Consistency of climate and energy projections for 2020

Case study for five Member States

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Summary

The European Union Climate and Energy Package adopted in 2009 provided Member States with a consistent policy framework for implementing climate and energy policies. This paper presents an analysis on the comparability and consistency of projections underpinning such national climate and energy policies, as reported by five Member States under different requirements. The analysis focused on key projection parameters used for projections of greenhouse gases, as well as on renewable energy and energy efficiency. These parameters are GDP, energy use, fuel import prices and CO_2 prices. The countries for which the analysis was carried out are the Czech Republic, France, Germany, the Netherlands and Spain. The comparability of projection parameters was made both within each country (reporting for different obligations) and across Member States (reporting by several countries for the same obligation).

Main findings

The transparency of the projections used by Member States is limited. Assessing the consistency of projections from Member States proved difficult as limited data was available. Most projection parameters were not reported in public submissions from Member States. It was not possible to retrieve all projection parameters from all Member States for all their projections.

Differences in reporting requirements make the comparisons of available data difficult. Such differences concern for example scenarios, units, policies included, or definitions of energy use. Furthermore, different timings in reporting increases the differences between projections and make their comparison more difficult. Most projections were prepared in different years. More recent projections tend to have included more recent developments, policies and projection parameters than older projections. Most projections for renewable energy we analysed were prepared in 2009/2010, while the projections of greenhouse gases were prepared in 2012.

The energy consumption levels in the various projections from the five Member States analysed seem comparable at national level, except for some projections by Spain and France. These differences could be explained by significant differences in assumed fuel import prices and additional energy saving policies.

Member States used overall consistent assumptions on GDP and population for their different projections. Conversely, the import prices for oil, gas and coal vary considerably across projections in each Member States, especially the assumed import price for oil. Significant variations are also observed for CO_2 prices. These differences may, to some extent, be explained by the timing of projections (incorporation of new insights and expectations).

Energy prices and CO_2 prices can vary considerably across Member States. This is remarkable as these prices are expected to be exogenous to Member States. The CO_2 price refers to the price of allowances in the EU Emission Trading System which should be equal to all Member States. Import prices of fuels are expected to be more comparable as markets for these commodities are generally international markets.

To improve the consistency of projections across Member States, ways to align projection parameters exogenous to Member States, such as the CO_2 price level and import prices for fossil fuels could be further examined. Aligning the timing of reporting requirements, definitions and units would probably help to simplify the preparation and analysis of projections. This may ultimately benefit the consistency of climate and energy policies in Europe.

1 Introduction

In 2009, the EU adopted a comprehensive climate and energy package that should enable the achievement of the so called '20-20-20' targets. These targets refer to the objectives to reduce greenhouse gas emissions with 20 %, the use of 20 % of renewable energy and 20 % lower energy consumption by 2020. The climate and energy package was to provide Member States with a consistent policy framework for implementing policies on a European and national level. As Member States are currently making progress towards these targets, it may be questioned to what extent the '20-20-20' targets are implemented in a consistent manner. There are indications that consistency may not be optimal. For instance, the current implementation of renewable energy action plans may have contributed to the lower than expected demand for emission allowances in the EU ETS. Also, as opposed to the targets for greenhouse gases and renewables, the energy savings target was not translated at EU level into Member State objectives, potentially leading to national policies that are inconsistent with their greenhouse gas and renewable energy policies.

Member States develop their climate and energy policies using projections on their energy use. These projections and policies are regularly reported in submissions to the European Commission, as required by the Monitoring Mechanism Decision (MMD; for greenhouse gases), the Renewable Energy Directive (RED) and the Energy Efficiency Directive (EED). As most climate policies have an impact on renewable energy and energy efficiency and vice versa, the use of consistent projections is one of the key elements of consistent policies.

This paper aims to analyse the consistency of key projection parameters used by Member States to develop their projections forming the basis for policy development on climate change mitigation, renewable energy sources and energy efficiency.

2 Methods

2.1 Data sources

In order to analyse the consistency of projections underpinning Member State 2020 policies on greenhouse gases, renewable energy and energy efficiency, key parameters used for those projections were compared. The projections used were included in the most recent official reports or action plans for these policy areas. These reports were the following:

- For greenhouse gas projections, the 2013 submissions under the Monitoring Mechanism Decision
- For renewable energy, National Renewable Energy Action Plans (NREAP)
- For energy efficiency, the 2013 target reporting according to the Energy Efficiency Directive.

2.2 Selection of Member States

Five Member States were selected to carry out the analysis. Several criteria played were used to select the Member States:

1. Energy use is key for both climate and energy policies, therefore Member States belonging to the top energy consumers are relevant for the European 20-20-20 policy framework
2. The size and geographical location was relevant (in order to prevent the selection of only big, Western European Member States)
3. Some Member States where already selected in other EEA projects related to the analysis of national projections.

This has resulted in the selection of the Czech Republic, France, Germany, the Netherlands and Spain. France, Germany and Spain currently belong to the top-5 of highest energy consuming Member States in the EU.

2.3 Selection of key projection parameters

In order to analyse the consistency of projections, selected key projection parameters should be relevant to all three topics:

- general parameters related to the economy and demography;
- energy-related parameters, such as energy consumption and, energy and CO_2 prices.

The analysis was restricted to input parameters, as these are key for the resulting energy use, CO_2 emissions, energy-efficiency and renewable energy use. Other input parameters may also determine projections, such as policies and cost-curves of technologies and sector specific activity levels (i.e. car use), but these were not taken into account in order to limit the magnitude of the analyses. Therefore, this analysis gives a first and basic indication of the consistency of the projections used to underpin their climate and energy policies for 2020.

In order to enable comparisons between energy consumption levels between the various reporting requirements, the definitions of gross inland energy consumption (GIEC) and final energy consumption (FEC) used

were somewhat different than required for reporting under the RED, EED and ESD. For RED, total energy use by aviation is included in FEC. For EED, also non-energy use is included in GIEC. For ESD, final energy consumption is requested for the entire scope (thus including ETS and armed forces).

Table 2.1 Key projection parameters used to analyse consistency

Parameter	*Details*
Gross Domestic Product	Absolute level in euros (constant 2010 prices)
Population size	Number of inhabitants
Energy prices	Commodity prices for the import of coal, oil and gas
CO_2 price	CO_2 price in the EU ETS
Gross inland energy consumption (GIEC)	Defined as primary production plus imports, recovered products and stock change, less exports and fuel supply to maritime bunkers (for seagoing ships of all flags). It therefore reflects the energy necessary to satisfy inland consumption within the limits of national territory (i.e. total primary energy demand). GIEC includes non-energy use.
Final energy consumption (FEC)	Defined as energy delivered for energy purposes to industry, transport (including total energy use by aviation), households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission.

3 Main results

3.1 Projected energy consumption

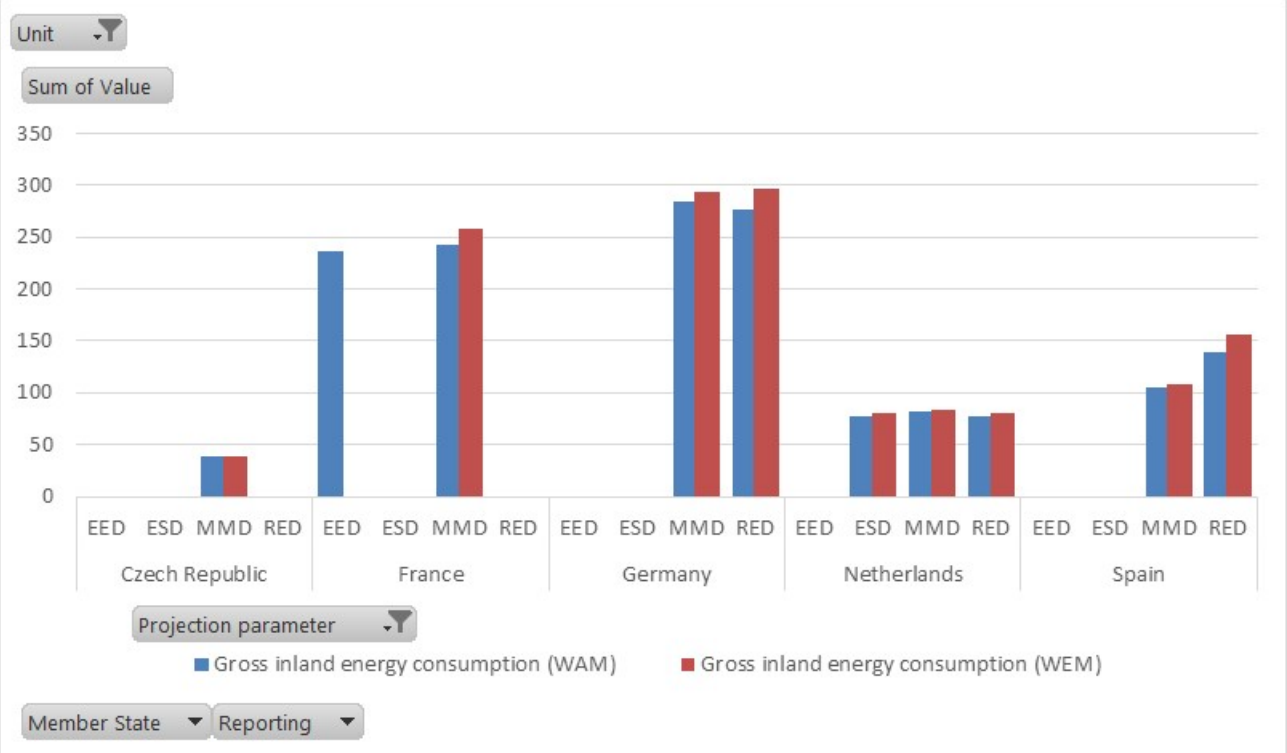
This section presents projected energy consumption levels for the five selected Member States. This gives an indication of the consistency of their projections for the various regulations. The comparisons must be considered with caution, as differences may exists in the projection methods and included policies. The energy consumption level is not analysed on a sectoral level, possibly obscuring inconsistencies. Therefore, conclusions about the consistency of energy consumption across the various projections should be considered as indications.

For Germany and the Netherlands, the projected gross inland energy consumption for MMD and RED differ only slightly (see Figure 3.1). The energy consumption levels projected by France for EED and MMD including planned policies are also similar.

Significant differences can be observed between the projections for MMD and RED from Spain. This may be explained by lower import prices of fossil fuels and a higher population size (see sections below).

Due to a lack of data, the possibility to compare projections was limited for most Member States. For the Czech Republic no comparison was possible at all. It was also not always clear whether GIEC from certain Member States includes non-energy use or not.

Figure 3.1 Projected gross inland energy consumption by 2020 for five Member States (in Mtoe)

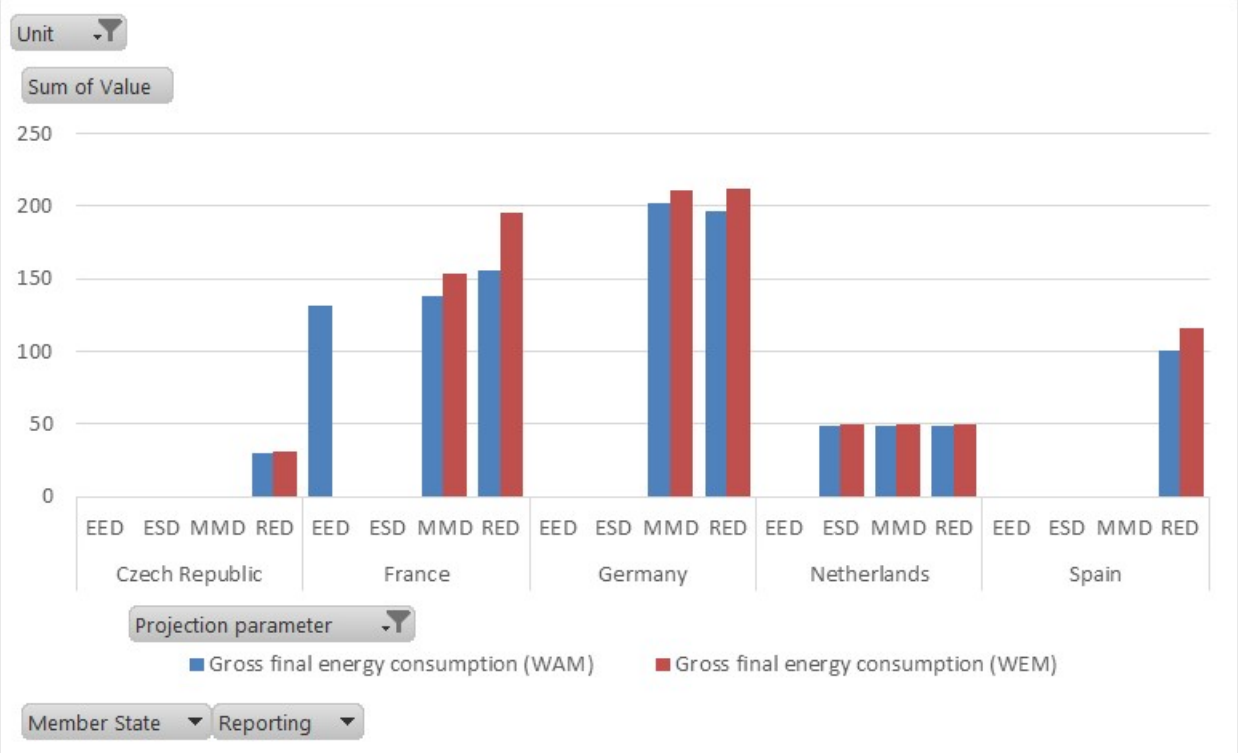


The German projections of the gross final energy consumption levels show only small variations between the projections for MMD and RED (see Figure 3.2). For the Netherlands, the levels seem comparable in the projections for ESD, MMD and RED.

The MMD and RED projections from France shows a significant difference of final energy consumption but only in the case of the scenario that included existing policies. This may be explained by different assumptions in energy savings and renewable energy policies in the existing policies scenario of the RED projection compared to the MMD projection. The energy consumption level may also be (slightly) lower in the MMD projection compared to the RED projection due to the use of a more recent projection. The projection for RED was launched in 2010, while the projection for MMD was prepared in 2012. The MMD projection may therefore have used different projection parameters (for example for GDP and energy prices), but this explanation is rather tentative as little data was available on the projection parameters used in the RED projection (see sections below).

For this indicator, the possibility to compare projections was limited due to a lack of data, especially for Spain and the Czech Republic.

Figure 3.2 Projected final energy consumption by 2020 for five Member States (in Mtoe)

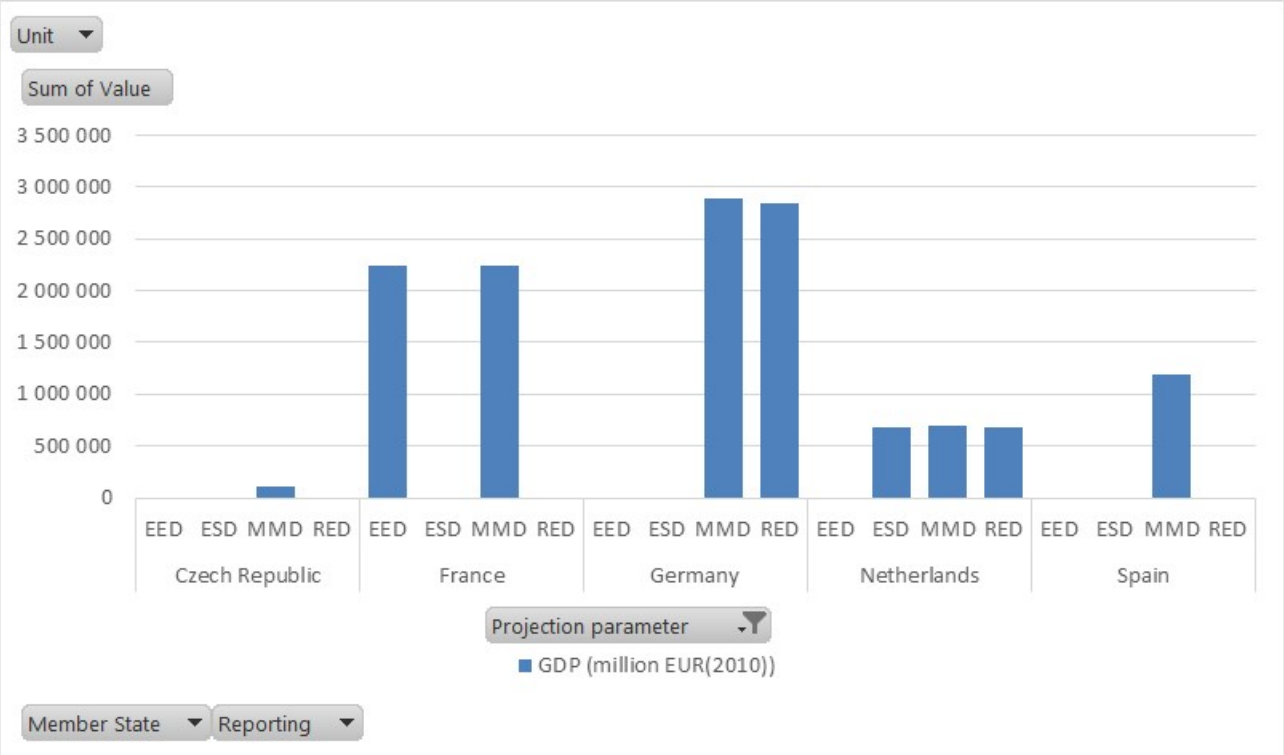


3.2 Projection parameters

Gross domestic product

Based on the data that was available, no significant differences can be observed in the assumed GDP level in the projections from Germany, France and the Netherlands (see Figure 3.3). The possibility to compare projections was however limited due to a lack of data, especially for Spain and the Czech Republic.

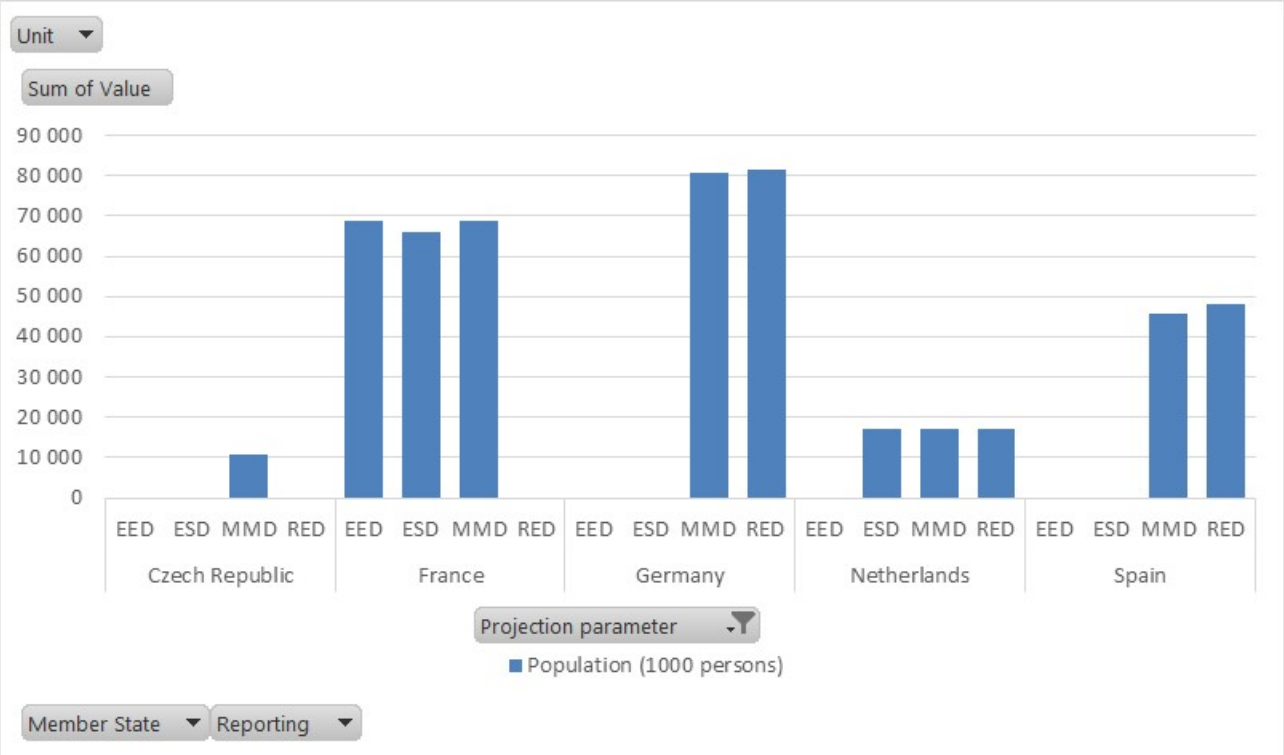
Figure 3.3 Projected gross domestic product in 2020 for five Member States



Population

Based on the data that was available, no significant differences can be observed in the assumed population size in the projections from Germany, Spain, France and the Netherlands (see Figure 3.4). The possibility to compare projections was however limited due to a lack of data, especially for the Czech Republic.

Figure 3.4 Projected population by 2020 for five Member States



Energy import prices

Import prices for oil

Large differences can be observed in import price level of oil in the German, Spanish, French and Dutch projections (see figure 5). For the Netherlands, only the oil price differs significantly for the MMD projection compared to the ESD and RED projections. This could be explained by the fact that the MMD projection (prepared in 2012) is more recent than the projections used for ESD and RED (prepared in 2010). This could also explain the lower oil import price of the ESD projection (launched in 2010) from France compared to the MMD and EED projections (prepared in 2012). Also the units are also slightly different: the import price of oil in the ESD projection is reported in €2008, while the price level in the other projections are in €2010.

Import prices for gas

Gas import prices seem to vary too, but less pronounced compared to oil prices. Gas import prices in the projections from Germany, France and the Netherlands differ only slightly and could be explained by the use of more recent projections for MMD compared to other submissions.

Import prices for coal

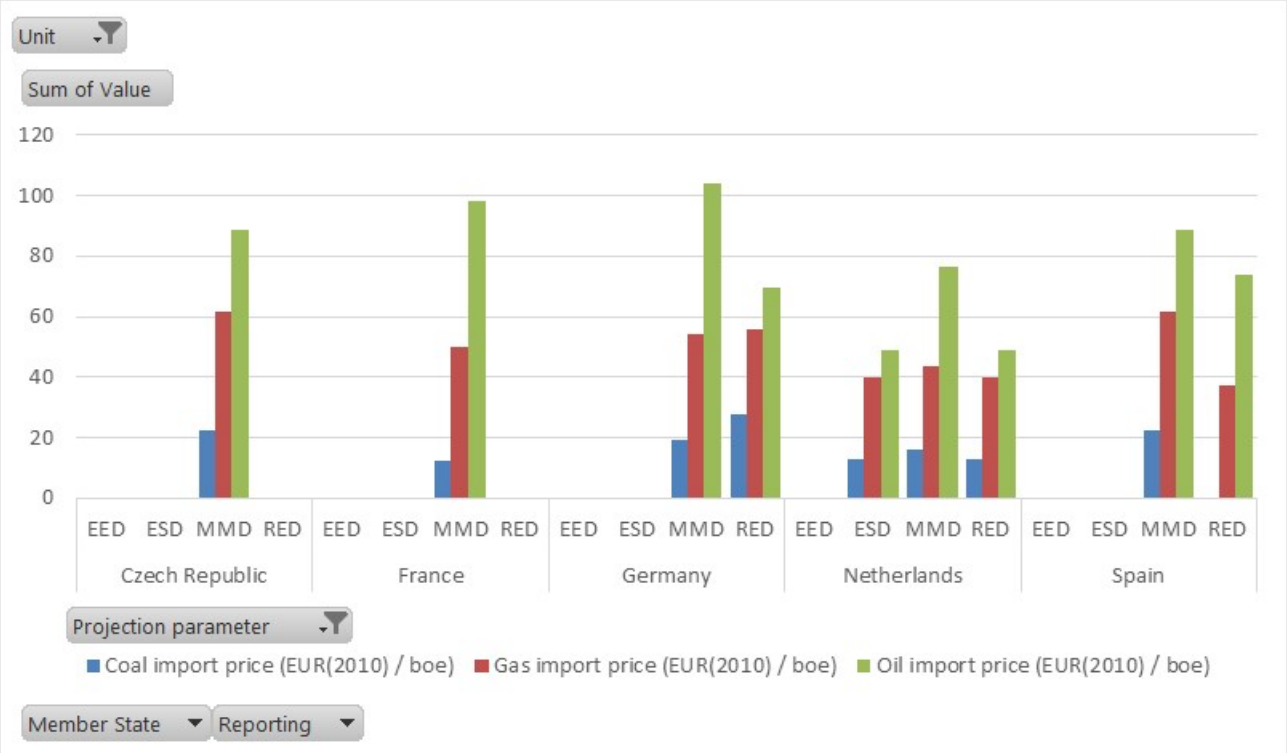
Little comparisons could be made due to limited data availability. Differences between projections seem limited, although the price level in the RED projection from Germany is significantly higher.

Remarkable differences of import fuel prices across Member States

Significant differences can be found across the projections from a single Member State, but also across Member States themselves, especially with regard to the import price level of oil. Significant differences between Member States are remarkable, considering that the prices are determined by international markets (and thus exogenous to Member States). The import price of oil in the MMD projection from the Netherlands is for example significantly lower than the price level in the MMD projections from Germany, Spain and France. Differences between Member States with regard to the import price level of gas and coal are less pronounced but in some cases still substantial.

One explanation for some differences could be the use of more recent projections. MMD projections are generally more recent than projections for MMD and ESD. This can however not explain differences in price levels between MMD projections.

Figure 3.5 Import prices of fossil fuels by 2020 for five Member States

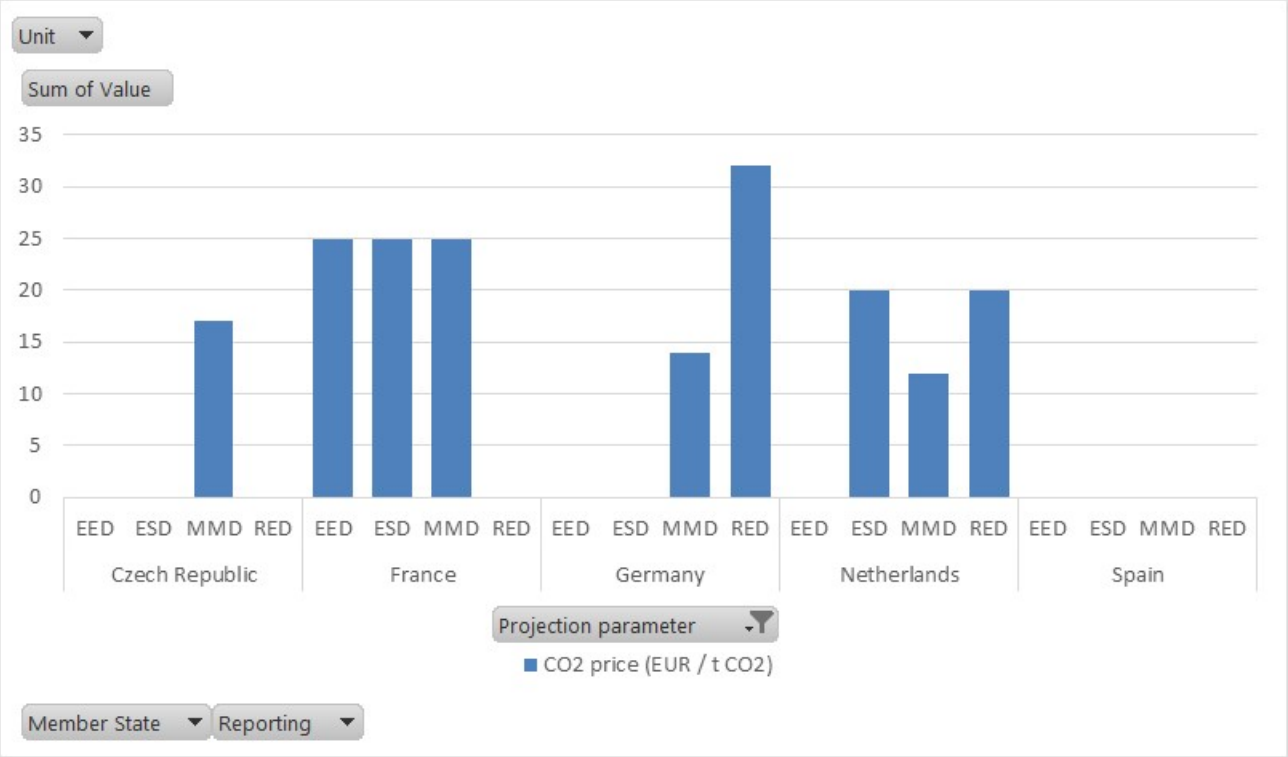


CO_2 prices

Little comparisons could be made due to limited data availability. Figure 6 shows that CO_2 prices in projections from Germany are substantially different. The CO_2 price in the RED projection is more than twice as high as in the MMD projection. Significant differences can also be observed in the projections from the Netherlands. These differences could be explained by the timing of the projection (2010 for RED versus 2012 for MMD).

Similar to the observation made with regard to differences in import price levels across Member States, CO_2 prices in projections used by Member States seem to vary considerably. This is remarkable as the CO_2 price refers to the price of emission allowances in European Emission Trading System (EU ETS) which should be equal for all Member States. The timing of projection can only explain these differences partly, as for example, the MMD projections from the Netherlands, France and Germany are all prepared in 2012.

Figure 3.6 CO_2 price in the EU ETS by 2020 assumed by five Member States



4 Detailed results

4.1 Czech Republic

Sum of Value	Column Labels			
Row Labels	EED	ESD	MMD	RED
CO2 price (EUR / t CO2)	0	0	17	0
Coal import price (EUR(2010) / boe)	0	0	23	0
Gas import price (EUR(2010) / boe)	0	0	62	0
GDP (million EUR(2010))	0	0	111 732	0
Gross final energy consumption (WAM)	0	0	0	30
Gross final energy consumption (WEM)	0	0	0	31
Gross inland energy consumption (WAM)	0	0	38	0
Gross inland energy consumption (WEM)	0	0	39	0
Oil import price (EUR(2010) / boe)	0	0	89	0
Population (1000 persons)	0	0	10 761	0

4.2 France

Som van value	Kolomlabels			
Rijlabels	EED	ESD	MMD	RED
CO2-price (euro / t CO2)	25	25	25	-
GDP (Millions of €2010)	2.244.422	-	2.244.422	-
import price coal (€2010 / boe)	12		12	-
import price gas (€2010 / boe)	50	54	50	-
import price oil (€2010 / boe)	98	80	98	-
population (thousands of people)	68.928	65.928	68.928	-
gross inland fuel consumption (WAM)	108	-	108	-
gross inland fuel consumption (WEM)	236	-	123	-
gross final energy consumption (WAM)	131	-	138	155
gross final energy consumption (WEM)	154	-	154	196

Projection practice

Regarding the MMD submission from March 2011, a single modelling exercise was launched in June 2010 by the Modelisation & Prospective Bureau of the General Directorate for Energy and Climate Change. Then these results were used specifically by the Modelisation & Prospective Bureau for the MMD Submission, but also by many other bureau of the ministry for their own submissions (RED, ESD, EED). This means the same methods and models were used, same parameters and assumptions.

More recently, we launched a new modelling exercise in June 2012 for the MMD submission due March 2013. These results were used for the EED 2013 submission.

Indeed, we update our projections every two years, that is to say every time a new MMD submission is due.

4.3 Germany

Som van value	Kolomlabels			
Rijlabels	EED	ESD	MMD	RED
CO2-price (euro / t CO2)	-	-	14	32
GDP (Millions of €2010)	-	-	2.896.000	2.844.000
import price coal (€2010 / boe)	-	-	19	28
import price gas (€2010 / boe)	-	-	54	56
import price oil (€2010 / boe)	-	-	104	70
population (thousands of people)	-	-	80.625	81.393
gross inland fuel consumption (WAM)	-	-	284	277
gross inland fuel consumption (WEM)	-	-	294	297
gross final energy consumption (WAM)	-	-	202	197
gross final energy consumption (WEM)	-	-	211	212

Projection practices

For the projections submitted under the MMD, research contractors use a variety of modelling tools to calculate the energy demand. Another set of models is then used to calculate how this energy demand is being met. For a description of the models see section 1.2 in the respective report.

For the projections submitted under the RED, research contractors use an accounting framework model to estimate the future development of renewable energy consumption. Estimates of FEC were based on results of different studies available at that time.

Under the EED, according to the requirements of Art. 3 EED, an indicative national energy efficiency target has been set and expressed as an absolute level of primary energy consumption and final energy consumption in 2020.

A consortium of research institutes prepared the projections submitted under the MMD in 2013. The institutes were: Öko-Institut and Fraunhofer-ISI.

The projections submitted under the RED were prepared by a consortium of DLR-TT, Ecofys and ZSW, supported by additional input from DBFZ.

The projections submitted under the MMD were prepared in the fall/winter of 2012.

The projections submitted under the RED were prepared between fall 2009 and spring 2010.

Projections submitted under the MMD are updated every two years in order to meet the deadline of 15th March.

Within the framework of the reporting under the RED (Art. 22), it is evaluated whether projections need to be updated.

Under the EED, progress towards the indicative national energy efficiency targets for 2020 is monitored on the basis of the annual reports submitted to the Commission by Member States according to Art. 24 para. 1 and Annex XIV part 1 EED. Therefore, no Member State projections are being used for monitoring of progress on the indicative national energy efficiency targets according to Art. 3 EED.

In the projections submitted under the MMD, all energy-related policies are included. Energy-related targets are not expected to be met automatically.

In the projections submitted under the RED, all energy-related policies concerning the expansion of renewable energy are included.

4.4 The Netherlands

Som van value	Kolomlabels			
Rijlabels	EED	ESD	MMD	RED
CO2-price (euro / t CO2)	-	20	12	20
GDP (Millions of €2010)	-	686.000	693.000	686.000
import price coal (€2010 / boe)	-	13	16	13
import price gas (€2010 / boe)	-	40	43	40
import price oil (€2010 / boe)	-	49	76	49
population (thousands of people)	-	17.000	17.229	17.000
gross inland fuel consumption (WAM)	-	78	82	78
gross inland fuel consumption (WEM)	-	81	83	81
gross final energy consumption (WAM)	-	49	49	49
gross final energy consumption (WEM)	-	50	50	50

1. Were the submissions from the Netherlands under the MMD, RED, ESD and EED based on a single projection exercise? If not, please indicate in what way these projections where different. For instance:

   - Were different methods and/or models used?
     No

   - Were different input parameters and assumptions used?
     Yes

   - Were projections prepared by different organizations?
     No

   - Were projections prepared at different points in time?
     Yes

2. With regard to the practice of updating projections: are your projections regularly updated? Please indicate the frequency and when projections are usually updated.
   Major revisions occur every few years, partial updates about yearly.

3. If different projections have been used for reporting under different obligations:

   - Are these projections updated simultaneously or in a similar way? If not, what are the differences?
     Not simultaneously but in the same way; the differences are updated expectations of future developments.

   - Are all energy-related policies included in all projections (apart from the differences between adopted and planned policy scenarios)? If not, what are the main differences?
     Yes

   - Are these policies taken into account in a consistent way (i.e. similar input parameters and projection methods)?
     Yes

4.5 Spain

Sum of Value	Column Labels			
Row Labels	EED	ESD	MMD	RED
CO2 price (EUR / t CO2)	0	0	0	0
Coal import price (EUR(2010) / boe)	0	0	23	0
Gas import price (EUR(2010) / boe)	0	0	62	37
GDP (million EUR(2010))	0	0	1 183 632	0
Gross final energy consumption (WAM)	0		0	100
Gross final energy consumption (WEM)	0	0	0	116
Gross inland energy consumption (WAM)	0	0	105	140
Gross inland energy consumption (WEM)	0	0	108	157
Oil import price (EUR(2010) / boe)	0	0	89	74
Population (1000 persons)	0	0	45 626	48 000