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Public Governance across Borders / European Public Administration

The Implementation of the European Emission Trading System and its Effects on European Greenhouse Gas Emissions

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Abstract

This research focuses on the implementation of the Directive 2003/87 'European Emission Trading System' and its impact on the emission of greenhouse gas in Europe. In this context, implementation is split into legal and practical implementation. When legal implementation occurs but practical implementation is lacking, this is called 'decoupling'. The research question is: **To what extent has the legal and practical implementation of the Directive 2003/87 'European Emission Trading System' contributed to a reduction in greenhouse gas emissions in Europe?** By using an interrupted time series design, greenhouse gas emissions are measured before and after implementation of the EU Directive. Under the condition of successful legal implementation of the Directive, it is assumed that the more successful the practical implementation in a country is, the more likely a reduction in emission in that country is. To the extent that emissions of stationary installations are analysed, legal and practical implementation have led to a reduction in emissions. However, the degree of decoupling was not an amplifying factor. This study helps the EU to improve its performance on tackling climate change by showing the influence of implementation on emission reduction. This is of great social relevance due to the hazardous consequences of climate change. This study is also scientifically relevant due to the prevailing knowledge gap on legal and practical implementation practices in the EU and on the success of cap-and-trade schemes.

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List of abbreviations

ACC	Annual compliance cycle
CA	Competent authority
CERs	Certified Emission Reductions
CO2	Carbon dioxide
Directive 2003/87	Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC
Directive 2009/29	Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community
EC	European Commission
ERUs	Emission Reduction Units
EU	European Union
EU ETS	European Union Emission Trading System
EZG	Bundesgesetz über ein System für den Handel mit Treibhausgasemissionszertifikaten
GDP	Gross domestic product
GHG	Greenhouse gas
KLO	Key legal obligation
MRV	Monitoring, reporting and verification
MS	Member States
NAP	National Allocation Plan
NEA	Nederlandse Emissie Autoriteit
Regulations No 437/2004	European Communities (Greenhouse Gas Emissions Trading) Regulations 2004
Regulations No 490/2012	European Communities (Greenhouse Gas Emissions Trading) Regulations 2012
Regulations No 434/2013	European Union Greenhouse Gas Emissions Trading Scheme for Stationary Installations Regulations
TEHG	Gesetz über den Handel mit Berechtigungen zur Emission von Treibhausgasen
TEU	Treaty on European Union

TFEU	Treaty on the Functioning of the European Union
US	United States
WMB	Wet Milieubeheer
XI-329	Law on Financial Instruments for Climate Change Management

1. Introduction

"Climate change is not a myth, but a terrifying reality which is disrupting the lives of millions of people affected by drought and other extreme weather events" declares Antonio Tajani (2017), president of the European Parliament, towards the European Commission (EC). The European Union (EU) is the second largest economy in the world with a gross domestic product (GDP) of 19,97 trillion allocating itself just before the United States (US) behind China (Central Intelligence Agency, 2018). With that, the EU does not only bear economic power but also environmental responsibility. Behind China and the US, the EU is the world's third largest emitter of carbon dioxide (CO2) (European Commission Joint Research Centre, 2017).

Antonio Tajani (European Parliament, 2017) argues that "The EU must continue to be at the forefront" when it comes to tackling climate change. In order to do so, the EU established the *'Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC'* (Directive 2003/87), also known as the European Emission Trading System (EU ETS). The EU ETS aims at the reduction of greenhouse gas (GHG) emissions by deploying market-mechanisms. Member States (MS) allocate so-called GHG emission permits (allowances) to companies (operators), which allow for the emission of one tonne of GHG. These allowances need to be submitted to the MS annually in order to cover emissions with allowances. Since some operators emits more than they were granted allowances and some less, the allowances can be traded to make it possible for operators to cover emissions with allowances. The overall amount of permitted GHG, however, is limited with a 'cap'- a maximum of emissions. By deploying a cap, operators are forced to reduce their emissions if they want to avoid fines for missing allowances. The cap has been continuously lowered over time in order to lower emissions within the EU. The Directive was launched first from 2005 to 2007, then renewed for the second phase from 2008 to 2012 and is now in its third period from 2013 to 2020. The EU ETS covers around 45% of the EU's GHG emission emitted by 11.000 stations and aims at a reduction of GHG emissions by 21% in 2020 in comparison to 2005 (European Commission, 2016; Milunovich, Stegman. Alison, & Cotton, 2007; Zetterberg, Burtraw, Engström Stensson, Paulie, & Roth, 2014).

Due to the subsidiarity principle, the EU relies on its MS to implement the Directive. Implementation can be seen as a process with two steps. The first step is the legal implementation of a policy and its transposition into law and the second step is practical implementation meaning the practical application of the law. Legal implementation is a prerequisite for practical implementation (Zhelyazkova, Kaya, & Schrama, 2016). The MS are granted a certain degree of discretion when it comes to implementing the EU ETS, leaving room for manoeuvre in the form and method of implementation. It can occur that a MS does not implement a policy in accordance with the EU's interests. This deviation can be forced due to a lack of capacities and resources or occur wilfully due to deviating interests and political will.

The success of this policy is relevant in different ways. As stated previously, the EU is the world's third largest polluter. Great pollution leads to a rapid change in climate with diverse and hazardous environmental, social, and economic consequences. With the rise of the global temperature, polar ice shields are increasingly melting, leading to a rise in sea levels and islands disappearing in the sea. While some regions experience more extreme weather and an increase in rainfall, other regions are increasingly subject to heat waves and droughts, leaving many areas uninhabitable (European Commission, n.d.). "People die or are obliged to leave their homes because of desertification, lack of water, exposure to disease, [and] extreme weather conditions" reminds Antonio Tajani (2017) the European community. Environmental changes also impact societies with issues "such as health, food security, employment, incomes and livelihoods, gender equality, education, housing, poverty and mobility" (World Health Organization, 2011, p. 24). Furthermore, migration will become a social issue when many areas of the earth become uninhabitable. As of 2017, migration number have already increased by nearly 50 percent in comparison to 2000, reaching a peak of 258 million migrants globally (United Nations, Department of Economic and Social Affairs, Population Division, 2017). Next to this, climate change also has economic impacts, causing damage to property and infrastructure. Especially developing countries suffer from this since the means for reconstruction are often missing. In addition, sectors that rely on the environment such as agriculture are particularly vulnerable (European Commission, n.d.). By reducing pollution in the EU, the EU contributes its share to climate protection and acts a role model for other nations to follow this path.

Summing up, both legal and practical implementation are necessary for the Directive 2003/87 to take effect and tackle climate change. In countries where the EU ETS has been legally and practically implemented, the GHG emissions are thus expected to decrease. The research question is: **To what extent has the legal and practical implementation of the Directive 2003/87 'European Emission Trading System' contributed to a reduction in greenhouse gas emissions in Europe?**

This question is an explanatory question since it studies the influence of legal and practical implementation of the EU ETS (independent variable) on the GHG emissions (dependent variable) in European MS (units of analysis). In order to answer this research question, several sub-questions are needed: (1) Have MS incorporated the Directive 2003/87 successfully into their national law? (2) Did the MS that legally implemented the Directive 2003/87 also practically implement it? (3) Did the GHG emissions decline in MS in which the Directive 2003/87 was legally and practically implemented? The research will enrich the knowledge about a common problem in the EU – the implementation gap. By distinguishing between legal and practical implementation, implementation is studied with a more differentiated view than commonly practiced. This paper seeks to discuss different implementation practices and assesses the impact of the Directive on GHG emissions.

After introducing the topic and posing a research question, the second chapter discusses relevant theory on cap-and-trade and on three main issues within policy implementation in the EU. The third chapter presents the used methods in terms of research design, case selection and operationalisation. In

the fourth chapter, the findings are displayed and analysed in regard to the hypotheses. The fifth chapter includes the conclusion as well as a reflection on the research.

2. Theory

In the following, the relevant theory is laid out. This section focuses first on cap-and-trade theories, second on competences and responsibilities of implementation in the EU, third on policy failure and fourth on policy implementation. On basis of this, hypotheses on the relation between the implementation of the EU ETS and GHG emissions are derived.

2.1. Theoretical roots of cap-and-trade schemes

Cap-and-trade, also known as 'emission trading', is the theory behind the EU ETS. Dales (1968) drafted the idea of "using market forces to reduce pollution by making companies buy and sell the right to pollute" (University of Calgary, n.d.). These rights to pollute, often called permits or allowances, are either allocated by the government or through auctioning. The amount of rights is limited by a governmental maximum on emission. This limit is called a 'cap' and is supposed to shrink each year. By decreasing the cap, companies are forced to reduce emission. Pollution rights within the cap can be traded between the participants of the scheme. Dales (1968) argues that individual entities have the choice between buying permits to validate their GHG emission or to reduce emission and sell the permits. The theory makes the estimation, that entities, that are able to reduce emission cheaper than the price of the permit, will also do so. Unused permits are then sold to companies whose emission-reduction costs exceed the price of the permits (Milunovich et al., 2007, p. 4). By putting a price on emission, the externality of pollution is being internalised. Companies are forced to buy pollution rights and thus forced to pay for emissions which they used to emit for free (University of Calgary, n.d.).

The US were one of the first to realise a cap-and-trade policy[1] and it quickly showed that it was way more popular than regular 'command-and-control' policies[2]. Cap-and-trade policies were "everybody's favourite way to deal with pollution problems" (Conniff, 2009). This is the case since they fulfil the human need to maximize profits by creating the possibility of making money and achieving the best price possible. "There's an upside potential here, you're going to make money. People do get up early and do drive hard around the possibility of finding themselves winners on this" (Conniff, 2009).

Quickly after that, the Kyoto Protocol (in 1997) picked up on the practice. It was seen as a unique opportunity to use a "market-based instrument to reduce […] GHG's [and] carbon dioxide"

[1] The policy was part of the Clean Air Act of 1990 which was adopted under the George H.W. Bush administration and aimed at the reduction of pollution that caused acid rain in the North-West of the US and West-Canada.

[2] Command-and-control policies rely on prescribing or forbidding certain behavior of companies or individuals (Conniff, 2009). They are seen as a restriction of freedom and not followed passionately.

(University of Calgary, n.d.). In the Kyoto scheme, carbon allowances are traded between countries and individual entities and the cap is set in relation to historical emissions.

In 2005, the EU adopted the world's largest mandatory cap-and-trade scheme. The first phase (2005-2007) was used to prepare for compliance with the Kyoto Protocol while the second phase (2008-2012) widened the scope of the EU ETS and thus fulfilled the criteria of the Kyoto Protocol. Since the second trading period, operators may substitute allowances with international credits. These international credits stem from programmes initiated under the Kyoto Protocol such as the Clean Development Mechanism[3] and Joint Implementation[4]. The credits are also known as 'Certified Emission Reductions' (CERs) and 'Emission Reduction Units' (ERUs) and may be surrendered in place of allowances under certain conditions (European Union, 2015, p. 96). CERs and ERUs are thus equivalent to emission allowances. The cap was set by the MS for the first two trading period but is regulated community wide since the third trading period. When MS set the cap, it was fixed for the entire trading period. Only with the community-wide regulation, the cap decreased by 1.74% each year (European Commission, 2016). The current cap for 2018 resides at 1.892.981. Allocation of EU allowances was made on basis of National Allocation Plans (NAPs). The NAPs oriented themselves at historical data as was the case in the Kyoto Protocol (Milunovich et al., 2007). The Carbon Trade Watch (2009, p. 2) criticised this approach since the historical data stems from the industry itself and the "industry has a clear incentive to overstate its past emissions in order to gain more credits" .

In addition, the Carbon Trade Watch (2009) identified several issues related to cap-and-trade environmental policies. First, cap-and-trade gives high incentives to cheap, short-term emission reduction measures which do not necessarily translate to sustainable and enduring emission reduction. Second, costs of the permits are by far lower than costs of sustainable emission reduction measures. In order to facilitate sustainable reduction, the prices of permits would have to be at about 150€/tonne.[5] Third, companies source out emissions to entities that are outside the trading scheme. This way, their emissions encompassed in the trading scheme are reduced, however overall emissions did not decrease. Fourth, companies pass on costs for emission reduction measures and allowances to consumer. However, most allowances were allocated for free leading to the companies making more profit while the costs stay the same. Fifth, a cap-and-trade scheme will encourage 'carbon leakage'. Carbon leakage

[3] The Clean Development Mechanism is "a programme under the Kyoto Protocol that allows industrialised countries to meet part of their required cuts in greenhouse gas emissions by paying for projects that reduce emissions in other industrialised countries" (European Union, 2015, p. 96).

[4] The Joint Implementation is "an arrangement under the Kyoto Protocol that allows industrialised countries with a greenhouse gas reduction commitment […] to invest in projects that reduce GHG emissions in developing countries as an alternative to more expensive GHG emissions reductions in their own countries" (European Union, 2015, p. 96).

[5] In comparison, fines for missing allowances in the EU ETS rate at 100€/tonne.

describes the phenomenon of industries migrating from highly regulated countries to areas with lower regulations.

Summing up, cap-and-trade schemes intent to reduce emissions by using market mechanisms that internalise the externality of pollution. By doing so, individuals get the opportunity to make profit with the trade of permits which makes the policies very popular. However, several issues such as the sustainability of emission reduction and increased costs for consumers arose during the implementation of the policy. These need to be taken into consideration when analysing the EU ETS and other cap-and-trade schemes.

2.2. Competences and responsibility of policy implementation in the EU

In areas where the EU does not have exclusive competences, its actions are bound by the subsidiarity principle of Article 5(3) of the Treaty on European Union (TEU) and *'Protocol (No 2) on the application of the principles of subsidiarity and proportionality'*. Subsidiarity is to ensure EU Member States' power and discretion and only grants the EU an active role when an objective requires Union-level action or coordination. This way, actions are taken as close to the citizens as possible and the justification for actions by the EU are constantly checked (European Parliament, 2018).

According to Article 288 of the Treaty on the Functioning of the European Union (TFEU) the EU has four different instruments to exercise its competences: regulations, directives, decisions, and recommendations or opinions. Regulations are binding in their nature and generally and directly applicable in all MS. In comparison, directives are binding, but only to the results that are to be achieved. MS thus have to implement directives and are granted discretion in deciding on form and methods of implementation. Decisions are fully binding, but only to those to whom they are addressed, and recommendations and opinions are not binding (Art. 288, TFEU, 2012).

In the area of environmental policies, the EU does not have exclusive competences and is thus bound by the subsidiarity principle. However, since climate change is not a national but global phenomenon, it requires actions by the Union as a supranational actor. The EU can thus take action on the topic because the MS are not able to coordinate measures on such a cross-border issue in a way the EU can.

The delegation of responsibilities can be explained through the framework of the principal-agent theory. This theory assumes superordinate principals that delegate tasks to subordinate agents, which, in return, are to produce outcomes desired by the principal (Meier & Krause, 2003). The relationship between the principal and the agent is hierarchical and agents are granted discretion in implementation. Frederickson, Smith, Larimer, and Licari (2015) argued that agents may have interests that are different than the interests of the principal, which can lead to a conflict of interest when fulfilling tasks. Agents might not fulfil tasks if they contradict their own interests or if capacities for fulfilling the task are not present. Since it is difficult or even impossible for the principal to control the agent and its actions, implementation of tasks may lack behind. The underlying assumption for this theory is the politics-

administration dichotomy by Weber (1864-1920) and Wilson (1856-1924). Both scholars studied the role of public administrations and concluded that politics and public administration should be seen separately of each other.

Taking the principal-agent theory into account, the EU is the principal which relies on the MS (agents) to implement directives. However, the MS as agents can be assumed to have own interests. These interests can conflict with the interests of the principal (EU). This can lead to MS not complying with tasks delegated by the Union or not producing the desired outcome due to wilfully disregarding the task or simply not having the capacity to do so.

2.3. Policy failure

The EU ETS as a directive needs to be implemented by the MS in order to fulfil its aim of GHG emission reduction in the EU. However, implementation of a policy does not necessarily lead to the desired outcome. This is the case when the policy did not achieve its goals and the policy has thus failed. Subsequently, the term policy failure is discussed.

Due to the existence of many different evaluation measures, there is no universal benchmark to measure failure, as McConnell (2015) indicated. Ambiguity plagues the process, since policies can deploy several objectives and benchmarks can change over time. Furthermore, policy failure or success depends on the perceptions of the stakeholders involved. Assuming a policy with two stakeholders – the government and the civil society - it is possible that a policy is perceived as a success by the government due to on-time implementation, use of adequate resources and achievement of policy goals, while the civil society is dissatisfied with the policy since it aimed at the consequences and not at the causes of a problem. These perceptions must be weighed out against each other to identify whether the policy was a success. In addition, policy failure depends on the time of measurement. A policy that is predicted to be successful in the ex-ante evaluation might fail in the ex-post evaluation due to unforeseeable complications in the implementation process. In addition, a policy with short-term success might fail in the long run or the other way around. Evaluations at different times can thus lead to different outcomes in measuring policy success. Taking these issues into account, McConnell (2015, p. 230) came up with the following definition of policy failure:

> "A policy fails, even if it is successful in some minimal respects, if it does not fundamentally achieve the goals that proponents set out to achieve, and opposition is great and/or support is virtually non-existent".

Policy failure can occur on different levels of the policy-making cycle. McConnell (2015) identified three levels of policy failure: Process, programme and politics. Process refers to the governance process in which a policy is established. Failure can happen when governments do not manage to get approval for their designed policy. Programme refers to the policies themselves. Failure can be "varying degrees

of failure to be implemented as intended, achieve desired outcomes, benefit target groups, meet criteria which are highly valued in that policy domain […] and attract opposition to, and attract little or no support, for either the policy goals and/or the means of achieving them" (McConnell, 2015, p. 236). Politics looks at the degree to which governments achieved their intended political outcome. These levels can be intertwined and failure in one level might be accepted in order to achieve success in a different level.

The EU ETS cannot be considered a failure in process since the Directive 2003/87 was adopted accordingly. However, the EU ETS might show failure in the programme level due to difficulties in implementation or failure to achieve emission reductions as planned. Also the politics level might be a failure when national governments or the EU do not manage to achieve their political outcomes and are subject to public critique or reputational damage due to the EU ETS.

Not only can policy failure occur on different levels of the policy-making cycle, but also in different degrees. Not all policy failures are as severe. McConnell (2015) defined three degrees of policy failure: (1) Tolerable failure describes failures that do not scratch at the fundamental goals of a policy and which in core show resilient successful outcomes. The support for the policy is high with barely any criticism. (2) Conflicted failure applies to policies that failed in the same degree as they succeeded in achieving policy goals. Opposition and support are equally strong. (3) Outright failure are policies that do not fulfil their fundamental goals and have a strong opposition and little support.

2.4. Policy implementation

Lampinen and Uusikylä (1998) as well as Zhelyazkova et al. (2016) differentiated between two types of implementation: legal and practical or final implementation. Legal implementation is described as "the incorporation of EU legislation into national law" (Lampinen & Uusikylä, 1998, p. 233) and practical implementation is defined as "the actions taken by implementation actors […] established and/or coordinated by national ministries that carry responsibility of ensuring the proper application of EU rules" (Zhelyazkova et al., 2016, p. 832).

Zhelyazkova et al. (2016) studied the relationship between legal and practical implementation, called decoupling. They identified legal implementation as a precondition for practical implementation, implying that the latter is not possible in countries where the former has not taken place.

> "In the context of EU policy making, decoupling reflects the extent to which practical implementation lags behind the legal implementation of EU rules. Thus, it captures non-compliant practical deviation from domestic measures adopted in response to EU requirements. At the policy-practice level, decoupling occurs when rules are unimplemented or routinely violated" (Zhelyazkova et al., 2016, p. 828).

Due to the discretion of MS to implement the EU Directive, it is possible that the degree of legal and practical implementation within a country can vary due to full, partial or no compliance with legal and practical obligation. It also possible that legal and practical implementation deviate, and that legal implementation is successful while practical implementation is poor. The higher the deviation between legal and practical implementation is, the higher the degree of decoupling.

The implementation of EU directives can be influenced by several factors. Knill and Lenschow (1998) examined the relationship between national administrative arrangements and legal implementation. Their findings showed that the degree of (mis)match between the national administrative arrangements and the legislative adaptation requirements had a significant effect on the legal implementation. Directives whose requirements matched national regulatory patterns were implemented more often than directives that did not correspond. Lampinen and Uusikylä (1998) also looked at factors influencing legal implementation. They took a broader approach and studied the influence of political institutions, political culture, degree of corporatism and citizen's support on legal implementation. Their findings quickly revealed the significance of political culture and institutions. The inclusion of civil society actors and mass opinion did not play a role. Falkner and Treib (2008) broadened the scope and looked at legal as well as practical implementation. Together they investigated whether the promise of becoming a European MS motivated candidate countries to comply with EU legislative requirements. They expected implementation efforts to decrease or even come to a halt after accession. Surprisingly, this assumption did not hold true since they found high legal implementation within the new MS, even after accession. Only the practical implementation within the new MS was low. However, this was not due to accession but to problems such as an insufficient judiciary system, missing independent institutions, and a missing or inactive civil society. Also, Zhelyazkova et al. (2016) focused on legal and practical implementation. The scholars studied the influence of enforcement (policy preference of state actors), management (political constraints and administrative capacities) and legitimacy (perceived by the society) on decoupling. They found out that only the latter two had significant impact on legal and practical implementation.

On top of that, Woerdman (2015) identified four essential problems the EU ETS encountered during its implementation. First, MS over-allocated allowances to protect their industries' competitiveness. This, in combination with the financial crisis in 2008, has lead to a sharp fall in allowance prices. Low allowance prices give little incentives to invest in energy-efficient technologies. Second, operators received so-called windfall profits by passing on costs of allowances, equivalent to market prices, to consumers. However, most allowances were allocated free of charge, leaving the operators with profits without increasing costs. Third, Woerdman (2015) criticises free allocation of allowances to new entrants and extensions and the need for operators to surrender allowances for closing plants. This leads to companies keeping energy-inefficient plants in place to keep receiving allowances, even if production costs outweigh profits. Fourth, many operators committed tax fraud and allowance theft from the MS which has led to losses of around 5 billion euros in Europe.

Summing up, the degree of (mis)match between national administrative arrangements and legislative adaptation requirements, the political culture, and political institutions affect legal implementation. Practical implementation is hindered by problems such as a missing civil society or independent institutions and insufficient judiciaries. Management and legitimacy impact the degree of decoupling. The EU ETS is influenced by over-allocation, low allowance prices, windfall profits, entrants and closure rules, tax fraud and allowance theft. This provides a richness of factors that provenly influence the implementation of European policies in the MS. However, in parts the findings contradict each other, e.g. legitimacy is an influencing factor in the study of Zhelyazkova et al., but not in the research of Lampinen and Uusikylä. In these cases, the distinction between legal and practical implementation is of great relevance. It might be that legitimacy, as suggested by Lampinen and Uusikylä (1998), does not affect legal implementation, but impacts decoupling instead, as argued by Zhelyazkova et al. (2016).

2.5. Hypotheses

On the basis of the aforementioned theories on cap-and-trade and policy implementation, hypotheses are derived. The hypotheses are: (H1) Countries with poor legal implementation are not likely to reduce emissions; (H2) Under the condition of successful legal implementation of the Directive 2003/87, it is assumed that the more successful the practical implementation in a country is, the more likely a reduction in emission in that country is. The amount of emission after implementation is to be seen in relation to the amount of emission before implementation.

3. Methodology

In order to test the previously derived hypotheses, adequate methods are needed. In the following, the appropriate research design, case selection, operationalisation and data collection methods are described. The section will close with an outlook on the data analysis.

3.1. Research design

In this study, an interrupted time series design is chosen to prove the relationship between the independent and the dependent variable while considering the time order. Therefore, reversed causation can be ruled out. In the interrupted time series, the dependent variable of a group of units is studied over time and at one point in time the group receives a treatment - a change in the independent variable. This treatment is then expected to cause a change in the dependent variable.

When looking at the implementation of the Directive 2003/87 and its effect on emissions, GHG emissions (dependent variable) of European MS (units of analysis) are measured before and after the implementation of the Directive 2003/87 (independent variable). Implementation of the EU ETS is thus the treatment. The EU's emissions can be split into emissions falling within the EU ETS, the so-called trading sectors, and emissions that do not fall under the EU ETS, the so-called non-trading sectors. The trading sector covers around 45 percent of the overall GHG emissions of the EU. Even though the EU's

general climate target aims at a reduction of 20 percent by 2020 in comparison to 1990, the EU ETS aims at a reduction of 21 percent by 2020 in comparison to 2005. The reference points differ due to the lack of data on trading sectors. Only with the establishment of the EU ETS, the split into trading and non-trading sectors took place, enabling data collection only from that point on. Since the EU ETS restricts emissions in trading sectors only, these emissions will be used to measure the effect of the policy. Subsequently, the first point of measurement will be 2005 since data is not available before that point (European Parliament, 2014; Zetterberg et al., 2014). The second point of measurement of GHG emissions will be 2017. It is the most recent year in which data is available. Predictions on upcoming years will not be used since predictions are not factual statements but can be subjects to change.

However, X needs to precede Y with a time lag in order to give X the time to assert its effect on Y. Unfortunately, this is only limitedly possible here. The first point of measurement for GHG emission collides with the introduction of the policy, giving only a limited indication of the GHG emissions before the EU ETS. This is due to the lack of data on trading sectors, since that distinction only came into being together with the introduction of the policy. Furthermore, there are only 12 years between the introduction of the policy and the second point of measurement. Taking into account the three periods of the EU ETS, this might hardly be enough time for the Directive 2003/87 to take effect. The first period (2005-2007) was a try-out period with a cap that was higher than actual emission, leading to the price of allowances dropping to zero. In the second period (2008–2012), the cap was lowered, however, the economic crisis dropped economic activities and thus emissions. Also, in this period allowances stayed unused, weighing heavy on the allowance price. Only in the third period (2013-2020), allowances were not allocated for three anymore but granted through auctions which led to higher allowance prices (EUROPEAN COURT OF AUDITORS, 2015). Furthermore, a EU-wide cap was introduced which is lowered every year and not only every period. Summing up, the third period is considered most effective in emission reduction, nevertheless, this is only 4 years ahead of the point of measurement. The outcome of the research can be threatened by the lack of time lag.

In addition, the interrupted time series cannot rule out the effect of third variables on the causal relationship and can thus not guarantee non-spuriousness. This could be encountered by including control variables, such as other legislation on climate change or the economic growth of a country. Furthermore, the interrupted time series design holds several threats to validity. The internal validity can be affected by the possible spuriousness of the research; the external validity is not guaranteed since generalisation is limited. Also, the statistical conclusion validity can be violated when looking at the changes the treatment caused. Many changes can be seen as accidental or are not big enough to argue the treatment worked.

3.2. Case selection

The unit of analysis within this research are European Member States. The independent variable consists of two steps – the legal and practical implementation – with step one being a precondition for step two.

This needs to be taken into consideration carefully. Only in MS with thorough legal implementation effective practical implementation is possible. Thus, it first needs to be assessed whether MS actually legally implemented the EU ETS and how successful this legal implementation was[6]. Therefore, a first pool of cases is selected on the basis of successful legal implementation. Norway, Liechtenstein and Iceland are not considered since they are formally not members of the European Union. The United Kingdom (UK) will be excluded for the reason of ongoing Brexit negotiations. This might have negative influences on the implementation performance due to a lack of compliance pressure. Furthermore, MS that entered the EU after the beginning of the first trading period (Bulgaria, Croatia and Romania) will not be taken into account. This is the case, since these countries lack implementation experience and might face more severe problems at a later stage than other participating countries. This leaves 24 possible cases[7]. These cases can be seen as typical cases as categorised by Seawright and Gerring (2008). They are used to test a causal mechanism suggested from theory, in this case the reduction of emissions due to the implementation of the EU ETS. A 'pattern-matching investigation' is being undertaken (Seawright & Gerring, 2008).

If the amount of cases that legally implemented the EU ETS successfully is limited, all of the cases will be selected and analysed in regard to their practical implementation and subsequently their emission changes. If the number of cases with successful legal implementation is high, a second step in the selection process is needed in order to guard feasibility. The 'diverse case'-concept of Seawright and Gerring (2008) will be applied in this second step. Control variables will be used, such as the size of the country, the duration of the membership in the EU, the size of the economy, the degree of the industrialisation and the wealth of the state, to ensure variance in these dimensions. This is done to exclude that other factors besides implementation might influence the success of the Directive 2003/87.

However, practical limitations need to be taken into consideration. On the one hand the availability of data is important to consider, on the other hand the language of the available data is of vital importance for understanding the data and retrieving information. Even though the cases should be selected according to the theory, practical limitations prevail. Due to language barriers, a pool of seven cases with legislation in Dutch, English or German remains: Austria, Germany, Ireland, Latvia, Lithuania, Malta and the Netherlands (see Appendix A). These seven cases will be assessed on their legal implementation and the cases with successful legal implementation will also be analysed in regard to their practical implementation and GHG emission.

[6] Requirements for successful legal implementation are laid out in the operationalisation.

[7] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden

3.3. Operationalisation and data collection methods

3.3.1. Legal implementation

Legal implementation is about the transposition of the EU ETS into national law. The Directive 2003/87 holds several key legal obligations (KLO). These obligations are aimed at the operators and the MS.

According to the EUROPEAN COURT OF AUDITORS (2015, p. 30), "The implementation of the EU ETS by Member States should involve the allocation of allowances to installations, the implementation of the NAPs and relevant rules by the Member States, emissions monitoring, reporting and verification [(MRV)] procedures, including the accreditation or recognition of verifiers where applicable". In addition, implementation needs to include the establishment of GHG emission permits and related obligations, the requiring of a monitoring plan from operators and the establishment of a registry (Fleurke & Verschuuren, 2015).

According to Article 5 Directive 2003/87, the issuing of GHG emission permits intrinsically holds the obligation of monitoring plans for operators. (Article 4 (2) Directive 2003/87). This monitoring plan includes "the technical details of the installation and how emissions will be monitored (i.e. by applying calculations and/or measurements) and reported" (EUROPEAN COURT OF AUDITORS, 2015, p. 31). This leaves the MS with the KLO to establish *GHG emission permits*. Furthermore, the MS have to establish and maintain a *registry* in order to ensure the "accurate accounting of the issue, holding, transfer and cancellation of allowances" (Article 19 Directive 2003/87). The registry has to be accessible to the public and needs to contain separate accounts for each person (Article 19 (2) Directive 2003/87). This obligation however changed over time with the amendment of the Directive 2003/87 by *'Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community'* (Directive 2009/29). The registry went from being a national obligation to a Community-wide registry maintained by the EC. Moreover, MS are obliged to allocate allowances. Legally, this holds the obligation to establish an appropriate *method of allocation* as well as the *administrative measures* necessary to issue the allowances. The method of allocation changed from having to allocate 95% of the allowances for free in the first period and 90% free in the second period to a system of allowance auctioning in the third trading period (Article 10 Directive 2003/87). The administrative measures include the need for a administrative authority (CA). The CA is responsible for the implementation of the Directive 2003/87 and fulfils different tasks depending on the MS. When designating more than one CA, the MS have to allocate the tasks between the CAs strictly (Article 18 Directive 2003/87). Closely connected is the implementation of the NAPs. The NAPs specify the quantity and the way of allocation of allowances. They are to be planned in line with objective and transparent criteria and have to take the opinion of the public into account (Article 9 (1) Directive 2003/87). However, with Directive 2009/29 the obligation to draw up a NAP disappeared and was replaced with a Community-wide allocation drawn up by the EC. MS are thus required to include an

obligation for a *NAP* in line with the Directive's requirements in their national legislation for the first two trading periods.

According to the EUROPEAN COURT OF AUDITORS (2015), MS are also required to fulfil the MRV procedures.[8] The MRV procedures will not be taken into account for several reasons. On the one hand, the procedures aim at and hold obligations for the operators and not the MS. On the other hand, the legal obligation for the MS do not remain in the Directive 2003/87 but origin in *'Commission Regulation (EU) No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports and tonne-kilometre reports and the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council'* and *'Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council'*. Due to this and time constraints, the MRV procedures will not be considered.

However, two more KLOs are not covered by Fleurke and Verschuuren (2015) and the EUROPEAN COURT OF AUDITORS (2015). On the one hand, the MS need to submit *annual application reports* to the EC. The reports are vital to assess the compliance of the MS with the Directive 2003/87 and give an overview of the MS's activities. Subsequently, the EC is obliged to publish an annual report on the implementation and application of the Directive 2003/87 in which it summarizes the annual application reports. On the other hand, the national legislation is to contain a *reference* to the Directive 2003/87. This can occur directly through an article dedicated to the reference or indirectly through mentioning the Directive 2003/87 in the preamble and throughout the legislation.

Summing up, the KLOs for the MS are: 1) the introduction of GHG emission permits (Article 4); 2) the establishment of a NAP (Article 9); 3) the usage of appropriate methods of allocation (Article 10); 4) the designation of the CA and appropriate administrative arrangements (Article 18); 5) the establishment and maintenance of a registry (Article 19); 6) the submission of annual application reports (Article 21); and 7) the reference to the Directive 2003/87 (Article 31). (See Appendix B)

Thus, successful legal implementation requires the thorough adaptation of national law to these KLOs. When the national legislation is not changed, that could have two possible reasons: 1) the MS did not legally implement the Directive and does thus not have successful legal implementation; 2) the national legislation already complied with the KLOs and adaptation was not needed. This is considered successful legal implementation. When the national legislation is changed, then 3) the change can either be in accordance with the EU Directive or 4) not as intended by the Directive. If changes do not reflect

[8] The MRV procedures, also known as the annual compliance cycle (ACC), are to ensure that all emission falling under EU ETS are also reported and subsequently covered by an allowance. The ACC includes the obligation of operators to own approved monitoring plans as part of their GHG emission permits. On top of that, operators are required to submit an annual emission report which's data needs to be verified by an accredited verifier until 31 March each year. Subsequently, operators need to surrender sufficient amounts of allowances until 30 April each year (European Commission, 2018).

the intensions of the Directive, this is not considered successful legal implementation. Bearing this in mind, not the change of the national legislation will be analysed but whether the KLOs are present in the national legislation.

The degree of legal implementation will be established on basis of the annual application reports as required by Article 21 of the Directive 2003/87, national legislations, and with help of secondary literature such as Verschuuren and Fleurke (2014), which are collected through desk research. Since European directives give MS a lot of discretion in the implementation, different countries then adopt different measures in order to fulfil a directive's obligations. It is also possible that only parts of a directive are implemented. Taking the possibility of full, partial and missing implementation into account, a compliance rate is established in percentage. The compliance rate bases itself on a point system. Each fully legally transposed obligation delivers one point, a partially legally transposed obligation delivers ½ point and missing legally transposed obligations do not deliver points. When data is missing on one of the obligations, that obligation will not be considered anymore when calculating the compliance rate. The calculation thus is: delivered points through transposition / KLOs on which data is available.

3.3.2. Practical implementation

Zhelyazkova et al. (2016, p. 832) defined practical implementation as "the actions taken by implementation actors". Also for practical implementation, a distinction needs to be made between public implementation actors and private operators. Practical implementation are thus the actions taken by public implementation actors or operators to apply the Directive and its KLOs.

When looking at operators, the GHG emission permit obliges the operators to submit allowances equal to their verified emissions. Practical implementation for operators will thus be measured in regard to the submission of allowances equal to verified emissions. If operators surrender allowances equal to the verified emissions, the practical implementation was successful. In contrast, if operators do not surrender allowances equal to the verified emissions, the practical implementation was not successful. Since the second trading period, emission allowances, CERs and ERUs may be submitted to cover emissions. Thus, they are considered when it comes to the practical implementation of operators. In the following, they will be called 'units'. Operators thus have to hand in sufficient amounts of units. Furthermore, a distinction needs to be made between stationary installations and aircraft operators (aviation). Aircraft operators were only included in the EU ETS in the third trading period and showed low compliance at the beginning due to legal issues (Ben Garside, 2016). However, compliance rates rose after the beginning difficulties. The benchmark for compliance will be set at 99.5%. The benchmark is established by looking at historical compliance rates and is a realistic reflection of current compliance rates (Ben Garside, 2016; European Commission, 2017). The data needed to assess the practical implementation of operators in different countries can be found on the website of the European Environment Agency (EEA: n.d.). The EEA provides a comprehensive data set on the EU ETS. This

data set includes the variable ‘verified emissions’ which reflects the emissions emitted within the framework of the EU ETS by operators. They are measured in tonnes. Verified emissions will be weighed out against the amount of ‘total surrendered units’. These units include surrendered EU allowances, CERs and ERUs. One emission unit is equivalent to one tonne. These two variables are compared to each other by calculating them into a compliance percentage by applying following calculation: total surrendered units / verified emissions. The percentage will be rounded to two decimals (100,00%). This will be done per year as well as for the overall time period. The compliance rate is thus measured in percentage and is a ratio variable.

The MS, in return, have to fulfil more requirements of the EU ETS. They are obliged to: 1) submit annual application reports to the EC; 2) submit realistic NAPs to the EC; and 3) maintain the registry. First, the MS need to submit their application reports annually to the EC. Successful practical implementation is present, when reports for all years of the EU ETS are submitted. This leaves an amount of twelve reports in the time period from 2005 to 2016. Reports for 2017 are not required for successful practical implementation, since MS still have time to submit the report until 30 June 2018. The submission of reports will be assessed by looking at the submitted reports as stored in the Central Data Repository of the EU (Eionet - Central Data Repository, 2005-2018). This variable is measured on a ratio level, since the differences between the values are constant and there is a meaningful zero point. Secondly, the MS need to submit realistic NAPs. In order to assess this requirement for practical implementation, two steps are needed. On the one hand, the NAPs need to be handed in for the first two trading periods as required by the Directive 2003/87. On the other hand, these NAPs need to be realistic, meaning the amount of allowances may not exceed the amount of emissions drastically. The EC already undertook an estimation of the realism of the NAP, since the EC has to assess the NAPs before they were allowed to come into force. Realistic NAPs are thus those, that came into force after inspection by the EC. Successful practical implementation hence implies two NAPs in force, one for each trading period. This will be assessed by conducting desk research. Thirdly, the MS have to maintain a registry. The registry needs to be available to the operators as well as to the public. Availability can occur through having legal access to the registry or by practically being able to access the registry. The legal availability was already covered in the legal implementation. Practical availability is measured on basis of the average downtime. A downtime are the minutes the registry is offline, either due to planned maintenance or unplanned breakdowns. The average downtime will be calculated by accumulating the downtime from each year and by dividing this number by the amount of years. MS with lower average downtime were more successful in maintaining their registry than MS with higher average downtime. The data on the downtime will be taken from the annual application reports which deal with the downtime in point 7.3. Only data for the first two trading periods will be considered, since the EC took over the responsibility in the third trading period.

3.3.3. GHG emissions

The third concept is GHG emissions. In this case, the operationalisation of GHG emissions is dependent on the Directive 2003/87. In Article 2, the Directive identifies the scope as: "emission from the activities listed in Annex I and greenhouse gases listed in Annex II". Annex I declare the following activities to be taken into account: Energy activities; Production and processing of ferrous metals; Mineral industry; Other activities. Annex II considers the following greenhouse gases: CO2, Methane (CH4), Nitrous Oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur Hexafluoride (SF6). These emissions are found in the dataset provided by the European Environment Agency (n.d.). The data set bases itself on the emission reported by the MS in their annual application reports to the EC. Since an interrupted timeseries design is chose, the emissions before and after the implementation are measured and compared. In order to accept the hypotheses, a reduction of GHG emission has to have taken place. The reduction is measured by calculating the percentage of reduction with the 2005 level representing 100% and the 2017 level representing X%. The calculation thus is: 100-(2017/2005*100). Both, stationary installations and aviation, should be included in the calculation since the EU's reduction targets aims at the reduction of all emissions by 21% in 2020 compared to the 2005 level (Eurostat, 2017). However, aviation were only included in the EU ETS from 2012 on. In addition, their cap is based on historical aviation emission data, meaning "5% below the average annual level of emission in the years 2004-2006" (European Commission, 2016, p. 2). Nevertheless, it is not clear whether it measured on a national or European level. Therefore, stationary installations and aviation will be calculated and compared separately from each other.

3.4. Summary

Since the used data is qualitative, the analysis is based on cases. These cases are selected on basis of EU membership (Norway, Liechtenstein, Iceland, UK, Bulgaria, Croatia and Romania will thus not be considered) and data availability. The selected cases will first be analysed regarding their legal implementation. Successful legal implementation implies that the KLOs and their inherent criteria are present in the current national legislation in force. Depending on the number of cases with successful legal implementation, either all cases will be considered for further research or a second step for the case selection will be applied using control variables. Subsequently, the cases that are selected for further research will be analysed regarding their practical implementation. Practical implementation will be seen as successful when the obligations of the EU Directive are fulfilled. The cases are sorted in the order of the quality of the practical implementation. This is the case, since H2 assumes that, under the condition of successful legal implementation, the more successful the practical implementation in country is, the more likely reduction in emissions is. Following practical implementation, the cases will be analysed regarding their emission reduction. Both stationary installations and aircraft operators are able to reduce their emissions and therefore, both will be analysed. On basis of these steps, the research

question will be answered, whether legal and practical implementation of the Directive 2003/87 lead to GHG emission reduction in Europe.

4. Findings and analysis

After having introduced the topic, presented the theoretical background and laid out the methods, the findings are presented and subsequently analysed. First, the findings on legal implementation, then the findings on practical implementation and lastly the findings for the selected cases are displayed and analysed in regard to the hypotheses.

4.1. Legal implementation

The cases for legal implementation were selected on basis of EU-membership and practical limitations such as data availability. Considering the procedure of selecting the cases, the legal implementation of Austria, Germany, Ireland, Latvia, Lithuania, Malta and the Netherlands will be presented and analysed. The findings orient themselves along the KLOs and the associated criteria as mentioned in the operationalisation.

4.1.1. Republic of Austria

In 2004, the Austrian *Nationalrat*[9] adopted the so-called '*Bundesgesetz über ein System für den Handel mit Treibhausgasemissionszertifikaten* ' (EZG) which transferred the Directive 2003/87 into Austrian national law. In accordance with the amendment of Directive 2003/87 by Directive 2009/29, the *Nationalrat* amended the national legislation. The current version in force is the EZG of 2011 (Bundesgesetz über ein System für den Handel mit Treibhausgasemissionszertifikaten, 2011).

The first KLO of the EU ETS is the establishment of GHG emission permits (Article 4 Directive 2003/87). These permits have to include the obligation for operators to draw up a monitoring plan (Article 5 Directive 2003/87). In the Austrian legislation, §4 EZG 2011 obliges operators that fall within the scope of the EU ETS to acquire a permit that grants them the pollution of GHG emissions (§4 (1) EZG 2011). In order to be granted a permit, operators have to prove that they are able to monitor their emission and hand in an emission report (§4(2) EZG 2011). The paragraph also specifies the conditions for granting a permit (§§4 (3)-(8) EZG 2011). Furthermore, §4 EZG 2011 makes a distinction between the second and the third trading period when it comes to withdrawing (§4 (7) EZG 2011) and prolonging permits (§4 (8) EZG 2011). The EZG 2011 thus fulfils the first legal obligation in great depth.

Until the third trading period, MS had to hand in a NAP to the EC in which they specified the amount of allowances and the way they were planning on granting the allowances in the respective period. Furthermore, the NAP had to be drawn up in line with objective and transparent criteria and

[9] The parliament of Austria. In the following, the national names of institutions and persons will be used and indicated by using italicised letters.

needs to take into account the public (Article 9 Directive 2003/87). Section 4 EZG 2011 regulates the allocation of allowances until 2012. §15 EZG 2011 obliges the *Bundesminister für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft*[10], the *Bundesminister für Wirtschaft, Familie und Jugend*[11] and the *Bundesminister für Finanzen*[12] to draw up a NAP for the second trading period in an objective and transparent way. The NAP specifies the quantity of allowances, their relation to emissions in other sectors, the allocation of allowances to operators and the percentage of emission to be auctioned. Furthermore, the process of making the NAP has to fulfil the criteria in §17 (2) EZG 2011[13] (§15 (1) EZG 2011). The obligation to take the public into account is transposed in §15 (8) EZG 2011. According to this paragraph, the public has a period of 6 weeks to comment on the NAP. Hence, the EZG 2011 also fulfils the second obligation in a thorough way.

In the first trading period, Austria allocated all allowances free of charge (§14 (1) EZG 2004). In the second trading period, Austria allocated at least 90% of its allowances free of charge (§18 EZG 2011). This is in line with the legal obligation of Article 10 Directive 2003/87. In 2013, the method of allocation has changed drastically, requiring the MS to amend their national legislation (Article 1 (11)-(12) Directive 2009/29). Section 5 EZG 2011 focuses on the allocation of allowances after 2012. §§20-25 EZG 2011 regulate the auctioning of allowances for installations, while Section 6 EZG 2011 (§§28-31 EZG 2011) regulate the auctioning for aviation. According to §21 EZG 2011, all allowances that have not been allocate free of charge need to be auctioned on an auctioning platform. Also this is in line with Article 10 Directive 2003/87, leaving the third KLO fully implemented.

Article 18 Directive 2003/87 requires the MS to designate a CA and to take appropriate administrative measures. In case of multiple CAs, tasks need to be coordinated. With §49 EZG 2011, the Austrian National Council designates specific CAs. In cases, where the granted permit is in accordance with national legislation, the *Landeshauptmann*[14] is responsible (§49 (1) EZG 2011). In all

[10] Minister of Agriculture and Forestry, Environment and Water management

[11] Minister for Economy, Family and Youth

[12] Minister of Finance

[13] The criteria of §17 (2) EZG 2011 are: 1) the amount of allowances have to be in accordance with the (technical) potential of emission reduction of the operators; 2) the allocation needs to take the expansion of cogeneration and long-distance heating generation into account; 3) the allocation needs to be in line with other legal and political instruments of the EU and Austria; 4) the allocation may not favour specific sectors or companies; 5) the amount of allowances for the industry and energy sector have to be in line with national climate legislation; 6) the amount of allowances needs to be in line with the obligations of the Kyoto-protocol; 7) the actual and the predicted progress need to be assessed and the amount of allowances needs to be in line with this assessment; 8) for the determination of the amount of allowances the criteria of Z 1, 3 – 7 and for the allocation the criteria of Z 1 – 4 need to be taken into account.

[14] Governor

other cases, the *Bundesbehörde*[15] is responsible in accordance with administrative regulations. If more than one *Bundesbehörde* is responsible, then the *Bezirksverwaltungsbehörde*[16] is responsible, or the *Bundesbehörden* need to coordinate with the federal government (§49 (2) EZG 2011). This paragraph gives clear tasks to specific CAs and thus fulfils the fourth legal obligation of Directive 2003/87.

As required by Article 19 Directive 2003/87, the *Bundesminister für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft* has to establish and maintain a registry (§21 (1) EZG 2004). The registry is to be made available to the public and requires separate accounts for each person (§21 (2) EZG 2004). Hence, the fifth KLO is transposed in-depth.

In line with Article 21 Directive 2003/87, §48 EZG 2011 obliges the *Bundesminister für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft* to report to the EC about the application of the Directive 2003/87 annually. Thus, also the sixth KLO is fulfilled by the EZG. Lastly, §58 EZG 2011 fulfils the Article 31 obligation to include a reference to Directive 2003/87 in the national legislation, leaving the seventh KLO transposed.

In conclusion, the EZG fulfils all KLOs of Directive 2003/87 in great width and depth.

4.1.2. Republic of Germany

In Germany, the '*Gesetz zur Umsetzung der Richtlinie 2003/87/EG über ein System für den Handel mit Treibhausgasemissionszertifikaten in der Gemeinschaft*' (TEHG 2004) was adopted on 15 July 2004 and transposes the Directive 2003/87. The amended version of the Directive 2003/87 is transposed by the '*Gesetz über den Handel mit Berechtigungen zur Emission von Treibhausgasen*' (TEHG 2011) (Verschuuren & Fleurke, 2014, p. 33) into national law. The TEHG 2011 is the current version in force. Verschuuren and Fleurke (2014, p. 33) found that "the TEHG has provisions on all elements of the ETS, such as the issuing of the GHG permit, monitoring and control, the keeping of a national record and national and international reporting".

Fulfilling the first KLO, the TEHG obliges operators to acquire a permit from the CA for polluting GHG (§4 TEHG 2011). The legislation specifies the conditions for granting a permit (§§4 (2) – (3) TEHG 2011) and gives clear instructions on how to report changes in the activity of the operator (§4 (5) TEHG 2011). The conditions for granting a permit include a monitoring plan from the operator. Thus, the first KLOs is fulfilled in depth.

In the TEHG 2004, §7 TEHG 2004 states the *Bundestag's*[17] intention to draw up a NAP for each trading period. The NAP will be the basis for a law, which will regulates the allocation of allowances. The NAP will cover the amount of allowances to be allocated and the rules of allocation. The amount of allowances needs to be in proportion to non-trading sectors and take into account new installations

[15] Public authority

[16] District administration authority

[17] The parliament of Germany.

and changes within existing installations according to §7 TEHG 2004. §8 TEHG 2004 regulates the process of drawing up the NAP. As part of the process the public will be consulted (§8 (1) TEHG 2004). The German national legislation thus fulfils three out of the four criteria of the second KLO. Only the objective and transparent way of drawing up the NAP is missing. However, by making the process of drawing up the NAP public, the German *Bundestag* acts in a transparent way. This criterion is thus not specifically mentioned by intrinsic to the legislation. Followingly, the second KLO is transposed. With the amendment by Directive 2009/29, the NAP was not needed anymore and is thus not part of the TEHG 2011.

Since the method of allocation changed with the third trading period, the TEHG 2004 should include regulations on the first two trading periods. However, the TEHG 2004 gives no further information about the method of allocation and simply refers to the NAP as the regulating document. The NAP for the first trading period states that all allowances will be allocated free of charge for the first trading period (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2004, p. 5). The first criterion of the second KLO can thus be seen as fulfilled. The NAP for the second trading period does not specifically state that at least 90% of the allowances are allocated for free but includes it in its calculations (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2006, 27, 33, 56). According to the *Umweltbundesamt*[18] (2015, p. 12), the energy sector and the industry were allocated allowances free of charge. The possibility of auctioning up to 10% of the allowances was used by Germany thoroughly by cutting free allocation in electricity generation (Umweltbundesamt, 2015, p. 12). Also the second criterion of the NAP obligation is thus fulfilled. The method of allocation for the third trading period can be found in §§8 – 13 TEHG 2011. §8 TEHG 2011 is the national legislation equivalent to Article 10 Directive 2003/87 and covers the auctioning of allowances in the third trading period. §9 TEHG 2011 covers Article 10a (1) – (5), (7) and (11) – (20) Directive 2003/87 on free allocation. With §10 TEHG 2011, the German *Bundestag* gets the authority to adopt further decrees on the harmonised free allocation of Article 10a Directive 2003/87. §11 TEHG 2011 sets out rules for free allocation for aviation with §§12 and 13 TEHG 2011 covering allocation from the special reserves. Hence, also the third criterion of the NAP obligation is fulfilled, leading to the thorough transposition of the second KLO.

Section 4 TEHG 2011 sets out common rules and with that covers the designation of the CA and the establishment of appropriate administrative measures in line with Article 18 Directive 2003/87. According to §19 (1) 3 TEHG 2011, the *Umweltbundesamt* is the CA. This is the case for all cases not covered by §§19 (1) 1 – 2 TEHG 2011. The CA has to oversee the compliance of the TEHG 2011 (§20 TEHG 2011). Furthermore, §21 TEHG 2011 establishes inspection bodies to assess emission reports in accordance with §5 (2) TEHG 2011, §22 TEHG 2011 sets the fees for public services of the

[18] Ministry of Environment

bureaucracies and §23 TEHG 2011 regulates the electronic communication. The third KLO is thus fulfilled, since a CA is designated, and tasks are assigned.

As required by Article 19 Directive 2003/87, §14 TEHG 2004 establishes a registry in which allowances are documented. The CA is responsible for establishment and maintenance of it. Each person is obliged to create a separate account. When having created an account, information stored in the account can be accessed freely. With the third trading period, the registry was transferred into the realm of responsibility of the EC. §17 TEHG 2011 thus only obliges to register allowances in line with Article 19 (3) Directive 2003/87. Summing up, the criteria to establish and maintain the registry for the first two trading period and to create separate account for each person are fulfilled. The accessibility of the public is not guaranteed by the national legislation. Thus, the fifth KLO is only partially transposed.

The transposition of Article 21 Directive 2003/87 covering national annual reports to the EC is missing. This leaves the sixth KLO legally not transposed. The reference to the Directive 2003/87 as required by Article 31 Directive 2003/87 is not an own paragraph within the TEHG 2011 but is mentioned in the preamble. The seventh KLO is thus fulfilled.

All in all, Germany transposed five KLO fully and one partially. The remaining KLO is not transposed legally.

4.1.3. Ireland

The *Government of Ireland* adopted the '*European Communities (Greenhouse Gas Emissions Trading) Regulations 2012*' (Regulations No 490/2012) in order to implement the Directive 2003/87 and the Directive 2009/29. The Regulation No 490/2012 repeals '*European Communities (Greenhouse Gas Emissions Trading) Regulations 2004*' (Regulations No 437/2004), the first national legislation adopted to transpose the Directive 2003/87.

With Section 5 Regulations No 490/2012, the Irish law obliges operators to obtain a GHG emission permit. This permit is to be granted by the *Agency* and is needed for activities that fall within the framework of the EU ETS. Section 6 Regulations No 490/2012 lays out the application procedure for GHG emission permits. Accordingly, operators have to provide the CA with a description of the installation[19] and hand in a monitoring plan. Section 7 Regulations No 490/2012 sets the conditions and content of GHG emission permits. Hence, the first KLO and all its criteria are fulfilled.

The NAP, as required by Article 9 Directive 2003/87, is transposed with Section 10 Regulations No 490/2012. The NAP is "setting out the total quantity of allowances to be allocated for that period and how such allowances are to be allocated" (Section 10 (1) Regulations No 490/2012). Furthermore, allocation has to take place in a fair and open way. According to Section 10 (4) Regulations No 490/2012 a draft of the NAP is also published for public comment before reporting to the EC. The Section 10

[19] The description includes its activities, the use of raw and auxiliary material, the sources of emissions of gases, the planned monitoring and reporting measures, other useful information and a non-technical summary.

Regulations No 490/2012 specifically includes the fact that the NAP is only needed for first two trading periods. The NAP obligation is thus fully transposed by Section 10 Regulations No 490/2012.
While Section 11 Regulations No 490/2012 regulates the method of allocation for the first two trading periods, Section 13 Regulations No 490/2012 coordinates the community-wide quantity of allowances during the third trading period. At least 95% of the allowances in the first trading period and 90% of the allowances in the second period shall be allocated free of charge (Section 11 Regulations No 490/2012). These two criteria of the third KLO are thus transposed. However, Regulations No 490/2012 do not include a more specific paragraph on the method of allocation for the third trading period. This leaves the third KLO only partially transposed.

The CA is designated through Section 29 Regulations No 490/2012. The *Agency* is the assigned CA and carries out all tasks on behalf of the *Government of Ireland*. It is also recognized as the CA for MRV. The fourth KLO is thus fulfilled.

Section 19 Regulations No 437/2004 obliges the *Agency* to establish and maintain a registry for allowances. "The Registry shall be accessible to the public and shall contain separate accounts to record the allowances held by each person to whom and from whom allowances are issued or transferred" (Section 19 (3) Regulations No 437/2004). Section 30 Regulations No 490/2012 regulates the Ireland's participation in the Union registry and assigns the Agency to be responsible for the national accounts. The fifth KLO is thus transposed in full depth.

With Section 31 Regulations No 490/2012 the *Agency* is obliged to report annually to the EC in accordance with Article 21 Directive 2003/87. The sixth KLO is hence fulfilled. A reference to Directive 2003/87, as required by Article 31 Directive 2003/87, is done in the preamble as well as throughout the text, leaving the seventh KLO to be fulfilled too.

In conclusion, Ireland has transposed six KLOs in full depth and one KLO partially.

4.1.4. Republic of Latvia

Since 2001, Latvia strives an ambitious plan to reduce pollution with the aim to "prevent or reduce harm caused to human health, property or the environment" (Law on Pollution, Section 2). In its *Law on Pollution*, *Saeima*[20] included the legal transposition of the EU ETS. The current version in force is from 2014.

Section 19 (5) Law on Pollution obliges operators that fall within the scope of the EU ETS to acquire GHG emission permits and to provide the CA with a monitoring plan. While Section 24.[1] Law on Pollution lists the activities for which a permit is needed, Section 31.[1] Law on Pollution lays down the conditions for a GHG emission permit and what it should include. Thus, the first KLO is fulfilled.

Chapter V.[1] Law on Pollution, which was amended in 2003, introduces the GHG emission allowances and deals with the allocation of allowances. According to Section 32.[1] (1) Law on Pollution,

[20] The parliament of the Republic of Latvia

the *Ministry of Environmental Protection and Regional Development* has to draw up the NAP for Latvia. This is to be done in consultancy with the public. Subsequently, the *Cabinet* has to approve the plan in line with Article 9 Directive 2003/87. The NAP lays out the total quantity of allowances to be allocated as well as the way of allocation (Section 32.[1] (2) Law on Pollution). Furthermore, it has to fulfil certain conditions as required by Section 32.[1] (3) Law on Pollution. Summing up, the NAP fulfils all criteria of the second KLO, besides the need for objective and transparent criteria. However, these are intrinsic to the legislation since the process of drawing up the NAP is laid out in great detail in the *Law on Pollution*. The second KLO can thus be seen as transposed.

Section 32.[2] (3) Law on Pollution regulates the method of allocation. The paragraph makes a distinction between the first two trading periods and the third trading period and responds to Articles 10 and 10a Directive 2003/87 as amended by Directive 2009/29. Allowances that are issues before 2012 are allocated free of charge. In the third trading period, aircraft operators have to acquire their allowances through auctioning from 1 January 2012 on. Installations have to acquire their allowances through auctioning only from 1 January 2013 on. According to Section 32.[3] Law on Pollution, operators are obliged to surrender allowances equivalent to pollution to the State limited liability company *'Latvian Environment, Geology and Meteorology Centre'* until 30 April each year. This, hence, fulfils the third KLO.

The designation of a CA is not specifically mentioned in the *Law on Pollution*, however, specific agencies are assigned to specific tasks: 1) the *Latvian Environment, Geology and Meteorology Centre* is assigned to collect the allowances, administer the registry and report to the EC; 2) The *Ministry of Environmental Protection and Regional Development* decides on the allocation of allowances and, together with the *Cabinet*, adopts the NAP. CAs have thus been assigned to specific tasks and appropriate administrative measures have been taken, leaving the fourth KLO fulfilled.

In line with Article 19 Directive 2003/87, Section 32.[4] Law on Pollution regulates the registration of allowance activities. These activities have to be performed electronically in the framework of the register and are to be accessible to the public. This fulfils one criterion of the fifth KLO. Since 1 January 2012, the national registries are merged into a community registry, which is established and maintained by the EC. Subsequently, the *Latvian Environment, Geology and Meteorology Centre* is the state administer for the registry for the third trading period. Due to a lack of data, it cannot be assessed how the legislation looked like for the first two trading periods. The fifth KLO can thus not be assessed.

According to Section 32.[8] (1) Law on Pollution, the *Latvian Environment, Geology and Meteorology Centre* has to report to the EC in line with Article 21 Directive 2003/87. This transposes the sixth KLO. Furthermore, the seventh KLO is transposed, since reference to the Directive 2003/87 are made throughout the legislation as required by Article 31 Directive 2003/87.

All in all, six of the KLOs have been transposed into national law. The transposition of the registry obligation cannot be assessed due to the lack of data.

4.1.5. Lithuania

In Lithuania, the '*Law on Financial Instruments for Climate Change Management*' (XI-329) regulates the implementation of the Directive 2003/87. The law was adopted in 2009 and earlier version could not be accessed in English and can thus not be considered.

Article 5 XI-329 obliges operators that engage in GHG emitting activities to "obtain a greenhouse gas emissions permit, acquire allowances and be entered in the Greenhouse Gas Registry" (Article 5 (1) XI-329). Furthermore, operators need to report on their GHG emissions and monitor them (Article 5 (2) XI-320). Article 7 (4) XI-329 obliges operators to hand in a monitoring plan in order to obtain a GHG emission permit. This is in line with the first KLO of Directive 2003/87.

The Lithuanian NAP is to be drawn up by the "*Minister of Environment in conjunction with other institutions authorized by the Government*" (Article 6 (1) XI-329). It is valid until the end of the second trading period and needs to be accessible to the public (Article 6 (2)-(3) XI-329). This fulfils the fourth criterion of the second KLO. In addition, the XI-329 requires the NAP to be in line with legal obligations by the EU. By this, the national legislation implies the transposition of the criteria of the NAP obligation but does not specifically include regulations on it. The second KLO will thus be seen as only partially transposed.

The method of allocation is regulated in Article 8 XI-329. However, the Article only obliges the *Minister of Environment in conjunction with other institutions authorised by the Government* to adopt further procedures on the topic. The third KLO is thus not transposed in the national legislation.

Since the *Minister of Environment in conjunction with other institutions authorised by the Government* is responsible for issuing GHG emission permits, drawing up the NAP, laying down the method of allocation and registry, they can be seen as the CA. Since the CA has clearly designated tasks, the fourth KLO if fulfilled.

Obtained GHG emission permits, acquired and submitted allowances as well as the transfer of allowances are to be recorded in the registry. It is established by the Lithuanian Government and maintained by the *Ministry of Environment* and the *Lithuanian Environmental Investment Fund* (Article 12 (2) XI-329). The establishment and maintenance of the registry are thus regulated by XI-329, however, the accessibility to the public and the need for separate accounts is not mentioned nor implied in the national legislation. The fifth KLO is thus only partially transposed.

The submission of annual application reports to the EC are not mentioned in the law. The sixth KLO is thus missing in the national legislation and is not transposed. In Annex 2 to XI-329, the Seimas[21] references the Directive 2003/87. The seventh KLO is thus fulfilled.

In conclusion, three KLO are fully transposed by the national legislation (obligation one, four, and seven). Obligation two and five are partially transposed while obligation three and six are fully missing.

[21] The Parliament of the Republic of Lithuania

4.1.6. Republic of Malta

In 2013, *Kamra Tad-Deputati*[22] adopted the '*European Union Greenhouse Gas Emissions Trading Scheme for Stationary Installations Regulations*' (Regulations No 434/2013). The Regulations were adopted in 2013 and thus regulate the implementation of the Directive 2003/87 for the third trading period. Earlier version could not be accessed in English and can thus not be considered.

Article 4 Regulations No 434/2013 regulate GHG emission permits. Operators are obliged to acquire a permit to conduct GHG emitting activities. The application for a permit needs to include relevant information about the operator, a description of the installation and its activities, a description of the usage of raw and auxiliary materials, the sources of GHG emissions, a description of the planned measures to monitor and report emissions and a non-technical summary (Article 5 Regulations No 434/2013). Furthermore, Article 15 Regulations No 434/2013 oblige the operators to hand in a monitoring plan. Since the operator is obliged to hand in a monitoring plan in order to be granted a GHG emission permit, the first KLO is fulfilled.

Since the Regulations No 434/2013 have been established within the third trading period, the legislation does not include provisions on the allocation of allowances for the first two trading periods, including the NAP. It is possible, that earlier versions of Regulations No 434/2013 included provisions on the NAP, but these are not accessible. Hence, the data is missing to assess the transposition of the second KLO.

Similar issues occur when looking at the method of allocation of allowances. Article 11 Regulations No 434/2013 regulates the allocation of allowances, however, does not specify the trading period this is valid for. Since the legislation is dated in 2013, the provisions are assumed to be valid for the third trading period. Data on the first two trading periods is thus missing. Article 11 Regulations No 434/2013 lays out that operators, that are eligible to free allocation will get allowances free of charge, while Article 12 Regulations No 434/2013 states that all allowances that are not allocated free of charge will be auctioned. This is in line with the criterion of the third KLO. Nevertheless, the third KLO can not be fully assessed since data on the first two criteria are missing.

The designated CA is the *Malta Resource Authority*, referred to as '*Authority*' in the legislation (Article 1 Regulations No 434/2013). The *Authority* is responsible for tasks related to GHG emission permits and the allocation of allowances. It also acts as the national registry administrator and takes care of the MRV. It takes a vital role in implementing the Directive 2003/87 in Malta. Therefore, the fourth KLO can be seen as transposed.

Since the Regulations No 434/2013 rule on the third trading period, information about the establishment of the registry is not available. The *Authority* however is set to maintain the registry as the national registry administrator (Article 13 Regulation No 434/2013). The first criterion of the fifth KLO is thus only partially fulfilled. Moreover, the accessibility to the public and need for separate

[22] The Parliament of Malta

accounts for operators are not mentioned in the law. Subsequently, the fifth ley legal obligation cannot be seen as transposed.

Provisions on the submission of annual application reports to the EC cannot be found in the Regulations No 434/2013. The sixth KLO is thus not transposed. However, he seventh KLO is fulfilled since references to Directive 2003/87 are made throughout the legislation.

All in all, the Maltese national legislation on the EU ETS is rather fragmentary. Only three out of the seven KLOs were transposed in full depth (KLO one, four and seven) while the third KLO was partially transposed. KLO two, five and six were fully missing.

4.1.7. The Netherlands

In 1979, the Netherlands adopted an extensive plan for environmental protection: the *Wet Milieubeheer* (WMB). The law is very comprehensive and ranges from pollution, over production and waste to noise management. With the *Besluit handel in emissierechten*, adopted in December 2004, the WMB was amended to include provisions on the EU ETS. In addition, the *Implementatiewet EG-richtlijn handel in broeikasgasemissierechten* amends the WMB in respect to the implementation of the Directive 2003/87. The current version of the WMB is in force since 20 August 2017. Chapter 16 is dedicated to the legal transposition of the Directive 2003/87. Verschuuren and Fleurke (2014, p. 40) found that "all elements of the ETS are arranged, such as the issuing of the GHG emissions permit, the monitoring and inspection by the Dutch Emission Authority, the national record, auctioning and international reporting".

Chapter 16.2 WMB regulates GHG emission and GHG emission allowances. This Chapter is split in two and focuses separately on installations (Chapter 16.2.1. WMB) and aviation (Chapter 16.2.2. WMB). Installations in the Netherlands are obliged to own a GHG emission permit in order to conduct polluting activities (Paragraph 16.2.1.2. WMB; Article 16.5 WMB). The main condition for acquiring a GHG emission permit is the submission of a monitoring plan (Article 16.6 WMB; Verschuuren & Fleurke, 2014, p. 40). The *Nederlandse Emissie Autoriteit* (NEA) is responsible for granting GHG emission permits (Article 16.7 WMB; Verschuuren & Fleurke, 2014, p. 40). Since operators are required to possess a GHG emission permit and to hand in a monitoring plan, the first KLO is fulfilled.

Due to the adoption of Directive 2009/29 amending the Directive 2003/87, the submission of a NAP to the EC is no longer required. Thus, the current version of the WMB does not include this element. However, Article IV *Implementatiewet EG-richtlijn handel in broeikasgasemissierechten* regulates the need for a NAP for the first trading period. Nevertheless, data is missing on what the NAP regulates and how it's being drawn up. An assessment of the legal transposition of the second KLO is thus not possible.

With the abolishment of NAPs, the allocation method of allowances changed. Paragraph 16.2.1.3 WMB regulates the allocation and trading of GHG emission allowances. In accordance with Article 10 Directive 2003/87 as amended by Directive 2009/29, the Subparagraph 16.2.1.3.1. WMB states that all allowances, which are not allocated for free, will be auctioned. Exceptions are made for

aviation: aviation may apply for free allocation at the NEA for the time periods a) from 1 January 2012 to 31 December 2012, b) from 1 January 2013 to 31 December 2020, c) for the 8-year trading period following 2020 (Article 16.39j WMB). This is in line with the criterion for the third trading period. The method of allocation for the first trading period can be found in the Dutch NAP for 2005 to 2007. It states that all allowances are allocation free of charge in this time period. The Dutch Government does not intend to use the possibility to auction 5% of the allowances (Minister van Economische Zaken & Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 2004, p. 4). The criterion for the first trading period is thus fulfilled. Similarly, the method of allocation for the second trading period is regulated in the Dutch NAP for 2008 to 2012. According to the NAP, most of the allowances will be allocated free of charge while a small amount will be auctioned in line with Article 10 Directive 2003/87 (Minister van Economische Zaken & Minister van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, 2007, p. 14). Even though the NAP is not very specific on the percentages, the criterion for the second trading period can be seen as fulfilled. Followingly, the third KLO is transposed into Dutch national legislation.

In order to implement the Directive 2003/87EC, the *Ministry of Housing, Spatial Planning and the Environment* set up the NEA (Chapter 2, §2.1. WMB). The NEA is responsible for "Issuing and actualization of the emission permits; Allocation of emission rights; Inspection and site-visits; Imposing sanctions; Supervision on the surrender of emission allowances; Supervision on compliance of regulations concerning bio-fossils" (Verschuuren & Fleurke, 2014, p. 41). Furthermore, it is responsible for the registry (Article 16.43 WMB). It is the CA for the implementation of Directive 2003/87 and bundles all functions in relation to the implementation. Hence, the fourth KLO is fulfilled.

In accordance with Article 19 Directive 2003/87, Chapter 16.2.4. WMB regulates the establishment and maintenance of the registry. However, the law is not very detailed about the registry, leaving it impossible to assess the quality of the legal transposition of the fifth KLO.

The WMB does not mention the need to report annually to the EC on the implementation of the Directive 2003/87. Legally the sixth KLO is thus not transposed. However, the WMB contains constant references to Directive 2003/87 leaving Article 31 Directive 2003/87 transposed by the national legislation.

In conclusion, the first, third, fourth and seventh KLO are transposed fully and transparently into the national legislation. Conclusion cannot be drawn on KLO two and five due to the lack of data. The sixth KLO is not transposed.

4.1.8. Summary and analysis

Key legal obligation	Republic of Austria	Republic of Germany	Ireland	Republic of Latvia	Lithuania	Republic of Malta	The Nether-lands
GHG emission permits (Art. 4)	Fully	Fully	Fully	Fully	Fully	Fully	Fully
NAP (Art. 9)	Fully	Fully	Fully	Fully	Partially	Lack of data	Lack of data
Allocation method (Art. 10)	Fully	Fully	Partially	Fully	Not transposed	Lack of data	Fully
CA and administrative measures (Art. 18)	Fully	Fully	Fully	Fully	Fully	Fully	Fully
Registry (Art. 19)	Fully	Partially	Fully	Lack of data	Partially	Not transposed	Lack of data
Annual reports (Art. 21)	Fully	Not transposed	Fully	Fully	Not transposed	Not transposed	Not transposed
Reference (Art. 31)	Fully	Fully	Fully	Fully	Fully	Fully	Fully
Score	7/7	5,5/7	6,5/7	6/6	4/7	3/5	4/5
Percentage	100%	78,57%	92,86%	100%	57,14%	60%	80%

Table 1: Summary of legal implementation

As can be seen in table 1, there are great differences between the legal implementation of the selected cases. In Austria, all KLOs are transposed in national legislation, leaving Austria with a compliance rate of 100%. In Germany, the registry obligation was only partially transposed and the obligation to report to the EC annually on the application is missing. This leaves Germany with five fully transposed, one partially transposed and one not transposed obligation. Germany thus ranks at a compliance rate of 78,57%. In Ireland, obligation one, two, four, five, six and seven are fully transposed into Irish national legislation. Only the allocation obligation is partially transposed. Legal implementation in Ireland thus has a compliance rate of 92,86%. In Latvia, all obligations, besides the registry obligation, were transposed. When taking the lack of data regarding the registry obligation into account, Latvia ranks at a compliance rate of 100%. In Lithuania, KLO one, four and seven are fully transposed, however, KLO two and five are partially transposed and KLO three and six have not been transposed. This leaves

Lithuania with a compliance rate of 57,14%. When assessing the compliance rate of Malta, the availability of data needs to be taken into account. On five KLO data was available. Out of these five, three KLOs were fully transposed while two KLOs were not transposed. The compliance rate of Malta is thus 60%. Just as was the case in Malta, data is missing on two KLOs in the Netherlands. However, four KLOs were fully transposed while one KLO was not transposed. The Netherlands thus ranks at a compliance rate of 80%.

Bearing in mind that legal implementation is only the first step of the independent variable and thus a prerequisite for practical implementation due to decoupling (Zhelyazkova et al., 2016), the findings are analysed.

With a compliance rate of 100%, Austria has a highly successful legal implementation. Even though Latvia's national legislation only had data available on six KLOs, with a compliance rate of 100%, also Latvia shows highly successful legal implementation. Ireland has the third highest compliance rate with 92,86% and legal implementation is thus seen as successful. The fourth highest compliance rate can be found in the Netherlands with 80%. Even though the compliance rate of the Netherlands is high, the legal implementation cannot be assessed fully due to the lack of data on two KLOs. The Netherlands are thus excluded from the analysis in regard to practical implementation. Even though Germany's compliance rate (78,57%) is lower than the compliance rate in the Netherlands, the legal implementation is still considered to be successful. On one hand, this is the case since data is available on all the KLOs. On the other hand, only the reporting obligation is missing, which is not transposed by four out of the seven countries. This mean that the lack of the reporting obligation is a rather structural problem than an individual problem. Malta is not considered for the analysis of practical implementation due to two reasons: First, the compliance rate of Malta is not high (60%); Second, data on two KLOs is missing. This leaves it impossible to assess the success of the legal implementation thoroughly. Lastly, Lithuania's legal implementation is not considered successful and thus not considered for further analysis on practical implementation due to its low compliance rate (57,14%). Summing up, legal implementation is successful in Austria, Germany, Ireland and Latvia.

H1 expects countries with successful legal implementation to have reductions in GHG emissions. Since Austria, Germany, Ireland and Latvia had successful legal implementation, their emissions are expected to decrease. In return, legal implementation in Lithuania, Malta and the Netherlands were either not successful or could not be assessed fully due to a lack of data. Their emissions are expected to increase. Nevertheless, H1 cannot be tested since legal implementation is only the first step within a two-step independent variable. A change in emission is dependent on both, successful legal and practical implementation. The influence of legal implementation on GHG emissions can thus not be assessed independently due to the influencing nature of practical implementation. Therefore, H1 cannot be tested.

4.2. Practical implementation

Since legal implementation between the selected cases varied greatly, only the cases with successful legal implementation are considered for analysis in regard to practical implementation. Austria and Latvia are considered for further analysis since both countries show highly successful legal implementation with a compliance rate of 100%. Furthermore, Ireland is selected since legal implementation is successful, data is available on all KLOs and compliance is high (92,86%). In addition, Germany is selected for the following step. This is the case, since data on all KLOs is available and compliance is comparably high (78,56%). Malta and the Netherlands do not have successful legal implementation and are not taken into consideration when analysing the practical implementation due to a lack of data and rather low compliance rates. Even though data is available on all KLOs in Lithuania, the compliance rate and thus legal implementation is by far the poorest. Thus, Lithuania is not selected either.

Summing up, Austria, Germany, Ireland and Latvia will be analysed in regard to their practical implementation based on the availability of data and high compliance rates. Success of practical implementation will be measured by comparing verified emissions of operators to their total surrendered units, by the submission of annual application reports and NAPs and by the average downtime of the registry. In the following, the findings on practical implementation are presented and analysed. The analysis closes with a ranking of the cases regarding the success of practical implementation.

4.2.1. Republic of Austria

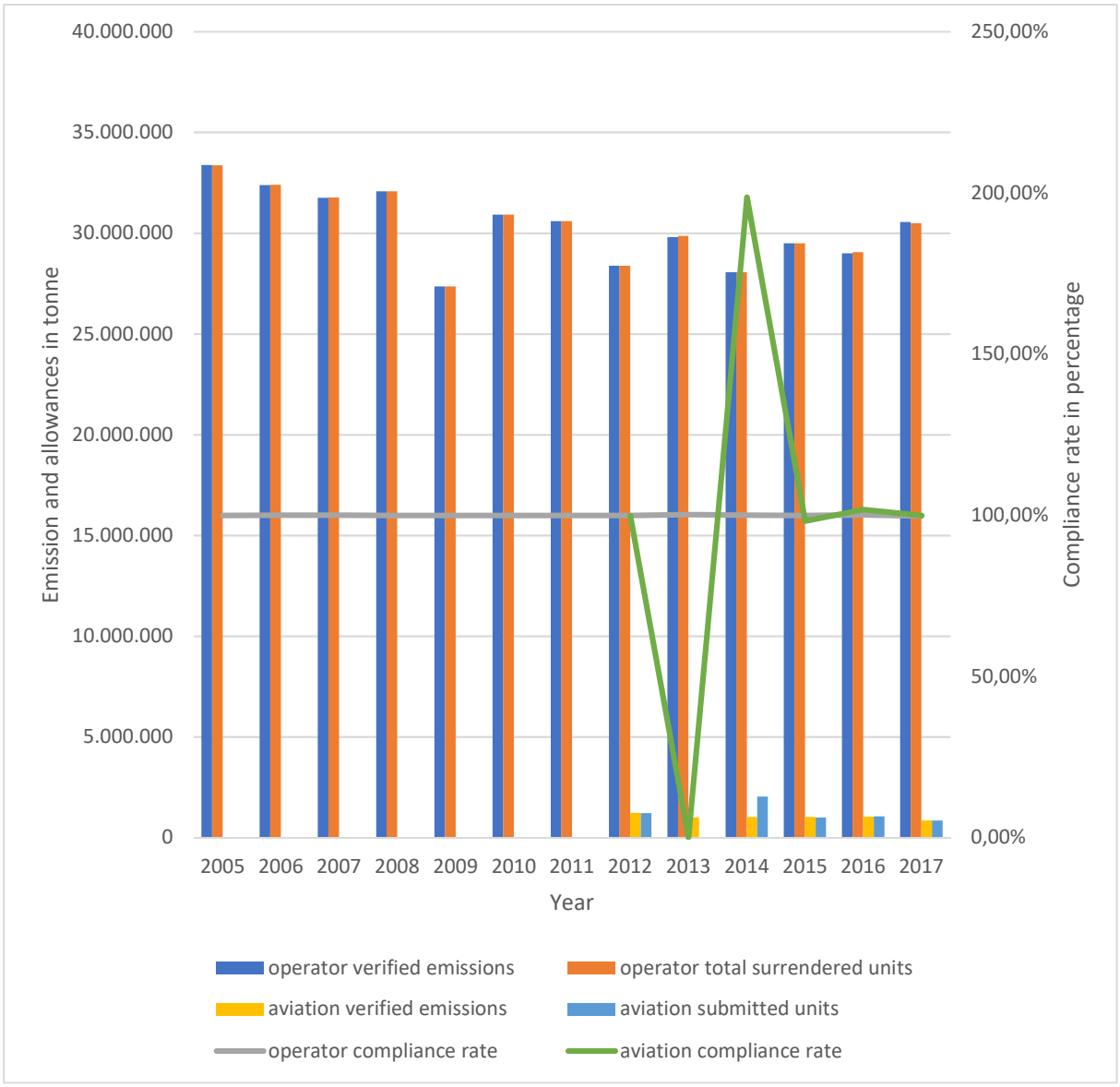

Fig. 1: Austria GHG emissions

In order to test the practical implementation rate of operators, verified emissions will be compared to the amount of total surrendered units. First, the compliance rate of stationary installations will be measured. In 2005, 33.373.155t emissions were verified. in comparison, only 33.363.598 units were surrendered. This leaves a compliance rate of 99,97%. In 2006, stationary installations emitted 32.384.372t verified emissions which are covered by 32.392.062 surrendered emission units. The compliance rate for 2006 is 100,02%. In 2007, 31.751.260t were emitted by stationary installations. 31.767.302 surrendered units covered the emissions with a compliance rate of 100,05%. In 2008, stationary installations emitted 32.078.974t verified emission which are covered by 32.073.437 allowances leaving a compliance rate of 99,98%. In 2009, 27.359.833t emission were emitted and 27.359.322 units were surrendered. Compliance rate in 2009 is thus 100,00%. In 2010, stationary installations emitted 30.919.711t verified emission and covered them with 30.916.761 units. This leaves

a compliance rate of 99,99% for 2010. In 2011, 30.599.418t were emitted by stationary installations. At the same time, 30.601.044 units were surrendered to cover the emissions. The compliance rate is 100,01%. In 2012, compliance rate resided at 99,89% with 28.387.060t emissions and 28.380.727 surrendered units. In 2013, an amount of 29.804.410t was emitted. 29.867.905 units were surrendered to cover these emissions. This leaves a compliance rate 100,21%. In 2014, stationary installations emitted 28.055.974t and covered them with 28.062.796 surrendered units. The compliance rate is thus at 100,02%. In 2015, verified emissions (29.492.065t) equalled the surrendered units (29.492.153) so far, that the compliance was 100,00%. In 2016, 29.000.120t emission were verified and 29.051.366 units were surrendered. The compliance rate is thus 100,18%. In 2017, compliance rate dropped to 99,79% since 30.555.226t emissions were verified and only 30.489.691 units were surrendered. In total, Austrian stationary installations emitted 393.761.578t between 2005 and 2017. These verified emissions were covered by 393.818.164 surrendered units. The overall compliance rate is thus at 100.01% (European Environment Agency, n.d.).

Second, the compliance rates of aircraft operators are presented. Aircraft operators were only included in the EU ETS in the third trading period. Thus, their compliance is only measured from 2012 onwards. In 2012, aircraft operators emitted 1.227.373t verified emission. These were covered by 1.226.144 surrendered units. The compliance rate is 2012 is thus at 99,90%. In 2013, the compliance rate dropped drastically to 0,13% with 1.017.409t verified emissions and 1.286 surrendered units. This could be case, since legal issues arose between the EC and aircraft operators. In return, compliance rate went up to 198,66% in 2014. 1.028.211t emission were verified and 2.042.692 units were surrendered. This extremely high compliance rate probably origins in the fact, that units that were missing in the previous compliance year need to be surrendered in the following year. This is a sanction measures next to the prescription of fines (Fleurke & Verschuuren, 2015, p. 10). In 2015, 1.022.438t emissions were verified by the CA and 1.004.530 units were surrendered to the CA. This leaves a compliance rate of 98,25%. In 2016, aircraft operators verified 1.045.291t emissions and surrendered 1.064.301 units. The compliance rate is thus at 101,82%. In 2017, emissions went down to 848.968t. Subsequently, 848.953 units were surrendered leading to a compliance rate of 100,00%. All in all, Austrian aircraft operators emitted 6.189.690t emission. At the same time, they surrendered 6.187.906 units. This leaves Austrian aircraft operators with a compliance rate of 99,97% (European Environment Agency, n.d.).

The practical implementation of MS is measured by the submission of annual application reports and of the NAPs for the first two trading periods as well as by the maintenance of the national registry. Austria submitted ten annual application reports to the EC. The reports cover 2005-2009 and 2012-2016. The reports for 2010 and 2011 are missing (Eionet - Central Data Repository, 2005-2018).

In return, Austria submitted both NAPs for the first two trading period. Both were approved by the EC and can thus be seen as realistic (Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2004, 2007).

The maintenance of the registry is measured by the average of the scheduled and unscheduled downtime as reported in the annual application reports. Since the reports for 2010 and 2011 have not been handed in, data for these two compliance years is not available. In 2005, Austria's registry reported a scheduled downtime of 210 minutes and an unscheduled downtime of 60 minutes. In 2006, the registry was offline as scheduled for 530 minutes and unscheduled for 105 minutes. In 2007, no downtimes was planned, but the registry went offline for 651 minutes unscheduled. In 2008, the registry was scheduled to be offline for 17.100 minutes. In addition, the registry was unreachable for 5.560 unscheduled minutes. A possible reason for such a high downtime can be the switch from the first to the second trading period. In 2009, the registry reported a scheduled downtime of 90 minutes and unscheduled downtime of 1.355 minutes. In 2012, the registry went offline for a scheduled amount of 24.570 minutes. In total, this mounts up to 42.500 minutes of scheduled downtime and 7.731 minutes of unscheduled downtime. Together, the registry was offline for 50.231 minutes. Divided by the amount of years (6 years of reported data), the average downtime is 8.371,83 min/year (Eionet - Central Data Repository, 2005-2018).

4.2.2. Republic of Germany

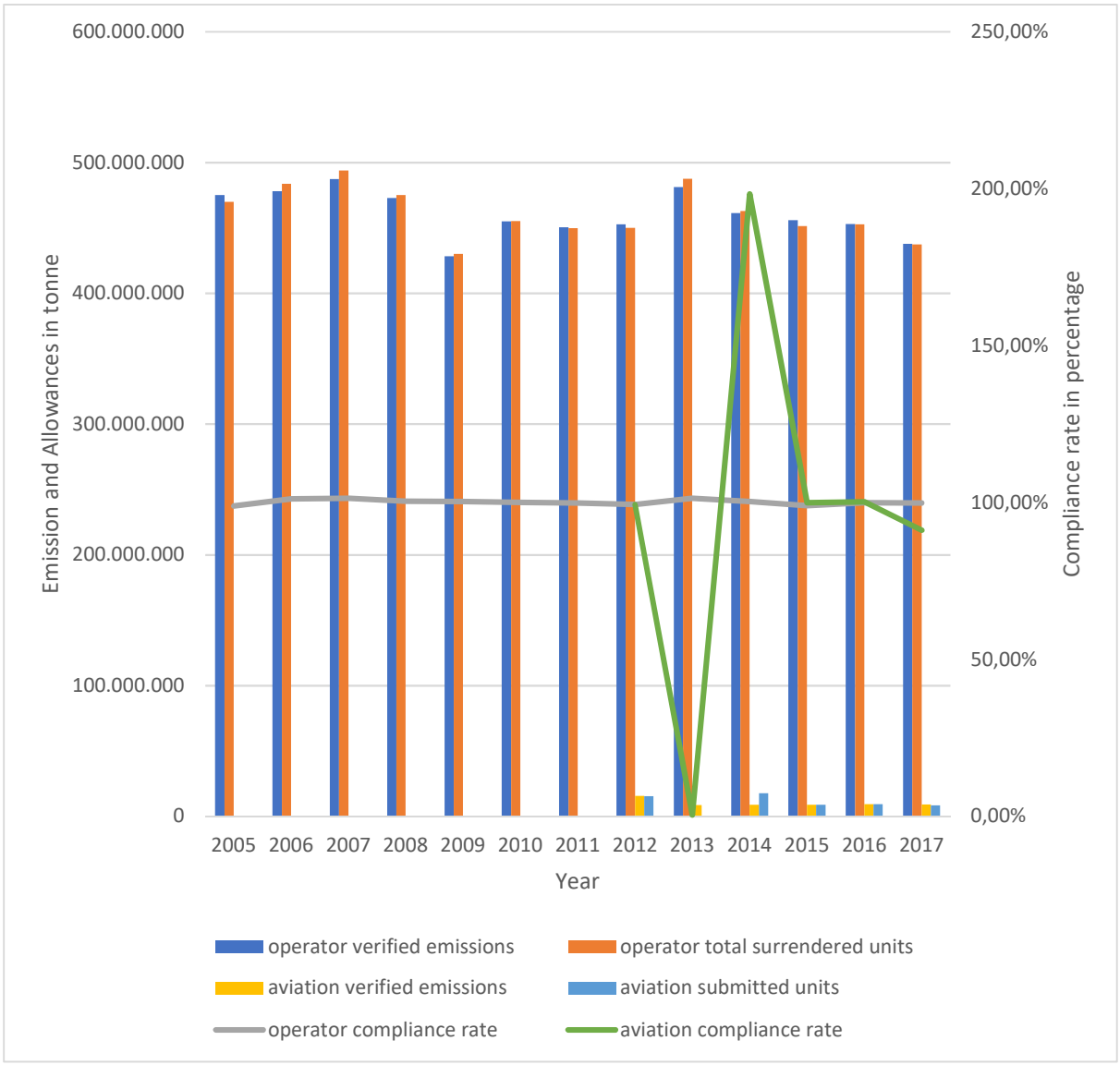

Fig. 2: Germany GHG emissions

In Germany, stationary installations verified 475.051.535t emission in 2015. At the same time, they surrendered 469.871.802 units to the CA. This leaves a compliance rate of 98,91%. In 2006, 478.074.868t emissions were verified and 483.590.318 units were surrendered. The compliance rate is thus 101,15%. In 2007, stationary installations emitted 487.148.432t emissions. In comparison, 493.788.383 units were surrendered, leading to a compliance rate of 101,36%. In 2008, 472.853.534t emissions were verified while 475.078.247 units were surrendered. The compliance rate for 2008 is 100,47%. In 2009, stationary installations verified 428.294.502t emissions and surrendered 429.951.602 units to the CA. The compliance rate lies at 100,39%. In 2010, the CA reported 454.864.599t verified emissions and 455.233.707 surrendered units leading to a compliance rate of 100,08%. In 2010, 450.351.343t emissions were verified while 449.636.343 units were surrendered. The compliance rate was lower with 99,84%. In 2012, stationary installations emitted 452.594.544t verified emissions.

However, only 449.907.696 units were surrendered leaving a compliance rate of 99,41%. In 2013, 481.043.076t emissions were verified and 487.454.003 units were surrendered. The compliance rate rose to 101,33%. In 2014, the CA reported 461.289.627t verified emissions and 462.764.031 surrendered units. The compliance rate is thus 100,32%. In 2015, stationary installations emitted 455.783.453t emissions. However, only 451.345.861 units were surrendered for that year leading to a compliance rate of 99,03%. In 2016, the CA reported 452.886.208t verified emissions and only 452.675.989 surrendered units. The compliance rate is at 99,95% in 2016. In 2017, stationary installations emitted 437.647.200t emissions and surrendered 437.219.530 units. The compliance remained at 99,90%. Combining the twelve years, German stationary installations emitted 5.987.882.921t emissions. In return, they surrendered 5.998.517.512 units to the CA. The compliance rate for stationary installations in Germany is thus 100,18% (European Environment Agency, n.d.).

Aircraft operators were only included in the EU ETS in 2012 and reported 15.571.068t verified emissions for that year. At the same time, they surrendered 15.456.385 units to the CA. The compliance rate for 2012 is thus 99,26%. Similarly to Austria, the compliance rate dropped sharply to 0,49% in 2013. The aircraft operators verified 8.689.931t emissions but only surrendered 42.562 units. Also this extremely low compliance rate is connected to the legal issues operators faced in the beginning of the third trading period. In 2014, operators made up for the lack of units by surrendering 17.577.505 units to cover 8.863.926t verified emissions. The compliance rate was at 198,30%. In 2015, the CA reported 8.928.612t verified emissions. With 8.925.569 surrendered units to cover those emissions, the compliance rate was at 99,97%. In 2016, aircraft operators emitted 9.274.019t emission and surrendered 9.299.779 units. The compliance rate thus is 100,28%. In 2017, 9.104.787t verified emission were emitted and 8.300.680 units were surrendered, leading to a compliance rate of 91,17%. In total, aircraft operators emitted 60.432.343t emissions while surrendering 59.602.480 units to cover the emissions. The compliance rate thus remains at 98,63% (European Environment Agency, n.d.).

Furthermore, practical implementation of Germany is measured by the submission of annual application reports. Germany has handed in eleven reports covering 2006-2016 (Eionet - Central Data Repository, 2005-2018). Only the annual application report for 2005 is missing. In addition, Germany had handed in both NAPs for the first two trading period and both NAPs were approved by the EC (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2004, 2006).

Concerning the maintenance of the registry, the data on the downtime could not be received for 2005, since the annual application report is missing, and 2006, since the report for that year is blocked for the public. In 2007, the registry was offline for scheduled 150 minutes and in 2008 it was 3.540 scheduled minutes. In 2009, the registry was unavailable for 1.130 scheduled and 45 unscheduled minutes. In 2010, the downtime was scheduled for 1.005 minutes, but the registry went offline for another 6.180 unscheduled minutes. In 2011, the registry was offline for 20.422 scheduled minutes next to 23.580 unscheduled minutes. In 2012, the downtime was 895 scheduled and 688 unscheduled minutes. All in all, the registry showed a downtime of 57.635 minutes (27.142 scheduled minutes and

30.493 unscheduled minutes). In average, the registry was offline for 9605,83 minutes per year (Eionet - Central Data Repository, 2005-2018).

4.2.3. Ireland

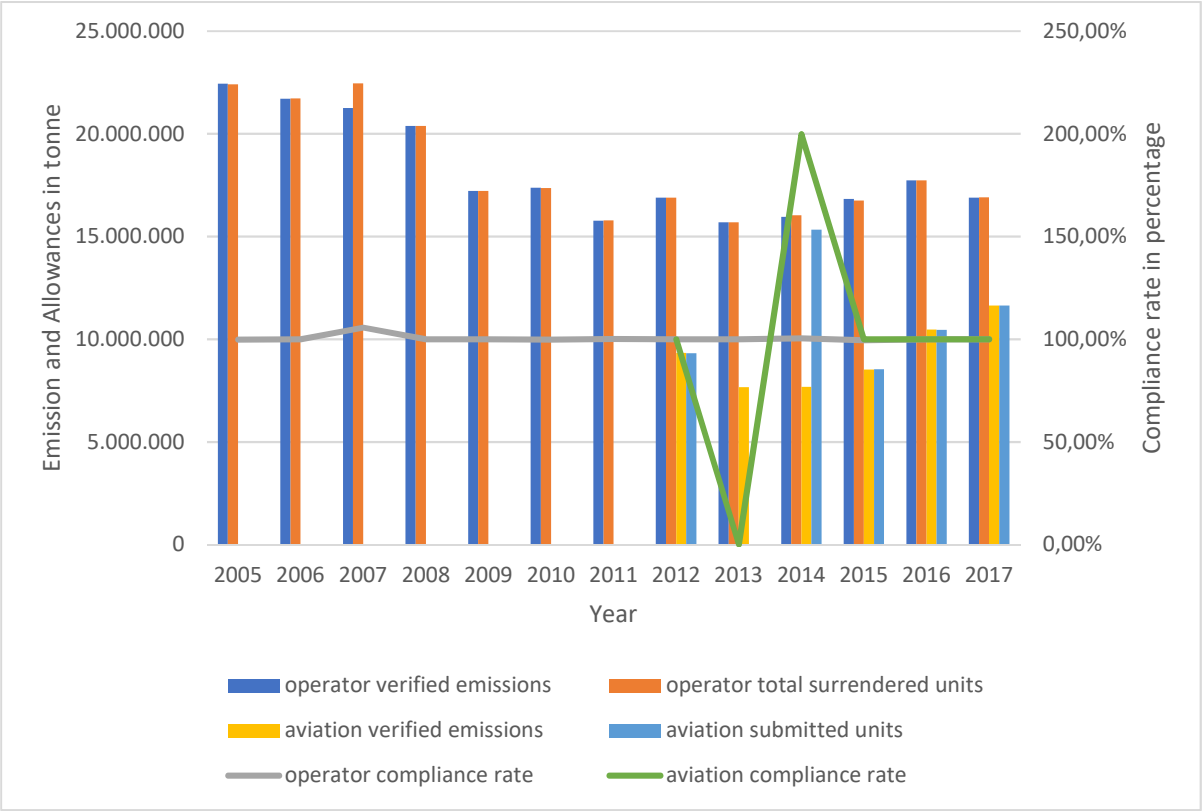

Fig. 3: Ireland GHG emissions

In Ireland, stationary installations emitted 22.441.006t emissions in 2005. In return, they surrendered 22.400.788 units, leading to a compliance rate of 99,82%. In 2006, the CA reported 21.705.338t emission and 21.719.775 surrendered units. The compliance rate is 100,07%. In 2007, stationary installations emitted 21.246.280t emissions while surrendering 22.446.763 units. This leads to a compliance rate of 105,65%. In 2008, 20.381.890t verified emissions were reported. These were covered by 20.381.707 surrendered units with a compliance rate of 100,00%. Again in 2009, the compliance rate was at 100% when stationary installations emitted 17.215.429t emissions and surrendered 17.215.357 units. In 2010, the compliance rate was lowered to 99,90%, when the CA reported 17.373.260t emission but only 17.356.018 surrendered units. In 2011, the compliance rate rose to 100,10% with 15.769.980t verified emission and 15.786.531 surrendered units. In 2012, stationary installations emitted 16.896.557t emission and surrendered 16.886.731 units, leading to a compliance rate of 99,94%. In 2013, the CA reported 15.688.792t emission covered by 15.694.659 units. This reflects a compliance rate of 100,04%. In 2014, stationary installations emitted 15.955.563t emission and covered those with 16.036.869 surrendered units. The compliance rate thus is 100,51%. In 2015, 16.832.734t verified emissions were reported. However, only 16.752.565 units were surrendered, leading to a compliance rate of 99,52%. In

2016, stationary installations emitted 17.734.226t emissions and surrendered equivalent 17.734.926 units. The compliance rate for that year is thus 100%. In 2017, the CA reported 16.896.391t emissions together with 16.906.638 surrendered units. The compliance rate reflects 100,06%. In total, Irish stationary installations emitted 236.137.446t emissions and surrendered 237.319.327 units. The compliance rate lies at 100,50% (European Environment Agency, n.d.).

In 2012, Irish aircraft operators emitted 9.325.779t GHG and surrendered 9.319.795 units. The compliance rate lies at 99,94%. Also in Ireland, aircraft operators showed an extremely low compliance rate of 0,08% in 2013. For that year, the CA reported 7.666.515t emission and 6.351 surrendered units. The aircraft operators made up for the lack of units by surrendering 15.333.398 units in 2014 to cover 7.671.683t emission. The compliance rate lies at 199,87%. In 2015, the relationship between verified emissions (8.525.073t) and units (8.527.285) stabilised at 100,03%. In 2016, the compliance rate was again high (100,00%) with 10.459.414t verified emission and 10.459.262 surrendered units. The same compliance rate applies for 2017, in which aircraft operators emitted 11.631.435t emission and surrendered 11.631.435 units. All in all, the compliance rate of Irish aircraft operators reflects 100,00% with a total amount of 55.279.899t verified emission and 55.277.526 surrendered units (European Environment Agency, n.d.).

In addition, Ireland handed in all twelve annual application reports from 2005-2016 (Eionet - Central Data Repository, 2005-2018). Furthermore, the two NAPs for the first two trading period were handed in (Environmental Protection Agency, 2004, 2008; EURACTIV, 2004). Concerning the downtime of the registry, data could not be retrieved from the annual application reports, since the reports for 2006-2012 are not available to the public. The report for 2005, which is available to the public, does not include information on the registry downtime.

4.2.4. Republic of Latvia

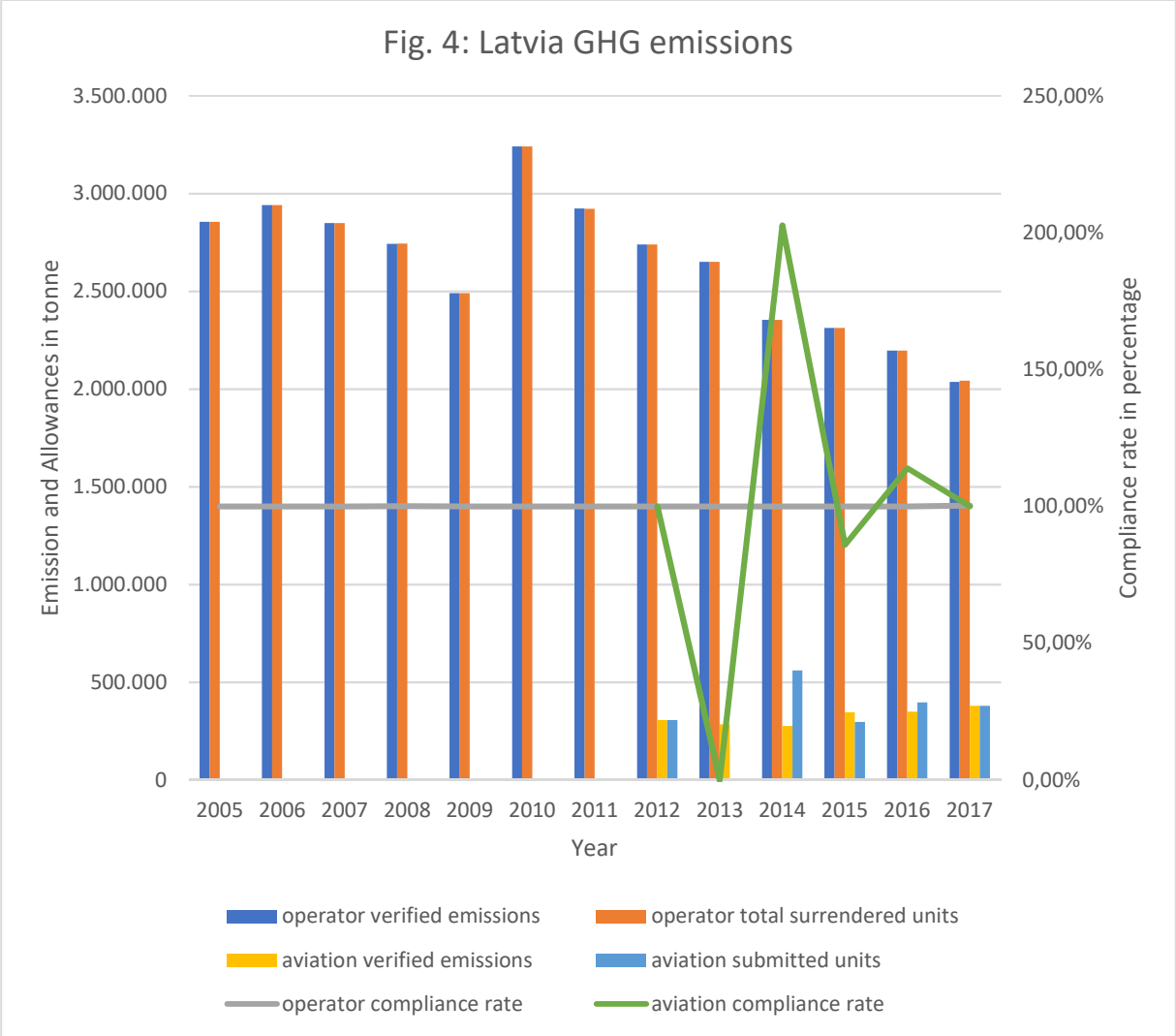

Fig. 4: Latvia GHG emissions

In 2005, Latvian stationary installations emitted 2.854.492t emission and surrendered 2.854.424 units to cover their emissions. This reflects a compliance rate of 100,00%. Also in 2006, the compliance rate remained at 100,00% with 2.940.753 surrendered units that cover 2.940.685t emission. Same applies for 2007, where the compliance rate for stationary installations again remained at 100,00%. In 2007, the CA reported 2.849.210t emission and the same amount of surrendered units. In 2008, the compliance rate rose to 100,07% with 2.742.918t emission and 2.744.718 surrendered units. In 2009, the compliance dropped back to the initial 100,00%. Stationary installations emitted 2.489.805t verified emission and surrendered the exact some amount of units. The same development is seen in 2010, where verified emissions and surrendered units equal at 3.240.172. The compliance thus reflect 100,00% again. In 2011, stationary installations only surrendered 2.921.655 units for 2.923.455t verified emission. This leads to a compliance rate of 99,94%. In return, the compliance rate those again to 100,00% in 2012 and remained this high until 2016. Each year, the verified emissions equalled the surrendered allowances (2.740.013 in 2012; 2.649.814 in 2013; 2.354.247 in 2014; 2.312.538 in 2015; 2.197.000 in 2016). In

2017, compliance rate rose to 100,29% with 2.036.482t emission and 2.042.479 surrendered units. In total, Latvian stationary installations emitted 34.330.831t verified emission and surrendered 34.336.828 units. The overall compliance rate reflects 100,02% (European Environment Agency, n.d.).

Aircraft operators in Latvia emitted 306.499t emission in 2012. They surrendered the exact same amount of units to the CA, leading to a compliance rate of 100,00%. In 2013, Latvian aircraft oprators faced the same issue as Austria, Germany and Ireland. For that year, 283.909t emission were reported, but no units surrendered. In return, the aircraft operators surrendered 560.288 units in 2014, even though emission was at 276.379t. The compliance rate was thus 202,72% in 2014. In 2015, the verified emission and the surrendered units again did not match leading to a compliance rate of 85,95%. The CA reported 345.271t emission in 2015 but only 296.752 surrendered units. In 2016, compliance rate rose to 113,91% with 348.737t emission and 397.256 surrendered units. In 2017, the amount of verified emissions and surrendered units equalled at 378.590, leaving a compliance rate of 100,00%. All in all, Latvian aircraft operators comply at a rate of 100% with overall verified emission and overall surrendered units equalling at 1.939.385 (European Environment Agency, n.d.).

Moreover, Latvia handed in all annual application report from 2005-2016 (Eionet - Central Data Repository, 2005-2018). Besides that, Latvia presented two NAPs to the EC which were both approved. The existence of the NAP for 2005-2007 is derived from secondary literature (Gilbert, Bode, & Phylipsen, 2004; Nordisk Ministerråd, 2005) while the NAP for 2008-2012 is available in English (Latvia, 2008).

According to the annual application report for 2005, the registry was offline for 720 scheduled minutes. The reports for 2006, 2007 and 2008 give conflicting information concerning the downtime. On the one hand, the reports state that the registry was available all year without any interruption. On the other hand, the reports state that the registry was offline all year. These years will thus not be taken into consideration. In 2009, the registry was unavailable for 13.950 scheduled minutes and 2.920 unscheduled minutes. In 2010, the scheduled downtime mounted up to 13.560 minutes while the unscheduled downtime was 1.320 minutes. In 2011, the registry was offline for 1.260 scheduled minutes for 87.828 unscheduled minutes. The report on 2012 does not entail data on this matter. Together, the registry was offline for 121.558 minutes, of which 29.490 were scheduled and 92.068 were unscheduled. Divided by the years of available data, the average downtime for the Latvian registry was 30.389,5 minutes (Eionet - Central Data Repository, 2005-2018).

4.2.5. Summary and analysis

Practical implementation	Austria	Germany	Ireland	Latvia
Compliance rate of stationary installations	100,01%	100,18%	100,50%	100,02%
Compliance rate of aircraft operators	99,97%	98,63%	100,00%	100,00%
Submission of annual application reports	10 reports (2005-2009 and 2012-2016)	11 reports (2006-2016)	12 reports (2005-2016)	12 reports (2005-2016)
Submission of NAPs	Yes	Yes	Yes	Yes
Average downtime of the registry	8.371,83 minutes per year	9.605,83 minutes per year	No data	30.389,5 minutes per year

Table 2: Summary of practical implementation

Summing up, Austrian stationary installations showed a compliance rate of 100,01%, while aircraft operators complied at a 99,97% level. The MS itself handed in 10 out of 12 required reports. Two reports are thus missing. Both NAPs were handed in and approved by the EC. The average downtime of the registry is 3.371,83 min/year. In Germany, stationary installations complied with a rate of 100,18% and aircraft operators with 98,63%. In addition, Germany has handed in 11 reports for 2006-2016 and submitted both NAPs. The average downtime of the registry is 9.605,83 min/year. In comparison, Irish stationary installations complied with a rate of 100,50% while aircraft operators complied with 100%. Furthermore, all 12 reports and the two NAPs were submitted to the EC. However, data on the downtime of the registry was not available. Last, stationary installations in Latvia complied with 100,02% and aircraft operators with 100%. Also Latvia submitted all 12 reports and both NAPs. The average downtime of the registry was 30.389,5 min/year. As can be seen in the table, operators often comply with more than 100%. Making an educated guess, this is the case for two reasons: 1) operators are obliged to hand in missing allowances from previous years leading to over-compliance; 2) due to over-allocation, operators have more allowances than emission. In fear of allowance cuts, operators hand in all the allowances they have, even if the amount exceeds the emissions.

Keeping in mind that practical implementation is the second step within the two-step approach of the independent variable, the findings on practical implementation are analysed. A successful legal

implementation is a prerequisite for successful practical implementation. Due to this, only cases with successful legal implementation are being analysed in regard to their practical implementation and subsequently in regard to GHG emissions. Previously, Austria, Germany, Ireland and Latvia have been defined as cases with successful legal implementation and are thus analysed.

The first criterion for successful practical implementation is the compliance of operators with the allowance submission obligation. The threshold for successful compliance was set at 99,95%, based on historical compliance data. In Austria, stationary installations complied with a rate of 100,01% and aircraft operators with 99,97%. This is above the threshold of compliance, leaving Austria with successful practical implementation regarding market actors. Concerning the submission of annual application reports, Austria failed to submit two reports. This leaves Austria with partial practical implementation regarding this obligation. Austria complied fully with the NAP obligation. The practical implementation of this obligation is thus successful. The Austrian registry was offline for 8.371,83 min/year. This is the lowest average downtime of all the cases which makes Austria the most successful implementor of this practical requirement. Austria thus implemented two obligations successfully, one partially and has the lowest average downtime.

In Germany, stationary installations covered their verified emissions with 100,18% allowance units. This is well above the threshold for compliance, leaving German stationary installations as successful practical implementors. However, the same cannot be said about aircraft operators in Germany. Compliance ranks at 98,63% which is the lowest rank in comparison to the other cases and underneath the threshold of 99,95%. Therefore, market actors in Germany only show partial practical implementation. Also the reporting obligation was only partially successful, since Germany failed to submit one report. The NAP obligation was fully transposed and thus successful. With a downtime of 9.605,83 min/year, Germany has the second lowest downtime and the second best practical implementation. Hence, Germany implemented only one obligation fully and two obligations partially. The MS has the second best average downtime.

Market actors in Ireland were successful in implementing the EU Directive 2003/87 practically. Both, stationary installations (100,50%) and aircraft operators (100,00%), complied with the threshold and practically implemented the Directive 2003/87 successfully. Also the reporting and the NAP obligation were successfully implemented. Concerning the downtime, data was not available. This leaves Ireland with three successfully implemented practical obligations.

In Latvia, Stationary installations complied at a rate of 100,02% while aircraft operators complied at 100,00%. This means that practical implementation of market actors was successful in Latvia. The reporting and the NAP obligation were implemented successfully. With the highest average downtime of 30.389,5 min/year, Latvia has the poorest practical implementation of this obligation.

To sum up, Ireland showed the greatest practical implementation due to full implementation of the allowance submission, reporting and NAP obligation. However, Ireland's practical implementation needs to be considered carefully due to the lack of data on one of the obligations. The second best

implementor is Austria with two fully and one partially implemented practical obligation and the lowest average downtime. The third best implementor is Latvia, which implemented three obligations fully and has the highest average downtime. The least successful implementation can be found in Germany. Only one obligation was fully implemented while two were partially implemented. The MS had the second best average downtime.

Since H2 assumes highest emission reduction in countries with best practical implementation, under the condition of successful legal implementation, greatest emissions reduction are expected in Ireland. Smaller reductions are expected in Austria followed by Latvia. The least reduction in emissions are expected in Germany.

4.3. Greenhouse gas emission

In order to accept or reject H2, the findings on GHG emissions in Austria, Germany, Ireland and Latvia will be laid out before analysing them.

4.3.1. Findings

In Austria, stationary installations emitted 33.373.155t GHG in 2005 and 30.555.226t GHG in 2017. This mounts up to a reduction of 8,44%[23] between 2005 and 2017. Aviation, in return, emitted 1.227.373t GHG in 2012 and 848.968t GHG in 2017. This reflects a reduction of 30,83%[24].

In Germany, 475.051.535t GHG were emitted by stationary installations in 2005. In 2017, it were 437.647.200t GHG only, leading to a reduction of 7,87% between 2005 and 2012. Aviation achieved a reduction rate of 41,53% since 15.571.068t GHG were emitted in 2012 and 9.104.787t GHG were emitted in 2017.

Irish stationary installations emitted 22.441.006t GHG in 2005 and 16.896.391t in 2017. The reduction rate is at 24,71%. Aviation emitted 9.325.779t GHG in 2012 and 11.631.435t in 2017. The aviation reduction rate lies at -24,72%. The emission thus increased with 24,72%.

In Latvia, 2.854.492t GHG were emitted by stationary installations in 2005 and 2.036.482t in 2017. This leads to a reduction rate of 28,66%. Aviation, in return, increased by 23,52% since emission laid at 306.499t in 2012 and at 378.590t in 2017.

4.3.2. Analysis

Taking the theoretical framework of this research into account, H2 assumes that, under the condition of successful legal implementation of the Directive 2003/87, the more successful the practical implementation in a country is, the higher the emission reduction in that country. Bearing H2 in mind,

[23] Emission reduction of stationary installations is measured in comparison to 2005.

[24] Emission reduction of aircraft operators is measured in comparison to 2012.

emissions reductions are expected to be highest in Ireland, then Austria, followed by Latvia and smallest in Germany.

Regarding stationary installations, all cases managed to reduce GHG emission. The greatest reduction was found in Latvia with 28,66% GHG emission reduction. The second largest reduction was found in Ireland with 24,71% and the third largest in Austria with 8,44%. The smallest reduction was found in Germany with 7,87%. The reduction in Germany corresponds to the expectations of H2. This is the case since Germany had the least successful practical implementation and the least emission reduction concerning stationary installations. However, the other cases did not correspond to the expectations of H2. Latvia, which ranks third in practical implementation, reported the greatest emission reduction of stationary installations. In return, Austria, which had the second best successful practical implementation, only reported the third highest reduction of GHG emission from stationary installations. Even though Ireland had the most successful practical implementation, their emission reduction of stationary installations was the third highest. Hence, H2 was able to predict one out of four cases correctly and has to be rejected in regard to stationary installations.

Difficulties arose when aircraft operators tried to reduce their emissions. Only Austria and Germany were able to report reduction in GHG emission from aviation. Germany was most successful in reducing emission from aviation with 41,53%, followed by Austria with a reduction of 30,83%. In return, Ireland and Latvia reported increasing emission from aviation. In Ireland GHG emissions from aircraft operators increased by 24,72% and in Latvia emissions increased by 23,52%. The reduction of aviation emission in Austria corresponds to the expectation. Austria as the second best practical implementor also reported the second greatest emission reduction from aviation. However, H2 was not able to predict the other cases correctly. Germany, which was predicted the least emission reductions due to the least successful practical implementation, eventually reported the greatest reduction in regard to aviation. In comparison, Ireland with the most successful practical implementation even reported increases in emission from aviation. The case of Latvia has to be analysed more carefully. As the third best practical implementor it was predicted the third greatest emission reduction. Latvia does rank third both in practical implementation and in emission change, however, their emissions did not decline but increased. Thus, the case was also not predicted correctly. All in all, H2 has to be rejected in regard to aviation since it was able to predict only one out of the four cases correctly.

5. Conclusion and reflection

After having introduced the topic, discussed the relevant current discourses, laid out the methodology, presented the findings and analysed the data, the research ends with a conclusion and a reflection. Frist, the research is summed up and an answer to the research question is formulated. Subsequently, encountered issues are reflected upon and an outlook for further research is given.

5.1. Conclusion

Summing up, the EU ETS is the world's largest mandatory trading scheme and the EU's flagship policy when tackling climate change. The EU ETS aims at a reduction of GHG emission by 21% in 2020 in comparison to 2005 levels. This is to be achieved through mandatory emission allowances which allow operators to pollute GHG. The allowances are tradable and are limited with a cap. Germany and Austria managed to reduce their aviation emission in line with the EU target, while Ireland and Latvia were able to reduce emissions from stationary installation as requested by the EU target. In order to implement the policy, the EU has to rely on its MS due to the legal nature of a Directive. The MS are granted discretion as suggested by the principal-agent theory and implementation can thus have varying degrees of success. Implementation in this research occurs in two stages as suggested by Zhelyazkova et al. (2016). Legal implementation is a prerequisite for practical implementation and both have to be present for the policy to take effect.

Hence, it was first asked, "have MS incorporated the Directive 2003/87 successfully into their national law?". On the basis of the transposition of KLOs into national legislation, Austria, Germany, Ireland and Latvia were identified to have incorporated the legal obligations successfully. However, H1, expecting a reduction in emissions with successful legal implementation, could not be answered due to the two-step approach within the independent variable. Subsequently, the question was asked whether the MS that legally implemented the Directive 2003/87 also practically implemented it. This sub-question can be answered by stating the order of implementation. Ireland was the most successful implementor, followed by Austria, Latvia and then Germany. Followingly, a third sub-question was asked: did the GHG emissions decline in MS in which the Directive 2003/87 was legally and practically implemented? Concerning stationary installations, emissions declined in countries that legally and practically implemented the EU ETS, but concerning aircraft operators, emission did not decline with implementation as was seen in Ireland and Latvia. In contrary to what H2 expected, better practical implementation, under the condition of successful legal implementation, has not lead to greater emissions reduction. The degree of decoupling was not an amplifying factor.

In this research, it was analysed **to what extent the legal and practical implementation of the Directive 2003/87 'European Emission Trading System' has contributed to a reduction in greenhouse gas emissions in Europe?** On the one hand, implementation of the EU ETS did not lead to emission reduction when looking at aircraft operators. Both, Ireland and Latvia reported high increases in aviation emission, even though legal and practical implementation have, more or less successful, taken place. Hence, to the extent, that aircraft operators are considered, legal and practical implementation did not contribute to GHG emission reduction in Europe. This could be the case, since aviation were only included in the EU ETS in 2012 and are thus still getting used to complying with the Directive. In addition, incentives for emission reduction are not high, since allowances are allocated free of charge and thus do not provide aircraft operators with costs (Woerdman, 2015). Another reason might be the nature of profit making for aircraft operators. When wanting to reduce emissions, aircraft

operators either have to use more efficient airplanes or reduce the amounts of flights. By reducing the among of flights, less consumers can fly, meaning smaller profits for operators. Thus, reducing emission by reducing business is not an economically attractive way. It could also be possible, that emissions in Ireland did not decrease due to its special geographical circumstances. Aviation might be vital for the country's economy and society and cannot be decreased greatly. Emissions from aviation in Latvia might have increased due to the country's economic situation. With the recovery of the Euro, export and investment rose sharply in Latvia leading to great economic growth (OECD, 2018, pp. 182–184).

On the other hand, implementation of the Directive 2003/87 has led to a reduction of GHG emission. This is the case when looking at emissions of stationary installations where all cases reported emission reduction. When taking this as the reference point, legal and practical implementation can be said to have reduced emissions. Thus, to the extent that emissions of stationary installations are considered, legal and practical implementation has contributed to a reduction in GHG emission in Europe. This might be the case, since stationary installations are part of the EU ETS for a longer period of time and are subject to stricter allocation rules. Furthermore, allowances are auctioned and not allocated free of charge, leading to costs when wanting to emit GHG. This might give a higher incentive to stationary installations to opt for emission reduction measures instead of buying more allowances.

5.2. Reflection

The purpose of the research was to apply a more differentiated view on implementation practices in Europe, by using a two-step approach in the independent variable. The differentiation between legal and practical implementation makes this study unusually detailed, since current debates on implementation do not make that distinction. By doing so, the black-box of implementation is opened, and the web of implementation is entangled. Also cap-and-trade theories are investigated and put to a practical test by examining emission reduction in the EU ETS. However, it could not be shown that cap-and-trade schemes work as tightly as the theory suggests. Just by internalising the externality, emissions do not get reduced. Lower allocation and higher incentives are needed to facilitate sustainable emission reduction measures (Woerdman, 2015). The popularity of cap-and-trade policies might need to be revaluated by environment protectionist and legislators.

Not only the use of theory, but also the methods require reflection. It can be criticised that practical limitations prevailed over theoretical considerations in the case selection. By doing so, the use of control variables was not possible, leaving the possibility that GHG emission reduction in the EU is influenced by other factors than implementation. Moreover, representation of the EU MS was only partially given. The cases included four 'old' MS and three 'new' MS in the legal implementation, but only one new MS and three old MS in the practical implementation. Also small and big countries were included in the selection. However, dimensions as the size of the economy, the degree of industrialisation and the wealth of the state are not considered. Representation and thus generalisation are limited. When considering implementation, the issue of data availability has to be taken into account.

The question remains, whether it is possible to make assumption even though specific data is missing, as was the case in the practical implementation of Ireland. Also the exclusion of cases, due to the lack of data on legal implementation, can be assessed critical. Through the lack of data, important information might be omitted which would have influences the outcome of the research. Furthermore, the choice of legal and practical obligations can be questioned. Only some choices are grounded on theory and might seem 'random' or not well grounded to other researchers. In addition, the judgement of successful implementation is problematic. Is it correct to assume implementation was successful on basis of the obligations? When considering GHG emissions, other influencing factors besides implementation were omitted which might bias the research. External factors such as national reduction targets or the financial crisis of 2008 might influence GHG emission as well. In addition, the number of operators was not considered. It can be asked, whether the Directive 2003/87 was successful, if the number of installations declined more drastic than the emissions, thus leading to higher emission per operator.

Further research has to take the issue of case selection, data availability, obligation choice, judgment of successfulness, omitted influences, and number of installations into consideration. It is necessary for further research to apply different obligations, in order to see the effects of the obligation on the outcome. A more comprehensive study, including wide-reaching control variables and data assessment in different languages, is needed to draw final conclusions on the effect of implementation on GHG emissions. Taking implementation as precondition for a policy to take effect, further research should focus on other factors that influence policy success. It might be interesting to compare new to old, small to big and rich to poor countries.

Knowing that legal implementation is only the prerequisite for practical implementation will bring new possibilities and responsibilities for European and national legislators. Also, the importance of practical implementation for the success of a policy is relevant for national bureaucrats that want to improve performance and compliance with policies. If the EU wants to achieve its climate targets, compliance rates, especially concerning practical implementation, need to increase. European and national bureaucrats need to ensure high compliance in all areas of the Directive if emissions are to be reduced. However, administrations need to be aware of the limited capabilities of the EU ETS to reduce emissions, due to over-allocation of allowances. By using union-wide allocation and annual reduction, the EU is on a good way to reduce the amount of allowances to a level that is lower than actual emissions. Until that point, the EU ETS will not function as predicted in cap-and-trade theories but will continue to have low prices on emission that do not lead to sustainable emission reduction.

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Appendix

Appendix A: Case Selection Table

Selected cases	Not selected cases
Austria	Belgium (too federal, each federal state has its own legislation)
Germany	Bulgaria (only MS since 2007)
Ireland	Croatia (only MS since 2013)
Latvia (accessible in English)	Cyprus (language issues)
Lithuania (accessible in English)	Czech Republic (language issues)
Malta (accessible in English)	Denmark (language issues)
Netherlands	Estonia (language issues)
	Finland (language issues)
	France (language issues)
	Greece (language issues)
	Hungary (language issues)
	Italy (language issues)
	Poland (did not transpose the law until 2006; bad legal implementation; language issues)
	Portugal (language issues)
	Romania (MS since 2007)
	Slovakia (language issues)
	Slovenia (language issues)
	Spain (language issues)
	Sweden (language issues)

Appendix B: specified key legal obligations

Key legal obligation	Criteria
GHG emission permits (Art. 4)	1. GHG emission permit 2. Operator monitoring plan
NAP (Art. 9)	1. Quantity of allowances 2. Way of allocation 3. Objective and transparent 4. Taking into account the public
Allocation method (Art. 10)	1. Trading period 1: free allocation of at least 95% of the allowances 2. Trading period 2: free allocation of at least 90% of the allowances 3. Trading period 3: auctioning of allowance which are not allocated free of charge in line with Article 10a and 10c
CA and administrative measures (Art. 18)	1. Designation of a CA and other administrative measures 2. Task allocation in case of several Cas
Registry (Art. 19)	1. Trading period 1 and 2: establishment and maintenance of the registry 2. Accessible to the public 3. Separate accounts for each person
Annual reports (Art. 21)	1. Handing in annual application reports to the EC on basis of an EC questionnaire
Reference (Art. 31)	1. Reference to Directive 2003/87

Data Appendix A: legal implementation

Country	Name of the national legislation	abbreviation	year	hyperlink
Austria	Bundesgesetz über ein System für den Handel mit Treibhausgasemissionszertifikaten	EZG	2004	https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2004_I_46/BGBLA_2004_I_46.pdfsig
	Bundesgesetz über ein System für den Handel mit Treibhausgasemissionszertifikaten	EZG	2011	https://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/20007503/EZG%202011%2c%20Fassung%20vom%2008.05.2018.pdf
Germany	Gesetz zur Umsetzung der Richtlinie 2003/87/EG über ein System für den Handel mit Treibhausgasemissionszertifikaten in der Gemeinschaft	TEHG	2004	https://www.dehst.de/SharedDocs/downloads/DE/gesetze-verordnungen/TEHG_08-07-2004.pdf?__blob=publicationFile&v=4
	Gesetz über den Handel mit Berechtigungen zur Emission von Treibhausgasen	TEHG	2011	http://www.gesetze-im-internet.de/tehg_2011/index.html
Ireland	European Communities (Greenhouse Gas Emissions Trading) Regulations 2004	Regulations No 437/2004	2004	http://extwprlegs1.fao.org/docs/html/ire66798.htm
	European Communities (Greenhouse Gas Emissions Trading) Regulations 2012	Regulations No 490/2012	2012	http://www.irishstatutebook.ie/eli/2012/si/490/made/en/pdf
Latvia	Law on Pollution		2014	*www.vvc.gov.lv/export/sites/default/docs/LRTA/Citi/On_Pollution.doc*
Lithuania	Law on Financial Instruments for Climate Change Management	XI-329	2009	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.353938
Malta	European Union Greenhouse Gas Emissions Trading Scheme for Stationary Installations Regulations	Regulations No 434/2013	2013	http://mra.org.mt/wp-content/uploads/2012/11/2807/LN434_2013-SL504_66_EU-ETS-for-Stat-Inst.pdf
Netherlands	Wet Milieubeheer	WMB	2017	http://wetten.overheid.nl.ezproxy2.utwente.nl/BWBR0003245/2017-08-30#Hoofdstuk16

Data Appendix B: practical implementation and greenhouse gas emissions

Austria																
Allowances vs. Emissions																
	operator		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	total
		verified emi	33.373.155	32.384.372	31.751.260	32.078.974	27.359.833	30.919.711	30.599.418	28.387.060	29.804.410	28.055.974	29.492.065	29.000.120	30.555.226	393.761.578
		total surrenc	33.363.598	32.392.062	31.767.302	32.073.437	27.359.322	30.916.761	30.601.044	28.380.727	29.867.905	28.062.796	29.492.153	29.051.366	30.489.691	393.818.164
			99,97%	100,02%	100,05%	99,98%	100,00%	99,99%	100,01%	99,98%	100,21%	100,02%	100,00%	100,18%	99,79%	100,01%
	aviation															
		verified emissions								1.227.373	1.017.409	1.028.211	1.022.438	1.045.291	848.968	6.189.690
		submitted units								1.226.144	1.286	2.042.692	1.004.530	1.064.301	848.953	6.187.906
										99,90%	0,13%	198,66%	98,25%	101,82%	100,00%	99,97%
Submission Annual Application Report																
	2005-2009; 2012-2016															
Submission Realistic NAPs																
	submission and approval of both NAPs															
downtime registry			2005	2006	2007	2008	2009	2010	2011	2012	total					
		scheduled	210	530		17100	90	no data	no data	24570	42500					
		unscheduled	60	105	651	5560	1355	no data	no data		7731					
											50231					
										Min/year:	8371,83333					
Germany																
Allowances vs. Emissions																
	operator		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	total
		verified emi	475.051.535	478.074.868	487.148.432	472.853.534	428.294.502	454.864.599	450.351.343	452.594.544	481.043.076	461.289.627	455.783.453	452.886.208	437.647.200	5.987.882.921
		total surrenc	469.871.802	483.590.318	493.788.383	475.078.247	429.951.602	455.233.707	449.636.343	449.907.696	487.454.003	462.764.031	451.345.861	452.675.989	437.219.530	5.998.517.512
			98,91%	101,15%	101,36%	100,47%	100,39%	100,08%	99,84%	99,41%	101,33%	100,32%	99,03%	99,95%	99,90%	100,18%
	aviation															
		verified emissions								15.571.068	8.689.931	8.863.926	8.928.612	9.274.019	9.104.787	60.432.343
		submitted units								15.456.385	42.562	17.577.505	8.925.569	9.299.779	8.300.680	59.602.480
										99,26%	0,49%	198,30%	99,97%	100,28%	91,17%	98,63%
Submission Annual Application Report																
	2006-2016															
Submission Realistic NAPs																
	submission and approval of both NAPs															
downtime registry			2005	2006	2007	2008	2009	2010	2011	2012	total					
		scheduled	no data	no data	150	3540	1130	1005	20422	895	27142					
		unscheduled	no data	no data			45	6180	23580	688	30493					
											57635					
										Min/year:	9605,83333					

Ireland																
Allowances vs. Emissions																
	operator		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	total
		verified emi	22.441.006	21.705.338	21.246.280	20.381.890	17.215.429	17.373.260	15.769.980	16.896.557	15.688.792	15.955.563	16.832.734	17.734.226	16.896.391	236.137.446
		total surrenc	22.400.788	21.719.775	22.446.763	20.381.707	17.215.357	17.356.018	15.786.531	16.886.731	15.694.659	16.036.869	16.752.565	17.734.926	16.906.638	237.319.327
			99,82%	100,07%	105,65%	100,00%	100,00%	99,90%	100,10%	99,94%	100,04%	100,51%	99,52%	100,00%	100,06%	100,50%
	aviation															
		verified emissions								9.325.779	7.666.515	7.671.683	8.525.073	10.459.414	11.631.435	55.279.899
		submitted units								9.319.795	6.351	15.333.398	8.527.285	10.459.262	11.631.435	55.277.526
										99,94%	0,08%	199,87%	100,03%	100,00%	100,00%	100,00%
Submission Annual Application Report																
	2005-2016 + 2017															
Submission Realistic NAPs																
	submission and approval of both NAPs															
downtime registry			2005	2006	2007	2008	2009	2010	2011	2012						
		scheduled	no data	no data	no data	no data	no data	no data	no data	no data						
		unscheduled	no data	no data	no data	no data	no data	no data	no data	no data						
Latvia																
Allowances vs. Emissions																
	operator		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	total
		verified emi	2.854.492	2.940.685	2.849.210	2.742.918	2.489.805	3.240.172	2.923.455	2.740.013	2.649.814	2.354.247	2.312.538	2.197.000	2.036.482	34.330.831
		total surrenc	2.854.424	2.940.753	2.849.210	2.744.718	2.489.805	3.240.172	2.921.655	2.740.013	2.649.814	2.354.247	2.312.538	2.197.000	2.042.479	34.336.828
			100,00%	100,00%	100,00%	100,07%	100,00%	100,00%	99,94%	100,00%	100,00%	100,00%	100,00%	100,00%	100,29%	100,02%
	aviation															
		verified emissions								306.499	283.909	276.379	345.271	348.737	378.590	1.939.385
		submitted units								306.499		560.288	296.752	397.256	378.590	1.939.385
										100,00%	0,00%	202,72%	85,95%	113,91%	100,00%	100,00%
Submission Annual Application Report																
	2005-2016															
Submission Realistic NAPs																
	submission and approval of both NAPs															
			online from November 2005													
downtime registry			2005	2006	2007	2008	2009	2010	2011	2012						
		scheduled	720	no data	no data	no data	13950	13560	1260	no data	29490					
		unscheduled		no data	no data	no data	2920	1320	87828	no data	92068					
											121558					
										Min/year:	30389,5					