zone. The same commodity cost, transmission tariffs (transmission tariffs in France start at a connection level of 1 kV and hence include all consumer profiles under review) and taxes and levies apply everywhere on the national territory for the four consumer profiles under review.

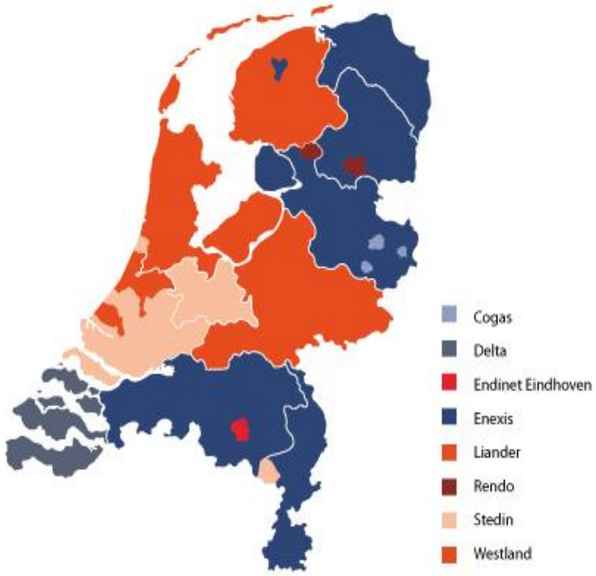
The Netherlands

The Netherlands will also be treated as one single zone in this study. In terms of commodity costs and taxes, levies and certificates schemes, no regional differences are observed: there is one single electricity market and the taxes on electricity are only imposed on a national basis.

On the network cost level, the situation is somewhat more complicated. The Netherlands counts only one TSO: TenneT. For this reason, the tariff methodology implemented is the same throughout the national transmission grid. Therefore the network cost for the two largest consumer profiles (E3 and E4) consists out of the transmission tariffs imposed by TenneT. On the contrary, in the Netherlands, profiles E1 and E2 are connected to the Dutch distribution grid, which covers the entire grid below the 110 kV voltage level. Hence the network cost for profiles E1 and E2 will consist out of the distribution tariffs imposed by the DSO's.

The Dutch distribution network counts eight different DSOs of different size and importance (see map below), who each apply different tariffs. As is the case in Germany, these distribution costs are integrated with transmission costs (two layers integrated in one cumulative tariff).

[19] From Distribution networks to smart Distribution systems: rethinking the regulation of European electricity DSO's, European University Institute, THINK paper topic 12, Final report, 2013, pgs. 12-13.



These DSOs are characterised by differences in size and number/type of clients. For profiles E1 and E2, we will therefore present a weighted average of distribution tariffs in accordance with the number of grid connections for every DSO. An overview of their number of connections (and hence their market share) can be found in the table below.

DSO	Number of connections (2014)[20]	Market share
Liander	2.938.787	36,27%
Enexis	2.647.300	32,67%
Stedin	2.055.520	25,37%
Delta	211.262	2,61%
Endinet	108.591	1,34%
Westland	55.745	0,69%
Cogas	52.930	0,65%
Rendo	31.974	0,39%
Total	**8.102.109**	**100%**

Liander, Enexis and Stedin have a combined market share of around 95%. Therefore their tariffs have a high impact on the weighted average for distribution tariffs for profiles E1 and E2.[21]

United Kingdom

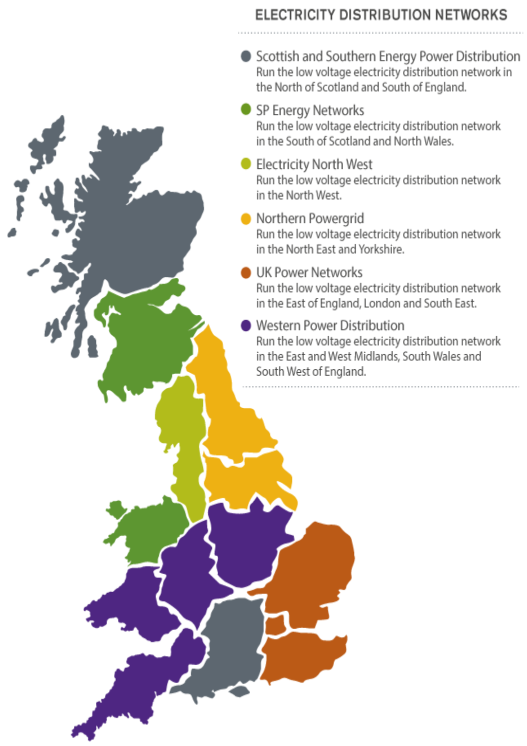
As is the case for France and the Netherlands, the United Kingdom will also be treated as one single zone in this study. In terms of commodity costs and taxes, levies and certificates schemes, no regional differences are observed: there is one single electricity market and the only taxes on electricity are imposed on a national basis.

In terms of network costs, the United Kingdom has three transmission system operators:

[20] The number of connections are those from 2014, collected by Netbeheer Nederland and Gasunie Transport Services. For more details see the Energietrends 2014 rapport.
[21] Cogas and Rendo do not provide electricity to consumers of profile E1, while Enexis, Liander and Stedin are the only DSO's providing electricity to consumers of profile E2.

1. National Grid (for England and Wales);
2. Scottish Hydro Electric Transmission (SHET);
3. Scottish Power Transmission (SPT).

On top of these three transmission system operators, six distribution system operator groups are active.[22] The TSO's and DSOs all charge different tariffs in the same fourteen tariff zones in the UK (without Northern Ireland).



TSO	**DSO**	**Zones**
3	6	14
Scottish Hydro Electricity Transmission (SHE)	Scottish and Southern Energy Power Distribution	Northern Scotland
		Southern
Scottish Power Transmission (SPT)	SP Energy Networks	Southern Scotland
		North Wales & Mersey
National Grid Electricity Transmission (NGET)	Electricity North West	North West
	Northern Power Grid	Northern
		Yorkshire
	UK Power Network	Eastern
		London
		South East
	Western Power Distribution	East Midlands
		Midlands
		South Wales
		South Western

For network costs - transmission tariffs for profiles E3 and E4, transmission and distribution tariffs for profiles E1 and E2 - we will hence present average values for all fourteen zones.

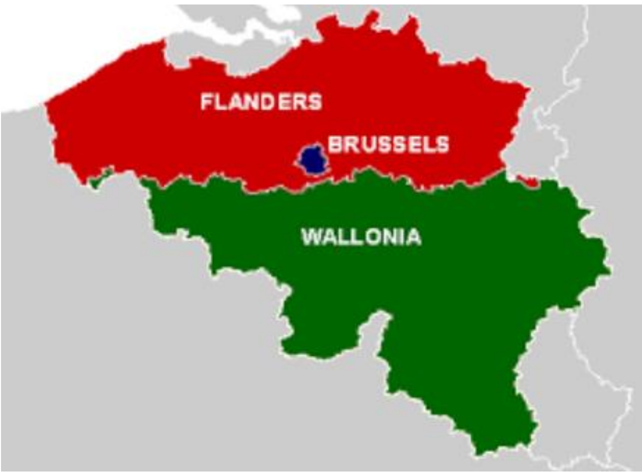
As to taxes and levies, we assume that industrial consumers considered in this study are all part of a Climate Change Agreement.

[22] In addition to these large DSO's, the UK also has some smaller Independent Network Operators (IDNO's). These are not taken into account in this study.

4.3. Gas: Countries/zone(s) identified

Belgium

In terms of commodity cost and transmission cost, no regional differences are observed in Belgium. The same commodity prices on the gas market are available to all consumers. Belgium counts only one Transmission system operator: Fluxys Belgium. About 230 clients are directly connected to the transmission system, and profile G2 is assumed to be part of this group of directly connected clients.[23]



We take as assumption that profile G1 is connected to the maximum operational tension level of the distribution grid (T6[24]). The Flemish region has 12[25] DSOs for gas that are mainly operated by Eandis and Infrax, whilst in the Walloon region (7 DSOs) the distribution grid is mainly operated by ORES and RESA. We will present a weighted average of the distribution tariffs in each of the regions, based on the volume of gas distributed on each of their grids. The DSO for gas in the Brussels region is Sibelga.

DSOs of the Flemish region	Gas distributed MWh (2014)[26]	Market share
Gaselwest	9.505.654	17,54%
Intergem	3.894.316	7,19%
Iveka	8.728.409	16,10%
Iverlek	8.426.707	15,15%
Imewo	8.188.716	15,11%
Imea	5.936.722	10,95%
Inter-energa	5.684.795	10,49
Intergem	3.894.316	7,19%
Iveg	1.847.567	3,41%
Sibelgas	918.471	1,69%
Infrax west	1.045.551	1,93%
Enexis	23.200	0,04%
Total	**54.200.128**	**100%**

[23] None of these clients directly connected to the transport grid is located in the Brussels Capital Region.
[24] For Sibelga, the DSO of the Brussels Region, the category in question is T5 due to the fact that the former national AMR categories T5 (<10 GWh/year) and T6 (>10 GWh/year) were regrouped in accordance between Sibelga and their regional regulator Brugel.
[25] Enexis is not considered in the study.
[26] Figures from VREG

DSOs of the Walloon region	Gas distributed MWh (2014)[27]	Market share
Ores Hainaut	7.507.000	38,96%
RESA	6.054.000	31,42%
Ores Brabant wallon	2.578.000	13,38%
Ores Mouscron	1.334.000	6,92%
Ores Namur	1.055.000	5,47%
Gaselwest	399.000	2,07%
Ores Luxembourg	343.000	1,78%
Total	**1.3785.000**	**100%**

In terms of taxes and levies, however, some (very) small differences exist between regions. This is why we present the results for Belgium in the same way as we did for electricity: a separate analysis for Wallonia, Flanders and the Brussels capital region.

Germany

The only component of the gas price for our profile under review that does not show any regional differences is the taxes and levies component.

In terms of commodity price, there are two market areas in Germany: *Gaspool* and *Netconnect Germany (NCG)* and eleven different transmission system operators. Each of them is mainly active in one market area, but some of them are active in both.

1. In the *Gaspool* area, the following operators are active: Gascade Gastransport, GTG Nord, ONTRAS Gastransport, Nowega and Gasunie.
2. *NetConnect Germany (NCG)* counts the following TSO's in its area: Bayernets, Fluxys TENP, GRTgaz, Terranets BW, Thyssengas and Open Grid Europe.

Given the fact that we observe an advanced form of convergence between the Gaspool and NCG-market prices, and given the amount of different TSO's, we will present one single result for Germany. In terms of commodity, we will present the average of Gaspool and NCG-prices. With regards to network costs, we will base the

[27] Figures from VREG

evaluation of the tariffs for profile G2 on the average of the exit tariffs of 11 TSO's serving directly connected industrial clients.

As our profile G1 is directly connected to the distribution grid it will pay a distribution cost and therefore its network cost will be based upon the distribution tariffs imposed by the DSO's. As there are over 800 different DSOs in Germany[28] we will present an average of the distribution tariffs of two large rural and two large urban DSOs from each of the two market areas, similar to what has been done for the electricity market.

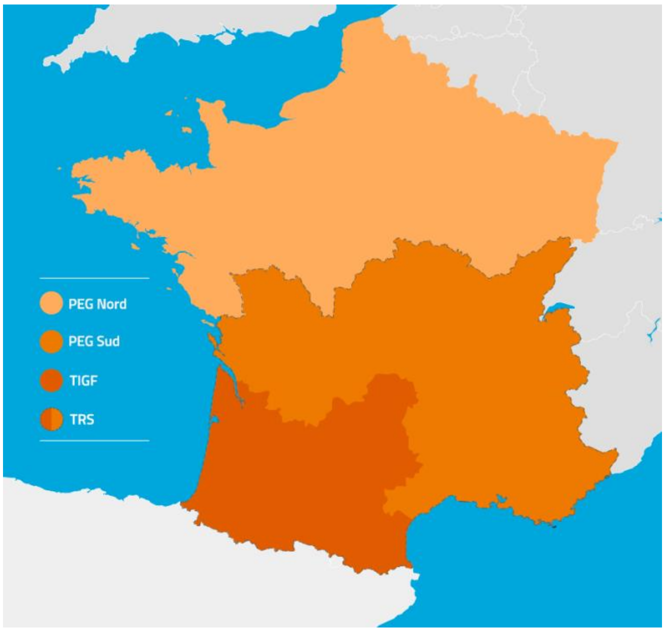
France

France has two different market areas for gas and two different transmission system operators.

As shown on the map below, the two transmission system operators (TSO) are:

1. *GRTGaz,* operating respectively in the North of the country and in the central and South-Eastern regions.
2. *TIGF,* concentrated on the South-Western region.

Within France, there are two different gas markets: PEG Nord and TRS (Trading Region South). TRS exists since 1st of April 2015 and is the result of a merger between the PEG Sud-market (the Central and South-Eastern regions that are operated by GRTGAZ) and the South-Western region operated by TIGF.[29][30]



Although there is one common market zone in the South of France, there are still two separate physical networks: GRTGaz operates the PEG Sud area and the TIGF operates the transport grid in the South-West. As we observe substantial differences between the two different transport tariffs and between the commodity prices in the two market areas, we will analyse the French result by presenting three different price zones: GRTGaz/Nord (representing about 75% of gas consumption in France),

[28] From Distribution networks to smart Distribution systems: rethinking the regulation of European electricity DSO's, European University Institute, THINK paper topic 12, Final report, 2013, pgs. 12-13.
[29] https://www.gazprom-energy.fr/gazmagazine/2015/04/trs-le-peg-sud-et-le-tigf-ont-fusionne/
[30] http://www.u-tech.fr/actualites/coupuresgaz2013

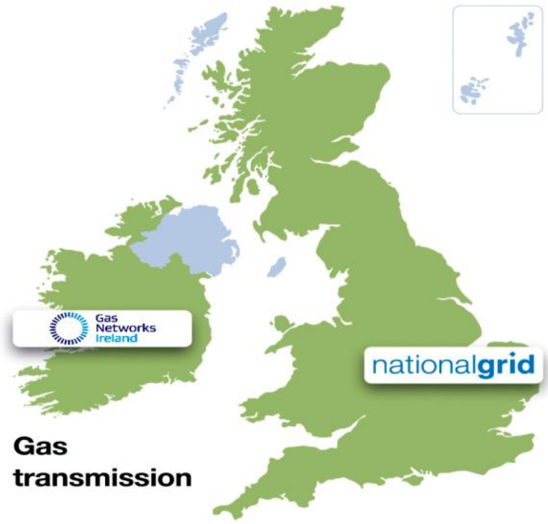
GRTGaz/Sud (about 20%) and TIGF (about 5%).[31] In terms of distribution, GrDF (Gaz Réseau Distribution France) distributes 96% of all gas[32] in France.

The Netherlands

The Netherlands counts one single gas market (TTF), where all gas entering the Dutch transport system is being traded. The TTF was established in 2003 in order to concentrate trade of gas in one marketplace. Furthermore, the Dutch gas market does not impose any regional taxes on gas, and has one Transmission System Operator: Gasunie Transport Services. About 300 industrial clients are directly connected to the gas transmission grid, and we assume profiles G1 and G2 are part of this group.[33] For both profiles we will hence, logically, present the Netherlands as one single zone.

United Kingdom

The United Kingdom will be presented as one single zone for gas in this study (leaving out Northern Ireland). There is one single gas market (NBP: National Balancing Point), there are no regional taxes, and there is one single gas transmission system operator, *National Grid Gas plc*.



On top of the transmission system operator, there are eight gas distribution networks. These eight networks are owned and managed by the following companies:

i. National Grid Gas (East Midlands, West Midlands, North West England and East of England);

ii. Northern Gas Networks (North East England including Yorkshire and Northern Cumbria);

iii. Wales & West Utilities (Wales and South West England);

iv. SGN (Scotland and Southern England including South London).

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[31] CRE, Marchés de gros: Observatoire des marchés de l'électricité, du gaz et du CO2, 3ième trimestre 2014.
[32] http://www.cre.fr/reseaux/infrastructures-gazieres/description-generale#section3
[33] Gasunie Transport Services is obliged by the Gas Act (Article 10, paragraph 6b) to provide a direct connection point when the applicant has a flow rate greater than 40 m³(n) per hour (equal to 350.400 m³ per year).

In addition, there are a number of smaller networks owned and operated by Independent Gas Transporters.

4.4. Summary table on number of zones per country

Country	Number of zones	
	Electricity	Gas
Belgium	3	3
Germany	4	1
France	1	3
The Netherlands	1	1
United Kingdom	1	1
Total	**10**	**9**

5. Electricity: Detailed description of the prices, price components and assumptions

5. Electricity: Detailed description of the prices, price components and assumptions

5.1. Belgium

Component 1 - the commodity price

Commodity prices in Belgium are calculated on the basis of market prices and represent the cost of electricity consumed by industrial consumers in January 2016. The national indexes used in the calculation of the commodity price are the ICE Endex CAL and the Belpex DAM.

The commodity formula is applied to all profiles. For profiles E1 and E2, we use all hours except weekends of Belpex DAM, whilst for profiles E3 and E4 we use all hours of Belpex DAM.

The formula used for pricing commodities in this study was provided by the CREG and are based on an analysis by the Belgian regulator of the electricity supply contracts of all Belgian consumers with an annual consumption above 10 GWh, dating back to 2014. In order to assure comparative results and after stakeholder consultation, it was decided in agreement with the CREG to maintain this formula – also for possible future updates of this price comparison.

$$\textit{Commodity price} = 47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ Belpex\ DAM$$

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2015
CAL Y_{-2}	Average two year ahead forward price in 2014
CAL Y_{-3}	Average three year ahead forward price in 2013
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2015
Mi_{-1}	Average month ahead forward price in December 2015

Component 2 - network costs

Transmission cost

Whether connected to the transmission grid 30-70 kV (Local Transmission System) or to the transmission network itself, the same transmission tariff structure applies to all profiles under review in this study. However, in function of the voltage connection and used capacity, different rates apply.

Transmission costs in Belgium have five components:

1. *Connection tariffs*: in this case, the study only takes into account the charges to operate and maintain the user connection;
2. *Tariffs for the management and the development of the grid infrastructure*: this cost includes (i) the tariff for the monthly peak for the offtake, (ii) the tariff for the yearly peak for the offtake and (iii) the power put at disposal;

3. *Tariffs for the management of the electric system*: this cost includes (i) the tariff for the management of the electric system and (ii) tariffs for the offtake of additional reactive energy (not taken into account);
4. *Tariffs for the compensation of imbalances*: this cost includes: (i) the tariff for the power reserves and black-start and (ii) the tariff for the maintenance and restoring of the residual balance of the individual access responsible parties. The latter includes (a) imbalance tariffs, which are not taken into account as they are (generally) not explicitly billed by the TSO or by suppliers to end consumers and (b) network losses. In Belgium, network losses on the federal transport grid (380/220/150 kV) make for an additional and separate component of transport tariffs. They are generally billed by the supplier as a percentage (fixed every year by the TSO) of the commodity cost. Even though they are not part of the transmission tariff structure as such, we consider these network losses and their cost as part of component 2 (network costs);
5. *Tariffs for market integration:* this cost relates to services provided by Elia such as the development and integration of an effective and efficient electricity market, the operation of interconnections, coordination with neighbouring countries and the European authorities and publication of data as required by transparency obligations.

Distribution costs

For profile E1 connected to the distribution grid (at 26-36 kV), distribution tariffs have to be added to the transmission tariffs. In our study, we select the tariffs for the highest voltage level networks on the distribution grid (i.e. TRANS HS/ TRANS HT)[34]. For each Belgian region, distribution tariffs typically have three components:

1. *Tariffs for power put at disposal*[35]*;*
2. *Tariffs for system management;*
3. *Metering cost.*

For each region of Belgium, we compute the tariff through a weighted average of each component across all DSOs active in the region (weights are given in terms of distributed electricity per DSO in 2014). As stated above, for the Flemish region, all DSOs operated by INFRAX or EANDIS were taken into account (representing 100% of distributed electricity in the region in 2014). For the Walloon region, all DSOs operated by ORES and RESA were taken into account (representing 94% of distributed electricity in the region in 2014).

It should be noted that regional regulators have different timings in terms of adoption of transmission tariffs and federal contributions (see table below). The table below illustrates this.

Adoption of new tariffs by regional regulators	Transmission	Federal contribution
VREG	1/3/2016	1/1/2016
BRUGEL	1/1/2016	1/1/2016
CWAPE	1/2/2016	1/2/2016

[34] TRANS MT is the highest voltage level for RESA and Sibelga networks which we use in the scope of this study.
[35] In the Walloon region, there are different methodologies for ORES and RESA concerning the distribution tariff component of power put at disposal (upper boundary for RESA and standard formula for Eandis). For the Flemish region, there are different methodologies for INFRAX and EANDIS concerning the distribution tariff component of power put at disposal (upper boundary for Infrax and standard formula for Eandis). In the Brussels region, the power put at disposal component of the distribution tariff is based on a standard formula.

Hence, as the period analysed in the scope of this study is the month of January 2016, some transmission tariffs (Flanders, Wallonia) as well as the rates for the federal contribution (Wallonia) were taken into account at their 2015 level, still applicable in the first months of 2016. This is the case for the adoption of transmission tariffs by the VREG[36] and the adoption of transmission tariffs and federal contribution by the CWAPE. This explains the differences in federal contribution between the three Belgian regions. Another element to be highlighted is the fact that for profile E1, federal public service obligations as well as federal taxes and levies vary across the three regions due to DSO network losses, which vary between different individual DSOs.

Component 3 - all extra costs

In Belgium, three different kinds of extra costs apply to electricity, detailed below:

1. ***Tariffs for Public Service Obligations* (PSO)**: eight different public service obligations apply to the profiles under review. The first three (a-b-c) are imposed on Elia as TSO (and hence apply to all profiles under review), the four (d-e-f-g) next ones are imposed DSO's and on Elia as LTSO (and hence only apply to profiles E1 and E2), and the last one applies for consumers connected to the distribution grid (E1):
    a. Financing of connection of offshore wind power generation units (0,0629 €/MWh);
    b. Financing of federal green certificates (offshore wind) (3,8261 €/MWh) but discount and cap based on quantity apply;
    c. Financing of Strategic Reserves (0,9972 €/MWh);
    d. Financing of support measures for renewable energy and cogeneration in Flanders (0,7568 €/MWh) but discount based on quantity applies (only E1 and E2);
    e. Financing measures for the promotion of rational energy use in Flanders (0,0616 €/MWh) (only E1 and E2);
    f. Financing support measures for renewable energy in Wallonia (13,8159 €/MWh) but discount based on quantity applies (only E1 and E2);
    g. Financing regional energy policies in Brussels (0,87 €/kVA/month) but only due up to 5000 kVA/month (only E1 and E2);
    h. Public service obligations for consumers connected to the distribution grid[37] i.e. (i) public service obligations in Flanders, (ii) public service obligations in Wallonia; (iii) public service obligations in Brussels (only E1).

2. ***Taxes and levies*** on the federal and on the regional level. We can identify five different taxes and levies:

[36] Transmission tariffs in the Flemish region are computed according to pre-2016 methodology (i.e. tariff for the reservation of primary frequency control, tariff for voltage control, tariff for congestion management and tariff for compensation of losses of active energy in the grid)

[37] For each region of Belgium, we compute the tariff through a weighted average of each component across all DSO active in the region (weights are given in terms of distributed electricity per DSO in 2014). As stated above, for the Flemish region, all DSOs operated by INFRAX or EANDIS were taken into account (representing 100% of distributed electricity in the region in 2014). For the Walloon region, all DSOs operated by ORES and RESA were taken into account (representing 94% of distributed electricity in the region in 2014).

a. Federal contribution (3,0033 €/MWh), increased by 1,1% to pay for supplier administrative costs, no exemptions but discount and cap based on quantity apply;[38]

b. Levy for occupying public domain in Wallonia (0,3446 €/MWh), which is only applicable to the local transport network and below (only E1 and E2);

c. Levy for occupying road network in Brussels (3,253 €/MWh);[39]

d. Levy for the taxes "pylons" and "trenches" in Flanders (0,1 €/MWh);

e. Connection fee in Wallonia (0,3 €/MWh).

3. **Certificate schemes and other indirect costs**. These are the indirect costs that are comprised within the electricity price, as a consequence of the regional quota for green certificates (three regions) and combined heat/power-certificates (only Flanders). Based upon the information received from the CREG, we estimate the cost of certificates at 85% of the penalty a supplier has to pay for not meeting the quota. The three regions have a green certificate system for renewable energies, Flanders also has a certificate system for combined heat/power. Additional taxes and levies apply for consumers who are connected to the distribution grid in each of the three regions.

   a. Flanders (green certificates): the fine for non-compliance is 100 EUR/certificate. The quota increases every year. Important progressive quota reductions apply to all industrial consumers;

   b. Flanders (combined heat/power certificates): the fine for non-compliance is 41 EUR/certificate. The quota increases every year. Important progressive reductions apply to all industrial consumers;

   c. Wallonia: the fine for non-compliance is 100 EUR/certificate. The quota increases every year. Progressive quota reductions apply to large consumers, reinforced by the new regional decree that entered into force on July 1st 2014;

   d. Brussels: the fine for non-compliance is 100 EUR/certificate. The quota increases every year. No quota reductions for large consumers exist;

   e. Flanders, Wallonia and Brussels: local taxes and levies for consumers connected to the distribution grid which comprise of (i) expenses and unfunded pensions, (ii) income tax and (iii) other local, provincial, state and federal taxes, levies, charges, contributions and payments (only for E1).[40]

[38] For the Walloon region, the 2015 rate was still applicable on the distribution grid (profile E1) in January 2016.

[39] For this fee, the regional legislator introduced a cap starting January 1st 2007 (no fee due on electricity above 25 GWh/year), but the decree to make it applicable has not been issued so far. As a consequence, this ceiling is not applied in Brussels (source: *Ordonnance du 14 décembre 2006 modifiant les ordonnances du 19 juillet 2001 et du 1er avril 2004 relatives à l'organisation du marché de l'électricité et du gaz en Région de Bruxelles-Capitale et abrogeant l'ordonnance du 11 juillet 1991 relative au droit à la fourniture minimale d'électricité et l'ordonnance du 11 mars 1999 établissant des mesures de prévention des coupures de gaz à usage domestique, article 102*).

[40] For each region of Belgium, we compute the tariff through a weighted average of each component across all DSOs active in the region (weights are given in terms of distributed electricity per DSO in 2014). As stated above, for the Flemish region, all DSOs operated by INFRAX or EANDIS were taken into account (representing 100% of distributed electricity in the region in 2014). For the Walloon region, all DSOs operated by ORES and RESA were taken into account (representing 94% of distributed electricity in the region in 2014).

5.2. Germany

Component 1 - the commodity price

Commodity prices in Germany are calculated on the basis of market prices and represent the cost of electricity consumed by industrial consumers in January 2016. The national indexes used in the calculation of the commodity price are the EEX Futures and EPEX DAM prices.

The commodity formula is applied to all profiles. For profiles E1 and E2, we use all hours except weekends of EPEX DAM, whilst for profiles E3 and E4 we use all hours of EPEX DAM.

The formulas used for pricing commodities in this study was provided by the CREG and are based on an analysis by the Belgian regulator of the electricity supply contracts of all Belgian consumers with an annual consumption above 10 GWh, dating back to 2014. In order to assure comparative results and after stakeholder consultation, it was decided in agreement with the CREG to maintain this formula – also for possible future updates of this price comparison.

$$\textbf{\textit{Commodity price}}$$
$$= 47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ EPEX\ Spot\ DE$$

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2015
CAL Y_{-2}	Average two year ahead forward price in 2014
CAL Y_{-3}	Average three year ahead forward price in 2013
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2015
Mi_{-1}	Average month ahead forward price in December 2015

Component 2 - network costs

The German electricity grid organization is fairly different from the Belgian one. The four transmission grid operators only operate the (extra-) high voltage grid, while everything else (often, but not always, up to 110 kV) is operated by the distribution system operators.

<table>
<tr><th>Connection voltage (U_n)</th><th>Voltage profile</th><th>Consumer profile</th><th>Grid operator</th></tr>
<tr><td rowspan="2">1 kV ≤ U_n ≤ 50 kV</td><td rowspan="2">Medium voltage</td><td>E1</td><td rowspan="4">DSO</td></tr>
<tr><td rowspan="2">E2</td></tr>
<tr><td rowspan="2">U_n = 110 kV</td><td rowspan="2">High Voltage</td></tr>
<tr><td rowspan="2">E3</td></tr>
<tr><td rowspan="2">220 kV < U_n ≤ 350 kV</td><td rowspan="2">Extra high voltage</td><td rowspan="2">TSO</td></tr>
<tr><td>E4</td></tr>
</table>

For the first profile (E1), we assume the consumer benefits from the medium voltage tariff on the distribution grid, while the second profile (E2) benefits from the ‘Umspannung in Mittelspannung’ tariff on the distribution grid. Profile E3 is assumed to be directly connected to the ‘Umspannung in Hochspannung’ high voltage transformation grid, while profile E4 is assumed to be directly connected to the extra high voltage grid. Both the ‘Umspannung in Hochspannung’ and extra high voltage grid are operated by the TSO.

Transmission and distribution tariffs in Germany are integrated and presented as one single tariff to the consumers on the distribution grid. As stated in the description of the dataset, we present results for the four transmission zones in Germany. As Germany counts about 870 distribution system operators[41], the network cost we present for profiles E1 and E2 is an average of two large DSOs in each transmission zone (one rural, one urban DSO).

Transmission costs

German integrated grid fees, imposed on transmission grid, follow the same methodology and involve three main components:

1. *Annual capacity charge*: depends upon the maximum capacity in kW contracted, expressed in €/kW per year;
2. *Energy charge*: depends upon the volume of energy consumed in kWh per year, expressed in ct/kWh per year;
3. *Metering, billing and metering point operation per counting point charges:* charges related to the cost of metering and invoicing, fixed prices expressed in € per year.

Other fees, such as capacity excess fees are not taken into account in this study given the assumption that load profiles do not exceed their contracted capacity.

When annual consumption exceeds 10 GWh, important transmission network costs reductions can apply on large industrial consumers.[42] Users with a very abnormal load profile (case by case) get a reduction of max. 90%. Users who exceed 7000 consumption hours a year, benefit from reductions as shown in the table below:

Annual consumption	Annual consumption	Grid fee reduction
> 10 GWh	≥ 7000 hrs	- 80%
> 10 GWh	≥ 7500 hrs	- 85%
> 10 GWh	≥ 8000 hrs	- 90%

These reductions apply to profiles E3 and E4. We assumed that Profile E3 has a profile of 7692 hours and pays as a consequence only 15% of the grid fee, while this is only 10% for profile E4 (8000 consumption hours).[43] As opposed to France, where a similar and recent reduction (until December 2015) was paid by the regulatory account, this reduction is financed by a separate levy (see next part).

Distribution costs

German distribution grid fees follow a similar methodology as those of the transmission grid but have a different terminology. Although every DSO imposes different rates for different ranges of both maximum capacity contracted and electricity consumer, their tariffs involve the same three components:

1. *Capacity charge* (i.e. "*Leistungspreis*"): depends upon the maximum capacity in kW contracted, expressed in €/kWh/h per year;
2. *Consumption charge* (i.e. "*Arbeitspreis*"): depends upon the volume of energy consumed in kWh per year, expressed in ct/kWh per year;

[41] From Distribution networks to smart Distribution systems: rethinking the regulation of European electricity DSO's, European University Institute, THINK paper topic 12, Final report, 2013, pgs. 12-13.
[42] Stromnetzentgeltverordnung, §19, abs. 2.
[43] Consumption of 100GWh/year divided by peak capacity of 13.000 kW = 7692 peak load hours; Consumption of 500GWh/year divided by peak capacity of 62.500 kW = 8000 peak load hours.

3. *Metering, billing and metering point operation per counting point charges*: charges related to the cost of metering and invoicing, fixed prices expressed in € per year.

Component 3 - all extra costs

Regarding taxes and levies, the German situation is particularly complex, with a host of progressive reductions, diversified rates and exemptions. As laid out in the general assumptions, we assume our consumer is an economically rational actor and aims at obtaining the lowest tax rate. Whenever the application of reductions or exemptions depends on economic criteria that are not under the full control of the user (energy cost/turnover, energy cost/gross added value, pension payments, etc.), we will present a range with all possible options.

In Germany, six taxes/surcharges can apply on electricity[44]:

1. The *Combined heat & power generation surcharge* (CHP) is a surcharge that pays for CHP-plant subsidies. The calculation is based on present forecast data of DSOs and the Federal office for Economic Affairs and Export Control (BAFA). There are three different rates for the three following consumer groups:

Category A	All other consumers	4,45 €/MWh
Category B	> 0,1 GWh / year and not Category C	0,4 €/MWh
Category C	> 0,1 GWh / year and manufacturing industry with electricity cost > 4% of turnover in 2015	0,3 €/MWh

For the four consumer profiles under review, we present a range from the category B to the category C rate.

2. The *"StromNEV" §19-Umlage,* which is a digressive levy to compensate for the §19 transmission tariff reductions. Different rates apply to different bands of total electricity consumption.

Band A	Consumption ≤ 1 GWh/year	3,78 €/MWh
Band B	Consumption > 1 GWh /year	0,5 €/MWh
Band C	Consumption > 1 GWh/year and manufacturing industry with electricity cost > 4% of turnover in 2015	0,25 €/MWh

For the four profiles under review, we present a range of two possibilities: either the consumer can benefit from the Band C-rate for its consumption above 1 GWh (bottom of range) or he cannot in case of which the Band B-rate applies (top of range) on the consumption above 1 GWh.

3. *Offshore liability overload,* which is a digressive levy to pay for offshore wind power generation units. Different rates apply to different bands of total electricity consumption.

Band A	Consumption ≤ 1 GWh/year	0,4 €/MWh
Band B	Consumption > 1 GWh /year	0,27 €/MWh
Band C	Consumption > 1 GWh/year and manufacturing industry with electricity cost > 4% of turnover in 2015	0,25 €/MWh

44 Until last year a seventh tax was imposed, the AblaV Surcharge, which was a levy to finance interruptible load agreements. In the absence of a new regulation for the period starting 1st January 2016, collection of the levy for interruptible loads has been suspended until further notice.

For the four profiles under review, we present a range of two possibilities: either the consumer can benefit from the Band C-rate for its consumption above 1 GWh (bottom of range) or he cannot in case of which the Band B-rate applies (top of range) on the consumption above 1 GWh.

4. The *"eEG-Umlage"* contributes to the financing of all renewable energies other than offshore wind power generation units. Consumers are divided in 2 different categories: those belonging to category A pay one single 'top rate' on their entire consumption, while consumers belonging to category B only pay this top rate for the 1st GWh of electricity consumption. For any consumption exceeding 1 GWh/year, category B customers benefit at least from an 85% reduction on the eEG-Umlage. The system can be summarized as follows:

Category A	All consumers that do not belong to category B	63,54 €/MWh
Category B	If consumption > 1 GWh / year and electricity cost is : • For an extensive list of industrial sectors: >17% of gross value creation in 2016 • For a less extensive list of industrial sectors : >20% of gross value creation in 2015	9,53 €/MWh, but capped[45] at • 0,5% of gross value creation (average last 3 years) for all consumers with electricity cost >20% of gross value creation • 4,0% of gross value creations (average last 3 years) for all consumers with electricity cost <20% of gross value creation

However, for category B consumers, a bottom rate of 0,5 EUR/MWh applies for several industrial sectors, and of 1,0 EUR/MWh for all other industrial sectors.

No eEG-Umlage is due on the consumption self-generated electricity. As we do throughout the entire report, we assume here as well that the four profiles under review do not produce any electricity themselves.

In this study, we present a range of possibilities given the fact that it is not possible to determine whether the four consumer profiles meet the economic criteria to qualify as a category B consumer. Category A will be presented as an outlier, but constitutes the reality for an important group of non-electro-intensive consumers. In 2014, only 2.026 of the over 45.000 industrial companies in Germany qualified for the criteria in category B (when the criteria was only 14% and not 17% as is the case in 2016). These 2026 companies, however, represent about 39% of total German industrial energy consumption, while 46 % of the German industrial energy consumption was surcharged with the full surcharge in category A.[46]

5. The "*Stromsteuer*" is an electricity tax. Since 2003, the normal tax rate equals 20,5 €/MWh. All industrial consumers that apply for it, benefit from a rate of 15,37 €/MWh, which is a reduction of the full rate with 25%. Further reductions on the rate for industrial consumers are attributed on the basis of the amount of pension contributions a company pays: the fewer pension contributions a company pays, the higher the amount of the reduction on the Stromsteuer. The maximum reduction is 90%, which

[45] However, these caps are only applicable if the consumer is part of an energy efficiency system improvement program.
[46] Bundesamtes für Wirtschaft un Ausfuhrkontrolle (BAFA), *Statistischen Auswertungen zur "Besonderes Ausgleichsregelung"*; and *BDEW Strompreisanalyse Juni 2014* – Haushalte und Industrie, Bundesverband der Energie- und Wasserwirtschaft e.V., Berlin.

results in a reduced rate of 1,537 €/MWh.[47] In 2014, 22.300 companies benefited from some kind of reduction through this system.[48]

Aside from these reductions, electricity used as a raw material for electro-intensive industrial processes is totally exempt from the electricity tax.

Hence, for all profiles, we will present a range from 0 (exempted) to 15,37 €/MWh. The lowest tariff for non-exempted users - 1,537 €/MWh - is included in this range.

6. The *"Konzessionsabgabe"* or concession fee is an energy tax that is imposed on all users to fund local governments. The basic rate for industrial users is 1,1 €/MWh. One exemption exists: consumers whose final electricity price (all taxes and grid fees included) remains under an annually fixed threshold (*in 2016: 132,27 €/MWh*)[49] are exempted from the concession fee.

In practice, for the profiles under review, this means that the concession fee is only due when no substantial reductions are applicable for the eEG-Umlage. We will hence only apply the concession fee in the (outlier) case where the full rate (63,54 €/MWh) of the eEG-Umlage is due.

47 *Stromsteuergesetz, §10.*

48 *24. Subventionsbericht der Bundesregierung*, Bericht der Bundesregierung über die Entwicklung der Finanzhilfen des Bundes und der Steuervergünstigungen für die Jahre 2011 bis 2014, pg. 65.

49 The *Grenzpreis* is fixed by the German statistics office and represents the average final electricity price of all industrial consumers.

5.3. France

Component 1 - the commodity price

In France, consumers are entitled to a certain amount of electricity at regulated rates ("Accès Régulé à l'Electricité Nucléaire Historique" (ARENH)), depending on their consumer profile. Commodity prices for industrial consumers are theoretically composed of a part of this ARENH-electricity at regulated rates on the one hand, and electricity based on market prices on the other hand.

In this study, we assume that our consumers being rational can choose between:

1. a combination of the market price and the regulated price (ARENH),
2. market prices only.

Given the fact that for 2016, market prices are lower than regulated prices (ARENH is at 42 EUR/MWh), we present market prices only in our study.

The commodity formula to calculate this market price is applied to all profiles. For profiles E1 and E2, we use all hours except weekends of Epex Spot FR DAM, whilst for profiles E3 and E4 we use all hours of Epex Spot FR DAM.

The formula was provided by the CREG and based on an analysis by the Belgian regulator of the electricity supply contracts of all Belgian consumers with an annual consumption above 10 GWh dating back to 2014. In order to assure comparative results and after stakeholder consultation, it was decided in agreement with the CREG to maintain this formula – also for possible future updates of this price comparison.

$$\textit{Commodity price} = 47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ EPEX\ Spot\ FR$$

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2015
CAL Y_{-2}	Average two year ahead forward price in 2014
CAL Y_{-3}	Average three year ahead forward price in 2013
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2015
Mi_{-1}	Average month ahead forward price in December 2015

Component 2 – network costs

Integrated transmission and distribution costs

In France, the transmission System Operator (TSO) in charge of the transport network is "RTE" ("Réseau de Transport d'Electricité"). The French high voltage network starts at 1 kV as shown in the table below.

<table>
<tr><th>Connection voltage (U_n)</th><th colspan="2">Tariff scheme</th><th>Grid</th></tr>
<tr><td>$U_n \leq 1$ kV</td><td colspan="2">BT</td><td>Low voltage (DSO)</td></tr>
<tr><td>1 kV < $U_n \leq 40$ kV</td><td>HTA1</td><td rowspan="2">HTA Profile</td><td rowspan="4">High voltage (TSO)</td></tr>
<tr><td>40 kV < $U_n \leq 50$ kV</td><td>HTA2</td></tr>
<tr><td>50 kV < $U_n \leq 130$ kV</td><td>HTB1</td><td rowspan="3">HTB Profile</td></tr>
<tr><td>130 kV < $U_n \leq 350$ kV</td><td>HTB2</td></tr>
<tr><td>350 kV < $U_n \leq 500$ kV</td><td>HTB3</td><td>Extra high voltage (TSO)</td></tr>
</table>

We assume that profile E1 pays the HTA1 tariff (1-40kV). As the HTA2-tariff is identical to the HTB1-tariff, we assume profile E2 pays the HTB1-tariff (40-130 kV). We assume profiles E3 and E4 pay the HTB2-tariff.

Transmission tariffs in France involve four components detailed below:

1. *Management cost*;
2. *Metering cost*;
3. *Withdrawal tariff*:
    1. For HTA2/HTB1 and HTB2 tariffs, this tariff includes the fee for reserved load capacity (which is a single fee), a fee for load capacity weighted according to 5 times slots and the fee for consumption which is a variable fee based on the consumption in 5 times slots. This tariff offers three contract options with different rates: medium, long and very long utilization. We assume our profiles pick the most advantageous contract option: long for E2, and very long for E3 and E4.
    2. For HTA1 tariffs, the tariff works in a similar way offering three contract options this time based on consumption in a different number of time slots: 1 single time slot, 5 time slots and 8 time slots. We assume our profile E1 takes the most advantageous contract option: 1 single time slot.
4. *Other fees* such as a fee for planned and unplanned exceeding of power capacity, fee for regrouping of connection, or transformation fee. Those fees are not taken into account for the profiles under review.

Since January 1st 2016, the transmission tariff reduction that was applicable since mid-2014 for several large industrial consumers is suspended.[50]

Component 3 - all extra costs

In France, two different surcharges apply to electricity. They are detailed as follows.

1. The *"Contribution tarifaire d'acheminement"* (CTA) is a surcharge for energy sector pensions.

For consumers directly connected to the transmission grid or who are connected to the distribution grid on or above 50 kV (profiles E2, E3 and E4 in France), the CTA amounts to 10,14% of the fixed part of the transmission tariff. For all other

[50] The government decree necessary to fix the reduction rate for this measure, based on article L-341-4-2 of the *Code de l'Energie*, has not been published yet. The draft version contained rates of 5 to 90% reduction.

consumers connected to the distribution grid, the CTA amounts to 27,07% of the fixed part of the transmission tariff (profile E1 in France).

2. The *"Contribution au service public d'électricité"* (CSPE)[51][52] is a surcharge that pays (amongst other things) for the cost of renewables, the *péréquation tarifaire* and social tariffs.

In 2016, the CSPE is 22,5 €/MWh. Three reductions are applicable:

i. For electro-intensive consumers where the CSPE would have been (without reductions and exemptions) at least equal to 0,5% of added value, the CSPE is equal to:

   a. for consumers consuming above 3 kWh per euro of added value, CSPE is equal to 2 €/MWh;

   b. for consumers consuming between 1,5 and 3 kWh per euro of added value, CSPE is equal to 5 €/MWh;

   c. for consumers consuming below 1,5 kWh per euro of added value, CSPE is equal to 7,5 €/MWh.

ii. For <u>very</u> electro-intensive consumers, the tariff amounts to 0,5 €/MWh. To be very electro-intensive, consumers must satisfy both conditions:

   a. its energy consumption represents more than 6 kWh per euro of added value;

   b. its activity belongs to a sector with a high trade intensity with third countries (> 25%).

iii. Sectors with a high risk of carbon leakage are metallurgy, electrolysis, non-metal minerals or chemical sectors. For electro-intensive consumers described under (i) above with a high risk of carbon leakage linked to indirect carbon emissions, the CSPE amounts to:

   a. for consumers consuming above 3 kWh per euro of added value, CSPE is equal to 1 €/MWh ;

   b. for consumers consuming between 1,5 and 3 kWh per euro of added value, CSPE is equal to 2,5 €/MWh ;

   c. for consumers consuming below 1,5 kWh per euro of added value, CSPE is equal to 5,5 €/MWh.

Lacking more detailed economic and financial data on the consumer profiles, we cannot exclude that the maximum rate of 22,5 euros per MWh applies to one or more of our consumer profiles. More specifically, the economic conditions needed for the maximum rate to be applicable are the following (**cumulative**):

1. The annual added value of the industrial company exceeds:

	Added value
Profile 1 (10 GWh)	45 mio €
Profile 2 (25 GWh)	112,5 mio €
Profile 3 (100 GWh)	450 mio €
Profile 4 (500 GWh)	2.250 mio €

[51] In 2015, the *"Contribution au service public d'électricité"* (CSPE) and « *Taxe intérieure sur la consommation finale"* merged, and were renamed CSPE.
[52] *Code des douanes,* article 266 quinquies C.

2. The industrial company does not meet the criteria for hyper electro intensity specified under (ii).
3. The industrial company does not meet the criteria for carbon leakage risk defined under (iii).

We will therefore present the maximum rate of 22,5 euros per MWh as a possible outlier for all consumer profiles. Moreover, we will present a range from 0,5 euros per MWh to 7,5 euros per MWh.

5.4. The Netherlands

Component 1 - the commodity price

The commodity prices for the Netherlands are calculated on the basis of market prices. The national indexes used in the calculation of the commodity price is the ICE Endex CAL and the APX NL DAM.

The commodity formula is applied to all profiles. For profiles E1 and E2, we use all hours except weekends of APX NL DAM, whilst for profiles E3 and E4 we use all hours of APX NL DAM.

The formulas used for pricing commodities in this study was provided by the CREG and are based on an analysis by the Belgian regulator of the electricity supply contracts of all consumers with an annual consumption above 10 GWh, dating back to 2014. In order to assure comparative results and after stakeholder consultation, it was decided in agreement with the CREG to maintain this formula – also for possible future updates of this price comparison.

$$\textit{Commodity price} = 47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ APX\ NL\ DAM$$

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2015
CAL Y_{-2}	Average two year ahead forward price in 2014
CAL Y_{-3}	Average three year ahead forward price in 2013
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2015
Mi_{-1}	Average month ahead forward price in December 2015

Component 2 – network costs

In the Netherlands, the network costs involve two components[53]:

1. Standing charge, metering charge and periodical connection tariff;
2. Transport service tariff (capacity tariff);

The Dutch transmission grid, operated by the TSO TenneT, encompasses all electricity transport infrastructures above 110 kV. Profiles E3 and E4 are hence assumed to be directly connected to the transmission grid, to the high voltage (110-150 kV) and to the extra high voltage grid (220-380 kV) respectively.

Profiles E1 and E2, on the other hand, are assumed to be connected to the distribution grid. As is the case in Germany, the distribution and transmission tariffs are integrated. As we explained before, we will present a weighted average of the eight distribution zones.

Since January 1st 2014 a substantial reduction[54] ("volumecorrectie") on transport tariffs is granted to large base-load consumers on the basis of two simultaneous conditions:

1. The customer exceeds 50 GWh/year in terms of consumption;

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[53] As of January 1st 2015, system service tariffs have been abolished.
[54] For a more detailed explanation of the reduction, see Elektriciteitswet 1998, Artikel 29, 7e – 10de lid.

2. The consumer consumes at least during 65% of all the 2.920 off-peak hours per year.[55]

These two conditions must be matched together. If so, the maximum reduction is limited to 90%, which is the case for profile E4 in this study. Profile E3 benefits from this measure as well with a reduction of 45%. The formula for which the reduction has been calculated is the following:

Reduction on transmission tariffs (in %) =

(bedrijfstijd – 65%) / (85%-65%) * (usage -50 GWh) / (250 GWh – 50 GWh) * 100

Where bedrijfstijd (in %) =

$$\frac{\text{(total consumption in off-peak hours/ maximum capacity)} * 100}{\text{(hours per annum)}}$$

Component 3 – all extra costs

In general, two surcharges apply to the electricity bill for industrial consumers:

1. The *Energy Tax* is a digressive tax on all energy carriers. The energy tax for electricity in 2016 has the following rates:

Band A	Consumption up to 10 MWh	100,7 €/MWh
Band B	Consumption from 10-50 MWh	49,96 €/MWh
Band C	Consumption from 50-10.000 MWh	13,31 €/MWh
Band D	Consumption above 10.000 MWh (professional)	0,53€/MWh

2. The *ODE levy* is a digressive levy on gas and electricity that pays for renewable capacity. The rates for 2016:

Band A	Consumption up to 10 MWh (with tax reduction)	5,6 €/MWh
Band B	Consumption from 10-50 MWh (with tax reduction)	7 €/MWh
Band C	Consumption from 50-10.000 MWh	1,9€/MWh
Band D	Consumption above 10.000 MWh (professional)	0,084 €/MWh

There are several exceptions on these tax surcharges. First of all, some consumers can apply for a tax refund scheme ('teruggaafregeling'). This refund is destined for

[55] The off-peak hours are those between 11pm and 7pm and all of those in the weekends and national holidays.

industrial consumers who are classified as being energy-intensive[56] and who concluded a multiple-year agreement with the Dutch government to save energy by improving their energy efficiency. These consumers can apply for a refund of any tax paid above their consumption of 10.000 MWh after each financial year. The refund is equal to the part that has been charged above the European minimum tax level per MWh (0,5€/MWh).

Next to this refund scheme, taxes are completely exempted for those industrials whose electricity is produced with renewable energy sources, with an emergency installation during power breakdowns and with combined heat and power (CHP) installations. Tax exemption is also granted to those industrials that use their electricity for chemical reduction, electrolytic and metallurgic processes[57].

Given the fact that several of the criteria that give access to these tax refunds are based upon economic and accounting data, we will present a range of results with an outlier option (maximum rate only applicable if the industrial consumer is not energy intensive (see Footnote 56) and cannot qualify for the full exemption), and a range spanning from the minimal option (totally exempted) to the refund rate (0,5 euros per MWh).

[56] An energy-intensive company is a company for which the costs of energy or electricity is more than 3% of the total value of production or the energy taxes and tax on mineral oils is at least 0,5% of the added value (Wet Belastingen op Milieugrondslag , Artikel 47, 1p).
[57] A more detailed version of the rules regarding the exemptions and refund schemes can be found in Wet Belastingen op Milieugrondslag, Artikel 64 and 66.

5.5. United Kingdom

Component 1 - the commodity price

Commodity prices in the United Kingdom are based on market prices. The national index used in the calculation of commodity price is the APX UK DAM. The commodity price formulas used for pricing commodities in this study were provided by the CREG and are based on an analysis by the Belgian regulator of the electricity supply contracts of all consumers with an annual consumption above 10 GWh, dating back to 2014. In order to assure comparative results and after stakeholder consultation, it was decided in agreement with the CREG to maintain this formula – also for possible future updates of this price comparison.

As no "Calendar +1/2/3" product exists for the UK power market, it was replaced by the aggregation of seasonal products on the ICE futures market. GQx quotes the baseload electricity price on the ICE index for x seasons[58] ahead. Therefore we have used twelve months of GQ2 (two seasons ahead) to replace CAL Y-1[59], twelve months of GQ4 (four seasons ahead) to replace CAL Y-2 and twelve months of GQ6 (six seasons ahead) to replace CAL Y-3.

The commodity formula is applied to all profiles. For profiles E1 and E2, we use all hours except weekends of APX UK DAM, whilst for profiles E3 and E4 we use all hours of APX UK DAM.

$$\textbf{\textit{Commodity price}}$$
$$= 47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ APX\ UK\ DAM$$

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2015
CAL Y_{-2}	Average two year ahead forward price in 2014
CAL Y_{-3}	Average three year ahead forward price in 2013
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2015
Mi_{-1}	Average month ahead forward price in December 2015

We calculated the commodity cost (based on the formula above) entirely in Pound Sterling, and converted the final result to Euro at the January 2016 exchange rate (see also section 4.2).

Component 2 - the network costs

Transmission costs

The network structure in the United Kingdom has been described above on geographical level with three TSO's, six DSOs and 14 tariff zones identified. On a technical level, the grid is organized as follows:

[58] A season corresponds to a six-month period, either the summer (April – September) or the winter (October – March).

[59] For instance, to estimate CAL Y-1 price for January 2016, we have taken the average price quotation over the course of 12 months (from October 2014 to September 2015) of the 'two seasons ahead' seasonal forward. This can be equated to the year-ahead price quotations present in the other countries under review, with the difference that the UK year within which the electricity is consumed lasts from October 2015 to September 2016 while for the other countries it runs from January 2016 to December 2016

Connection voltage (U_n)	Operator	Tariff scheme
U_n < 22 kV	DSO	Common distribution charging methodology (CDCM) + Transmission charges (TNUoS)
22kV ≤ U_n ≤ 132 kV		Extra high voltage distribution charging methodology (EDCM) + TNUoS
275 kV ≤ U_n ≤ 400 kV	TSO	Transmission charges (TNUoS)

As in the German case, given the particularly high voltage level of the transmission grid, we assume profiles E1 and E2 are both connected to the distribution grid and pay both distribution and transmission charges. Profiles E3 and E4 are assumed to be directly connected to the transmission grid and only pays transmission charges.

Transmission Network Use of System (TNUoS) charges in the UK have two different rates: half-hourly (HH) metered customers pay a capacity tariff in function of their power subscription, while customers who are not half-hourly metered pay a demand rate in function of their electricity consumption. We assume profiles E1, E2, E3 and E4 are half hourly metered and hence pay the capacity rate. This HH tariff is zonal: there is a different rate for all 14 zones of the UK. We present an average value of these fourteen zonal tariffs as transmission cost for profiles E1, E2, E3 and E4.

Distribution costs

Distribution charges, which are due for profiles E1 and E2, have a more complex methodology. Profile E1 pays the Common Distribution Charging Methodology (CDCM) and is billed for total consumption across all demand time periods, with important differences between peak and off-peak consumption. Profile E2 is charged differently, through the EHV Distribution Charging Methodology (EDCM). EDCM charges are largely based on capacity with a small element for consumption in the high demand time period. The EDCM provides for individual tariffs for each customer depending upon location, demand, generation (type) and capacity. As the individual EDCM-rates are made public on an anonymous basis, we have calculated the average discount of individualized EDCM-rates compared to CDCM-tariffs in each of the 14 zones. We present the average discount of EDCM-rates on CDCM-tariffs in the 14 zones as the distribution cost value for profile E2.

With regards to *network losses* on the transmission grid, a similar (but more dynamic) system to the one applicable in Belgium exists. Each half hour, the Balancing and Settlement Code Administrator defines the Transmission losses multiplier (TLM) applicable for offtake and delivery. This cost of the network losses on the transmission grid is added to the bill as a percentage of the commodity cost for offtake, but we consider it to be part of component 2, as it is a true network cost – even though it is not part of the tariff structure as such.

Component 3 - all extra costs

Three different extra costs are identified for the UK: two levies and the indirect cost of one renewable subsidies schemes.

1. The ***Climate Change Levy* (CCL)** is a levy payable on electricity, gas, fuel, etc. Its basic rate for electricity consumption is 7,342€/MWh (0,554p/kWh), but users part of a Climate Change Agreement (CCA) benefit from 90% reduction. Given the assumption of this study that the customer profiles under review are economically rational and given the large scope and rate of

application of CCA's, we assume profiles E1, E2, E3 and E4 are all part of Climate Change Agreement.

2. The ***Assistance for Areas with High electricity distribution Costs*** *(*AAHEDC) levy is a simple rate general levy to compensate for high distribution costs in the zone of Northern Scotland (1 of the 14 zones) corresponding to 0,021649 p/kWh.
3. The ***Renewables Obligation* (RO)** is the cost taken into account for the large scale renewable subsidy scheme. From April 2015 to April 2016, the renewable quota is 0,290 Renewable Obligation Certificates (ROC's) per MWh. Given the fee per missing ROC of 58,8€, the penalty for non-ROC-covered electricity is 17,0 €/MWh. As we did in the Belgian case, based on the CREG input, we take 85% of this cost into account.
4. **The pausing of the FIT scheme**[60] takes effect from 15 January 2016 and lasts until 7 February 2016. Hence we do not consider this cost in the report.

[60] The decision from 17 December 2015 on pausing the Feed-in-tariff (FIT) scheme (see https://www.ofgem.gov.uk/environmental-programmes/feed-tariff-fit-scheme) which takes effect from 15 January 2016 and lasts until 7 February 2016. On 8 February 2016 deployment caps will be introduced to the scheme.

6. Gas: Detailed description of the prices, price components and assumptions

6. Gas: Detailed description of the prices, price components and assumptions

6.1. Belgium

Component 1 - the commodity price

Commodity prices for natural gas in this study are based on market prices.

For profile G1, the national market index used in the calculation of the gas commodity price for Belgium is the Zeebrugge HUB 101 for gas (month ahead price). For consumer profile G2, we adopt an average of day-ahead prices over the course of January 2016. All commodity data were provided by the CREG.

Component 2 - network costs

Transmission costs

As discussed in the consumer profiles, we assume that profile G2 is directly connected to the transport grid, whilst profile G1 is connected to the distribution grid (T6).

About 230 industrial clients in Belgium are directly connected to the grid of TSO Fluxys Belgium.[61] We assume consumer G2 is connected at the high pressure level (which is the case for the vast majority of industrial consumers).

In Belgium, the transmission costs for a direct client have three main components:

i. *Entry capacity fee* (border point entry fee);

ii. *Exit capacity fee* (HP capacity fee or "fix/flex" option and MP capacity fee) [62];

iii. *Commodity fee* ("energy in cash").

Optional tariffs for odorisation exist, but are not taken into account in the scope of this study, given the fact that the vast majority of industrial consumers in Belgium dispose of their own odorisation system.

Part of the network in Belgium is supplied with "L-gas". This gas has a lower calorific value than the "H-gas" that is used in much of Western-Europe. About 20% of industrial consumers directly connected to the gas transport grid in Belgium use L-gas.[63]

[61] It has to be noted that no such client exists in the Brussels Capital Region.
[62] For HP capacity at end-user domestic exit points, the "fix/flex" tariff option can be chosen. We have opted to choose the "fix/flex" option as it is the most advantageous option for both consumer profiles. Furthermore, 99% of the Belgian industrial consumers need to pay HP capacity fees, while the MP capacity fee is due for 38% of the Belgian industrial consumers. The exit capacity was therefore calculated as follows: 0,99* "fix/flex" –tariff + 0,38*MP-tariff
[63] Calculation of PwC based on figures publicly available on the Fluxys website.

	Label	Capacity tariff (€/kWh/h/ year)	Direct exit points (excluding power plants)	€/MWh allocated at the domestic exit point (for the "Fix/Flex" option)
HP capacity	H-grid	1,090	80%	
	L-grid	1,257	20%	
"Fix/ flex" option	H-grid	0,55	80%	h<=2000: 0,273 €/MWh h>2000: 0,016 €/MWh
	L-grid	0,629	20%	
MP capacity	H-grid	0,655	80%	
	L-grid	0,755	20%	

Belgian gas transport tariffs are largely capacity based and expressed in €/kWh/h/year. This means that profile G2 has a higher transport cost in parts of the country with a lower calorific value of the gas. In the scope of this study, we therefore propose a weighted average of H and L-tariffs as value for the transport cost for profile G2.

For HP capacity at end-user domestic exit points, a "fix/flex" tariff option can be chosen instead of the HP capacity tariff. The variable term (Flex term) depends on a number of hours "h", which is calculated as the division of the allocated energy at the domestic exit point by the subscribed capacity at that point. We assume our profiles pick the most advantageous contract option i.e. "flix/flex" option instead of the standard HP capacity tariff. For some industrial consumers a MP capacity fee has to be included to the transport costs as well.[64]

Finally, the commodity fee depends on the annual consumption of the end user (in MWh/year). It accounts to 0,08% of a theoretical commodity cost per year, based on the ZTP day-ahead commodity price, as published by ICE-Endex.

Distribution costs

As stated above, profile G1 is connected to the distribution grid. Industrial consumers connected to the distribution grid need to pay an additional distribution tariff next to the transmission cost. In our study, we select the tariffs for the highest category on the distribution grid (i.e. T6).[65] For each Belgian region, gas distribution tariffs typically have three components:

1. *Fixed component;*
2. *Proportional component;*
3. *Capacity component.*

For each region of Belgium, we compute the tariff through a weighted average of each component across all DSOs active in the region (weights are given in terms of distributed gas per DSO in 2014). As stated above, for the Flemish region, all DSOs operated by INFRAX or EANDIS were taken into account (representing 100% of distributed gas in the region in 2014). For the Walloon region, all DSOs operated by ORES, RESA and GASELWEST were taken into account (also representing 100% of distributed gas in the region in 2014).

Component 3 - all extra costs

In Belgium, two extra costs are charged to all gas consumers directly connected to the transport grid:

[64] We have used the weights of these connections in order to calculate the exit tariff fee, see footnote 62.
[65] T5 (and not T6) is the highest category for Sibelga network active in Brussels which we use in the scope of this study.

1. *Federal contribution* (0,6309 €/MWh), increased by 1,1% by the supplier, with digressive tariff reductions:

0-20 GWh	0%
20-50 GWh	-15%
50-250 GWh	-20%
250-1.000 GWh	-25%
> 1.000 GWh	-45%
-> Ceiling of 750.000 €/year by consumption site	

2. *Energy contribution*, with three different tariffs.
   - The normal rate (top rate) of 0,9978 €/MWh.
   - Users that are part of an energy efficiency agreement in their region benefit from a reduced rate of 0,54 €/MWh.
   - Users that use natural gas as a raw material for their industrial process are exempted from the energy contribution (0 €/MWh).

   We assume profile G1, as a rational actor, has concluded an energy efficiency agreement. Therefore, the energy contribution for profile G1 is 0,54 €/MWh.

   As we include the option that profile G2 is a feedstock consumer (using natural gas as a raw material during the industrial process), we present a range from 0 (totally exempted from the energy contribution) to 0,54€/MWh (reduction when concluding an energy efficiency agreement).

Normal rate (not applicable for profiles G1 and G2)	0,9978 €/MWh
Companies with sectoral energy efficiency agreements	0,54 €/MWh
Companies that use natural gas as a raw material	Totally exempt

Aside from those extra costs, two other regional taxes exist:

1. The Brussels levy for occupying road network (1,183 €/MWh). For this fee, the regional legislator introduced a cap starting January 1st 2007 (no fee due on gas above 5.000.000 m^3/year (=+/-57,5 GWh)), but the decree to make it applicable has not been issued so far. As a consequence, this ceiling is not applied in Brussels[66];
2. The *connection fee* in Wallonia (0,03 €/MWh) which is a tax on grid connection with digressive rates. The rate for large consumers (≥10 GWh/year) of 0,03 €/MWh applies both to profile G1 and G2.

[66] Source: *Ordonnance du 14 décembre 2006 modifiant les ordonnances du 19 juillet 2001 et du 1er avril 2004 relatives à l'organisation du marché de l'électricité et du gaz en Région de Bruxelles-Capitale et abrogeant l'ordonnance du 11 juillet 1991 relative au droit à la fourniture minimale d'électricité et l'ordonnance du 11 mars 1999 établissant des mesures de prévention des coupures de gaz à usage domestique, article 102*

For profile G1 connected to the distribution grid (at T6), local taxes and levies[67] have to be added to federal taxes. These comprise:

1. *Additional taxes and levies* which are (i) expenses and unfunded pensions, (ii) income tax and (iii) other local, provincial, state and federal taxes, levies, charges, contributions and payments (only for profile G1);
2. The Brussels region public service obligation: 56,87 €/month (only for profile G1).

[67] For each region of Belgium, we compute the tariffs through a weighted average of each component across all DSO active in the region (weights are given in terms of distributed gas per DSO in 2014). As stated above, for the Flemish region, all DSOs operated by INFRAX or EANDIS were taken into account (representing 100% of distributed gas in the region in 2014). For the Walloon region, all DSOs operated by ORES, RESA and GASELWEST were taken into account (representing 100% of distributed gas in the region in 2014).

6.2. Germany

Component 1 - the commodity price

Commodity prices for natural gas in this study are based on market prices. As explained above, in Germany two market indices exist: Gaspool and NetConnectGermany (NCG). For profile G1, the commodity price is an average of the month ahead prices of the NCG 101 and Gaspool 101 indices, while for profile G2 we adopt a day-ahead average over the course of January 2016 of the NCG 101 and Gaspool 101 indices. All commodity data were provided by the CREG.

Component 2 – the network costs

Transmission costs

As explained in section 4.3 Germany counts eleven TSO's with directly connected clients. They all apply a similar tariff methodology, with different rates. For profile G2 we have taken into account the entry and exit capacity tariffs for all TSO's with end-users directly connected to the transport grid as well as the costs related to metering and invoicing. Although every TSO's uses a slightly different terminology, transmission tariffs comprise in general the same three components:

1. *Entry point (i.e. "Einspeisung") capacity rate*: depends on the contracted entry point and the capacity contracted (in kW) ;
2. *Exit point (i.e. "Ausspeisung") capacity rate:* depends on the exit point chosen and the capacity contracted (in kW);
3. *Metering, billing and metering point operation per counting point charges*: charges related to the cost of metering and invoicing, fixed prices expressed in € per year;

Distribution costs

As profile G1 is connected to the distribution grid, the tariffs of 8 different DSOs (4 rural, 4 urban) are being considered. In Germany for those consumers connected to the distribution grid, transmission and distribution costs are integrated in one single tariff. Although every DSO uses different bands and different rates, these tariffs comprise the same three components:

1. *Power charge (i.e. "Leistungspreis")*: depends upon the maximum capacity in kW contracted;
2. *Labour charge (i.e. "Arbeitspreis")*: depends upon the volume of energy consumed in kWh per year;
3. *Metering, billing and metering point operation per counting point charges*: charges related to the cost of metering and invoicing, fixed prices expressed in € per year.

Component 3 - all extra costs

Three additional costs on natural gas exist for industrial consumers in Germany: the Biogas levy (i.e. "Biogaskostenwälzung"), the Market Conversion Levy (i.e "Marktraumumstellungsumlage") and the Gas tax (i.e. "Energiesteuer – Erdgassteuer"):

1. The *Biogas Levy* is a nationwide standard biogas levy since January 1, 2014. This Biogas levy for 2016 amounts to approximately 0,59458 €/(kWh/h)/a.

2. The *Market Conversion Levy* is a charge that makes up for the costs of the conversion from L- to H-gas. The charge for the NCG market area amounts to 0,021 €/(kWh/h)/a and for the Gaspool market area to 0,087 €/(kWh/h)/a.

3. The "*Energiesteuer*" is an energy tax, with different rates for different sources of energy. For natural gas for industrial use, the normal tax rate amounts to 5,50 €/MWh with a standard reduction that lowers the rate to 4,12€/MWh. As is the case for the electricity tax in Germany, further reductions are attributed on the basis of the amount of pension contributions a company pays: the fewer pension contributions a company pays, the higher the amount of the reduction on the *Energiesteuer*. The maximum reduction is 90%, but this reduction does not apply to the reduced tax rate of 4,12 €/MWh, but to a lower figure of 2,28 €/MWh. A basic rate of 1,84 €/MWh (4,12-2,28) remains 'incompressible'. The minimum rate is hence 2,07 €/MWh (1,84 + 10%*2,28).[68]

   For natural gas that is not used as fuel or for heating purposes (but rather as a raw material, feedstock in an industrial process), no energy tax (Energiesteuer) is due.[69]

   As the pension payment reduction system is based on economic criteria that are not detailed for profile G1 and we do not assume that G1 uses gas as a raw material, we will present a range from 2,07 €/MWh (the minimum rate of the Energiesteuer) to 4,12 €/MWh (standard reduction of the Energiesteuer).

   As we include the option that profile G2 is a feedstock consumer (that uses natural gas a raw material in its industrial process), we present a range from 0 (assuming it only has to pay the Biogas Levy and is exempted from the Energiesteuer) to 4,12 €/MWh (standard reduction of the Energiesteuer).

The *Konzessionsabgabe* (concession fee) that exists for electricity also applies to natural gas consumption. However, as consumers with an annual consumption of more than 5 GWh are exempted, it is not relevant in the framework of this study.

[68] *Energiesteuergesetz, §54, 55.*
[69] *Energiesteuergesetz, §25.*

6.3. France

Component 1 - the commodity price

The commodity price for gas in France is based on the market prices in two different market areas: PEG Nord and TRS.[70] As explained in section 4 of this report, we present different market prices for each of these two market zones: PEG Nord market price is applicable to the PEG Nord zone, while the TRS market price is applicable to the former PEG SUD zone and the TIGF zone (which have different transmission system operators)[71]. For profile G1, we present the month ahead prices for each of the two market zones, while for profile G2 we present an average of the day-ahead prices over the course of January 2016 for both market zones. All commodity data were provided by the CREG.

Component 2 - the network costs

Transmission costs

As stated before, there are two Transmission System Operators (TSOs) in charge of the gas transport network: GRTGaz and TIGF (Transport et Infrastructures Gaz France).

Their transmission tariffs are built along the same methodology, and made of three main components for end users on the transmission grid:

1. *A fixed charge* per year per delivery station;
2. *An entry capacity fee* applicable to daily delivery capacity subscriptions;[72]
3. *A delivery charge (exit capacity fee)* applicable to daily delivery capacity subscriptions for industrial consumers.

Distribution costs

Profile G1 is located on the distribution grid (T4). As stated before, GrDF (Gaz Réseau Distribution France) delivers 96% of all distributed gas in France.[73] This is an integrated tariff meaning that it includes transmission costs. The tariff has three components:

1. *A fixed charge* per year per delivery station (15.295,56 €);
2. *A proportional component* (0,79 €/MWh);
3. *A delivery charge* applicable to daily delivery capacity subscriptions (199,08 €/MWh/day).

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[70] Since April 1st 2015, a common market area in Southern France, "Trading Region South" (TRS), has replaced the existing PEG TIGF and PEG SUD. The objective is to have on single PEG France market area by 2018.

[71] The difference in commodity prices between PEG Nord and TRS have been 0,6 €/MWh on average since the creation of TRS in April of 2015, according to Powernext. However, for the particular period under review in this report (January 2016), the difference was exceptionally high (about 1,0€/MWh).

[72] For the GRTGaz network we present an average of the entry capacity fees of four border entry points Dunkerque, Obergailbach, Tasnières H and Tasnières B, weighed by their respective contracted annual firm capacity. For the TIGF network there is just one border entry point, Pirineos.

[73] http://www.cre.fr/reseaux/infrastructures-gazieres/description-generale#section3

Component 3 - all extra costs

In France, two surcharges apply on gas:

1. The "*Contribution tarifaire d'acheminement*" (CTA) is a surcharge for energy sector pensions. On natural gas, for clients directly connected to the transmission grid, it amounts to 4,71% of the fixed part of the transmission cost (in France, profile G2). For clients connected to the distribution grid, the CTA amounts to 20,8% of the fixed part of the transmission cost (in France, profile G1).
2. The "*Taxe intérieure sur la consommation de gaz naturel"* (TICGN) is a tax on gas consumption, that amounted to 4,34 €/MWh in 2016.

The reduction or exemption of the TICGN depends on three criteria:

a. Companies that participate in the carbon market[74] and that are energy intensive[75] can pay a reduced rate of 1,85 €/MWh[76];

b. Companies that belong to a sector with a high risk of carbon leakage and that are energy intensive can pay a reduced rate: 1,93 €/MWh;

c. Companies that do not use natural gas as a fuel (for example as raw materials) are exempted from the TICGN.

As we include the option that profile G2 uses natural gas as a raw material, we will present a range from 0 (totally exempted from the TICGN) to 4,34 €/MWh. As we do not consider the option that profile G1 uses natural gas a raw material or a fuel, we will present a range from 1,85 €/MWh (reduced rate) to 4,34 €/MWh for consumer profile G1.

74 https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000028594278
75 The definition of energy intensity of a company is defined under article 17 of Directive 2003/96/CE (https://www.legifrance.gouv.fr/affichCode.do;jsessionid=256258677C0C7E2AC465838B143CBF2E.tpdila15v_2?idSectionTA=LEGISCTA000006122062&cidTexte=LEGITEXT000006071570&dateTexte=20160217)
76 TICGN of 31/12/2013, increased with 0,33 €/MWh since January 1st 2016 (Article 265 nonies of the *Code des Douanes*).

6.4. The Netherlands

Component 1 - the commodity price

For profile G1, the commodity price for gas in the Netherlands is based on the TTF 101 index (month ahead price). For consumer profile G2, we adopt an average of the day-ahead prices over the course of January 2016. All commodity data were provided by the CREG.

Component 2 - the network costs

Transmission costs

The gas transmission network in the Netherlands serves distribution networks and direct exit points. Given the nature of the Dutch grid[77], we assume both profile G1 and G2 have high pressure connections and are directly connected to an exit point on the transport network. Therefore they are only required to pay transmission tariffs to the TSO (Gasunie). These transmission tariffs are composed of:

1. *Exit capacity fee* (depends on the exit point and capacity contracted);
2. *Balancing tariff* (fee equal for all users to make up for pressure differences on the transport grid, payable for both the entry and exit capacity, in function of capacity contracted);
3. *Existing connection fee* (fee equal for all users to make op for the maintenance costs related to the transport grid, payable for the exit capacity only, in function of capacity contracted);
4. *Quality conversion fee* (fee equal for all directly connected users to make up for the costs related to converting gas, payable for both the entry and exit capacity, in function of the capacity contracted).

In the Netherlands, a large part of the network is supplied with so called "Groningen-gas". This gas has a lower calorific value (G or G+-gas) than the gas used in much of the rest of Western-Europe (H-gas). The Dutch transmission tariffs are fixed in terms of capacity and expressed in €/kWh/h/year, which evens out this calorific value effect.

Gasunie does not disclose the calculation pattern of the individualized rate of the entry and exit capacity fees (which makes up for over 80% of total network costs). It provides the entry capacity fees of 20 entry points for which we will present an average. It also provides the exit capacity fees of +/- 300 directly connected industrial consumers and which type of gas (H, G or G+) they consume. We will therefore present a weighted average of the exit capacity fees based on the share every type of gas has in the total number of connections of the +/- 300 directly connected industrial consumers[78].

Component 3 - all extra costs

Two surcharges apply to the gas bill for industrial consumers in the Netherlands:

1. *Energy Tax,* or "Regulerende Energiebelasting" (REB) is a digressive tax on all energy carriers. The table below shows the 2016 rates for each band of gas consumption:

[77] According to the Gas Act (Article 10, paragraph 6b), it is the duty of the Dutch TSO, Gasunie Transport Services to provide an applicant with a connection point if the connection has a flow rate greater than 40 m^3(n) per hour.

[78] From this list, we have not taken into account the tariffs paid by very particular consumers such as gas-fired power plants.

Band A	Consumption up to 170.000 m^3	0,25168 €/m^3
Band B	Consumption from 170.000-1.000.000 m^3	0,06954 €/m^3
Band C	Consumption from 1.000.000-10.000.000 m^3	0,02537 €/m^3
Band D	Consumption above 10.000.000 m^3	0,01212 €/m^3

A lowered tariff exists, but only for (especially agricultural) heating installations. We assume our profiles do not benefit from the lowered tariffs.

2. *The ODE levy* ("Opslag duurzame energie") is a digressive levy on gas and electricity that pays for renewable capacity. Rates for 2016 are reported in the table below:

Band A	Consumption up to 170.000 m^3	0,0113 €/m^3
Band B	Consumption from 170.000-1.000.000 m^3	0,0042 €/m^3
Band C	Consumption from 1.000.000-10.000.000 m^3	0,0013 €/m^3
Band D	Consumption above 10.000.000 m^3	0,0009 €/m^3

For the ODE levy as well a lowered tariff exists, but only for (especially agricultural) heating installations. We assume our profiles do not benefit from the lowered tariffs.

As the Energy tax and ODE Levy are fixed in euros per volume units (€/m^3) and not in euros per energy units, the calorific value of the used gas has an impact on the total amount paid. We propose again to use a weighted average in function of the calorific value distribution of all industrial gas users directly connected to the transport grid in the Netherlands.

As is the case for electricity in the Netherlands, there are several exemptions and reductions on these tax surcharges for gas as well, but with slightly different conditions than those for electricity.

Industrial consumers are eligible for an exemption of taxes when one of the following conditions is met:

1. Gas has been used to produce electricity in a plant with an efficiency of over 30% or when it has been used to generate electricity in a plant exclusively with renewable energy sources.
2. Gas that has not been used as a fuel or gas that has been used as an additive or filler substance.

Furthermore, as is the case for electricity, there is a tax refund scheme ('teruggaafregeling') for gas as well but as it is not applicable for our consumer profiles[79], we will not discuss it in this section.

As we do not consider consumer G1 a consumer using gas as a fuel or gas that has been used as an additive or filler substance, we present the maximum option (no refund applicable) for consumer G1.

[79] The tax refund scheme applies to public and religious institutions such as clinics, schools, sport centres, churches, etc.

As we included the option that consumer G2 can represent a large consumer using gas as a feedstock for its industrial processes, we assume that it can apply for an exemption of taxes and we therefore present a range between the minimal option (totally exempted from taxes) to the maximum option (no refund applicable) for this consumer profile.

6.5. United Kingdom

Component 1 - the commodity price

For commodity in the UK, we use the NBP (National Balancing Point) market index. For profile G1 they are based on month ahead prices while for profile G2 we adopt an average of the day-ahead prices over the course of January 2016. All commodity data were provided by the CREG.

Component 2 - the network costs

Transmission costs

The national transmission system in the UK (except for Northern Ireland) is operated by one single entity: National Grid Gas.

The Gas Transmission Transportation Charges are comprised of the following components.

1. *Entry capacity charge:* capacity charges are payable to bring gas on to the system irrespective of whether or not the right is exercised - based on peak demand capacity;
2. *Exit capacity charge:* capacity charges are to take gas off the system irrespective of whether or not the right is exercised - based on peak demand capacity;
3. *Commodity charge:* a charge per unit of gas transported by NTS payable for flows entering and exiting the system (see above, cumulative).

National Grid Gas provides a weighted average of the entry and exit capacity tariffs in their Statement of Gas Transmission Transportation Charges.[80]

Distribution costs

Given the fact that profile G1 is connected to the distribution grid, distribution and transmission tariffs have to be paid. As stated before, the UK has eight DSOs for gas, amongst which four are owned by national grid. The distribution tariff for gas is composed of:

1. *LDZ system capacity charge;*
2. *LDZ system commodity charge*

   LDZ charges are based on functions, these functions use Supply Point Offtake Quantity (SOQ) in the determination of the charges. This SOQ is calculated in terms of peakday kWh (e.g. 300 000 peakday kWh for our profile G1);
3. *Customer (capacity):* the customer charges for our profile G1 is also based on a function related to the registered Supply Offtake Quantity (SOQ);
4. *LDZ Exit capacity* (corresponding to transmission tariffs): this is a capacity charge that is applied to the supply point in the same manner as the LDZ system capacity charge. These charges are applied per exit zone on an administered peak day basis.

We present an average of these components across all DSOs for gas active in the UK.

[80] We have used the weighted averages published in the Gas Transmission Transportation Charges of the NGG from the 1st of October 2015.

Component 3 – all extra costs

In the United Kingdom, one single levy is applied on gas consumption: the Climate Change Levy (CCL). The CCL is payable on electricity, gas, fuel, etc. The standard rate for natural gas is 0,193 p/kWh (about 2,6 €/MWh), but consumers who are part of Climate Change Agreement get a 35% reduction. We assume that profile G1 is an economically rational actor and benefits from the reduced rate of +/- 1,7 €/MWh.

Consumers that do not use natural gas as a fuel, but rather as a feedstock, are exempted from the climate change levy. As in other countries, we included the option that profile G2 can be such a consumer and hence we present a range from 0 €/MWh (exempted from the Climate Change Levy) to +/- 1,7 €/MWh (reduction when being part of Climate Change Agreement).

7. Presentation and interpretation of results

7. Presentation and interpretation of results

7.1. Interpretation of figures (Electricity)

Figure A: Total yearly invoice

	Symbol	Legend	Interpretation
Graph 1 ***Total invoice comparaison (€/year)***	179	Maximum option (non-electro intensive)	Applies to Germany, if the full eEG tax is applicable; to France, if the full CSPE tax is applicable and to the Netherlands, if the Energy tax is applicable
	92 86	Maximum option (electro-intensive) Minimum (electro-intensive)	Demonstrates the range of points between the minimum option for electro-intensive consumers and the maximum option (with regards to taxes / levies / certificate scheme), regarding the national criteria.
	99	Single result	No range is presented (as only one level of taxes/ certificate scheme)
		Average (all options)	Average (non-weighted) of all options (incl. non-electro-intensive)
		Average (electro-intensive)	Average (non-weighted) of all min and max options for electro-intensive consumers

Figure B: Total yearly invoice comparison (Belgium = 100)

	Symbol	Legend	Interpretation
Graph 2 ***Yearly invoice comparison (Belgium = 100)***	179	Maximum option (non-electro-intensive)	Applies to Germany, if the full eEG tax is applicable; to France, if the full CSPE tax is applicable and to the Netherlands, if the Energy tax is applicable
	92 86	Maximum option (electro-intensive) Minimum option (electro-intensive)	Demonstrates the range of points between the minimum option for electro-intensive consumers and the maximum option (with regards to taxes / levies / certificate scheme), if applicable.
	99	Single result	No range is presented (as only one level of taxes/ certificate scheme)

Figure C: Average power price by component / MWh

	Symbol	Legend	Interpretation
Graph 3 ***Energy price per component (€/MWh)***	64,5	Commodity	Represents the total commodity cost
	26,3	Network	Represents the total network cost
	15,5	Taxes/Levies/ Certificate scheme	Represents the cost of taxes/levies/certificate scheme in BE and UK.
		Taxes/Levies/Certificate scheme –minimum (electro-intensive)	Represents the minimum cost of taxes/ levies/certificate scheme for electro-intensive consumers in FR, DE and NL.
		Taxes/Levies/Certificate scheme –maximum (electro-intensive)	Represents the **possible range between minimum and maximum** cost of taxes/levies/certificate scheme for electro-intensive consumers in FR, DE, NL.
	48,7	Taxes/Levies/Certificate scheme – maximum (non-electro-intensive)	Applies to Germany, if the full eEG tax is applicable Applies to France, if the full CSPE tax is applicable Applies to the Netherlands, if the Energy tax is applicable

7.2. Profile E1 (Electricity)

Total invoice analysis

Figure 15 provides a comparison of the total yearly invoices paid by the reference consumer belonging to profile E1 in the various countries under review. Results are expressed in kEUR/year.

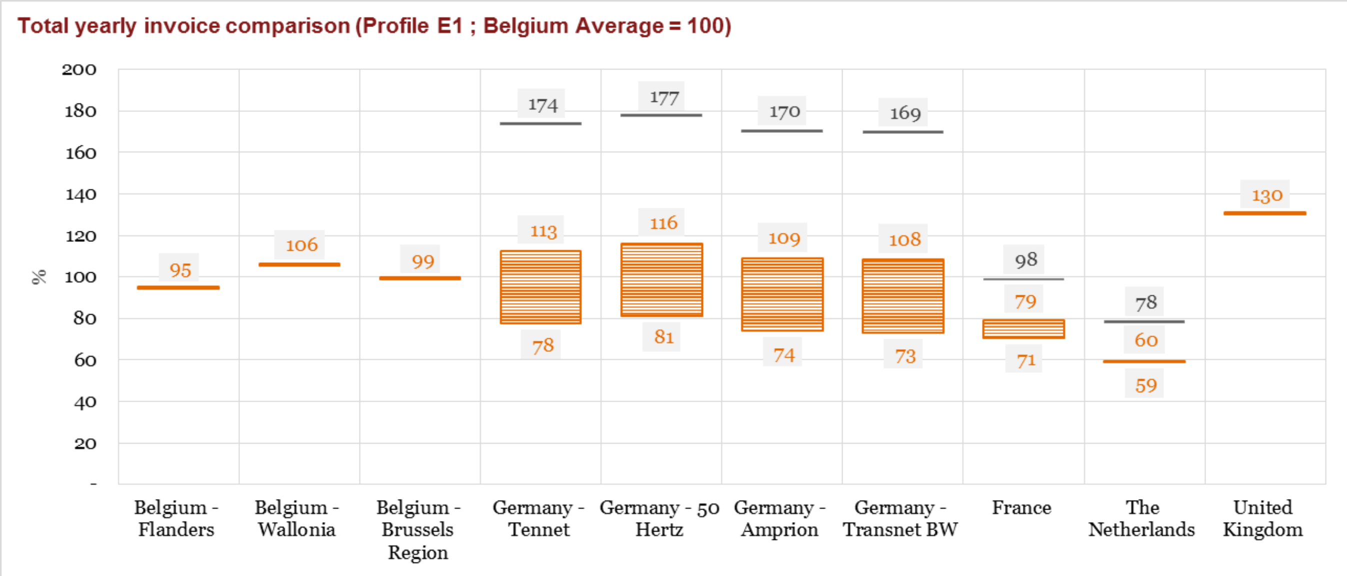
Figure 15 – Total yearly invoice in kEUR/year (profile E1)

For an extensive legend for all figures, see page 91.

Belgium is split in three regions and Germany in four regions, while only one single result is presented for the UK, France and the Netherlands. For the UK and the Netherlands, reported data correspond to averaged values driven from the sub-regions.

For the purpose of facilitating the comparison, in Figure 16 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average = 100%).

Figure 16 – Total yearly invoice comparison in % (profile E1)



For an extensive legend for all figures, see page 91.

The three Belgian regions show slightly different results, with the Flemish region slightly more competitive and the Walloon region slightly less competitive than the Belgian average, but still much lower than the UK. As a whole, Belgium is not very well positioned, showing less competitive results than the Netherlands, France and all German regions (when minimal options are considered).

The particularly competitive prices for the Dutch case can be partly explained by the tax refund scheme ('teruggaafregeling') destined for industrial consumers who are classified as energy-intensive and who concluded a multiple-year agreement with the Dutch government to save energy by improving their energy efficiency, (see above), but also through competitive network costs.

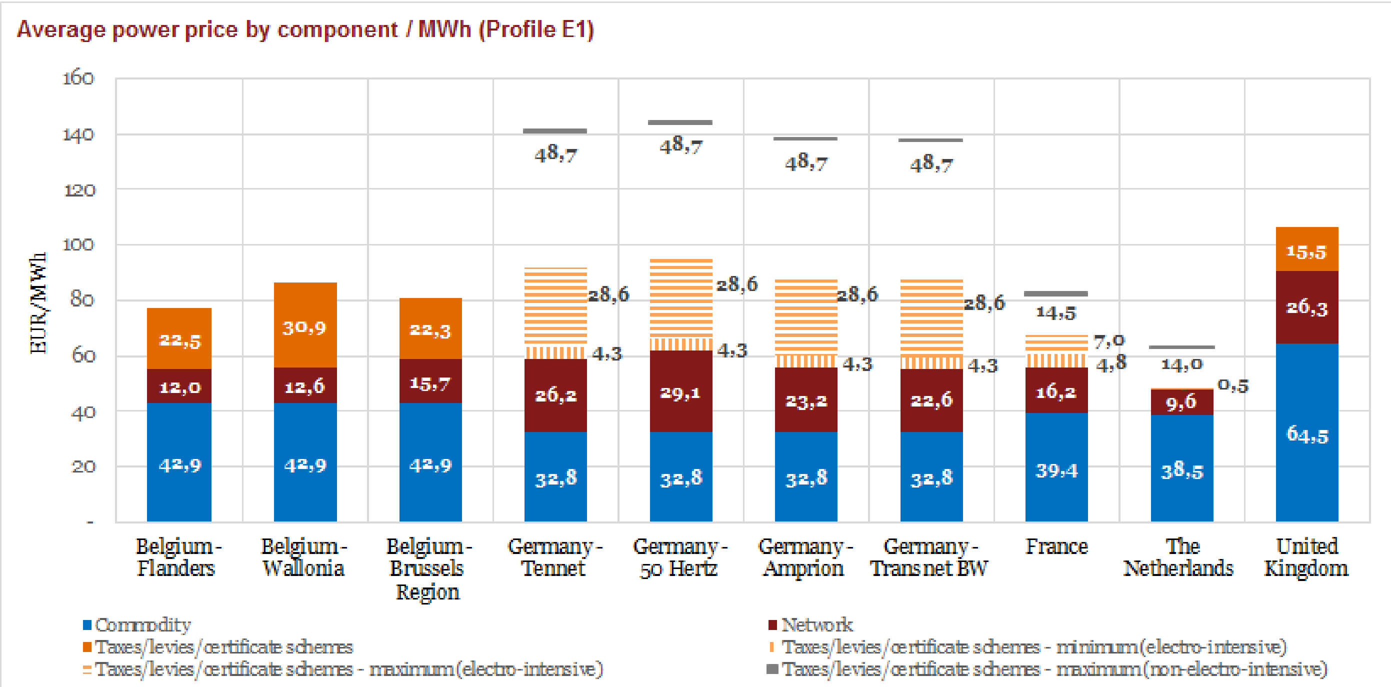
The detailed analysis of the German apparent lower competitiveness (when maximal options are considered) should be assessed carefully because of the large variance that occurs between the minimum and maximum options (including the eEG maximum option for consumers that are not electro-intensive according to the national criteria) that mainly depends on the relative size of power costs in their gross value creation: when average annual electricity cost over the last three years represents less than 17% of gross value creation of an industrial consumer, he inevitably pays the maximum rate.

The French higher competitiveness is partly explained by the reductions applicable to the *"Contribution au service public d'électricité"* (CSPE) for consumers that are classified as (very) electro-intensive (see above).

Breakdown by component

The previous results are further detailed for profile E1 in Figure 17 which provides a closer look at the components breakdown.

Figure 17 – Average power price by component in EUR/MWh (profile E1)



For an extensive legend for all figures, see page 91.

In most cases, the **commodity** makes up for the largest part of the bill. Belgian commodity cost is slightly higher than the cost of commodity charged in the Netherlands and France and significantly higher than in Germany. Commodity costs in the UK are markedly higher than in the other countries.

In all regions and/or countries, **network costs** (which include transmission and distribution for this profile) contribute to a variable extent of the invoice. In this respect, the Netherlands and to a lesser extent Belgium and France are more competitive than the other countries/regions of comparison. Network costs are especially high in Germany and the UK where they can be nearly three times higher than in the most competitive country/region (the Netherlands).

The third component, "**taxes, levies and certificates schemes**", has a large impact in all countries. As discussed before, the German situation offers the potential for very low values as well as the highest values. The Dutch and French levels for electro-intensive consumers are very low compared to the other countries. Important differences are observed between the three Belgian regions, with the Walloon region being more expensive than the other regions.

KEY FINDINGS

The first electricity (E1) profile suggests the following findings:

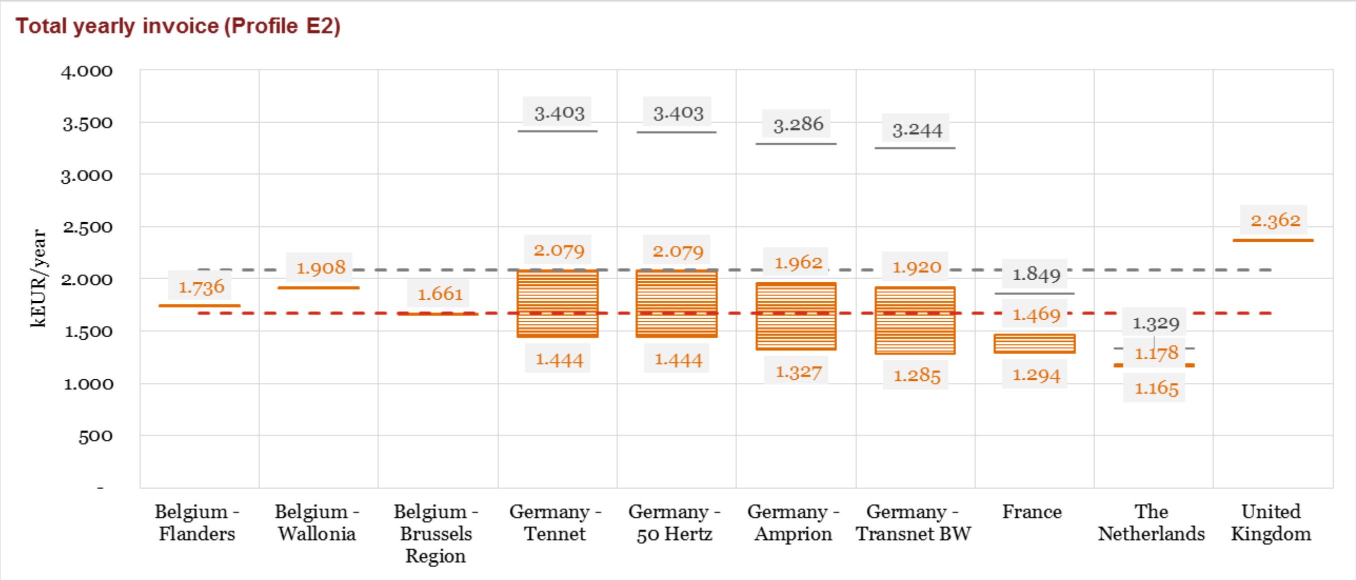
- We observe very important differences between the countries under review and even within the countries: a possible total invoice for profile E1 can vary between 482 kEUR and 1.445 kEUR.
- *Commodity costs* largely contribute to the total bill. In this respect, Belgium has a competitive disadvantage compared to all neighbouring countries except the UK. Germany shows the lowest commodity prices, while the United Kingdom deals with a considerably higher commodity price.
- *Network costs* usually absorb a variable but possibly substantial part of the total bill. They also diverge between the different countries/regions. They are the highest in the United Kingdom and in Germany and lowest in the Netherlands. Belgium is a relatively competitive country for network costs.
- *"Taxes, levies and certificates schemes"* are characterised by a large variance. They are among the highest in the Walloon region, rather important in the other Belgian regions and the UK, but low (potentially almost inexistent) in the Netherlands and France for electro-intensive consumers. In Germany the situation is mixed, depending on the electro-intensity of the consumer. In this respect, the range between the best and the worst situation is high as it can reach twice the size of commodity cost.

7.3. Profile E2 (Electricity)

Total invoice analysis

Figure 18 provides a comparison of the total yearly invoices paid by profile E2 in the various countries under review. Results are expressed in kEUR/year.

Figure 18 – Total yearly invoice in kEUR/year (profile E2)

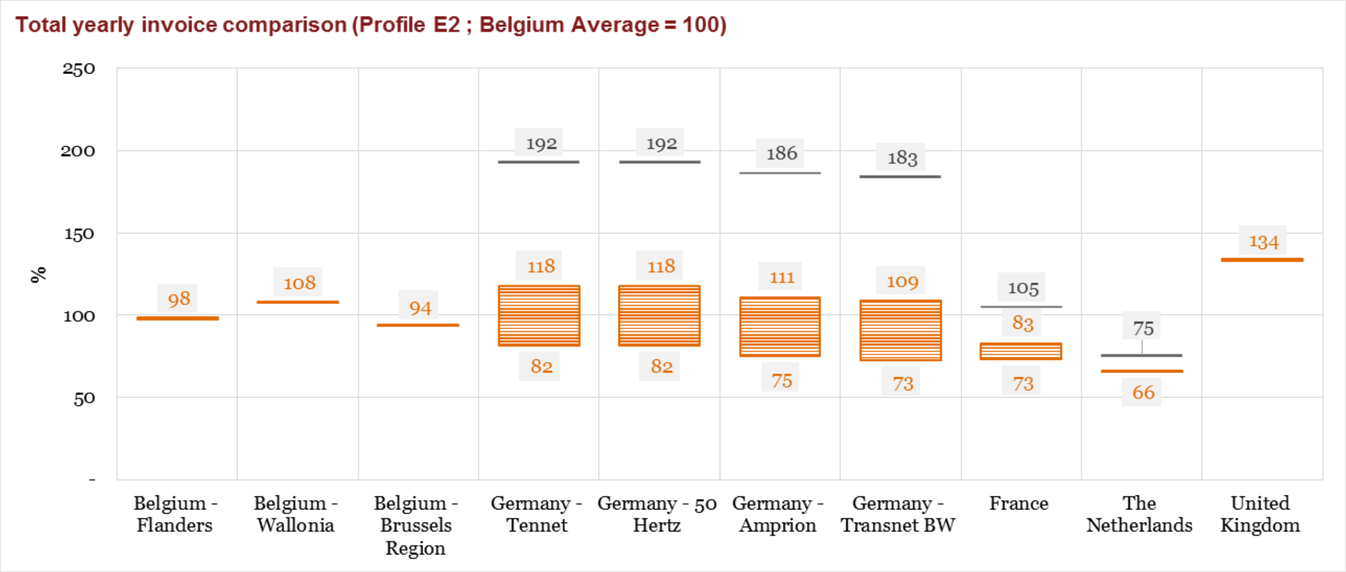


For an extensive legend for all figures, see page 91.

Again, Belgium is split in three regions and Germany in four regions, while only one single result is presented for the UK, France and the Netherlands. For the UK and the Netherlands, reported data correspond to averaged values driven from the sub-regions.

For the purpose of facilitating the comparisons, in Figure 19 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average = 100%).

Figure 19 – Total yearly invoice comparison in % (profile E2)



For an extensive legend for all figures, see page 91.

The Belgian average is not very well positioned compared to the other countries, the Walloon region being the least competitive case under review. The Netherlands is the most competitive country, similar to profile E1. Prices for electro-intensive consumers in France and the four German regions (low range) are within a very close range. Like for profile E1, the United Kingdom is an outlier.

The particularly competitive prices for the Dutch case can be partly explained by the tax refund scheme ('teruggaafregeling') destined for industrial consumers who are classified as energy-intensive and who concluded a multiple-year agreement with the Dutch government to save energy by improving their energy efficiency, see above), but also through the very competitive network costs.

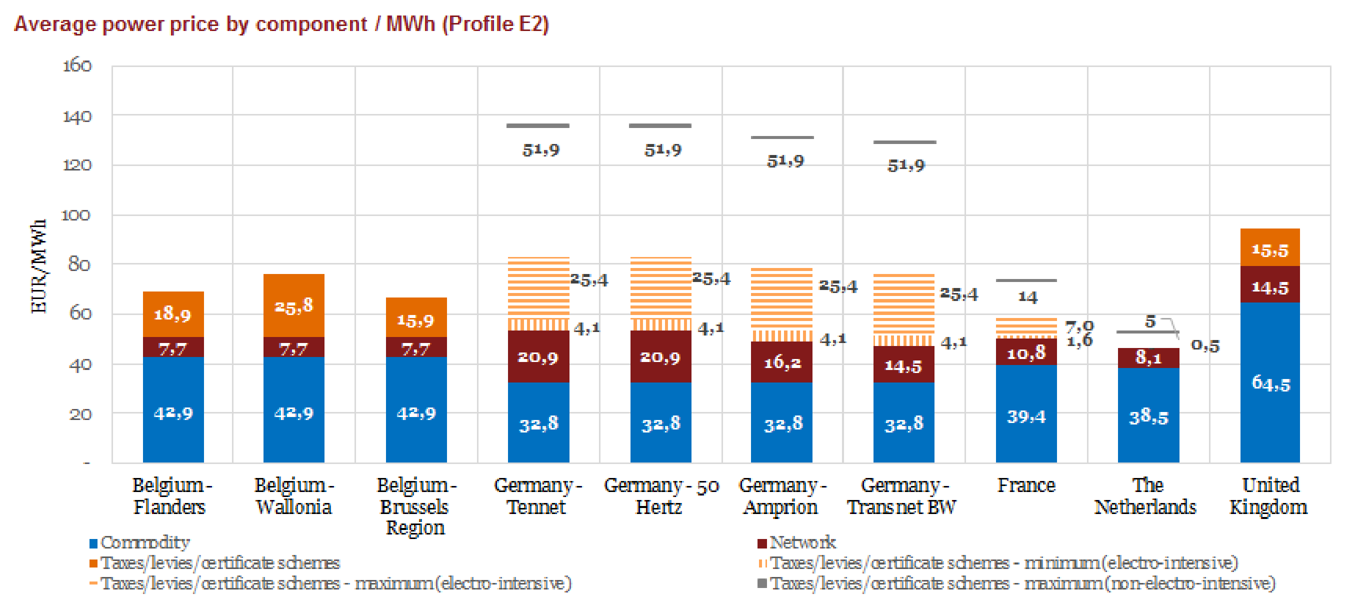
The detailed analysis of the German apparent lower competitiveness (when maximal options are considered) should be assessed carefully because of the large variance that occurs between the minimum and maximum options (including the eEG maximum option for consumers that are not electro-intensive according to the national criteria) that mainly depends on the relative size of power costs in their gross value creation: when average annual electricity cost over the last three years represents less than 17% of gross value creation of an industrial consumer, he inevitably pays the maximum rate.

The French higher competitiveness is (except maximum case) is partly explained by the reductions applicable to the *"Contribution au service public d'électricité"* (CSPE) for consumers that are classified as (very) electro-intensive (see above).

Breakdown by component

The previous results are further detailed for the profile E2 in Figure 20 which provides a closer look at the components breakdown.

Figure 20 – Average power price by component in EUR/MWh (profile E2)



For an extensive legend for all figures, see page 91.

In terms of commodity cost, we have to remember that profile E2 has the same consumption and load profile as profile E1; their commodity cost is the same. The **commodity** makes up for the largest part of the bill. Belgian commodity cost is higher than the cost of commodity charged in the Netherlands and France and significantly higher than in Germany. Commodity costs in the United Kingdom are substantially higher.

In all countries, **network costs** contribute to a variable extent to the invoice. Belgium presents the lowest network costs, followed by the Netherlands and France. The UK and the four German zones have the highest network costs. This is partly – but not entirely - due to the fact that in these countries (UK and Germany), profile E2 not only pays transmission but also distribution charges.

The third component "**taxes, levies and certificates schemes**", has a (potentially) large impact in all countries, except for the Netherlands where its level is comparatively very low, even for non electro-intensive consumers. The highest values can be found in Belgium and Germany (high range). Yet again, we observe relatively important differences between the Belgian regions.

As already mentioned, the German position should be assessed in line with the large variance characterizing minimum and maximum "taxes, levies and certificate schemes" which – in the least favourable situation for consumers that do not qualify as electro-intensive - can be bigger than commodity and network costs combined.

KEY FINDINGS

The second electricity profile (E2) suggests the following findings:

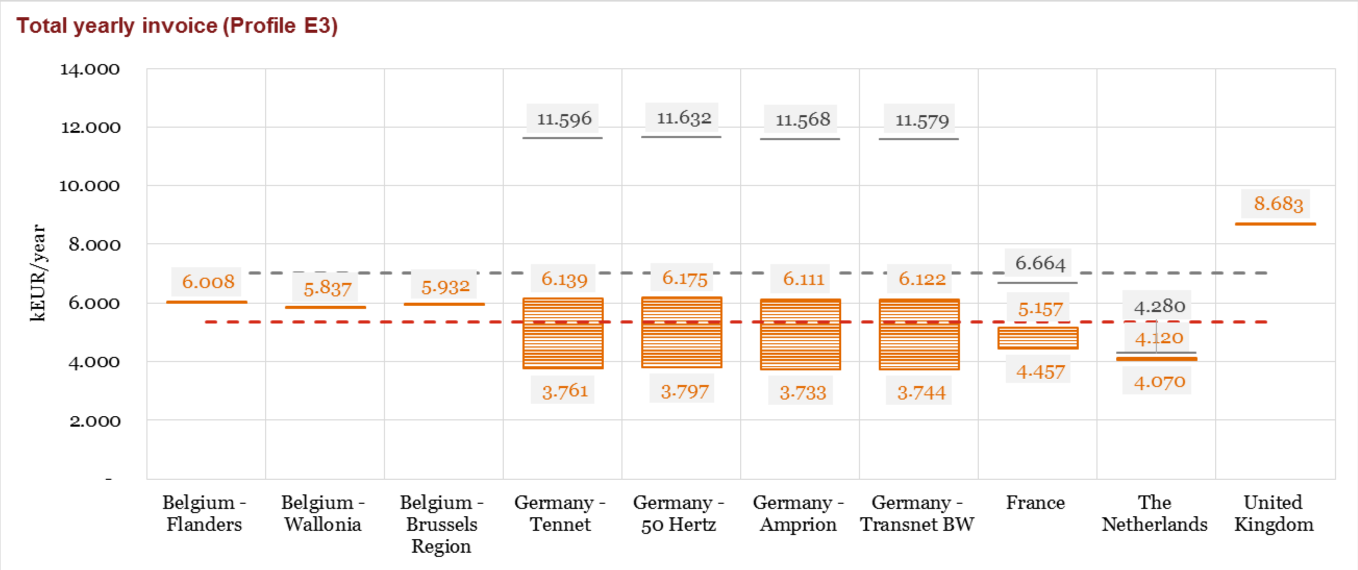
- We observe very important differences between the countries under review and even within the countries: a possible total invoice for profile E2 can vary between 1,17 mEUR and 3,40 mEUR.
- Belgium is not very well positioned compared to other countries in terms of total electricity cost, especially the Walloon and (to a lesser extent) Flemish region. The Netherlands is the most competitive, even more so than for profile E1. Prices in France and the four German regions (low range) are within a very close range. Like for profile E1, the United Kingdom is an outlier.
- *Commodity cost* plays a key role. Belgian commodity cost is higher than the cost of commodity charged in the Netherlands and France and significantly higher than in Germany. Commodity costs in the United Kingdom are substantially higher.
- *Network costs* absorb a variable but possibly substantial part of the total bill. They also diverge between the different countries/regions. They are the highest in Germany and the UK, partly due to presence of distribution charges in those countries. Belgium is the most competitive country for network costs, even more than is the case for profile E1.
- *"Taxes, levies and certificates schemes"* are characterised by a large variance. They are rather important in Belgium, especially in the Walloon region, while they remain very low in the Netherlands, even for non electro-intensive consumers. In Germany and France, the situation is mixed, depending on the electro intensity according to national criteria. In this respect, the range between the best and the worst situation is high as it can reach about the same size of commodity cost and network cost combined.

7.4. Profile E3 (Electricity)

Total invoice analysis

Figure 21 provides a comparison of the total yearly invoices paid by profile E3 in the various countries under review. Results are expressed in kEUR/year.

Figure 21 – Total yearly invoice in kEUR/year (profile E3)

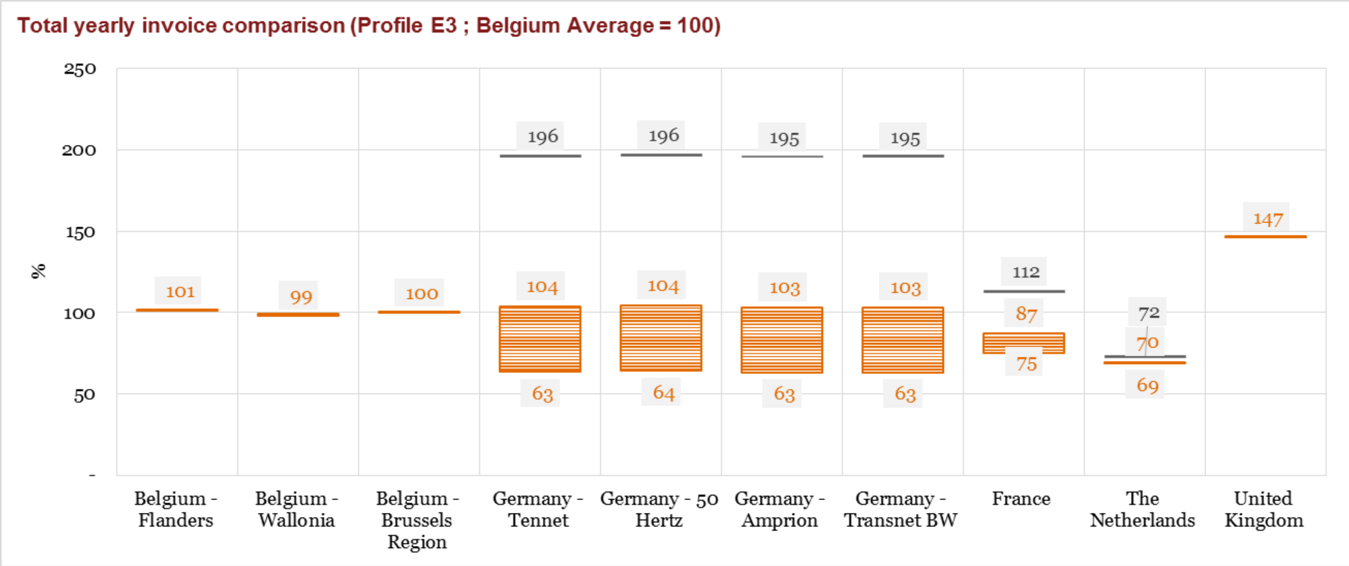


For an extensive legend for all figures, see page 91.

Again, Belgium is split in three regions and Germany in four regions, while only one single result is presented for the UK, France and the Netherlands. For the UK and the Netherlands, reported data correspond to averaged values driven from the sub-regions.

For the purpose of facilitating the comparisons, in Figure 22 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average = 100%).

Figure 22 – Total yearly invoice comparison in % (profile E3)



For an extensive legend for all figures, see page 91.

Belgium is less competitive than the Netherlands, France (except non-electro-intensive case) and important parts of the German range. This is true for all three Belgian regions, even though the Walloon region offers a slightly lower electricity cost than the Flemish and Brussels regions. The UK and the German eEG-maximum case are high outliers.

The detailed analysis of the German apparent lower competitiveness (when maximal options are considered) should be assessed carefully because of the large variance that occurs between the minimum and maximum options (including the eEG maximum option for consumers that are not electro-intensive according to the national criteria) that mainly depends on the relative size of power costs in their gross value creation: when average annual electricity cost over the last three years represents less than 17% of gross value creation of an industrial consumer, he inevitably pays the maximum rate.

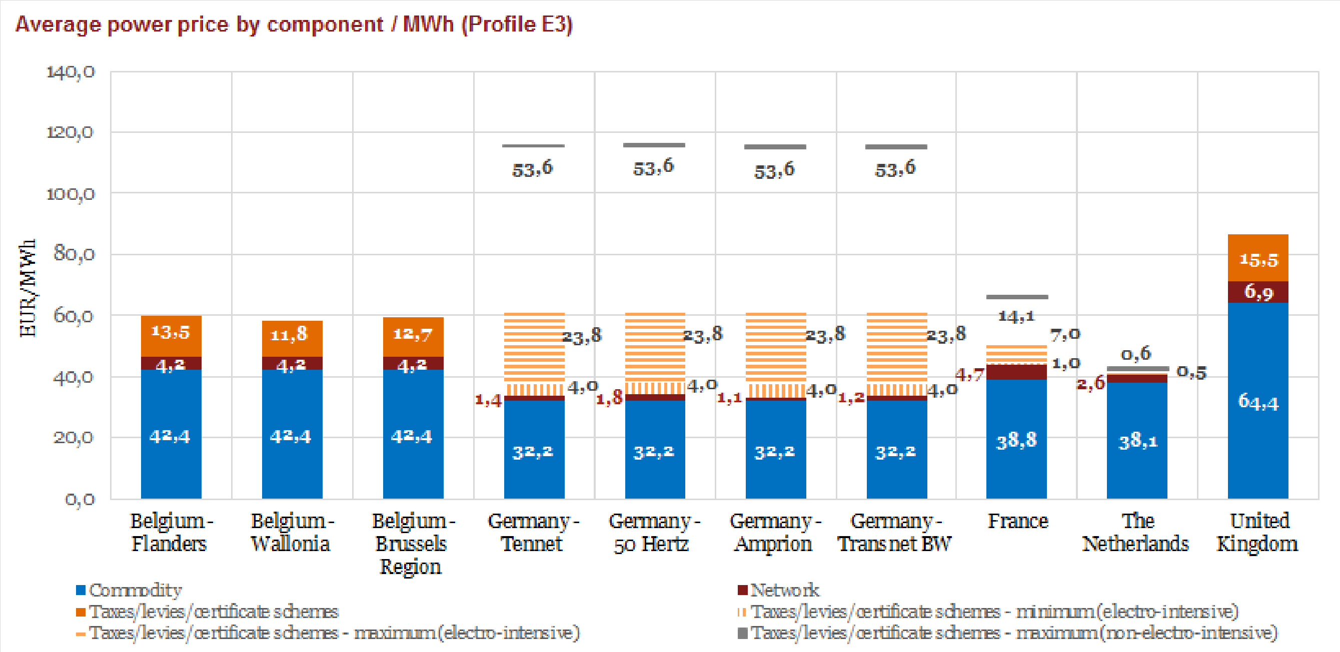
For profile E3, the competitiveness of prices levels in the Dutch case can only very partly be attributed to the tax refund scheme ('teruggaafregeling') destined for industrial consumers who are classified as energy-intensive and who concluded a multiple-year agreement with the Dutch government to save energy by improving their energy efficiency. Given the digressive nature of the Energy tax, the Netherlands offers by far the most competitive prices for non-electro intensive consumers as well, regardless of their level of electro-intensity.

Concerning the French apparent higher competitiveness, it can be partly explained by the reductions applicable to the *"Contribution au service public d'électricité"* (CSPE) for consumers that are classified as (very) electro-intensive (see above).

Breakdown by component

The previous results are further detailed for the profile E3 in Figure 23 which provides a closer look on the components breakdown.

Figure 23 – Average power price by component in EUR/MWh (profile E3)



For an extensive legend for all figures, see page 91.

Even more so than for profiles E1 and E2, **commodity cost** plays a major role. Belgian commodity cost is in the average of sampled countries and similar to the commodity cost in the Netherlands and France. Germany has a substantially lower commodity cost. Commodity costs in the United Kingdom are high, and are an important factor in the outlier result for the UK.

For profile E3, **network costs** only constitute a limited part of the total invoice. Large baseload consumers in the UK, Belgium and France pay higher transmission tariffs than those in the Netherlands and Germany. This is explained by the fact that in Germany and the Netherlands, large baseload consumers such as E3 in this study can benefit from transport tariff reductions (up to 85% and 45% respectively). These reductions profoundly alter the situation in terms of network costs, and by doing so the general picture in terms of competitiveness.

Taxes, levies and certificates schemes play a variable role. They have a relatively large impact in the United Kingdom, but also in Belgium (where differences between regions are small). Dutch consumers, whether electro-intensive or not, benefit from very low cost of taxes, levies and certificates schemes. Generally speaking, German taxes and levies compensate part (or all) of the competitive advantage that is built up through the low commodity cost - depending on the exact amount of taxes that has to be paid.

KEY FINDINGS

The third electricity profile (E3) suggests the following findings:

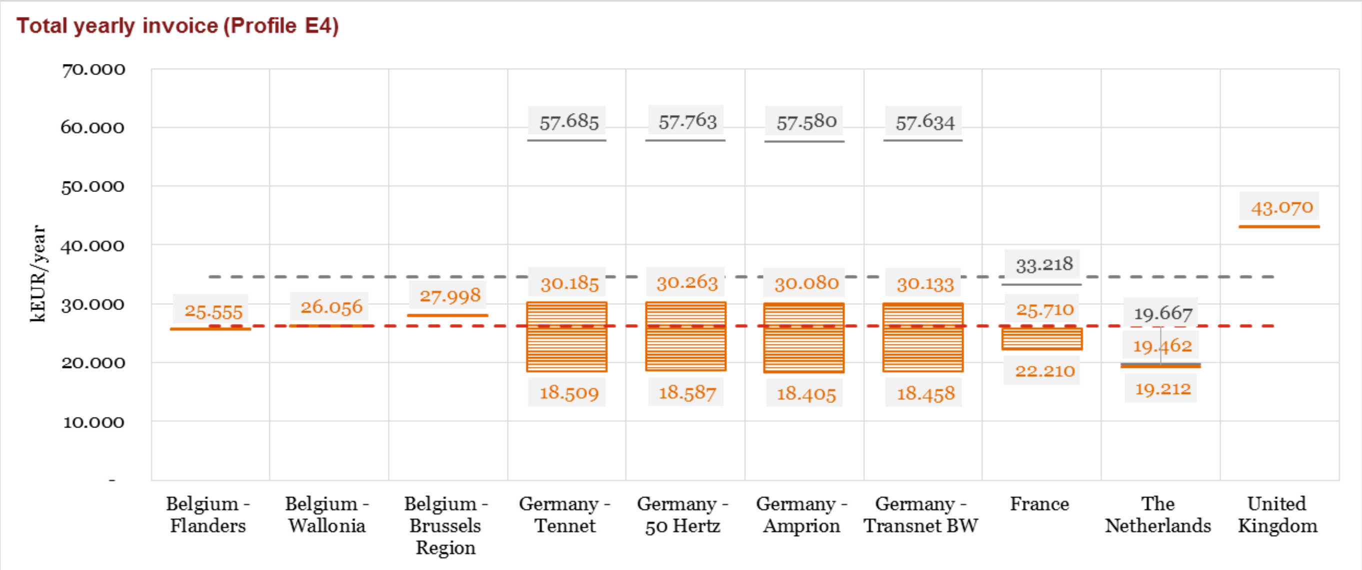
- The majority of cases under review are clearly more competitive than Belgium: France, the Netherlands and Germany (low and medium range).
- Commodity costs play a very important role. In this respect, Belgium has higher commodity costs than Germany, the Netherlands and France. Germany has a substantial competitive advantage, while the UK is more expensive.
- Network costs are responsible for a relatively small part of the bill. Important reductions in Germany and the Netherlands make that otherwise low (UK) to very low (Belgium and France) transmission tariffs still constitute a competitive disadvantage. Transmission tariff reductions for large baseload consumers constitute a sizeable competitive advantage for Germany, and the Netherlands.
- "Taxes, levies and certificates schemes" are characterised by a large variance. They are high in the United Kingdom and rather important in Belgium while they remain very low in the Netherlands, even for non-electro intensive consumers. In France and Germany the situation is mixed, depending on the taxation scheme implemented at company level. In this respect, paying the high end of the German tax range can mean more than doubling the total electricity cost of a low end scenario.

7.5. Profile E4 (Electricity)

Total invoice analysis

Figure 24 provides a comparison of the total yearly invoices paid by profile E4 in the various countries under review. Results are expressed in kEUR/year.

Figure 24 – Total yearly invoice in kEUR/year (profile E4)

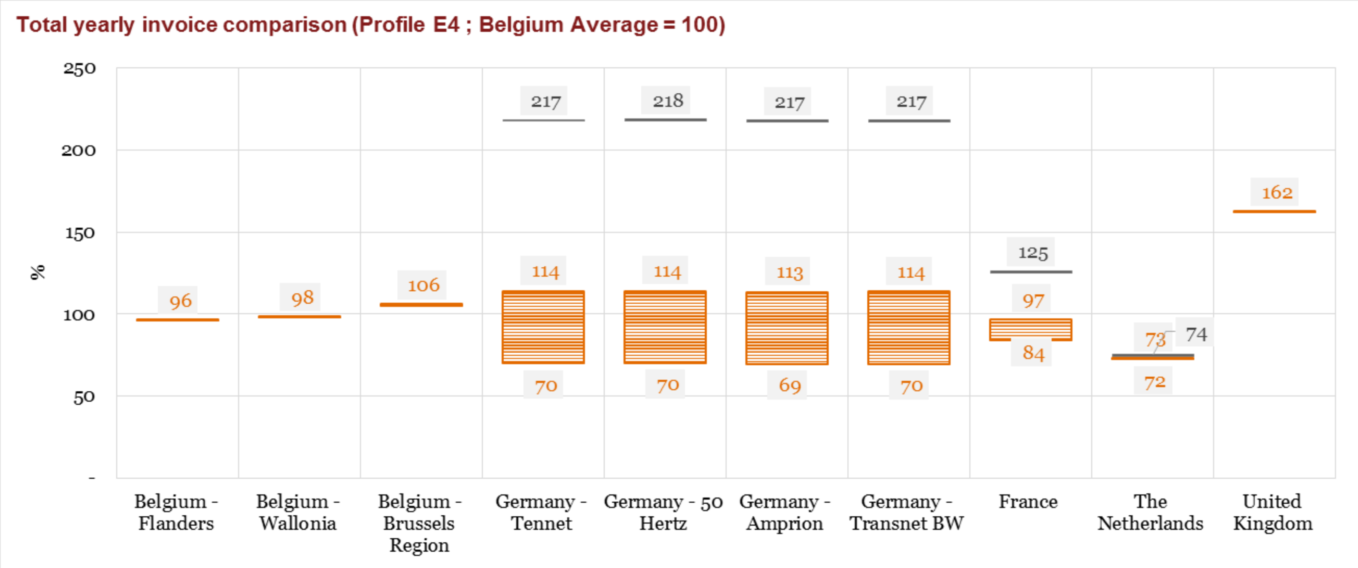


For an extensive legend for all figures, see page 91.

Again, Belgium is split in three regions and Germany in four regions, while only one single result is presented for the UK, France and the Netherlands. For the UK and the Netherlands, reported data correspond to averaged values driven from the sub-regions.

For the purpose of facilitating the comparisons, in Figure 25 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average = 100%).

Figure 25 – Total yearly invoice comparison in % (profile E4)



For an extensive legend for all figures, see page 91.

Belgium is less competitive than the Netherlands, France (except for the non-electro-intensive case) and important parts of the German range. This is true for all three Belgian regions, even though the Flemish and Walloon regions offer a slightly lower electricity cost than the Brussels regions[81]. The UK and the German eEG-maximum case are high outliers.

The detailed analysis of the German apparent lower competitiveness (when maximal options are considered) should be assessed carefully because of the large variance that occurs between the minimum and maximum options (including the eEG maximum option for consumers that are not electro-intensive according to the national criteria) that mainly depends on the relative size of power costs in their gross value creation: when average annual electricity cost over the last three years represents less than 17% of gross value creation of an industrial consumer, he inevitably pays the maximum rate.

As is the case for profile E3, the very competitive prices for the Dutch consumers can only very partly be explained by the tax refund scheme ('teruggaafregeling') destined for industrial consumers who are classified as energy-intensive and who concluded a multiple-year agreement with the Dutch government to save energy by improving their energy efficiency. Given the digressive nature of the Energy tax, the Netherlands offers by far the most competitive prices for non-electro intensive consumers as well, regardless of their level of electro-intensity.

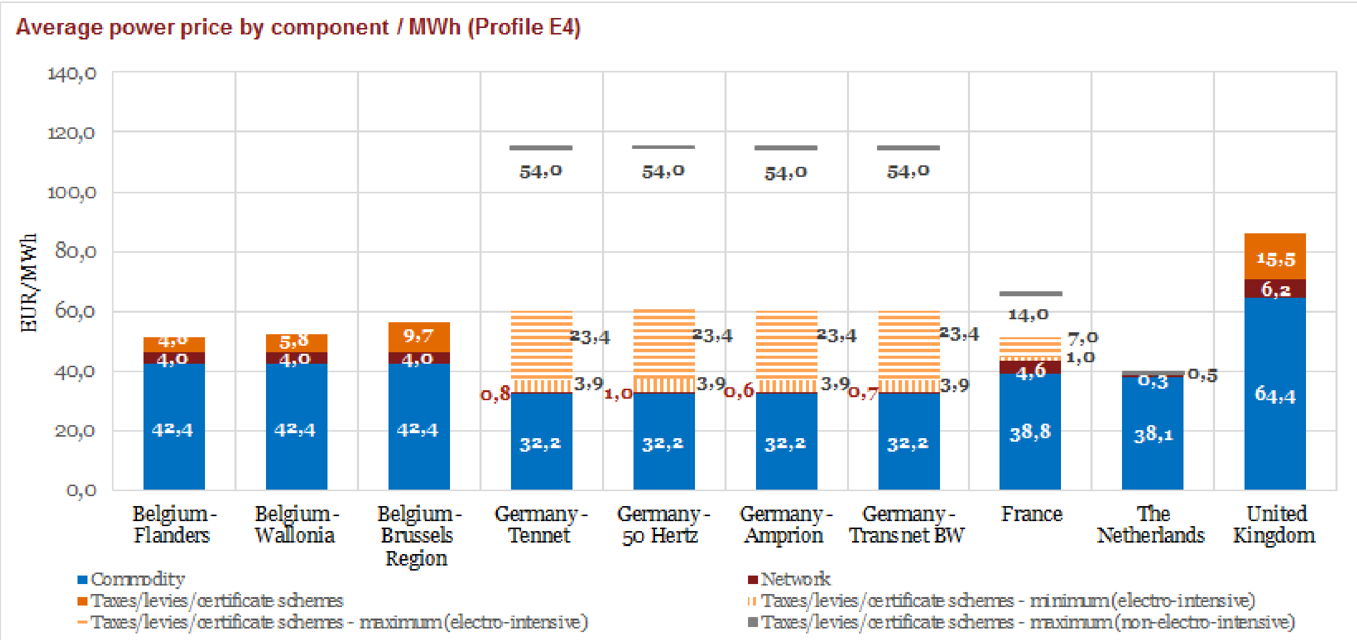
Concerning the French apparent higher competitiveness, it can be partly explained by the reductions applicable to the *"Contribution au service public d'électricité"* (CSPE) for consumers that are classified as (very) electro-intensive (see above).

[81] It should be noted that in Brussels there is currently no industrial consumer with the consumption level of profile E3, which could be an explanation for the high taxes in this region.

Breakdown by component

The previous results are further detailed for the profile E4 in Figure 26 which provides a closer look on the components breakdown.

Figure 26 – Average power price by component in EUR/MWh (profile E4)



For an extensive legend for all figures, see page 91.

In terms of commodity cost, we have to remember that profile E4 has the same load profile as profile E3; their commodity cost is the same. The **commodity** makes up for the largest part of the bill. Like for the other profiles under review, Belgian commodity cost is higher than the cost of commodity charged in the Netherlands and France and significantly higher than in Germany. Commodity costs in the United Kingdom are high, and are an important factor in the outlier result for the UK.

For profile E4, **network costs** only constitute a limited part of the total invoice. Large baseload consumers in the UK, Belgium and France pay higher transmission tariffs than those in the Netherlands and Germany. This is explained by the fact that in Germany and the Netherlands, large baseload consumers such as E4 in this study can benefit from transport tariff reductions up to 90%. These reductions profoundly alter the situation in terms of transmission tariffs, and by doing so the general picture in terms of competitiveness.

Taxes, levies and certificates schemes play a variable role. They have a relatively large impact in the United Kingdom, but also in Belgium (especially for the Brussels region[82]). Dutch large baseload consumers benefit from quite low cost of taxes, levies and certificates schemes, even when they do not fit the national criteria for electro-intensiveness. Generally speaking, German taxes and levies compensate part (or all) of the competitive advantage that is built up through the low commodity cost - depending on the exact amount of taxes that has to be paid.

[82] The explanation for the latter is mainly the levy for occupying road network in Brussels and the Green Certificate obligation for Brussels.

For Flanders and Wallonia, we observe that the annual caps and digressive rates for several of the taxes and surcharges result in a considerably more competitive cost of taxes, levies and certificates schemes than for the other consumer profiles (including E3).

KEY FINDINGS

The fourth electricity profile (E4) suggests the following findings:

- The majority of cases under review are clearly more competitive than Belgium: France (except maximum case), the Netherlands and Germany (low and medium range).
- For Flanders and Wallonia, we observe that the annual caps and digressive rates for several of the taxes and surcharges results in a considerably more competitive cost of taxes, levies and certificates schemes than for the other consumer profiles (including E3).
- Commodity costs play a very important role. Like for the other profiles under review, Belgian commodity cost is higher than the cost of commodity charged in the Netherlands and France and significantly higher than in Germany. Commodity costs in the United Kingdom are high, and are an important factor in the outlier result for the UK.
- Network costs are responsible for a relatively small part of the bill. Important reductions in Germany and the Netherlands make that otherwise low (UK) to very low (Belgium and France) transport tariffs still constitute a competitive disadvantage.
- “Taxes, levies and certificates schemes” are characterised by a large variance. They are high in the United Kingdom and rather important in Belgium while they remain lowest in the Netherlands. In France and Germany the situation is mixed, depending on the electro-intensity of the consumer. In this respect, paying the high end of the German tax range can mean doubling the total electricity cost of a low end scenario.

7.6. Interpretation of figures (Gas)

Figure A: Total yearly invoice

	Symbol	Legend	Interpretation
Graph 1 ***Total invoice comparaison (€/year)***	92 86	Maximum option Minimum option	Demonstrates the range of points between the minimum and the maximum option (with regards to taxes and levies) for consumers that use gas as a feedstock, regarding the national criteria.
	99	Single result	No range is presented (as only one level of taxes)
		Average	Average (non-weighted) of all options

Figure B: Total yearly invoice comparison (Belgium = 100)

	Symbol	Legend	Interpretation
Graph 2 ***Yearly invoice comparison (Belgium = 100)***	92 86	Maximum option Minimum option	Demonstrates the range of points between the minimum option and the maximum option (with regards to taxes and levies), if applicable.
	99	Single result	No range is presented (as only one level of taxes)

Figure C: Average gas price by component / MWh

	Symbol	Legend	Interpretation
Graph 3 ***Energy price per component (€/MWh)***	64,5	Commodity	Represents the total commodity cost
	26,3	Network	Represents the total network cost
	15,5	Taxes/Levies	Represents the cost of taxes and levies.
		Taxes/Levies – minimum	Represents the minimum cost of taxes and levies.
		Taxes/Levies – maximum	Represents the **possible range between minimum and maximum** cost of taxes and levies

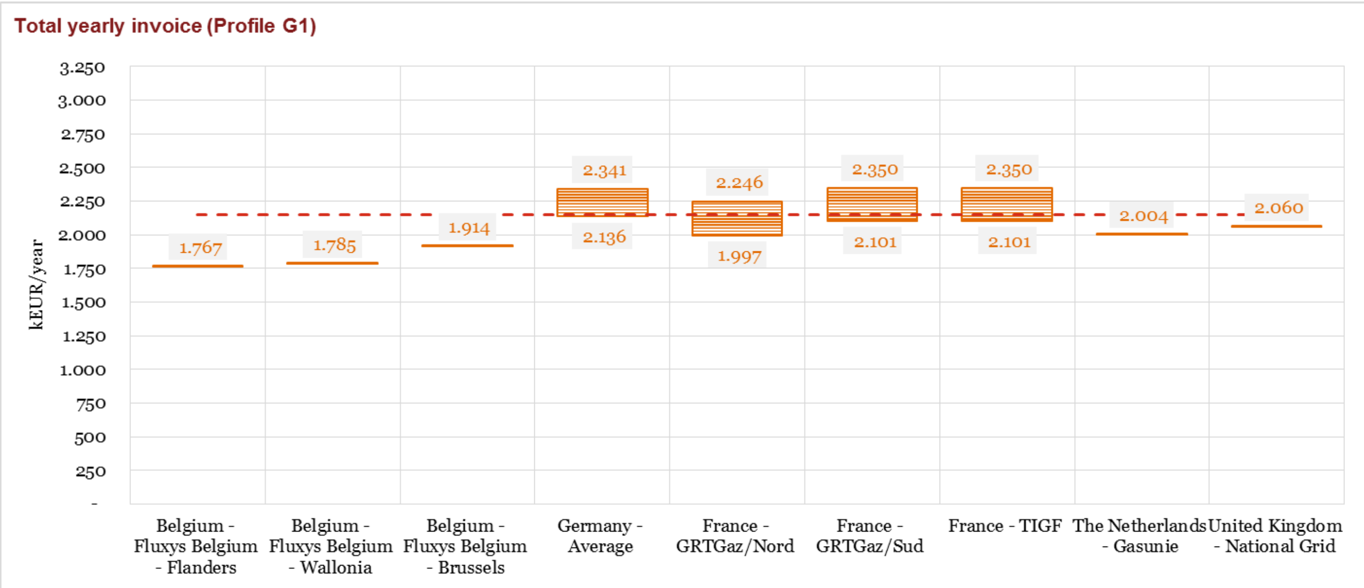
7.7. Profile G1 (Gas)

Total invoice analysis

The analysis of the two gas consumption profiles is carried out along the same pattern as the one used for the electricity profiles. However, while the three Belgian regions are still considered in the gas comparison, results are now averaged in the case of Germany. In France, three regions are treated separately. The Netherlands and the UK are each considered as one single zone.

Figure 27 depicts the total yearly invoice charges to the consumer characterised by the reference profile (G1). As a reminder, for this profile we exclude the possibility that G1 uses gas as a raw material in the industrial process.

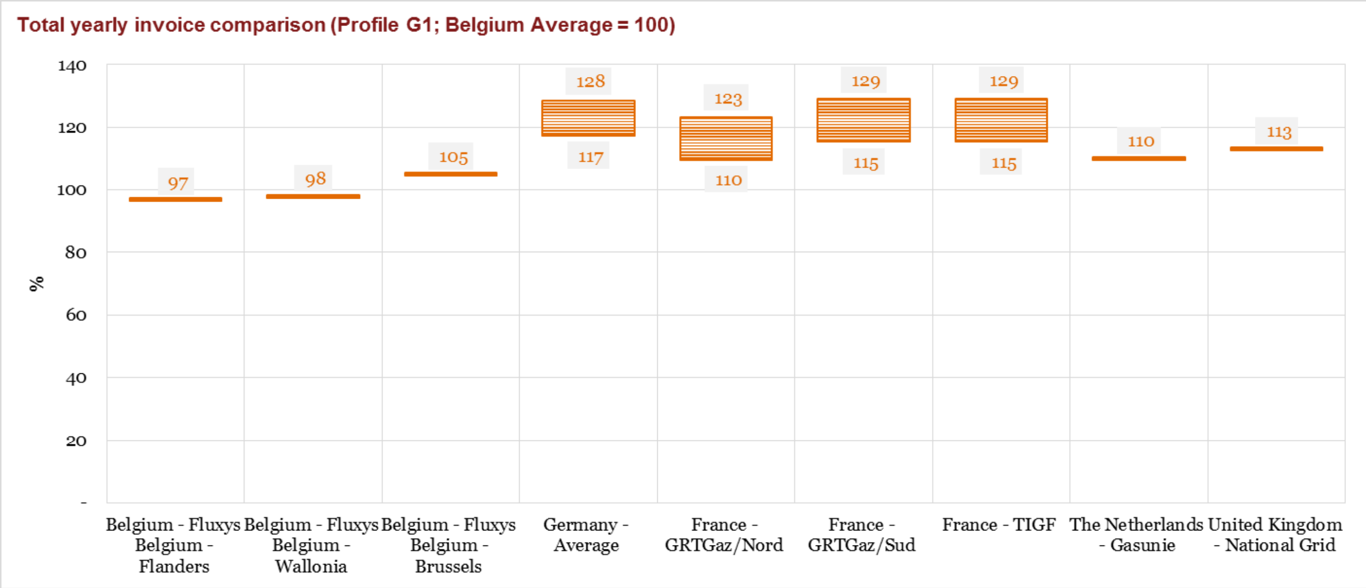
Figure 27 – Total yearly invoice in kEUR/year (profile G1)



For an extensive legend for all figures, see page 108.

For the purpose of facilitating the comparisons, in Figure 28 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average = 100%).

Figure 28 – Total yearly invoice comparison in % (profile G1)



For an extensive legend for all figures, see page 108.

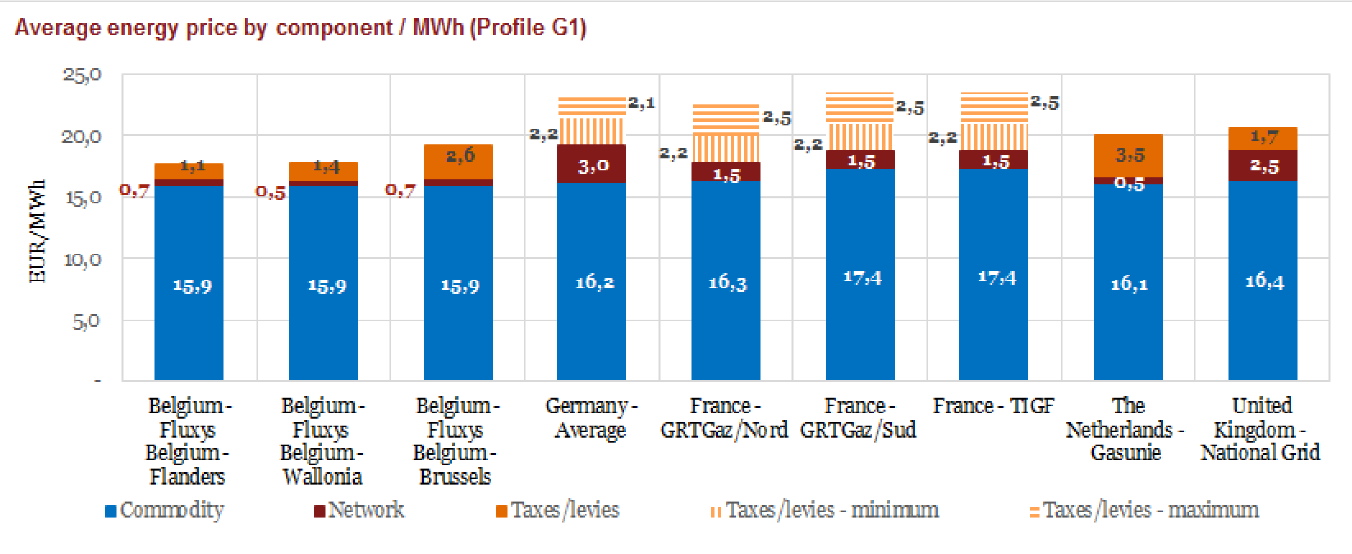
In terms of natural gas for a relatively large industrial consumer like profile G1, Belgium as a whole offers the most competitive prices of the entire sample. All three Belgian regions are more competitive than all other regions under review, with Flanders and Wallonia offering lower prices than Brussels. Industrial consumers like profile G1 (and who do not use gas as a raw material) in Germany, France, the Netherlands and the UK pay at least 10% to 15% more than similar consumers in Belgium (and potentially up to 30%).

We equally observe that in all cases, total cost for natural gas in Germany and the South and South-West French regions is higher than that in the UK and especially in the Netherlands.

Breakdown by component

The previous results are further detailed for profile G1 in the following chart, Figure 29, which provides a closer look on the components' breakdown.

Figure 29 – Average gas price by component in EUR/MWh (profile G1)



For an extensive legend for all figures, see page 108.

More than for electricity and in all countries, the **commodity cost** plays the major role in the composition of the total gas price. Commodity cost is lowest in Belgium and almost identical in Germany, the northern half of France, the Netherlands and the UK. The South and South West of France have to deal with a considerably higher gas market price, which constitutes a substantial competitive disadvantage.

The impact of the other two components is considerably lower. In terms of **network cost** (as a reminder, these are transport and distribution tariffs combined for this profile, except for the Netherlands), we observe two different groups of countries: Belgium and the Netherlands have similar, low tariffs, while in Germany, the UK and France network cost lies considerably higher.

As to **taxes and levies**, the tax levels in the Flemish and Walloon regions are lowest in the entire sample. In spite of the volume related reductions applicable in the Netherlands, it offers among the highest cost. In Germany and France, exemptions and reductions based on economic criteria (such as participation in a carbon market in France, or a threshold in terms of pension contributions) create a mixed picture. In case consumers do not qualify for these reductions and exemptions, France and Germany offer the highest possible tax rates. As stated above, possible tax exemptions for natural gas consumers that use gas as a raw material are not taken into account for profile G1.

KEY FINDINGS

Gas profile (G1) suggests the following findings:

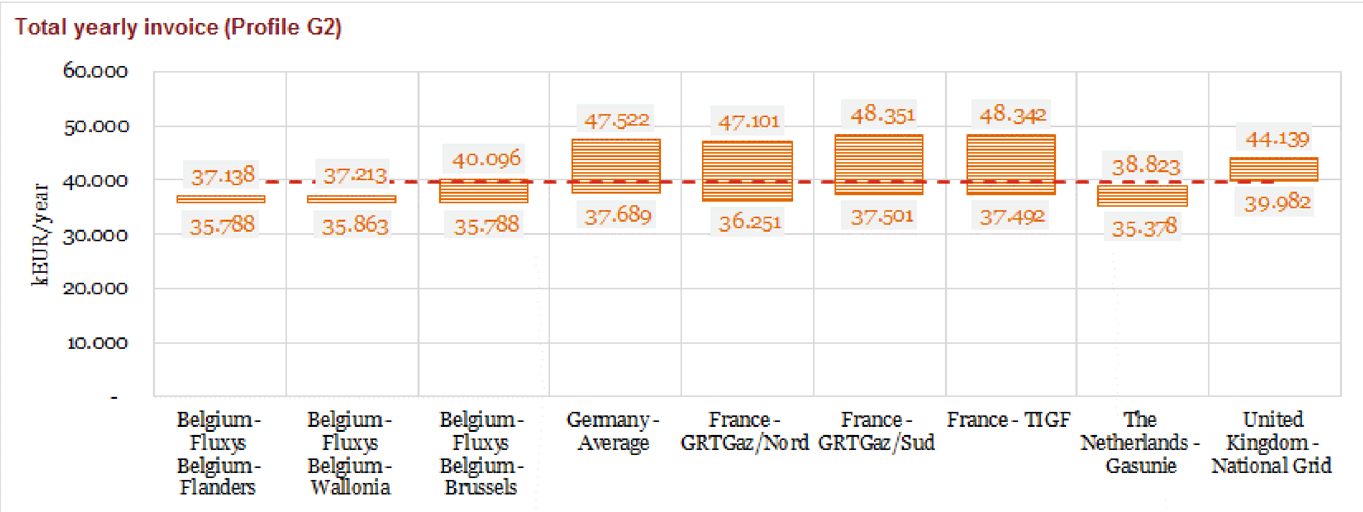
- Belgium is the most competitive country in terms of natural gas prices for relatively large industrial consumers.
- Together with the important share of commodity cost in the total cost, price convergence on the commodity market in the UK, Northern France, Germany and the Netherlands makes for relatively small differences between the zones under review (except for southern France). For this specific period (January 2016) commodity cost in Belgium is slightly lower than for all other countries under review.
- The impact of network costs and taxes and levies on the total cost is very limited in absolute numbers, but determines the positioning of a country and a consumer in terms of competitiveness.

7.8. Profile G2 (Gas)

Total invoice analysis

The next chart, Figure 30, depicts the total yearly invoice charges to the consumer characterised by the reference profile (G2). As a reminder, we assume profile G2 can be a feedstock consumer using natural gas as a raw material in the industrial process (bottom range) but we also depict the possibility that he is not such a consumer (top range).

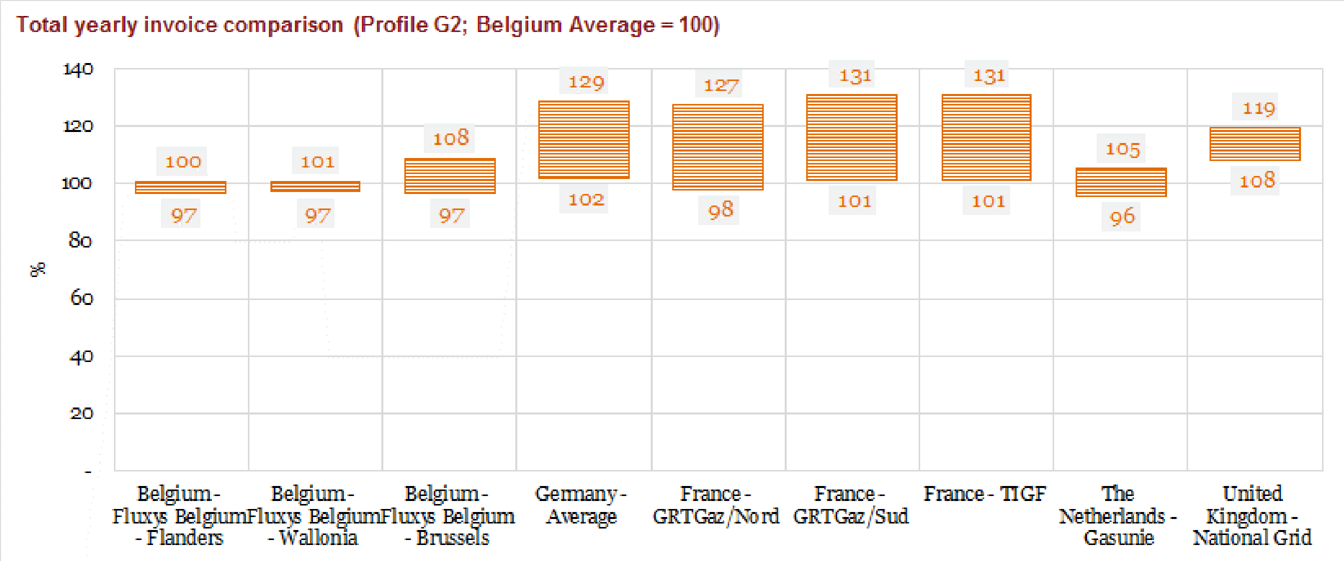
Figure 30 – Total yearly invoice in kEUR/year (profile G2)



For an extensive legend for all figures, see page 108.

For the purpose of facilitating the comparisons, in Figure 31 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average = 100%).

Figure 31 – Total yearly invoice comparison in % (profile G2)



For an extensive legend for all figures, see page 108.

In terms of natural gas for very large industrial consumers (profile G2), Belgium generally offers very competitive prices.

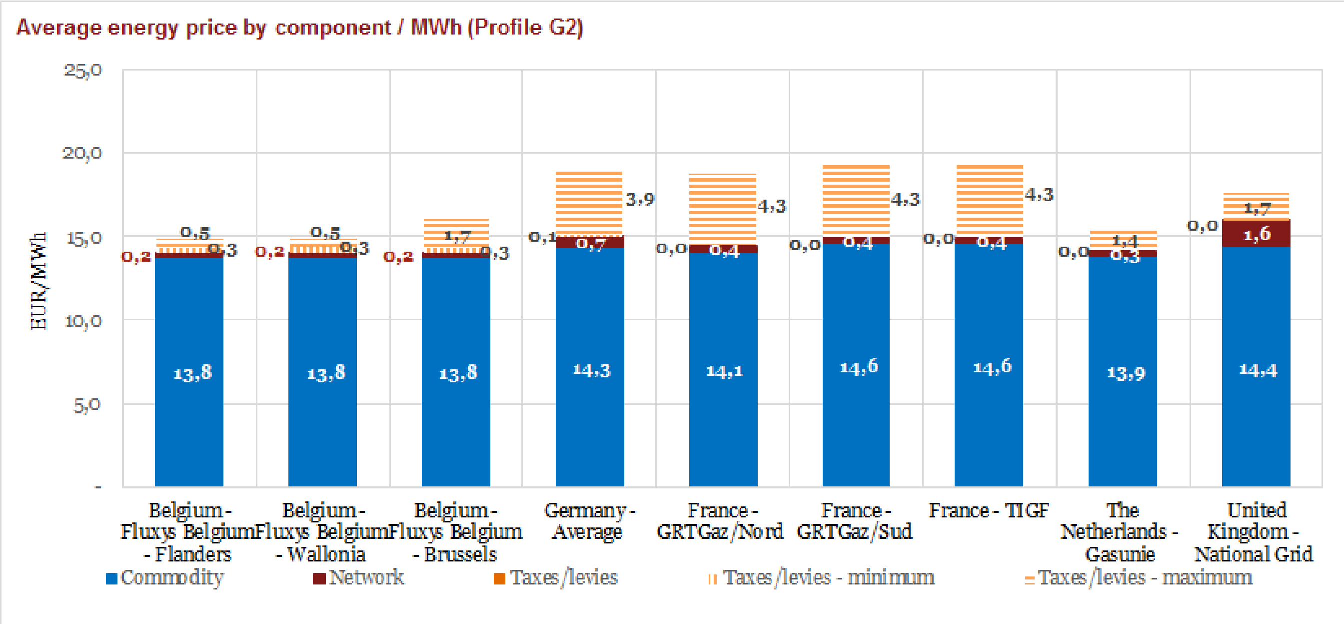
For very large industrial feedstock consumers using natural gas as a raw material (bottom range), cost differences between the countries under review are relatively small, except for the UK that offers a substantially higher cost. For these consumers, the Netherlands and Belgium are the most competitive countries under review, followed very closely by Northern France. The three Belgian regions are more competitive than all other regions, except for the Netherlands that offers a slightly lower total cost.

For very large industrial consumers that do not use natural gas as a raw material, but rather for heating and other purposes (top range), cost differences between the countries under review are much more important. Belgium is generally very well positioned, with comparable consumers in the Netherlands paying up to 5% more. Consumers in the UK, Germany and France can pay up to 20 – 30% more than comparable consumers in Belgium.

Breakdown by component

The previous results are further detailed for the profile G2 in the following chart, Figure 32, which provides a closer look on the components' breakdown.

Figure 32 – Average gas price by component in EUR/MWh (profile G2)



For an extensive legend for all figures, see page 108.

As is the case for profile G1, the **commodity cost** is by far the largest part of the total gas price. Price differences are fairly limited. Commodity cost is cheapest in Belgium, followed by the Netherlands, Northern France, Germany and the UK. The South and South West of France have to deal with a higher gas market price, which constitutes a competitive disadvantage compared to the Northern part of the country.

Network costs only make up a limited amount of the total cost. We observe the lowest values in Belgium, and slightly higher values in the Netherlands and France (for both TSO's). Tariffs in the UK are markedly higher than in the other countries under review.

As to **taxes and levies**, all countries under review give exemptions for large baseload industrial consumers. All volume based exemptions have already been taken into account in the maximum option in Figure 32. For these results, that only apply to consumers that do not use gas as raw material, we observe the highest tax levels in Germany, and the lowest in the Flemish and Walloon regions.

For consumers that use natural gas as a raw material (feedstock), all countries under review apply important tax exemptions on top of some existing volume reductions. This is the case for Belgium (energy contribution), Germany (Energiesteuer), France (TICGN), Netherlands (Energiebelasting) and the UK (Climate Change Levy). The general level of taxes and levies for these feedstock consumers, reflected by the minimum option in Figure 32, is hence very low for all regions under review.[83] Nevertheless, due to the federal contribution on which no exemptions apply, Belgium offers the highest level of taxes for these feedstock consumers.

[83] With the exception of the hypothetical Brussels case (see Footnote 61).

KEY FINDINGS

The very large industrial gas consumer profile (G2) suggests the following findings:

- Belgium is generally very competitive in terms of natural gas prices for very large industrial consumers of natural gas. For feedstock consumers, only the Netherlands offers a slightly lower total cost than Belgium, while for all other very large industrial consumers, Belgium offers the lowest total cost.
- Together with the important share of commodity cost in the total cost, price convergence on the commodity market in the UK, Northern France, Germany and the Netherlands makes for relatively small differences between the zones under review.
- Even though rather limited in absolute numbers, the impact of network costs is important in determining the positioning of a country and a consumer in terms of competitiveness. Network cost for clients directly connected to the transport grid are lowest in Belgium, and highest in Germany and the UK.
- When considering taxes and levies without taking into account the exemptions for feedstock consumers, Belgium is the country with the lowest cost for this component. Germany and France clearly offer the highest potential cost.
- When considering taxes and levies after taking into account the exemptions for feedstock consumers and the other applicable reductions, taxes and levies are almost negligible in most countries. In this case, Belgium is the country with the highest cost for this component.

8. Energy prices: Conclusion

8. Energy prices: conclusion

8.1. Electricity

Some **general conclusions** can be drawn in terms of electricity:

1. In every country, governments intervene in order to reduce the electricity cost for some categories of large industrial consumers. These interventions occur on two components: transport (Germany and the Netherlands) and most importantly taxes, levies and certificate schemes (Belgium, UK, Germany, France and the Netherlands). Given the low market prices, the French intervention on commodity prices (ARENH) has become irrelevant.
2. Commodity cost plays a very important role: Dutch, French and most of all German consumers are clearly in a more competitive starting position than Belgium. This competitive advantage finds its origin in a lower electricity market price.
3. In terms of overall competitiveness, all countries under review (except for the UK) can offer lower prices than the three Belgian regions for the four consumer profiles, but in case of Germany and France this is only true for (sometimes very) electro-intensive consumers. Prices in Belgium for very large baseload consumers (profile E4) are comparatively more competitive than for smaller consumers such as E1.
4. The United Kingdom is an outlier on the high side for total electricity prices for all profiles under review. This is partly – but not entirely - explained by significantly higher commodity prices, and to a lesser extent by network costs and taxes, levies and certificate schemes.

8.2. Gas

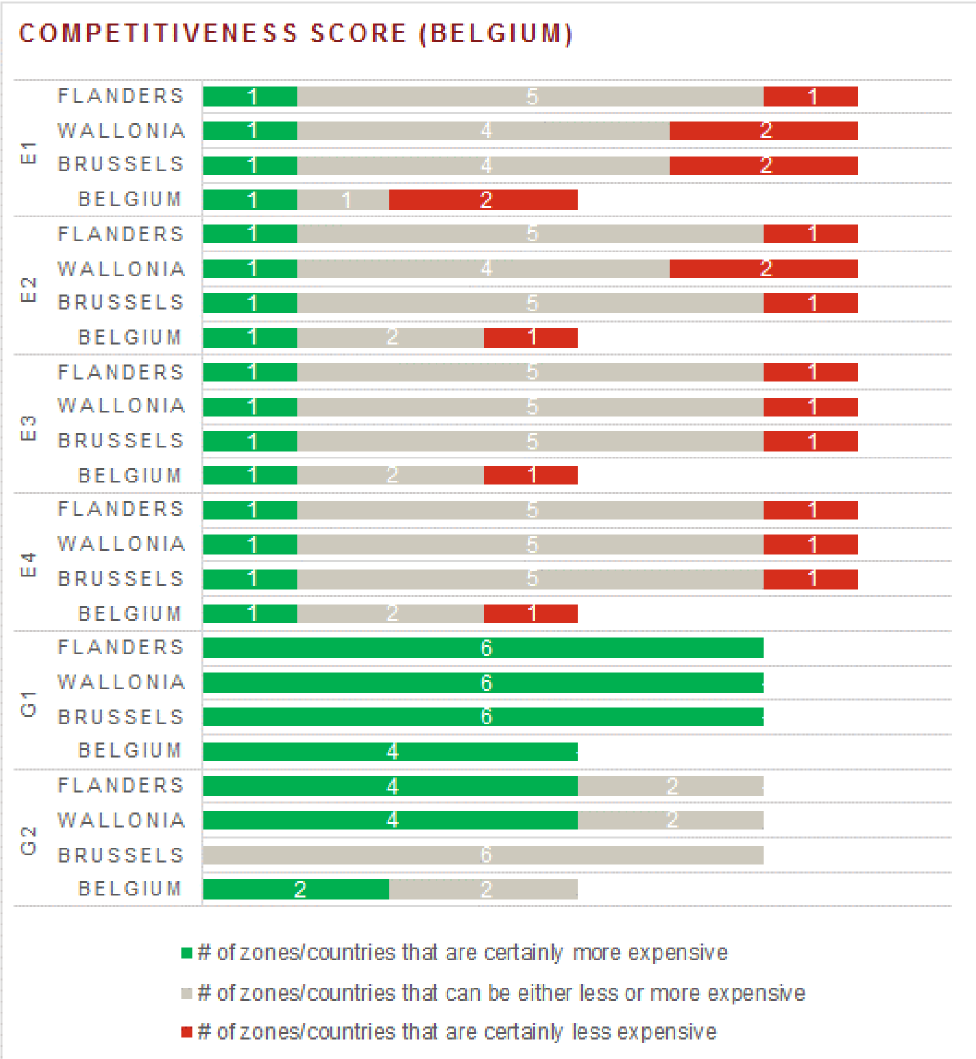
As far as natural gas is concerned, some **general conclusions** can be presented as well:

1. Commodity costs make up a very important part of the gas bill, and their relative importance is higher than for electricity.
2. Price convergence on the commodity market in Belgium, the UK, Northern France, Germany and the Netherlands makes for relatively small differences between the zones under review (except for southern France). For this specific period (January 2016) commodity cost in Belgium is slightly lower than for all other countries under review. Differences in commodity prices are in any case small compared to electricity.
3. For industrial consumers not using gas as a raw material, whether they are large or very large consumers, the Flemish and Walloon regions offer the most competitive total prices. For very large feedstock consumers using gas as a raw material, the competitive advantage of Belgian gas consumers is less important than for other gas consumers, with the Netherlands even offering a slightly lower price. For both consumer profiles the competitive advantage of Belgium is based on a competitive commodity cost, low network costs, and a comparatively low level of taxes and levies.

8.3. Competitiveness score

To interpret the **Belgian situation** in terms of energy cost for industry, we present a competitiveness scorecard that does an effort to summarize the complex and nuanced situation that we have described throughout this report. We address the question whether, based on the consumer profiles provided by the CREG and on the assumptions that we set out earlier on, the energy cost for industrial consumers in Belgium/Flanders/Wallonia/Brussels is competitive when compared to the neighbouring countries (and the price zones within those countries). In section 3.1 of this report, this analysis will be elaborated based on macro-economic data.

Figure 33 – Competitiveness scorecard



The results vary greatly between the two commodities.

For all electricity consumption profiles, only one neighbouring country is certainly less competitive than Belgium: the United Kingdom. Similarly, for all consumption profiles and in all cases, the Netherlands are more competitive than Belgium.

The grey zone represents the complexity of electricity cost for industrial consumers. In Germany and France, for instance, consumers that do not qualify for electro-intensity criteria are worse off than their Belgian counterparts. However, for electro-intensive consumers benefiting from the existing reductions and exemptions, Germany, France and the Netherlands offer electricity cost that are consistently 15 to 40% lower than in Belgium.

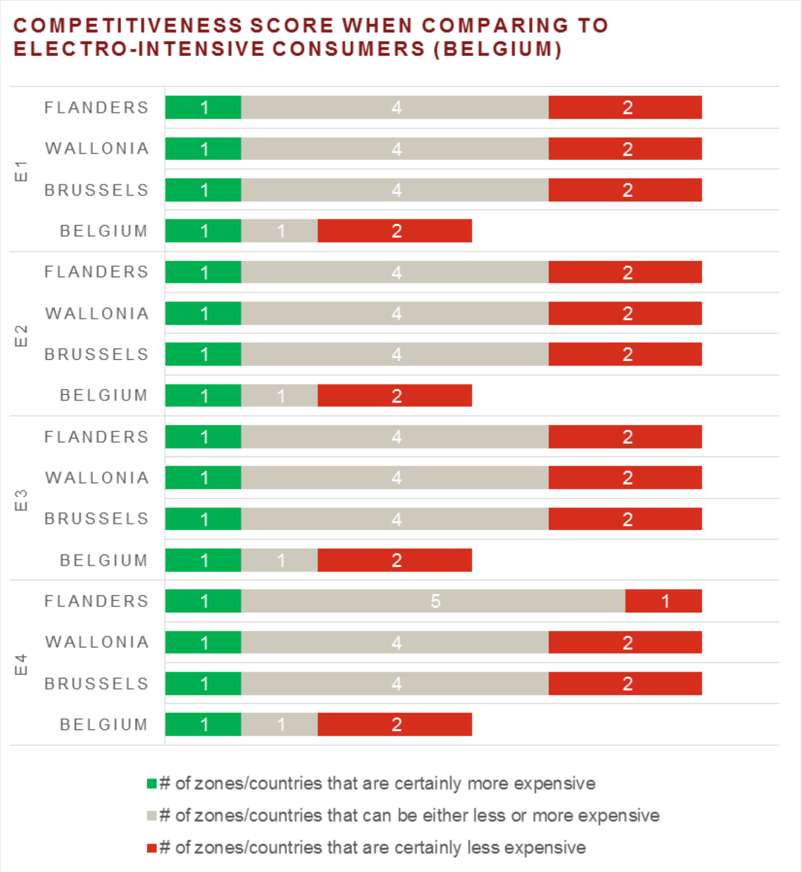
The differences between the Flemish and Walloon regions is most important for profiles E1 and E2 where electricity cost observed in the Walloon region is about 10% above the cost observed in the Flemish region. This difference is reflected in the competitiveness score (the Netherlands and France are certainly less expensive than the Walloon region), and can be solely attributed to regional taxes, levies and certificate schemes. For profiles E3 and E4, the picture is much more nuanced, with a small 2% difference between both regions and the Walloon region being more competitive for E3, while the Flemish region is more competitive for E4.

In terms of industrial gas consumers, the situation depicted by the competitiveness scorecard is very different. For profile G1, the three Belgian regions are more competitive than all other zones/regions under review. For profile G2, the situation is slightly more nuanced. When considering both the top range prices (no feedstock) and the low range prices (feedstock) separately, the Belgian regions are more competitive than the other zones/regions. The grey zones in the competitiveness scorecard reflect the uncertainty that is linked to possible reductions that can be obtained based on economic parameters in neighbouring countries.

The competitiveness scorecard in Figure 33 is a good attempt to summarize the general picture in terms of competitiveness of electricity and gas prices in Belgium and its regions vis à vis its neighbouring countries, but it hides some of its complexity regarding to the competitiveness of electricity prices. As was shown in section 7 of this report, some industrial consumers in the neighbouring countries benefit from considerably lower prices because of reductions based on electro-intensity criteria. This is not the case in Belgium, where reductions are largely based on consumption only.

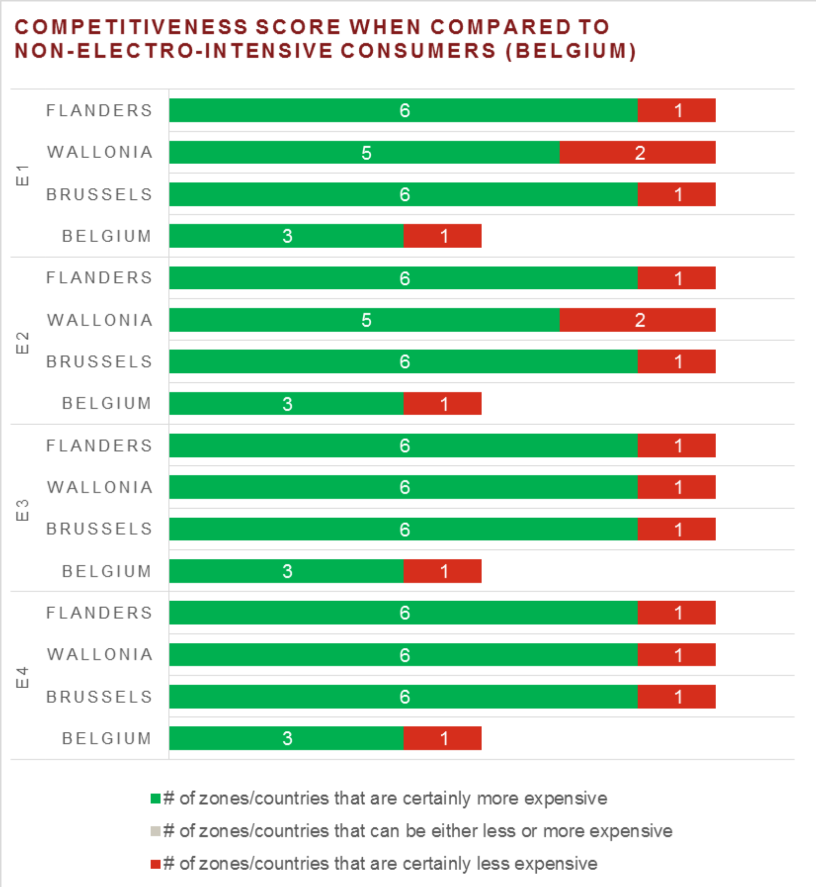
Therefore, it makes sense to present a competitiveness scorecard comparing electricity and gas prices in Belgium and its regions with those of consumers that benefit from reductions (electro-intensive consumers) and those that do not (non-electro-intensive consumers) in the neighbouring coutnries. They are presented in Figure 34 and Figure 35 respectively.

Figure 34 – Competitiveness scorecard when comparing to electro-intensive consumers



When comparing Belgian prices to those for electro-intensive consumers in the neighbouring countries, only one neighbouring country is certainly less competitive than Belgium: the United Kingdom. Similarly, for all consumption profiles and in all cases, the Netherlands and France are more competitive than Belgium, except for Flanders in the case of E4, where only the Netherlands is more competitive. The grey zone can be solely attributed Germany and represents the complexity of reduction schemes.

Figure 35 – Competitiveness scorecard when comparing to non-electro-intensive consumers

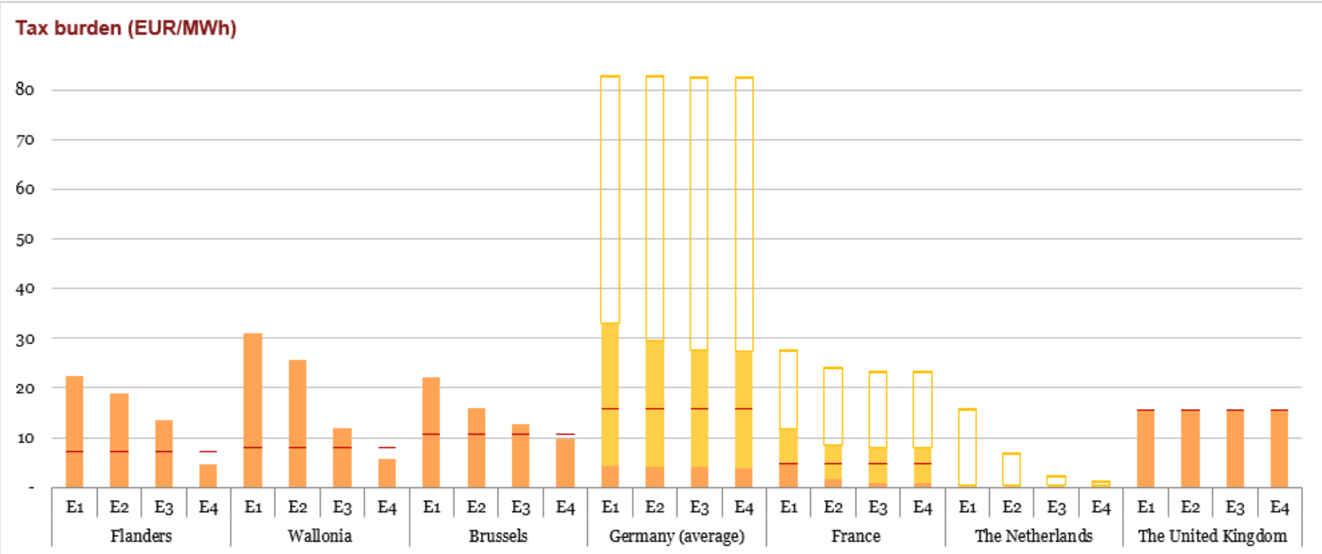


When comparing prices in Belgium and its regions to those for non-electro-intensive consumers in the neighbouring countries, a completely different competitiveness scorecard can be observed. From Figure 35 it is clear that the picture for Belgium and its regions looks much more positive. The Netherlands offers lower total prices for all electricity consumer profiles, but all other countries offer clearly higher electricity prices for these consumers that are not benefiting from any electro-intensity-based reduction (except for France being more competitive than Wallonia for profiles E1 and E2).

8.4. Tax burden for electricity consumers

When analysing and summarising the results in terms of electricity, it is interesting to see how the third component (taxes, levies and certificate schemes) compares between the different consumer profiles. In Figure 34, the orange bars represent the total cost per MWh of component 3: taxes, levies and certificate schemes. The full yellow bars represent the minimum- maximum ranges where different options are possible, while the transparent yellow bars represent the maximum range for non-electro-intensive consumers in Germany, France and the Netherlands. The red lines represent the weighted average tax burden of the four consumer profiles for a certain country (in EUR/MWh) (for electro-intensive ranges in UK, FR and NL).

Figure 36 – Taxes, levies and certificate schemes throughout 4 profiles



Each of the Belgian regions allocate the total burden of extra costs (simplified: tax burden) differently, but one common trend is clearly visible: the more one consumes, the lower the tax burden. In contrast, the UK grants no reductions based on volume and allocates the tax burden completely evenly over the four profiles.

Nevertheless, we also observe that the majority of the other countries under review (Germany, the Netherlands and France) have shifted towards electro-intensity criteria regarding the allocation of the tax burden, while Belgium still defines exemptions strictly based on consumption (same for the three regions). Indeed, in Germany, France and the Netherlands, we observe large possible differences within one single consumer profile depending on the economic profile and the electro-intensity of the consumer. In Belgium, on the other hand, we observe important differences only between different consumer profiles, which are mainly caused by differences in consumption level and grid connection level (apart from some general sector conditions).

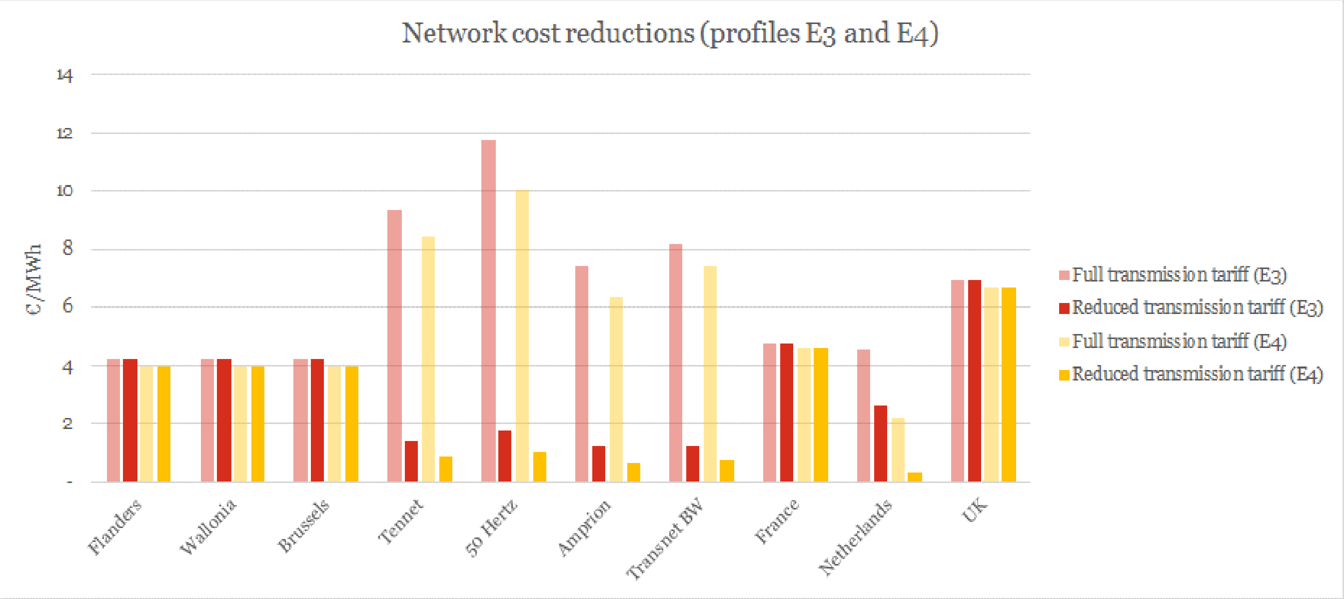
In other words, from a fiscal point of view, Belgian federal and regional authorities mainly grant reductions and/or exemptions to taxes, levies and certificate schemes based on the level of electricity offtake, and not on the level of electro-intensity of an industrial consumer. This could possibly mean that tax revenues are directed toward protecting consumers that are not particularly affected by a lack of competitiveness of electricity prices, while more vulnerable consumers keep suffering from an important disadvantage compared to their electro-intensive competitors in neighbouring countries.

8.5. Impact of reductions on network costs

As briefly stated above, the impact of reductions on network costs for large baseload consumers such as profiles E3 and E4 are important. Germany introduced these reductions in 2012 and the Netherlands in January 2014. Belgium, France and the UK do not grant reductions.

In Germany and the Netherlands, large baseload consumers such as E4 in this study can benefit from a transport tariff reduction up to 90%. As shown in Figure 37 below, these reductions profoundly alter the situation in terms of transmission tariffs, and by doing so the general picture in terms of competitiveness.

Figure 37 – Network cost reductions (profiles E3 and E4)



Source: PwC

In both cases, the cost is transferred to the other consumers. In the Netherlands these reductions are compensated by the transport tariff itself (through regulatory accounts, for instance). In Germany, a separate levy (the "StromNEV §19-Umlage") was created to pay for the reduction. It is due by all consumers, but yet again reductions for large consumer profiles are granted on this levy. We can therefore say that high transmission tariffs in Germany are not the consequence of the reductions, but rather the cause.

9. Competitiveness of the Belgian industry in terms of energy and recommendations

9. Competitiveness of the Belgian industry in terms of energy and recommendations

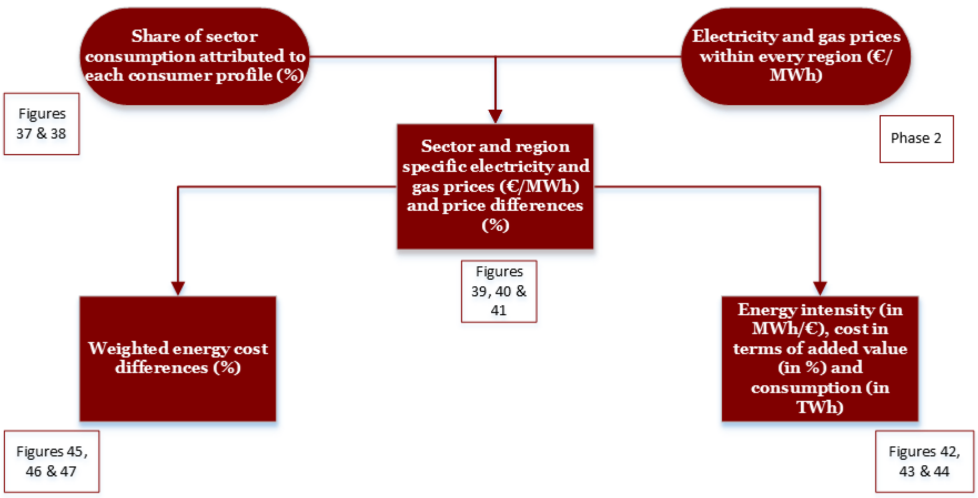
9.1. Competitiveness analysis

9.1.0 Methodology

During the first phase of this research the top 5 most important industrial sectors in Belgium in the framework of an energy price comparison were selected: the chemical (NACE 20), basic metal (NACE 24), pharmaceutical (NACE 21), food & beverages (NACE 10-12) and non-metallic mineral (NACE 23) industries.[84] Based upon the selection of those sectors, four relevant electricity and two relevant gas profiles for industrial consumers in Belgium and its regions were presented. In a second phase the gas and electricity prices were compared with those of Belgium's neighbouring countries: Germany, France, the Netherlands and the UK.

In this third and final phase of the project the information gathered in both previous phases is combined to analyse the competitiveness of the top 5 most important sectors in Belgium and its regions. The line of reasoning on which the competitiveness analysis is based, is presented in Figure 38.

Figure 38 – Methodology flowchart



As is observed from the flowchart, in a first step the electricity and gas prices in Flanders, Wallonia and Brussels (see section 7) are combined with the distribution of the different consumer profiles over the CREG-sample of invoicing data over the top 5 sectors, resulting in **sector- and region-specific electricity and gas prices**. In a second step, these prices are used to calculate two important variables, through two separate pathways. The first pathway calculates a **weighted energy cost difference**, which combines electricity and gas prices in one single measure that makes it possible to compare energy

[84] In this section we will use this order to present the results. It resembles the order of the importance of the sectors.

prices of a certain sector (within a certain region) with that of the European average, while the second pathway elaborates the **total energy cost**, which expresses the energy (electricity and gas) cost of a certain sector and region in terms of added value.

This chapter is organised around this flowchart, which will be explained and discussed in detail in the following sections.

9.1.1 Sector and region specific electricity and gas prices

In phase 2 the electricity and gas prices for each of the three regions in Belgium were gathered. As the objective in this phase is to analyse the competitiveness of these prices for the top 5 most important sectors, developing a method that uses these regional prices and express them on a sector level is needed. This is done by combining the regional electricity and gas prices with the distribution of consumer profiles per sector (see Table 2 and Table 3), which were retrieved in the first phase. They are based on data provided by the CREG and show how consumer profiles are distributed per sector, which consumer profile is the most predominant within each sector and therefore has the largest impact on the electricity and gas prices for that sector.

The relative frequency of each consumer profile per sector (retrieved by multiplying the absolute number of profiles with the consumption of each profile[85][86]and dividing by the total consumption per sector[87]) are presented in the tables below. As one can see from Table 2, E2 is the predominant profile in the food and beverages sector (NACE 10-12), while it is E3 for the NACE 20, 21 and 23 sectors and E4 in the NACE 24 sector. The prices of those predominant consumer profiles will have the largest effect on the electricity prices for each of the top 5 sectors within each region. From Table 3 it is apparent that in all sectors, profile G1 is the predominant one, except for the NACE 20 sector.

The columns (1) in Table 2 refer to the absolute frequencies, while the columns (2) in the same table refer to the relative frequencies.

[85] The data in both Table 2 and Table 3 are based on invoicing data from the CREG for all consumers with an offtake of more than 10 GWh of gas or electricity a year. These were used in phase 1 to identify the industrial sectors different consumers belong to.
[86] For electricity: 10 GWh for E1, 25 GWh for E2, 100 GWh for E3 and 500 GWh for E4.
[87] As presented during phase 1, based on Federal Planning Bureau data (Energy Consumption accounts).

Table 2 – Distribution of electric consumer profiles per sector

Code NACE-Sector	E1 (10-17,5 GWh/yr)		E2 (17,5-62,5 GWh/yr)		E3 (62,5-300 GWh/yr)		E4 (>300 GWh/yr)	
	(1)[88]	(2)[89]	(1)	(2)	(1)	(2)	(1)	(2)
20 Chemicals and chemical products	20	**6%**	25	**18%**	16	**47%**	2	**29%**
24 Basic metals and fabricated metal products	10	**3%**	15	**10%**	14	**36%**	4	**52%**
21 Pharmaceutical products and preparations	1	**2%**	7	**36%**	3	**62%**	-	**0%**
10-12 Food products, beverages and tobacco products	51	**23%**	52	**59%**	4	**18%**	-	**0%**
23 Other non-metallic mineral products	11	**10%**	13	**29%**	7	**62%**	-	**0%**

Source: CREG (2014), PwC Calculations

Table 3 – Distribution of gas consumer profiles per sector

Code NACE-sector	G1 (10-1000 GWh/year)		G2 (> 1000 GWh/year)	
	(1)[90]	(2)[91]	(1)	(2)
20 Chemicals and chemical products	71	**36%**	5	**64%**
24 Basic metals and fabricated metal products	32	**56%**	1	**44%**
21 Pharmaceutical products and preparations	12	**100%**	-	**0%**

[88] The figures in column 1 refer to the absolute frequencies of each consumer profile per sector within the respective consumption range. For example, there are 51 cases of consumer profile E1 (with a consumption between 10 and 17,5 GWh/year) within the NACE 10-12 sector.

[89] The figures in column 2 refer to the relative frequencies or the ratio between the total consumption of each consumer profile within a sector (absolute frequency times 10, 25, 100 or 500 GWh) and the consumption of all consumer profiles within that sector (absolute frequency of E1 * 10 GWh + absolute frequency of E2* 25 + ...). Per sector (horizontal summation), the relative frequencies add up to 100%, except for NACE 23 and 24, because they are presented as rounded figures.

[90] The figures in column 1 refer to the absolute frequencies of each consumer profile per sector within the respective consumption range. For example, there are 71 cases of consumer profile G1 (with a consumption between 10 and 1.000 GWh/year) within the NACE 20 sector.

[91] The figures in column 2 refer to the relative frequencies or the ratio between the total consumption of each consumer profile within a sector (absolute frequency times 100 or 2.500 GWh) and the total consumption of gas between that sector (absolute frequency of G1 * 100 GWh + absolute frequency of G2 * 2.500 GWh). Per sector (horizontal summation), the relative frequencies add up to 100%.

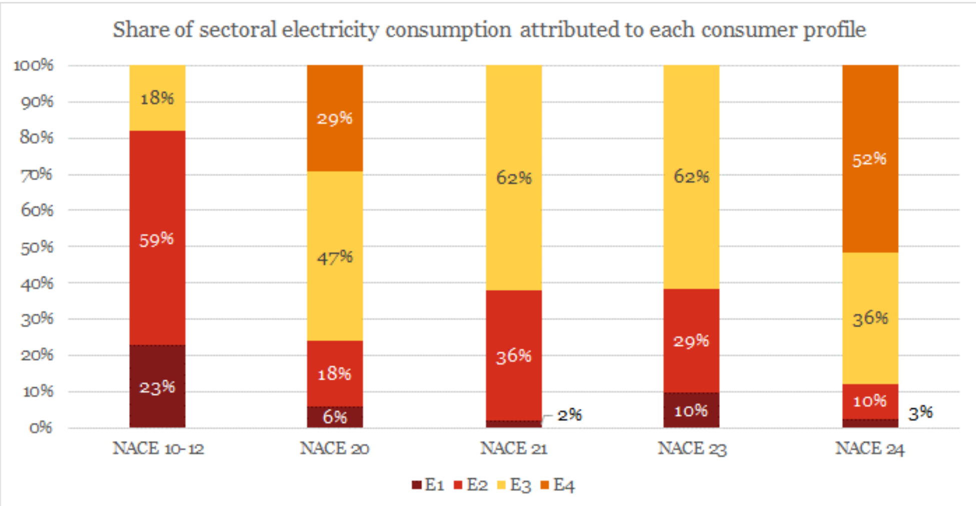
10-12 Food products, beverages and tobacco products	181	**100%**	-	**0%**
23 Other non-metallic mineral products	33	**57%**	1	**43%**

Source: CREG (2014), PwC Calculations

As an example, the absolute frequencies for the chemicals and chemical products (NACE 20) sector is 20 or 20 consumers with a quantity of invoiced electricity similar to the consumption of profile E1, 25 consumers for E2, 16 consumers for E3 and 2 consumers for E4. Multiplying these numbers by their respective consumption and summing them, results in a theoretical total electricity consumption on the sector level of 3425 GWh[92]. Expressed in relative frequencies, 6% of the total consumption is represented by profile E1, 18% by E2, 47% by E3 and 29% by E4[93]. For this sector, the prices for E3 will have a predominant effect on the calculation of the weighted electricity price for that sector, as it simply represents the largest share in the total electricity consumption for that sector. For gas, there are 71 consumers of profile G1 and 5 of G2. Multiplying these numbers by their consumption and summing both up, results in a theoretical total consumption for the sector of 19600 GWh. This reflects a relative frequency of 36% for G1 and 64% for G2.

Along the same logic the relative frequencies of the consumer profiles for the other sectors have been calculated and are presented again in Figure 39 and Figure 40. As is clear from Figure 39, profile E3 is the predominant profile in most of the sectors (NACE 20, 21 and 23), while for NACE 24 profile E4 is predominant (very large users) and for the food and beverages sector (NACE 10-12) it is profile E2.

Figure 39 – Share of sectoral electricity consumption attributed to each consumer profile



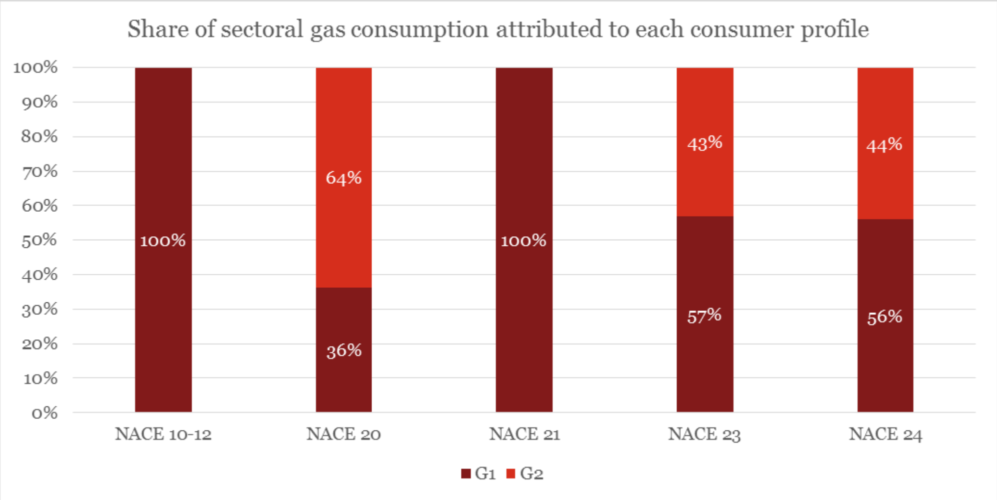
Source: CREG (2014), PwC Calculations

From Figure 40 it is observed that for all sectors, except for NACE 20, G1 is the profile with the highest relative frequency. Although there are just a few G2 consumer profiles represented in the different sectors, they can have a substantial relative frequency, caused by their high volume of gas consumption (2.500 GWh).

[92] Total electricity consumption of 3425 GWh = (20* 10 GW h) + (25 * 25 GWh) + (16 * 100 GWh) + (2 * 500 GWh).
[93] Weighted average for E1 of 6% = (20 * 10 GWh) / 3.425 GWh

Of course this is not the case for the pharmaceutical (NACE 21) and the food & beverages (NACE 10-12) sectors, as no consumers of G2 are represented within those sectors.

Figure 40 – Share of sectoral gas consumption attributed to each consumer profile



Source: CREG (2014), PwC Calculations

As stated before, these relative frequencies can be used together with the electricity and gas prices for each region to calculate sector and region specific electricity and gas prices (in €/MWh). This is done by summing the multiplications of the prices retrieved for each consumer profile and their relative frequencies according to the formulas below:

$$P_{elec}\ for\ Sector_i\ in\ Region_j = \sum_{X=1}^{4} (Price\ for\ E_X\ in\ Region_j * Relative\ frequency\ of\ E_X\ in\ Sector_i\ )$$

$$P_{gas}\ for\ Sector_i\ in\ Region_j = \sum_{Y=1}^{2} (Price\ for\ G_Y\ in\ Region_j * Relative\ frequency\ of\ G_Y\ in\ Sector_i)$$

When comparing those region and sector specific prices to the European average[94] they can be expressed as price differences with the European average. We have calculated the average prices of electricity and gas in the neighbouring countries according to the following formulas[95]:

$$European\ average\ of\ P_{elec}\ for\ Sector_i = \sum_{X=1}^{4} (Average\ price\ for\ E_X\ in\ neighbouring\ countries * Relative\ frequency\ of\ E_X\ in\ Sector_i\ )$$

[94] The European average throughout this section refers to the average of the neighbouring countries under scope in this report: Germany, France, the Netherlands and the United Kingdom.

[95] We have used the same share of sectoral electricity and gas consumption attributed to each consumer profile to calculate the average price of electricity and gas in the neighbouring countries. This way we assume that the different consumer profiles are equally distributed in the sectors under scope of the neighbouring countries.

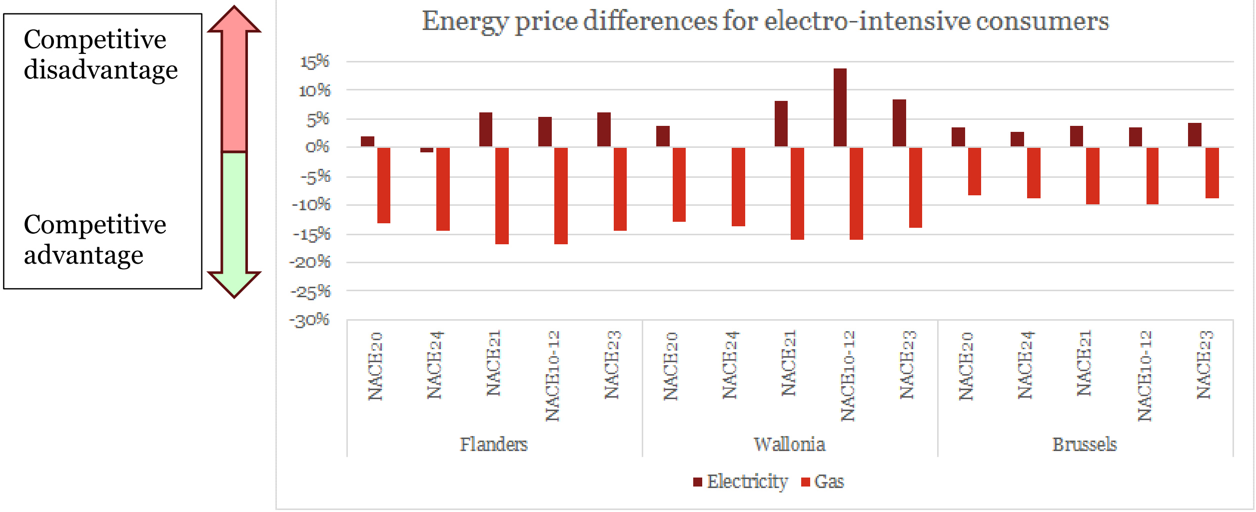
$$Eureopan\ average\ of\ P_{gas}\ for\ Sector_i = \sum_{Y=1}^{2} (Average\ price\ for\ G_Y\ \ in\ neighbouring\ countries * Relative\ frequency\ of\ G_Y\ in\ Sector_i\ )$$

The electricity and gas price differences (in %'s) measure the price difference for a certain sector i in a certain region j with the European average. These sector and region specific electricity and gas price differences when compared with the average of Belgium's neighbouring countries can be found below and are presented in Figure 41 (for the non-electro-intensive consumers) and Figure ***42*** (for electro- intensive consumers).

$$X_{ij} = \left(\frac{P_{elec}\ for\ Sector_i\ in\ Region_j - \ European\ average\ of\ P_{elec}\ for\ Sector_i}{Eureopan\ average\ of\ P_{elec}\ for\ Sector_i} \right)$$

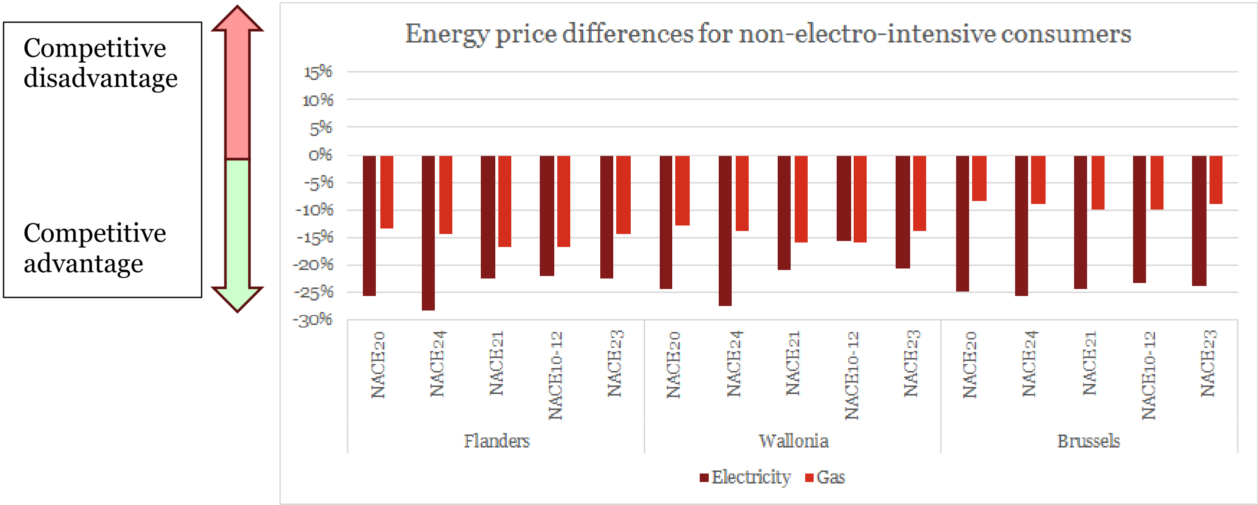
$$Y_{ij} = \left(\frac{P_{gas}\ for\ Sector_i\ in\ Region_j - \ European\ average\ of\ P_{gas}\ for\ Sector_i}{European\ average\ of\ P_{gas}\ \ for\ Sector_i} \right)$$

Figure 41 – Electricity and gas price differences for electro-intensive consumers compared with the average in the neighbouring countries



Source: CREG (2014), PwC Calculations

Figure 42 – Electricity and gas price differences for non-electro-intensive consumers in comparison with the average in the neighbouring countries



Source: CREG (2014), PwC Calculations

One can observe in Figure 41 and Figure 42 that electricity price differences differ substantially from sector to sector and from region to region, but are always higher, except for NACE 24 in Flanders when comparing for electro-intensive consumers (lack of competitiveness) and lower when comparing for non-electro-intensive consumers (competitive prices). The gas prices are more competitive in Belgium than in the neighbouring countries, for all sectors and in all regions.

9.1.2 Electro-intensive and non-electro-intensive consumers

It is important to note that in the previous and following sections two different results in terms of energy price differences are presented: one when comparing to electro-intensive consumers and the other when comparing to non-electro-intensive consumers. The first one, valid for electro-intensive consumers, compares prices for each region in Belgium to the low range of prices observed in the neighbouring countries; assuming that, in each of the neighbouring countries, the 'competitors' of Belgian industrial consumers **qualify for the national electro-intensity criteria and hence benefit from important reductions on several price components for electricity**, as is specified in Table 4.

Table 4 – National electro-intensity criteria

Country	Criteria
Germany	For consumers of most industrial sectors: when electricity cost >17% of gross value creation in 2015 For consumers of a less extensive list of industrial sectors: when electricity cost >20% of gross value creation[96]
The Netherlands	Industrial consumers who are classified as being energy-intensive[97] and who concluded a multiple-year agreement with the Dutch government to save energy by improving their energy efficiency.
France	Important reductions exist for industrial consumers where the CSPE (of 22,5 €/MWh) amounts to at least 0,5% of their added value. For example, for a 10 GWh/year consumer an added value of 45 million euros or less in the annual accounts is needed, in order to qualify for this criteria (i.e. the CSPE amounts to at least 0,5% of the added value),

The second result, on the other hand, is valid for non-electro-intensive industrial consumers in Belgium, and compares the prices in the three Belgian regions to the top range of prices observed in the neighbouring countries; assuming that, in each of the neighbouring countries, the 'competitors' of Belgian industrial consumers **do not qualify for the national electro intensity criteria and hence pay the maximum price.**

For both the electro-intensive and non-electro-intensive cases, the same prices for natural gas are presented. Whenever a range of results in neighbouring countries was available, we compared the prices in the three Belgian regions to the middle of the range of the neighbouring countries.

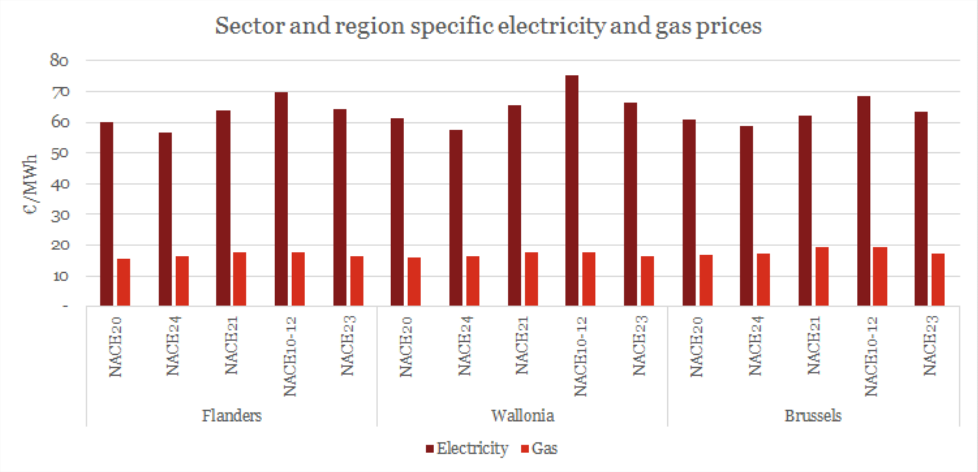
On a Belgian level, the information to identify the importance of electro-intensive companies within each of the industrial sectors under review is lacking. However, it is possible to give an indication on a purely macro-economic level as to the sector wide electro-intensity (and gas-intensity). It has to be clearly said that behind these macro-level numbers, a lot of complexity in terms of specific sub-sectors and consumer profiles is hidden. Nevertheless, they do shed a light on sector-wide energy-intensity in Belgium, and on the severity of the criteria in the neighbouring countries.

To have an idea how the electro-intensity criteria of the neighbouring countries relate to the level of electro-intensity in Belgium and its top 5 important sectors, first the concept of energy cost is introduced in this section, based on the electricity and gas prices for each sector and every region (in €/MWh) on the one hand (Figure 43) and MWh/€ of added value for electricity and gas (or energy intensity) per sector on the other hand (Figure 44). The energy cost expresses the cost of electricity and gas for the whole sector in terms of added value.

As can be observed from Figure 43, the electricity prices are highest for the NACE 10-12 sector, as in that sector, the more expensive consumer profiles E1 and E2 are relatively well represented (see Figure 39).

[96] These consumers have a significant reduction on their eEG-Umlage (base rate of 63,54 €/MWh).
[97] An energy-intensive company is a company for which the costs of energy or electricity is more than 3% of the total value of production or the energy taxes and tax on mineral oils is at least 0,5% of the added value (Wet Belastingen op Milieugrondslag , Artikel 47, 1p).

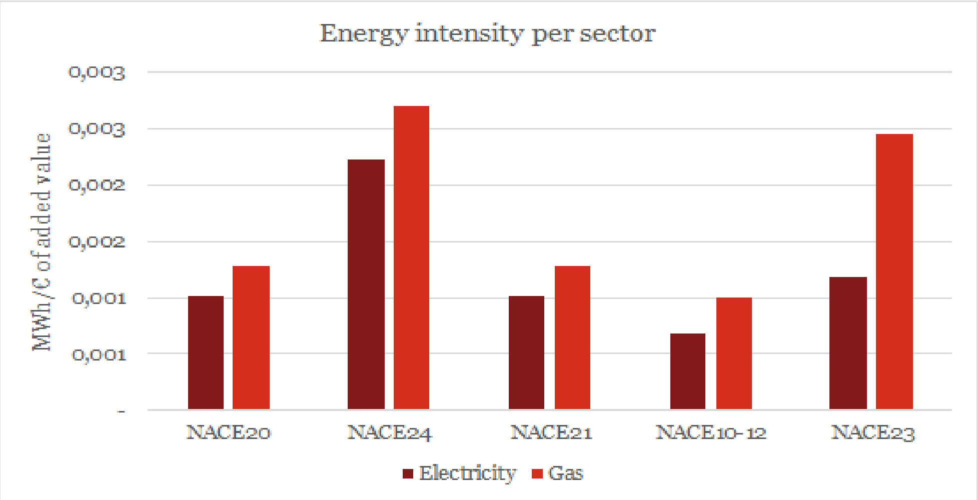
Figure 43 – Sector and region specific electricity and gas prices



Source: CREG (2014), PwC Calculations

The energy intensity figures have been presented before in section 3. As is illustrated in Figure 44, these figures are higher for gas than for electricity and vary significantly throughout the different sectors. Sectors that have high values for MWh/€ of added value are seen to be energy intensive, as is the case for the NACE 24 and, to a lesser extent, the NACE 23. The food & beverages sector (NACE 10-12) is the least energy intensive sector of those in the scope of the present study. Again no separate data for the NACE 20 and 21 sectors were available.

Figure 44 – Energy intensity per sector



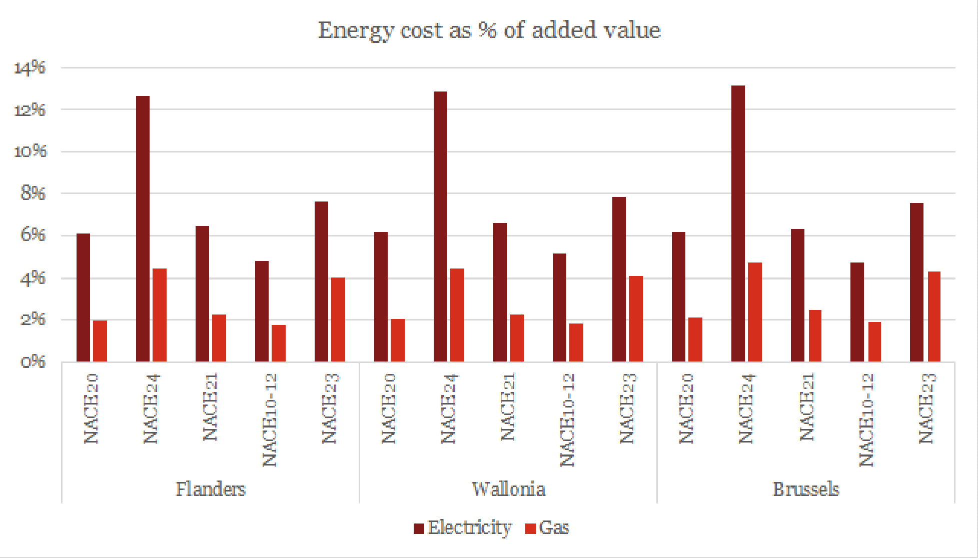
Source: Federal Planning Bureau, Eurostat, PwC Calculations

Combining the sector and region specific electricity and gas prices with the energy intensity figures results in a measure that represents the electricity or gas cost as a percentage of added value (presented in Figure 45). These are retrieved according to the following formulas:

$$\begin{aligned}&\textbf{Electricity cost for Sector } \boldsymbol{i} \textbf{ in Region } \boldsymbol{j} \ (\% \textbf{ of added value}) \\ &\quad = \boldsymbol{P_{elec}} \textbf{ for Sector } \boldsymbol{i} \textbf{ in Region } \boldsymbol{j} \\ &\quad * \textbf{Energy intensity } (\textbf{electricity}) \textbf{ for } \textbf{Sector}_{\boldsymbol{i}}\end{aligned}$$

$$\begin{aligned}&\textbf{Gas cost for Sector } \boldsymbol{i} \textbf{ in Region } \boldsymbol{j} \ (\% \textbf{ of added value}) \\ &\quad = \boldsymbol{P_{gas}} \textbf{ for Sector } \boldsymbol{i} \textbf{ in Region } \boldsymbol{j} * \textbf{Energy intensity } (\textbf{gas}) \textbf{ for } \textbf{Sector}_{\boldsymbol{i}}\end{aligned}$$

Figure 45 – Energy cost as % of added value



Source: Federal Planning Bureau, Eurostat, PwC Calculations

From Figure 45 it is apparent that, although gas is relatively more consumed (see Figure 46) in the production process than electricity, its cost as a percentage of the added value is much lower than for electricity. This is caused by the relatively low gas prices in comparison with those of electricity and the fact that the consumption of gas per euro of added value is just slightly higher than that of electricity. Furthermore, it is observed that the electricity cost per added value is highest for the NACE 24 (because of E4 predominance) and NACE-23 sectors (E3 predominance) in all regions, while the energy cost in general is lowest for the NACE 10-12 sectors in all regions (because of E2 predominance).

As stated above, in Germany, France and the Netherlands, certain industrial consumers can apply for reductions or exemptions in their energy taxes, based on national criteria. Most of these criteria are linked to the cost of energy expressed as a percentage of added value (see Table 4). For example, in Germany, the criteria to benefit from a lower tax scheme is an electricity cost higher than 17% of the added value. Although clear from Figure 45, no sectors in Belgium attain an electricity cost higher than 17% on a sector-wide level, as these are aggregate figures that hide information on the level of the industrial consumer. However, some individual industrial consumers could have a higher electro-intensity than the average and hence have to compete with consumers that qualify as electro-intensive in the neighbouring countries. For those energy-intensive companies, as we will see in the next section, there could be a substantial disadvantage vis-à-vis their German competitors.

9.1.3 Weighted energy cost differences

The sector and region specific electricity and gas price differences retrieved in section 9.1.1 are useful as they make it possible to compare electricity and gas prices for a certain sector and region with the European average. However, they cannot teach us whether the energy cost as a whole is advantageous or not. This depends on the amount of electricity and gas that is consumed throughout the production process. As this information is publicly available, we will outlay in this section how we can combine the electricity and gas price differences with the consumption volumes of both energy types in one single measure: the weighted energy cost difference. This measure makes it possible to compare the overall energy cost within a certain sector and region with the European average. If an industrial consumes a lot of electricity and almost no gas during the process, most likely the prices of electricity will have a large impact on the energy bill. The weighted energy cost difference is calculated according to the following formulas:

$$\textit{Energy cost difference for Sector}_i \textit{ in Region}_j \left(in \frac{€}{MWh}\right) = \frac{(\textit{European average of } P_{elec} \textit{ for Sector}_i * X_{ij}) * C_i + (\textit{European average of } P_{gas} \textit{ for Sector}_i * Y_{ij})}{C_i + 1}$$

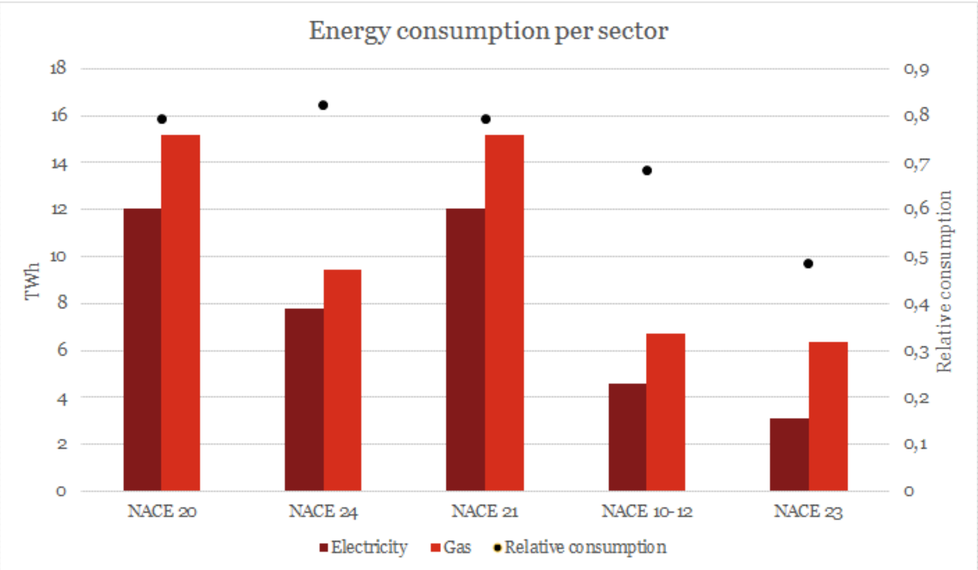
$$\textit{European average of } P_{energy} \textit{ for Sector}_i = \frac{(\textit{European average of } P_{elec} \textit{ for Sector}_i) * C_i + \textit{European average of } P_{gas} \textit{ for Sector}_i}{C_i + 1}$$

$$\textit{Weighted energy cost difference for Sector}_i \textit{ in Region}_j \ (in\ \%) = \frac{\textit{Energy cost difference for Sector}_i \textit{ in Region}_j}{\textit{European average of } P_{energy} \textit{ for Sector}_i}$$

The relative consumption (C_i) used in the first equation to calculate the energy cost difference is the ratio between the total volume of electricity and gas consumed in every sector and represents which of the two energy types are most intensively being used during the production process. It is calculated based on macro-economic data from the energy consumption accounts we retrieved for every sector (Federal Planning Bureau). An overview of the relative consumption per sector can be found in Figure 46.

The volume of each energy type consumer per sector is presented on the left axis, while the relative consumption (amount of electricity divided by the amount of gas) is presented on the right axis. It is apparent that all of the top 5 most important sectors have a relative consumption less than 1, meaning that all of the top 5 most important sectors consume more gas then electricity during the production process. For NACE 24, the consumption is relatively balanced (relative consumption of 0.82), but within the NACE 23 sector, almost twice as much gas is consumed (relative consumption of 0.48). Please note that for the chemical (NACE 20) and the pharmaceutical (NACE 21) sectors the same consumption figures has been used because of lack of more detailed data (see section 3).

Figure 46 – Energy consumption per sector



Source: Federal Planning Bureau, PwC calculations

The relative consumption plays a significant role in calculating the weighted energy cost differences, as the lower the value for c_i is (the more gas is being consumed in relation to electricity during the production process), the higher will be the importance of gas prices in the total energy cost and in the calculation of the weighted energy cost differences.

The results of the electricity and gas price differences for both electro-intensive as non-electro-intensive consumers and the calculation of the weighted energy cost differences are presented in Table 5. These electricity and gas price differences have been calculated for the whole sector. As they are presented on a macro level, it is possible that they will hide important differences between industrial consumers within a sector.

Table 5 – Results for every industrial sector in Flanders, Wallonia and Brussels when compared to the average prices in Germany, France, the Netherlands and the UK

Region	Sector	Electricity price difference (electro-intensive)	Electricity price difference (non-electro-intensive)	Gas price difference	Relative Consumption	Weighted energy cost difference (electro-intensive)	Weighted energy cost difference (non-electro-intensive)
Flanders	NACE20	2,1%	-25,7%	-13,2%	0,79	-2,2%	-23,0%
	NACE24	-0,9%	-28,2%	-14,4%	0,82	-4,8%	-25,1%
	NACE21	6,1%	-22,5%	-16,8%	0,79	-1,0%	-21,1%
	NACE10-12	5,3%	-21,9%	-16,8%	0,68	-1,7%	-20,6%
	NACE23	6,0%	-22,5%	-14,4%	0,48	-2,0%	-19,9%
Wallonia	NACE20	3,8%	-24,4%	-12,8%	0,79	-0,8%	-21,9%
	NACE24	0,2%	-27,4%	-13,8%	0,82	-3,8%	-24,3%
	NACE21	8,2%	-20,9%	-16,0%	0,79	0,8%	-19,7%
	NACE10-12	13,7%	-15,6%	-16,0%	0,68	4,2%	-15,7%
	NACE23	8,3%	-20,7%	-13,8%	0,48	-0,4%	-18,5%
Brussels	NACE20	3,5%	-24,7%	-8,4%	0,79	0,1%	-21,1%
	NACE24	2,8%	-25,5%	-8,9%	0,82	-0,6%	-21,8%
	NACE21	3,7%	-24,3%	-9,9%	0,79	-0,5%	-20,7%
	NACE10-12	3,5%	-23,2%	-9,9%	0,68	-0,8%	-19,8%
	NACE23	4,4%	-23,7%	-8,9%	0,48	-0,9%	-18,9%

Source: Federal Planning Bureau, CREG, PwC calculations

(green)	**Competitive advantage**
(red)	**Competitive disadvantage**

The conclusions are very important. For the largest part of sectors, industrial consumers competing with electro-intensive competitors in Germany, France, the Netherlands and the UK, have a limited competitive advantage (green cells) on the energy component between 0,4% and 4,8%, except the NACE 21 and NACE 10-12 sectors in Wallonia and the NACE 20 sector in Brussels, where the disadvantage ranges between 0,1% and 4,2%.

For industrial consumers in the three Belgian regions that compete with non-electro intensive competitors in Germany, France, the Netherlands and the UK, the situation is very different and remains competitive across the board. This conclusion can also be drawn based on Figure 47. A positive percentage symbolizes a price level higher than in the average of the neighbouring countries, and hence a competitive disadvantage

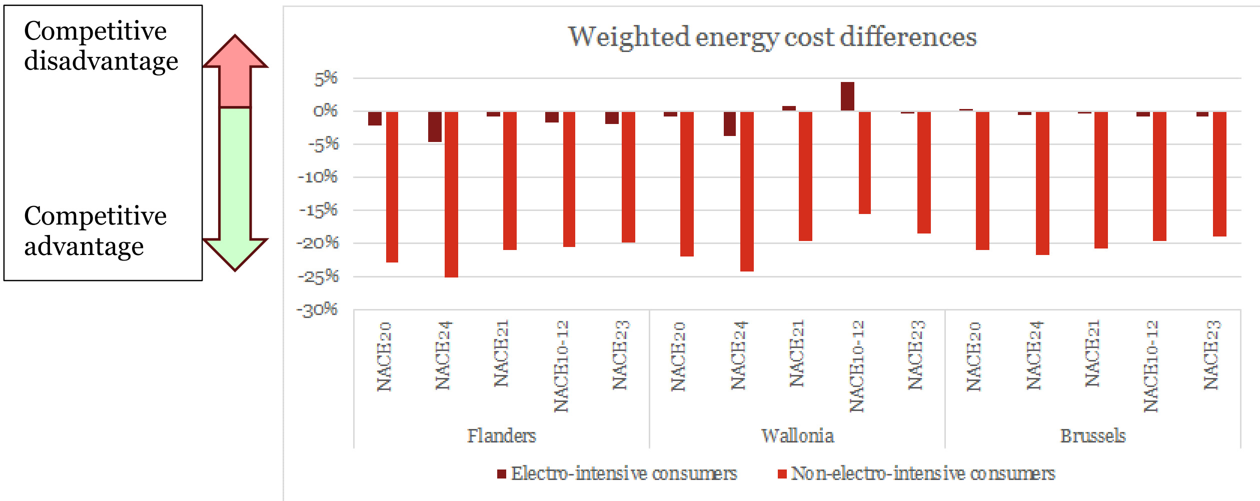


Figure 47 – Weighted energy cost differences for electro-intensive and non-electro intensive consumers

Source: Federal Planning Bureau, CREG, PwC Calculations

As can be observed from Figure 47, there is a slight variation within the regions and sectors regarding the weighted energy cost differences when comparing for electro-intensive consumers. First of all, it is apparent that the situation in Flanders is slightly better than in Wallonia, as for every sector prices are on average higher in Wallonia. Both in Flanders and Wallonia, the basic metal sector (NACE 24) has the most advantageous weighted energy cost. This is mainly due to the importance of the E4 profile –that is the most competitive one for all Belgian regions – within the NACE 24 sector. In Wallonia, the NACE 10-12 sector has the most disadvantageous weighted energy cost, because the more expensive profiles E1 and E2 are relatively well presented in that sector. In Brussels, every sector suffers from a slight advantage regarding energy costs, except the NACE 20 sector.

Weighted energy cost differences for non-electro-intensive consumers are substantial and negative (advantageous) for all regions and sectors in Belgium. When comparing with non-electro-intensive consumers in neighbouring countries, weighted energy prices in Belgium are between 15,7% and 25,1% below the average of the neighbouring countries.

9.1.4 Weighted energy cost differences when excluding the UK

The comparison of energy prices in the Belgian regions to the average of the four neighbouring countries under review brushes over part of the complexity of the results that were shown in section 7 and 8. Most importantly, we have observed that the UK was a distinct outlier at the high end for all four consumer profiles for electricity. As a consequence, it is interesting as well as relevant to do the same exercise in terms of total energy prices differences between the Belgian regions and a basket of neighbouring countries, but excluding the UK from that basket.

As one could expect, when excluding the UK from the price comparisons, the situation is very different. Both for the electro-intensive and non-electro-intensive consumers, the competitiveness of the three Belgian regions in terms of electricity price deteriorates compared to a situation where the UK is part of the basket of neighbouring countries. For gas prices, the impact is less important and opposite: when excluding the UK from picture, the average of gas prices in the neighbouring countries increases slightly, which improves the competitiveness of Belgian industry.

The results when comparing for (non-)electro-intensive consumers can be found in Table 6 below. The weighted energy cost differences for electro-intensive consumers and non-electro-intensive consumers can be found in Figure 48 and Figure 49.

Table 6 – Results for every industrial sector in Flanders, Wallonia and Brussels when compared to the average prices in Germany, France and the Netherlands

Region	Sector	Electricity price difference (electro-intensive)	Electricity price difference (non-electro-intensive)	Gas price difference	Relative Consumption	Weighted cost difference (electro-intensive)	Weighted energy cost difference (non-electro-intensive)
Flanders	NACE20	23,5%	-23,1%	-13,1%	0,79	11,8%	-20,8%
	NACE24	20,6%	-25,5%	-14,5%	0,82	9,0%	-22,9%
	NACE21	27,3%	-20,0%	-17,6%	0,79	11,6%	-19,4%
	NACE10-12	24,1%	-19,8%	-17,6%	0,68	9,1%	-19,2%
	NACE23	27,3%	-19,9%	-14,6%	0,48	8,9%	-18,2%
Wallonia	NACE20	25,4%	-21,7%	-12,7%	0,79	13,3%	-19,7%
	NACE24	21,9%	-24,6%	-13,9%	0,82	10,1%	-22,1%
	NACE21	29,7%	-18,3%	-16,8%	0,79	13,5%	-18,0%
	NACE10-12	33,9%	-13,4%	-16,8%	0,68	15,7%	-14,3%
	NACE23	29,9%	-18,1%	-14,0%	0,48	10,6%	-16,8%
Brussels	NACE20	25,2%	-22,0%	-8,3%	0,79	14,5%	-18,9%
	NACE24	25,2%	-22,7%	-9,1%	0,82	13,9%	-19,5%
	NACE21	24,5%	-21,8%	-10,8%	0,79	12,2%	-19,0%
	NACE10-12	21,9%	-21,2%	-10,8%	0,68	10,2%	-18,4%
	NACE23	25,3%	-21,2%	-9,1%	0,48	10,2%	-17,2%

Source: Federal Planning Bureau, CREG, PwC calculations

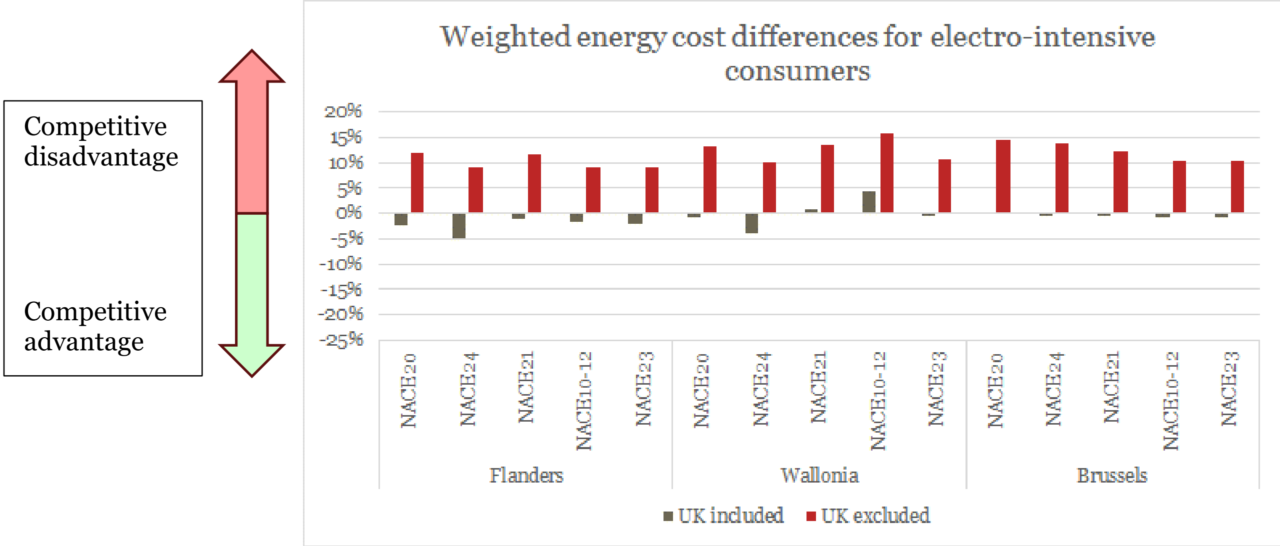
(green)	**Competitive advantage**
(red)	**Competitive disadvantage**

The conclusions are very important. For industrial consumers in the three Belgian regions, competing with electro-intensive competitors in Germany, France and the Netherlands, the situation in terms of energy competitiveness is serious, with a competitive disadvantage on the total energy cost (gas and electricity) of 8,9% to 15,7%.

For industrial consumers in the three Belgian regions that compete with non-electro intensive competitors in Germany, France and the Netherlands, the situation is very different and remains competitive. Leaving the UK out of consideration has little impact on those consumers.

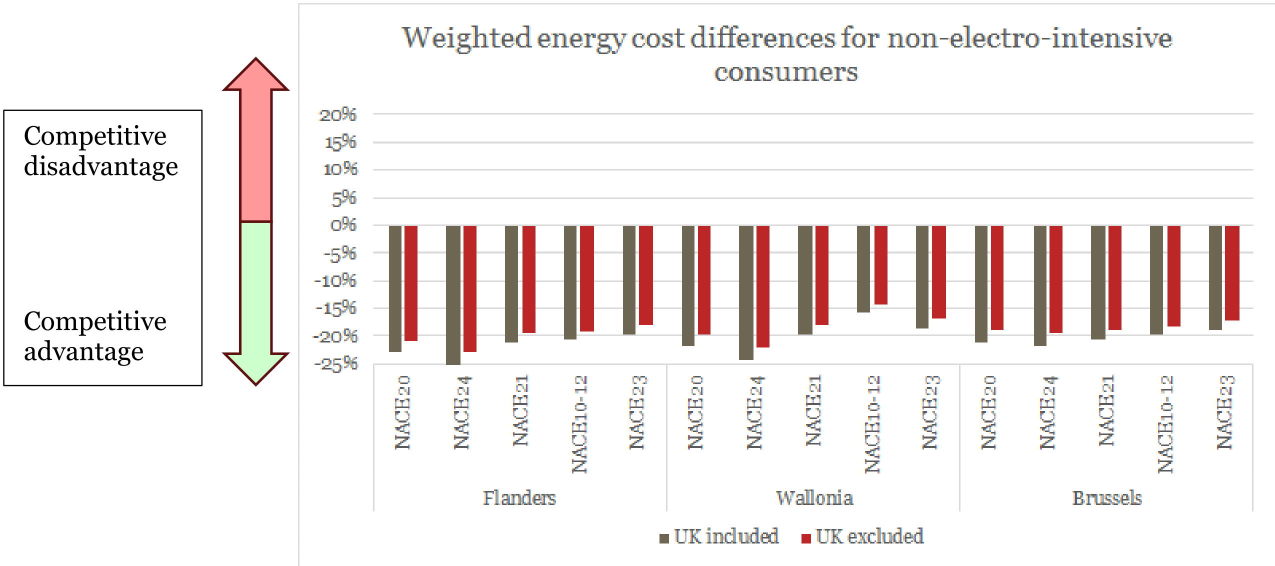
This conclusion can also be drawn based on Figure 48 and Figure 49: removing the UK from the comparison allows in the first place to draw a very different and stark picture for electro-intensive consumers. For the non-electro-intensive consumers the weighted energy cost differences show just a slightly worse situation when excluding the UK.

Figure 48 – Weighted energy cost differences for electro-intensive consumers



Source: Federal Planning Bureau, CREG, PwC Calculations

Figure 49 – Weighted energy cost differences for non-electro-intensive consumers



Source: Federal Planning Bureau, CREG, PwC Calculations

9.2. Conclusions and recommendations

Conclusions on competitiveness of the economy

We can draw a certain amount of important conclusions from this analysis of the total energy cost. Even though it is necessary to apply caution to the exact impact of these findings, given their strong reliance on a host of macro-level data, certain messages are very clear.

1. The most striking conclusion in terms of energy competitiveness is that the situation for all important industrial sectors in Belgium is **less beneficial when they compete with electro-intensive consumers** in neighbouring countries, than when they compete with non-electro intensive consumers in neighbouring countries.

   Even when taking the UK (high outlier) out of the equation, industrial consumers in Belgium that compete with non-electro intensive consumers in the neighbouring countries have a clear competitive advantage in terms of total energy cost (gas and electricity combined). For industrial consumers that compete with counterparts in neighbouring countries that benefit from reductions for electro-intensive consumers, the situation is totally opposite. Their total energy cost constitutes an important competitiveness problem, certainly when compared to Germany, France and the Netherlands. When including the UK in the comparison, for some sectors there is even a slight competitive advantage.

2. The **impact of the relatively low gas cost** for industry in Belgium - that we observed in section 7 and 8 - on total energy cost for industrial consumers is **fairly limited**. Even though some sectors consume twice as much natural gas as electricity (such as NACE 23, other non-metallic mineral products), the lower cost per energy unit of natural gas makes that electricity plays the determining role in the total energy cost competitiveness.

3. The situation in the **Walloon region** in terms of total energy cost for industry is generally **less favourable** than in **Flanders**. This is most striking for industrial sectors with an important amount of smaller industrial electricity consumers (E1-E2), such as the food and beverages sector (NACE 10-12).

Recommendations

The competitiveness problem on total energy cost that we observe in this report applies to electro-intensive industrial consumers across all sectors and across all regions. As we have shown in section 7 and 8 of this report, its origin lies in the electricity cost, and in the three components of the electricity cost: commodity prices, grid fees (mainly due to reductions granted in Germany and the Netherlands) and taxes/surcharges/green certificate schemes.

In terms of policy recommendations, the most direct and palpable impact can be exerted on the third component: taxes/surcharges/green certificate schemes. At this moment, in the three regions, important efforts are done in terms of mitigating the impact of taxes, surcharges on competitiveness. As opposed to France, Germany and the Netherlands, this is generally done without taking into account the electro-intensity of the industrial consumers. As shown in annex A to this report, the quantity of off taken electricity is the only important criteria – apart from the energy efficiency agreement - that is used on the federal level (federal contribution, offshore) and on the regional level (green certificate quota, public service obligations) to protect the competitiveness of electricity cost for industrial consumers.

In other words, from a fiscal point of view, Belgian federal and regional authorities mainly grant reductions and/or exemptions to taxes, levies and certificate schemes based on the level of electricity offtake, and not on the level of electro-intensity of an industrial consumer.

This leads to important competitive advantages for companies that compete with non-electro intensive consumers in France and certainly Germany, while at the same time these reductions cannot sufficiently impact the total energy cost to protect electro-intensive industrial consumers from the competition of their electro-intensive counterparts in France, the Netherlands and Germany.

Our economic impact analysis leads us to support this analysis: **tax revenues are directed toward protecting consumers that are not particularly affected by a lack of competitiveness of electricity prices, while more vulnerable consumers suffer from an important disadvantage compared to their electro-intensive competitors in neighbouring countries.**

It is hence very interesting to reflect upon the possibility of adapting the present tax reductions for industrial consumers that have been put in place by federal and regional governments. The general objective should be to generate an evolution toward more competitive total energy prices for electro-intensive industrial consumers, while preserving (part of) the present competitive advantage for non-electro intensive consumers.

Annex A of this report offers a thorough insight in the large realm of possibilities that policy makers have at their disposal to target electro-intensive consumers. We would like to mention several points and guidelines that should be taken into consideration:

1. In the Belgian case, given the competitive gas prices, it seems important to focus on electro-intensity, and not energy-intensity as a whole.

2. The introduction of electro-intensity criteria can be combined with digressive rates for large non-electro intensive consumers (similar to what exists presently).

3. Introducing too many layers of different access criteria and reduction levels (as is the case for the CSPE-tax in France and the EEG-Umlage in Germany) can negatively influence the evaluation of the effectiveness of the measures. It can also lower the predictability of fiscal revenue.

4. One should be aware of possible negative side-effects. Granting access to certain reductions based on the amount of full load hours per year (as is the case for grid fee reductions in Germany) can have the adverse effect of discouraging the development of demand response.

Appendix

Appendix: Industry reduction criteria

As an annex to this report, we present the catalogue of criteria that can grant the possibility to reductions on transport tariffs, taxes, levies and certificate schemes for certain (groups of) electricity and gas consumers.

Electricity

Country/Zone	Criteria	Reduction
Belgium	Annual consumption (condition: energy efficiency agreement)	Progressive reductions on federal contribution and offshore surcharge: - 20-50 MWh/year : -15% - 50-1.000 MWh/year : -20% - 1.000-25.000 MWh/year : -25% - >25.000 MWh/year : -45% Capped at 250.000 euro/year.
Belgium (Flanders)	Annual consumption	Progressive reductions of the financing measures for renewable energy and cogeneration: - 1.000-20.000 MWh/year: -47%* - 20.000-100.000 MWh/year: -80% -100.000-250.000 MWh/year:-80% - >250.000 MWh: -98% * only for industry (NACE 5-33) and deep frost alimentary (46391 and 52100).
	Annual consumption	Progressive reductions of the renewables quota: - 1.000-20.000 MWh/year: -40%* - 20.000-100.000 MWh/year: -75% -100.000-250.000 MWh/year:-80% - >250.000 MWh: -98% * only for industry (NACE 5-33) and deep frost alimentary (46391 and 52100).
	Annual consumption	Progressive reductions of the combined heat-power quota:

		- 1.000-5.000 MWh/year: -10%* - 5.000-20.000 MWh/year: -15% - 20.000-100.000 MWh/year: -25% -100.000-250.000 MWh/year:-50% - >250.000 MWh: -80% *only for industry (NACE 5-33) and deep frost alimentary (46391 and 52100).
Belgium (Wallonia)	Annual consumption (condition: energy efficiency agreement)	Progressive reductions of the renewables quota[98]: - < 20.000 MWh/year: -25% - 20.000-100.000 MWh/year: -50% -100.000-300.000 MWh/year:-85% - >300.000 MWh/year: -90%
	Annual consumption	Connection fee (base rate: 0,75€/MWh) has two reduced tariffs for high voltage clients: - clients < 10 GWh/year: 0,6€/MWh - clients > 10 GWh/year: 0,3€/MWh
Germany	Annual consumption + consumption hours	Reduction on the transmission tariff apply for all companies that exceed 10 GWh/year, if annual consumption hours exceed: - more than 7000 hrs/year: :- 80% - more than 7500 hrs/year : -85% - more than 8000 hrs/year: -90%
	Annual consumption + electricity cost/turnover	The combined heat and power surcharge (KWK-Umlage) has a base rate of 4,45 €/MWh. For users with an annual consumption that exceeds 0,1 GWh/year two reduced rates exists: - If electricity cost > 4% turnover: 0,3 €/MWh - If electricity cost is < 4% turnover: 0,4 €/MWh
	Annual consumption + electricity cost/turnover	The StromNEV §19 – Umlage has a base rate of 3,78 €/MWh. It is applicable to the first GWh consumed on an annual basis. For consumption that exceeds 1 GWh/year two rates exists: - If consumption > 1GWh/year: 0,5 €/MWh - If consumption > 1 GWh/year and the consumer is part of the manufacturing industry with electricity cost > 4% of turnover in 2015: 0,25 €/MWh

[98] The Walloon reductions are attributed on the basis of three month periods of consumption. We transposed them to a yearly basis in order to facilitate comparison.

	Annual consumption + Electricity cost/ gross value creation	The eEG-Umlage has a base rate of 63,54 €/MWh. For an extensive list of industrial sectors with electricity cost >17% of gross value creation in 2015 and for a less extensive list of industrial sectors with electricity cost >20% of gross value creation in 2015 the following reductions exist: - 9,53 €/MWh if consumption is above 1 GWh/year, but capped at › 0,5% of gross value creation (average last 3 years) for all consumers with electricity cost >20% of gross value creation › 4,0% of gross value creation (average last 3 years) for all consumers with electricity cost <20% of gross value creation However, for the reduction, a bottom rate of 0,5 €/MWh applies for several industrial sectors, and of 1,0 €/MWh for all other industrial sectors.
	Pension contributions + sector criteria	The Stromsteuer (Electricity tax) in Germany has a base rate of 20,5€/MWh, and a lowered rate of 15,37 €/MWh for all industrial companies. Further reductions are attributed based on the amount of pension contributions a company pays: the fewer pension contributions (on which the state has given some reductions) a company pays, the more right it has to reductions on the Electricity tax. The maximum reduction is 90%. A company that uses electricity as a raw material is exempted from the tax.
	Annual consumption + electricity cost/turnover	The Offshore liability overload is a digressive levy to pay for offshore wind power generation units. Different rates apply to different bands of total electricity consumption: - For consumption less than or equal to 1 GWh/year: 0,4 €/MWh - For consumption above 1 GWh/year: 0,27 €/MWh - For consumption above 1 GWh/year and manufacturing industry with electricity cost >4% of turnover in 2015: 0,25 €/MWh
	Electricity cost	For the Concession fee (Konzessionsabgabe) on electricity, all industrial consumers benefit from a basic rate of 1,1 €/MWh. If an industrial consumer's total electricity bill is below an annually fixed threshold (2016: €132,27/MWh) it is exempted from the Concession fee. In other words: companies that pay the full rate on the eEG-Umlage will almost certainly pay the concession fee as well. The Concession fee can be seen as an amplifier of other reduction.
France	Annual consumption	The CSPE-surcharge has a base rate of 22,5€/MWh. Three reductions apply, based on consumption criteria: 1. For electro-intensive consumers where the CSPE would have been (without reductions and exemptions) at least equal to 0,5% of added value, the CSPE is equal to:

		- for consumers consuming above 3 kWh per euro of added value, CSPE is equal to 2 €/MWh - for consumers consuming between 1,5 and 3 kWh per euro of added value, CSPE is equal to 5 €/MWh - for consumers consuming below 1,5 kWh per euro of added value, CSPE is equal to 7,5 €/MWh 2. For very electro-intensive consumers, the tariff amounts to 0,5 €/MWh. To be very electro-intensive, consumers must satisfy both conditions: - its energy consumption represents more than 6 kWh per euro of added value; - its activity belongs to a sector with a high trade intensity with third countries (> 25%). 3. Sectors with a high risk of carbon leakage are metallurgy, electrolysis, non-metal minerals or chemical sectors. For electro-intensive consumers described under (i) above with a high risk of carbon leakage linked to indirect carbon emissions, the CSPE amounts to : - for consumers consuming above 3 kWh per euro of added value, CSPE is equal to 1 €/MWh ; - for consumers consuming between 1,5 and 3 kWh per euro of added value, CSPE is equal to 2,5 €/MWh ; - for consumers consuming below 1,5 kWh per euro of added value, CSPE is equal to 5,5 €/MWh.
	Grid level	The "Contribution tarifaire d'acheminement" (CTA) for electricity is a surcharge for energy sector pensions. It amounts to 27,07% of the fixed part of the transport tariff for consumers connected to the distribution grid. One reduction applies, based on grid level criteria: - For consumers connected directly to the transmission grid or those who are connected to the distribution grid on or above 50 kV, the CTA amounts to 10,14 % of the fixed part of the transmission tariff.
The Netherlands	Annual (off-peak) consumption	A substantial reduction ("volumecorrectie") on transport tariffs is granted to large baseload consumers when they meet both criteria - Annual consumption > 50 GWh/year - Annual off peak consumption > 65% of all 2920 annual off-peak hours Reductions are incremental and cannot exceed 90%
	Annual consumption	The energy tax is a digressive tax: - 0 to 10 MWh/year: 100,7 €/MWh - 10 to 50 MWh/year: 49,96 €/MWh - 50 to 10.000 MWh/year: 13,31 €/MWh

		above 10.000 MWh/year: 0,53 €/MWh
	Annual consumption	The ODE-levy is a digressive levy: - 0 to 10 MWh/year: 5,6 €/MWh - 10 to 50 MWh/year: 7 €/MWh - 50 to 10.000 MWh/year: 1,9 €/MWh above 10.000 MWh/year: 0,084 €/MWh
UK	Energy efficiency	The Climate Change Levy has a base rate of 7,342 €/MWh. When users have signed up to a Climate Change Agreement (sectoral or individual), they obtain a 90% reduction.

Gas

Country/Zone	Criteria	Reduction
Belgium	Annual consumption	Progressive reductions on federal contribution (0,6309 €/MWh) - 20-50 GWh/year : -15% - 50-250 GWh/year : -20% - 250-1.000 GWh/year : -25% - 1.000 GWh/year : -45% Annual cap of 750.000 €/year by consumption site.
	Energy efficiency + sector criteria	Energy contribution with a base rate of 0,9978 €/MWh. Companies part of an energy efficiency agreement pay 0,54 €/MWh. Companies that use natural gas as a raw material are totally exempted.
Belgium (Wallonia)	Annual consumption	Digressive rates apply to the connection fee in the Walloon region. For the first 100 kWh, the rate is 7,5 EUR/MWh for all consumers. Above that base rate, different rates apply to different consumers: - 0,75 EUR/MWh for consumers with an annual consumption below 1 GWh - 0,06 EUR/MWh for consumers with an annual consumption from 1 to 10 GWh - 0,03 EUR/MWh for consumers with an annual consumption equal to or above 10 GWh
Germany	Pension contributions + sector criteria	The Energiesteuer (Energy tax) on gas in Germany has a base rate for industrial use of 5,5€/MWh, and a standard reduction to 4,12 €/MWh. Further reductions are attributed based on the amount of pension contributions a company pays: the fewer pension contributions (on which the state has given some reductions) a company pays, the more right it has to reductions on the Energy tax. The minimum rate is 2,07 €/MWh. When a company uses natural gas for purposes other than fuel or heating, it is exempted from the Energy tax on gas.
	Annual consumption	The Biogas Levy is a nationwide standard biogas levy since January 1, 2014. This Biogas levy for 2016 amounts to approximately 0,59458 EUR/(kWh/h)/a.
France	Carbon market participation + sector criteria	The TICGN tax has a base rate of 4,34 €/MWh. Companies that participate in the carbon market and that are energy intensive can pay a reduced rate: 1,52 €/MWh ;

		Companies that belong to a sector with a high risk of carbon leakage and that are energy intensive can pay a reduced rate: 1,6 €/MWh . Companies that do not use natural gas as a fuel (for example as a raw material) are exempted from the TICGN.
	Grid level	The “Contribution tarifaire d’acheminement” (CTA) is a surcharge for energy sector pensions. For clients connected to the distribution grid, the CTA amounts to 20,8% of the fixed part of the transmission tariff. One reduction applies: - For clients directly connected to the transmission grid, the CTA amounts to 4,71% of the fixed part of the transmission tariff.
The Netherlands	Annual consumption + sector criteria	The energy tax is a digressive tax: - 0 to 170.000 m³/year: 0,25168 €/m³ - 170.000 to 1.000.000 m³/year: 0,06954 €/m³ - 1.000.000 to 10.000.000 m³/year: 0,02537 €/m³ - above 10.000.000 m³/year: 0,01212 €/m³ Companies that do not use natural gas as a fuel (for example as a raw material) are exempted from the energy tax.
	Annual consumption + sector criteria	The ODE levy is a digressive tax: - 0 to 170.000 m³/year: 0,0113 €/m³ - 170.000 to 1.000.000 m³/year: 0,0042 €/m³ - 1.000.000 to 10.000.000 m³/year: 0,0013 €/m³ - above 10.000.000 m³/year: 0,0009 €/m³ Companies that do not use natural gas as a fuel (for example as a raw material) are exempted from the energy tax and the ODE Levy.
UK	Energy efficiency + sector criteria	The Climate Change Levy has a base rate of 2,6 €/MWh for natural gas (January 2016). When users have signed up to a Climate Change Agreement (sectoral or individual), they obtain a 35% reduction. Companies that do not use natural gas as a fuel (but for example as a raw material) are exempted from the climate change levy on gas.