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

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Executive Summary

1. Executive Summary

1.1. Executive Summary – English

In this updated report, 2017 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 results for 2017 are compared to the results rendered by the 2016 price comparison that was published by CREG on June 29th 2016.**[1] The comparison looks at three components of the bill: commodity cost, network cost and all other costs: taxes, levies, certificate schemes.

The **consumer profiles** were composed based on a thorough analysis (published last year) of the industrial fabric of the Belgian regions, with extended stakeholder input. Consumer profiles E1 and E2 represent industrial electricity consumers with an annual consumption of respectively 10 and 25 GWh. Consumer profiles E3 and E4 represent very large industrial electricity 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 price comparison is preceded by an **elaborate description** of the build-up 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).

Results in 2017 are very similar to 2016 results, and most general conclusions still hold. The lowest electricity cost for consumer profiles E1 and E2 can still be found in the Netherlands, while Germany still 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 generally linked to electro-intensity, 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.

Compared to 2016, the German (increased renewable surcharge) and French (increased commodity cost) industrial consumers – especially those that cannot benefit from the reductions for electro-intensive – see their comparative competitive position deteriorate slightly.

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. While power market indices in all countries but the Netherlands have gone up compared to 2016, Germany keeps a sizeable competitive advantage on the other countries in terms of electricity commodity cost, while gas

[1] The 2016 report is available on the CREG website:
http://www.creg.info/pdf/Divers/20160629-EnergyPrices-FinalReport.pdf

market prices remain 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 for 2017 are mixed and generally very similar to 2016. 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 remains most important for profiles E1 and E2, where the electricity cost is substantially higher in the Walloon region (even though the gap for E1 and E2 has been reduced due to the *Vlaamse Energieheffing* on the distribution grid). 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 offered the lowest cost of all countries under review in 2016, except when comparing to feedstock consumers in the Netherlands for profile G2. In 2017, this is still the case, with two minor evolutions. Firstly, the gap between the Netherlands and Belgium for profile G2 feedstock consumers has widened due to changes in market prices for gas. These market price changes have also pushed the Brussels region to become more expensive than the Netherlands for non-feedstock consumers, which limits the applicability of our 2016 conclusion (Belgium offers the lowest cost of all countries for non-feedstock consumers) to the Flemish and Walloon regions.

In **a last chapter**, 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. For this part of the study, our 2016 conclusion still applies for 2017.

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 – in 2016 as well as 2017 –part of the tax revenues in Belgium 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.

In 2016, we wrote that 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 in Belgium. 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.

A series of simulations on Belgian industrial consumers that PwC conducted at the demand of the CREG (in response to a demand by the federal Minister of Energy) in November 2016 suggest that governments – through the European Commission Framework EEAG – have a wide range of opportunities where choices have to be made on three levels:

1) The level of competitiveness for electro-intensive companies
2) The level of competitiveness for non-electro-intensive companies
3) The cost of reductions for the government budget, knowing that renewable cost will be rising

1.2. Executive Summary – Nederlands

In deze jaarlijkse updatestudie voor 2017 worden de energieprijzen voor zes industriële verbruikers (vier in elektriciteit en twee in aardgas) vergeleken tussen 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 resultaten voor 2017 worden vergeleken met de resultaten van de prijsvergelijking van 2016, door de CREG gepubliceerd op 29 juni 2016.[2] De vergelijking behandelt de drie componenten van de eindfactuur: commodity, netwerk en alle andere kosten: belastingen, toeslagen en certificaatsystemen.

De **consumptieprofielen** werden opgesteld op basis van een diepgaande analyse (vorig jaar gepubliceerd) van het industrieel weefsel van de Belgische gewesten, met uitgebreide input van stakeholders. Consumptieprofielen E1 en E2 vertegenwoordigen industriële elektriciteitsverbruikers met een jaarlijkse consumptie van respectievelijk 10 en 25 GWh. Consumptieprofielen E3 en E4 daarentegen vertegenwoordigen industriële grootverbruikers van elektriciteit 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 prijsvergelijking wordt voorafgegaan door een uitgebreide **beschrijving van de opbouw van de 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 bottom-up geanalyseerd en de verschillende componenten worden in detail beschreven 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).

Resultaten in 2017 zijn erg gelijkend met de resultaten voor 2016, en de meeste conclusies gelden nog steeds. We stellen vast dat Nederland nog steeds de laagste elektriciteitskost biedt voor consumptieprofielen E1 en E2, terwijl Duitsland nog steeds de laagste elektriciteitskost biedt voor E3 en E4. Het van toepassing zijn van de verschillende verminderingen op de netwerkkost en de belastingen in Nederland, Duitsland en Frankrijk, hangt immers af van een hele reeks specifieke economische criteria die in het algemeen gelinkt worden aan elektro-intensiteit, waardoor het resultaat een relatief breed spectrum beslaat. Hierdoor biedt Duitsland voor grootverbruikers die niet voldoen aan deze criteria ook de hoogste elektriciteitskost voor alle profielen in deze studie, gevolgd door het Verenigd Koninkrijk.

Vergeleken met 2016, zien Franse (verhoogde commodityprijs) en Duitse (verhoogde hernieuwbare toeslag) industriële grootverbruikers van elektriciteit, die niet kunnen genieten van verminderingen voor elektro-intensiteit, hun competitieve positie lichtjes achteruitgaan.

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. Hoewel marktindicatoren voor elektriciteit in alle landen – met uitzondering van Nederland – gestegen zijn ten opzicht van vorig jaar, heeft Duitsland een substantieel competitief voordeel ten opzichte van de andere landen qua commoditykost voor

[2] Het rapport 2016 is beschikbaar op de website van de CREG: http://www.creg.info/pdf/Divers/20160629-EnergyPrices-FinalReport.pdf

elektriciteit, terwijl de marktprijzen voor aardgas nog steeds grotendeels overeenkomen 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 de waaier 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.

De gemengde conclusies aangaande de competitiviteit van België voor 2017 komen overeen met deze van 2016. Voor alle industriële elektriciteitsverbruikers is er slechts één buurland minder competitief 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 blijven het grootst voor profielen E1 en E2, waarbij de elektriciteitskost substantieel hoger is in Wallonië (hoewel de kloof voor E1 en E2 verkleind is omwille van de invoering van de *Vlaamse Energieheffing* op het distributienet*)*. 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 was de conclusie in 2016 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. Dat is in 2017 nog steeds het geval, met twee kleine evoluties. Ten eerste is de kloof tussen Belgische en Nederlandse feedstock consumers voor profiel G2 toegenomen door lagere marktprijzen in Nederland. Ten tweede hebben die marktprijsevoluties er ook voor gezorgd dat het Brussels Gewest nu duurder is geworden dan Nederland, waardoor onze conclusie van 2016 (België biedt de laagste kost voor non-feedstock verbruikers) enkel nog van toepassing is op Vlaanderen en Wallonië.

In een **laatste hoofdstuk** worden sector- en regiospecifieke elektriciteits- en aardgasprijzen geanalyseerd op het vlak 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. Voor dit gedeelte van de studie gelden onze conclusies van 2016 nog altijd in 2017.

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 tamelijk 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 – zowel in 2016 als in 2017 – een deel van de belastinginkomsten in België 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.

In 2016 schreven we dat het daarom nuttig kon zijn om in België stil te staan bij een eventuele aanpassing van de huidige belastingvermindering voor industriële verbruikers die ingesteld zijn door de federale en gewestelijke regeringen. In het algemeen, schreven we, 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.

Een aantal simulaties op industriële verbruikers in België die door PwC werden uitgevoerd op vraag van de CREG (en in antwoord op een vraag van de federale Minister van Energie) in november 2016 toont aan dat regeringen door het EEAG framework van de Europese Commissie een brede waaier aan mogelijkheden hebben om in te grijpen, maar dat keuzes gemaakt moeten worden op drie niveaus:

1) Het competitiveitsniveau van elektro-intensieve bedrijven

2) Het competitiviteitsniveau van niet-elektro-intensieve bedrijven

3) De kost van de verminderingen voor de overheidsbegroting, in de wetenschap dat de kost van hernieuwbare energie nog zal stijgen

1.3. Executive Summary – Français

Dans ce rapport mis à jour pour 2017, 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. **Les résultats pour 2017 sont comparés aux résultats de 2016 qui avaient été publiés par la CREG le 29 juin 2016.**[3] 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.

Les **profils de consommation** ont été composés sur la base d'une analyse approfondie (publiée l'année passée) du tissu industriel des régions belges et avec l'apport d'informations complémentaires de parties prenantes. Les profils E1 et E2 représentent des consommateurs industriels d'électricité ayant une consommation annuelle de respectivement 10 et 25 GWh. Les profils E3 et E4 représentent des consommateurs industriels d'électricité 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 comparaison des prix est précédée par une **description élaborée des composantes** détaillées du prix et de la méthodologie suivie pour la comparaison. 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 résultats en 2017 sont très similaires aux résultats de 2016, et la grande majorité des conclusions vaut toujours. Les Pays-Bas présentent toujours les prix de l'électricité les plus faibles pour les profils E1 et E2 alors que l'Allemagne présente toujours 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 – généralement lié à l'électro-intensité - 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.

Comparé à 2016, les consommateurs industriels allemands (augmentation de la surcharge renouvelable) et français (augmentation du coût de la commodité) – voient une légère dégradation de leur situation compétitive, surtout pour les non-électro-intensifs.

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

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[3] Le rapport 2016 est publié sur le site de la CREG
http://www.creg.info/pdf/Divers/20160629-EnergyPrices-FinalReport.pdf

est cependant plus important pour l'électricité que pour le gaz. Pendant que les indices boursiers dans tous les pays (hormis les Pays-Bas) ont augmenté par rapport à 2016, l'Allemagne préserve son 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 restent 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 pour 2017 sont mitigées et généralement très similaires à 2016. 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 reste la plus importante pour les profils E1 et E2 pour lesquels le coût de l'électricité est sensiblement plus élevé en région wallonne, malgré une réduction de l'écart pour les profils E1 et E2 causé par l'introduction de la *Vlaamse Energieheffing*. 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 en 2016 offrait 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. En 2017, ceci est généralement toujours le cas, mais à nuancer avec deux évolutions mineures. Tout d'abord, l'écart entre les Pays-Bas et la Belgique pour les consommateurs profil G2 utilisant le gaz comme matière primaire s'est creusé à cause de l'évolution des prix de marché du gaz. Cette évolution entre les indices boursiers belges et néerlandais a également rendu la Région bruxelloise plus onéreuse que les Pays-Bas pour tous les consommateurs, limitant ainsi l'applicabilité de notre conclusion 2016 (la Belgique offre le coût le plus bas pour les consommateurs utilisant le gaz comme source de chaleur) à la Flandre et la Wallonie.

Dans un dernier chapitre, 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. Pour cette partie de l'étude, notre conclusion 2016 s'applique toujours pour 2016.

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 qu'en 2017 comme en 2016, une partie des recettes fiscales en Belgique est utilisée 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.

En 2016, on a écrit qu'il pourrait dès lors être utile de réfléchir à la possibilité d'une adaptation des réductions de surcharges actuelles qui ont été mises en place par les gouvernements fédéraux et régionaux et dont bénéficient les consommateurs industriels. L'objectif général, on écrivait, 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.

Une série de simulations par rapport à la consommation industrielle belge qui a été exécutée par PwC à la demande de la CREG en novembre 2016, en réponse à une demande de la Ministre fédérale de l'Energie, indique que les gouvernements – en utilisant le cadre EEAG de la Commission européenne – ont un large panel de possibilités pour intervenir, mais doivent faire des choix à trois niveaux :

1) le niveau de compétitivité requis pour les électro-intensifs

2) le niveau de compétitivité requis pour les non-électro-intensifs

3) le coût des réductions pour le budget de l'Etat fédéral, tout en sachant que les coûts du renouvelable vont augmenter

2. Introduction

2. Introduction

This report is an update of the previous report commissioned by the CREG, the Belgian federal regulator for Energy and Gas, published 29 June 2016[4]. 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. This report contains an update on the 2016 report, with electricity and gas prices observed in January 2017. 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 also pays special attention to reduction schemes that are beneficial to electro-intensive industrial consumers qualifying for certain criteria.

This report consists of three different sections.

The **first section** (described in chapter 3 to 5) 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, where we pay attention to certain trends regarding electricity and gas prices in Belgium and the neighbouring countries.

In the **second section** (described in chapter 6 and 7), 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 section** of this report, described in chapter 8, consists in a detailed analysis of the impact of the results from the first section 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 and their most important industrial sectors.

[4] The 2016 report can be found on the website of the CREG: http://www.creg.info/pdf/Divers/20160629-EnergyPrices-FinalReport.pdf

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 the first section 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. Description of the dataset

3. Description of the dataset

3.1. General Assumptions

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

1. *January 2017*. This study gives an overview of the price levels in January 2017.
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. Furthermore, we assume that all Belgian consumers have concluded a sectoral agreement whenever they had the possibility to do so.
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, except for the commodity price of electricity of the United Kingdom, which was 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 rates*. For the UK comparison, we have always used the January average exchange rate to convert from Pound Sterling to Euro (0,755 GBP/EUR for 2016 and 0,861 GBP/EUR for 2017).[5] The commodity cost formula was calculated entirely in Pound Sterling, and the final result converted to Euro at the January 2016 exchange rate for 2016 results and the January 2017 exchange rate for 2017 results.
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

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

review, we assume that electricity consumption (and invoicing) equals offtake.

3.2. Consumer profiles

		E1 (Electricity 1)	E2 (Electricity 2)	E3 (Electricity 3)	E4 (Electricity 4)
When?		January 2017	January 2017	January 2017	January 2017
Annual demand	MWh	10.000	25.000	100.000	500.000
Consumption profile		Baseload (working days only)	Baseload (working days only)	Baseload (including weekends)	Baseload (including weekends)
Consumption hours eq.*	h/year	5.000	5.000	7.692	8.000
Connection	kV	26-36	30-70	≥ 150	≥ 150
Grid operator		DSO (TransHS)	LTSO	TSO	TSO
Contracted capacity	kW	2.000	5.000	13.000	62.500

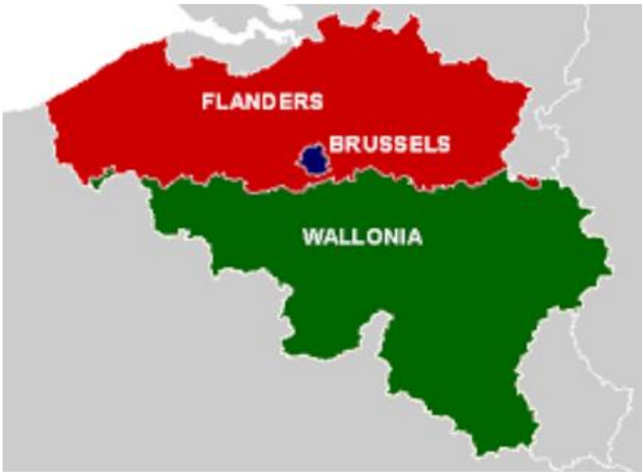
		G1 (Gas 1)	G2 (Gas 2)
When?		January 2017	January 2017
Annual demand	MWh	100.000	2.500.000
Consumption profile		Baseload	Baseload
Consumption hours eq.*	h/year	6.667	8.333
Grid operator		DSO (T6)	TSO
Contracted capacity	kW	15.000	300.000

* These are theoretical consumption hours, obtained by dividing the annual demand by the contracted capacity. Given the load profile described, E1 and E2 consume electricity during 6257 hours per year, while E3 and E4 consume during 8760 hours per year. G1 and G2 consume natural gas during 8000 (G1) and 8760 (G2) hours per year.

3.3. 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).

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). 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)[6]	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%**

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

[6] Figures from VREG

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' DSOs 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)[7]	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.

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 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

[7] Figures from CWAPE

Germany. As to taxes, levies and certificate schemes, we observe no regional differences for electricity consumers, not even for the local taxes[8].

On the German territory, four different TSOs 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 distribution system operators[9], 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.

[8] 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)*.

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

France

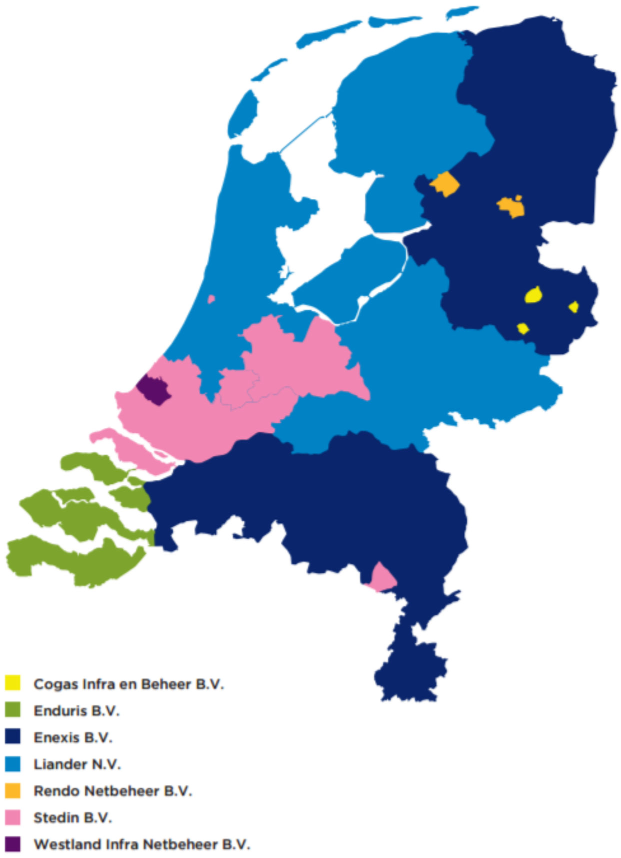
In terms of electricity market, France will be treated as one single zone. The same commodity cost, transmission tariffs (transmission tariffs in France start at a connection level of 1 kV and hence include all consumer profiles under review) and taxes and levies apply everywhere on the national territory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

The Dutch distribution network counts seven different DSOs[10] 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).



[10] Endinet Eindhoven has been integrated in Enexis as of 1st of January 2017.

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)[11]	Market share
Liander	2.938.787	36,27%
Enexis[12]	2.755.891	34,01%
Stedin	2.055.520	25,37%
Enduris	211.262	2,61%
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 almost 97%. Therefore their tariffs have a high impact on the weighted average for distribution tariffs for profiles E1 and E2.[13]

United Kingdom

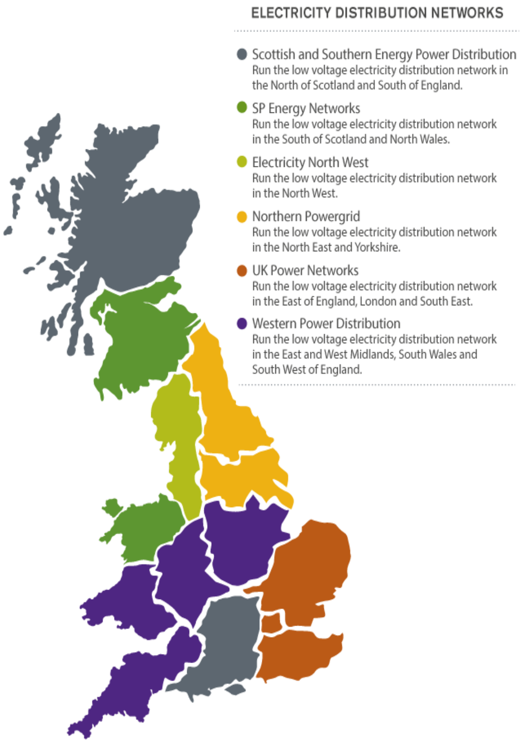
As is the case for France and the Netherlands, the United Kingdom will also be treated as one single zone in this study. In terms of commodity costs and taxes, levies and certificates schemes, no regional differences are observed: there is one single electricity market and the only taxes on electricity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

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

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.[14] The TSOs and DSOs all charge different tariffs in the same fourteen tariff zones in the UK (without Northern Ireland).

[11] The number of connections are those from 2014, collected by Netbeheer Nederland and Gasunie Transport Services. For more details see the Energietrends 2014 rapport.
[12] The number of connections of Endinet Eindhoven are added to those of Enexis.
[13] Cogas and Rendo do not provide electricity to consumers of profile E1, while Enexis, Liander and Stedin are the only DSOs providing electricity to consumers of profile E2.
[14] In addition to these large DSOs, the UK also has some smaller Independent Network Operators (IDNO's). These are not taken into account in this study.



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

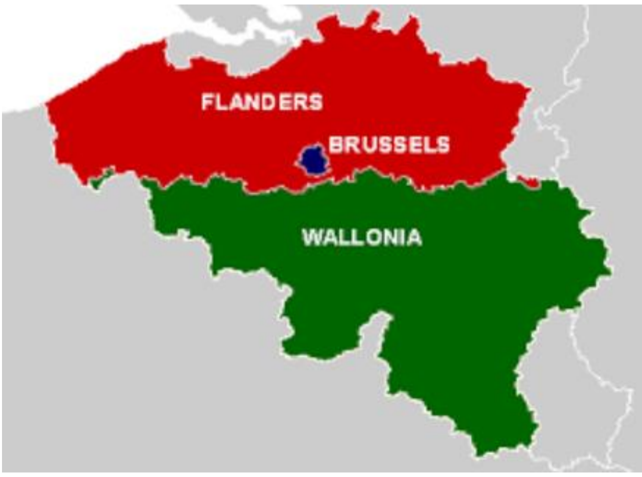
For network costs - transmission tariffs for profiles E3 and E4, transmission and distribution tariffs for profiles E1 and E2 - we will hence present average values for all fourteen zones.

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

3.4. 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.[15]



We take as assumption that profile G1 is connected to the maximum operational tension level of the distribution grid (T6[16]). The Flemish region has 12 DSOs[17] 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)[18]	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%**

[15] None of these clients directly connected to the transport grid is located in the Brussels Capital Region.
[16] 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.
[17] Enexis active in the Belgian enclave of Baarle-Hertog, is not considered in the study.
[18] Figures from VREG

DSOs of the Walloon region	Gas distributed MWh (2014)[19]	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	**19.270.000**	**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 TSOs 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 TSOs, 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

[19] Figures from VREG

evaluation of the tariffs for profile G2 on the average of the exit tariffs of 11 TSOs 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 DSOs. As there are over 800 different DSOs in Germany[20] 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.

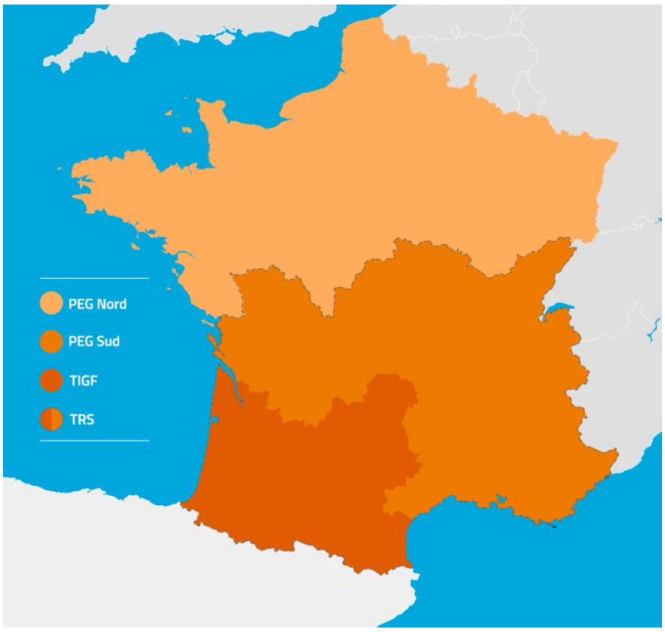
France

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.[21][22]



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),

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

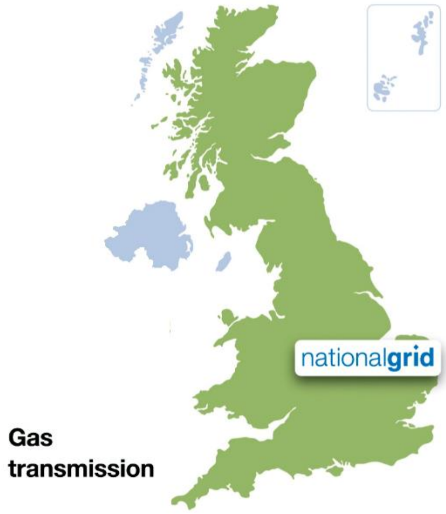
GRTGaz/Sud (about 20%) and TIGF (about 5%).[23]In terms of distribution, GrDF (Gaz Réseau Distribution France) distributes 96% of all gas[24] in France.

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.[25] 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);

[23] CRE, Marchés de gros: Observatoire des marchés de l'électricité, du gaz et du CO2, 3[ième] trimestre 2014.
[24] http://www.cre.fr/reseaux/infrastructures-gazieres/description-generale#section3
[25] 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).

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

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

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

3.5. Summary table on number of zones per country

Table 1 – 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**

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

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

4.1. 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 2017. 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.

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

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2016
CAL Y_{-2}	Average two year ahead forward price in 2015
CAL Y_{-3}	Average three year ahead forward price in 2014
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2016
Mi_{-1}	Average month ahead forward price in December 2016

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)[26]. For each Belgian region, distribution tariffs typically have three components:

1. *Tariffs for power put at disposal[27];*
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	1/3/2017	1/1/2017
BRUGEL	1/1/2017	1/1/2017
CWAPE	1/3/2017	1/3/2017

Hence, as the period analysed in the scope of this study is the month of January 2017, some transmission tariffs (Flanders, Wallonia) as well as the rates for the federal contribution (Wallonia) were taken into account at their 2016 level, still

[26] TRANS MT is the highest voltage level for RESA and Sibelga networks which we use in the scope of this study.
[27] 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.

applicable in the first months of 2017. This is the case for the adoption of transmission tariffs by the VREG 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 on DSOs 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 (0,0785 €/MWh);
    b. Financing of federal green certificates (offshore wind) (4,3759 €/MWh) but discount and cap based on quantity apply;
    c. Financing of Strategic Reserves (0,1902 €/MWh);
    d. Financing of support measures for renewable energy and cogeneration in Flanders (1,4849 €/MWh) but discount based on quantity applies (only E1 and E2);
    e. Financing measures for the promotion of rational energy use in Flanders (0,0308 €/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 (0,89 €/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[28] 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:
    a. Federal contribution (3,3705 €/MWh), increased by 1,1% to pay for supplier administrative costs, no exemptions but discount and cap based on quantity apply;[29]
    b. Levy for occupying public domain in Wallonia (0,2695 €/MWh), which is only applicable to the local transport network and below (only E1 and E2);

[28] 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).
[29] For the Walloon region, the 2016 rate was still applicable on the distribution grid (profile E1) in January 2017.

c. Levy for occupying road network in Brussels (3,3005 €/MWh);[30]

d. Levy for the taxes "pylons" and "trenches" in Flanders (0,116 €/MWh);

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

f. Since March 2016, the *Vlaamse Energieheffing* was introduced in the Flemish region to finance (part of) the (historic) cost of green certificates that had been acquired by the DSOs. It amounts to a fixed annual fee of 16.531,71 € for consumers consuming between 5 and 20 GWh/year like E1 (for whom the surcharge amounts to 1,65 €/MWh), and 31.008,21 € for consumers consuming between 20 and 50 GWh/year like E2 (for whom the surcharge amounts to 1,24 €/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).[31]

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[30] 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*).

[31] 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).

4.2. 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 2017. 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.

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

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2016
CAL Y_{-2}	Average two year ahead forward price in 2015
CAL Y_{-3}	Average three year ahead forward price in 2014
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2016
Mi_{-1}	Average month ahead forward price in December 2016

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.

Connection voltage (U_n)	Voltage profile	Consumer profile	Grid operator
1 kV ≤ U_n ≤ 50 kV	Medium voltage	E1	DSO
		E2	
U_n = 110 kV	High Voltage	E3	
220 kV < U_n ≤ 350 kV	Extra high voltage	E4	TSO

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[32], 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.[33] 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).[34] As opposed to France, where a similar reduction is 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;

[32] From Distribution networks to smart Distribution systems: rethinking the regulation of European electricity DSOs, European University Institute, THINK paper topic 12, Final report, 2013, pgs. 12-13.
[33] Stromnetzentgeltverordnung, §19, abs. 2.
[34] 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, seven taxes/surcharges can apply on electricity:

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	4,38 €/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	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	3,88 €/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	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, except for the first band which is negative, to pay for offshore wind power generation units. Different rates apply to different bands of total electricity consumption.

Band A	Consumption ≤ 1 GWh/year	-0,028 €/MWh
Band B	Consumption > 1 GWh /year	0,38 €/MWh
Band C	Consumption > 1 GWh/year and manufacturing industry with electricity cost > 4% of turnover	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.

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[35] and category C customers at least from an 80% reduction on the EEG-Umlage. The system can be summarized as follows:

Category A	All consumers that do not belong to category B	68,80 €/MWh
Category B	If consumption > 1 GWh / year and electricity cost is : • For an extensive list of industrial sectors (annex 3 of EEAG)[36]: >17% of gross added value[37] • For a less extensive list of industrial sectors (annex 5 of EEAG) : >20% of gross added value	10,32 €/MWh (85% reduction), but capped[38] at • 0,5% of gross added value (average last 3 years) for all consumers with electricity cost >20% of gross added value • 4,0% of gross added values (average last 3 years) for all consumers with electricity cost <20% of gross added value
Category C (introduced in 2017)	If consumption > 1 GWh / year and electricity cost is : • For an extensive list of industrial sectors (annex 3 of EEAG)[39]: between 14 and 17% of gross added value (avg. last 3 years)	13,76 €/MWh (80% reduction), but capped[40] at • 0,5% of gross added value (average last 3 years) for all consumers with electricity cost >20% of gross added value 4,0% of gross added values (average last 3 years) for all consumers with electricity cost <20% of gross added value

However, for category B and C consumers, a bottom rate of 0,5 EUR/MWh applies for four specific industrial sectors (aluminium, zinc, lead and copper production), and of 1,0 EUR/MWh for all other industrial sectors.

The EEG-Umlage is only partially due on the consumption of self-generated electricity, depending on the nature and the quantity of self-generated electricity (*Eigenversorgung*). As we do throughout the entire report, we assume here as well that the four profiles under review do not produce any electricity themselves and are hence not concerned by the regulations regarding EEG-Umlage on self-generated electricity.

35 Reductions such as the EEG-Umlage that are destined to fund renewable energy are allowed according to the Environmental and Energy State Aid Guidelines or so-called EEAG framework.
36 Environmental and Energy State Aide Guidelines, Communication C200/50 of the European Commission.
37 The notion of gross added value is defined in Annex 4 of the Environmental and Energy State Aide Guidelines, Communication C200/50 of the European Commission.
38 However, these caps are only applicable if the consumer is part of an energy efficiency system improvement program.
39 Environmental and Energy State Aide Guidelines, Communication C200/50 of the European Commission.
40 However, these caps are only applicable if the consumer is part of an energy efficiency system improvement program.

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 or C consumer. Category A – paying the full amount of 68,8 EUR/MWh – will be presented as an outlier, but constitutes the reality for an important group of non-electro-intensive consumers. In 2016, only 2.138 companies (representing 2.835 offtake points) of the over 45.000 industrial companies in Germany qualified for the criteria in category B (when the criteria was 17% and not 14% as is the case in 2017). These 2.138 companies, however, represent about 39% of total German industrial energy consumption.[41]

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 results in a reduced rate of 1,537 €/MWh. Since 2015, the application of this reduction (*Spitzenausgleich)* depends on the reaching of countrywide energy efficiency goals.[42] In 2014, 22.300 companies benefited from some kind of reduction through this system.[43]

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: 126,9 €/MWh*)[44] 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 (68,80 €/MWh) of the EEG-Umlage is due.

7. The "*AblaV §18 Umlage"* is a levy to finance interruptible load agreements. In the year 2016, it was fixed at 0 EUR/MWh, but in 2017 it was reintroduced into the electricity bill at a value of 0,6 EUR/MWh.

[41] Bundesamtes für Wirtschaft un Ausfuhrkontrolle (BAFA), *Statistischen Auswertungen zur "Besonderes Ausgleichshregelung"*; and *BDEW Strompreisanalyse Mai 2016* – Haushalte und Industrie, Bundesverband der Energie- und Wasserwirtschaft e.V., Berlin.

[42] *Stromsteuergesetz, §10.*

[43] *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.

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

4.3. 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.

As opposed to the year 2016, when market prices were lower than regulated prices (ARENH is at 42 EUR/MWh) and ARENH was not used, the French regulator has announced 80 TWh of nuclear power at regulated prices will be reserved for consumers in 2017 due to the higher market prices.

The quantity of nuclear power at regulated prices (ARENH) attributed to a supplier depends on its consumer portfolio and the consumption of that portfolio during a 'reference period'. Since 2015, this reference period consists of off-peak hours (1am to 7am and 24 hours on weekends) from April to October, except for July and August, when peak-hours are taken into account as well.[45] Given the consumption profiles we have determined, this means that 57,1% of the consumption of profiles E1 and E2 is taken into account to allocate nuclear power at regulated prices to its supplier, 87,8% for E3 and 91,3% for E4.

The commodity formula to calculate the 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.

We summarize the commodity price formulas used for the different consumers below:

$$\textit{Commodity price E1 and E2}$$
$$= 57{,}1\%\ ARENH + 42{,}9\%\ (47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ EPEX\ Spot\ FR)$$

$$\textit{Commodity price E3}$$
$$= 87{,}8\%\ ARENH + 42{,}9\%\ (47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ EPEX\ Spot\ FR)$$

$$\textit{Commodity price E4}$$
$$= 91{,}3\%\ ARENH + 8{,}7\%\ (47{,}1\%\ CAL\ Y_{-1} + 20{,}1\%\ CAL\ Y_{-2} + 7{,}1\%\ CAL\ Y_{-3} + 7{,}8\%\ Qi_{-1} + 2{,}2\%\ Mi_{-1} + 15{,}7\%\ EPEX\ Spot\ FR)$$

where:

	Explanation
ARENH	Nuclear power at regulated price of 42€/MWh
CAL Y_{-1}	Average year ahead forward price in 2016

[45] *Arrêté du 17 mai 2011 relatif au calcul des droits à l'accès régulé à l'électricité nucléaire historique*, article 2.

CAL Y_{-2}	Average two year ahead forward price in 2015
CAL Y_{-3}	Average three year ahead forward price in 2014
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2016
Mi_{-1}	Average month ahead forward price in December 2016

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.

Connection voltage (U_n)	Tariff scheme		Grid
$U_n \le 1$ kV	BT		Low voltage (DSO)
1 kV < $U_n \le 40$ kV	HTA1	HTA Profile	High voltage (TSO)
40 kV < $U_n \le 50$ kV	HTA2		
50 kV < $U_n \le 130$ kV	HTB1	HTB Profile	
130 kV < $U_n \le 350$ kV	HTB2		
350 kV < $U_n \le 500$ kV	HTB3		Extra high voltage (TSO)

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 February 2016, a new and relatively complex transmission tariff reduction was introduced to replace the more straightforward transmission tariff reductions that were in place between mid-2014 and late 2015.[46]

Reductions are granted to baseload, 'anti-cyclical' and very large consumers according to the principles laid out in the table below:

ORIGIN OF ELIGIBILITY			REDUCTION PERCENTAGE GRANTED			
Stable profiles	**Anti-cyclical profiles**	**Large consumers**	**Hyper electro-intensive consumption sites (art. D. 351-3)**	**Electro-intensive consumption sites (art. D. 351-2 or art D. 351-1)**	**Power storage sites connected to the grid**	**Other sites**
annual offtake >10 GWh and ≥7000 hours	annual offtake >20 GWh and off peak grid utilisation ≥44%	annual offtake >500 GWh and off peak grid utilisation ≥40% and ≤44%	80 %	45 %	30 % (*)	5 %
annual offtake >10 GWh and ≥7500 hours	annual offtake >20 GWh and off peak grid utilisation ≥48%		85 %	50 %	40 % (*)	10 %
annual offtake >10 GWh and ≥8000 hours	annual offtake >20 GWh and off peak grid utilisation ≥53%		90 %	60 %	50 % (*)	20 %

Electro intensive and hyper electro intensive consumers are defined as follows:

	Power consumed/Value added	**Trade-intensity**	**Annual power consumption**
Electro-intensive	>2,5 kWh/EUR	>4%	>50 GWh
Hyper-electro-intensive	>6 kWh/EUR	>25%	Not applicable

Given this framework, we can make the following assumptions for the four consumer profiles under review:

- Profile E1 is not eligible for any reduction, as it does not meet the criteria for stable, anti-cyclical or large consumer.

[46] Décret n° 2016-141 du 11 février 2016 relatif au statut d'électro-intensif et à la réduction de tarif d'utilisation du réseau public de transport accordée aux sites fortement consommateurs d'électricité.

- Profile E2 is not eligible for any reduction, as it does not meet the criteria for stable, anti-cyclical or large consumer - with an off-peak utilisation rate of 41%.
- Profile E3 is eligible for a reduction, as a stable consumer profile. With 7692 consumption hours per year, depending on the industrial activity and hence the electro-intensity of the consumer, the reduction can vary from 10% to 85%.
- Profile E4 is eligible for a reduction, as a stable consumer profile. With 8000 consumption hours per year, depending on the industrial activity and hence the electro-intensity of the consumer, the reduction can vary from 20% to 90%.

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 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)[47][48] is a surcharge which feeds a special budgetary program "Public service of energy" that pays (amongst other things) for the cost of support for the production of electricity from gas-fired cogeneration plants, the *péréquation tarifaire* (including a small part of cost of renewables) and social tariffs.

In 2016 and in 2017, 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. 2 €/MWh for consumers consuming above 3 kWh per euro of added value;

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

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

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

    b. their 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

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

carbon leakage linked to indirect carbon emissions, the CSPE amounts to:

a. 1 €/MWh for consumers consuming above 3 kWh per euro of added value;

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

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

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 €

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 (non-electro-intensive consumers). Moreover, we will present a range from 0,5 euros per MWh to 7,5 euros per MWh for electro-intensive consumers.

4.4. 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.

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

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2016
CAL Y_{-2}	Average two year ahead forward price in 2015
CAL Y_{-3}	Average three year ahead forward price in 2014
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2016
Mi_{-1}	Average month ahead forward price in December 2016

Component 2 – network costs

In the Netherlands, the network costs involve two components[49]:

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[50] ("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;

[49] As of January 1st 2015, system service tariffs have been abolished.
[50] 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.[51]

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 2017 has the following rates:

Band A	Consumption up to 10 MWh	101,3 €/MWh
Band B	Consumption from 10-50 MWh	49,01 €/MWh
Band C	Consumption from 50-10.000 MWh	13,05 €/MWh
Band D	Consumption above 10.000 MWh (professional)	0,53€/MWh

2. The *ODE levy* is a digressive levy, except for the first 10 MWh, on gas and electricity that pays for renewable capacity. The rates for 2017:

Band A	Consumption up to 10 MWh (with tax reduction)	7,4 €/MWh
Band B	Consumption from 10-50 MWh (with tax reduction)	12,3 €/MWh
Band C	Consumption from 50-10.000 MWh	3,3€/MWh
Band D	Consumption above 10.000 MWh (professional)	0,131 €/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

[51] 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[52] 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[53].

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 52) 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).

[52] 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).
[53] 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.

4.5. 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.

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[54] ahead. Therefore we have used twelve months of GQ2 (two seasons ahead) to replace CAL Y-1[55], 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.

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

where:

	Explanation
CAL Y_{-1}	Average year ahead forward price in 2016
CAL Y_{-2}	Average two year ahead forward price in 2015
CAL Y_{-3}	Average three year ahead forward price in 2014
Qi_{-1}	Average quarter ahead forward price in the fourth quarter of 2016
Mi_{-1}	Average month ahead forward price in December 2016

We calculated the commodity cost (based on the formula above) entirely in Pound Sterling, and converted the final result to Euro at the January 2017 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 TSOs, six DSOs and fourteen tariff zones identified. On a technical level, the grid is organized as follows:

[54] A season corresponds to a six-month period, either the summer (April – September) or the winter (October – March).
[55] For instance, to estimate CAL Y-1 price for January 2017, we have taken the average price quotation over the course of 12 months (from October 2015 to September 2016) 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 fourteen 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 fourteen zones. We present the average discount of EDCM-rates on CDCM-tariffs in the fourteen 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 6,492 €/MWh (0,559p/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 0,023129 p/kWh.

3. The ***Renewables Obligation*** **(RO)** is the cost taken into account for the large scale renewable subsidy scheme. From April 2016 to April 2017, the renewable quota is 0,348 Renewable Obligation Certificates (ROC's) per MWh. Given the fee per missing ROC of 51,998€, the penalty for non-ROC-covered electricity is 18,095 €/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**[56] takes effect from 15 January 2016 and lasts until 7 February 2016. Hence we do not consider this cost in the report.

[56] 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 took effect from 15 January 2016 and lasted until 7 February 2016. On 8 February 2016 deployment caps were introduced to the scheme.

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

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

5.1. Belgium

Component 1 - the commodity price

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

For both profiles G1 and G2, the commodity price that is reflected in this study is the average of:

- Zeebrugge month ahead price for gas consumed in January 2017
- ZTP average of day-ahead prices over the course of January 2017.

The analysis of invoices shows that the use of a mixed indexation (50 % day ahead and 50 % month ahead) applies to a number of industrial clients. Besides, the use of such a mixed indexation for both profiles G1 and G2 tackles the non-intuitive results obtained with the previous methodology when the commodity prices are strongly rising from one month to another, as it was the case between December 2016 and January 2017. Day ahead prices are normally lower than month ahead prices, but this is not always the case e.g. when the prices sharply rise from one month to another.

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.[57] 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)[58];
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 on the TSO-grid does not need odorisation services from Fluxys.

[57] It has to be noted that no such client exists in the Brussels Capital Region.
[58] For HP capacity at end-user domestic exit points, the “fix/flex” tariff option can be chosen. 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* HP-tariff + 0,38*MP-tariff

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.[59]

	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	1,109	90%	
	L-grid	1,279	10%	
“Fix/ flex” option	H-grid	0,555	90%	h<=2000: 0,278 €/MWh h>2000: 0,016 €/MWh
	L-grid	0,64	10%	
MP capacity	H-grid	0,667	90%	
	L-grid	0,768	10%	

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.[60]

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. the standard HP capacity tariff[61]. For some industrial consumers a MP capacity fee has to be included to the transport costs as well.[62]

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 average of day-ahead commodity prices, as published by Powernext.

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).[63] 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

[59] Calculation of PwC based on figures publicly available on the Fluxys website.
[60] At the time of the previous report, 20% of industrial consumers were paying more expensive L-tariffs, compared to 10% as of January 1st 2017 based on data provided by CREG.
[61] In 2016 the “Fix/flex”-option was still the most advantageous option..
[62] We have used the weights of these connections in order to calculate the exit tariff fee, see footnote 58.
[63] T5 (and not T6) is the highest category for Sibelga network active in Brussels which we use in the scope of this study.

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:

1. *Federal contribution* (0,5672 €/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 m³/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[64];

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.

For profile G1 connected to the distribution grid (at T6), local taxes and levies[65] 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: 57,99 €/month (only for profile G1).

[64] 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*

[65] 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).

5.2. 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 both profiles G1 and G2, the commodity price that is reflected in this study for Germany is the average of:

- the month ahead prices for gas consumed in January 2017 of NCG and Gaspool
- an average of day-ahead prices for NCG and Gaspool over the course of January 2017.

The analyse of invoices shows that the use of a mixed indexation (50 % day ahead and 50 % month ahead) applies to a number of industrial clients. Besides, the use of such a mixed indexation for both profiles G1 and G2 tackles the non-intuitive results obtained with the previous methodology when the commodity prices are strongly rising from one month to another, as it was the case between December 2016 and January 2017. Day ahead prices are normally lower than month ahead prices, but this is not always the case e.g. when the prices sharply rise from one month to another.

All commodity data were provided by the CREG.

Component 2 – the network costs

Transmission costs

As explained in section 3.4 Germany counts eleven TSOs 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 TSOs with end-users directly connected to the transport grid as well as the costs related to metering and invoicing. Although every TSOs 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 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 Area 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 2017 amounts to approximately 0,63279 €/(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 amounts to 0,134 €/(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).[66]

   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.[67]

   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.

[66] *Energiesteuergesetz, §54, 55.*
[67] *Energiesteuergesetz, §25.*

5.3. 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.[68] 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)[69].

For both profiles G1 and G2, the commodity price that is reflected in this study for France is the average of:

- the month ahead prices for gas consumed in January 2017
- an average of day-ahead prices for over the course of January 2017.

The analyse of invoices shows that the use of a mixed indexation (50 % day ahead and 50 % month ahead) applies to a number of industrial clients. Besides, the use of such a mixed indexation for both profiles G1 and G2 tackles the non-intuitive results obtained with the previous methodology when the commodity prices are strongly rising from one month to another, as it was the case between December 2016 and January 2017. Day ahead prices are normally lower than month ahead prices, but this is not always the case e.g. when the prices sharply rise from one month to another.

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;[70]
3. *A delivery charge (exit capacity fee)* applicable to daily delivery capacity subscriptions for industrial consumers.

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[68] 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.

[69] For the particular period under review in this report (January 2017), the difference between TRS and PEG NORD indices was exceptionally high.

[70] 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.

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.[71] 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 (15.717,36 €);
2. *A proportional component* (0,82 €/MWh);
3. *A delivery charge* applicable to daily delivery capacity subscriptions (204,60 €/MWh/day).

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. For clients connected to the distribution grid, the CTA amounts to 20,8% of the fixed part of the distribution cost (in France, profile G1) and 4,71% of the fixed part of the transmission cost (in France, G2).
2. The "*Taxe intérieure sur la consommation de gaz naturel"* (TICGN) is a tax on gas consumption, that amounted to 5,88 €/MWh in 2017.

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

a. Companies that participate in the carbon market[72] and that are energy intensive can pay a reduced rate of 1,52 €/MWh;

b. Companies that belong to a sector with a high risk of carbon leakage and that are energy intensive can pay a reduced rate: 1,60 €/MWh[73];

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 5,88 €/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 5,88 €/MWh for consumer profile G1.

[71] http://www.cre.fr/reseaux/infrastructures-gazieres/description-generale#section3
[72] Arrêté du 24 janvier 2015 fixant la liste de exploitants auxquels sont affectés des quotas d'émission de gaz à effet de serre et le montant des quotas affecté à titre gratuit pour la période 2013-2020, annex 2 and 3.
[73] 2014/746/UE: Décision de la Commission du 27 octobre 2014 établissant, conformément à la directive 2003/87/CE du Parlement européen et du Conseil, la liste des secteurs et sous-secteurs considérés comme exposés à un risque important de fuite de carbone, pour la période 2015-2019.

5.4. The Netherlands

Component 1 - the commodity price

For both profiles G1 and G2, the commodity price that is reflected in this study for the Netherlands is the average of:

- the month ahead prices for gas consumed in January 2017 (TTF index)
- an average of day-ahead prices for over the course of January 2017.

The analyse of invoices shows that the use of a mixed indexation (50 % day ahead and 50 % month ahead) applies to a number of industrial clients. Besides, the use of such a mixed indexation for both profiles G1 and G2 tackles the non-intuitive results obtained with the previous methodology when the commodity prices are strongly rising from one month to another, as it was the case between December 2016 and January 2017. Day ahead prices are normally lower than month ahead prices, but this is not always the case e.g. when the prices sharply rise from one month to another.

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[74], 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 (L-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

[74] 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.

every type of gas has in the total number of connections of the +/- 300 directly connected industrial consumers[75].

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 2017 rates for each band of gas consumption:

Band A	Consumption up to 170.000 m³	0,25244 €/m³
Band B	Consumption from 170.000-1.000.000 m³	0,06215 €/m³
Band C	Consumption from 1.000.000-10.000.000 m³	0,02265€/m³
Band D	Consumption above 10.000.000 m³	0,01216 €/m³

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 2017 are reported in the table below:

Band A	Consumption up to 170.000 m³	0,0159 €/m³
Band B	Consumption from 170.000-1.000.000 m³	0,0074 €/m³
Band C	Consumption from 1.000.000-10.000.000 m³	0,0027 €/m³
Band D	Consumption above 10.000.000 m³	0,0013 €/m³

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 (€/m³) 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.

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

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[76], 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.

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.

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

5.5. United Kingdom

Component 1 - the commodity price

For commodity in the UK, we use the NBP (National Balancing Point) market index.

For both profiles G1 and G2, the commodity price that is reflected in this study for the UK is the average of:

- the month ahead prices for gas consumed in January 2017 (NBP index)
- an average of day-ahead prices for over the course of January 2017.

The analyse of invoices shows that the use of a mixed indexation (50 % day ahead and 50 % month ahead) applies to a number of industrial clients. Besides, the use of such a mixed indexation for both profiles G1 and G2 tackles the non-intuitive results obtained with the previous methodology when the commodity prices are strongly rising from one month to another, as it was the case between December 2016 and January 2017. Day ahead prices are normally lower than month ahead prices, but this is not always the case e.g. when the prices sharply rise from one month to another.

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.[77]

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

[77] We have used the weighted averages published in the Gas Transmission Transportation Charges of the NGG from the 1st of October 2016.

calculated in terms of peakday kWh (e.g. 300 000 peakday kWh for our profile G1);

3. *Customer (capacity): t*he 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.

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 0,195 p/kWh (about 2,3 €/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 +/- 1,5 €/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 +/- 1,5 €/MWh (reduction when being part of Climate Change Agreement).

6. Presentation and interpretation of results

6. Presentation and interpretation of results

6.1. Interpretation of figures (Electricity)[78]

Figure A: Total yearly invoice

	Symbol	Legend	Interpretation
Graph 1 ***Total yearly invoice (€/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 2017 (all options)	2017 average (non-weighted) of all options (incl. non-electro-intensive)
		Average 2016 (all options)	2016 average (non-weighted) of all options (incl. non-electro-intensive)
		Average 2017 (electro-intensive)	2017 average (non-weighted) of all min and max options for electro-intensive consumers
		Average 2016 (electro intensive)	2016 average (non-weighted) of all min and max options for electro-intensive consumers

Figure B: Total yearly invoice comparison (Belgium 2017 = 100)

	Symbol	Legend	Interpretation
Graph 2 ***Yearly invoice comparison (Belgium 2017 = 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)

[78] A **correction of 2016 electricity prices** has been made in comparison with the previous report published on June 29th 2016. The erroneous appearance of the Ablav-surcharge in Germany (which was not applicable in 2016) and a supplier margin of €0,5/MWh in all countries under review was removed from the 2016 results on all electricity figures presented in this report. Even though the impact of these changes is minimal, we can hence state that 2017 results are compared to a correct and corrected version of 2016 prices.

Figure C: Average power price by component / MWh

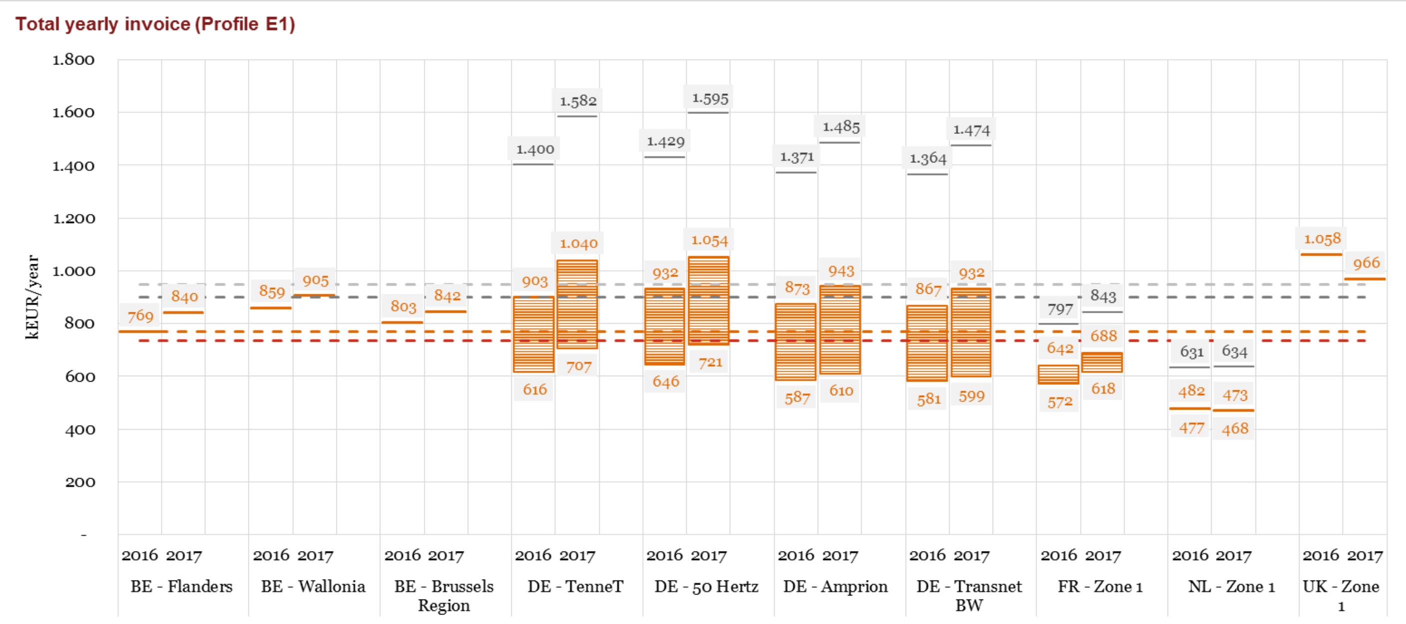
	Symbol	Legend	Interpretation
Graph 3 ***Average power price by component (€/MWh)***	64,5	Commodity	Represents the total commodity cost
	26,3	Network	Represents the total network cost in BE, DE, NL and UK
		Network – minimum	Represents the minimum network cost for electro-intensive consumers in FR
		Network - maximum	Represents the **possible range between minimum and maximum** network cost for electro-intensive consumers in FR
	15,5	Taxes/Levies	Represents the cost of taxes/levies/certificate scheme in BE and UK.
		Taxes/Levies – minimum (electro-intensive)	Represents the minimum cost of taxes/levies/certificate scheme for electro-intensive consumers in FR, DE and NL
		Taxes/Levies – maximum (electro-intensive)	Represents the **possible range between minimum and maximum** cost of taxes/levies/certificate scheme for electro-intensive consumers in FR, DE and NL
	54,0	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

6.2. Profile E1 (Electricity)

Total invoice analysis

Figure 1 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 1 – Total yearly invoice in kEUR/year (profile E1)

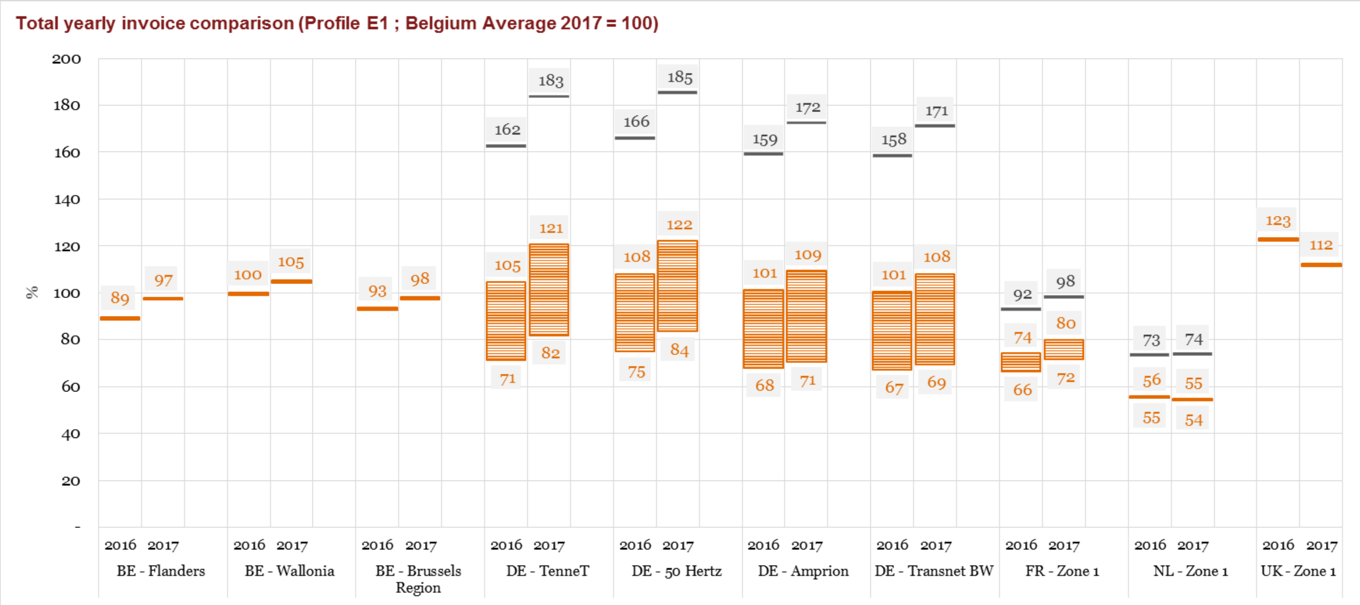


For an extensive legend for all figures, see page 69.

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 2 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average in 2017 = 100%).

Figure 2 – Total yearly invoice comparison in % (profile E1)



For an extensive legend for all figures, see page 69.

All countries show higher prices in 2017 than in 2016, except for the Netherlands where total prices remained stable and for the UK where an important exchange rate effect impacts the result.

The three Belgian regions still show slightly different results, with the Flemish region slightly more competitive and the Walloon region slightly less competitive than the Belgian average. As a whole, Belgium is not very well positioned, showing less competitive results than the Netherlands, France and all German regions (when reduction criteria for electro-intensive consumers apply).

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 and generally low tax levels.

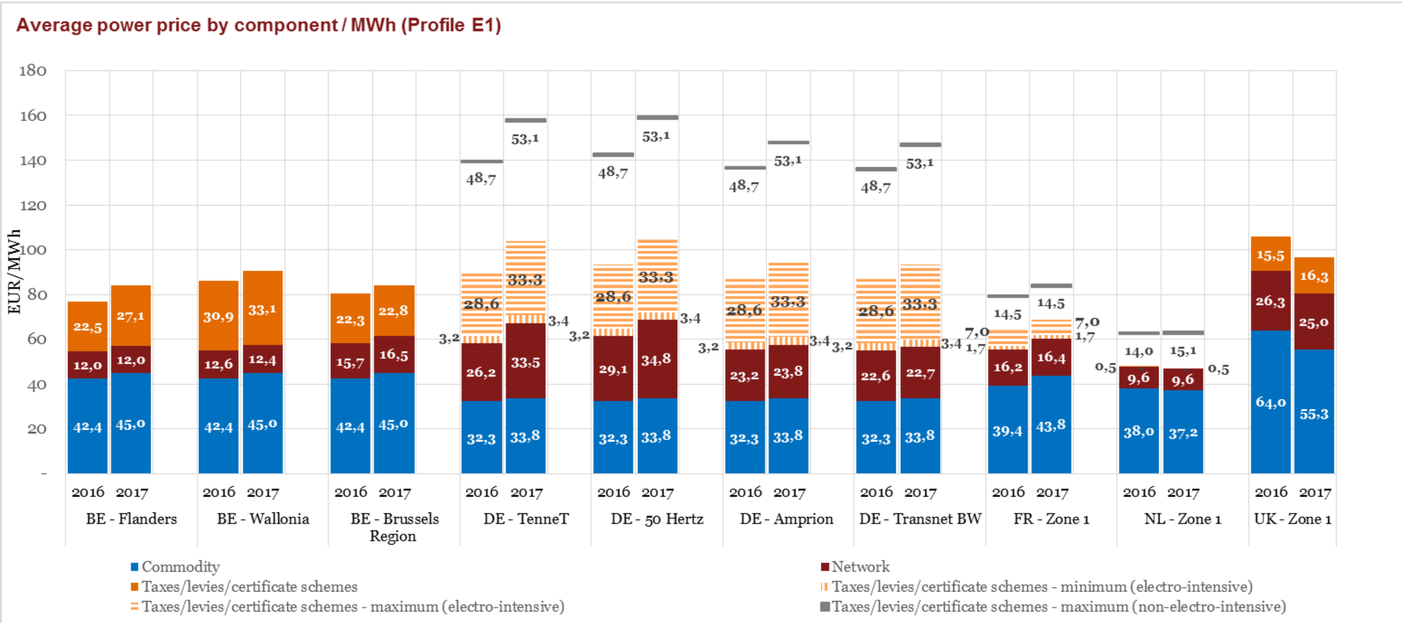
The detailed analysis of the German apparent lower competitiveness (when maximal options are considered) should be assessed carefully because of the large variance that occurs between the minimum and maximum options (including the EEG maximum option for consumers that are not electro-intensive according to the national criteria) that mainly depends on the relative size of power costs in their gross added value: when average annual electricity cost over the last three years represents less than 14% of the gross added value of an industrial consumer, he inevitably pays the maximum rate (in 2016 this threshold was at 17%).

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 3 which provides a closer look at the components breakdown.

Figure 3 – Average power price by component in EUR/MWh (profile E1)



For an extensive legend for all figures, see page 69.

In most cases, the **commodity** makes up for the largest part of the bill. Commodity prices generally increased compared to last year, with two exceptions: the UK (exchange rate effect) and the Netherlands that have become more competitive. Commodity cost in Germany is still lowest, while the important increase in commodity cost in France has brought French consumers to pay commodity prices almost at the same level as Belgian consumers. Belgian (and French) commodity cost is now significantly higher than in Germany and the Netherlands. Commodity costs in the UK remained stable in local currency, and remain 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). Compared to 2016, we remark an important increase of network costs for two of the four German regions: TenneT and 50 Hertz, mainly due to the transmission part of the network costs.

The third component, "**taxes, levies and certificates schemes**", has a large impact in all countries. Compared to 2016, this component has become more expensive only in Belgium (green certificate quota increase), Germany (EEG-Umlage increase) and the United Kingdom. As discussed before, the German situation offers the potential for very low values for very electro-intensive companies as well as the highest values. The French levels for electro-intensive consumers are comparable to those in Germany, while the Netherlands offer the lowest tax levels for electro-intensives. 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:

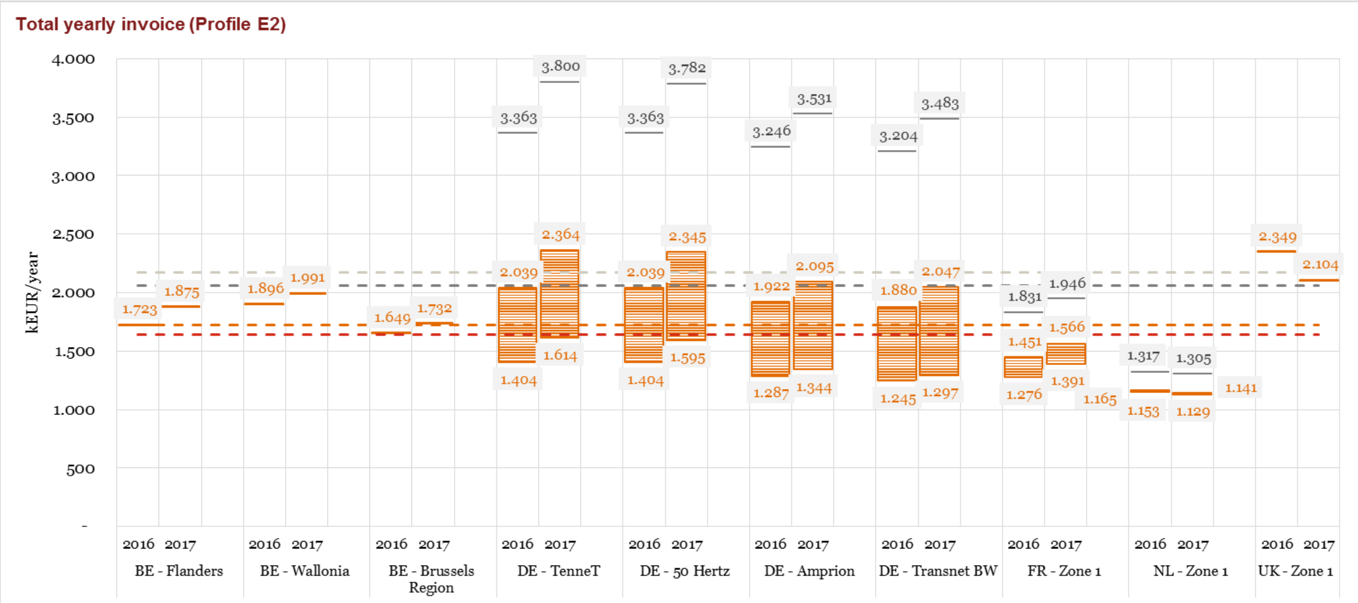
- We observe very important differences between the countries under review and even within the countries: a possible total invoice for profile E1 can vary between 468 kEUR and 1.595 kEUR. Compared to last year, total cost in Germany, Belgium and France increased, while it remained stable in the Netherlands and decreased in the UK (exchange rate effect).
- *Commodity costs* largely contribute to the total bill and generally increased compared to 2016 (except for the Netherlands were it slightly decreased). In this respect, Belgium and France now have a competitive disadvantage compared to the Netherlands and Germany. Germany shows the lowest commodity prices, while the United Kingdom deals with a considerably higher commodity price – even though it decreased compared to last year (exchange rate effect).
- *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 (where large regional differences exist and network costs increased compared to 2016) and lowest in the Netherlands. Belgium remains a relatively competitive country for network costs.
- *"Taxes, levies and certificates schemes"* are characterised by a large variance, and saw an increase in 2017 compared to 2016 in Belgium, Germany and the United Kingdom. They are among the highest in the Walloon region and rather important in the other Belgian regions and the UK. For electro-intensive consumers, tax levels are relatively low in Germany and France and almost inexistent in the Netherlands. In Germany – where the most important tax still increased upon last year – 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.

6.3. Profile E2 (Electricity)

Total invoice analysis

Figure 4 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 4 – Total yearly invoice in kEUR/year (profile E2)

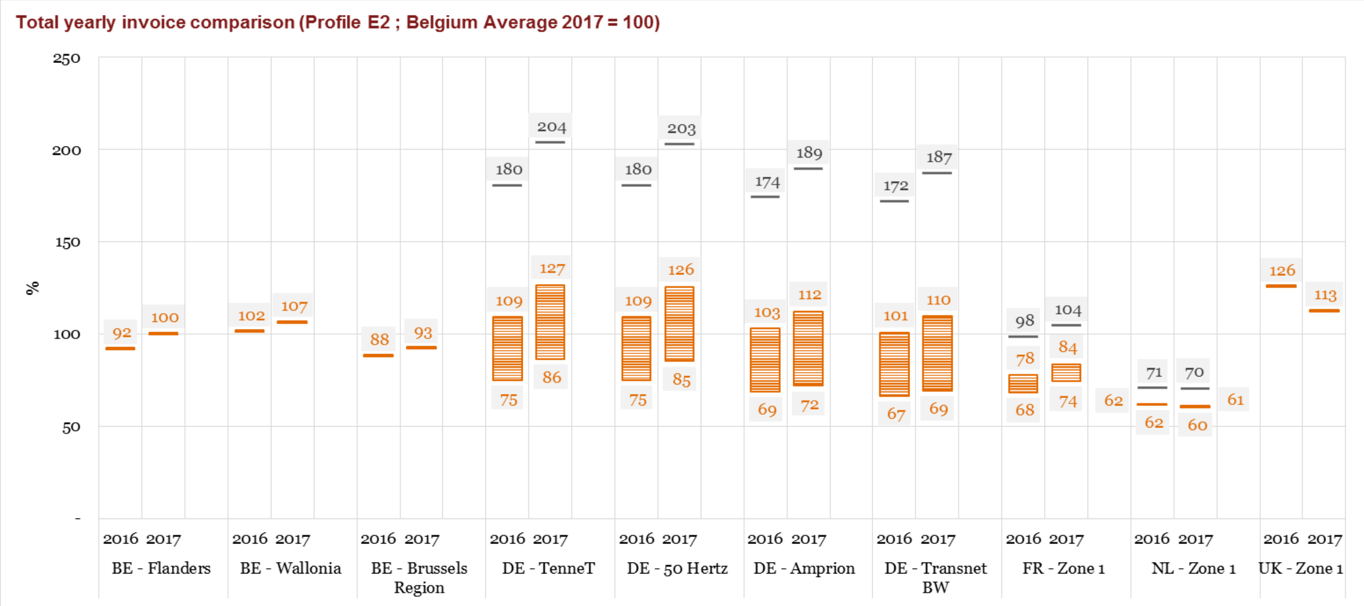


For an extensive legend for all figures, see page 69.

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 4 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average 2017 = 100%).

Figure 5 – Total yearly invoice comparison in % (profile E2)



For an extensive legend for all figures, see page 69.

All countries show higher prices in 2017 than in 2016, except for the Netherlands where total prices remained stable and for the UK where an important exchange rate effect impacts the result.

The Belgian average is not very well positioned compared to the other countries, the Walloon region being the least competitive case (except for UK) under review for electro-intensive consumers. The Netherlands is the most competitive country, similar to profile E1. Prices for electro-intensive consumers in France and the Amprion and TransnetBW regions in Germany (low range) are within a 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 and generally low tax levels.

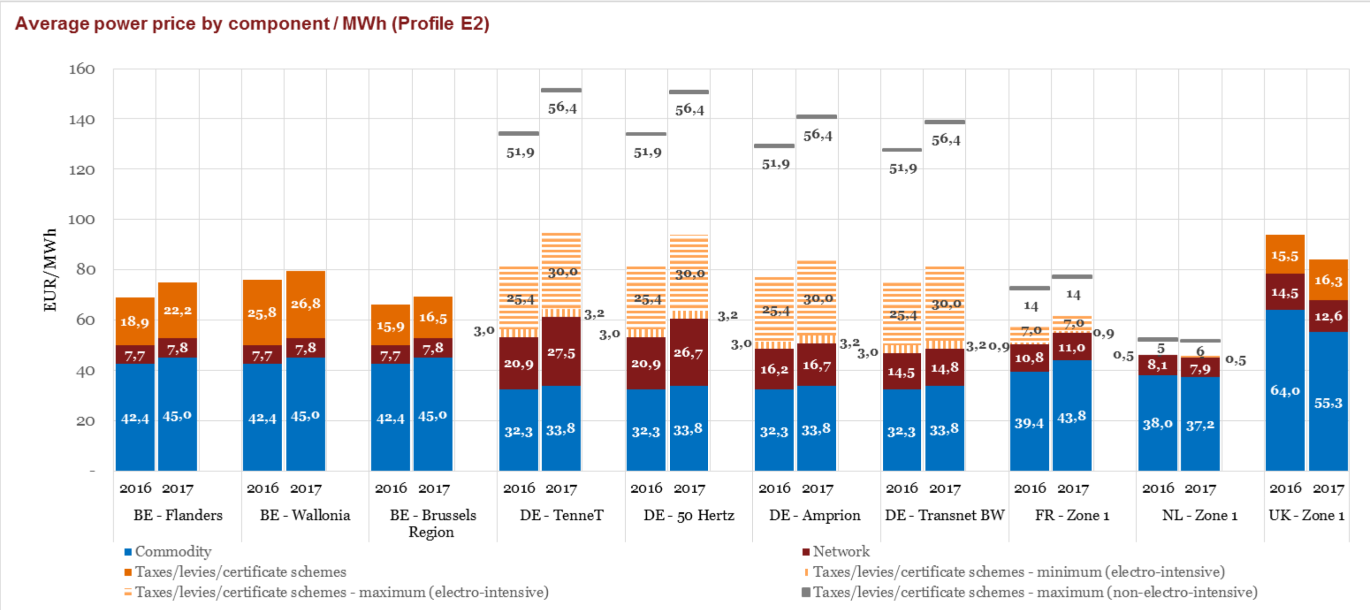
The detailed analysis of the German apparent lower competitiveness (when maximal options are considered) should be assessed carefully because of the large variance that occurs between the minimum and maximum options (including the EEG maximum option for consumers that are not electro-intensive according to the national criteria) that mainly depends on the relative size of power costs in their gross added value: when average annual electricity cost over the last three years represents less than 14% of gross added value of an industrial consumer, he inevitably pays the maximum rate (in 2016 this threshold was 17%).

The French higher competitiveness (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 6 which provides a closer look at the components breakdown.

Figure 6 – Average power price by component in EUR/MWh (profile E2)



For an extensive legend for all figures, see page 69.

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. In most cases, the **commodity** makes up for the largest part of the bill. Commodity prices generally increased compared to last year, with two exceptions: the UK (exchange rate effect) and the Netherlands that have become more competitive. Commodity cost in Germany is still lowest, while the important increase in commodity cost in France has brought French consumers to pay commodity prices at the same level as Belgian consumers. Belgian (and French) commodity cost is now significantly higher than in Germany and the Netherlands. Commodity costs in the UK remained stable in local currency, and remain markedly higher than in the other countries.

In all countries, **network costs** contribute to a variable extent to the invoice. Belgium and the Netherlands presents the lowest network costs, followed by 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. Compared to 2017, we can also observe the differences between German regions becoming even sharper than before, with increases in the TenneT and 50 Hertz regions heavily impacting total cost.

The third component "**taxes, levies and certificates schemes**", has a (potentially) large impact in all countries. Compared to 2016, this component has become more expensive only in Belgium (green certificate quota increase), Germany (EEG-Umlage increase) and the United Kingdom (Renewables Obligation increase). As discussed before, the German situation offers the potential for very low values for very electro-intensive companies as well as the highest values. For electro-intensive consumers, the Dutch tax levels are lowest (almost inexistent), followed by the French and German tax levels. For non-electro-intensive consumers, the Dutch competitive advantage is even more important, while 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:

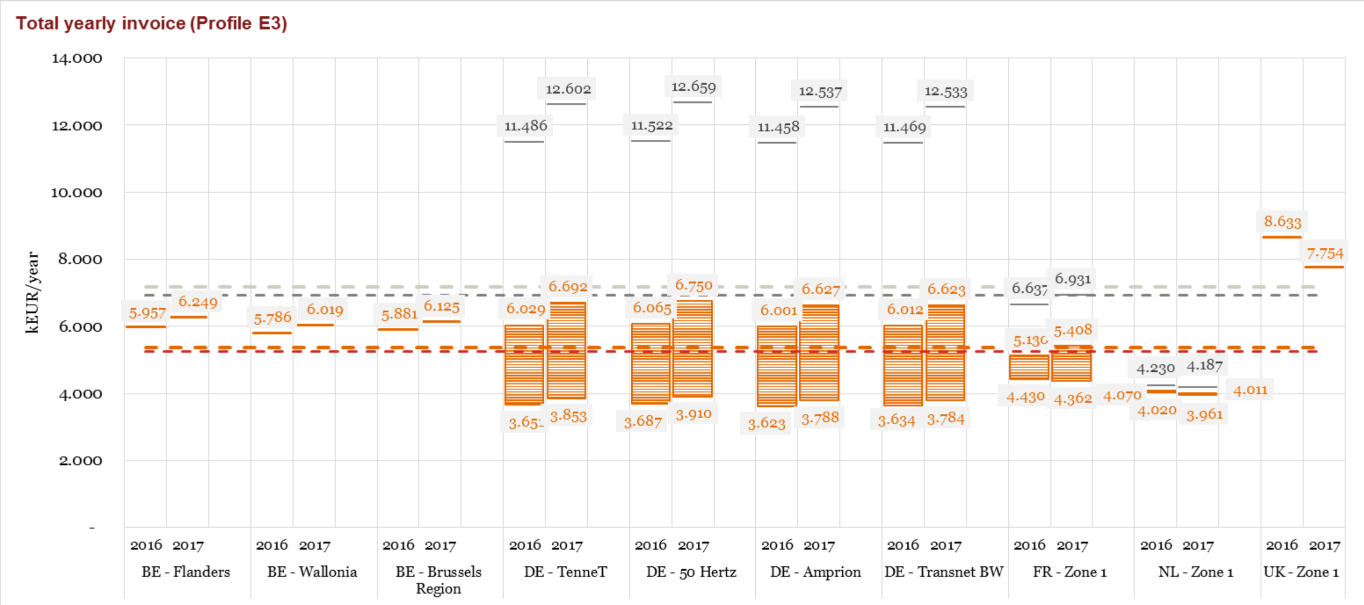
- We observe very important differences between the countries under review and even within the countries: a possible total invoice for profile E2 can vary between 1,13 MEUR and 3,80 MEUR. Compared to last year, total cost in Germany, Belgium and France increased, while it remained stable in the Netherlands and decreased in the UK (exchange rate effect).
- 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 by far the most competitive case under review, for electro-intensive as well as non-electro-intensive consumers. Prices in France and two of the four German regions (electro-intensive consumers) are within a very close range. Like for profile E1, the United Kingdom is an outlier.
- *Commodity costs* largely contribute to the total bill and generally increased compared to 2016 (except for the Netherlands were it slightly decreased). In this respect, Belgium and France now have a competitive disadvantage compared to the Netherlands and Germany. Germany shows the lowest commodity prices, while the United Kingdom deals with a considerably higher commodity price – even though it decreased compared to last year (exchange rate effect).
- *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 (especially in the 50 Hertz and TenneT regions) and in the UK, partly due to presence of distribution charges in those countries. Belgium and the Netherlands are the most competitive countries for network costs, as is the case for E1.
- *"Taxes, levies and certificates schemes"* are characterised by a large variance, and show increases in Belgium (mainly green certificate quota), Germany (increase of EEG-Umlage) and the United Kingdom (increase of Renewables Obligation). 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.

6.4. Profile E3 (Electricity)

Total invoice analysis

Figure 7 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 7 – Total yearly invoice in kEUR/year (profile E3)

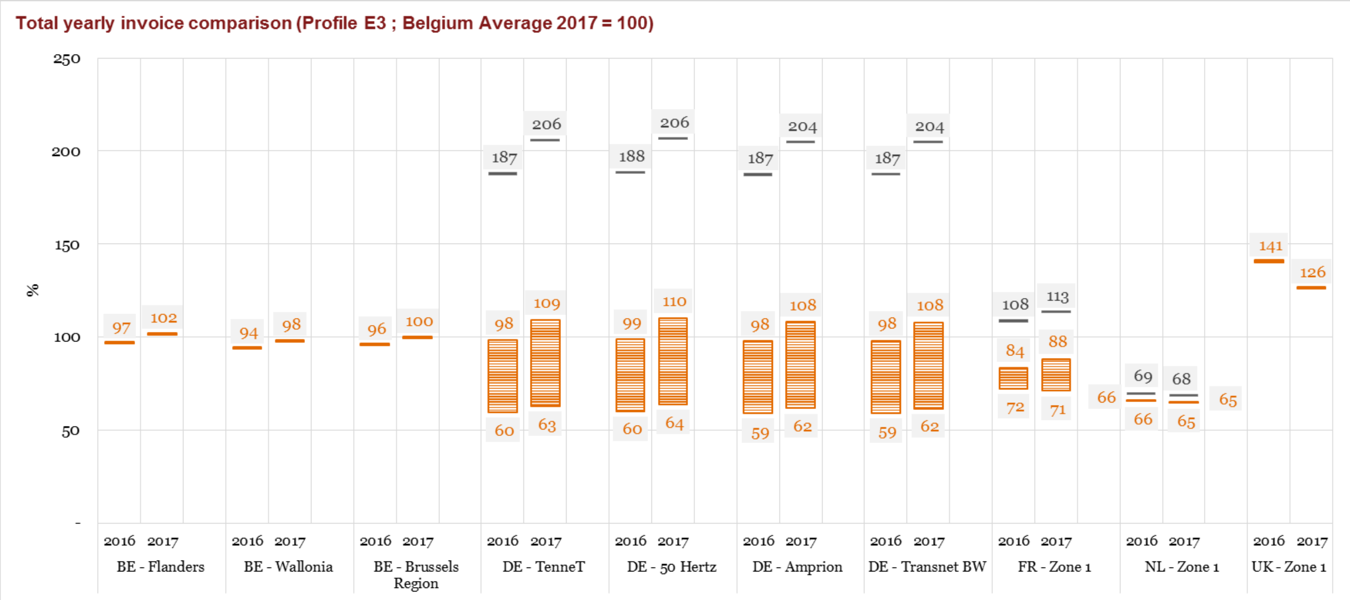


For an extensive legend for all figures, see page 69.

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 8 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average 2017 = 100%).

Figure 8 – Total yearly invoice comparison in % (profile E3)



For an extensive legend for all figures, see page 69.

As was the case for profile E1 and E2, total cost increased compared to 2016 in Belgium, Germany and France, while it remained stable in the Netherlands and decreased in the UK (currency effect).

Belgium remains 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 lower electricity cost than the Flemish and Brussels regions for profile E3. 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 non-electro intensive case 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 added value: when average annual electricity cost over the last three years represents less than 14% of gross added value of an industrial consumer, he inevitably pays the maximum rate. In 2016, this threshold was 17%.

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.

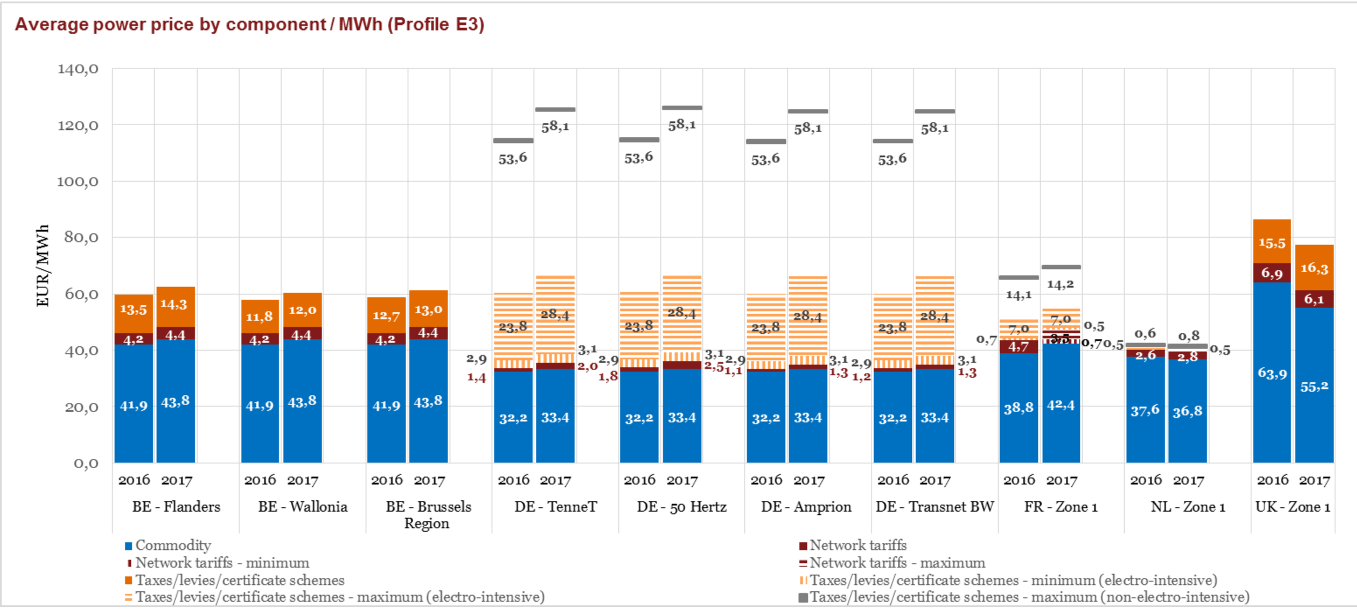
Thanks to the reintroduction of transmission tariff reductions (not reflected in the 2016 prices)[79], the competitiveness position of French electro-intensive consumers hardly changes compared to last year, in spite of the increase in commodity cost. For non-electro-intensive consumers, however, French competitiveness deteriorated compared to Belgium.

[79] The reductions were retroactively introduced in spring of 2016, after the publishing deadline of the 2016 report that looked at prices for power consumed in January 2016.

Breakdown by component

The previous results are further detailed for the profile E3 in Figure 9 which provides a closer look on the components breakdown.

Figure 9 – Average power price by component in EUR/MWh (profile E3)



For an extensive legend for all figures, see page 69.

Even more so than for profiles E1 and E2, **commodity cost** plays a major role. Commodity prices generally increased compared to last year, with two exceptions: the UK (exchange rate effect) and the Netherlands that have become more competitive. Commodity cost in Germany is still lowest, while the important increase in commodity cost in France has brought French consumers (with 87,8% of ARENH at 42 EUR/MWh in their sourcing) to pay commodity prices at the same level as Belgian consumers. Belgian (and French) commodity cost is now significantly higher than in Germany and the Netherlands. Commodity costs in the UK remained stable in local currency, and remain markedly higher than in the other countries.

For profile E3, **network costs** only constitute a limited part of the total invoice. Large baseload consumers in the UK and Belgium pay higher transmission tariffs than those in the Netherlands, France and Germany. This is explained by the fact that in those three countries, large baseload consumers such as E3 in this study can benefit from transport tariff reductions (85% in Germany, 45% in the Netherlands and between 10 and 85% in France depending on electro-intensity). These reductions profoundly alter the situation in terms of network costs, and by doing so the general picture in terms of competitiveness, especially for Germany where continually increasing network costs are the highest of all countries under review.

Taxes, levies and certificates schemes play a variable role that strongly depends on the electro-intensity of the consumer. Compared to 2016, their general level increased in Belgium and the UK (green certificate quota) and Germany (EEG-Umlage increase). They can have a relatively large impact in the United Kingdom and Belgium (where differences between regions are small), particularly on electro-intensive consumers for whom no specific reductions exist in these countries.

For non-electro-intensive consumers (depending on local criteria), taxes in Germany, France and the UK are higher than in Belgium. Dutch consumers, whether electro-intensive or not, benefit from the lowest 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:

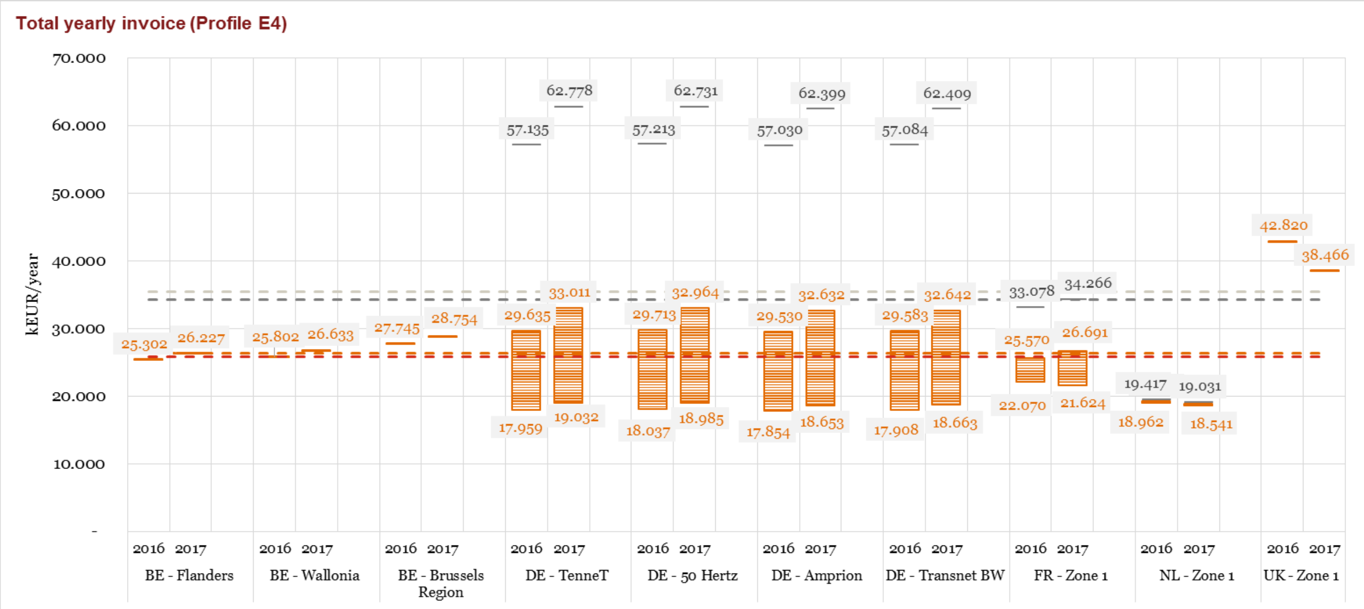
- Compared to 2016, total cost in Germany, Belgium and France increased, while it remained stable in the Netherlands and decreased in the UK (exchange rate effect).
- The majority of cases under review are clearly more competitive than Belgium: France, the Netherlands and Germany (low and medium range).
- *Commodity costs* play a very important role. In this respect, Belgium and France have higher commodity costs than Germany and the Netherlands. Germany – and to a lesser extent the Netherlands – have a substantial competitive advantage, while the UK remains more expensive.
- *Network costs* are responsible for a relatively small part of the bill. Important reductions in Germany, France and the Netherlands make that otherwise low (UK) to very low (Belgium) transmission tariffs still constitute a competitive disadvantage. Transmission tariff reductions for large baseload consumers constitute a sizeable competitive advantage for France and the Netherlands, but especially for Germany were the base rates of transmission tariffs are by far the highest of all cases under review.
- *"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.

6.5. Profile E4 (Electricity)

Total invoice analysis

Figure 10 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 10 – Total yearly invoice in kEUR/year (profile E4)

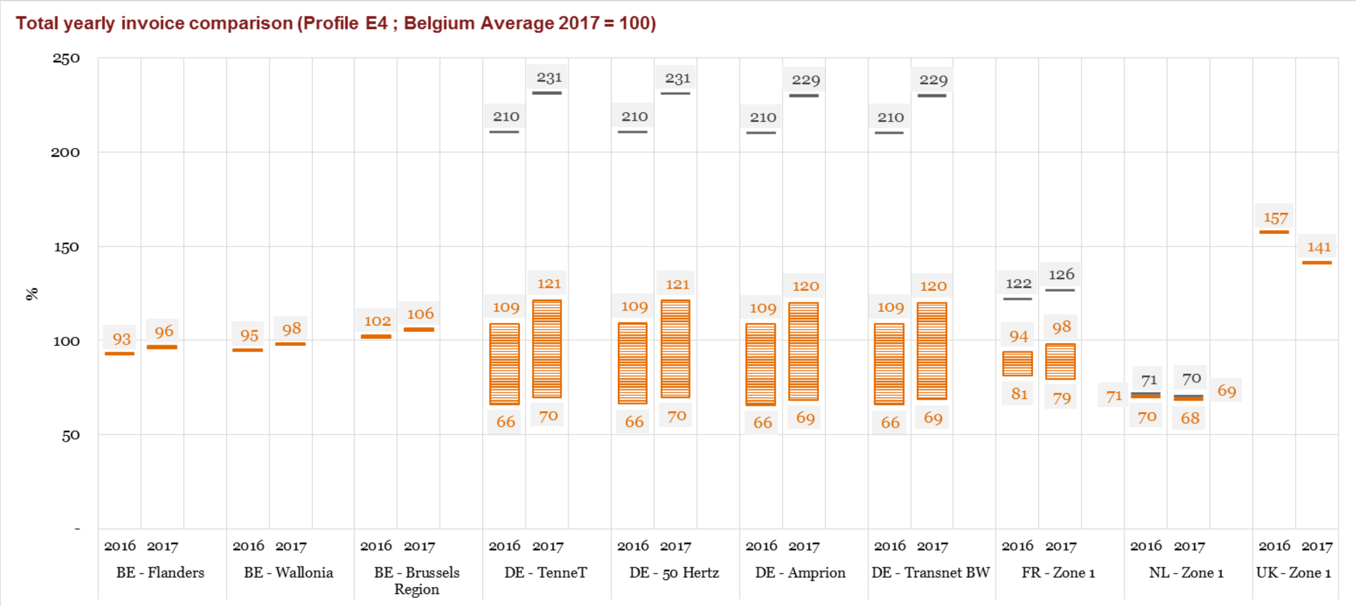


For an extensive legend for all figures, see page 69.

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 11 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average 2017 = 100%).

Figure 11 – Total yearly invoice comparison in % (profile E4)



For an extensive legend for all figures, see page 69.

As was the case for all other consumer profiles, total electricity cost clearly increased compared to 2016 in Belgium, Germany and France, while it remained stable in the Netherlands and decreased in the UK (currency effect).

Belgium is less competitive than the Netherlands for all consumers, and less competitive than France and Germany for electro-intensive consumers. When compared to non-electro-intensive consumers in Germany and France, the Belgian competitiveness position improved compared to 2016. This is true for all three Belgian regions, even though the Flemish and Walloon regions offer a slightly lower electricity cost than the Brussels region[80]. 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 added value: when average annual electricity cost over the last three years represents less than 14% of gross added value of an industrial consumer, he inevitably pays the maximum rate (in 2016 this threshold was fixed at 17%).

As is the case for profile E4, 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.

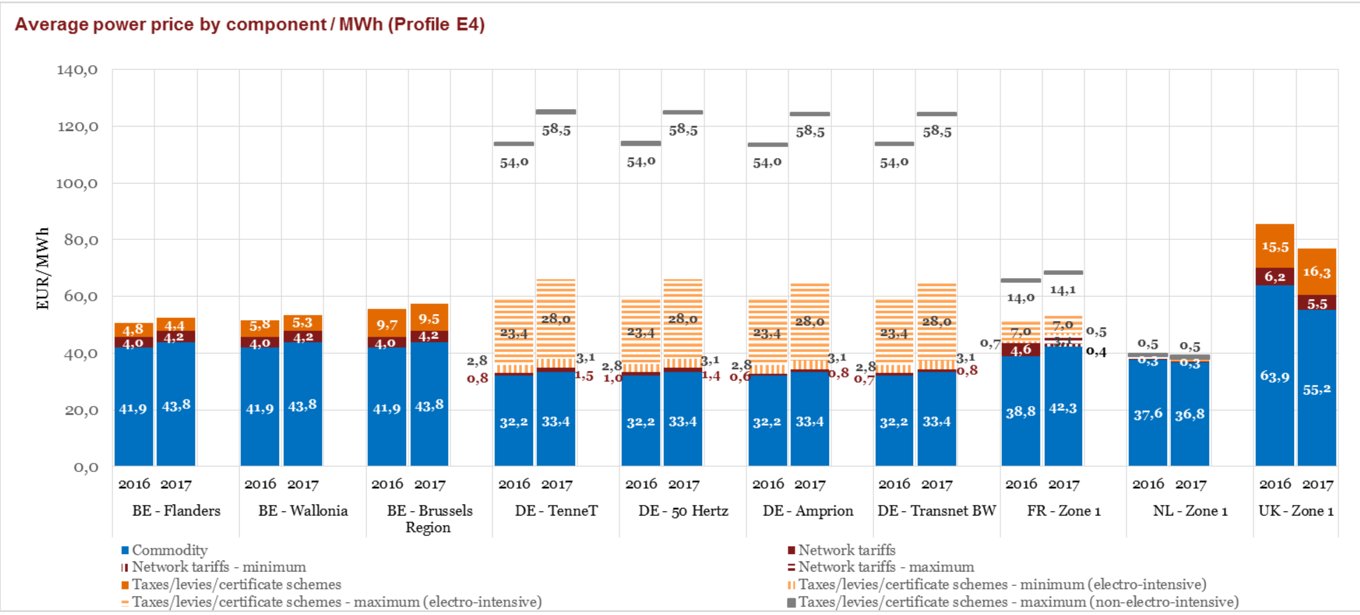
[80] It should be noted that in Brussels there is currently no industrial consumer with the consumption level of profile E3, which could be an explanation for the high taxes in this region.

Thanks to the reintroduction of transmission tariff reductions (not reflected in the 2016 prices)[81], the competitiveness position of French electro-intensive consumers hardly changes compared to last year, in spite of the increase in commodity cost. For non-electro-intensive consumers, however, French competitiveness deteriorated compared to Belgium as mentioned before.

Breakdown by component

The previous results are further detailed for the profile E4 in Figure 12 which provides a closer look on the components breakdown.

Figure 12 – Average power price by component in EUR/MWh (profile E4)



For an extensive legend for all figures, see page 69.

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. **Commodity** prices generally increased compared to last year, with two exceptions: the UK (exchange rate effect) and the Netherlands that have become more competitive. Commodity cost in Germany is still lowest, while the important increase in commodity cost in France has brought French consumers (with 91,3% of ARENH at 42 EUR/MWh in their sourcing) to pay commodity prices at the same level as Belgian consumers. Belgian (and French) commodity cost is now significantly higher than in Germany and the Netherlands. Commodity costs in the UK remained stable in local currency, and remain markedly higher than in the other countries.

For profile E4, **network costs** only constitute a limited part of the total invoice. Large baseload consumers in the UK and Belgium pay higher transmission tariffs than those in the Netherlands, France and Germany. This is explained by the fact that in those three countries, large baseload consumers such as E4 in this study can benefit from transport tariff reductions – even more so than profile E3 (90% in Germany and the Netherlands and between 20 and 90% in France depending on

[81] The reductions were retroactively introduced in spring of 2016, after the publishing deadline of the 2016 report that looked at prices from January 2016.

electro-intensity). 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. For profile E4, the Belgian tax level (except for the Brussels region[82]) is lower than in 2016 (because of the decrease in strategic reserve levy) and considerably lower than for other consumption profiles because the annual caps and digressive rates for several of the taxes and surcharges. This brings down the tax level for all industrial E4 consumers in Flanders and Wallonia consumers in to slightly above the level for electro-intensive consumers in neighbouring countries, but well below top tax levels for non-electro-intensives in France and Germany.

Dutch large baseload consumers benefit from the lowest 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 (and reduced network tariffs) - depending on the exact amount of taxes that has to be paid.

KEY FINDINGS

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

- The majority of cases under review are more competitive than Belgium: France and Germany (for electro-intensives) and the Netherlands (for all consumers). Nevertheless, the competitive disadvantage of Belgium for profile E4 is clearly less important than for the three other consumption profiles.
- 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 and French commodity cost is higher than the cost of commodity charged in the Netherlands and significantly higher than in Germany. Commodity costs in the United Kingdom remain high and are an important factor in the outlier result for the UK, even though the exchange rate effect closes part of the gap for 2017 compared to 2016.
- *Network costs* are responsible for a relatively small part of the bill. Important reductions in Germany, the Netherlands and France make that otherwise low (UK) to very low (Belgium) transport tariffs still constitute a competitive disadvantage.
- *"Taxes, levies and certificates schemes"* are characterised by a large variance. For profile E4, the only countries showing an increase compared to 2016 for this component are Germany (with the increase in EEG-Umlage) and the United Kingdom (increase of Renewable Obligation). The Netherlands clearly show the lowest level of taxes, even for non-electro-intensive consumers, while in France and Germany competitiveness entirely depends on the electro-intensity of the individual consumer. 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.

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

6.6. *Interpretation of figures (Gas)*

Figure A: Total yearly invoice

	Symbol	Legend	Interpretation
Graph 1 ***Total yearly invoice (€/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 2017	2017 average (non-weighted) of all options
		Average 2016	2016 average (non-weighted) of all options

Figure B: Total yearly invoice comparison (Belgium 2017 = 100)

	Symbol	Legend	Interpretation
Graph 2 ***Yearly invoice comparison (Belgium 2017 = 100)***	92 86	Maximum option Minimum option	Demonstrates the range of points between the minimum 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 ***Average gas price by 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

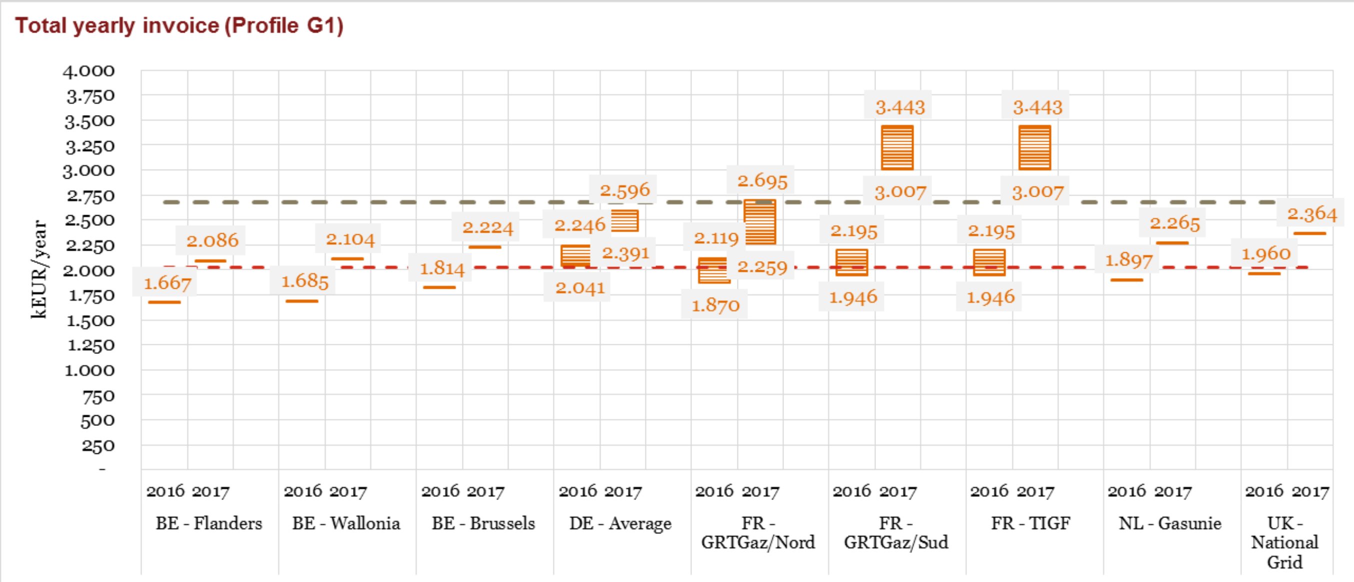
6.7. Profile G1 (Gas)

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. Furthermore, commodity prices of 2016 have been recalculated according to the new methodology and do not longer correspond to commodity prices presented in the 2016 report.

Figure 13 depicts the total yearly invoice charged 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.

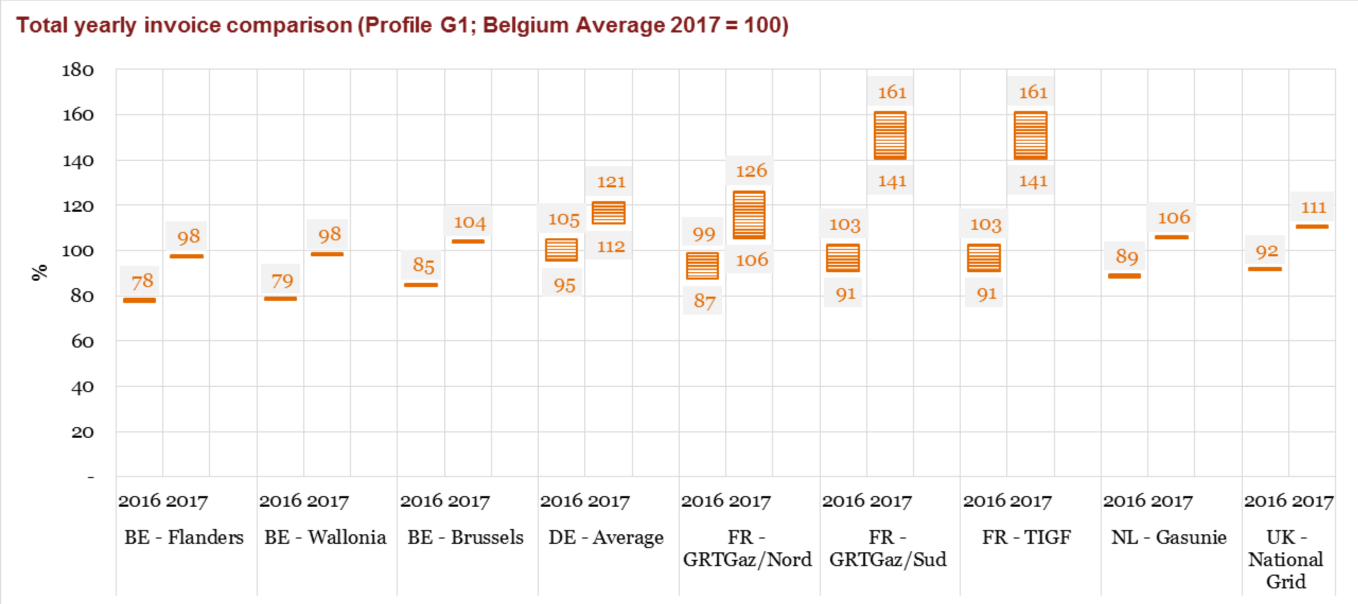
Figure 13 – Total yearly invoice in kEUR/year (profile G1)



For an extensive legend for all figures, see page 88.

For the purpose of facilitating the comparisons, in Figure 14 the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average 2017 = 100%).

Figure 14 – Total yearly invoice comparison in % (profile G1)



For an extensive legend for all figures, see page 88.

In terms of natural gas for a relatively large industrial consumer like profile G1, we observe a general price increase compared to 2016 that applies to all countries.

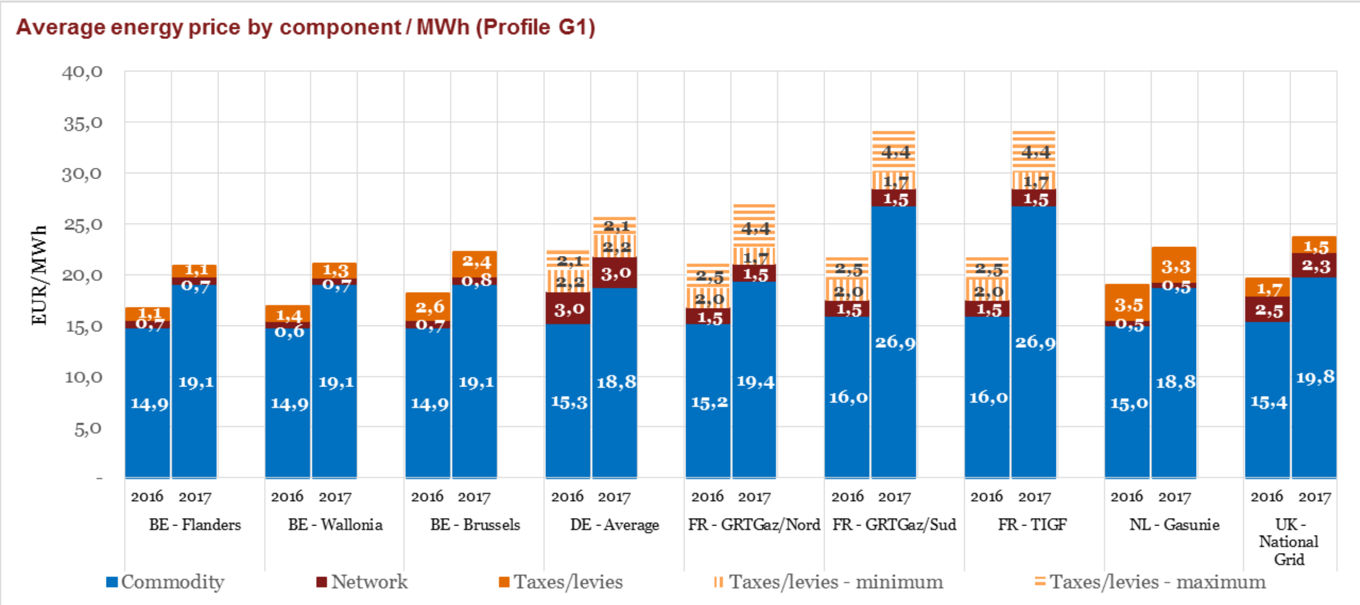
Belgium as a whole offers the most competitive prices of the entire sample, as was the case in 2016. All three Belgian regions are more competitive than all other regions under review, with Flanders and Wallonia offering lower prices than Brussels. Industrial consumers like profile G1 (and who do not use gas as a raw material) in Germany, France, the Netherlands and the UK pay at least 5% to 10% 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 15, which provides a closer look on the components' breakdown.

Figure 15 – Average gas price by component in EUR/MWh (profile G1)



For an extensive legend for all figures, see page 88.

More than for electricity and in all countries, the **commodity cost** plays the major role in the composition of the total gas price. Apart from the TRS market region (south and south-west France), market prices in all countries under review converge at a level about 4 to 5 EUR/MWh above the January 2016 level. Where last year the lowest commodity cost was to be found in Belgium, in 2017 prices in the Netherlands and Germany were slightly below those in Belgium, France (PEG Nord) 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.[83]

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. Compared to 2016, the only notable evolution is a slightly downward trend in the UK.

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 for this component. 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, Germany and especially France (where the TICGN-tax shows a considerable increase compared to 2016) 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.

[83] The difference between the South and the North of France is exceptionally high in the period under review in this report.

KEY FINDINGS

Gas profile (G1) suggests the following findings:

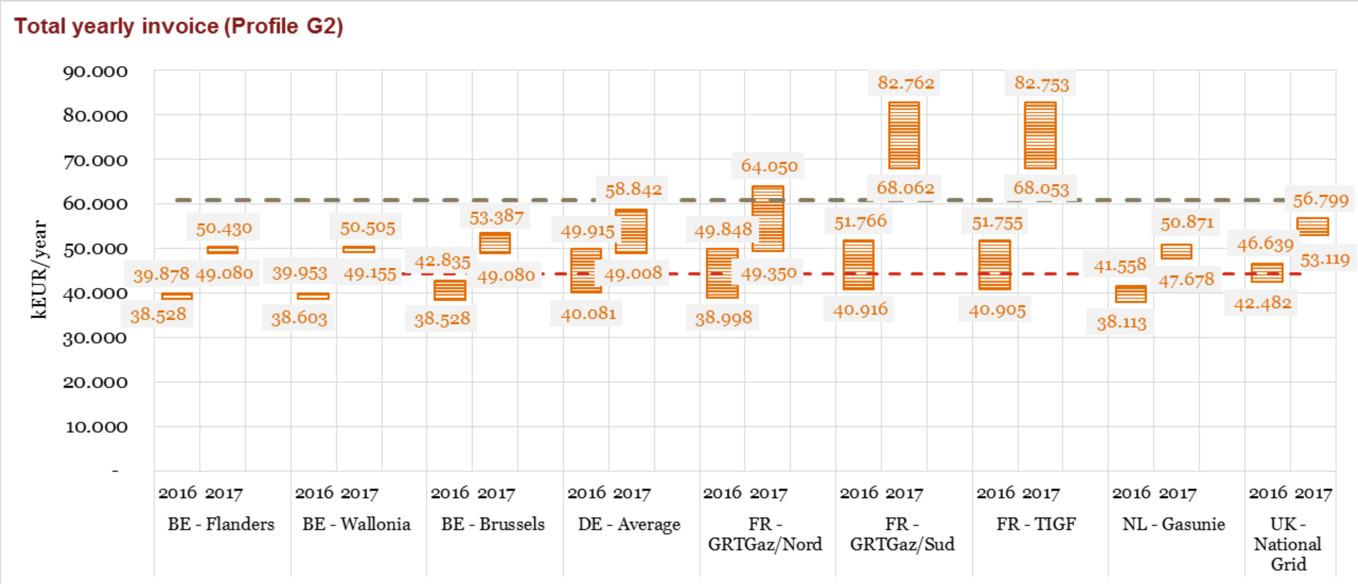
- Belgium is the most competitive country in terms of natural gas prices for relatively large industrial consumers.
- Together with the important share of commodity cost in the total cost, price convergence on the commodity market in the UK, Northern France, Germany and the Netherlands makes for relatively small differences between the zones under review (except for southern France). For this specific period (January 2017) commodity cost in the Netherlands and Germany is slightly lower than in Belgium, Northern France and the UK.
- 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.

6.8. Profile G2 (Gas)

Total invoice analysis

The next chart, Figure 16, depicts the total yearly invoice charged 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).

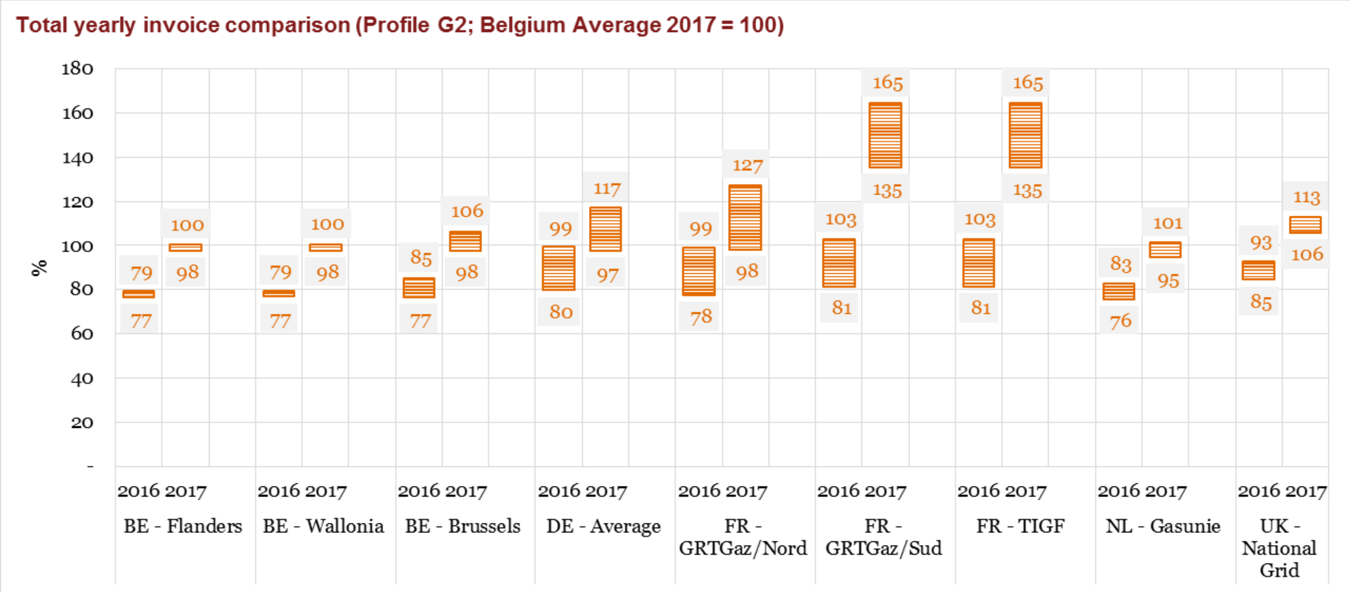
Figure 16 – Total yearly invoice in kEUR/year (profile G2)



For an extensive legend for all figures, see page 88.

For the purpose of facilitating the comparisons, in Figure 17, the same results are compared to the reference situation which relates to the average of the three Belgian regions (Belgian average 2017 = 100%).

Figure 17 – Total yearly invoice comparison in % (profile G2)



For an extensive legend for all figures, see page 88.

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

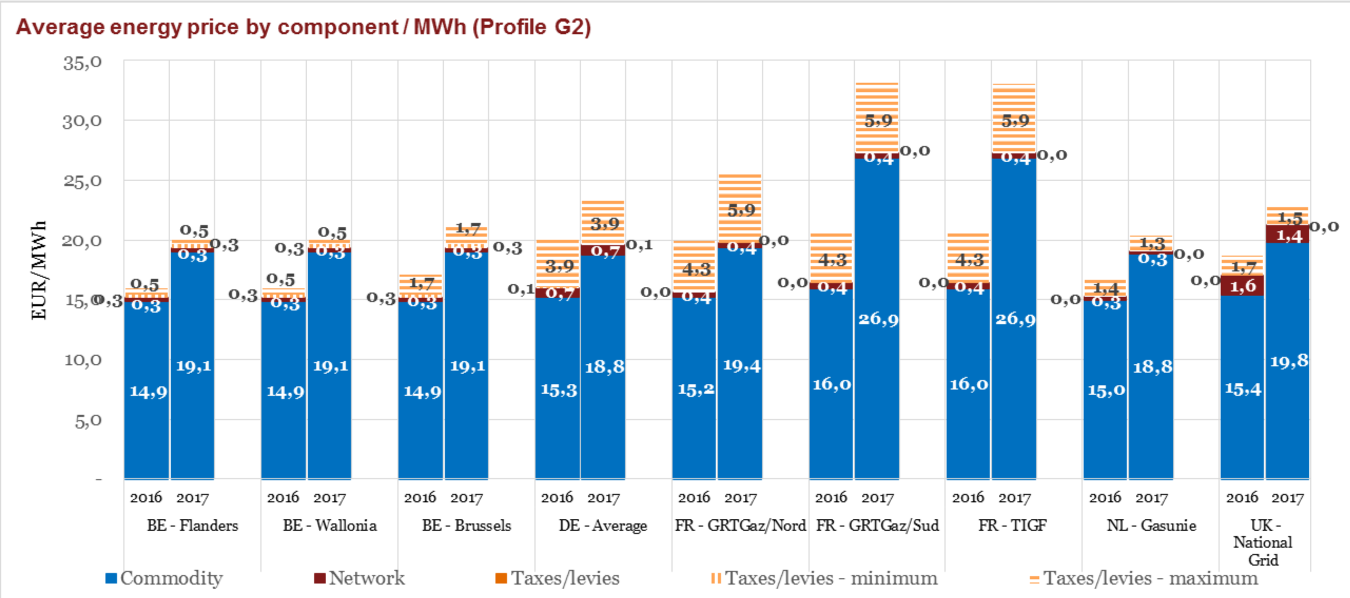
For very large industrial feedstock consumers using natural gas as a raw material (bottom range of the figures), cost differences between the countries under review are relatively small, except for the UK that offers a substantially higher cost. For these consumers, the Netherlands is the most competitive countries under review, followed very closely by Northern France, Germany and Belgium. This constitutes a small change from 2016, when only the Netherlands offered more competitive prices than Belgium.

For very large industrial consumers that do not use natural gas as a raw material, but rather for heating and other purposes (top range of the figures), cost differences between the countries under review are much more important. Belgium is generally very well positioned, joined by the Netherlands (that gained in competitiveness compared to last year). Consumers in the UK, Germany and France can pay up to 20 – 30% more than comparable consumers in Belgium. Southern France represents an outlier due to the high commodity cost.

Breakdown by component

The previous results are further detailed for the profile G2 in the following chart, Figure 18, which provides a closer look on the components' breakdown.

Figure 18 – Average gas price by component in EUR/MWh (profile G2)



For an extensive legend for all figures, see page 88.

As is the case for profile G1, the **commodity cost** is by far the largest part of the total gas price. Apart from the TRS market region (south and south-west France), market prices in all countries under review converge at a level about 4 to 5 EUR/MWh above the January 2016 level. Where last year the lowest commodity cost was to be found in Belgium, in 2017 prices in the Netherlands and Germany were slightly below those in Belgium, France (PEG Nord) 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.

Network costs only make up a limited amount of the total cost and show very little evolution compared to 2016. We observe the lowest values in Belgium, and slightly higher values in the Netherlands and France (for both TSOs). 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 18. For these top range results, that only apply to consumers that do not use gas as raw material, we observe the highest tax levels in France (where the TICGN increases compared to last year) and 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 18, is hence very low for all regions under review.[84]

[84] With the exception of the hypothetical Brussels case (see Footnote 57).

Nevertheless, Belgium offers the highest level of taxes for these feedstock consumers, because no exemption exist on the federal contribution, although capping and digressiveness apply.

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, the Netherlands offer a lower total cost than Belgium that shows a cost roughly similar to the one in Germany and Northern France. 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. Price levels for gas consumed in January 2017 have increased compared to those for January 2016.
- 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. France and also Germany 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.

7. Energy prices: Conclusion

7. Energy prices: conclusion

7.1. 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 mainly occur on two components: transport (Germany, France and the Netherlands) and most importantly taxes, levies and certificate schemes (Belgium, UK, Germany, France and the Netherlands). Given the increased market prices compared to 2016, the French intervention on commodity prices (ARENH) has become relevant again, slightly reducing commodity cost for French large industrial consumers.
2. Commodity cost plays a very important role: in spite of the general increase in commodity prices for all countries under review, Dutch and especially German consumers are clearly in a more competitive starting position than their Belgian and – recently so – French competitors. 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. Even though the difference is smaller than in 2016 due to currency effects, the United Kingdom remains 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.

7.2. Gas

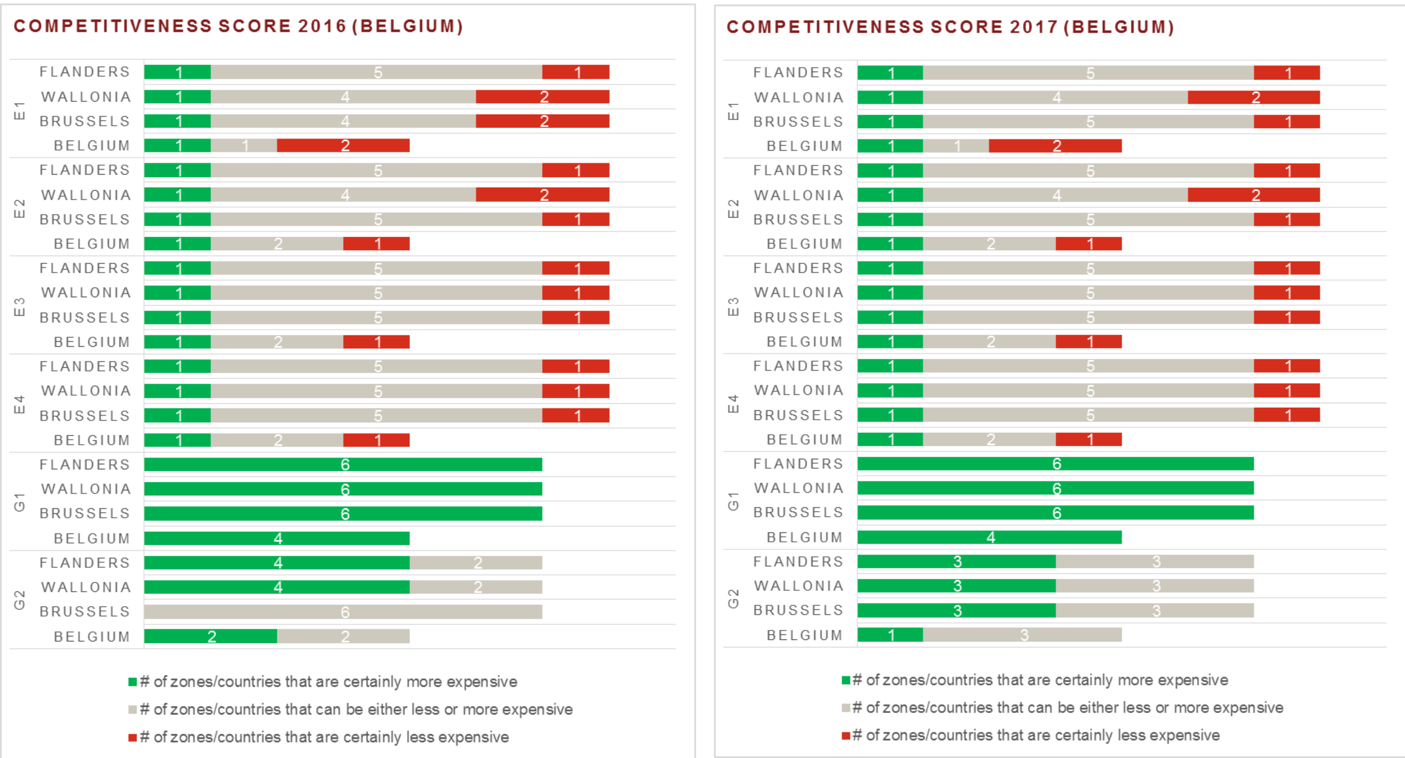
As far as natural gas is concerned, some **general conclusions** can be presented as well:

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 2017) commodity cost in the Netherlands and Germany is slightly lower than for in Belgium, Northern France and the UK. 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, Belgian gas consumers in 2017 have no clear competitive advantage on their competitors in neighbouring countries anymore, with the Netherlands clearly offering a lower price. This evolution is caused by price evolutions on the gas market, but influenced as well by the fact that Belgium remains the only country not exempting feedstock consumers from all taxes (federal contribution). For both consumer profiles, the competitive position of Belgium is based on a competitive commodity cost (even though less so than in 2016), low network costs, and a comparatively low level of taxes and levies.

7.3. 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 8.1 of this report, this analysis will be elaborated based on macro-economic data.

Figure 19 – Competitiveness scorecard



For electricity, the only visible evolution compared to 2016 is a slight improvement of the competitive positioning of profile E1 in the Brussels Region (thanks to the increase in commodity cost for France).

No different from last year, only one neighbouring country is less competitive than Belgium, for all electricity consumption profiles: the United Kingdom. The only exception is profile E1, for which prices are now more advantageous in Belgium than in France. 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 45% lower than in Belgium.

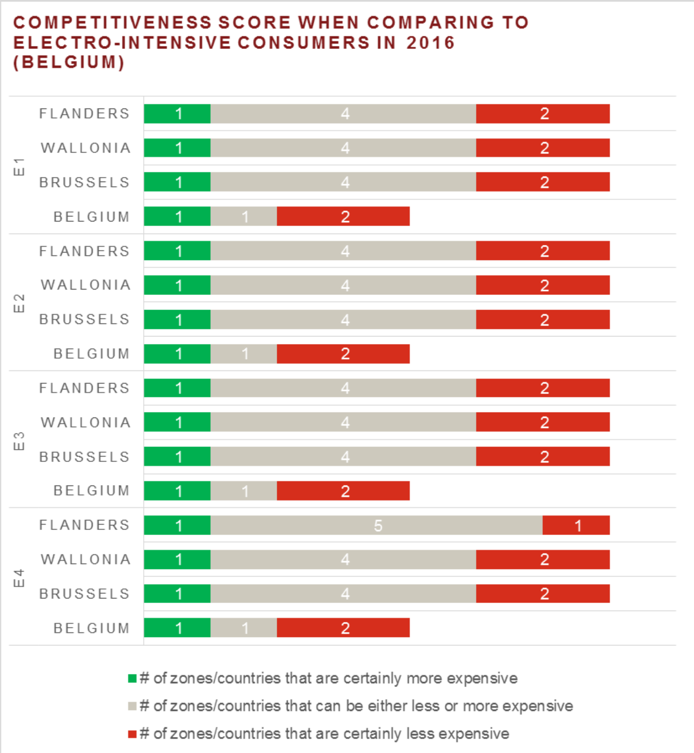
The differences between the Flemish and Walloon regions is most important for profiles E1 and E2 where electricity cost observed in the Walloon region is about 8% above the cost observed in the Flemish region. This difference is reflected in the competitiveness score (the Netherlands and France are certainly 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 relatively small differences between both regions and with the Walloon region being more competitive for E3 (4% difference), while the Flemish region is more competitive for E4 (2% difference).

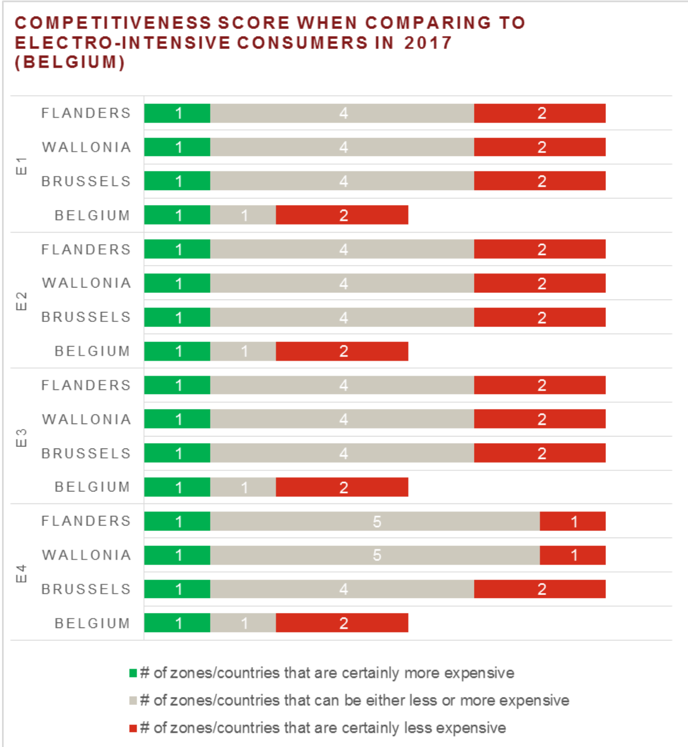
In terms of industrial gas consumers, the situation depicted by the competitiveness scorecard is very different. For profile G1, the three Belgian regions are more competitive than all other zones/regions under review. For profile G2, the situation is more nuanced and has clearly evolved compared to 2016. When considering top range prices (no feedstock consumers), the situation is similar to G1, with the Belgian regions more competitive than the other zones/regions. However, for feedstock consumers (bottom range prices) the competitive position slightly deteriorated, with three countries (France, Netherlands and Germany) that can offer lower prices than Belgium. The grey zones in the competitiveness scorecard reflect this uncertainty that is linked to possible reductions that can be obtained based on economic parameters (feedstock activity or not).

The competitiveness scorecard in Figure 19 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 6 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 countries. They are presented in Figure 20 and Figure 21 respectively.

Figure 20 – 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 in the case of E4 in Flanders and Wallonia, where the French competitive position deteriorated compared to last year due to the increase in commodity cost. The comparative improvement of Wallonia constitutes the only difference between 2016 and 2017. The grey zone can almost entirely be attributed to Germany and represents the complexity of reduction schemes.

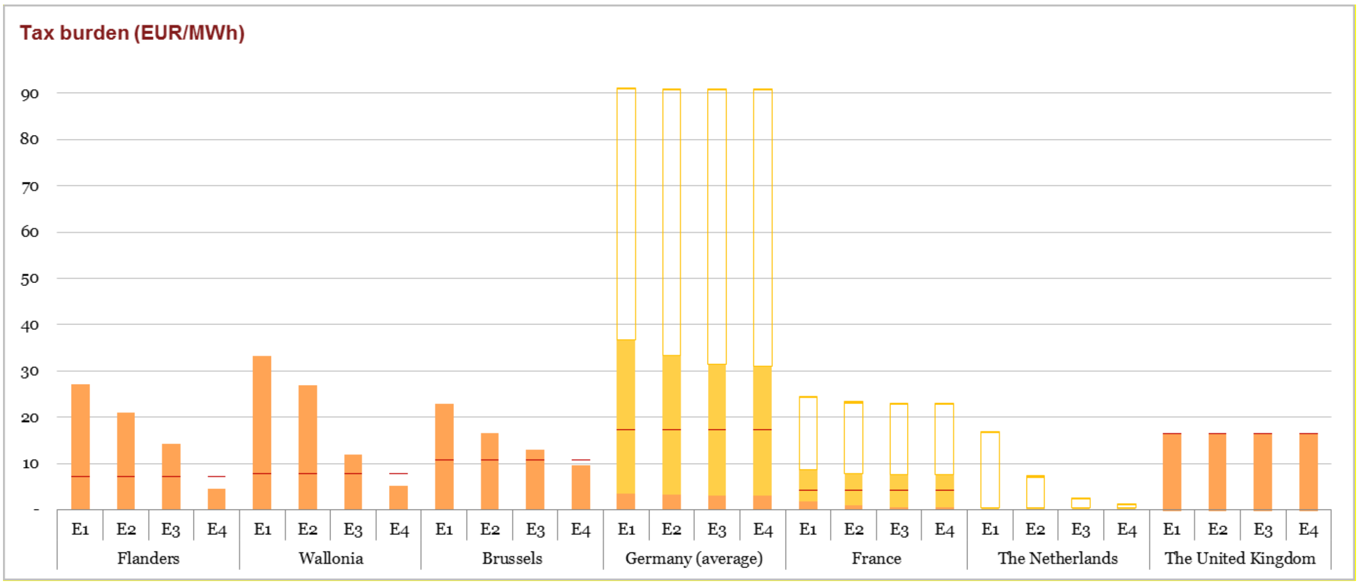
Figure 21 – Competitiveness scorecard when comparing to non-electro-intensive consumers

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 21 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). We do not observe any evolution in this regard from 2016 to 2017.

7.4. 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 22, 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 22 – Taxes, levies and certificate schemes throughout 4 profiles



No different from 2016, 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 (and this shift happened in 2016 already, but is confirmed in 2017) towards electro-intensity criteria regarding the allocation of the tax burden, while Belgium still defines exemptions strictly based on consumption, even on regional surcharges. 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).

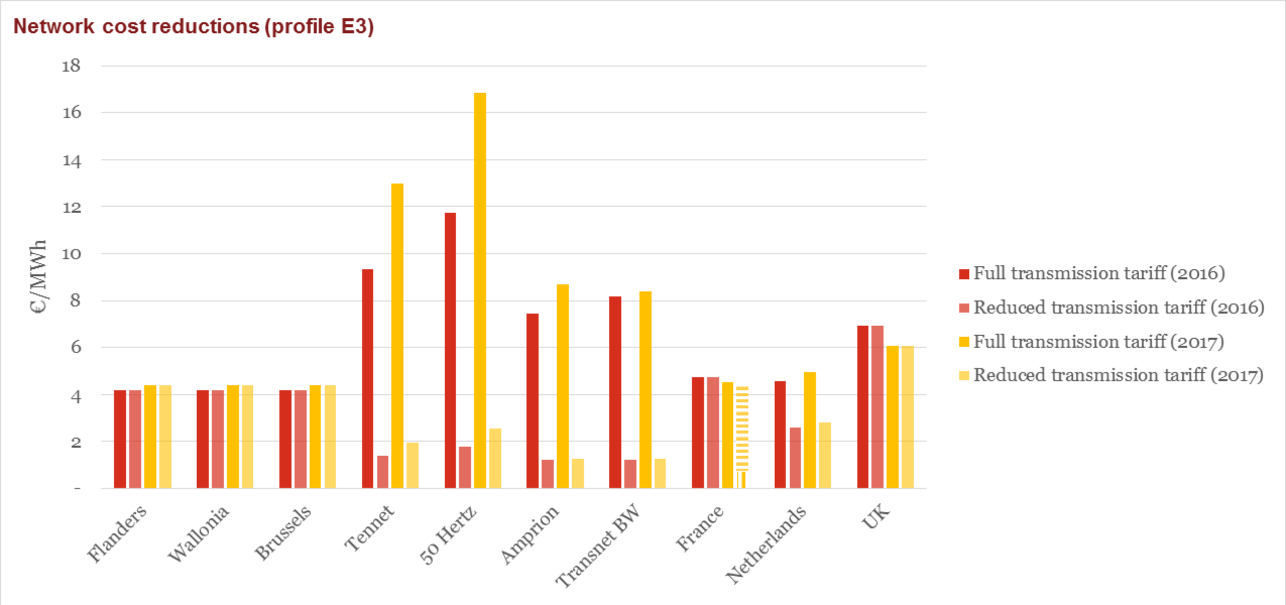
In other words, from a fiscal point of view, we can make the same remark as we did in 2016: Belgian federal and regional authorities mainly grant reductions and/or exemptions to taxes, levies and certificate schemes based on the level of electricity offtake, and not on the level of electro-intensity 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.

7.5. 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, the Netherlands in January 2014 and France reintroduced them in January 2017. Belgium and the UK do not grant reductions.

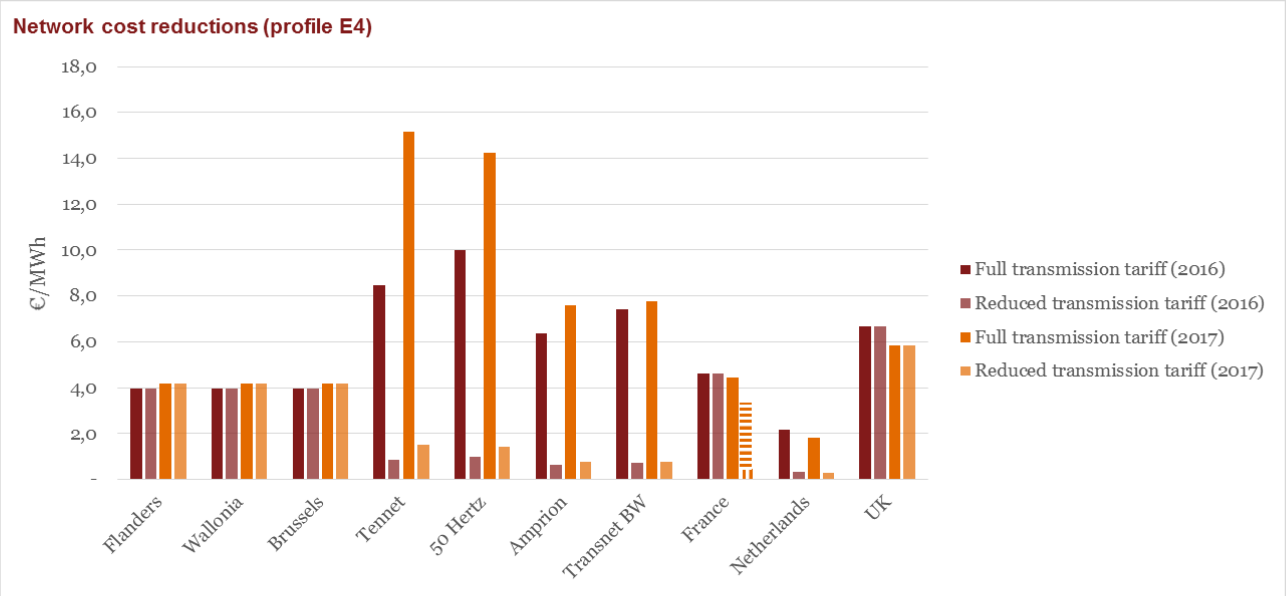
In Germany, France and the Netherlands, large baseload consumers such as E3 and E4 in this study can benefit from a transport tariff reduction up to 90%. As shown in Figure 23 and Figure 24 below, these reductions profoundly alter the situation in terms of transmission tariffs for profile E3 and even more for profile E4, and by doing so the general picture in terms of competitiveness.

Figure 23 – Network cost reductions (profile E3)



Source: PwC

Figure 24 – Network cost reductions (profile E4)



Source: PwC

In all cases, the cost is transferred to the other consumers. In the Netherlands and France, 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.

Comparing 2016 with 2017, we need to highlight two other effects. First of all, we can see that **transmission tariffs in Germany are evolving unevenly** between the West and South-West (Amprion and Transnet BW) and the North and East (TenneT and 50 Hertz). We have not researched the question whether these increases in the North and East can be attributed to investment in grid adaptations for renewables, or also to other causes. Hence, the tariff reductions for baseload consumers in Germany do not only serve to protect competitiveness compared to neighbouring countries, but also to even out intra-German differences that are getting increasingly important.

Secondly, we can see that – as the first country in the five countries under review – **France has introduced the notion of electro-intensity** in the criteria for tariff reductions. All baseload or anti-cyclical consumers that meet the criteria (very similar to other countries) receive tariff reductions, but the height of these reductions varies in function of the electro-intensity level of the individual consumer.[85] This further enhances the gap between prices for electro-intensive and non-electro-intensive consumers in France.

[85] The system is explained in detail on page 45 and following.

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

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

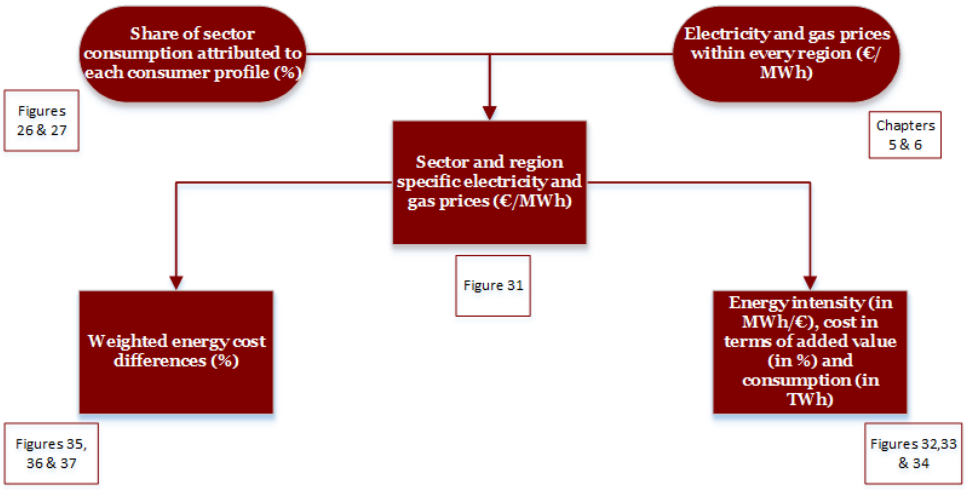
8.1. Competitiveness analysis

8.1.1 Methodology

In the previous report 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.[86] 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 the previous chapters of this report, the gas and electricity prices were compared with those of Belgium's neighbouring countries: Germany, France, the Netherlands and the UK.

In this final chapter the information gathered in the previous chapters 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 25.

Figure 25 – Methodology flowchart



As is observed from the flowchart, in a first step the electricity and gas prices in Flanders, Wallonia and Brussels (see sections 6 and 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 prices of a certain sector (within a certain region) with that of the European average, while the second pathway elaborates on the **total energy cost**, which

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

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.

8.1.2 Sector and region specific electricity and gas prices

In the previous chapters, the electricity and gas prices for each of the three regions in Belgium were gathered. As the objective in this chapter 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 previous report. 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[87][88]and dividing by the total consumption per sector[89]) 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.

[87] 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.
[88] For electricity: 10 GWh for E1, 25 GWh for E2, 100 GWh for E3 and 500 GWh for E4.
[89] As presented during phase 1 of the 2016 report, 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)[90]	(2)[91]	(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 (10-1.000 GWh/year)		G2 (> 1.000 GWh/year)	
	(1)[92]	(2)[93]	(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%**

[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 51 cases of consumer profile E1 (with a consumption between 10 and 17,5 GWh/year) within the NACE 10-12 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 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.
[92] 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.
[93] 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%.

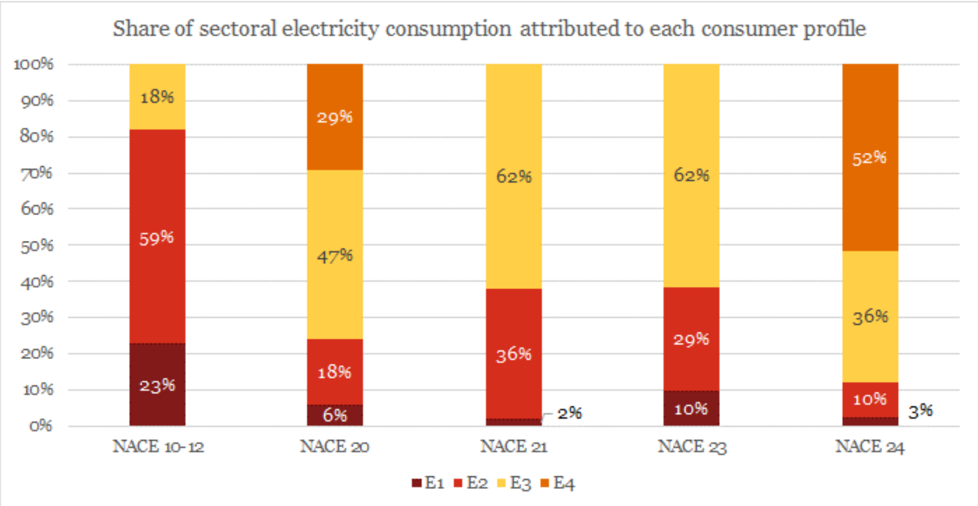
10-12 Food products, beverages and tobacco products	181	**100%**	-	**0%**
23 Other non-metallic mineral products	33	**57%**	1	**43%**

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 3.425 GWh[94]. Expressed in relative frequencies, 6% of the total consumption is represented by profile E1, 18% by E2, 47% by E3 and 29% by E4[95]. 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 19.600 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 26 and Figure 27. As is clear from Figure 26, 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 26 – Share of sectoral electricity consumption attributed to each consumer profile



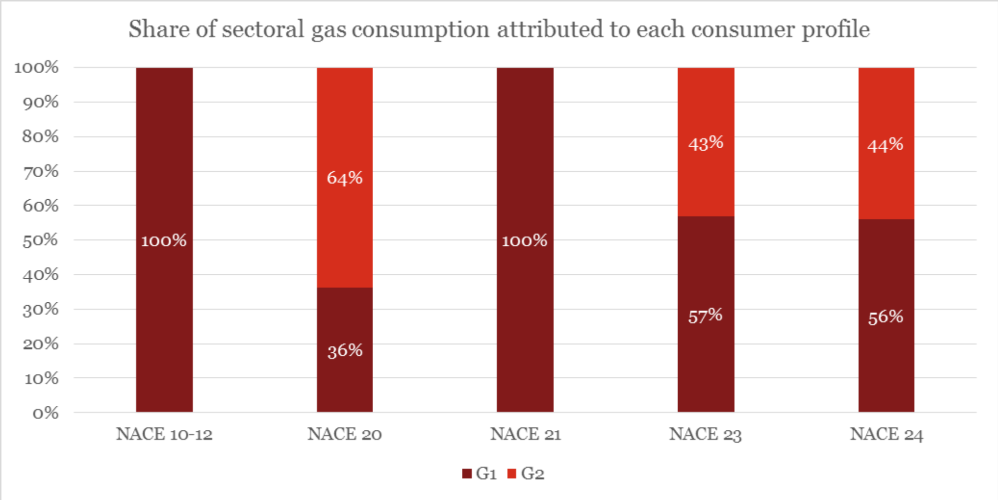
Source: CREG (2014), PwC Calculations

From Figure 27 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).

94 Total electricity consumption of 3425 GWh = (20* 10 GW h) + (25 * 25 GWh) + (16 * 100 GWh) + (2 * 500 GWh).
95 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 27 – 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[96] 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[97]:

[96] 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.
[97] 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.

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

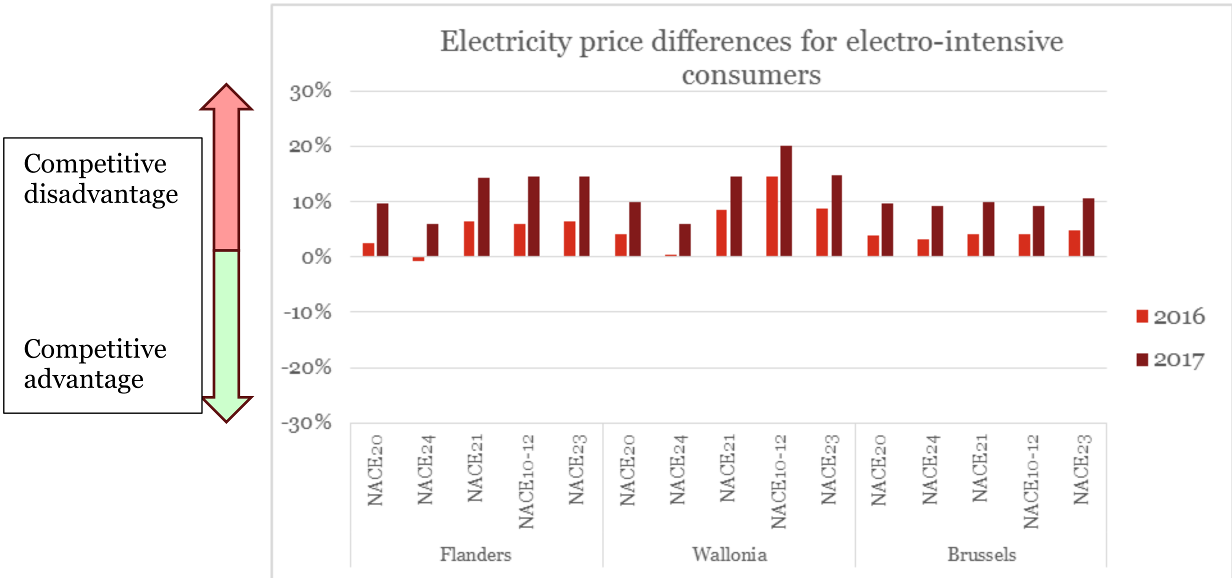
$$Eureopan\ average\ of\ P_{gas}\ for\ Sector_i = \sum_{Y=1}^{2} (Average\ price\ for\ G_Y\ \ in\ neighbouring\ countries * Relative\ frequency\ of\ G_Y\ in\ Sector_i\ )$$

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 28 (for the electro-intensive consumers), Figure 29 (for non-electro intensive consumers) and Figure 30 for gas consumers.

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

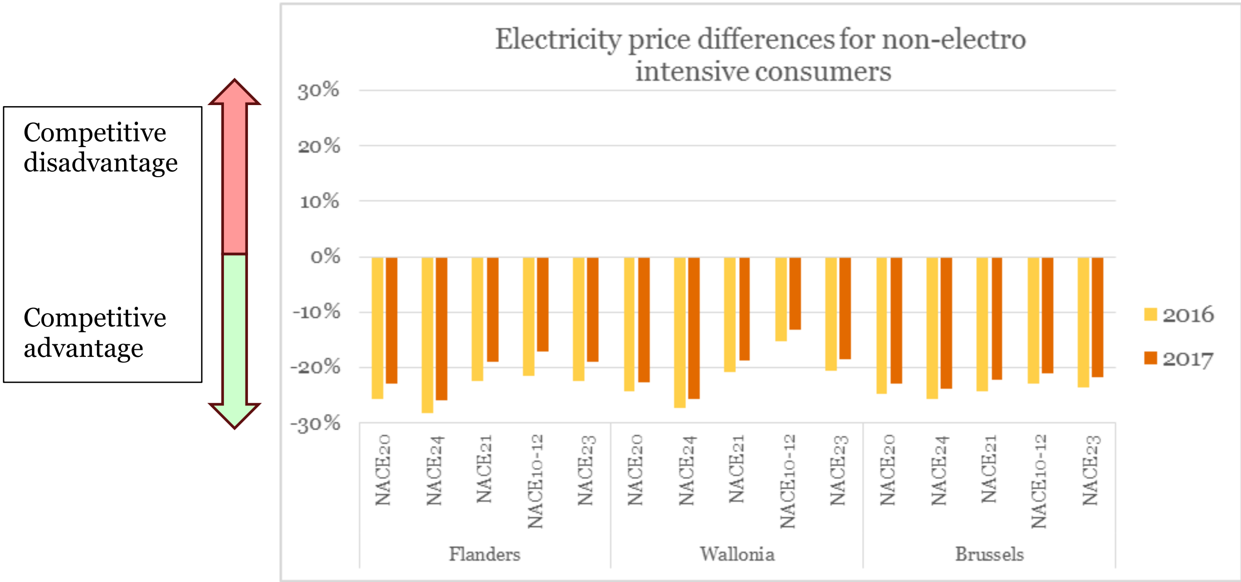
$$Y_{ij} = \left(\frac{P_{gas}\ for\ Sector_i\ in\ Region_j - \ European\ average\ of\ P_{gas}\ for\ Sector_i}{European\ average\ of\ P_{gas}\ \ for\ Sector_i} \right)$$

Figure 28 – Electricity price differences for electro-intensive consumers compared with the average in the neighbouring countries



Source: CREG (2014), PwC Calculations

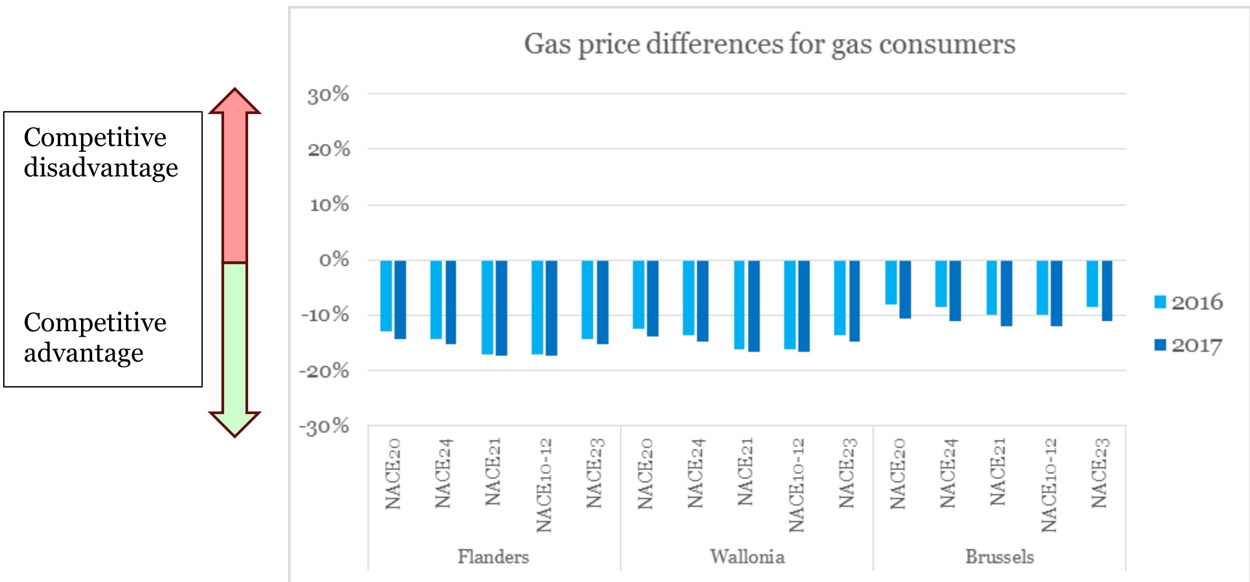
Figure 29 – Electricity price differences for non-electro-intensive consumers in comparison with the average in the neighbouring countries



Source: CREG (2014), PwC Calculations

One can observe in Figure 28 and Figure 29 that electricity price differences differ substantially from sector to sector and from region to region, but are always higher, when comparing for electro-intensive consumers (lack of competitiveness). Compared with last year, this disadvantage has increased even further. Furthermore, when comparing for non-electro-intensive consumers, prices are considerably lower (competitive prices), but with a slightly decreased competitive advantage when comparing with last year.

Figure 30 – Gas price differences for gas consumers in comparison with the average in the neighbouring countries



From Figure 30 can be observed that gas prices are more competitive in Belgium than in the neighbouring countries, for all sectors and in all regions. In comparison with 2016, gas prices are even more competitive in Belgium. This is due to a significant increase in commodity prices in January 2017 in Southern France.

8.1.3 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 >14% of gross added value For consumers of a less extensive list of industrial sectors: when electricity cost >20% of gross added value[98]
The Netherlands	Industrial consumers who are classified as being energy-intensive[99] 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

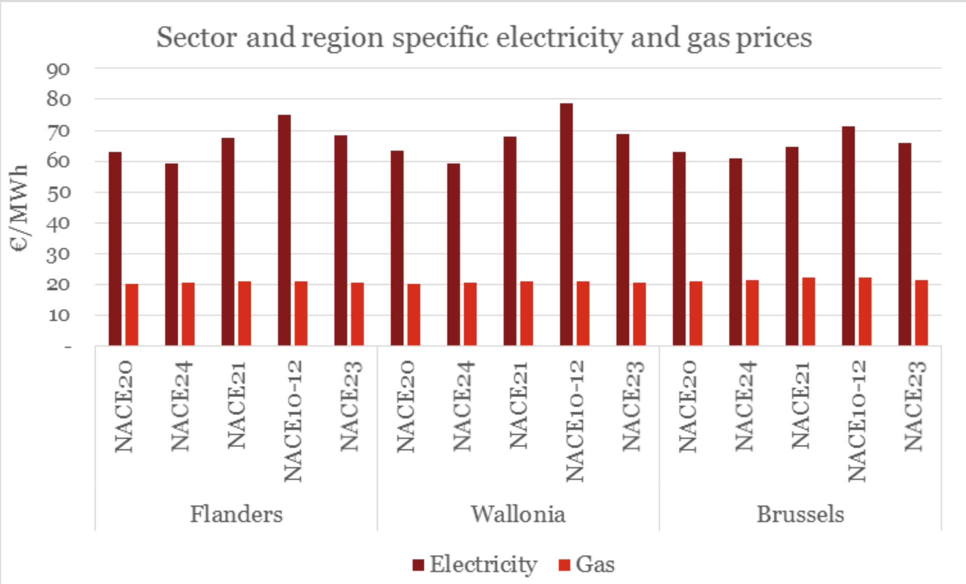
[98] These consumers have a significant reduction on their EEG-Umlage (base rate of 68,80 €/MWh).

[99] 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).

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 31) and MWh/€ of added value for electricity and gas (or energy intensity) per sector on the other hand (Figure 32). 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 31, 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 26).

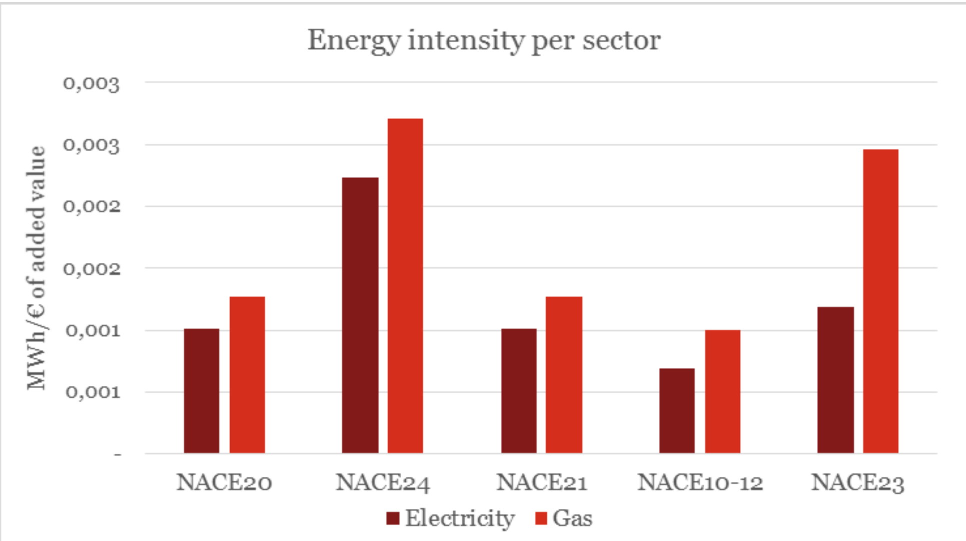
Figure 31 – Sector and region specific electricity and gas prices



Source: CREG (2014), PwC Calculations

The energy intensity figures have been presented for the first time in the 2016 report. As is illustrated in Figure 32, 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 32 – Energy intensity per sector



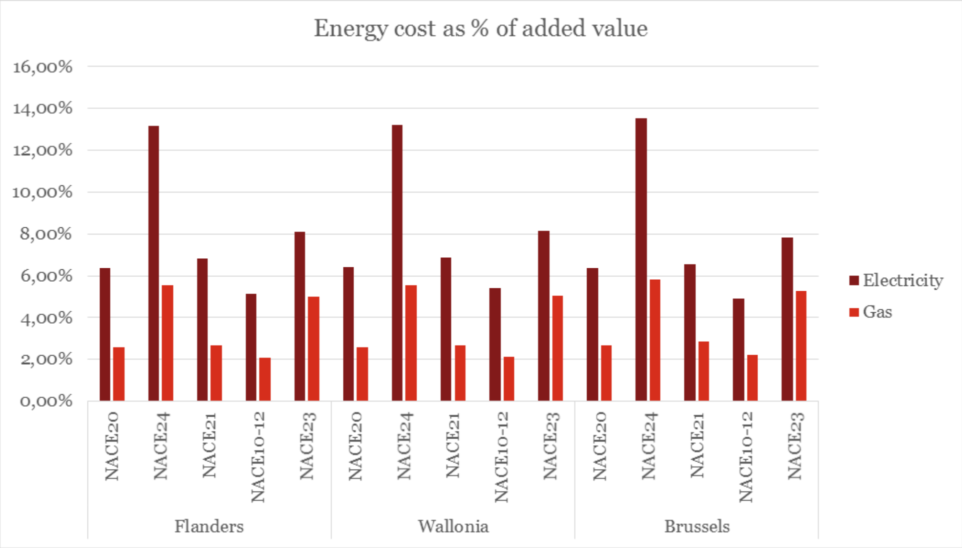
Source: Federal Planning Bureau, Eurostat, PwC Calculations

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 33). These are retrieved according to the following formulas:

$$\textit{Electricity cost for Sector i in Region j} \ (\% \textit{ of added value}) = P_{elec} \textit{ for Sector i in Region j} * \textit{Energy intensity (electricity) for Sector}_i$$

$$\textit{Gas cost for Sector i in Region j} \ (\% \textit{ of added value}) = P_{gas} \textit{ for Sector i in Region j} * \textit{Energy intensity (gas) for Sector}_i$$

Figure 33 – Energy cost as % of added value



Source: Federal Planning Bureau, Eurostat, PwC Calculations

From Figure 33 it is apparent that, although gas is relatively more consumed (see Figure 34) 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 14% of the added value. Although clear from Figure 33, no sectors in Belgium attain an electricity cost higher than 14% 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.

8.1.4 Weighted energy cost differences

The sector and region specific electricity and gas price differences retrieved in section 8.1.2 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:

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

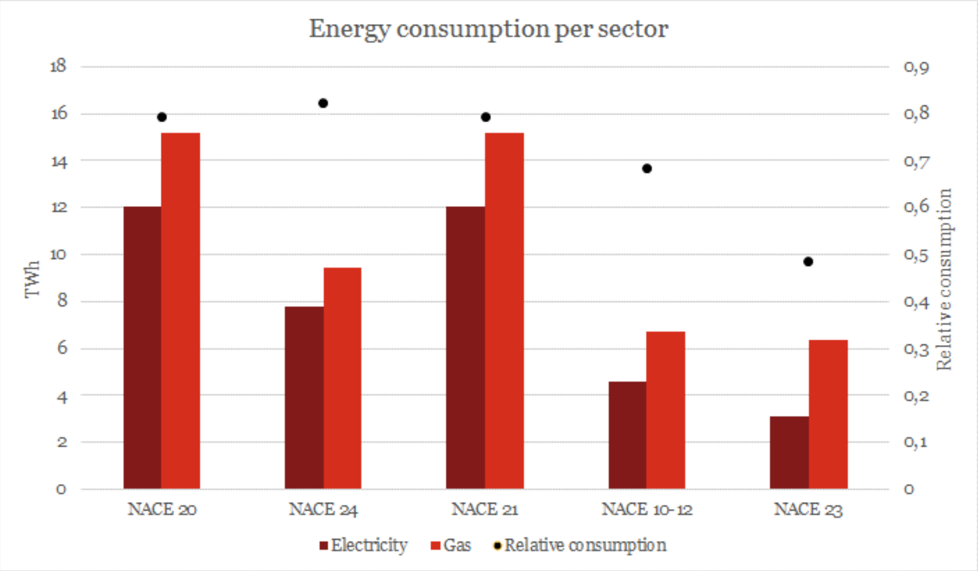
$$\textit{European average of } P_{energy} \textit{ for Sector}_i = \frac{(\textit{European average of } P_{elec} \textit{ for Sector}_i) * C_i + \textit{European average of } P_{gas} \textit{ for Sector}_i}{C_i + 1}$$

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

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 34.

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 of the 2016 report).

Figure 34 – 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	9,6%	-22,9%	-14,2%	0,79	1,5%	-20,6%
	NACE24	5,9%	-26,0%	-15,2%	0,82	-1,4%	-23,1%
	NACE21	14,4%	-19,0%	-17,4%	0,79	3,2%	-18,6%
	NACE10-12	14,6%	-17,1%	-17,4%	0,68	3,1%	-17,2%
	NACE23	14,4%	-18,9%	-15,3%	0,48	0,9%	-17,6%
Wallonia	NACE20	9,9%	-22,6%	-13,9%	0,79	1,8%	-20,3%
	NACE24	6,1%	-25,8%	-14,7%	0,82	-1,1%	-22,8%
	NACE21	14,5%	-18,9%	-16,6%	0,79	3,6%	-18,2%
	NACE10-12	20,1%	-13,1%	-16,6%	0,68	6,8%	-14,1%
	NACE23	14,7%	-18,6%	-14,8%	0,48	1,3%	-17,2%
Brussels	NACE20	9,7%	-22,9%	-10,6%	0,79	2,8%	-19,6%
	NACE24	9,1%	-23,8%	-11,0%	0,82	2,2%	-20,3%
	NACE21	9,8%	-22,3%	-11,9%	0,79	2,2%	-19,4%
	NACE10-12	9,1%	-21,1%	-11,9%	0,68	1,5%	-18,4%
	NACE23	10,5%	-21,7%	-11,0%	0,48	0,7%	-17,7%

Source: Federal Planning Bureau, CREG, PwC calculations

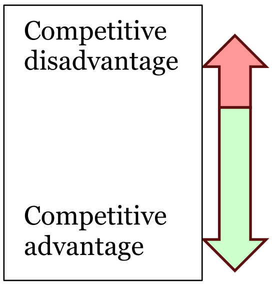
(green)	**Competitive advantage**
(red)	**Competitive disadvantage**

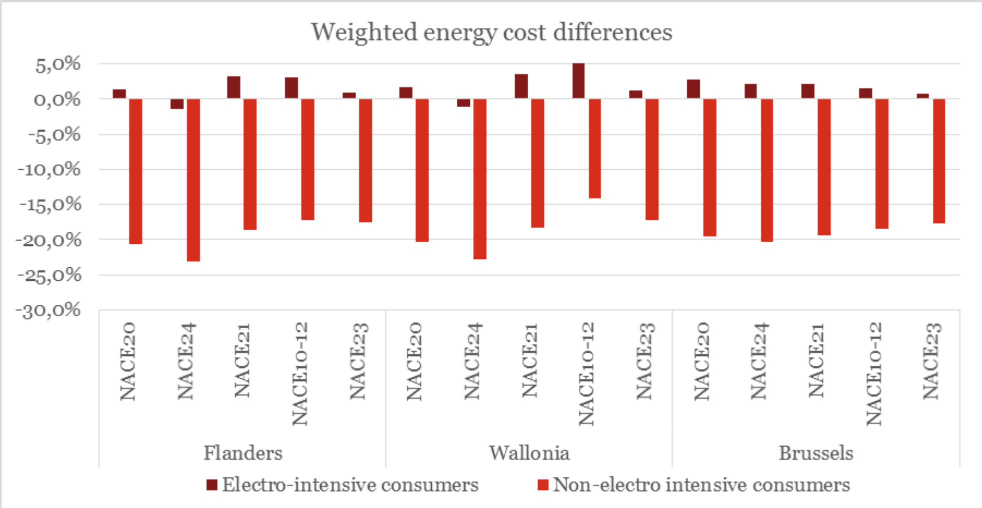
The conclusions are very important and quite different from last year. Last year, for the largest part of sectors, industrial consumers competing with electro-intensive competitors in Germany, France, the Netherlands and the UK, had a limited competitive advantage (green cells) on the energy component between 0,4% and 4,9%, except the NACE 21 and NACE 10-12 sectors in Wallonia and the NACE 20 sector in Brussels, with a disadvantage ranging between 0,2% and 4,7%.

This year, for almost all sectors, except for NACE 24 in Flanders and the Walloon region, industrial consumers competing with electro-intensive consumers in the neighbouring countries are confronted with a competitive disadvantage, ranging between 0,7% and 6,8%. This can be partially explained by the depreciation of the Pound Sterling in comparison with last year, which made electricity prices in the UK drop significantly. The disadvantage vis à vis the neighbouring countries regarding electricity prices could not be offset by more advantageous gas prices.

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 35. A positive percentage symbolizes a price level higher than in the average of the neighbouring countries, and hence a competitive disadvantage.

Figure 35 – 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 35, 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 disadvantage regarding energy costs.

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 14,1% and 23,1% below the average of the neighbouring countries.

8.1.5 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 6 and 7. 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. No different from last year the competitiveness of the three Belgian regions in terms of electricity price for electro-intensive consumers deteriorates compared to a situation where the UK is part of the basket of neighbouring countries. For gas prices and electricity prices for non-electro intensive consumers, 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 36 and Figure 37.

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	26,1%	-23,4%	-15,5%	0,79	10,4%	-20,6%
	NACE24	22,7%	-26,3%	-16,6%	0,82	7,6%	-23,1%
	NACE21	30,4%	-19,9%	-19,1%	0,79	11,3%	-18,6%
	NACE10-12	28,3%	-18,4%	-19,1%	0,68	9,7%	-17,2%
	NACE23	30,6%	-19,7%	-16,6%	0,48	7,3%	-17,6%
Wallonia	NACE20	26,3%	-23,2%	-15,1%	0,79	10,7%	-20,3%
	NACE24	22,9%	-26,2%	-16,1%	0,82	7,9%	-22,8%
	NACE21	30,4%	-19,8%	-18,4%	0,79	11,6%	-18,2%
	NACE10-12	34,2%	-14,5%	-18,4%	0,68	13,6%	-14,1%
	NACE23	30,8%	-19,5%	-16,2%	0,48	7,7%	-17,2%
Brussels	NACE20	26,4%	-23,4%	-11,9%	0,79	11,9%	-19,6%
	NACE24	26,5%	-24,1%	-12,5%	0,82	11,6%	-20,3%
	NACE21	25,3%	-23,1%	-13,7%	0,79	10,3%	-19,4%
	NACE10-12	22,2%	-22,3%	-13,7%	0,68	8,1%	-18,4%
	NACE23	26,2%	-22,5%	-12,5%	0,48	7,2%	-17,7%

Source: Federal Planning Bureau, CREG, PwC calculations

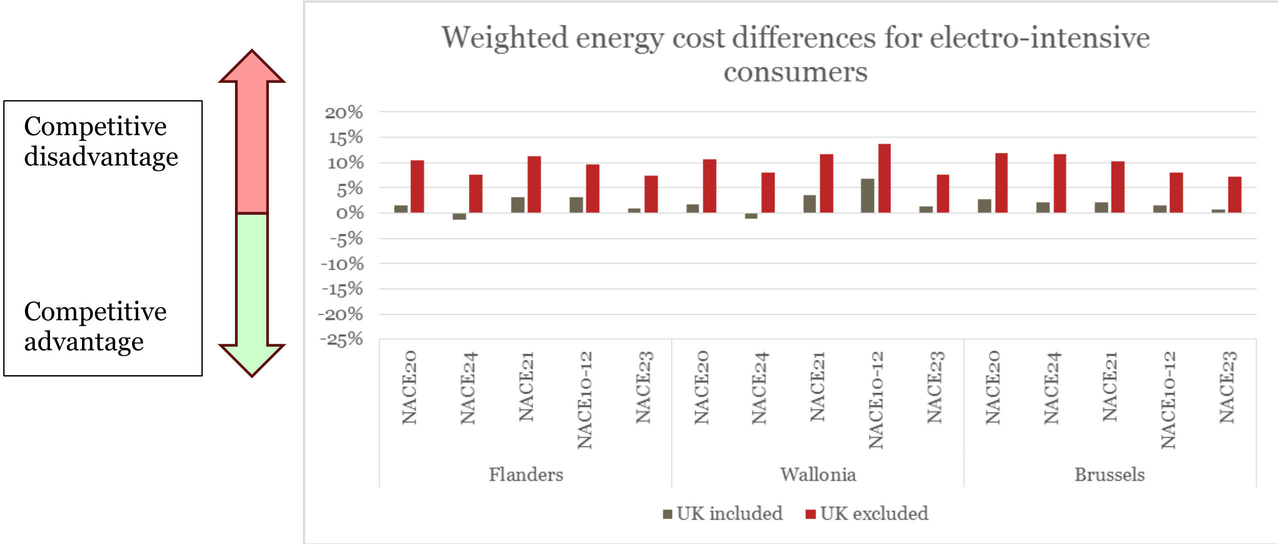
(green)	**Competitive advantage**
(red)	**Competitive disadvantage**

The conclusions are very important and are in line with last year. 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 has slightly improved in comparison with last year, with a competitive disadvantage on the total energy cost (gas and electricity) of 7,2% to 13,6%.

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 even has a positive impact on those consumers.

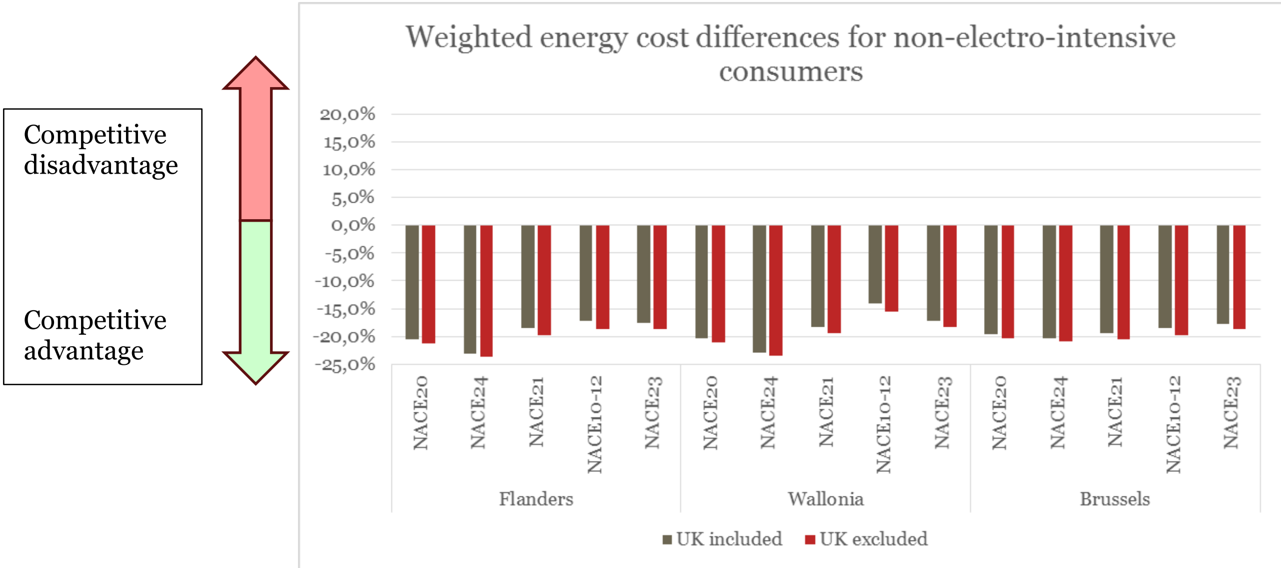
This conclusion can also be drawn based on Figure 36 and Figure 37: removing the UK from the comparison allows in the first place to draw a very different and stark picture for electro-intensive consumers. For the non-electro intensive consumers the weighted energy cost differences show a slightly better situation when excluding the UK.

Figure 36 – Weighted energy cost differences for electro-intensive consumers



Source: Federal Planning Bureau, CREG, PwC Calculations

Figure 37 – Weighted energy cost differences for non-electro-intensive consumers



Source: Federal Planning Bureau, CREG, PwC Calculations

8.2. 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.

   In countries where reductions are given to electro-intensive consumers, government is shifting investment away from non-electro intensive sectors towards electro-intensive sectors, as the Energy and Environmental State Aid Guidelines of the European Commission demand. In scenarios with entry criteria (German system), where individual electro-intensity targets at company level need to be reached, even for consumers that belong to electro-intensive sectors, this shift only benefits certain very electro-intensive legal entities within the annex 3 and 5 of the EEAG.

2. The **impact of the relatively low gas cost** for industry in Belgium - that we observed in section 6 and 7 - 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 6 and 7 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, France 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.

Simulations done by PwC at the demand of the CREG in November 2016 indicate that the cost supported by the Belgian Federal state to finance the current digressiveness applied on the federal contribution and the offshore surcharge would decrease significantly when duplicating the German reduction systems, shifting investment away from non-electro-intensive consumers to certain very electro-intensive legal entities within the annex 3 and 5 of the EEAG .

To the contrary, when granting the reductions to all legal entities part of the most electro-intensive sectors (annex 3) – regardless of their individual electro-intensity – cost would be roughly comparable to the cost of the present system, but the investment would be shifted from non-electro-intensive sectors to all (especially smaller industrial) consumers in electro-intensive sectors.

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)		Reductions for the compensation of indirect carbon emissions are not taken into account.
	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: sectoral energy efficiency agreement)	Progressive reductions of the renewables quota[100]: - < 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 (condition: sectoral energy efficiency agreement)	Partial exemptions of the tariff for public service obligation financing support measures for renewable energy (only Elia), that has a base rate of 13,82 EUR/MWh : - Exemption of 85% for final customers with a sector agreement, regardless of the level of consumption; - Exemption of 50% for final customers connected to a voltage level higher than low voltage without a sector agreement and with an activity that falls under the NACE code 'culture and animal production' (01 - without distinction between principal and complementary activities); - Exemption of 50% for final customers connected to a voltage level higher than low voltage without a sector agreement and with an annual consumption higher than 1 GWh, in so far as they fall under the following primary NACE codes: 1. industrial enterprises (10 to 33); 2. education (85); 3. hospitals (86); 4. medico-social (87-88). ➔ On the exempted part of the consumption, a surcharge of 2,55 EUR/MWh is due.
	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

[100] 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.

Germany		Reductions for the compensation of indirect carbon emissions are not taken into account.
	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 4,38 €/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 3,88 €/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: 0,25 €/MWh
	Annual consumption + Electricity cost/ gross added value	The EEG-Umlage has a base rate of 68,80 €/MWh. a) Individual consumers that are part of electro- and trade-intensive sectors (annex 3 of the Commission communication 2014/C200) with an individual electricity cost >14% of gross added value, are entitled to a **80% reduction**, <u>and</u> the total amount of the surcharge is capped in all cases at: › 0,5% of gross added value (average last 3 years) for all consumers with electricity cost >20% of gross added value › 4,0% of gross added value (average last 3 years) for all consumers with electricity cost <20% of gross added value b) Individual consumers that are part of electro- and trade-intensive sectors (annex 3 of the Commission communication 2014/C200) with an individual electricity cost >17% of gross added value, or individual consumers that are part of trade-intensive sectors (annex 4 of the Commission communication 2014/C200) with an individual electricity cost > 20% gross added value are entitled to a **85% reduction**, <u>and</u> the total amount of the surcharge is capped in all cases at: › 0,5% of gross added value (average last 3 years) for all consumers with electricity cost >20% of gross added value

		› 4,0% of gross added value (average last 3 years) for all consumers with electricity cost <20% of gross added value This reduction system also has a 'floor': a bottom rate of 0,5 €/MWh applies for several industrial sectors (using electricity as a raw material in the production process), 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: -0,028 €/MWh - For consumption above 1 GWh/year: 0,38 €/MWh - For consumption above 1 GWh/year and manufacturing industry with electricity cost >4% of turnover: 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: €126,9€/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		Reductions for the compensation of indirect carbon emissions are not taken into account.
	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.
	Load profile, annual consumption and energy-intensity	On transmission tariffs, several reductions apply. <u>Group A</u> A1. Stable consumption profiles, annual offtake >10 GWh/year and over 7000 hours, A2. Anti-cyclical profiles, annual offtake >20 GWh/year and off peak grid utilisation over 44% A3. Large consumers, annual offtake >500 GWh/year and off peak grid utilisation between 40-44% Group A is granted : -80% reduction when hyper electro intensive -45% reduction when electro intensive -5% reduction when none of both <u>Group B</u> B1. Stable consumption profiles, >10 GWh/year and over 7500 hours, B2. Anti-cyclical profiles, annual offtake >20 GWh/year and off peak grid utilisation over 48% Group B is granted: -85% reduction when hyper electro intensive -50% reduction when electro intensive -10% reduction when none of both <u>Group C:</u> C1. Stable consumption profiles, >10 GWh/year and over 8000 hours C2. Anti-cyclical profiles, annual offtake >20 GWh/year and off peak grid utilisation over 53% Group C is granted: -90% reduction when hyper electro intensive

		-60% reduction when electro intensive -20% reduction when none of both Hyper electro intensity is defined as > 6 kWh consumption per euro of added value, with a trade-intensity over 25%. Electro-intensity is defined as >2,5 kWh of consumption per euro of added value with a trade-intensity over 4% and annual offtake over 50 Gwh..
	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: 101,3 €/MWh - 10 to 50 MWh/year: 49,01 €/MWh - 50 to 10.000 MWh/year: 13,05 €/MWh above 10.000 MWh/year: 0,53 €/MWh
	Annual consumption	The ODE-levy is a digressive levy, except for the first 10 MWh: - 0 to 10 MWh/year: 7,4, €/MWh - 10 to 50 MWh/year: 12,3 €/MWh - 50 to 10.000 MWh/year: 3,3 €/MWh above 10.000 MWh/year: 0,131 €/MWh
UK	Energy efficiency	The Climate Change Levy has a base rate of 6,492 €/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 (0,5672 €/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 2017 amounts to approximately 0,63279 EUR/(kWh/h)/a.
France	Carbon market participation + sector criteria	The TICGN tax has a base rate of 5,88 €/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 m^3/year: 0,25244 €/m^3 - 170.000 to 1.000.000 m^3/year: 0,06215 €/m^3 - 1.000.000 to 10.000.000 m^3/year: 0,02265 €/m^3 - above 10.000.000 m^3/year: 0,01216 €/m^3 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 m^3/year: 0,0159 €/m^3 - 170.000 to 1.000.000 m^3/year: 0,0074 €/m^3 - 1.000.000 to 10.000.000 m^3/year: 0,0027 €/m^3 - above 10.000.000 m^3/year: 0,0013 €/m^3 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 2,3 €/MWh for natural gas (January 2017). 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.