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THE GREEN-ECONOMIC EUROPEAN ENERGY INDEX (GEEEI)

LAYING THE FOUNDATIONS FOR FUTURE RESEARCH ON ENERGY POLICIES IN EUROPE

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Abstract

The following master thesis addresses the ever more important quest for best practices in the context of domestic energy policymaking in Europe. It consists of three chapters, each set to their own purpose. The first chapter offers a literary study on both the theory behind green-economic and energy security policies, and the methodology behind evaluating those policies' performances. The main argument set forth here is that, while both policymakers, academics and the general public in the EU are in need for a solid foundation they can build their (re)search and perceptions upon, none is given at moment. As a consequence thereof, the present-day search for best practices is misguided and therefore inefficient. The second chapter, accordingly, aims to tackle this issue through the development of a new energy performance index and framework. This Green-Economic European Energy Index (GEEEI) is made up of two sub-indices, each consisting of ten indicators. The third chapter, finally, reflects on the former two chapters by offering a general overview of the index, as well as three empiric research findings. Firstly, it is discussed how leadership is contested. Secondly, it is argued that leadership is relative. Finally, three methods of identifying best practice potential – through the use of the GEEEI – are presented. In the final analysis, it is concluded that, even though this master thesis arguably succeeds in both identifying and resolving a crucial political and political-scientific issue, a variety of other issues remain. Two are introduced, i.e. the relationship between energy security and green-economic concerns, and the explanatory factors behind the GEEEI-scores. These examples help explain why this master thesis – quite willingly – constitutes only the first step in a three-step political-science process. It is in fact laying the foundations for future research on energy policies in Europe.

Abstract (Dutch)

De volgende masterthesis bespreekt de steeds belangrijkere zoektocht naar zogenaamde 'best practices' in de context van de Europese binnenlandse beleidsvoering inzake energie. Het bestaat uit drie hoofdstukken, die elk hun eigen doelstelling omvatten. Het eerste hoofdstuk biedt een literatuurstudie over zowel de theorie achter groen-economisch en energiezekerheidsbeleid, alsook over de methodologie achter het evalueren van dergelijk beleid. Het hoofdargument dat hier wordt uiteengezet, is dat, hoewel beleidsmakers, academici, en het grote publiek in de EU nood hebben aan een solide fundering om hun onderzoek en percepties op te baseren, er geen voorhanden is. Als een gevolg daarvan, is de hedendaagse zoektocht naar beste praktijken inefficiënt. Dienovereenkomstig, pakt het tweede hoofdstuk deze problematiek aan door een nieuwe energieprestatie-index en bijkomend kader te ontwikkelen. Deze Green-Economic European Energy Index (GEEEI) bestaat uit twee sub-indices, die elk tien indicatoren omvatten. Het derde hoofdstuk, ten slotte, koppelt terug naar de vorige twee hoofdstukken door een overzicht van de index aan te bieden, alsook drie empirische onderzoeksbevindingen. Ten eerste, wordt er besproken hoe leiderschap gecontesteerd wordt. Ten tweede, wordt er beargumenteerd dat leiderschap relatief is. Tot slot, worden er drie methoden gepresenteerd om – aan de hand van de GEEEI – beste-praktijken-potentieel te identificeren. Als finaal besluit wordt er geconcludeerd dat de master thesis er in geslaagd is om zowel een cruciale politieke en politiek-wetenschappelijke problematiek aan te kaarten, alsook te verhelpen, maar dat er nog vele andere problematieken overblijven. Twee specifieke voorbeelden worden aangehaald, zijnde de relatie tussen energiezekerheids- en groen-economische belangen, enerzijds, en de verklarende factoren achter de GEEEI-scores, anderzijds. Deze voorbeelden verduidelijken waarom deze master thesis – doelbewust – slechts de eerste stap uitmaakt van een drieledig politiek-wetenschappelijk proces. Het legt als het ware de funderingen voor verder onderzoek naar energiebeleid in Europa.

“[O]ur opinion is that the peer community is ultimately the legitimate forum to judge the soundness of the framework and fitness for purpose of the derived composite.”

– OECD, 2008, p. 17 –

Acknowledgements

The following master thesis is the result of close to two years of hard work, ups and downs, mindful deliberations, and – above all – a recurrent enthusiasm to start over again and incorporate whatever new knowledge was available. It's ought to be the pinnacle of my academic career as a student at the Ghent University Centre for EU Studies (CEUS), and is hence characterised by its confidence and audacity. The latter is true, not only because it's possibly the first of its kind to be presented as a methodologic study at the CEUS, but also because it defies the methodologic practices of a great variety of internationally renowned institutions and scholars. Yet, I was not alone in my endeavour. This master thesis would, in fact, not have been possible without the inspiration, guidance and support of many others. Special gratitude, firstly, goes to my promotor, Dr. Sarah Delputte, and my unofficial co-promotor, Marjolein Derous, for guiding me along the way and offering insights whenever I wanted to change things up again. Secondly, I would render thanks to the CEUS and Lund University instructors that infused me with knowledge on the European Union and green-economic policies, respectively. Last but not least, much deserved gratitude goes to my family who supported me throughout the whole process in whatever way possible.

My sincere hope is that this master thesis offers an engaging and worthwhile reading, despite its technicality.

Table of contents[1]

[1] Each of the three main chapters, as well as the annexes, are introduced by a more detailed table of contents.

List of abbreviations

Units of measurement

g	Gram	Unit of mass
kWh	Kilowatt hour	Unit of energy (derived)
toe	Tonne of oil equivalent	Unit of energy
%	Percentage	Unit of ration
€	Euro	Unit of currency

Indices

CCPI	Climate Change Performance Index
EAPI	Energy Architecture Performance Index
EPI	Environmental Performance Index
ESI	Energy Sustainability Index
GEEEI	Green-Economic European Energy Index
$GEEEI_{Eco}$	Green-Economic European Energy Index – Ecologic dimension
$GEEEI_{Soc}$	Green-Economic European Energy Index – Socioeconomic dimension
GGEI	Global Green Economy Index
IIESR	International Index of Energy Security Risk
SPI	Social Progress Index

Other acronyms

CEEC	Central and Eastern European Countries
CO_2	Carbon dioxide
EC	European Commission
ECSC	European Coal and Steel Community
EEA	European Environment Agency
EEU	European Energy Union
EIO	Eco-Innovation Observatory
ETS	Emissions Trading System
EU	European Union
Europe(an)	*In relation to the European Union or its member states*
FPB	Federaal Planbureau (Belgium)
GDP	Gross Domestic Product
GGBP	Green Growth Best Practices
GGKP	Green Growth Knowledge Platform
GHG	Greenhouse Gas
IEA	International Energy Agency
IISD	International Institute for Sustainable Development
ILO	International Labour Organization
INR	Instituut voor de Nationale Rekeningen (Belgium)
IOE	International Organisation of Employers

ITUC	International Trade Union Confederation
MDGs	Millennium Development Goals
OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
SM	Single Market
TFEU	Treaty on the Functioning of the European Union
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNU-IHDP	United Nations University - International Human Dimensions Programme on Global Environmental Change
UN ESC	United Nations Economic and Social Council
USA	United States of America
vRE	Volatile Renewable Energy
WCED	World Commission on Environment and Development
WIPO	World Intellectual Property Organization

“It is difficult, if not impossible, to manage what is not measured.“

– UNEP, 2011a, p. 23 –

Introduction

Over the past century the European view on society has drastically changed: where the brown economy once stood commonplace, the green economy now stands most desirable (cf. infra). Accordingly, the need to measure the different European policies and societies, and the knowhow to do so, have equally evolved (cf. infra).

The modern measurement of the economy dates back to the 1920s and 1930s (UNECE, 2014). Nonetheless, it took the environmental movement until the 1950s and 1960s to become influential enough to establish a growing and lasting academic interest in the (ecologic) side-effects of economic activity. Once established the drive for more inclusive sets of indicators persisted, and a number of economic composite indicators[2] were established in the following years. Their overarching goal was to correct the GDP-thinking by adding social and other welfare indicators. The actual accounting for environmental aspect was further stimulated in 1972, when two significant events took place. Firstly, the Club of Rome's report called 'Limits to Growth' (Behrens, Meadows, Meadows & Randers, 1972) was published, highlighting the growing tug-of-war between the world's limited natural resources and the growing human population. Secondly, the Stockholm UN Conference on the Human Environment was held, confirming "*that economic development and environmental quality must be managed in a mutually beneficial way*" (UNECE, 2014, p. 11). More than a decade later the term 'green economy' was finally contrived (EEA, 2012). Nevertheless, it was the WCED (1987) report that really set the international tone for the coming years. The so-called Brundtland Report established the international breakthrough of the sustainable development thinking (Fiorino, 2014; Lander, 2011; UNECE, 2014; UNEP & UNU-IHDP, 2014). As of the mid-1990s tools for the measurement of the so-called sustainable societies were increasingly on offer (Benitez-Capistros, et al., 2014), and by the end of the century several major international organizations had made contributions to this measurement revolution (UNECE, 2014). The sustainability-momentum didn't last, however, and with the 2008-2009 financial crisis came a resurgence of the (green) economic thinking (Ciocoiu, 2011; EEA, 2014; McCormick, Richter & Pantzar, 2015; Mundaca & Richter, 2015). It was notably during the 2012 UN Conference on Sustainable Development that the importance of developing indicators[3] to measure progress towards a green economy was internationally recognized (GGKP, 2013; Mundaca & Richter, 2015).

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[2] Cf. subsection 1.2.1. for a better understanding of the term 'composite indicator'.

[3] Despite the remark made by Benitez-Capistros et al. (2014, p. 5519) that "*intuitively we probably all know what an indicator is*," a more nuanced explanation of what an indicator is or can be, can be found in subsection 1.2.2.

In the meantime, the use of indicators had become increasingly important, and perhaps even essential (Eurostat, 2017i). Undoubtedly this was due to the many different applications and advantages that come with it. First and foremost, indicators have an instrumental use when they provide policymaking support (Eurostat, 2017i; Borgnäs, 2016). They allow policymakers to predict the consequences a certain policy design may have (Benitez-Capistros, et al., 2014; UNEP, 2014a), to evaluate the effectiveness of those policies that have already been implemented (GGBP, 2014; UNEP, 2014a), and to calculate the distance-to-target their policies yet have to cover (Benitez-Capistros, et al., 2014; EEA, 2012). Secondly, indicators also ease the burden of communicating complex information (Benitez-Capistros, et al., 2014; Eurostat, 2014 & 2017i; Gudmundsson, 2003), and as such, "*facilitate continuous (social) learning among involved stakeholders and decision-makers*" (Benitez-Capistros, et al., 2014, p. 5527). Indicators, hence, increase policy accountability and transparency (Benitez-Capistros, et al., 2014; Eurostat, 2017h; GGBP, 2014), and thus contribute to the democratic nature of policymaking (Eurostat, 2017h). This is what is called the political use of indicators (Eurostat, 2017i). Lastly, there is the conceptual use (Eurostat, 2017i; Borgnäs, 2016). Here indicators serve as a tool that scholars can use to better understand and concretise elaborated policies and theoretical concepts (Benitez-Capistros, et al., 2014). They equally allow for the identification of causality (GGBP, 2014; UNEP, 2012a), data and knowledge gaps (Benitez-Capistros, et al., 2014), etc.

Just the same, the use of indicators is still an imperfect process. Indicators can, firstly and most importantly, be misinterpreted, misused, or – when done consciously – abused (Eurostat, 2017i; Gudmundsson, 2003). The latter is true when, for instance, indicators are chosen and a framework is designed with the sole purpose of legitimizing already existing policies or the lack thereof (Gudmundsson, 2003). Another example would be the selective representation of an existing framework or indicator set (Eurostat, 2017i). Secondly, there is also the question of policy relevance and time lag (EEA, 2012; Gudmundsson, 2003). The EEA (2012) notes that it can take up to fifteen years before a new indicator gets to be implemented, while Gudmundsson (2003) suggests that it can take decades to do so. Thirdly, there are the scholars that question the instrumental use of indicators, as they note that indicators enjoy too little influence on actual policy making (Benitez-Capistros, et al., 2014; Borgnäs, 2016; Gudmundsson, 2003). Lastly, there are also many different theoretical and methodological fallacies that are inherent to the contemporary use of indicators (cf. infra).

What follows in this master thesis is an examination of those latter fallacies in a contemporary and European context. More specifically, the following examination targets the ever more important quest for policy inspiration and best practices in the context of domestic energy policy in Europe[4]. The main argument set forth here is that, while both policymakers, academics and the general public in the EU are in need for a solid foundation they can build their (re)search and perceptions upon, none is given at moment. None of the indicator sets, frameworks or indices that are ought to provide the required overview of which member states lead by example and which ones lag, seem to be up to the task. As a consequence thereof, the present-day search for best practices is misguided and therefore inefficient.

The examination presented here addresses this issue in a threefold way. The first chapter aims to clarify some of the issues by reviewing both the theoretical and methodological challenges policymakers and academics face when evaluating ecologic policy, in general, and energy policy[5], in particular. The second chapter then offers a new and alternative evaluation framework and index, that incorporates some of the best available answers to these challenges. The purpose of this GEEEI is to serve as the new fundament for research and perception building on best energy practices. The third and final chapter furthermore contributes to this ambition by formulating three research findings that contrast this newly gathered knowledge with the contemporary perceptions presented in this master thesis. Firstly, it is discussed how leadership is contested. Secondly, it is argued that leadership is relative. Finally, three methods of identifying best practice potential – through the use of the GEEEI – are presented and discussed.

[4] "*In relation to green growth, the sharing of lessons and best practices is critical to the institutionalization and integration of green growth strategies in national development planning and programming*" (GGBP, 2014, p. 223).

[5] The role energy policy plays in this master thesis is further clarified in the first chapter.

“A sound theoretical analysis is crucial for the correct contextualisation of the message and to define indicators or indicator sets which go beyond being just a computational exercise and which instead 'speak' to the users. To be able to answer the fundamental question of 'what do we need to measure?' one has to be competent on all the different aspects and specific characteristics of the measured phenomena.”

– Eurostat, 2017a, p. 11 –

1. Literary study: The fallacy of ecologic policy evaluation frameworks

What follows in this master thesis' first chapter is a literary study on ecologic policy evaluation frameworks, in general, and their fallacies, in particular. The chapter consists of three sections. The first two sections present the twin challenge interested parties face when devising an ecologic (energy) policy evaluation framework. The third section applies these challenges to relevant frameworks. As such, specialised scholars and policymakers make up the target audience of this chapter.

1.1. Policy relevance

The following section consists of three subsections, and elaborates on what it means for present-day evaluation frameworks on ecologic policy to be policy relevant. The first subsection expounds on how and why a contemporary evaluation framework that aims to pass judgement on any form of ecologic policy, must do so from a green-economic perspective. Given that the green-economic policy compromises many different policy domains (UNEP, 2011a), and should hence be evaluated as such, the remainder of this section focuses on one particular ecologic domain: energy[6]. Accordingly, the second subsection addresses how and why a contemporary evaluation framework that aims to pass judgement on any form of energy policy, must do so from an energy security perspective. The final subsection concludes that de EU indeed incorporates the above presented green-economic and energy security concerns, and thus confirms their policy relevance.

The importance of this final subsection lies in its academic conviction that policy evaluation frameworks are defined by their context (cf. infra), and should therefore be oriented towards comparing policy performances against their desired results. This is also the belief this master thesis is founded upon. Whether green-economic or energy security policies are actually beneficial to society is of little or no importance here.

1.1.1. Green economy

The conventional economic model, i.e. the so-called brown economy that "*fails to account for environmental externalities in decisions concerning natural resource use and allocation*" (EEA, 2013a, p. 15), first came under major contention in the 1950s and 1960s when the environmental movement emerged (UNECE, 2014). Nonetheless, it would take until 1987 until a viable alternative was offered (Fiorino, 2014). It was the WCED (1987) report – that would later be known as the Brundtland Report – that finally set the scene for a global ecologic turnaround (Fiorino, 2014; Lander, 2011; UNECE, 2014; UNEP & UNU-IHDP, 2014). It introduced sustainable development as the leading development model, and made the establishment of the sustainable society its main impetus. Although, on the one hand, distinctions were often made between sustainability and sustainable development (Benitez-Capistros, et al., 2014), and on the other hand, both concepts know different meanings depending on the context (Brand, 2012), a clear understanding of the essence of sustainability thinking can be derived from the WCED (1987) report. The latter defines sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*"

[6] Cf. subsection 1.1.2. for a more elaborated argument on why the energy domain was chosen.

(WCED, 1987, p. 41). As such, sustainability is an illustrious attempt to reconcile the social, economic and ecologic problems and ambitions that are associated with development in general and the brown economy in particular (GGBP, 2014; UNEP, 2014b). It's about limits, needs and wants, and finding a balance between them (Ciocoiu, 2011). Economic growth and poverty reduction remain uttermost important, but ecologic limits have to be taken into consideration (WCED, 1987).

From a retrospective, the sustainability movement appeared too good to be true[7] as it failed to overthrow the brown economy (Benitez-Capistros, et al., 2014; Brand, 2012; UNEP & UNU-IHDP, 2014). Brand (2012) argues that this was due to a lack of endorsement by relevant socio-economic actors. Either way, the sustainability momentum would soon make way for a new momentum, a more economically driven one. In fact, it was the 2008-2009 financial crisis that made way for the new era of ecologic ambition the world still finds itself in a decade later (Ciocoiu, 2011; EEA, 2014; McCormick, et al., 2015; Mundaca & Richter, 2015). It was notably during the 2012 Rio+20 Conference on Sustainable Development that the international political community officially endorsed this green-economic thinking as the new way forward (GGKP, 2013).

While the Rio+20 Conference did still devise the green economy as a tool for achieving sustainable development (GGKP, 2013; IISD & UNEP, 2014; UNEP, 2011a), the former can also be examined as an idea or vision on its own. The term itself was first coined in 1989 by Barbier, Markandya & Pearce in their book called 'Blueprint for a Green Economy' (McCormick, et al., 2015). In the book, the case was made that the economy and the environment are mutually interdependent and should hence be treated as such (Barbier, Markandya, & Pearce, 1989). This is still the main idea set forth by many green-economic thinkers today (EEA, 2012). Yet, there is now much more to it than mere interdependence. Nowadays the acceptance of ecologic limits, for example, makes up an inherent part of the green-economic thinking while this isn't explicitly mentioned in the book (Barbier, et al., 1989; Fiorino, 2014). The green economy seems furthermore to have become an ambition in itself. This is perfectly illustrated by the green economy definition most academics refer to, i.e. the definition UNEP provided in its 2011 landmark report. It states: "*Green economy aims for improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities*" (IISD & UNEP, 2014, p. 4; UNEP, 2011b, p. 2). As such, the subtle difference between sustanability-thinking and green-economic thinking[8] is that the former underscores the need for ecologic policy to

[7] For a more elaborated criticism on the sustainability movement, see Brand (2012) and Lander (2011).
[8] The GGBP (2014, p. 32) notes that there is yet another important difference: "*They involve a different mindset and a different set of actors than those that have been involved in the quest for sustainable development over the past two decades. Most importantly, they involve national economic development and planning ministries as prime movers*." Brand (2012) confirms that the green economy does seem to appeal to the relevant stakeholders.

make growth ecologically and economically sustainable, while the latter believes one and the same policy can provide for both[9]. The latter is furthermore also deemed to be more actionoriented (UNEP, 2014b). In its own way this makes the green economy a perfect tool for acquiring a sustainable society.

Essentially the green economy thus aims to offer a single answer to a twin challenge through the extensive use and exploitation of synergies, co-benefits and win-win(-win) opportunities (Brand, 2012; EEA, 2012 & 2013b; GGBP, 2014; Fiorino, 2014; IISD & UNEP, 2014). In the belief that the latter are most likely to be found on the market, green-economic thinking comes with a major focus on investment and getting the market to work adequatly (Brand, 2012; Fiorino, 2014; Lander, 2011; McCormick, et al., 2015; UNEP, 2011). It is hence understandable that the terms 'green economy' and 'green growth' are most often used interchangeably[10] (Brand, 2012; EEA, 2012 & 2014). The relationship between ecology and growth was, moreover, especially evident in the early days of the green-economic momentum, when policymakers turned towards green investments to secure economic growth and jobs[11] (Ciocoiu, 2011; EEA, 2014; Mundaca & Richter, 2015).

Nonetheless, the green economy too knows its demerits and critiques. There is, for instance, no universal concept (Brand, 2012; EEA, 2014; GGKP, 2013). Some narrow definitions confine the green economy to the proper pricing of environmental externalities, while wider definitions speak of radical changes (McCormick, et al., 2015). Some authors believe a green economy comes with de-growth, while others believe its sole neoliberal purpose is to sustain growth[12]. Depending on the interpretation of the concept, critiques are given from one or either side of the political spectrum. The Left argues, for instance, that the idea serves to legitimise capitalism, while the Right, for example, won't accept a green economy that comes with a more active government (Fiorino, 2014). A more general critique from the Left is that the green-economic thinking is morally wrong: it's too anthropocentric and undermines the moral case for ecological protection[13] (Fiorino, 2014; Lander, 2011).

[9] This conclusion is the result of a comparison between the academic and non-academic literature on sustainability (e.g. WCED (1987)), green economy (e.g. GGBP (2014), or both (e.g. Brand (2012)).
[10] Cf. annex 1 for other related concepts.
[11] See ILO, IOE, ITUC & UNEP (2008) for a better understanding of the green jobs that are provided for in a sustainable society – and ipso facto green economy.
[12] The truth probably lies somewhere in the middle. While the continuation of growth in the not-so-distant future does seem to be self-evident in most of the green-economic literature, it doesn't seem to be the case either that economic aspirations triumph the social or ecologic ones.
[13] See Lander (2011) for a similar critique on sustainable development.

1.1.1.1. Policy

National governments have an important role to play in the green-economic transition as they can influence and shape the choices their citizens make, the strategies businesses setup and the policies the sub-national governments devise and implement (McCormick, et al., 2015). To be successful a comprehensive mixture of policies will have to be executed (EEA, 2012; McCormick, et al., 2015). To this end policymakers have three broad categories of green-economic policy instruments at their disposal. Firstly, and most importantly, there are the market-based or economic tools. Secondly, there are the regulatory measures. Lastly, national governments will have to spend time and resources on communication.

Market-based or economic policy measures in a green economy come in many different shapes and sizes but all share one and the same logic: facilitate what is desirable, burden was is undesirable, and then let the market allocate the resources efficiently (McCormick, et al., 2015). These measures have the advantage of being less intrusive and burdensome, and are therefore ought to be the most efficient form of policy. The parties involved are, as such, assumed to the right thing out of their own free will – because of the potential financial implications. Nevertheless, economic instruments also come with some design and implementation difficulties (EEA, 2013a). It is, for instance, a comprehensive task to assess potential externalities or an appropriate tax rate. Either way, economic policy measures make up the core of the green-economic toolbox (McCormick, et al., 2015; UNEP, 2011a). They are after all, most in line with the general green-economic belief that the brown economy needs to be fixed, not changed (cf. supra). Well known examples are ecologic taxes, green subsidies, and the removal of harmful subsidies (Fiorino, 2014; McCormick, et al., 2015; UNEP, 2011a).

Market-based mechanism alone won't do the trick, however, and regulatory measures are needed where the market is destined to fail due to behavioural, market or political barriers (McCormick, et al., 2015). This second kind of instruments "*tell obligated parties what they must do or what they are not allowed to do. The rules are typically linked to a sanction that will be imposed if the regulation is not followed*" (McCormick et al., 2015, p. 53). Energy efficiency standards are an example (EEA, 2013a).

The last category of policy measures stems from the belief that information alone is often enough to change behaviour. Even more so than in the case of economic instruments, the parties involved are entirely free to do as they please. There is no marker-based or any other form of government interference, whatsoever. The government's role is confined to providing the right information and pointing out the benefits that could be reaped from changing one's behaviour. Ecolabeling stands as an example here (McCormick, et al., 2015).

1.1.1.2. Evaluation

A single round of green-economic policies won't get countries where they want to be (GGBP, 2014). Instead, a number of smaller steps need to be taken, each time incorporating the best available practices, knowledge and techniques. Monitoring and evaluating the already implemented policies is therefore a crucial part of the green-economic process, as it allows policymakers and academics a better view on which governments are doing well, under which circumstances, and why. This is acknowledged by the international community (UNEP, 2014a; UN ESC, 2016).

It is hence unsurprising that many national and international initiatives have been taken in the past three decades to measure the ecologic transition (UNEP & UNU-IHDP, 2014). A myriad of frameworks, indicator sets and indices have been established (Benitez-Capistros, et al., 2014; UNECE, 2014) and only little harmonisation efforts have been made (UNECE, 2014). UNECE (2014, p. 13) explains that this is partly due "*to the fact that countries consider different aspects as being the most important for their sustainable development, which leads to different policy priorities. Cultural, religious and philosophical viewpoints also play a role. Other reasons for the lack of harmonization relate to differences in academic approaches and data availability*."

The actual evaluation of green-economic policy is either way no easy task and involves many trade-offs (Dual Citizen LLC, 2016). Economic indicators namely need to be applied to evaluate both the policy impact on the environment as well as on the society. On the one hand, it's about tackling climate change, protecting biodiversity, and safeguarding ecosystems, while on the other hand it's about creating jobs, reducing poverty, enhancing social equality and stimulating growth (EEA, 2012; UNEP, 2011a). Indicators need to be applied that can incorporate all of this, and at the same time "*help to identify potential synergies and tradeoffs among different policy objectives and among green and growth goals*" (GGKP, 2013, p. 17).

1.1.2. Energy security

Despite the emergence of energy security concerns in the early twentieth century, energy security studies only really came to be in the 1960s (Cherp & Jewell, 2014). It was in the 1970s, back at a time when oil crises shocked the world, that they first fully thrived. Yet, the academic interest in energy security was of a temporary nature. As the crises were averted, the relevant studies too gave way. Ang, Choong & Ng (2015) report that prior to 2001 only one or two publications on energy security were published each year.

The dawn of the twenty-first century, nonetheless, came with a resurgence of academic interest[14] (Ang, et al., 2015; Cherp & Jewell, 2014). This was due to "*the rising demand in Asia, disruptions of gassupplies in Europe, and the pressure to de-carbonize energysystems*" (Cherp & Jewell, 2014, p. 415). The nature of energy security had changed, however, and furthermore continued to do so in the following years.

"*Historically, Europe's choices about how much energy to consume and how to generate it have largely been shaped by market forces — and in particular by the relative costs of extracting fuels and converting them into energy*" (EEA, 2013a, p. 95). As such, the distinct twentieth century vision on energy security was a socioeconomic one. The only two priorities were the availability and affordability of energy (Cherp & Jewell, 2014). This perspective continues to resemble a great deal of the contemporary views (Narula & Reddy, 2015). To this day the IEA, for instance, still defines energy security as "*the uninterrupted availability of energy sources at an affordable price*" (IEA, 2014, p. 13). Other examples that come to mind, are the models that incorporate the so-called 'four A's of energy security,' i.e. availability, accessibility, affordability and acceptability (Cherp & Jewell, 2014). However, not all twenty-first century definitions of energy security confine themselves to these two or four characteristics, on the contrary. Today, energy security has a multi-dimensional nature, and its meaning is not only highly context dependent, but also varies over time and between disciplines and scholars (Ang, et al., 2015; Cherp & Jewell, 2014; Johansson, Månsson, & Nilsson, 2014). Energy security has, as such, become a very dynamic and complex concept (Ang, et al., 2015).

[14] The interest in energy security has been growing ever since and is expected to continue doing so (Ang, et al., 2015).

Ang et al. (2015) performed a survey on a hundred and four energy security studies published between 2001 and 2014, and found out that eighty-three of them provide their own definition. From these definitions they were "*able to identify the following seven major energy security themes or dimensions: Energy availability*[15]*, infrastructure*[16]*, energy prices*[17]*, societal effects*[18]*, environment*[19]*, governance*[20]*, and energy efficiency*[21]" (Ang, et al., 2015, p. 1081). This is remarkable for two reasons. First, all the themes appear to be either ecologic or socioeconomic in nature, or both[22] - apart from the governance-theme. Second, the survey results reveal that there's an apparent shifting importance of these themes over time.

Regarding the latter, Ang et al. (2015) divide the time period into three subsequent sections and conclude the following. Energy availability, first and foremost, appears to have been of the utter most importance throughout the whole period, as the theme is incorporated in all but one definitions. Secondly, energy prices too have been part of the vast majority of the studies, and even more so in the later ones. The environment, thirdly, enjoyed little interest in the earlier studies, while it's incorporated in almost two thirds of the most recent ones. Regarding the social effects, fourthly, a drop in interest is noticeable in the second period, while the third period comes with a revival of interest. Fifthly, governance and energy efficiency were left out almost entirely in the first section, while they were incorporated in one third of the most recent studies. The opposite is, lastly, true for infrastructure. The high amount of interest in infrastructure in the first period diminishes as time passes.

In conclusion, it is therefore safe to say that whereas the importance of the socioeconomic dimension of energy security, in general, stand the test of time, the importance of the ecologic dimension is ever increasing and is expected to continue doing so.

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[15] The key factors Ang et al. (2015) ascribe to 'availability' are geopolitical factors and diversification. Concerning the latter a distinction can be made between source, spatial, energy mix, and technologic diversity.

[16] The key factors Ang et al. (2015) ascribe to 'infrastructure' are the reliability of and the investment in this infrastructure.

[17] Ang et al. (2015, p. 1082) argue that affordability coincides with 'energy prices'. Concerning the latter a distinction can be made between, among others, "*the absolute price level, price volatility, and the degree of competition in energy markets*."

[18] The key factors Ang et al. (2015) ascribe to 'societal effects' are energy poverty and community acceptance.

[19] The key factors Ang et al. (2015) ascribe to 'environment' are emissions, inundation of forests, and oil leaks and spills.

[20] Regarding 'governance' Ang et al. (2015) simply report that sound government policies are needed.

[21] The key factors Ang et al. (2015) ascribe to 'energy efficiency' are the improvement of energy practices, systems and technologies.

[22] While Ang et al. (2015) present energy infrastructure as a socioeconomic asset, the latter is also crucial to the green energy transition. Without the required infrastructure, renewables energy supplies simply can't compete with traditional forms of energy (cf. infra).

1.1.2.1. Policy

As literature suggests, energy security and the green economy enjoy an interesting and very intense relationship (cf. infra). It is hence not surprising – or coincidental – that all the policy examples presented in the previous section (cf. supra) are energy-related. Energy security, furthermore, also shares the green-economic need for a mixture of policies (EEA, 2013a), besides the common focus on market-based instruments (Fouquet, 2013). Some of today's important energy-related barriers to a green-economic transition stem from the imperfection of the energy market. Energy markets might, for instance, be difficult to penetrate for new and renewable energy players (Fouquet, 2013). Other major barriers arise when governments fail to address their own malevolent influence on the energy markets. The EC (2015, p. 3), for instance, reports: "*Collectively, the EU spent over EUR 120 billion per year – directly or indirectly – on energy subsidies, often not justified.*"

Next to sharing the same policy toolbox, energy security policy and green-economic policy can also be said to share more or less the same objectives. The first step in green-economic policymaking is in fact most often the establishment of energy efficiency and renewable energies policies[23] (GGBP, 2014). The other way around, green-economic thinking also benefits security concerns. Ang et al. (2015), for instance, suggest that the development of renewable energy can enhance energy availability, while it is also widely acknowledged that an increase in energy efficiency equally addresses energy security concerns (Buzogány & Ćetković, 2016; EC, 2014; Froggatt & Levi, 2009). Fiorino (2014), furthermore, concludes that the ecologic movement is most likely to be successful in the energy sector.

Finally, energy policy is not only very susceptible to green-economic ambitions, but also crucial in regard to the latter. The energy sector is, on one hand, the most important contributor to climate change due to the exhaust of (carbon) emissions (GGBP, 2014; EU, 2014). About eighty percent of the GHG-emissions in the EU come from the energy sector (EU, 2014). On the other hand, however, it is also of vital importance to both developed and developing societies (Ang, et al., 2015), as both the quality of life and the functioning of the economy depend on it (Ang, et al., 2015; EEA, 2013a; EU, 2014). The energy sector, furthermore, entails major economic opportunities, especially in a green-economic context (Breyer, et al., 2014; EC, 2014; EEA, 2012; UNEP, 2011a & 2012a).

[23] As a consequence, the energy domain is also the most likely policy domain for any country to have established any kind of result.

1.1.2.2. Evaluation

"*Energy security index research and development is still in the stage of infancy from a methodological perspective*" (Ang, et al., 2015, p. 1089), despite the recent boom in interest in energy security policy and evaluations[24]. There is, hence, no standard procedure to evaluate energy security policy, and there probably won't be one in the near future, as different definitions come with different studies (Ang, et al., 2015). Just the same, there are several commonalities between the most recent studies. The first of which is the mostly holistic an integrated nature of the evaluations: energy security is no longer confined to availability and affordability. The use of indicators and indices has, secondly, become increasingly popular in this context[25] (Ang, et al., 2015; Narula & Reddy, 2015). A third characteristic shared by most evaluations is their simplicity. Indicator sets are limited in size and/or are accompanied by an overall aggregated indicator[26]. Less than a fourth of the indicator sets that were part of the survey by Ang et al. (2015), contain more than twenty indicators, while some are even limited to a single one. That doesn't mean, however, that the number of available indicators is equally limited, on the contrary (Narula & Reddy, 2015).

[24] Johansson et al. (2014) argue that the vagueness of the concept is to blame for the lack of interest in the methodological setup of corresponding evaluation frameworks.
[25] Forty-nine percent of all studies that were part of the survey by Ang et al. (2015) applied indicators, as well as sixty-one percent of the studies that date after 2008.
[26] Cf. subsection 1.2.1. for a better understanding of the term 'aggregated indicator'.

1.1.3. European context

In reference to the green economy and energy security, the EU and its member states are a particularly interesting case. Three specific reasons come to mind here. The first reason is that the EU has been proclaiming itself to be an ecologic leader for some time now, and has established ambitious objectives to support this statement (cf. infra). Secondly, the EU has enjoyed a very unique relationship with energy concerns (cf. infra). Finally, the distribution of energy competences between the EU and its member states is complicated – to say the least (cf. infra).

The EU has, firstly, aspired to assume the mantel of ecologic leader-by-example for some time now, and produced a substantial amount of legislation to back this claim up[27] (Dupont & Oberthür, 2015a & 2015b). It even has the EEA (2015, p. 21) not unrightfully call the EU acquis *"the most comprehensive modern set of standards in the world*." Nonetheless, a lot remains to be done (Dupont & Oberthür, 2015a; EC, 2014 & 2015) The EU recognizes this and has set forth an ambitious plan to become a competitive low-carbon society by 2050 (Bigerna, Bollino, & Micheli, 2015; Dupont & Oberthür, 2015b; EC, 2011; EEA, 2013b). This means that by that time the EU aims to reduce its carbon emissions by at least eighty percent compared to 1990 levels.

To reach this long-term objective, the EU has established two sets of medium-term energy targets. The first objectives are incorporated in the 'Europe 2020 Strategy'. According to this frame the objective is that by 2020 GHG-emissions are reduced by twenty percent compared to 1990 levels, the share of renewable energy in final energy consumption is raised to twenty percent, and energy efficiency is increased by twenty percent (Bigerna, et al., 2015; EC, 2010 & 2011; Eurostat, 2016; Focken, 2015). The strategy incorporates a socioeconomic component as well, as it includes targets on employment, poverty, education, and research and development (EC, 2010). The second set of targets are part of the 'EU framework on climate and energy for 2030'. The only quantifiable targets incorporated here are to reduce greenhouse gas emissions by forty percent compared to 1990 levels by 2030, and raise energy efficiency and the share of renewable energy in final energy consumption to twenty-seven percent by 2030 (Bigerna, et al., 2015; EC, 2014; EU, 2014). Of great importance here is the given that both frameworks explicitly affirm the need for economic-ecologic synergies, and the general ambition to become a green economy (EC, 2010 & 2014; EEA, 2013a).

[27] The EU has also quite substantially overachieved its Kyoto-commitments, and is even set to overachieve its 2020 commitments (Dupont & Oberthür, 2015a).

The given that the EU, secondly, enjoys a unique relationship with energy is largely due to the fact that the it "*consumes one fifth of the world's energy, but has very few reserves of its own*" (EU, 2014, p. 4). As a consequence, the EU has to import half of the energy it consumes (EC, 2015; EU, 2014). The total cost of this import is estimated to be around four hundred billion euro per year (EC, 2015). Just the same, not all's bad in the EU-energy relationship, on the contrary. Energy has been a part of the European integration process from the very beginning (Fischer, Gullberg, Sartor, & Szulecki, 2016), i.e. in the form of the ECSC and Euratom (EU, 2014; Focken, 2015). Present-day the energy sector, furthermore, continues to be depicted not only as a sensitive sector, but also as a sector of opportunity. It's more specifically the win-win-win package of a decrease in emissions, an increase in jobs and financial savings that is explicitly put forward by the EU (2014).

Thirdly, there's the complicated distribution of energy competences between the EU and its members states. Guided by the subsidiarity principle[28], the division of energy competences was finally settled with the Lisbon Treaty[29] (de Jong & Egenhofer, 2014; Focken, 2015). From then onwards energy was officially a competence shared by both the EU and its member states (EU, 2012). Two exceptions remain, however, as article 194 TFEU states that the member states retain their sovereignty when it comes to determining the national energy mix and deploying the states' national resources[30]. Renewable energy policy instruments are, as such, considered to be a national government policy tool (Primova, 2015). Even the EC (2015, p. 12) acknowledges that what concerns the green-economic energy transition "*Most of the work has to be done at national, regional and local level*."

Next to establishing the shared competence in energy policy, the Lisbon Treaty also fixed the three main energy objectives the EU adheres today: security, sustainability, and competitiveness (EU, 2012; Focken, 2015). It are these objectives, which Focken (2015, p. 186) collectively calls the "*the energy triangle*," that shape present-day energy policy, and that are all incorporated into the EU's latest energy model, i.e. the EEU (cf. infra).

[28] The subsidiarity principle is described by de Jong & Egenhofer (2014, p. 266) as "*the obligation to assign the competence to the level at which a task can best be done, that is, at the local, regional, member state, EU or even international level*."
[29] It took until the Maastricht Treaty in 1993 before energy was recognised as a separate European policy sector (Focken, 2015).
[30] The question stands how much of this sovereignty is in fact true, given the European competences in the internal market, environment and competition (de Jong & Egenhofer, 2014).

1.1.3.1. Policy

Despite the continued dominance of the national governments in energy policymaking, the European level has known a significant increase in importance since the Lisbon Treaty (Fischer, et al., 2016). As a result, European energy policy now not only comes in many different shapes and sizes, but also cuts across different policy disciplines[31] (Bigerna, et al., 2015). Presenting an elaborated overview of the EU energy acquis, would hence go beyond the scope of this master thesis. The following section therefore confines itself to identifying and discussing three remarkable characteristics.

Firstly, European energy policies are commonly presented as win-win scenarios. The EC argues, for instance, that renewable energy development and cross-border energy infrastructure investment are not only good from an ecologic and competitive perspective, but are also necessary to increase energy security (EC, 2011 & 2014; Juncker, 2015). Also, Eurostat (2016) and the EC (2014) confirm that an ecologic energy transition may result in additional investments and jobs. An increase in energy efficiency and the share of renewable energy in energy consumption are, furthermore, deemed to be the most capable of providing win-win opportunities (Dupont & Oberthür, 2015b; Eurostat, 2016).

Secondly, the EC predominantly focuses on the application of market-based mechanisms (Austvik, 2016), in general, and the better functioning of the ETS and the conception of the internal energy market (de Jong & Egenhofer, 2014; EC, 2015), in particular. The former has been established and knows quite a lot of shortcomings (EC, 2011 & 2014), whereas the latter not yet came to full fruition despite the many attempts by the EC (de Jong & Egenhofer, 2014). Just the same, both stem from the EC's belief that the market offers the most efficient way of organising the energy transition (Primova, 2015). "*A competitive and integrated internal energy market provides the necessary environment and cost signals for the achievement of energy policy objectives in a cost-efficient manner*." is the main argument (EC, 2014, p. 9). Liberalisation too is presented as a key issue (EC, 2014; Primova, 2015).

The beliefs of the EC notwithstanding, there is a certain necessity to reform the market and its infrastructure. The electricity system, in particular, offers a real challenge in the context of rapid renewable energy development (EEA, 2014). Renewable energy stakeholders, furthermore, agree that an improvement in the functioning of this market is a prerequisite to the desired[32] harmonisation of national support schemes (Primova, 2015).

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[31] "*Benson and Russel* (2015) *note that by 2010 the EU had produced a cumulative total of over 350 energy policy legal instruments*" (Fischer, et al., 2016, p. 549).

[32] The EC (2014) and Primova (2015) argue that this harmonisation is needed to further the energy transition.

Thirdly and finally, the present-day EEU, which can be seen as "*the most significant policy idea that seeks to reform European energy governance, policy and regional cooperation, streamlining these with long-term climate protection goals*" (Fischer, et al., 2016, p. 548), may perfectly incorporate the former two characteristics of European energy policy, as it both revolves around win-win opportunities and predominantly market-based mechanisms (EC, 2015).

Nonetheless, this has not always been the case. When the EEU was successfully reintroduced in April-March 2014 by Donald Tusk, the latter in fact presented it as an energy security instrument only (Austvik, 2016; Fischer, et al., 2016; Tusk, 2014). Stimulated by the recent gas crises and eager liberate the EU from its energy dependence on Russia, the then Polish Prime Minister proposed an EEU consisting of six pillars. Firstly, the EU should jointly negotiate energy contracts with Russia. Secondly, an energy solidarity mechanism should be established. Thirdly, the EU should invest more in energy infrastructure. Fourthly, the European member states should exploit domestic fossil fuels as much as possible. Fifthly, the EU should reach out for emerging suppliers as, for instance, the USA. Finally, the Energy Community should be strengthened. Accordingly, Fischer et al. (2016, p. 552) conclude: "*Environmental sustainability and climate change mitigation were marginalized – present only in justifications of the rehabilitation of coal in the form of clean coal technologies*."

Tusk's vision wasn't the only one, however, and what started out as a CEEC-project[33] had developed into a floating signifier (Fischer, et al., 2016). One particularly important actor with a vision was the newly appointed President of the EC Jean-Claude Juncker. He resolved to make the establishment of a new EEU one of his EC's core ambitions (Fischer, et al., 2016; Juncker, 2015). In February 2015 the EC's EEU was presented (EC, 2015; Fischer, et al., 2016). It consists of five dimensions that are ought to reinforce one another. They can be summarised as energy security, a fully integrated European energy market, energy efficiency, decarbonisation, and research. Ecologic ambition is thus incorporated into the EEU[34], as is the interdependence of the member states, and the establishment of energy as the fourth form of free movement in the internal market. Austvik (2016, p. 380), therefore, concludes that the EC's vision "*was heavily influenced by continued regulatory internal market measures, [and] largely colored by a "markets and institutions" approach, with a primary goal of completing the SM for energy*." In reply Mišík (2017) argues that the more comprehensive nature of the EC version of the EEU-proposal increases the likelihood of the latter being passed.

[33] "*Within EU studies, the CEEC are considered to be countries which (with the exception of Malta and Cyprus) entered the EU during the so-called eastern enlargement of 2004, 2007 and 2013*" (Mišík, 2017, p. 28).

[34] Nevertheless, "*the fact that the Energy Union Framework does not mention the Roadmap 2050 should be noted*" (Fischer, et al., 2016, p. 564).

1.1.3.2. Evaluation

The EC is responsible for the evaluation and monitoring of the European member states' performances in relation to the above presented green-economic ambitions (EC, 2010 & 2014). Its goal-oriented approach is threefold – at least what concerns the 2020-targets[35]. Firstly, the EC offers thematic evaluations (EC, 2010). These evaluations apply the above presented targets as headline indicators and clarify what the priorities are. Secondly, the EC also does country reporting, and as such, helps member states identity problems and define strategies. Finally, the EC ensures that policy guidelines and recommendations accompany both the thematic evaluations and the country reports. "*Policy warnings could"* furthermore *"be issued in case of inadequate response*" (EC, 2010, p. 6).

[35] The monitoring and evaluation scheme of the 2030-framework is mostly defined as a continuation of the existing scheme (EC, 2014), and is thus expected to not deviate much from the 2020-monitoring and evaluation scheme.

1.2. Methodological soundness

The following section elaborates on what it means for present-day evaluation frameworks on ecologic and energy policy to be methodologically sound when they are indicator-based. It consists of three subsections. The first subsection elaborates on the building of indicator-based frameworks, while the second subsection examines the indicators themselves more closely. The third and final subsection exposit the importance of reliable data collection and stakeholder involvement, respectively.

1.2.1. Framework building

A framework is needed to help scholars conceptualise what it is that should be measured, how it's going to be measured and what indicators to use in the process (Eurostat, 2014 & 2017h). Accordingly, the importance of a sturdy framework cannot be overestimated (OECD, 2008), and some considerations are due[36]. Three characteristics of a framework are of a particular interest here: purpose, transparency and complexity.

1.2.1.1. Purpose

When it comes to the purpose of frameworks, the basic distinction made is between conceptual and utilisation frameworks (Gudmundsson, 2003). A conceptual framework aims to provide structure. It "*establishes a certain logic to the selection of indicators and contains the supporting technical definitions, metrics and linkages*" (Gudmundsson, 2003, p. 4). Utilisation frameworks, conversely, aim to convey a message (Gudmundsson, 2003). Three kinds of utilisation frameworks exist: information frameworks provide indicator-based information to a broad audience, monitoring frameworks provide reporting on policies, and control frameworks help steer policymaking.

Regarding the latter two types of utilisation frameworks, an important remark can be made. That is to say that the academic literature also makes a distinction between evaluation frameworks, assessment frameworks and indicator sets. Even though scholars not always differentiate between evaluations and assessments (Benitez-Capistros, et al., 2014), the strictest interpretation of the two concepts dictates that the former is used to measure the effects of already established policies, whereas the latter is used to predict the effects of policies that are yet to be implemented (Benitez-Capistros, et al., 2014; UNEP, 2014a). Plain indicator sets have a more descriptive nature and are more indirectly linked to policymaking (Gudmundsson, 2003).

[36] Some examples of common mistakes are "*over-aggregation; hiding relevant more detailed information; measuring what is measurable, rather than what is important*" (Benitez-Capistros, et al., 2014, p. 5523).

1.2.1.2. Transparency

Transparency is a major concern that is inherent to indicator-based frameworks. The OECD (2008, p. 17) calls it "*the guiding principle*" in framework building. It's a threefold concern that encompasses, firstly, the fact that frameworks are always going to be contested (cf. infra), secondly, that contextual information should always be provided for (cf. infra), and thirdly, that frameworks should be adapted to their target audiences (cf. infra).

The given that a framework will, firstly, always be contested by someone – no matter what, stems from the fact that a perfect or perfectly objective framework simply doesn't exist (Benitez-Capistros, et al., 2014; GGKP, 2013; Hsu, 2016). "*Even the most widely accepted measures have their weak points*" (GGKP, 2013, p. 9), and frameworks and indicators are notorious for simplifying reality (Benitez-Capistros, et al., 2014). An additional reason why frameworks and indicators are under constant scrutiny is because they can be abused (cf. supra), legitimise governmental (in)action, or confront stakeholders that do not wish to be confronted.

Indicators, secondly, do not provide any relevant information on their own; they simply indicate (Eurostat, 2014). Contextual information is thus needed to make an indicator (politically) meaningful[37] (Benitez-Capistros, et al., 2014; Eurostat, 2014, 2017h & 2017i). The meaning of indicators can furthermore be reinforced by clustering corresponding indicators together or through the act of storytelling (Eurostat, 2017h).

Thirdly, the message that a framework aims to convey, has to be adapted to its target audience, because different audiences have different needs (Eurostat, 2017h). An audience of specialists consists of people "*who possess expert-level statistical knowledge and are able to process and interpret detailed data sets*" (Eurostat, 2017h, p. 22). What they want is detailed metadata[38] and other specific information (Eurostat, 2017h). The general public, on the contrary, is in need of accessible and clear-cut information. They are wary of the many numbers in indicator sets and are, as such, only interested in the conclusions that can be drawn from these numbers. When addressing this audience, it's therefore best not to use too many technical vocabulary, but instead apply descriptive narratives, explanatory images and/or symbols that are easy to understand.

[37] When the same indicator is used in a different context, it can have an entirely different meaning (Eurostat, 2017h).

[38] "*Metadata contain essential information needed to understand and effectively use the data […]. In general, they provide users with background information on data sources, data collection, statistical processing, accessibility and quality*" (Eurostat, 2017h, p. 33).

1.2.1.3. Complexity

That evaluation frameworks are complex, is a common observation. That doesn't mean, however that they are by definition incomprehensible or inaccessible. Quite the contrary, a number of instruments exist that address this concern. Three particular instruments come to mind: the use of indicator sets, the synthesis of indicators, and the use of so-called aggregated dashboards (Eurostat, 2017h).

Indicator sets[39], firstly, come in two shapes: dashboards and scoreboards (Eurostat, 2014 & 2017h). The difference between them is that the former has no normative function, whereas the latter usually consists of several performance indicators[40]. Either way, an indicator set offers a more comprehensive picture of a subject of analysis than a group of individual indicators ever could, as each *"indicator is designed to paint a part of this picture, but will often need to be interpreted in relation to others"* (Eurostat, 2014, p. 3). Another great advantage to indicator sets is that both the individual indicators and the different dimensions that make up the subject of analysis are presented in a transparent way.

An important aspect of an indicator set is its size. The larger the number of indicators that are part of a set, the less prone the set is to changes as the value of a single indicator changes (Ang, et al., 2015), and the more difficult it is to communicate that set (UNECE, 2014). While the ideal size of a set depends on the overarching framework, an assemblage of ten to twenty-five indicators should be adequate (Ang, et al., 2015)[41].

Secondly, two varieties of synthetic indicators exist: the aggregated[42] and the composite indicator. Both of these synthetic indicators are formed when a variety of individual indicators are joined together according to some kind of formula. The difference between the two is that the indicators that form the aggregated version, all share the same unit of measurement, while this is not the case with the composite version (Ang, et al., 2015; Eurostat, 2014). Even so, their threefold formation process is more or less the same. First the regular indicators need to be normalised (Ang, et al., 2015). A number of normalisation methods are available: standardisation, distance from the group leader, distance from the mean, distance to reference, min-max-method, etc. (Ang, et al., 2015; Freudenberg, 2003).

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[39] Throughout this master thesis the concepts 'indicator set' and 'indicator system' are used interchangeably, despite the differences between them. "*An indicator set can be defined as a list of indicators based on a policy reference, as opposed to an indicator system, in which the indicators rely on a specific conceptual framework*" (Eurostat, 2017i, p. 10). The assemblage of indicators, that is presented in chapter two and three, corresponds with both definitions.

[40] Cf. article 1.2.2.2. for a better understanding of the concept 'performance indicator'.

[41] "*About 75% of the studies [on energy security] employ no more than 20 indicators*" (Ang, et al., 2015, p. 1084).

[42] Very confusingly, Eurostat (2014 & 2017h) has named aggregated indicators 'synthetic indicators,' whereas the latter concept is used here as the overarching term for both aggregated and composite Indicators.

However, in order to be able to normalise indicators, the latter have to be comparable; and in order to be comparable, indicators have to be compared on the basis of a common theme, e.g. population or GDP (FPB & INR, 2017; Freudenberg, 2003). Once the indicators have been normalised, they can be weighted (Ang, et al., 2015). Yet again, a number of methods exist: weights based on experts or stakeholder opinions, weights from specific algorithms, equal weights[43], the fuel/import share method, the principle component analysis method, etc. The final step in the process is to aggregate the normalised and weighted indicators. "*The simplest and most popular aggregation method is the additive aggregation method, where the indicators are first multiplied by the weights assigned and then summed to arrive at the index. It is used in 83% of the energy security indices that aggregates their indicators. The remaining 17% of indices use some other methods including, for example, the root mean square of indicators to produce the index"* (Ang, et al., 2015, p. 1089).

The use of synthetic indicators is much debated on[44]. Those in favour (of composite indicators[45]) emphasise their communicative qualities (Eurostat, 2014 & 2017h; Freudenberg, 2003; GGBP, 2014; OECD, 2008; UNECE, 2014) and utility in benchmarking and comparing country performances (OECD, 2008; Freudenberg, 2003), whereas opponents refer to the lack of transparency of some existing examples (UNECE, 2014), the fact that they remain reductionist in nature (Benitez-Capistros, et al., 2014; Eurostat, 2014; GGKP, 2013; UNEP & UNU-IHDP, 2014), that they are susceptible to manipulation (Eurostat, 2014; Freudenberg, 2003), and that they may be misleading (OECD, 2008; Freudenberg, 2003; UNEP, 2012a). "*The tendency to include "soft" qualitative data is another source of unreliability*" (Freudenberg, 2003, p. 9).

Aggregated dashboards, finally, combine both the use of indicator sets and synthetic indicators (Eurostat, 2017h). They present themselves as regular dashboard, but consist of a selection of synthetic indicators instead of regular ones. Access to the details of every synthetic indicator is provided for. Because of all of this, aggregated dashboards are particularly useful when the subject of analysis is a complex phenomenon. On a negative note, however, a "*frequent criticism of aggregated dashboards is that they lack indications about causal links, and/or hierarchies amongst the indicators used*" (Eurostat, 2017h, p. 41).

[43] According to Ang et al. (2015) the equal weighting method is the most common weighting approach (as far as energy security studies concern). This largely due to its simplicity (Ang, et al., 2015; Freudenberg, 2003).
[44] See OECD (2008) for a detailed overview of the general merits and demerits of composite indicators.
[45] Close to all sources only refer to composite indicators when discussing the advantages and disadvantages there are to synthetic indicators.

1.2.2. Indicator selection

Despite the fact that everybody has an intuitive understanding of what an indicator is, there still is a lot of variety when it comes to defining the concept (Benitez-Capistros, et al., 2014). The definition this master thesis builds on, is the one presented by the OECD. According to the OECD (2008, p. 13) an indicator "*is a quantitative or a qualitative measure derived from a series of observed facts that can reveal relative positions (e.g. of a country) in a given area*." The advantage of using this definition is twofold. The definition, firstly, corresponds perfectly with the comparative nature of this master thesis, as the latter is focused almost entirely on the indicator-based comparison of countries. Secondly, this definition also introduces the obligation to make choices. Selecting indicators is not simply picking the best available examples, on the contrary. "*Indicators should be selected on the basis of their analytical soundness, measurability, country coverage, relevance to the phenomenon being measured and relationship to each other*" (OECD, 2008, p. 15). Perhaps most importantly, they also need to satisfy the users' needs in order to be used (Eurostat, 2017i). What follows is, therefore, a non-exhaustive overview of the many possible natures indicators can have. In the following order of sequence is addressed why, when, by whom, how, and about what indicators are devised.

1.2.2.1. Headline or detailed

A very basic distinction between indicators relates to their finesse. Headline indicators are simple, often composite or aggregated indicators that are easy to communicate, whereas detailed indicators allow for better monitoring, for instance, of green economic development (GGBP, 2014).

1.2.2.2. Descriptive or normative

When looking at it from a functional perspective, the first view on indicators is that they can be either descriptive or normative. The former is applied when an indicator is confined to describing a situation or trend. Synonyms to a descriptive indicator are a contextual and situational indicator. Conversely, an indicator is a normative or performance indicator when it compares the observed situation or trend to an objective or target (Benitez-Capistros, et al., 2014; Eurostat, 2014; Gudmundsson, 2003).

The second functional perspective argues that this dichotomy is false. The word 'indicator' is derived from the Latin verb 'indicare,' which means 'to point' (Benitez-Capistros, et al., 2014; Eurostat, 2014 & 2017i). As such, and indicator has to refer to something by definition (Benitez-Capistros, et al., 2014). Otherwise it's not an indicator but a variable.

1.2.2.3. Temporal or spatial

Concerning the intent of the indicator, a distinction exists between temporal and spatial indicators. The former is applied when the framework concerns an evaluation over time, while the latter is applied when a comparison is made between countries. Regarding energy security studies, the academic society do not seem to prefer either of the two over the other (Ang, et al., 2015).

1.2.2.4. Ex ante or ex post

The difference between ex ante and ex post indicators resembles the difference between assessments and evaluations, respectively (cf. supra). "*Ex-ante*" indicators "*provide information to assess the effects of decisions in advance and support choice between various options before practical implementation, while ex-post*" indicators "*provide information after decisions are taken to assess or evaluate their practical implementation*" (Benitez-Capistros, et al., 2014, p. 5525).

1.2.2.5. Top-down or bottom-up

A distinction can be made between indicators depending on who devised them (Benitez-Capistros, et al., 2014). Top-down indicators are also known as expert-driven or reductionist indicators, and are – as the word says itself – devised by experts. They allow the latter to build the measurement system around theoretical concepts and academic literature (Benitez-Capistros, et al., 2014; UNECE, 2014). These indicators are often quantitative and enjoy clearly stated methodologies (Benitez-Capistros, et al., 2014). Bottom-up indicators, which are also known as conversational, constructionist or community-driven indicators, are devised by (local) stakeholders. They allow the evaluation framework to be built around those issues that are deemed of critical importance, and as such, are better at engaging the relevant stakeholders (Benitez-Capistros, et al., 2014; UNECE, 2014). Benitez-Capistros et al. (2014) conclude that a combination of both indicators within one framework is recommended.

1.2.2.6. Qualitative or quantitative

When looking at it from a data collection and presentation perspective a distinction can be made between two kinds of indicators (Eurostat, 2014). "*Quantitative*" indicators "*are based on quantitative data and provide information in a quantitative—numerical—manner, while qualitative*" indicators "*are based on qualitative data and provide information in a qualitative—non-numerical—manner*" (Benitez-Capistros, et al., 2014, p. 5524). Over sixty percent of the studies in the survey by Ang et al. (2015) that had a clear definition on energy security, were quantitative.

1.2.2.7. Objective or subjective

The distinction between objective and subjective indicators is often confused with the distinction between quantitative and qualitative ones, respectively (Eurostat, 2014). Whereas the latter constitutes a dichotomy based on the type of data that is used (cf. supra), the former constitutes a dichotomy based on the type of information that is used (Benitez-Capistros, et al., 2014; Eurostat, 2014). Objective indicators are indicators whose value or information is based on explicit criteria, and which can be verified by external observers. Conversely, subjective indicators are based on individual concerns, beliefs, ideas, etc., and can only be verified though further explanation[46]. Both types of indicators can be quantitative or qualitative (Eurostat, 2014).

1.2.2.8. Direct or indirect

Depending on whether an indicator is directly related to the subject of analysis or not, a distinction can be made between direct and indirect or proxy indicators. The latter are most often used when direct measurement is impossible or extremely difficult. In this case a related indicator is used to estimate the value of the original indicator. "*E.g. Percentage of women in parliament, as a proxy for gender equality*" (Eurostat, 2014, p. 19).

1.2.2.9. System or agency

The last distinction between indicators refers to the subject of analysis. "*System indicators measure states, flows, and changes in human or natural systems, using appropriate descriptive or performance indicators. Agency indicators focus on the activities of an agent (organisation, government, etc) and assigns a responsibility to it (e.g. measuring in terms of 'input to', 'output from' or 'outcome of' the agents activities)*" (Gudmundsson, 2003, p. 3).

[46] Ultimately this makes all indicators subjective as they can only be useful when they are part of an existing methodology and theoretical frame (Benitez-Capistros, et al., 2014; Eurostat, 2014). In turn, "*subjective indicators borrow objective modes of grouping, ranking and partitioning the data*" (Eurostat, 2014, p. 20).

1.2.3. Data collection

Data, which can be defined as "*information compiled by national statistical authorities, on the basis of traditional statistical activities (e.g. sample surveys and censuses) or data from other sources that is reused for statistical purposes*" (Eurostat, 2014, p. 7), has an important role to play in indicator-based frameworks. The availability of qualitative data is in fact an essential precondition to establishing an adequate framework[47], as the use of the wrong data can lead to disputable messages (OECD, 2008). Data are deemed to be qualitative when they correspond to the quality standards of official statistics (UNECE, 2014). That doesn't mean, however, that the data has to be provided by official statistics in order to be acceptable. To the contrary, there is also a variety of other data sources that is well concerned with the quality of their data. Caution is in order, nonetheless.

1.2.4. Stakeholder involvement

Stakeholders[48] are ultimately the most important actors in the green-economic transition, for they are the ones that have to change their real-life behaviour (Benitez-Capistros, et al., 2014). Accordingly, it is encouraged to actively engage key stakeholders during every stage of the evaluation process (GGBP, 2014). A variety of ways to do this exist. Some of the examples already mentioned before are the creation of bottom-up indicators and the stakeholder role in weighting indicators (cf. supra). Other examples are the creation of ongoing feedback loops (GGBP, 2014) and the consultation on what needs to be prioritised (UNEP, 2011a).

The advantages to stakeholder involvement are manifold. It, for instance, helps "*ensure that indicators and data are interpreted and used correctly and […] decision makers and public stakeholders understand the implications and can act on them*" (GGBP, 2014, p. 223). It also helps to keep track of the changing political issues (Eurostat, 2017i), and improves the process' accountability and transparency (GGBP, 2014), and as such, democratises statistics (Eurostat, 2017h).

[47] See Freudenberg (2003) for insights on what to do when the required data is missing.

[48] Some examples of stakeholders are citizens, governmental and nongovernmental organisations, businesses, journalists, and research-based institutions (Benitez-Capistros, et al., 2014; Eurostat, 2017h; UNEP, 2011a).

1.3. Existing frameworks

This final section takes the former two sections together and applies them to a number of existing indices. First some formal indices are reviewed. Secondly, special attention is given to the informal green leader-laggard dynamic.

1.3.1. Formal

What follows in this subsection is the review of several formal indices[49]. The main argument presented is that none of the indices under scrutiny – or any index that came up in the literary study for that matter – is adequate when it comes to evaluating green-economic (energy) policy. Some aren't policy relevant enough because they fail to incorporate green-economic thinking, overgeneralize green-economic performance, and/or fail to incorporate energy security concerns. Others aren't methodologically sound enough. A few lack both merits.

Given that this master thesis confines itself to providing insights on the problematic use of evaluation frameworks to judge green-economic (energy) policy performances, the reviews of these indices do not go into detail too much. They are, with the exception of the GGEI, in fact limited to one or two major fallacies. As such, this concluding section aims to establish a solid understanding of what can generally be improved about this kind of indices.

1.3.1.1. MDGs & SDGs

The MDGs were agreed upon in 2000 during the so-called Millennium Summit, and are incorporated in the UN Millennium Declaration (UN, 2017a; UN General Assembly, 2000). They serve as eight time-bound targets, that share a common emphasis on poverty reduction. Their deadline was set on 2015. In that year they were replaced by the SDGs (UN, 2017b; UN General Assembly, 2015). The latter consist of seventeen different time-bound targets with a deadline set on 2030. The SDGs explicitly put the poverty and environmental agenda on equal footing.

Both MDGs and SDGs can be applied to the green-economic thinking[50], as they incorporate both the ecologic and socioeconomic dimension of the green economy (UN General Assembly, 2000 & 2015). Yet, they also aim to enhance certain aspect of society that are not explicitly mentioned in green-economic academic literature, and are consequently not fit for purpose as a green-economic

[49] Cf. annex 2.

[50] The GGBP (2014) confirms this statement as concerns the MDGs.

evaluation framework[51]. The MDGs, for instance, strive to improve maternal health (UN General Assembly, 2000), whereas the SDGs aim to realise "*gender equality and the empowerment of women and girls*" (UN, 2017b, p. 6/35). Both MDGs and SDGs, furthermore, aren't really shaped as indices, but as aggregated dashboard, and they do not serve well for communicative purposes. That is to say, if one acknowledges that less is more, and eight (and seventeen) indicators are too difficult to communicate.

1.3.1.2. GGEI

The GGEI is – as the name suggests – a performance index based on green-economic thinking (Dual Citizen LLC, 2016). It covers eighty countries, including all EU member states, and compromises twenty-four indicators (Dual Citizen LLC, 2017), divided over four dimensions. The dimensions are 'leadership & climate change,' 'efficiency sectors,' 'markets & investment' and 'the environment' (Dual Citizen LLC, 2016 & 2017). Next to the GGEI Performance Index, Dual Citizen LLC also publishes a Perception Index (Dual Citizen LLC, 2016).

From a theoretical perspective, the GGEI is inherently flawed. Nonetheless, its main weakness is its methodology. This is, first and foremost, due to the fact that the index oversimplifies and overgeneralises green-economic policy. Despite its importance (cf. supra) energy performance is, for instance, reduced to a single sub-indicator, i.e. "*Renewable electricity as a percentage of national total*" (Dual Citizen LLC, 2016, p. 29). Secondly, the arbitrary build of the framework and the selection of the indicators make the index feel random – to say the least. Yet again, the energy performance indicator stands as a good example, for it has the same weight as other indicators, such as tourism, that are arguable far less essential to the green-economic transition. Thirdly, the GGEI comes with some questionable usage of subjective indicators. The sub-indicators 'Head of State's advocacy for green issues,' 'Positive media coverage of national green economy,' and 'National positions & statements in international forums,' for instance, make up fifty percent of the 'Leader & Climate Change' category. This is quite ironic given that the accompanying GGEI report indicates that "*often the commitments and targets communicated by leaders do not match the reality*" (Dual Citizen LLC, 2016, p. 3).

[51] The fact that these objectives are not part of the green-economic core thinking does not make them less important, it simply makes them less policy relevant (cf. supra) from a green-economic policy perspective.

1.3.1.3. EPI, CPI & SPI

"*The Environmental Performance Index (environment), the Climate Change Performance Index (climate) and the Social Progress Index (social) are three examples of other indices that provide more in-depth coverage of topics also addressed in the GGEI*" (Dual Citizen LLC, 2016, p. 13). All three indices namely incorporate a certain aspect that is vital to the green-economic (energy) transition. Nonetheless, an encompassing index that takes the three indices together, would not be optimal. A number of reasons exist. One of them is the given that their methodologies don't correspond (cf. infra.). Another reason is that all three indices are somewhat flawed (cf. infra).

EPI, firstly, encompasses a hundred and eighty countries and ranks them according to their performance on protecting ecosystems and human health (Hsu, 2016). The protection of ecosystems is measured among six different issue categories, whereas the protection of human health counts three categories. Most categories consist of one or two indicators; two categories consist of four and five indicators, respectively. The 'Climate & Energy' category has, for instance, two indicators: the trend in carbon intensity, and the trend in carbon intensity per kWh. As such, the main issue with this performance index is the fact that it is methodologically complicated, and theoretically oversimplified.

The CCPI, secondly, examines fifty-eight countries and ranks them according to their performance on climate change policy (Bals, Burck, Dertinger, Marten, & Uhlich, 2016). Eighty percent of the evaluation is based on fifteen objective indicators, while the remaining twenty percent is based on the judgement of two hundred and eighty experts. Two major concerns here are the subjective nature of the index and the political agenda of its creators. The fact that one fifth of a countries' final score is decided on by local experts, impairs the otherwise solid methodology. This given is especially concerning in reference to the index itself, as its first three positions are left vacant because "*No country is doing enough to prevent dangerous climate change*" (Bals, et al., 2016, p. 12).

The SPI, finally, takes a hundred and twenty-eight countries into consideration and ranks them according to their performance on what the authors define as social progress, i.e. "*the capacity of a society to meet the basic human needs of its citizens, establish the building blocks that allow citizens and communities to enhance and sustain the quality of their lives, and create the conditions for all individuals to reach their full potential*" (Green, Porter, & Stern, 2017, p. 15). Correspondingly, the index framework consists of three dimensions (Green, et al., 2017). Each dimension is further divided into four categories. All taken together, these categories consist of fifty indicators. In general, there are little or no concerns of note to this index. In the setting provided by this master thesis, exclusively the fact that the index only slightly corresponds to green-economic thinking, is problematic.

1.3.1.4. Energy indices

Energy security indices are widely available in academic literature (Narula & Reddy, 2015). In a recent study Narula & Reddy (2015) named fifteen of these indices, and identified many more. They argue that the majority of these indices fail to take account of all energy security dimensions[52]. Environmental and social aspect are, for instance, neglected in favour of the economic ones. This has them reasoning that while "*the ranking from each of the variants of the index is correct, they only give a part of the picture and not the whole picture. Hence, it may be concluded that basing the assessment of a country's performance in attaining energy security and sustainability, on the score obtained in one specific study may not be accurate*" (Narula & Reddy, 2015, p. 155).

[52] To support their reasoning Narula & Reddy (2015) compared the ESI, the IIESR and the EAPI.

1.3.2. Informal

What is called the 'leader-laggard dynamic' is the notion that the variations "*in the speed and level of development of environmental policies in different countries*" have an effect on the international level (Arts, Kamstra, Liefferink, & Ooijevaar, 2009, p. 679). This effect can be described as a pull-effect, as leader are supposed to pull laggards towards the implementation of more environmentally friendly policy, and can partly be explained by the influence leaders have due to their role-model status[53]. Andersen & Liefferink (1997, pp. 3-4), hence, argue: *"Examples and models of solutions and strategies have traditionally played a significant role in environmental policy making, both at the domestic and international level*."

Whatever the underlying explanation of the effect may be, a rather consistent division of leaders and laggards within the EU is apparent. A group of North-Western member states, i.e. Germany[54], the Netherlands, Denmark, Sweden, Austria, (and Finland), is usually nominated as the group of pioneers or leaders[55] (Andersen & Liefferink, 1997 & 1998; Arts, et al., 2009; McCormick, et al., 2015). On the opposite side of the chart, the (Central and) Eastern member states[56] (Andersen & Liefferink, 1998; Arts, et al., 2009) and most Mediterranean countries (Arts, et al., 2009) are deemed to be lagging. The remaining member states are supposedly somewhere in the middle.

"*One may wonder, however, why certain countries are actually 'ahead of others' in environmental policy*." Arts et al. (2009, p. 678) note. All wonder aside, the remainder of this sub-section discusses three of those reasons, and argues that because of those reasons the leader-laggard dynamic is inadequate in its current condition.

[53] The pull-effect can also be achieved "*through regulatory competition" or "by stimulating international regulation*" (Arts, et al., 2009, p. 677).
[54] Concerning successful ecologic energy policy, Germany is arguably the most studied case (Borgnäs, 2016; Buzogány & Ćetković, 2016).
[55] This corresponds comparatively well with the EU member state that are put forward by the formal indices. That is to say that Germany, Denmark, Sweden, the UK, the Netherlands and Finland are in the GGEI's top ten performing countries (Dual Citizen LLC, 2016); France, Sweden, the UK, Cyprus, Luxembourg, Malta and France are in the CCPI's top ten performing countries (Bals, et al., 2016); Finland, Sweden, Denmark, Slovenia, Spain, Portugal, Estonia, Malta and France are in the EPI's top ten performing countries (Hsu, 2016); Denmark, Finland, the Netherlands, Sweden, Ireland, the UK, Germany and Austria are among the SPI-countries that are described as having 'very high social progress' (Green, et al., 2017).
[56] Buzogány & Ćetković (2016, p. 643) note that the "*position of the east-central European countries in EU climate and energy policy is hotly debated but theoretically still poorly understood*."

1.3.2.1. Conservative view on environmental policy

Firstly, the green leader-laggard dynamic is founded on a conservative notion of environmental policy. The self-evidence of this reasoning perhaps motivates why this isn't explicitly noted in any of the sources attended by this literary study. Just the same, it is remarkable how none of the texts that were part of the literary study acknowledged the socioeconomic dimension to being an environmental leader or laggard. From a green-economic perspective this is major demerit to the leader-laggard dynamic.

1.3.2.2. Perception of international performance

Secondly, the green leader-laggard dynamic appears to be mainly based on the perception of international performance (Agrawala & Andresen, 2002; Arts, et al., 2009). This is unfortunate because international reputations and commitments don't necessarily correspond with domestic performances (Arts, et al., 2009; Benitez-Capistros, et al., 2014; Dual Citizen LLC, 2016). Some countries are internally ambitious but choose not to translate this ambition externally, while others are motivated to act as an international leader despite their domestic performance[57] (Arts, et al., 2009). A reputation can also be "*based on a fairly limited number of specific, strongly politicized issues," whereas "Policies in other fields may be less heroic*" (Arts, et al., 2009, p. 689). The gap between words and deeds is furthermore growing (Benitez-Capistros, et al., 2014).

1.3.2.3. Dynamic nature of ecologic policy

Lastly, the roles countries assume on the leader-laggard axis are dynamic (Agrawala & Andresen, 2002), and the leader-laggard dynamic ironically fails to acknowledge this. A country may lead one phase of international negotiations and lag in the next (Agrawala & Andresen, 2002). Domestic environmental performances too vary over time (Arts, et al., 2009), as well as between sectors[58] and dimensions[59] (Dual Citizen LLC, 2016).

[57] "*On the one hand, strict international measures lead to the reduction of transboundary flows of pollution and thus contribute to achieving national environmental policy goals. On the other hand, competitive disadvantages for industry in the 'pioneer' countries will diminish if others have to take similarly costly measures*" (Andersen & Liefferink, 1998, p. 1350).

[58] E.g. in a given country the share of renewable energy in total energy production and the emissions of carbon in the transport sector can increase simultaneously (Dual Citizen LLC, 2016).

[59] E.g. a country "*where interventions around the environment may yield positive results, yet rapid growth without efficiency improvements increase emissions and adverse social impacts like air pollution*" (Dual Citizen LLC, 2016, p. 24).

“Policymaking and planning require a clear understanding of where we stand today and how we are progressing.”

– EEA, 2013b, p. 5 –

2. Methodology: The realisation of the GEEEI

What follows in this master thesis' second chapter is the formulation of an alternative and new evaluation framework. This GEEEI aims to address the methodological fallacies that are inherent to the existing indices, while incorporating the green economy and energy security concerns which the EU abides. The index consists of two sub-indices, i.e. $GEEEI_{Eco}$ and $GEEEI_{Soc}$, that incorporate the ecologic dimension and the socioeconomic dimension of the green economy, respectively. The first section of this chapter elaborates on the design of the framework and index, while the second section expounds on the indicators that have been chosen. The concluding section sums up the merits and demerits of this new index. As such, this chapter – as a whole – aims to address the transparency concern of developing and applying an indicator-based evaluation framework. None of the methodological choice presented here, are left unmotivated or without proper context[60]. Experts, furthermore, make up this chapter's target audience.

[60] As most of this context is presented in the master thesis' first chapter, this second chapter will refrain itself from going into detail too much. Literary references will, moreover, only be provided when new information is presented. Accordingly, the entirety of this second chapter should be read under a 'cf. supra' denominator.

2.1. Design

The following section consists of two subsections. The first subsection introduces a methodological handbook of note, as well an academic work that served as inspiration to the GEEEI. The second subsection follows through on those methodological best practices by discussing the GEEEI's overarching structure.

2.1.1. Best framework practices

It would be rather ironic to present a novel evaluation framework in aid of the quest for best policy practices, without any reference to best methodology practices. It's a mistake that was not made in the build-up of the GEEEI framework. To the contrary, a great variety of methodological handbooks and studies[61], existing frameworks and indexes[62] (cf. supra) were consulted. Two of these sources of inspiration and knowledge deserve particular attention.

The study by Mundaca & Richter (2015), firstly, served as the primary inspiration for the development of the GEEEI, back at a time when the literary study was still in its exploratory phase. The study presents itself as an evaluation of the green-economic stimulus policies that target renewable energies in the USA, and has a methodological configuration and a selection of indicators that are – not coinsidently – comparable to those of the GEEEI.

The handbook on constructing composite indicators that the OECD (2008) published , secondly, served as a roadmap for the development of the GEEEI subindices, i.e. $GEEEI_{Eco}$ and $GEEEI_{Soc}$. The handbook presents itself as a methodological manual and discribes a preferable sequence of ten steps. The GEEEI has been established according to those ten steps.

[61] Cf. annex 3.
[62] Cf. annex 2.

2.1.2. Methodological configuration

The GEEEI is both a conceptual and a utility framework, and as such, aims to both provide structure, technical definitions and linkages, as well as convey a clear message to policymakers and scholars interested in providing policymaking inspiration. While the latter function is dominant in the third and final chapter, the former is central to the remainder of this chapter. What follows in this subsection is the construction and the reasoning behind the construction of the GEEEI evaluation framework, its selection of indicator types, its selection of data, and its lack of stakeholder involvement, respectively.

2.1.2.1. Framework

Much in line with the evaluation performed by Mundaca & Richter (2015)[63] and general green-economic thinking, the GEEEI[64] compromises two dimensions, i.e. an ecologic dimension and a socioeconomic dimension. Each of these dimensions is presented in the form of a sub-index that aims to incorporate ten indicators: the $GEEEI_{Eco}$ encompasses eight (and potentially ten) indicators that evaluate ecologic energy performance, whereas the $GEEEI_{Soc}$ consists of ten indicators that evaluate socioeconomic energy performance[65]. Each of the twenty-eight European member states is evaluated according to these sub-indices[66], and scoreboards are set-up for each of the indicators[67].

– Why? – Given that it can be argued that both green-economic and energy security concerns are made up of ecological and socioeconomic components, firstly, a framework division into these two dimensions not only feels natural but also adds to its transparency. Secondly, the fact that both dimensions aim to share the same number of indicators stems from the green-economic belief that both are intrinsically linked, and therefore, equally important. Thirdly, the choice to have both indicator sets compromise ten indicators, making a total of twenty indicators, is in line with the current academic practice. It, moreover, allows for a sound examination without adding too much complexity. That all European member states are incorporated into the examination, fourthly, stems from the desire to be thorough and complete. The decision to establish a dashboard for each member state and a scoreboard for each indicator, lastly, adds to transparency and makes more profound communication possible.

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[63] Mundaca & Richter's (2015) third dimension, i.e. 'the Energy dimension,' is within the GEEEI framework incorporated into the other two dimensions, as a clear distinction could be made between the energy indicators that have an ecologic nature and those that have a socioeconomic one.
[64] Cf. annex 4 and 5.
[65] Cf. annex 6 and 7.
[66] Cf. annex 8.
[67] Cf. annex 9.

For each dimension or sub-index a composite indicator or overall score is constructed. All indicators are normalised and given a score according to the min-max method[68], "*where positioning is in relation to the global maximum and minimum and the index takes values between 0 (laggard) and 100 (leader)*" (Freudenberg, 2003, p. 10). Given that all indicators share equal weight, a member states' composite score equals to the average of its indicator scores in that dimension. As all indicator scores are between zero and a hundred, this too is the case for the composite indicator.

– Why? – The establishment of a synthetic indicator, firstly, comes with many different advantages. Secondly, in this case it also makes even more profound communication possible. The decision to apply the min-max method to normalise the indicators, thirdly, stems from the conviction that the GEEEI should represent as clear-cut as possible which member states lead and which ones lag. Fourthly, the option that all indicators share equal weight, stems from the belief that all green-economic and energy security concerns are equally important. Lastly, the choice to take the average of the normalised and weighted indicator scores as the composite indicator score, follows naturally from the equal weighting. It also adds to the transparency of the composite indicator as it makes the impact of a change in a single indicator score more evident[69]. Both the weighting and the formula are, furthermore, in line with common methodologic practice.

As a final step, the two sub-index composite scores are aggregated into a GEEEI overall score. Given that both sub-index composite indicators are expressed as a percentage, normalisation isn't required. Both indicators, furthermore, share equal weights again, making a member states' GEEEI-score equal to the average of its $GEEEI_{Eco}$-score and $GEEEI_{Soc}$-score.

– Why? – One the one hand, the proper ranking of the member states' green-economic energy policy performances is only possible when a single overall performance indicator is established. The existence of the latter makes it, furthermore, easier to communicate on country performances, and allows countries to be represented as 'Country X (GEEEI-score: $GEEEI_{Eco}$-score/$GEEEI_{Soc}$-score)[70]'. On the other hand, the provided contextual information reduces the likelihood of this overall aggregated indicator being abused or misused.

[68] As such, a member state's score on a particular indicator can be calculated as "*100*(actual value - minimum value)/(maximum value - minimum value)*" (Freudenberg, 2003, p. 10).

[69] E.g. if a particular indicator score is reduced by twenty percentiles, the overall score is reduced by two percentiles.

[70] E.g. Belgium has a total GEEEI-score of 45,5, while its $GEEEI_{Eco}$-score and $GEEEI_{Soc}$-score are 46,3 and 44,7 respectively. Therefore Belgium will be noted as 'Belgium (45,5: 46,3/44,7)'.

2.1.2.2. Indicators

As was presented earlier, selecting indicators is about making choices, and deciding between a great variety of indicator types. Some of these type dichotomies are truly incompatible, while others can (and are meant to) be used simultaneously. Headline and detailed indicators are, firstly, an example of the latter, and are therefore both incorporated into the GEEEI framework. It's, more precisely, the twenty basic indicators that make up the detailed indicators, while the two composite indicators and the overall aggregated indicator can be described as headline indicators. This way the GEEEI is both detailed, transparent and easy to communicate. Likewise, the GEEEI indicators can be described as both descriptive and normative. They are primarily normative in nature, as they aim to evaluate policy performance through the comparison with other country's policy performances. Nonetheless, they are also descriptive, in the sense that the basic indicator value is also presented[71]. Finally, the distinction between system and agency indicators isn't really clear-cut within the GEEEI framework. Explicitly only a few agency indicators have been applied, yet the implicit notion behind the build-up of the framework is that governmental (in)action has an important role to play in the other indicators as well.

Regarding the other type dichotomies, the GEEEI framework has made a deliberate decision. Spatial indicators are, firstly, applied because the framework aims to compare countries and not a particular country over time. As the framework translates policy performances as 'policy results' these indicators are, secondly, ex post and not ex ante. Thirdly, the GEEEI indicators have a distinct top-down nature, as theory and academic literature served as inspiration and not stakeholder engagement, thus enabling the establishment of a framework that is in line with theory. Fourthly and very importantly, all applied indicators are both quantitative and objective. The objectivity of the indicators follows from what is one of the main arguments presented in this master thesis, i.e. subjectivity leads to inaccuracy. Consequentially, there are quantitative because, on the one hand, green-economic thinking is predominantly translated into market-based instruments, and on the other hand, the use of qualitative indicators wouldn't be adequate in the context of this master thesis. The latter is true given that no objective yet qualitative indicator that was relevant here, was encountered during the literary study. Finally, all but one indicators that are applied, can be classified as direct indicators, due to the preferability of the latter type of indicators.

[71] The three synthetic indicators are the exception here.

2.1.2.3. Data

The GEEEI is the result of an intensive process of selecting and collecting data. The evidence is fourfold.

The process, firstly, involved three stages of data research. The earliest stage consisted of a survey of a great deal of indicator sets and databases, many of which not included in this master thesis. Well-known examples of the latter are the OECD database, the IEA database and the EIO database[72]. The overarching aim of this survey was to conceptualise what qualitative and recent data was available. Once this understanding was established and the GEEEI-indicators were assembled, the required data was then selected. During the final stage all data was revised and updated.

Secondly, the decision was made not to base the GEEEI on the data available for a particular year, but to use the most recent data available. This in line with the index' overarching ambition to serve as the scientific foundation for future research on best energy policy practices. Because of this arrangement, the two indicators on the average price per unit of energy apply to the second half of 2016, whereas the patent-indicator refers to the period 2008-2015, and the energy accessibility indicator to the year 2014. All other indicators apply to the year 2015.

Thirdly, data was deliberately retrieved as close to the political source as possible to guarantee its reliance. The EU (2017) country by country data overview served as a main source, as nine different indicators supported solely on the data presented in this overview. Data from the EU (2017) and WIPO[73] (2017b) was, furthermore, combined for the patent-data. The Eurostat database[74] and EurObserv'ER (2016) accounted for, respectively, four and three indicators. Data from both sources was combined to measure the values of one additional indicator. The World Bank, lastly, supplied data for the energy access-indicator. As such, apart from the EurObserv'ER data[75], all data is provided by organisations the EU member states are engaged in.

Finally, two indicators were integrated into the GEEEI framework despite the lack of relevant data. This was done consciously as these indicators arguably constitute the essence of green economic thinking: favour what is desired, burden what is undesired. The goal of this master thesis is, furthermore, to enhance scholarly understanding of best practices and evaluations, not to supply a perfect index.

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[72] See https://stats.oecd.org, https://www.eea.europa.eu/data-and-maps, and http://www.eco-innovation.eu, respectively.

[73] WIPO is a UN agency that serves as "*the global forum for intellectual property services, policy, information and cooperation*" (WIPO, 2017a).

[74] See http://ec.europa.eu/eurostat/data/database.

[75] A recent EU-funded study confirms the reliability of the EurObserv'ER data (EurObserv'ER, 2017).

2.1.2.4. Stakeholders

That the GEEEI is by no means perfect, is adequately reflected in the fact that no stakeholders were engaged during the design of the GEEEI framework, the selection of its indicators, or the reflection on its outcomes. This was, however, not due to a lack of intent. The original idea was to involve stakeholders in every phase of the process. A lack of time and resources prevented this plan from being executed.

2.2. Indicator set

This second section compromises twee subsections, that coincide with the two dimensions that are part of the GEEEI. The first subsection introduces the indicators that are or should be incorporated into the ecologic dimension. Accordingly, the second subsection elaborates on the socioeconomic dimension. The indicators are discussed and put into context, thus justifying their application. Their measurement units are also mentioned. As stands out, all of the latter are relative in nature. That is to say that they are either a percentage or compared to the respective member states' population or GDP. This is to ensure the indicators' comparability.

2.2.1. Ecologic dimension

As presented in the sixth annex, the $GEEEI_{Eco}$ aims to incorporate the following ten indicators.

2.2.1.1. Gross inland energy consumption

From an ecologic perspective, it's important that energy is consumed efficiently. The less energy the population of a member state consumes, the better. This first indicator incorporates this idea and measures how much energy a member state consumes per capita. The applied measurement unit is 'tonne of oil equivalent per capita'. Member states earn a higher score as they consume less energy.

It's important, however, to underscore here what is meant by 'consuming'. Gross inland energy consumption "*is the total energy demand of a country or region. It represents the quantity of energy necessary to satisfy inland consumption of the geographical entity under consideration*" (Eurostat, 2013), whereas final energy consumption can be described as "*the total energy consumed by end users, such as households, industry and agriculture. It is the energy which reaches the final consumer's door and excludes that which is used by the energy sector itself*" (Eurostat, 2012). It's the former that is applied here, as it has a broader scope than the latter.

2.2.1.2. Gross inland renewable energy consumption

This indicator reflects the green-economic logic that countries should consume as little as possible (read: as efficient as possible), and replace whatever energy they do consume with renewable alternatives. As such, this indicator doesn't measure how much renewable energy is consumed per capita, but how much of the consumed energy is renewable. It's, accordingly, about consuming better, not more. The applied measurement unit is 'percentage'. Member states earn a higher score as they consume relatively more renewable energy in comparison to their gross inland energy consumption.

2.2.1.3. CO_2-intensity

Of all GHG-emissions CO_2-emissions deserve special attention due to their central role in the development and mitigation of climate change (Eurostat, 2016). This indicator therefore aims to measure the amount of CO_2 that member states emit in relation to their GDP. The unit of measurement is 'gram per unit of GDP[76]'. Member states earn a higher score as they emit less CO_2. The fact that the emissions are compared to a member state's GDP instead of its population, stems from the efficiency aspirations that are inherent to green-economic thinking: doing economically more with less.

2.2.1.4. GHG-intensity

Despite the protagonist role ascribed to CO_2, a green economy also aims to mitigate the emission of other GHG's (Eurostat, 2016). In accordance with the previous indicator, this indicator, therefore, measures the amount of GHG's, other than CO_2[77], that member states emit in relation to their GDP. The unit of measurement is 'CO_2-equivalent gram per unit of GDP[78]'. Other than that, the same reasoning applies to this indicator, as did to the previous one.

2.2.1.5. Fossil fuel taxation-intensity

Following from the green-economic rationale that (economic) policies should facilitate what is desirable, and burden what is undesirable, comes the belief that fossil fuels should be taxed (McCormick, et al., 2015). Correspondingly, this indicator evaluates how intensively the member states are doing this, in comparison to their overall GDP. The unit of measurement is thus 'percentage'. Member states earn a higher score as they tax fossil fuels more intensively. A comparison with the member states' GDP's is preferred over one with their populations because of the economic nature of fossil fuel taxation.

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[76] Within this framework 'GDP' stands for 'GDP in euro's at the 2010 exchange rates'.
[77] E.g. nitrous oxide, methane and fluorinated gases (Eurostat, 2016).
[78] "*The aggregate of GHGs is often measured in CO_2 equivalents to make the data comparable*" (Eurostat, 2016, p. 88).

2.2.1.6. Energy generation market openness

According to the European vision on a green economy, energy markets need to be open to competition for a green-economic transition to be possible. One way to evaluate this openness is to calculate the dominance of the most important market players. That is exactly what this indicator does, as it indicates the magnitude of the cumulative share in the electricity generation market of those energy producing entities that have an individual market share above five percent. The unit of measurement is thus 'percentage'. Member states earn a higher score as the cumulative market share of the most important market players is smaller.

The decision to evaluate, firstly, the electricity market and not, for instance, the gas market is due to the given that renewable energy production in Europe is predominantly a matter of the former energy market (EC, 2014). Secondly, it would go beyond the scope of this paper to evaluate more than one energy market.

2.2.1.7. Non-renewable energy imports

From an ecologic perspective, the import of non-renewable energy is counterproductive, as it reduces the amount of emissions that are emitted within the importing country, without reducing the overall amount of emissions (Focken, 2015). Emissions are thus simply outsourced instead of reduced. This makes non-renewable energy imports highly deceiving. This indicator addresses how intensively the member states are importing non-renewable energy. The unit of measurement is 'micro-tonne of oil equivalent per unit of GDP'. Member states earn a higher score as they import relatively less non-renewable energy.

2.2.1.8. Energy- and environment-related patents

Evaluating the number of green-economic patents that the member states enjoy is important, as patents "*play a key role throughout the technology life cycle and act as an engine for technological innovation*[79]" (Isaka, 2013, p. 5). They also serve to forecast innovation in a given country. Unfortunately, however, no data is available on renewable energy patents that allows the effective distribution of these patents according to the respective patent applicants' member states of origin.

[79] "*Innovation is essential for the accelerated deployment of renewable energy technologies […] that will play a key role in addressing the issues of energy security, energy access and climate change*" (Isaka, 2013, p. 7).

This indicator, therefore, serves as a proxy indicator. It distributes the overall energy- and environment-related patents that were granted between 2008 and 2015, according to the respective patent applicants' member states of origin, and compares the member states' respective total to their 2015 GDP. The unit of measurement is 'number of patents per billion units of 2015 GDP'. Member states earn a higher score as they enjoy relatively more patents. A comparison with the member states' GDP's is preferred over one with their populations because of the economic nature of patents.

2.2.1.9. Renewable energy investment-intensity

The proliferation of renewable energy technologies, production and consumption is one of the main pillars of the green-economic transition. Consequentially, member states should invest in it. This indicator aims to measure how intensively they are doing this, in comparison to their overall GDP. The unit of measurement is thus 'percentage'. Member states earn a higher score as they invest relatively more in renewable energy. A comparison with the member states' GDP's is preferred over one with their populations because of the economic nature of these investments.

Unfortunately, no reliable data was available on this indicator.

2.2.1.10. Non-renewable energy investment-intensity

"*Subsidies [for fossil fuels] conflict with sound energy policies in two ways: first, they are expensive, diverting needed public and private funds from other priorities; and second, the subsidized activities often directly harm environmental quality*" (Victor, 2009, p. 9). Therefore, the need to confine the investment in non-renewable energy can also be said to constitute one the main pillars of the green-economic transition[80]. This indicator aims to measure how intensively member states are still investing in non-renewable energies, in comparison to their overall GDP. Again, the unit of measurement is thus 'percentage'. Member states earn a higher score as they invest relatively less in non-renewable energy. Yet again, a comparison with the member states' GDP's is preferred over one with their populations because of the economic nature of these investments.

Unfortunately, no reliable data was available on this indicator either.

[80] A variety of policy experts argue that subsidy reform is the first step towards a proper energy policy (Victor, 2009).

2.2.2. Socioeconomic dimension

As presented in the seventh annex, the $GEEEI_{Soc}$ incorporates the following ten indicators.

2.2.2.1. Gross final energy consumption-intensity

From an economic perspective, it's equally important that energy is consumed efficiently and with consideration. More energy consumption namely means more energy expenses (EC, 2015). This first economic indicator incorporates this idea and measures how much energy a member state consumes per unit of GDP. The applied measurement unit is 'tonne of oil equivalent per unit of GDP'. Member states earn a higher score as they consume less energy.

2.2.2.2. vRE-flexible capacity

Renewable forms of energy are sometimes volatile[81] (EurObserv'ER, 2016). Therefore, an increase in their market share should go hand in hand with more profound security measures, that can address a sudden change in the supply-demand-balance. EurObserv'ER introduced an indicator to evaluate the capacities of these measures, and called it the 'vRE-flexible capacity'. It "*displays how many times flexible capacities (share of gas, oil, lignite, coal, biomass fired plants and nuclear power capacities with ramp-up times of max. 15 min) could compensate unexpected short-term decreases in vRE generation. A value below one signalizes that a fraction of a hypothetical 100% vRE shortfall could be balanced within 15 min while a value above one ensures a complete compensation potential*" (EurObserv'ER, 2016, p. 247). Member states earn a higher score as they have more capacity to compensate changes in vRE supply.

2.2.2.3. Energy accessibility

Energy accessibility is essential in an economy that aims to be green and energy secure. This indicator measures the energy accessibility in a member state as the percentage of the latter's population that has access to energy. The unit of measurement is thus 'percentage'. Member states earn a higher score as a greater share of their respective population has access to energy.

[81] E.g. wind energy and solar power.

2.2.2.4. Energy availability

Energy availability is another aspect of a green and energy secure economy. This indicator measures the energy availability of a member state as the amount of energy available for final energy consumption in comparison to the member state's population. The measurement unit is 'tonne of oil equivalent per capita'. Member states earn a higher score as more energy is available to their respective populations.

2.2.2.5. Estimated average electricity unit cost

Green-economic thinking suggests that energy prices, on the one hand, are ought to reflect the true (environmental) cost of energy. On the other hand, however, a major energy security concern is the impediment of growth or the establishment of human welfare by excessive energy prices (Ang et al., 2015). This indicator estimates the average cost of electricity[82] by taking the average of the different electricity prices a member state incurs. Consumer and industrial prices are given the same treatment[83]. The measurement unit is 'price in euros per kilowatt hour'. Member states earn a higher score as electricity comes at a lower estimated average price.

2.2.2.6. Estimated average gas unit cost

Because "*natural gas is the cleanest of the fossil fuels*" it is often considered to be a viable alternative to coal and oil (Austvik, 2016, p. 379). In accordance with previous indicator, this indicator estimates the average cost of gas by taking the average of the different gas prices a member state incurs. Again, consumer and industrial prices are given the same treatment[84]. The measurement unit is 'price in euros per kilowatt hour'. Member states earn a higher score as gas comes at a lower estimated average price.

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[82] Cf. article 2.2.1.6. on the importance of electricity in a green economy.

[83] Due to a lack of reliable data for most member states, the industrial electricity prices for consumption over fifteen hundred thousand megawatt hour are not included in the calculation.

[84] Due to a lack of reliable data for most member states, the industrial gas prices for consumption over four million megawatt hour are not included in the calculation.

2.2.2.7. Energy dependence

A green and energy secure economy is an economy that isn't dependent on other countries for its energy supply. This indicator measures this dependence as the member states' net imports divided by the sum of their respective gross inland energy consumption plus a five percent bunker. The measurement unit is 'percentage'. Member states earn a higher score as they rely less on imports for their energy supply.

2.2.2.8. Renewable energy exports

Green-economic thinking suggests that renewable energy is not only of great interest from an ecologic point of view, but also from an economic one. Renewable energy exports showcase this suggestion perfectly, as it not only furthers the exporting country's economic cause but also the ecologic cause of the importing country. This indicator measures how much renewable energy is exported by the member states in comparison to their respective GDPs. The measurement unit is 'micro-tonne of oil equivalent per unit of GDP'. Member states earn a higher score as they export relatively more renewable energy.

2.2.2.9. Renewable energy turnover

Following the previous indicator, this indicator indicates how economically profitable a member state's renewable energy turnover has been, by depicting it as a percentage of the country's GDP. The measurement unit is thus 'percentage'. Member states earn a higher score as they have a relatively higher turnover.

2.2.2.10. Green jobs

This final indicator is in accordance with the two previous indicators, and in line with the green-economic belief that a green energy transition will result in the creation of jobs. It shows how many citizens per thousand citizens are employed in so-called green jobs. The measurement unit is thus 'number of green jobs per thousand capita'. Member states earn a higher score as relatively more of their citizens are employed in green jobs.

2.3. Merits and demerits

Every evaluation framework and index has its own strengths and weaknesses. The GEEEI is no different. What follows are three of its merits and three of its demerits.

2.3.1. Merits

The first great merit to the GEEEI is its twofold innovative character. On the one hand, it compromises the first openly green-economic evaluation model that aims to be fully objectifiable. Therefore, it's arguably one of the few models that allows for the adequate comparison of ecologic policy in Europe. On the other hand, the GEEEI also has a unique nature thanks to its explicit linkage with best practices. Its framework is designed so that it serves the quest for best practices the best possible way.

The GEEEI's second major merit is its transparency. Both the framework and its indicators are contextualised, and no methodologic choice is left unmotivated. At the same time metainformation is provided for the experts, and knowledge is made accessible for those that lack the prerequisite competences that such experts have.

The final merit is the methodologic bravura of the GEEEI framework, as the latter does not shy away from controversy in its ambition to innovate. The min-max normalisation method is, for instance, applied to emphasize the leader-laggard dichotomy that is inherent to ecologic policymaking. The indicators themselves too serve to strike a balance between innovation and stability. The energy accessibility-indicator is, for instance, applied despite the given that member states share the same indicator value, and the vRE-flexible capacity is used despite is relative obscurity. Finally, it is deemed more important to select the right indicators than to select available indicators.

2.3.2. Demerits

The first demerit of the GEEEI is the given that the two indicators that lack data, make the whole look unbalanced, and perhaps even confusing, as the remaining ecologic indicators appear to have become relatively more important in comparison to their economic antecedents. Secondly, the GEEEI also has a certain elitist feel to it, due to the lack of stakeholder involvement. Finally, some of the methodological choices do have downsides. The min-max normalisation method is perhaps the most important example, as it weighs the performances of the very best and worst performing member states more heavily than the mediocre performances. Another example concerns the fact that the equal weighting of the indicators comes with the risk of double weighting resembling indicators (Freudenberg, 2003).

“Most users are interested in the basic message: do numbers bring ‘good’ or ‘bad’ news?”

– Eurostat, 2017h, p. 32 –

3. Reflection: The dissonance between the perceptions and the GEEEI

What follows in this master thesis' third and final chapter is a reflection on the GEEEI, in general, and on the latter's relation to the already exiting indices and leader-laggard dynamic, in particular. The chapter consists of four sections. The first section presents both the GEEEI and its sub-indices, i.e. $GEEEI_{Eco}$ and $GEEEI_{Soc}$, and discusses them in a general fashion. The three sections that follow, each focus on a particular research finding. Firstly, it is discussed how leadership is contested: some supposed laggards outperform so-called leaders. Secondly, it is argued that leadership is relative: on a specific indicator member states who lag in general can outperform those who lead in general. Finally, three methods of identifying best practice potential – through the use of the GEEEI – are presented.

Overall, this chapter has a dual purpose. On the one hand, it aims to underscore the importance of establishing a new evaluation framework, while on the other hand, it simply means to communicate this framework's findings. Both experts and non-experts, furthermore, make up this chapter's target audience.

3.1. Index overview

When ranking the EU member states according to their overall GEEEI-performance, the following scoreboard is established:

	Member State	GEEEI	$GEEEI_{Eco}$	$GEEEI_{Soc}$
	EU-28 Average	49,4	54,7	44,1
	EU-28 median	48,0	52,4	44,2
1	Denmark	67,8	76,8	58,8
2	Latvia	64,1	61,6	66,7
3	Finland	59,7	68,6	50,8
4	Sweden	58,3	70,8	45,8
5	Austria	58,0	71,2	44,8
6	Italy	57,1	72,3	41,9
7	Slovenia	54,0	64,2	43,8
8	Estonia	53,2	48,0	58,4
9	Poland	50,7	56,6	44,7
10	UK	50,6	57,4	43,8
11	Luxembourg	50,0	51,5	48,4
12	Romania	49,4	53,0	45,8
13	Germany	48,7	51,2	46,2
14	Hungary	48,2	50,8	45,7
15	Spain	47,8	56,1	39,4
16	Croatia	47,5	55,9	39,1
17	Netherlands	46,9	51,8	42,0
18	France	46,6	50,3	43,0
19	Czech Republic	46,6	47,4	45,9
20	Portugal	45,5	55,9	35,1
21	Belgium	45,5	46,3	44,7
22	Lithuania	45,0	41,5	48,6
23	Greece	44,3	55,5	33,2
24	Ireland	43,8	49,5	38,0
25	Slovakia	42,5	44,5	40,4
26	Malta	38,6	43,6	33,7
27	Cyprus	37,0	48,0	25,9
28	Bulgaria	36,0	31,3	40,8

When ranking the EU member states according to their ecologic and socioeconomic GEEEI-performances, the following scoreboards are established:

GEEEI$_{Eco}$		
Rank	Member State	Score
	EU-28 Average	54,7
	EU-28 median	52,4
1	Denmark	76,8
2	Italy	72,3
3	Austria	71,2
4	Sweden	70,8
5	Finland	68,6
6	Slovenia	64,2
7	Latvia	61,6
8	UK	57,4
9	Poland	56,6
10	Spain	56,1
11	Croatia	55,9
12	Portugal	55,9
13	Greece	55,5
14	Romania	53,0
15	Netherlands	51,8
16	Luxembourg	51,5
17	Germany	51,2
18	Hungary	50,8
19	France	50,3
20	Ireland	49,5
21	Cyprus	48,0
22	Estonia	48,0
23	Czech Republic	47,4
24	Belgium	46,3
25	Slovakia	44,5
26	Malta	43,6
27	Lithuania	41,5
28	Bulgaria	31,3

GEEEI$_{Soc}$		
Rank	Member State	Score
	EU-28 Average	44,1
	EU-28 Median	44,2
1	Latvia	66,7
2	Denmark	58,8
3	Estonia	58,4
4	Finland	50,8
5	Lithuania	48,6
6	Luxembourg	48,4
7	Germany	46,2
8	Czech Republic	45,9
9	Romania	45,8
10	Sweden	45,8
11	Hungary	45,7
12	Austria	44,8
13	Poland	44,7
14	Belgium	44,7
15	UK	43,8
16	Slovenia	43,8
17	France	43,0
18	Netherlands	42,0
19	Italy	41,9
20	Bulgaria	40,8
21	Slovakia	40,4
22	Spain	39,4
23	Croatia	39,1
24	Ireland	38,0
25	Portugal	35,1
26	Malta	33,7
27	Greece	33,2
28	Cyprus	25,9

Several observations can be made. First and foremost, Denmark[85] and Latvia[86] appear to be the unrivalled green-economic leaders. They divide not only the first two positions on the GEEEI between them, but also top the $GEEEI_{Eco}$ and $GEEEI_{Soc}$. They are also the only member states that have an overall score above sixty. Finland[87], Sweden[88], Austria[89] and Italy[90] are the other member states that earned themselves an overall score above fifty-five. This is largely due to their high scores on the $GEEEI_{Eco}$. They can also be said to assume leading positions, and to be deserving of academic interest.

Bulgaria[91], Cyprus[92], Malta[93], Slovakia[94] and Ireland[95], secondly, can be found at the bottom of the GEEEI. They are the only member states that both failed to earn an overall score above forty-five, and failed to exceed the average or median score in any of the three indices. Greece[96] and Lithuania[97] failed the former condition but succeeded in surpassing the $GEEEI_{Eco}$ and $GEEEI_{SOC}$ average and median scores, respectively. These countries are all arguably laggards.

Thirdly, the scores are conspicuously low, and as such, more in line with the CCPI (Bals, et al., 2016) and the GGEI (Dual Citizen LLC, 2016), than with the EPI (Hsu, 2016) and the SPI (Green, et al., 2017). This is largely due to the combination of the min-max method and the fact that, regarding several indicators, the leaders lead by a very large margin. As concerns the renewable energy consumption-indicator, for instance, Croatia[98] only has a score just above fifty, despite being the sixth best performing member state.

Finally, member states' performances aren't necessarily consistent across dimensions. That is to say that many member states perform much better or worse in one sub-index than they do in the other. Italy stands as a good example, as it received the second highest score in the $GEEEI_{Eco}$ but ends up on the nineteenth place in the $GEEEI_{Soc}$. The opposite is true for Estonia[99], which scores the twenty-second and third place, respectively.

[85] Denmark (67,8: 76,8/58,8)
[86] Latvia (64,1: 61,6/66,7)
[87] Finland (59,7: 68,6/50,8)
[88] Sweden (58,3: 70,8/45,8)
[89] Austria (58,0: 71,2/44,8)
[90] Italy (57,1: 72,3/41,9)
[91] Bulgaria (36,0: 31,3/40,8)
[92] Cyprus (37,0: 48,0/25,9)
[93] Malta (38,6: 43,6/33,7)
[94] Slovakia (42,5: 44,5/40,4)
[95] Ireland (43,8: 49,5/38,0)
[96] Greece (44,3: 55,5/33,2)
[97] Lithuania (45,0: 41,5/48,6)
[98] Croatia (47,5: 55,9/39,1)
[99] Estonia (53,2: 48,0/58,4)

3.2. Research finding 1: Leadership is contested

The existing image that a group of North-Western member states[100] unambiguously takes the lead in domestic ecologic policy, is false for a good number of reasons. Many of these reasons are presented above (cf. supra). The GEEEI, furthermore, adds to these reasons by pointing out that, regarding energy policy, this image simply doesn't correspond with the reality if green-economic thinking is applied.

Even when the socioeconomic dimension of a green economy is not taken into consideration, it becomes clear that some supposed leaders are not in the position to claim the leadership title, while other member states who are ought to lag, are actually in the lead. Three relevant categories of member states can be distinguished here. Firstly, there is Denmark[101], Austria[102], Sweden[103] and Finland[104]. These countries are not only ought to lead, but also actually do. All four of them are part of the five best performing member states, and comfortably earned a score that is well above sixty. The UK[105], the Netherlands[106] and Germany[107] make up the second category, i.e. the member states who were supposed to lead, but don't have the scores the support that reputation. The Netherlands and Germany are average performers. They rank fifteenth and seventeenth, respectively. The UK peaks at the eight place of the ranking but has a score that is already more than eleven points lower than the members of the first category. Finally and perhaps most importantly, there are those countries that are performing well above the expectations. Italy[108] is only second to Denmark, while Slovenia[109] and Latvia[110] earn scores well above the UK. Poland[111] is less than one point behind on the latter.

The corrected image alters when the socioeconomic dimension is taken into consideration, but its core message does not. The first category of countries continues to top the chart, together with Latvia, Italy and Slovenia. Germany and the Netherlands rank thirteenth and seventeenth, respectively. The UK ranks tenth and is surpassed by both Estonia[112] and Poland.

[100] When combining the insights provided by both the formal indices and the informal leader-laggard dynamic (cf. supra), this group consists of Austria, Denmark, Finland, Germany, the Netherlands, Sweden and the UK.
[101] Denmark (67,8: 76,8/58,8)
[102] Austria (58,0: 71,2/44,8)
[103] Sweden (58,3: 70,8/45,8)
[104] Finland (59,7: 68,6/50,8)
[105] UK (50,6: 57,4/43,8)
[106] Netherlands (46,9: 51,8/42,0)
[107] Germany (48,7: 51,2/46,2)
[108] Italy (57,1: 72,3/41,9)
[109] Slovenia (54,0: 64,2/43,8)
[110] Latvia (64,1: 61.6/66,7)
[111] Poland (50,7: 56,6/44,7)
[112] Estonia (53,2: 48,0/58,4)

When looking at the ten best performing EU member states, the comparison with the indices under scrutiny is striking[113]. Only six of the ten best performing countries in the GEEEI are included among the ten best performing EU member states in the EPI, five in the GGEI and SPI, and four in the CCPI. A common understanding between these indices and the GEEEI is the given that (some of) the Scandinavian countries are indeed ecologic leaders. Regarding the other EU member states, the visions differ. Some interesting cases are France, Germany, Italy and Poland.

France[114] and Germany[115], firstly, rank eighteenth and thirteenth, respectively, in the GEEEI and received mediocre scores on both dimensions. In fact, they only scored well on the energy price-indicators, the non-renewable energy import-indicator, and the consumption-intensity-indicator. Just the same France ranks eleventh in the SPI, ninth in the EPI, fifth in the GGEI, and even first in the CCPI. That the French diplomacy "*that facilitated the new international climate treaty was acknowledged by national climate experts and rewarded with a good performance in the international policy ranking*" (Bals, et al., 2016, p. 4) explains why France tops the CCPI and not the GEEEI. Germany has a more ambiguous situation. It ranks twenty-second in the EPI, twentieth in the CCPI, seventh in the SPI, and third in the GGEI. A similar German story can be identified in the GEEEI, as Germany ranks seventh in the socioeconomic dimension and only seventeenth in the ecologic one.

Italy[116], thirdly, ranks sixth in the GEEEI and second in the $GEEEI_{Eco}$, but only nineteenth in the $GEEEI_{Soc}$. Regarding the other indices, Italy ranks twenty-first in the EPI, sixteenth in the SPI, eleventh in the CCPI and seventh in the GGEI. As such, Italy's results are somewhat mixed. On one hand, its SPI-rank is similar to its $GEEEI_{Soc}$-rank, and its overall GEEEI-rank corresponds to its GGEI-rank. Yet, on the other hand, Italy's CCPI- and EPI-rank suggest that the country is by no means an ecologic leader. Italy hence remains to be a country worth investigating.

Poland[117], fourthly, ranks ninth in the GEEEI and $GEEEI_{Eco}$, and thirteenth in the $GEEEI_{Soc}$. It received slightly above-average scores on both dimensions. It's the absolute leader as concerns the energy market openness-indicator. Nevertheless, the other indices indicate that Poland is a true laggard, as it ranks twenty-seventh in the GGEI, twenty-sixth in the EPI, twenty-fifth in the GGEI and nineteenth in the SPI. Arguably this is due to the GEEEI's inclusion of European policy-related indicators.

[113] Cf. annex 2. All references to ranks, refer to this annex, and not to the original indices (which include non-EU countries as well).
[114] France (46,6: 50,3/43,0)
[115] Germany (48,7: 51,2/46,2)
[116] Italy (50,7: 56,6/44,7)
[117] Poland (50,7: 56,6/44,7)

3.3. Research finding 2: Leadership is relative

As noted above, the act of referring to a particular country as a 'leader' or a 'laggard' is in itself a questionable and controversial act, as it involves overgeneralising that state's characteristics and performances. The GEEEI therefore doesn't aim to provide any definitive conceptualisation or explanation whatsoever as to what defines a leader or a laggard. When either of two terms is used in reference to a member state or group of member states, this stands simply as an act of convenience: those at the top of an index or scoreboard lead, while those at the bottom lag[118].

For two good reasons it would, furthermore, be very hypocritical for this master thesis to reason out a concept as dichotomous and cloudy as a leader-laggard division. Firstly, this thesis builds upon the given that many evaluation indices and frameworks are misleading or inadequate. Overgeneralising the performances of the EU member states would thus go against its intent to learn from the mistakes of others, and be fully transparent and honest in the process. Secondly, the GEEEI itself proves that leadership is relative, as the scores not only vary between countries, but also between dimensions and indicators.

Only by looking at the scoreboards it becomes clear how relative leadership really is, as thirteen different member states top the ranking of at least one of the seventeen contested indicators[119]. Denmark, Latvia, Luxemburg and Sweden each account for two indicators, while the remaining number one spots go to Belgium, Estonia, Finland, Ireland, Poland, Romania, Slovenia, the UK, and even Bulgaria. What this means, is that neither Austria nor Italy top any indicator ranking, whereas three member states from the bottom half of the GEEEI do.

[118] In order to avoid numerical rankings, Narula & Reddy (2015, p. 155) opt "*to club countries which fall within a range of scores, together. Such an approach, which presents the results of country rankings into four quartiles (top 25%, 25-50%, 50-75% and bottom 25%),*" would rank Austria, Denmark, Finland, Italy, Latvia, Slovenia and Sweden among the leaders. Conversely, Bulgaria, Cyprus, Greece, Ireland, Lithuania, Malta and Slovakia would be appointed as laggards. As such, the results of this method correspond perfectly with the intuitive reasoning presented in subsection 3.1.1.

[119] The energy access-indicator is not included among these indicators because all member states earned a perfect score for this indicator.

3.4. Research finding 3: Best practices are all around

As noted above, green-economic leadership is relative. As such, it can be expected that best practices are all around, and not just visible among the 'best' performing countries. Given the GEEEI, three ways exist to examine which member state's policy might prove worthwhile to do research on.

The swiftest way to do so, firstly, is to interpret the overall or dimensional score of a given member state as an indicator that shows the likelihood of that particular country being an interesting case for best practice research. Denmark, for instance, then has a 67,8% chance of offering best green-economic policy practices in a certain energy policy area. The advantage to this method is hence its accessibility. Policymakers only need to have a quick glance at the GEEEI to get a picture of which international colleagues they can go to for advice.

The most targeted way of examining the potential of member states, secondly, is to consult the dashboards or scoreboards, and focus on one particular indicator. In the case of the fossil fuel taxation-intensity-indicator, for instance, this would make Slovenia, Greece and Italy the top contenders. This method can be advantageous when scholars or policymakers aim to investigate the exact circumstances that allowed for the set-up of a particular policy, the policymaking process behind that policy, the societal consequences of that policy, etc.

Lastly, there is also the holistic way of exploring best practice potential. This method implies that interested parties consult the dashboards or scoreboards, and combine the knowledge that several indicators provide. It is the preferred method when a broader analysis of energy policy is in order[120]. Accordingly, one might, for instance, investigate Denmark, Finland, Italy, Latvia and Sweden if the objective is to establish a generally solid set of green-economic energy policies. When the enquiry is confined to finding economically profitable green-economic energy practices, Denmark and Latvia alone might suffice. Conversely, the group of Belgium, Estonia, Latvia, Lithuania and Romania seems to be more adequate when the subjects of analysis are conservative energy security issues.

[120] It also corresponds perfectly with the master theses' presupposition that a combination of policy successes is required in order to be deemed successful from a green-economic perspective.

Conclusion

The master thesis' main point of departure is the conviction that the present-day search for best energy policy practices in the EU is both misguided and inefficient due to a lack of relevant and/or reliable indices and evaluation frameworks. Accordingly, its aim is to address this issue in a threefold way. The first chapter explains why the existing indices and frames are indeed inadequate. It offers a literary study on both the theory behind green-economic and energy security policy, and on the methodology behind evaluating those policies' performances. The second chapter then follows through on this argument by devising a new energy performance index and accompanying framework. The third chapter finalises the master thesis' exercise by discussing this GEEEI and by elaborating on three research findings. First, the contemporary perceptions of which countries lead and which ones lag, are corrected. Secondly, it is discussed why leadership is in itself a relative notion. Finally, three different methods on how to use the GEEEI to examine the best practice potential of European member states, are presented. As such, this master thesis arguably succeeds in both identifying and resolving a crucial political and political-scientific issue. Nonetheless, a variety of unresolved issues remain.

One of those issues relates to the relationship between energy security and green-economic concerns. As was noted above, a green economy should de facto address both, yet the GEEEI suggests that this isn't the case in reality. Latvia is in fact the only one of the seven best performing member states that can actually be accounted among the most energy secure ones (cf. supra). It notably ranks first in the $GEEEI_{Soc}$ and 'only' seventh in the $GEEEI_{Eco}$. The question thus remains whether a green economy also constitutes an energy secure economy. One hypothesis is that it simply does not; another could be that this lack of security is of a temporary nature and, as such, inherent to the green-economic development process. Either way, more research is needed as to why governments fail to enjoy the expected co-benefits.

Another concern relates to the explanatory factors. Why do both Austria and Finland, for instance, invest in environmental and energy-related patent development? Why does the latter excel the most? Are they merely investing more intensively or are other factors also at play? The GEEEI isn't capable of providing an answer to any of these questions. Yet, there are a variety of studies that (partly) do. "*In the literature, three political motivations for acting as a pioneer in environmental policy*," for instance, "*prevail: High domestic problem pressure and/or high domestic demand for 'green' policies […]. Creating a competitive advantage for domestic industry […]. Influencing future international legislation*" (Arts, et al., 2009, p. 678).

As to why countries opt for or excel in a certain policy appears to be more complicated. According to literature, a larger number of factors is to be at play here. Firstly, issue-related factors are, for instance, the seriousness of the ecologic problem or the perception thereof, and the availability of marketable technical solutions (Arts, et al., 2009). Country-specific factors, secondly, include the public acceptance of policies (Primova, 2015), the degree of economic development (Arts, et al., 2009; Harris & Roach, 2013), a country's geography (McCormick, et al., 2015), a specific combination of policies (Dupont & Oberthür, 2015a), the strength of the green advocacy coalition (Arts, et al., 2009), the administrative capacity of the government, the country's culture or dominant religion, and institutional structure, among others. Finally, other factors like the political will of the ruling class and external events too play their part.

In conclusion, it can be argued that this master thesis and ipso facto the GEEEI only constitute the first step in a three-step political-scientific process. It helps policymakers, scholars and other interested parties estimate which European member states come with the best and most suited energy practices, but nothing more. Analysing what these practices compromise, makes up the following step, whereas the final step features the examination of the factors that made these practices not only possible but also successful. As such, this master thesis – quite willingly – confines itself to laying the foundations for future research on energy policies in Europe.

Bibliography

- Agrawala, S., & Andresen, S. (2002). Leaders, pushers and laggards in the making of the climate regime. *Global Environmental Change*, 12, 41-51.

- Andersen, M. S., & Liefferink, D. (1997). Introduction: the impact of the pioneers on EU environmental policy. In M. S. Andersen, & D. Liefferink (Eds.), *European environmental policy: The pioneers* (pp. 1-36). Manchester & New York: Manchester University Press.

- Andersen, M. S., & Liefferink, D. (1998). Strategies of the 'green' member states in EU environmental policy-making. *Journal of European Public Policy*, 5(2), 254-270.

- Ang, B., Choong, W., & Ng, T. (2015). Energy security: Definitions, dimensions and indexes. *Renewable and Sustainable Energy Reviews*, 42, 1077-1093.

- Arts, B., Kamstra, J., Liefferink, D., & Ooijevaar, J. (2009). Leaders and laggards in environmental policy: a quantitative analysis of domestic policy outputs. *Journal of European Public Policy*, 16(5), 677-700.

- Austvik, O. G. (2016). The Energy Union and security-of-gas supply. *Energy Policy*, 96, 372–382.

- Bals, C., Burck, J., Dertinger, A., Marten, F., & Uhlich, T. (2016). *CCPI: Results 2017*. Brussels & Berlin/Bonn: CAN Europe & Germanwatch.

- Barbier, E., Markandya, A., & Pearce, D. W. (1989). *Blueprint for a Green Economy*. New York: Earthscan.

- Behrens, W. W., Meadows, D. L., Meadows, D. H., & Randers, J. (1972). *The Limits of Growth - A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books.

- Benitez-Capistros, F., Block, T., Hugé, J., Verbruggen, A., Waas, T., & Wright, T. (2014). Sustainability Assessment and Indicators: Tools in a Decision-Making Strategy for Sustainable Development. *Sustainability*, 6, 5512-5534.

- Benson, D., & Russel, D. (2015). Patterns of EU energy policy outputs: Incrementalism or punctuated equilibrium? *West European Politics*, 38, 185–205.

- Bigerna, S., Bollino, C. A., & Micheli, S. (2015). *The Sustainability of Renewable Energy in Europe*. Cham: Springer International Publishing Switzerland.

- Borgnäs, K. (2016). The Policy Influence of Sustainability Indicators: Examining Use and Influence of Indicators in German Sustainability Policy Making. *German Politics*, 25(4), 480-499.
- Brand, U. (2012). Green Economy – the Next Oxymoron? No Lessons Learned from Failures of Implementing Sustainable Development. *GAIA*, 21(1), 28-32.
- Breyer, C., Creutzig, F., Fernandez, B., Goldschmidt, J., Jakob, M., Knopf, B., & Wiegandt, K. (2014). Catching two European birds with one renewable stone: Mitigating climate change and Eurozone crisis by an energy transition. *Renewable and Sustainable Energy Reviews*, 38, 1015-1028.
- Buzogány, A., & Ćetković, S. (2016). Varieties of capitalism and clean energy transitions in the European Union: When renewable energy hits different economic logics. *Climate Policy*, 16(5), 642-657.
- Cherp, A., & Jewell, J. (2014). The concept of energy security: Beyond the four As. *Energy Policy*, 75, 415-421.
- Ciocoiu, C. N. (2011). Integrating digital economy and green economy: opportunities for sustainable development. *Theoretical and Empirical Researches in Urban Management*, 6(1), 33-43.
- de Jong, J., & Egenhofer, C. (2014). A Call for More Regional Approaches to EU Energy Policy. *Intereconomics*, 5, 262-267.
- Dual Citizen LLC (2016). *GGEI 2016*.
- Dual Citizen LLC. (2017). *Performance Index*. Last consulted on July 31, 2017. Retrieved from GGEI: http://dualcitizeninc.com/global-green-economy-index/economic-environmental-indicators.php?id=3.
- Dupont, C., & Oberthür, S. (2015). Conclusions: Lessons Learned. In C. Dupont, & S. Oberthür (Eds.), *Decarbonization in the European Union: Internal Policies and External Strategies* (pp. 244-265). Hampshire/New York: Palgrave Macmillan.
- Dupont, C., & Oberthür, S. (2015). Decarbonization in the EU: Setting the Scene. In C. Dupont, & S. Oberthür (Eds.), *Decarbonization in the European Union: Internal Policies and External Strategies* (pp. 1-24). New York: Palgrave Macmillan.

- EC (2010). *Europe 2020: A strategy for smart, sustainable and inclusive growth*. Brussels: COM(2010) 2020.
- EC (2011). *A Roadmap for moving to a competitive low carbon economy in 2050*. COM(2011) 112.
- EC (2014). *A policy framework for climate and energy in the period from 2020 to 2030*. Brussels: COM(2014) 15.
- EC (2015). *A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy*. COM(2015) 80.
- EEA (2012). *Environmental Indicator Report 2012: Ecosystem Resilience & Resource Efficiency in a Green Economy in Europe*. Copenhagen: EEA.
- EEA (2013). *Environmental Indicator Report 2013: Natural Resources and Human Well-being in a Green Economy*. Copenhagen: EEA.
- EEA (2013). *Towards a green economy in Europe: EU environmental policy targets and objectives 2010–2050*. Copenhagen: EEA.
- EEA (2014). *Resource-efficient green economy and EU policies*. Luxembourg: Publications Office of the EU.
- EEA (2015). *The European environment — state and outlook 2015: synthesis report*. Copenhagen: EEA.
- EU (2012). *Consolidated Version of the TFEU*. Official Journal of the EU.
- EU (2014*). The European Union explained - Energy*. Luxembourg: Publications Office of the EU.
- EU (2017, July). *By country*. Last consulted on August 4, 2017. Retrieved from EC - Energy: http://ec.europa.eu/energy/en/data-analysis/country.
- EurObserv'ER (2016). *The state of renewable energies in Europe - Edition 2016*.
- EurObserv'ER (2017, March). *Data comparison between Eurostat and EurObserv'ER*. Last consulted on August 12, 2017. Retrieved from EurObserv'ER: https://www.eurobserv-er.org.

- Eurostat (2012, September 7). *Glossary: Final energy consumption*. Last consulted on August 6, 2017. Retrieved from Eurostat - Statistics Explained: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Gross_inland_energy_consumption.

- Eurostat (2013, February 12). *Glossary: Gross inland energy consumption*. Last consulted on August 6, 2017. Retrieved from Eurostat - Statistics Explained: http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Gross_inland_energy_consumption.

- Eurostat (2014). *Towards a harmonised methodology for statistical indicators - Part 1: Indicator typologies and terminologies - 2014 edition*. Luxembourg: Publications Office of the EU.

- Eurostat (2016). *Smarter, greener, more inclusive? Indicators to support the Europe 2020 strategy - 2016 edition*. Luxemburg: Publications Office of the EU.

- Eurostat (2017, June 8). *Complete energy balances - annual data*. Last consulted on August 3, 2017. Retrieved from Eurostat Database: http://ec.europa.eu/eurostat/data/database.

- Eurostat (2017, June 8). *Electricity prices for domestic consumers - bi-annual data (from 2007 onwards)*. Last consulted on August 3, 2017. Retrieved from Eurostat Database: http://ec.europa.eu/eurostat/data/database.

- Eurostat (2017, June 8). *Electricity prices for industrial consumers - bi-annual data (from 2007 onwards)*. Last consulted on August 5, 2017. Retrieved from Eurostat Database: http://ec.europa.eu/eurostat/data/database.

- Eurostat (2017, March 23). *Environmental tax revenues*. Last consulted on Augustus 3, 2017. Retrieved from Eurostat Database: http://ec.europa.eu/eurostat/data/database.

- Eurostat (2017, June 8). *Gas prices for domestic consumers - bi-annual data (from 2007 onwards)*. Last consulted on August 5, 2017. Retrieved from Eurostat Database: http://ec.europa.eu/eurostat/data/database.

- Eurostat (2017, June 8). *Gas prices for industrial consumers - bi-annual data (from 2007 onwards)*. Last consulted on August 5, 2017. Retrieved from Eurostat Database: http://ec.europa.eu/eurostat/data/database.

- Eurostat (2017, July 12). *Population on 1 January by age and sex*. Last consulted on 3 August 2017. Retrieved from Eurostat Database: http://ec.europa.eu/eurostat/data/database.

- Eurostat (2017). *Towards a harmonised methodology for statistical indicators: Part 2 - Communicating through indicators - 2017 Edition*. Luxembourg: Publications Office of the EU.

- Eurostat (2017). *Towards a harmonised methodology for statistical indicators: Part 3 - Relevance of indicators for policy making. 2017 edition*. Luxemburg: Publications Office of the EU.

- Fiorino, D. J. (2014). The Green Economy: mythical or meaningful? *Policy Quarterly*, 10(1), 26-34.

- Fischer, S., Gullberg, A. T., Sartor, O., & Szulecki, K. (2016). Shaping the 'Energy Union': between national positions and governance innovation in EU energy and climate policy. *Climate Policy*, 16(5), 548-567.

- Focken, H. (2015). Between national interests and the greater good: struggling towards a common European Union energy policy in the context of climate change. *Journal of International Affairs*, 69(1), 179-191.

- Fouquet, D. (2013). Policy instruments for renewable energy – From a European perspective. *Renewable Energy*, 49, 15-18.

- FPB & INR (2017). *Aanvullende indicatoren naast het bbp*. Brussels: FBP.

- Freudenberg, M. (2003). Composite Indicators of Country Performance: A Critical Assessment. *OECD Science, Technology and Industry Working Papers*, 2003/16. Paris: OECD Publishing.

- Froggatt, A., & Levi, M. A. (2009). Climate and energy security policies and measures: synergies and conflicts. *International Affairs*, 85(6), 1129-1141.

- GGBP (2014). *Green Growth in Practice: Lessons from Country Experiences*. Seoul: GGBP.

- GGKP (2013). *Moving towards a Common Approach on Green Growth Indicators*.

- Green, M., Porter, M. E., & Stern, S. (2017). *Social Progress Index 2017*. Social Progress Imperative.

- Gudmundsson, H. (2003). The Policy Use of Environmental Indicators - Learning from Evaluation Research. *The Journal of Transdisciplinary Environmental Studies*, 2(2).

- Gupta, J., & Mayrhofer, J. P. (2016). The science and politics of co-benefits in climate policy. *Environmental Science & Policy*, 57, 22-30.

- Harris, J. M., & Roach, B. (2013). Greening the economy. In J. M. Harris, & B. Roach*, Environmental and resource Economics: A Contemporary Approach*, Edition 3 (pp. 408-432). London & New York: Scharpe M.E.
- Hsu, A. (2016). *2016 Environmental Performance Index*. New Haven: Yale University.
- IEA (2014). *Energy Supply Security: Emergency Response of IEA Countries - 2014*. Paris: IEA & OECD.
- IISD & UNEP (2014). *Trade and Green Economy: A Handbook - Third Edition*. Geneva: IISD.
- ILO, IOE, ITUC & UNEP (2008). *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World*.
- Isaka, M. (2013). *Intellectual Property Rights: The role of Patents in Renewable Energy Technology Innovation*. IRENA.
- Johansson, B., Månsson, A., & Nilsson, L. J. (2014). Assessing energy security: An overview of commonly used methodologies. *Energy*, 73, 1-14.
- Juncker, J.-C. (2015, July 15). *A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change - Political Guidelines for the next European Commission*. Last consulted on August 7, 2017. Retrieved from European Commission: https://ec.europa.eu/commission/sites/beta-political/files/juncker-political-guidelines-speech_en_0.pdf.
- Lander, E. (2011). *The Green Economy: the Wolf in Sheep's clothing.* TNI.
- McCormick, K., Richter, J. L., & Pantzar, M. (Eds.) (2015). *Greening the Economy: Lessons from Scandinavia*. Lund: Lund University.
- Mišík, M. (2017). Comments on "the Energy Union and security-of-gas supply" by Ole Gunnar Austvik. *Energy Policy*, 102, 27-29.
- Mundaca, L., & Richter, J. L. (2015). Assessing 'green energy economy' stimulus packages: Evidence from the U.S. programs targeting renewable energy. *Renewable and Sustainable Energy Reviews*, 42, 1174-1186.
- Narula, K., & Reddy, S. B. (2015). Three blind men and an elephant: The case of energy indices to measure energy security and energy sustainability. *Energy*, 80, 148-158.

- OECD (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD Publishing.

- Primova, R. (2015). The EU Internal Energy Market and Decarbonization. In C. Dupont, & S. Oberthür (Eds.), *Decarbonization in the European Union: Internal Policies and External Strategies* (pp. 25-45). New York: Palgrave Macmillan.

- Tusk, D. (2014, April 21). *A united Europe can end Russia's energy stranglehold*. Last consulted on August 11, 2017. Retrieved from Financial Times: https://www.ft.com/content/91508464-c661-11e3-ba0e-00144feabdc0.

- UN (2017, August 1). *Background*. Last consulted on August 10, 2017. Retrieved from UN-Millennium Goals: http://www.un.org/millenniumgoals/bkgd.shtml.

- UN (2017, August 1). *The Sustainable Development Agenda*. Last consulted on August 10, 2017. Retrieved from UN - Sustainable Development: http://www.un.org/sustainabledevelopment/development-agenda.

- UN ESC (2016). *Report of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators*. E/CN.3/2016/2.

- UN General Assembly (2000). *Resolution adopted by the General Assembly - United Nations Millennium Declaration*. UN.

- UN General Assembly (2015). *Resolution adopted by the General Assembly on 25 September 2015 - Transforming our world: the 2030 Agenda for Sustainable Development*. UN.

- UNECE (2014). *Conference of European Statisticians Recommendations on Measuring Sustainable Development*. New York & Geneva: United Nations.

- UNEP & UNU-IHDP (2014). *Inclusive Wealth Report 2014: Measuring progress toward sustainability*. Cambridge: United Nations University – International Human Dimensions.

- UNEP (2011). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*.

- UNEP (2011). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication - A Synthesis for Policy Makers*.

- UNEP (2012). *Measuring Progress towards an Inclusive Green Economy*.
- UNEP (2012). *The Business Case for the Green Economy. Sustainable Return on Investment*.
- UNEP (2014). *Using Indicators for Green Economy Policymaking*.
- UNEP (2014). *Using Models for Green Economy Policymaking*.
- Victor, D. (2009). *The Politics of Fossil-Fuel Subsidies*. Geneva: International Institute for Sustainable Development Global Subsidies Initiatives.
- WCED (1987). *Report of the World Commission on Environment and Development: Our Common Future*. UN.
- WIPO (2017). *Inside WIPO - What is WIPO?* Last consulted on August 12, 2017. Retrieved from WIPO: http://www.wipo.int/about-wipo/en.
- WIPO (2017, February). *WIPO IP Statistics Data Center*. Last consulted on 6 August 2017. Retrieved from WIPO: https://www3.wipo.int/ipstats/editIpsSearchForm.htm?tab=patent.
- World Bank (2017). *Databank: Sustainable Development Goals (SDGs)*. Last consulted on August 5, 2017. Retrieved from The World Bank: http://databank.worldbank.org/data/reports.aspx?source=sustainable-development-goals-(sdgs).
- World Bank (2017). *Databank: World Development Indicators*. Last consulted on August 5, 2017. Retrieved from The World Bank: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators.

Annexes

Annex 1: Green economy and other concepts

The following table provides a non-exhaustive overview of concepts that are related to the green-economic thinking.

Concept	Definition	Source
Brown economy	*"conventional economic model [that] fails to account for environmental externalities in decisions concerning natural resource use and allocation"*	EEA (2013a, p. 15)
Business greening	business thinking that *"innovation in environmental, energy and other such areas was not only compatible with but contributes to business success"*	Fiorino (2014, p. 30)
Circular economy	*"industrial economy producing no waste or pollution"*	Eurostat (2016, p. 3)
Co-benefits	*"concept [that] implies a 'win–win' strategy to address two or more goals with a single policy measure"*	Gupta & Mayrhofer (2016, p. 22)
Ecologic modernisation	*"view that, by incorporating ecological issues into economic and political decision-making, and with technology innovation and policy change, the economy could be managed in ways that were consistent with the finite limits of ecosystems"*	Fiorino (2014, p. 29)
Ecological economics	economic analysis with an emphasis on ecologic values, as well as economic and political inequality	Fiorino (2014, p. 29)
Green economy	*"economy [that] aims for improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities"*	IISD & UNEP (2014, p. 4), UNEP (2011b, p. 2)

Green growth	"*term that is often used alongside or interchangeably with green economy*"	EEA (2014, p. 11)
Industrial ecology	term used for modelling "*human manufacturing systems on the closed-loop cycles found in nature*"	Harris & Roach (2013, p. 418)
Sustainable development	"*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*"	WCED (1987, p. 41)

Annex 2: Indices under scrutiny

The following table shows how the four major indices under scrutiny rank the EU member states.

	GGEI	CCPI	EPI	SPI
1	Sweden	France	Finland	Denmark
2	Finland	Sweden	Sweden	Finland
3	Germany	UK	Denmark	Netherlands
4	Austria	Cyprus	Slovenia	Sweden
5	Denmark	Luxembourg	Spain	Ireland
6	France	Malta	Portugal	UK
7	Italy	Portugal	Estonia	Germany
8	Portugal	Belgium	Malta	Austria
9	Netherlands	Denmark	France	Belgium
10	Spain	Latvia	UK	Spain
11	Slovenia	Italy	Croatia	France
12	UK	Croatia	Austria	Portugal
13	Hungary	Romania	Ireland	Slovenia
14	Luxembourg	Lithuania	Luxembourg	Czech Republic
15	Ireland	Ireland	Greece	Estonia
16	Croatia	Czech Republic	Latvia	Italy
17	Belgium	Greece	Lithuania	Cyprus
18	Lithuania	Slovakia	Slovakia	Slovakia
19	Greece	Netherlands	Czech Republic	Poland
20	Latvia	Germany	Hungary	Greece
21	Malta	Slovenia	Italy	Latvia
22	Bulgaria	Finland	Germany	Lithuania
23	Czech Republic	Spain	Bulgaria	Croatia
24	Slovakia	Hungary	Romania	Hungary
25	Cyprus	Poland	Netherlands	Bulgaria
26	Romania	Bulgaria	Poland	Romania
27	Poland	Austria	Cyprus	..[121]
28	Estonia	Estonia	Belgium	..[116]
From	Dual Citizen LLC (2016, pp. 11-12)	Bals, et al. (2016, p. 33)	Hsu (2016, pp. 18-19)	Green, et al. (2017, p. 4)

[121] The SPI-score of Luxembourg and Malta are estimated – not calculated – to be "*Very High Social Progress*" and "*High Social Progress*," respectively (Green, et al., 2017, p. 37).

Annex 3: Methodologic foundations

A variety of methodological handbooks and studies were examined before the GEEEI-framework was designed. Some turned out to have a bigger impact on the literary study and on the eventual design than others. The most influential examples were often referred to throughout the master thesis, and are introduced in the following table.

Source	Introduction	Source of the quote
Benitez-Capistros, et al. (2014)	The paper aims to contribute to a better understanding of sustainability indicators and assessments "*by adopting a theoretical perspective that frames*" these indicators and assessments "*in the context of sustainable development as a decision-making strategy and that introduces both fields along several essential aspects in a structured and comparable manner*."	Benitez-Capistros, et al. (2014, p. 5512)
Eurostat (2014, 2017h & 2017i)	These three sources make up a series of "*papers on statistical indicators published by Eurostat*." They aim to "*help professionals who develop, produce and communicate policy indicators*."	Eurostat (2017i, p. 3)
Freudenberg (2003)	"*This paper reviews the steps in constructing composite indicators and their inherent weaknesses. A detailed statistical example is given in a case study. The paper also offers suggestions on how to improve the transparency and use of composite indicators for analytical and policy purposes*."	Freudenberg (2003, p. 3)
GGKP (2013)	"*The goal of this publication […] is to propose a framework that provides a common basis for further developing*" green-economic "*indicators, with a special focus on the economy-environment nexus*."	GGKP (2013, p. 4)

Gudmundsson (2003)	"*The article exploits indicator theory and the evaluation research literature to develop an analytical framework so as to study the policy uses of indicators*."	Gudmundsson (2003, p. 1)
OECD (2008)	"This Handbook aims to provide a guide to the construction and use of composite indicators, for policy-makers, academics, the media and other interested parties."	OECD (2008, p. 3)
UNECE (2014)	"The current publication presents recommendations to assist countries in measuring sustainable development. It includes a measurement framework and suggests sets of indicators, including a small set that can be used for international comparison."	UNECE (2014, p. iii)

Annex 4: GEEEI-framework

GEEEI
(overall score)

GEEEI$_{Eco}$

	Value	Score
Dimension	..	GEEEI$_{Eco}$
Indicator 1	Eco-value 1	Eco-score 1
Indicator 2	Eco-value 2	Eco-score 2
Indicator 3	Eco-value 3	Eco-score 3
Indicator 4	Eco-value 4	Eco-score 4
Indicator 5	Eco-value 5	Eco-score 5
Indicator 6	Eco-value 6	Eco-score 6
Indicator 7	Eco-value 7	Eco-score 7
Indicator 8	Eco-value 8	Eco-score 8
Indicator 9	Eco-value 9	Eco-score 9
Indicator 10	Eco-value 10	Eco-score 10

GEEEI$_{Soc}$

	Value	Score
Dimension	..	GEEEI$_{Soc}$
Indicator 1	Soc-value 1	Soc-score 1
Indicator 2	Soc-value 2	Soc-score 2
Indicator 3	Soc-value 3	Soc-score 3
Indicator 4	Soc-value 4	Soc-score 4
Indicator 5	Soc-value 5	Soc-score 5
Indicator 6	Soc-value 6	Soc-score 6
Indicator 7	Soc-value 7	Soc-score 7
Indicator 8	Soc-value 8	Soc-score 8
Indicator 9	Soc-value 9	Soc-score 9
Indicator 10	Soc-value 10	Soc-score 10

Indicator score calculation

GEEEI$_{Eco}$

	Value	Score
Indicator 1	Eco-value 1	Eco-score 1
Indicator 2	Eco-value 2	Eco-score 2
Indicator 3	Eco-value 3	Eco-score 3
Indicator 4	Eco-value 4	Eco-score 4
Indicator 5	Eco-value 5	Eco-score 5
Indicator 6	Eco-value 6	Eco-score 6
Indicator 7	Eco-value 7	Eco-score 7
Indicator 8	Eco-value 8	Eco-score 8
Indicator 9	Eco-value 9	Eco-score 9
Indicator 10	Eco-value 10	Eco-score 10

Min-max method*

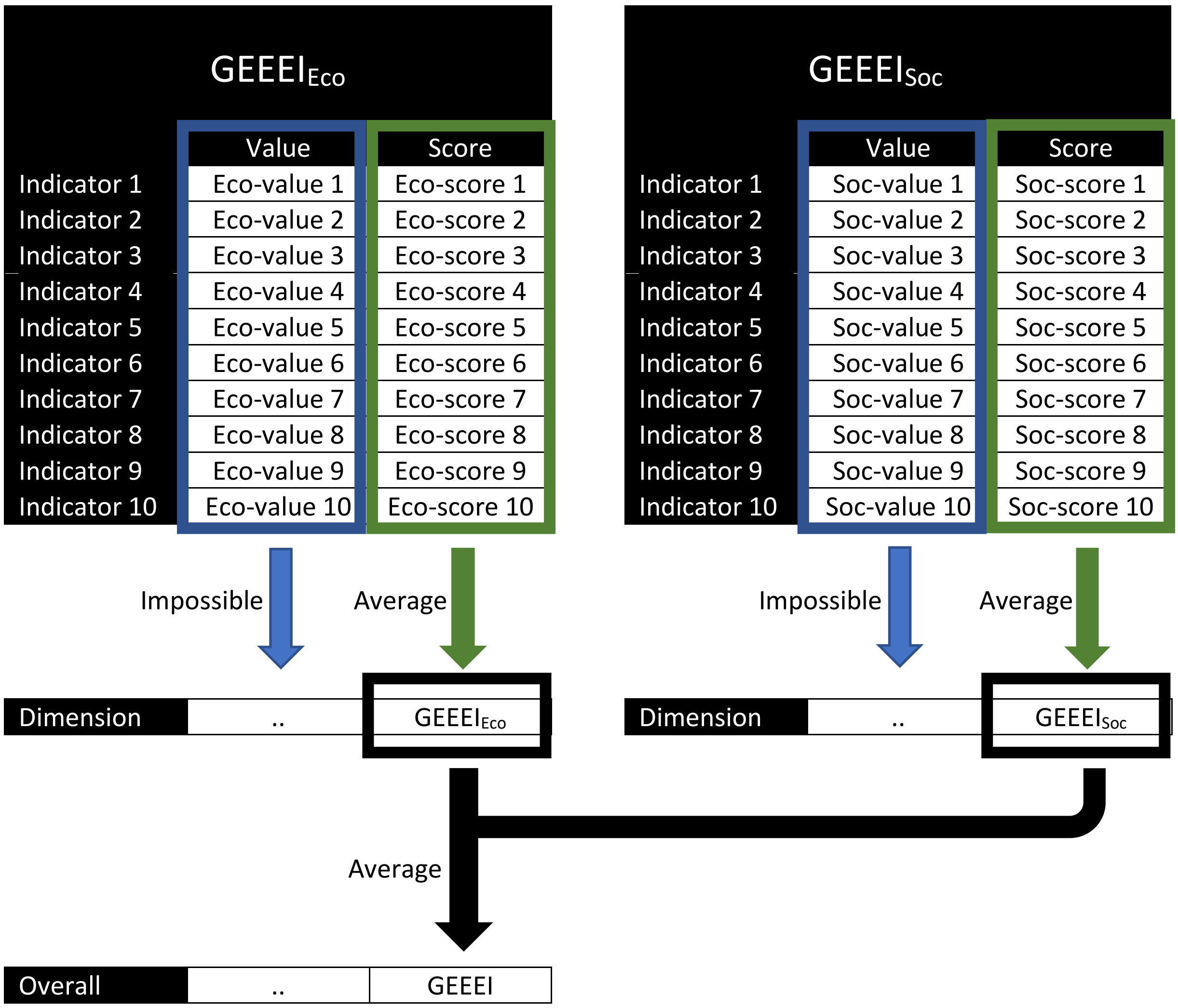
GEEEI$_{Soc}$

	Value	Score
Indicator 1	Soc-value 1	Soc-score 1
Indicator 2	Soc-value 2	Soc-score 2
Indicator 3	Soc-value 3	Soc-score 3
Indicator 4	Soc-value 4	Soc-score 4
Indicator 5	Soc-value 5	Soc-score 5
Indicator 6	Soc-value 6	Soc-score 6
Indicator 7	Soc-value 7	Soc-score 7
Indicator 8	Soc-value 8	Soc-score 8
Indicator 9	Soc-value 9	Soc-score 9
Indicator 10	Soc-value 10	Soc-score 10

Min-max method*

* According to the min-max method an indicator score is calculated as "*100*(actual value - minimum value)/(maximum value - minimum value)*" (Freudenberg, 2003, p. 10).

Synthetic indicator calculation



Annex 5: GEEEI

When ranking the EU member states according to their overall GEEEI-performance, the following table is established:

	Member State	GEEEI	$GEEEI_{Eco}$	$GEEEI_{Soc}$
	EU-28 Average	49,4	54,7	44,1
	EU-28 median	48,0	52,4	44,2
1	Denmark	67,8	76,8	58,8
2	Latvia	64,1	61,6	66,7
3	Finland	59,7	68,6	50,8
4	Sweden	58,3	70,8	45,8
5	Austria	58,0	71,2	44,8
6	Italy	57,1	72,3	41,9
7	Slovenia	54,0	64,2	43,8
8	Estonia	53,2	48,0	58,4
9	Poland	50,7	56,6	44,7
10	UK	50,6	57,4	43,8
11	Luxembourg	50,0	51,5	48,4
12	Romania	49,4	53,0	45,8
13	Germany	48,7	51,2	46,2
14	Hungary	48,2	50,8	45,7
15	Spain	47,8	56,1	39,4
16	Croatia	47,5	55,9	39,1
17	Netherlands	46,9	51,8	42,0
18	France	46,6	50,3	43,0
19	Czech Republic	46,6	47,4	45,9
20	Portugal	45,5	55,9	35,1
21	Belgium	45,5	46,3	44,7
22	Lithuania	45,0	41,5	48,6
23	Greece	44,3	55,5	33,2
24	Ireland	43,8	49,5	38,0
25	Slovakia	42,5	44,5	40,4
26	Malta	38,6	43,6	33,7
27	Cyprus	37,0	48,0	25,9
28	Bulgaria	36,0	31,3	40,8

Annex 6: $GEEEI_{Eco}$

The following table provides an overview of the indicators that are applied in the $GEEEI_{Eco}$. The accompanying scoreboard presents the member states' performances in the ecologic dimension of the GEEEI.

	Indicator	Unit of measurement
1	Gross inland energy consumption	toe per capita
2	Gross inland renewable energy consumption	% gross inland consumption
3	CO2-intensity	g per unit of GDP
4	GHG-intensity	CO2-equivalent g per unit of GDP
5	Fossil fuel taxation-intensity	% GDP
6	Energy generation market openness	% market players > 5%
7	Non-renewable energy imports	µtoe per unit of GDP
8	Energy- and environment-related patents	number per billion units GDP (°2015)
9	*** Renewable energy investment-intensity	% GDP
10	*** Non-renewable energy investment-intensity	% GDP

N°	Member State	$GEEEI_{Eco}$	1	2	3	4	5	6	7	8	9	10	GEEEI
	EU-28 Average	54,7	70,8	32,7	74,6	73,1	44,8	40,1	71,5	30,0	..	..	49,4
	EU-28 Median	52,4	77,2	24,0	81,7	77,9	40,7	39,6	77,4	18,3	..	..	48,0
1	Denmark	76,8	77,0	65,2	96,6	90,6	57,4	75,2	97,1	55,8	..	..	67,8
2	Italy	72,3	83,8	35,9	88,4	90,9	86,9	80,5	89,0	23,1	..	..	57,1
3	Austria	71,2	61,1	66,7	89,7	94,1	19,7	63,1	90,9	84,6	..	..	58,0
4	Sweden	70,8	47,5	100,0	100,0	98,6	31,1	35,7	94,9	58,7	..	..	58,3
5	Finland	68,6	23,5	73,2	87,3	87,3	44,8	49,9	83,0	100,0	..	..	59,7
6	Slovenia	64,2	73,1	34,1	76,0	78,3	100,0	10,3	70,5	71,2	..	..	54,0
7	Latvia	61,6	90,0	82,1	77,0	43,7	49,7	57,2	61,3	31,7	..	..	64,1
8	UK	57,4	77,4	12,9	89,8	92,2	35,5	34,1	100,0	17,3	..	..	50,6
9	Poland	56,6	84,8	17,2	40,9	47,6	60,1	100,0	82,4	20,2	..	..	50,7
10	Spain	56,1	83,1	28,0	85,4	87,1	22,4	47,9	81,3	13,5	..	..	47,8
11	Croatia	55,9	93,3	51,5	71,6	64,7	76,5	13,6	66,5	9,6	..	..	47,5
12	Portugal	55,9	89,8	48,0	80,3	74,6	33,3	48,9	72,2	0,0	..	..	45,5
13	Greece	55,5	89,3	22,2	71,0	69,5	97,3	32,6	55,2	6,7	..	..	44,3
14	Romania	53,0	100,0	39,9	58,6	17,8	55,7	46,8	94,8	10,6	..	..	49,4

N°	Member State	$GEEEI_{Eco}$	1	2	3	4	5	6	7	8	9	10	GEEEI
	EU-28 Average	54,7	70,8	32,7	74,6	73,1	44,8	40,1	71,5	30,0	..	..	49,4
	EU-28 Median	52,4	77,2	24,0	81,7	77,9	40,7	39,6	77,4	18,3	..	..	48,0
15	Netherlands	51,8	48,9	5,3	85,2	91,9	39,3	51,0	17,9	75,0	..	..	46,9
16	Luxembourg	51,5	0,0	5,8	89,1	100,0	28,4	41,6	92,6	54,8	..	..	50,0
17	Germany	51,2	61,3	24,2	83,1	94,0	23,0	32,2	90,9	1,0	..	..	48,7
18	Hungary	50,8	83,9	23,7	69,5	63,1	42,1	37,6	67,2	19,2	..	..	48,2
19	France	50,3	62,5	15,2	94,7	87,9	33,3	0,2	95,8	12,5	..	..	46,6
20	Ireland	49,5	75,3	12,6	93,7	75,9	0,0	25,5	99,7	13,5	..	..	43,8
21	Cyprus	48,0	81,9	9,8	70,2	77,5	61,2	0,0	73,2	10,6	..	..	37,0
22	Estonia	48,0	45,9	30,1	25,2	66,0	68,9	27,1	77,3	43,3	..	..	53,2
23	Czech Republic	47,4	58,5	18,9	52,2	61,2	42,1	51,0	77,5	17,3	..	..	46,6
24	Belgium	46,3	44,9	10,4	85,0	92,2	6,6	46,0	56,3	28,8	..	..	45,5
25	Slovakia	44,5	75,8	17,7	68,9	74,7	18,0	36,1	57,4	7,7	..	..	42,5
26	Malta	43,6	97,8	0,0	86,8	86,3	17,5	0,0	24,0	36,5	..	..	38,6
27	Lithuania	41,5	87,2	45,2	73,3	39,6	27,3	49,4	0,0	9,6	..	..	45,0
28	Bulgaria	31,3	83,8	20,7	0,0	0,0	75,4	29,0	32,7	8,7	..	..	36,0

Annex 7: $GEEEI_{Soc}$

The following table provides an overview of the indicators that are applied in the $GEEEI_{Soc}$. The accompanying scoreboard presents the member states' performances in the socioeconomic dimension of the GEEEI.

	Indicator	Unit of measurement
1	Gross final energy consumption-intensity	toe per unit of GDP
2	vRE-flexible capacity	value
3	Energy accessibility	% population
4	Energy availability	toe per capita
5	Estimated average electricity unit cost	€ per kWh
6	Estimated average gas unit cost	€ per kWh
7	Energy dependence	%
8	Renewable energy exports	µtoe per unit of GDP
9	Renewable energy turnover	% GDP
10	Green jobs	number per thousand capita

N°	Member State	$GEEEI_{Soc}$	1	2	3	4	5	6	7	8	9	10	GEEEI
	EU-28 Average	44,1	44,1	21,6	100,0	22,7	57,3	69,5	46,2	8,8	21,8	23,1	49,4
	EU-28 Median	44,2	81,0	15,3	100,0	16,0	65,4	68,7	49,9	1,7	16,4	12,9	48,0
1	Latvia	66,7	62,1	100,0	100,0	13,4	64,6	85,3	51,6	100,0	53,6	36,1	64,1
2	Denmark	58,8	98,5	0,6	100,0	22,4	30,3	42,7	93,7	0,0	100,0	100,0	67,8
3	Estonia	58,4	23,3	36,8	100,0	18,8	57,9	94,7	100,0	54,9	51,1	46,0	53,2
4	Finland	50,8	69,6	28,2	100,0	58,5	28,2	65,3	56,5	0,0	32,2	69,5	59,7
5	Lithuania	48,6	62,5	41,1	100,0	15,0	90,8	85,3	21,5	20,6	33,6	16,1	45,0
6	Luxembourg	48,4	92,4	28,2	100,0	100,0	36,4	82,7	2,2	0,0	0,7	41,8	50,0
7	Germany	46,2	86,3	0,0	100,0	28,7	78,5	65,3	39,8	1,3	16,4	45,2	48,7
8	Czech Republic	45,9	51,2	16,0	100,0	24,2	88,2	73,3	72,9	5,5	15,8	11,6	46,6
9	Romania	45,8	57,0	11,0	100,0	0,0	87,2	92,0	89,3	3,3	16,4	2,2	49,4
10	Sweden	45,8	86,7	19,6	100,0	36,8	51,3	0,0	74,9	0,6	23,9	64,4	58,3
11	Hungary	45,7	55,2	65,0	100,0	13,1	66,7	86,7	49,2	8,6	11,5	0,8	48,2
12	Austria	44,8	87,7	15,3	100,0	38,0	10,3	61,3	41,0	3,8	40,3	50,1	58,0
13	Poland	44,7	56,8	9,8	100,0	9,9	80,5	84,0	75,8	2,8	21,2	6,0	50,7
14	Belgium	44,7	78,9	6,1	100,0	47,1	100,0	77,3	15,0	0,6	3,8	17,6	45,5

N°	Member State	$GEEEI_{Soc}$	1	2	3	4	5	6	7	8	9	10	GEEEI
	EU-28 Average	44,1	44,1	21,6	100,0	22,7	57,3	69,5	46,2	8,8	21,8	23,1	49,4
	EU-28 Median	44,2	81,0	15,3	100,0	16,0	65,4	68,7	49,9	1,7	16,4	12,9	48,0
15	UK	43,8	91,0	4,3	100,0	16,6	55,4	78,7	66,9	0,3	11,5	13,4	50,6
16	Slovenia	43,8	69,6	28,2	100,0	19,7	71,3	68,0	54,4	0,0	11,5	15,4	54,0
17	France	43,0	84,3	13,5	100,0	21,0	59,0	56,0	57,3	0,2	14,9	24,0	46,6
18	Netherlands	42,0	85,0	21,5	100,0	44,7	46,2	48,0	50,6	5,7	6,3	12,2	46,9
19	Italy	41,9	89,5	12,9	100,0	14,3	91,3	56,0	23,0	0,2	20,0	12,3	57,1
20	Bulgaria	40,8	0,0	16,6	100,0	3,2	74,9	100,0	69,1	11,4	28,2	4,6	36,0
21	Slovakia	40,4	60,0	31,3	100,0	15,3	71,3	69,3	43,3	3,1	8,8	2,1	42,5
22	Spain	39,4	86,1	8,6	100,0	10,6	66,2	61,3	27,2	2,0	22,5	10,0	47,8
23	Croatia	39,1	65,7	10,4	100,0	8,7	12,3	84,0	54,8	15,9	28,6	10,9	47,5
24	Ireland	38,0	100,0	8,6	100,0	22,7	67,7	66,7	10,2	0,0	0,0	4,3	43,8
25	Portugal	35,1	80,9	4,9	100,0	8,6	28,2	57,3	22,7	5,4	22,5	20,4	45,5
26	Malta	33,7	91,9	..	100,0	4,0	66,7	..	0,7	0,0	2,9	3,0	38,6
27	Greece	33,2	81,2	9,2	100,0	7,1	24,1	66,7	29,0	0,0	8,1	6,6	44,3
28	Cyprus	25,9	82,2	34,4	100,0	14,3	0,0	..	0,0	0,0	2,7	0,0	37,0

Annex 8: EU member states' dashboards

	Austria (58,0)						N° 5
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		71,2		$GEEEI_{Soc}$		44,8
1	Gross inland energy consumption	3,88	61,1	1	Energy consumption-intensity	107,1	87,7
2	Gross renewable energy consumption	29,0	66,7	2	vRE-flexible capacity	3,2	15,3
3	CO_2-intensity	221,8	89,7	3	Energy accessibility	100	100
4	GHG-intensity	39	94,1	4	Energy availability	3,4	38,0
5	Fossil fuel taxation-intensity	1,53	19,7	5	Estimated average electricity unit cost	0,260	10,3
6	Energy generation market openness	53,0	63,1	6	Estimated average gas unit cost	0,055	61,3
7	Non-renewable energy imports	84,1	90,9	7	Energy dependence	60,8	41,0
8	Energy and Environment patents	9,1	84,6	8	Renewable energy exports	1,6	3,8
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	2,04	40,3
10	Non-renewable investment-intensity	..	..	10	Green jobs	4,33	50,1

Belgium (45,5) N° 21							
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		46,3		$GEEEI_{Soc}$		44,7
1	Gross inland energy consumption	4,82	44,9	1	Energy consumption-intensity	141,3	78,9
2	Gross renewable energy consumption	6,7	10,4	2	vRE-flexible capacity	1,7	6,1
3	CO_2-intensity	272,2	85,0	3	Energy accessibility	100	100
4	GHG-intensity	44,8	92,2	4	Energy availability	4,0	47,1
5	Fossil fuel taxation-intensity	1,29	6,6	5	Estimated average electricity unit cost	0,085	100
6	Energy generation market openness	65,7	46,0	6	Estimated average gas unit cost	0,043	77,3
7	Non-renewable energy imports	196,7	56,3	7	Energy dependence	84,3	15,0
8	Energy and Environment patents	3,3	28,8	8	Renewable energy exports	0,3	0,6
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,42	3,8
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,98	17,6

Bulgaria
(36,0)

N° 28

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		31,3		$GEEEI_{Soc}$		40,8
1	Gross inland energy consumption	2,57	83,8	1	Energy consumption-intensity	448,5	0,0
2	Gross renewable energy consumption	10,8	20,7	2	vRE-flexible capacity	3,4	16,6
3	CO_2-intensity	1183,0	0,0	3	Energy accessibility	100	100
4	GHG-intensity	322	0,0	4	Energy availability	1,4	3,2
5	Fossil fuel taxation-intensity	2,55	75,4	5	Estimated average electricity unit cost	0,134	74,9
6	Energy generation market openness	78,4	29,0	6	Estimated average gas unit cost	0,026	100
7	Non-renewable energy imports	273,8	32,7	7	Energy dependence	35,4	69,1
8	Energy and Environment patents	1,2	8,7	8	Renewable energy exports	4,9	11,4
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,50	28,2
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,04	4,6

Croatia
(47,5)

N° 16

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		55,9		$GEEEI_{Soc}$		39,1
1	Gross inland energy consumption	2,02	93,3	1	Energy consumption-intensity	192,9	65,7
2	Gross renewable energy consumption	23,0	51,5	2	vRE-flexible capacity	2,4	10,4
3	CO_2-intensity	416,0	71,6	3	Energy accessibility	100	100
4	GHG-intensity	127,3	64,7	4	Energy availability	1,7	8,7
5	Fossil fuel taxation-intensity	2,57	76,5	5	Estimated average electricity unit cost	0,256	12,3
6	Energy generation market openness	89,9	13,6	6	Estimated average gas unit cost	0,038	84,0
7	Non-renewable energy imports	163,4	66,5	7	Energy dependence	48,3	54,8
8	Energy and Environment patents	1,3	9,6	8	Renewable energy exports	6,8	15,9
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,52	28,6
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,50	10,9

Cyprus
(37,0)

N° 27

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		48,0		$GEEEI_{Soc}$		25,9
1	Gross inland energy consumption	2,68	81,9	1	Energy consumption-intensity	128,7	82,2
2	Gross renewable energy consumption	6,5	9,8	2	vRE-flexible capacity	6,3	34,4
3	CO_2-intensity	431,1	70,2	3	Energy accessibility	100	100
4	GHG-intensity	88,9	77,5	4	Energy availability	2,0	14,3
5	Fossil fuel taxation-intensity	2,29	61,2	5	Estimated average electricity unit cost	0,280	0,0
6	Energy generation market openness	100	0,0	6	Estimated average gas unit cost	.. [122]	..
7	Non-renewable energy imports	141,7	73,2	7	Energy dependence	97,9	0,0
8	Energy and Environment patents	1,4	10,6	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,37	2,7
10	Non-renewable investment-intensity	..	..	10	Green jobs	0,71	0,0

[122] There was no available data on Cyprus.

Czech Republic
(46,6)

N° 19

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		47,4		$GEEEI_{Soc}$		45,9
1	Gross inland energy consumption	4,03	58,5	1	Energy consumption-intensity	249,2	51,2
2	Gross renewable energy consumption	10,1	18,9	2	vRE-flexible capacity	3,3	16,0
3	CO_2-intensity	623,7	52,2	3	Energy accessibility	100	100
4	GHG-intensity	137,9	61,2	4	Energy availability	2,6	24,2
5	Fossil fuel taxation-intensity	1,94	42,1	5	Estimated average electricity unit cost	0,108	88,2
6	Energy generation market openness	62,0	51,0	6	Estimated average gas unit cost	0,046	73,3
7	Non-renewable energy imports	127,6	77,5	7	Energy dependence	31,9	72,9
8	Energy and Environment patents	2,1	17,3	8	Renewable energy exports	2,4	5,5
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,95	15,8
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,55	11,6

Denmark
(67,8)

N° 1

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		76,8		$GEEEI_{Soc}$		58,8
1	Gross inland energy consumption	2,96	77,0	1	Energy consumption-intensity	65,1	98,5
2	Gross renewable energy consumption	28,4	65,2	2	vRE-flexible capacity	0,8	0,6
3	CO_2-intensity	148,3	96,6	3	Energy accessibility	100	100
4	GHG-intensity	49,6	90,6	4	Energy availability	2,5	22,4
5	Fossil fuel taxation-intensity	2,22	57,4	5	Estimated average electricity unit cost	0,221	30,3
6	Energy generation market openness	44,0	75,2	6	Estimated average gas unit cost	0,069	42,7
7	Non-renewable energy imports	63,7	97,1	7	Energy dependence	13,1	93,7
8	Energy and Environment patents	6,1	55,8	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	4,69	100
10	Non-renewable investment-intensity	..	..	10	Green jobs	7,93	100

Estonia
(53,2)

N° 8

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		48,0		$GEEEI_{Soc}$		58,4
1	Gross inland energy consumption	4,76	45,9	1	Energy consumption-intensity	358,0	23,3
2	Gross renewable energy consumption	14,5	30,1	2	vRE-flexible capacity	6,7	36,8
3	CO_2-intensity	913,4	25,2	3	Energy accessibility	100	100
4	GHG-intensity	123,5	66,0	4	Energy availability	2,3	18,8
5	Fossil fuel taxation-intensity	2,43	68,9	5	Estimated average electricity unit cost	0,167	57,9
6	Energy generation market openness	79,8	27,1	6	Estimated average gas unit cost	0,030	94,7
7	Non-renewable energy imports	128,4	77,3	7	Energy dependence	7,4	100
8	Energy and Environment patents	4,8	43,3	8	Renewable energy exports	23,5	54,9
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	2,52	51,1
10	Non-renewable investment-intensity	..	..	10	Green jobs	4,03	46,0

Finland
(59,7)

N° 3

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		68,6		$GEEEI_{Soc}$		50,8
1	Gross inland energy consumption	6,06	23,5	1	Energy consumption-intensity	177,7	69,6
2	Gross renewable energy consumption	31,6	73,2	2	vRE-flexible capacity	5,3	28,2
3	CO_2-intensity	248,0	87,3	3	Energy accessibility	100	100
4	GHG-intensity	59,4	87,3	4	Energy availability	4,6	58,5
5	Fossil fuel taxation-intensity	1,99	44,8	5	Estimated average electricity unit cost	0,225	28,2
6	Energy generation market openness	62,8	49,9	6	Estimated average gas unit cost	0,052	65,3
7	Non-renewable energy imports	109,7	83,0	7	Energy dependence	46,8	56,5
8	Energy and Environment patents	10,7	100	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,68	32,2
10	Non-renewable investment-intensity	..	..	10	Green jobs	5,73	69,5

France (46,6) N° 18							
	Indicator	Value	Score		Indicator	Value	Score
	GEEEI$_{Eco}$		50,3		GEEEI$_{Soc}$		43,0
1	Gross inland energy consumption	3,8	62,5	1	Energy consumption-intensity	120,5	84,3
2	Gross renewable energy consumption	8,6	15,2	2	vRE-flexible capacity	2,9	13,5
3	CO_2-intensity	168,7	94,7	3	Energy accessibility	100	100
4	GHG-intensity	57,6	87,9	4	Energy availability	2,4	21,0
5	Fossil fuel taxation-intensity	1,78	33,3	5	Estimated average electricity unit cost	0,165	59,0
6	Energy generation market openness	92,4	0,2	6	Estimated average gas unit cost	0,059	56,0
7	Non-renewable energy imports	68,0	95,8	7	Energy dependence	46,0	57,3
8	Energy and Environment patents	1,6	12,5	8	Renewable energy exports	0,1	0,2
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,91	14,9
10	Non-renewable investment-intensity	..	..	10	Green jobs	2,44	24,0

Germany (48,7)							N° 13
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		51,2		$GEEEI_{Soc}$		46,2
1	Gross inland energy consumption	3,87	61,3	1	Energy consumption-intensity	112,6	86,3
2	Gross renewable energy consumption	12,2	24,2	2	vRE-flexible capacity	0,7	0,0
3	CO_2-intensity	292,5	83,1	3	Energy accessibility	100	100
4	GHG-intensity	39,4	94,0	4	Energy availability	2,9	28,7
5	Fossil fuel taxation-intensity	1,59	23,0	5	Estimated average electricity unit cost	0,127	78,5
6	Energy generation market openness	76,0	32,2	6	Estimated average gas unit cost	0,052	65,3
7	Non-renewable energy imports	84,0	90,9	7	Energy dependence	61,9	39,8
8	Energy and Environment patents	0,4	1,0	8	Renewable energy exports	0,6	1,3
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,98	16,4
10	Non-renewable investment-intensity	..	..	10	Green jobs	3,97	45,2

	Greece (44,3)						N° 23
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		55,5		$GEEEI_{Soc}$		33,2
1	Gross inland energy consumption	2,25	89,3	1	Energy consumption-intensity	132,5	81,2
2	Gross renewable energy consumption	11,4	22,2	2	vRE-flexible capacity	2,2	9,2
3	CO_2-intensity	421,9	71,0	3	Energy accessibility	100	100
4	GHG-intensity	113	69,5	4	Energy availability	1,6	7,1
5	Fossil fuel taxation-intensity	2,95	97,3	5	Estimated average electricity unit cost	0,233	24,1
6	Energy generation market openness	75,7	32,6	6	Estimated average gas unit cost	0,051	66,7
7	Non-renewable energy imports	200,3	55,2	7	Energy dependence	71,7	29,0
8	Energy and Environment patents	1,0	6,7	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,61	8,1
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,19	6,6

Hungary (48,2)							N° 14
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		50,8		$GEEEI_{Soc}$		45,7
1	Gross inland energy consumption	2,56	83,9	1	Energy consumption-intensity	233,6	55,2
2	Gross renewable energy consumption	12,0	23,7	2	vRE-flexible capacity	11,3	65,0
3	CO_2-intensity	438,7	69,5	3	Energy accessibility	100	100
4	GHG-intensity	132,4	63,1	4	Energy availability	1,9	13,1
5	Fossil fuel taxation-intensity	1,94	42,1	5	Estimated average electricity unit cost	0,150	66,7
6	Energy generation market openness	72,0	37,6	6	Estimated average gas unit cost	0,036	86,7
7	Non-renewable energy imports	161,4	67,2	7	Energy dependence	53,4	49,2
8	Energy and Environment patents	2,3	19,2	8	Renewable energy exports	3,7	8,6
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,76	11,5
10	Non-renewable investment-intensity	..	..	10	Green jobs	0,77	0,8

	Ireland (43,8) N° 24						
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		49,5		$GEEEI_{Soc}$		38,0
1	Gross inland energy consumption	3,06	75,3	1	Energy consumption-intensity	59,4	100
2	Gross renewable energy consumption	7,6	12,6	2	vRE-flexible capacity	2,1	8,6
3	CO_2-intensity	178,9	93,7	3	Energy accessibility	100	100
4	GHG-intensity	93,9	75,9	4	Energy availability	2,5	22,7
5	Fossil fuel taxation-intensity	1,17	0,0	5	Estimated average electricity unit cost	0,148	67,7
6	Energy generation market openness	81,0	25,5	6	Estimated average gas unit cost	0,051	66,7
7	Non-renewable energy imports	55,3	99,7	7	Energy dependence	88,7	10,2
8	Energy and Environment patents	1,7	13,5	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,25	0,0
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,02	4,3

Italy (57,1) N° 6							
	Indicator	Value	Score		Indicator	Value	Score
	GEEEI$_{Eco}$		72,3		GEEEI$_{Soc}$		41,9
1	Gross inland energy consumption	2,57	83,8	1	Energy consumption-intensity	100,4	89,5
2	Gross renewable energy consumption	16,8	35,9	2	vRE-flexible capacity	2,8	12,9
3	CO_2-intensity	235,9	88,4	3	Energy accessibility	100	100
4	GHG-intensity	48,8	90,9	4	Energy availability	2,0	14,3
5	Fossil fuel taxation-intensity	2,76	86,9	5	Estimated average electricity unit cost	0,102	91,3
6	Energy generation market openness	40,0	80,5	6	Estimated average gas unit cost	0,059	56,0
7	Non-renewable energy imports	90,1	89,0	7	Energy dependence	77,1	23,0
8	Energy and Environment patents	2,7	23,1	8	Renewable energy exports	0,1	0,2
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,14	20,0
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,60	12,3

Latvia
(64,1)

N° 2

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		61,6		$GEEEI_{Soc}$		66,7
1	Gross inland energy consumption	2,21	90,0	1	Energy consumption-intensity	206,7	62,1
2	Gross renewable energy consumption	35,1	82,1	2	vRE-flexible capacity	17,0	100
3	CO_2-intensity	357,9	77,0	3	Energy accessibility	100	100
4	GHG-intensity	190,5	43,7	4	Energy availability	2,0	13,4
5	Fossil fuel taxation-intensity	2,08	49,7	5	Estimated average electricity unit cost	0,154	64,6
6	Energy generation market openness	57,4	57,2	6	Estimated average gas unit cost	0,037	85,3
7	Non-renewable energy imports	180,6	61,3	7	Energy dependence	51,2	51,6
8	Energy and Environment patents	3,6	31,7	8	Renewable energy exports	42,9	100
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	2,63	53,6
10	Non-renewable investment-intensity	..	..	10	Green jobs	3,32	36,1

Lithuania (45,0)							N° 22
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		41,5		$GEEEI_{Soc}$		48,6
1	Gross inland energy consumption	2,37	87,2	1	Energy consumption-intensity	205,4	62,5
2	Gross renewable energy consumption	20,5	45,2	2	vRE-flexible capacity	7,4	41,1
3	CO_2-intensity	397,8	73,3	3	Energy accessibility	100	100
4	GHG-intensity	202,9	39,6	4	Energy availability	2,1	15,0
5	Fossil fuel taxation-intensity	1,67	27,3	5	Estimated average electricity unit cost	0,103	90,8
6	Energy generation market openness	63,2	49,4	6	Estimated average gas unit cost	0,037	85,3
7	Non-renewable energy imports	380,4	0,0	7	Energy dependence	78,4	21,5
8	Energy and Environment patents	1,3	9,6	8	Renewable energy exports	8,8	20,6
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,74	33,6
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,87	16,1

Luxembourg
(50,0)

N° 11

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		51,5		$GEEEI_{Soc}$		48,4
1	Gross inland energy consumption	7,42	0,0	1	Energy consumption-intensity	89,1	92,4
2	Gross renewable energy consumption	4,9	5,8	2	vRE-flexible capacity	5,3	28,2
3	CO_2-intensity	228,3	89,1	3	Energy accessibility	100	100
4	GHG-intensity	21,3	100	4	Energy availability	7,1	100
5	Fossil fuel taxation-intensity	1,69	28,4	5	Estimated average electricity unit cost	0,209	36,4
6	Energy generation market openness	69,0	41,5	6	Estimated average gas unit cost	0,039	82,7
7	Non-renewable energy imports	78,3	92,6	7	Energy dependence	95,9	2,2
8	Energy and Environment patents	6,0	54,8	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,28	0,7
10	Non-renewable investment-intensity	..	..	10	Green jobs	3,73	41,8

Malta
(38,6)

N° 26

	Indicator	Value	Score		Indicator	Value	Score
	GEEEI$_{Eco}$		43,6		GEEEI$_{Soc}$		33,7
1	Gross inland energy consumption	1,76	97,8	1	Energy consumption-intensity	90,7	91,9
2	Gross renewable energy consumption	2,6	0,0	2	vRE-flexible capacity	..[123]	..
3	CO_2-intensity	252,4	86,8	3	Energy accessibility	100	100
4	GHG-intensity	62,5	86,3	4	Energy availability	1,4	4,0
5	Fossil fuel taxation-intensity	1,49	17,5	5	Estimated average electricity unit cost	0,150	66,7
6	Energy generation market openness	100	0,0	6	Estimated average gas unit cost	..[123]	..
7	Non-renewable energy imports	302,0	24,0	7	Energy dependence	97,3	0,7
8	Energy and Environment patents	4,1	36,5	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,38	2,9
10	Non-renewable investment-intensity	..	..	10	Green jobs	0,93	3,0

[123] There was no data available on Malta.

Netherlands
(46,9)

N° 17

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		46,9		$GEEEI_{Soc}$		42,0
1	Gross inland energy consumption	4,59	48,9	1	Energy consumption-intensity	117,9	85,0
2	Gross renewable energy consumption	4,7	5,3	2	vRE-flexible capacity	4,2	21,5
3	CO_2-intensity	269,5	85,2	3	Energy accessibility	100	100
4	GHG-intensity	45,7	91,9	4	Energy availability	3,8	44,7
5	Fossil fuel taxation-intensity	1,89	39,3	5	Estimated average electricity unit cost	0,190	46,2
6	Energy generation market openness	62,0	51,0	6	Estimated average gas unit cost	0,065	48,0
7	Non-renewable energy imports	322,0	17,9	7	Energy dependence	52,1	50,6
8	Energy and Environment patents	8,1	75,0	8	Renewable energy exports	2,4	5,7
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,53	6,3
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,59	12,2

Poland
(50,7)

N° 9

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		56,6		$GEEEI_{Soc}$		42,0
1	Gross inland energy consumption	2,51	84,8	1	Energy consumption-intensity	227,3	56,8
2	Gross renewable energy consumption	9,4	17,2	2	vRE-flexible capacity	2,3	9,8
3	CO_2-intensity	744,4	40,9	3	Energy accessibility	100	100
4	GHG-intensity	179	47,6	4	Energy availability	1,8	9,9
5	Fossil fuel taxation-intensity	2,27	60,1	5	Estimated average electricity unit cost	0,123	80,5
6	Energy generation market openness	25,5	100	6	Estimated average gas unit cost	0,038	84,0
7	Non-renewable energy imports	111,6	82,4	7	Energy dependence	29,3	75,8
8	Energy and Environment patents	2,4	20,2	8	Renewable energy exports	1,2	2,8
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,19	21,2
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,14	6,0

Portugal (45,5)							N° 20
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		55,9		$GEEEI_{Soc}$		35,1
1	Gross inland energy consumption	2,22	89,8	1	Energy consumption-intensity	133,9	80,9
2	Gross renewable energy consumption	21,6	48,0	2	vRE-flexible capacity	1,5	4,9
3	CO_2-intensity	322,1	80,3	3	Energy accessibility	100	100
4	GHG-intensity	97,7	74,6	4	Energy availability	1,7	8,6
5	Fossil fuel taxation-intensity	1,78	33,3	5	Estimated average electricity unit cost	0,225	28,2
6	Energy generation market openness	63,6	48,9	6	Estimated average gas unit cost	0,058	57,3
7	Non-renewable energy imports	144,8	72,2	7	Energy dependence	77,4	22,7
8	Energy and Environment patents	0,3	0,0	8	Renewable energy exports	2,3	5,4
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,25	22,5
10	Non-renewable investment-intensity	..	..	10	Green jobs	2,18	20,4

Romania (49,9) N° 12							
	Indicator	Value	Score		Indicator	Value	Score
	GEEEI$_{Eco}$		53,0		GEEEI$_{Soc}$		45,8
1	Gross inland energy consumption	1,63	100	1	Energy consumption-intensity	226,7	57,0
2	Gross renewable energy consumption	18,4	39,9	2	vRE-flexible capacity	2,5	11,0
3	CO_2-intensity	555,2	58,6	3	Energy accessibility	100	100
4	GHG-intensity	268,5	17,8	4	Energy availability	1,2	0,0
5	Fossil fuel taxation-intensity	2,19	55,7	5	Estimated average electricity unit cost	0,110	87,2
6	Energy generation market openness	65,1	46,8	6	Estimated average gas unit cost	0,032	92,0
7	Non-renewable energy imports	71,3	94,8	7	Energy dependence	17,1	89,3
8	Energy and Environment patents	1,4	10,6	8	Renewable energy exports	1,4	3,3
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,98	16,4
10	Non-renewable investment-intensity	..	..	10	Green jobs	0,87	2,2

Slovakia
(42,5)

N° 25

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		44,5		$GEEEI_{Soc}$		40,4
1	Gross inland energy consumption	3,03	75,8	1	Energy consumption-intensity	215,1	60,0
2	Gross renewable energy consumption	9,6	17,7	2	vRE-flexible capacity	5,8	31,3
3	CO_2-intensity	444,8	68,9	3	Energy accessibility	100	100
4	GHG-intensity	97,4	74,7	4	Energy availability	2,1	15,3
5	Fossil fuel taxation-intensity	1,50	18,0	5	Estimated average electricity unit cost	0,141	71,3
6	Energy generation market openness	73,1	36,1	6	Estimated average gas unit cost	0,049	69,3
7	Non-renewable energy imports	193,2	57,4	7	Energy dependence	58,7	43,3
8	Energy and Environment patents	1,1	7,7	8	Renewable energy exports	1,3	3,1
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,64	8,8
10	Non-renewable investment-intensity	..	..	10	Green jobs	0,86	2,1

Slovenia (54,0)							N° 7
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		64,2		$GEEEI_{Soc}$		43,8
1	Gross inland energy consumption	3,19	73,1	1	Energy consumption-intensity	177,6	69,6
2	Gross renewable energy consumption	16,1	34,1	2	vRE-flexible capacity	5,3	28,2
3	CO_2-intensity	369,0	76,0	3	Energy accessibility	100	100
4	GHG-intensity	86,5	78,3	4	Energy availability	2,3	19,7
5	Fossil fuel taxation-intensity	3,00	100	5	Estimated average electricity unit cost	0,141	71,3
6	Energy generation market openness	92,3	10,3	6	Estimated average gas unit cost	0,050	68,0
7	Non-renewable energy imports	150,4	70,5	7	Energy dependence	48,7	54,4
8	Energy and Environment patents	7,7	71,2	8	Renewable energy exports	0,0	0,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,76	11,5
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,82	15,4

	Spain (47,8)						N° 15
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		56,1		$GEEEI_{Soc}$		39,4
1	Gross inland energy consumption	2,61	83,1	1	Energy consumption-intensity	113,7	86,1
2	Gross renewable energy consumption	13,7	28,0	2	vRE-flexible capacity	2,1	8,6
3	CO_2-intensity	268,0	85,4	3	Energy accessibility	100	100
4	GHG-intensity	60	87,1	4	Energy availability	1,8	10,6
5	Fossil fuel taxation-intensity	1,58	22,4	5	Estimated average electricity unit cost	0,151	66,2
6	Energy generation market openness	64,3	47,9	6	Estimated average gas unit cost	0,055	61,3
7	Non-renewable energy imports	115,3	81,3	7	Energy dependence	73,3	27,2
8	Energy and Environment patents	1,7	13,5	8	Renewable energy exports	0,8	2,0
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,25	22,5
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,43	10,0

Sweden (58,3)							N° 4
	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		70,8		$GEEEI_{Soc}$		45,8
1	Gross inland energy consumption	4,67	47,5	1	Energy consumption-intensity	111,3	86,7
2	Gross renewable energy consumption	42,2	100	2	vRE-flexible capacity	3,9	19,6
3	CO_2-intensity	111,4	100	3	Energy accessibility	100	100
4	GHG-intensity	25,4	98,6	4	Energy availability	3,4	36,8
5	Fossil fuel taxation-intensity	1,74	31,1	5	Estimated average electricity unit cost	0,180	51,3
6	Energy generation market openness	73,4	35,7	6	Estimated average gas unit cost	0,101	0,0
7	Non-renewable energy imports	70,9	94,9	7	Energy dependence	30,1	74,9
8	Energy and Environment patents	6,4	58,7	8	Renewable energy exports	0,2	0,6
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	1,31	23,9
10	Non-renewable investment-intensity	..	..	10	Green jobs	5,36	64,4

United Kingdom
(50,6)

N° 10

	Indicator	Value	Score		Indicator	Value	Score
	$GEEEI_{Eco}$		57,4		$GEEEI_{Soc}$		43,8
1	Gross inland energy consumption	2,94	77,4	1	Energy consumption-intensity	94,3	91,0
2	Gross renewable energy consumption	7,7	12,9	2	vRE-flexible capacity	1,4	4,3
3	CO_2-intensity	220,5	89,8	3	Energy accessibility	100	100
4	GHG-intensity	44,8	92,2	4	Energy availability	2,2	16,6
5	Fossil fuel taxation-intensity	1,82	35,5	5	Estimated average electricity unit cost	0,172	55,4
6	Energy generation market openness	74,6	34,1	6	Estimated average gas unit cost	0,042	78,7
7	Non-renewable energy imports	54,3	100	7	Energy dependence	37,4	66,9
8	Energy and Environment patents	2,1	17,3	8	Renewable energy exports	0,1	0,3
9	Renewable energy investment-intensity	..	..	9	Renewable energy turnover	0,76	11,5
10	Non-renewable investment-intensity	..	..	10	Green jobs	1,68	13,4

Annex 9: Indicator scoreboards

GEEEI$_{Eco}$

Gross inland energy consumption (toe per capita)

1.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	3.0	77,2		EU-28 Average	3.3	70,8
1	Romania	1,63	100	15	Denmark	2,96	77,0
2	Malta	1,76	97,8	16	Slovakia	3,03	75,8
3	Croatia	2,02	93,3	17	Ireland	3,06	75,3
4	Latvia	2,21	90,0	18	Slovenia	3,19	73,1
5	Portugal	2,22	89,8	19	France	3,8	62,5
6	Greece	2,25	89,3	20	Germany	3,87	61,3
7	Lithuania	2,37	87,2	21	Austria	3,88	61,1
8	Poland	2,51	84,8	22	Czech Republic	4,03	58,5
9	Hungary	2,56	83,9	23	Netherlands	4,59	48,9
10	Bulgaria	2,57	83,8	24	Sweden	4,67	47,5
11	Italy	2,57	83,8	25	Estonia	4,76	45,9
12	Spain	2,61	83,1	26	Belgium	4,82	44,9
13	Cyprus	2,68	81,9	27	Finland	6,06	23,5
14	UK	2,94	77,4	28	Luxembourg	7,42	0,0

Source: EU (2017)

Year: 2015

GEEEI$_{Eco}$

Gross inland renewable energy consumption (% gross inland energy consumption)

2.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	12,1	24,0		EU-28 Average	15,6	32.7
1	Sweden	42,2	100	15	Hungary	12,0	23,7
2	Latvia	35,1	82,1	16	Greece	11,4	22,2
3	Finland	31,6	73,2	17	Bulgaria	10,8	20,7
4	Austria	29,0	66,7	18	Czech Republic	10,1	18,9
5	Denmark	28,4	65,2	19	Slovakia	9,6	17,7
6	Croatia	23,0	51,5	20	Poland	9,4	17,2
7	Portugal	21,6	48,0	21	France	8,6	15,2
8	Lithuania	20,5	45,2	22	UK	7,7	12,9
9	Romania	18,4	39,9	23	Ireland	7,6	12,6
10	Italy	16,8	35,9	24	Belgium	6,7	10,4
11	Slovenia	16,1	34,1	25	Cyprus	6,5	9,8
12	Estonia	14,5	30,1	26	Luxembourg	4,9	5,8
13	Spain	13,7	28,0	27	Netherlands	4,7	5,3
14	Germany	12,2	24,2	28	Malta	2,6	0,0

Source: EU (2017) Year: 2015

GEEEI$_{Eco}$

CO$_2$-intensity
(g per unit of GDP)

3.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	307,3	81,7		EU-28 Average	383,4	74,6
1	Sweden	111,4	100	15	Portugal	322,1	80,3
2	Denmark	148,3	96,6	16	Latvia	357,9	77,0
3	France	168,7	94,7	17	Slovenia	369,0	76,0
4	Ireland	178,9	93,7	18	Lithuania	397,8	73,3
5	UK	220,5	89,8	19	Croatia	416,0	71,6
6	Austria	221,8	89,7	20	Greece	421,9	71,0
7	Luxembourg	228,3	89,1	21	Cyprus	431,1	70,2
8	Italy	235,9	88,4	22	Hungary	438,7	69,5
9	Finland	248,0	87,3	23	Slovakia	444,8	68,9
10	Malta	252,4	86,8	24	Romania	555,2	58,6
11	Spain	268,0	85,4	25	Czech Republic	623,7	52,2
12	Netherlands	269,5	85,2	26	Poland	744,4	40,9
13	Belgium	272,2	85,0	27	Estonia	913,4	25,2
14	Germany	292,5	83,1	28	Bulgaria	1183,0	0,0

Source: EU (2017)

Year: 2015

GEEEI$_{Eco}$

GHG-intensity
(CO_2-equivalent g per unit of GDP)

4.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	87,7	77,9		EU-28 Average	102,1	73,1
1	Luxembourg	21,3	100	15	Cyprus	88,9	77,5
2	Sweden	25,4	98,6	16	Ireland	93,9	75,9
3	Austria	39	94,1	17	Slovakia	97,4	74,7
4	Germany	39,4	94,0	18	Portugal	97,7	74,6
5	Belgium	44,8	92,2	19	Greece	113	69,5
6	UK	44,8	92,2	20	Estonia	123,5	66,0
7	Netherlands	45,7	91,9	21	Croatia	127,3	64,7
8	Italy	48,8	90,9	22	Hungary	132,4	63,1
9	Denmark	49,6	90,6	23	Czech Republic	137,9	61,2
10	France	57,6	87,9	24	Poland	179	47,6
11	Finland	59,4	87,3	25	Latvia	190,5	43,7
12	Spain	60	87,1	26	Lithuania	202,9	39,6
13	Malta	62,5	86,3	27	Romania	268,5	17,8
14	Slovenia	86,5	78,3	28	Bulgaria	322	0,0

Source: EU (2017)

Year: 2015

GEEEI$_{Eco}$

Fossil fuel taxation-intensity (% GDP)

5.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	1,9	40,7		EU-28 Average	2,0	44,8
1	Slovenia	3,00	100	15	Netherlands	1,89	39,3
2	Greece	2,95	97,3	16	UK	1,82	35,5
3	Italy	2,76	86,9	17	France	1,78	33,3
4	Croatia	2,57	76,5	18	Portugal	1,78	33,3
5	Bulgaria	2,55	75,4	19	Sweden	1,74	31,1
6	Estonia	2,43	68,9	20	Luxembourg	1,69	28,4
7	Cyprus	2,29	61,2	21	Lithuania	1,67	27,3
8	Poland	2,27	60,1	22	Germany	1,59	23,0
9	Denmark	2,22	57,4	23	Spain	1,58	22,4
10	Romania	2,19	55,7	24	Austria	1,53	19,7
11	Latvia	2,08	49,7	25	Slovakia	1,50	18,0
12	Finland	1,99	44,8	26	Malta	1,49	17,5
13	Czech Republic	1,94	42,1	27	Belgium	1,29	6,6
14	Hungary	1,94	42,1	28	Ireland	1,17	0,0

Source: Eurostat (2017d) Year: 2015

GEEEI$_{Eco}$

Energy generation market openness (% market players > 5%)

6.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	70,5	40,1		EU-28 Average	69,9	39,6
1	Poland	25,5	100	15	Hungary	72,0	37,6
2	Italy	40,0	80,5	16	Slovakia	73,1	36,1
3	Denmark	44,0	75,2	17	Sweden	73,4	35,7
4	Austria	53,0	69,0	18	UK	74,6	34,1
5	Latvia	57,4	63,1	19	Greece	75,7	32,6
6	Czech Republic	62,0	57,2	20	Germany	76,0	32,2
7	Netherlands	62,0	51,0	21	Bulgaria	78,4	29,0
8	Finland	62,8	51,0	22	Estonia	79,8	27,1
9	Lithuania	63,2	49,9	23	Ireland	81,0	25,5
10	Portugal	63,6	49,4	24	Croatia	89,9	13,6
11	Spain	64,3	48,9	25	Slovenia	92,3	10,3
12	Romania	65,1	47,9	26	France	92,4	0,2
13	Belgium	65,7	46,8	27	Cyprus	100	0,0
14	Luxembourg	69,0	41,6	28	Malta	100	0,0

Source: EU (2017) Year: 2015

GEEEI$_{Eco}$

Non-renewable energy imports (μtoe per unit of GDP)

7.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	128,0	77,4		EU-28 Average	147, 3	71,5
1	UK	54,3	100	15	Estonia	128,4	77,3
2	Ireland	55,3	99,7	16	Cyprus	141,7	73,2
3	Denmark	63,7	97,1	17	Portugal	144,8	72,2
4	France	68,0	95,8	18	Slovenia	150,4	70,5
5	Sweden	70,9	94,9	19	Hungary	161,4	67,2
6	Romania	71,3	94,8	20	Croatia	163,4	66,5
7	Luxembourg	78,3	92,6	21	Latvia	180,6	61,3
8	Germany	84,0	90,9	22	Slovakia	193,2	57,4
9	Austria	84,1	90,9	23	Belgium	196,7	56,3
10	Italy	90,1	89,0	24	Greece	200,3	55,2
11	Finland	109,7	83,0	25	Bulgaria	273,8	32,7
12	Poland	111,6	82,4	26	Malta	302,0	24,0
13	Spain	115,3	81,3	27	Netherlands	322,0	17,9
14	Czech Republic	127,6	77,5	28	Lithuania	380,4	0,0

Source: EU (2017) Year: 2015

GEEEI$_{Eco}$

Energy- and environment-related patents (number per billion units of GDP(°2015))

8.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	2,2	18,3		EU-28 Average	3,4	30,8
1	Finland	10,7	100	15	Czech Republic	2,1	17,3
2	Austria	9,1	84,6	16	UK	2,1	17,3
3	Netherlands	8,1	75,0	17	Ireland	1,7	13,5
4	Slovenia	7,7	71,2	18	Spain	1,7	13,5
5	Sweden	6,4	58,7	19	France	1,6	12,5
6	Denmark	6,1	55,8	20	Cyprus	1,4	10,6
7	Luxembourg	6,0	54,8	21	Romania	1,4	10,6
8	Estonia	4,8	43,3	22	Croatia	1,3	9,6
9	Malta	4,1	36,5	23	Lithuania	1,3	9,6
10	Latvia	3,6	31,7	24	Bulgaria	1,2	8,7
11	Belgium	3,3	28,8	25	Slovakia	1,1	7,7
12	Italy	2,7	23,1	26	Greece	1,0	6,7
13	Poland	2,4	20,2	27	Germany	0,4	1,0
14	Hungary	2,3	19,2	28	Portugal	0,3	0,0

Sources: EU (2017), WIPO (2017b) Period: 2008-2015

GEEEI$_{Soc}$

Gross final energy consumption-intensity (toe per unit of GDP)

1.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	133,2	81,0		EU-28 Average	165,6	43,5
1	Ireland	59,4	100	15	Portugal	133,9	80,9
2	Denmark	65,1	98,5	16	Belgium	141,3	78,9
3	Luxembourg	89,1	92,4	17	Slovenia	177,6	69,6
4	Malta	90,7	91,9	18	Finland	177,7	69,6
5	UK	94,3	91,0	19	Croatia	192,9	65,7
6	Italy	100,4	89,5	20	Lithuania	205,4	62,5
7	Austria	107,1	87,7	21	Latvia	206,7	62,1
8	Sweden	111,3	86,7	22	Slovakia	215,1	60,0
9	Germany	112,6	86,3	23	Romania	226,7	57,0
10	Spain	113,7	86,1	24	Poland	227,3	56,8
11	Netherlands	117,9	85,0	25	Hungary	233,6	55,2
12	France	120,5	84,3	26	Czech Republic	249,2	51,2
13	Cyprus	128,7	82,2	27	Estonia	358,0	23,3
14	Greece	132,5	81,2	28	Bulgaria	448,5	0,0

Source: Eurostat (2017a) Year: 2015

GEEEI$_{Soc}$

vRE-flexible capacity
(vRE-flexible capacity value)

2.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	3,2	15,3		EU-28 Average	4,2[124]	21,6
1	Latvia	17,0	100	15	France	2,9	13,5
2	Hungary	11,3	65,0	16	Italy	2,8	12,9
3	Lithuania	7,4	41,1	17	Romania	2,5	11,0
4	Estonia	6,7	36,8	18	Croatia	2,4	10,4
5	Cyprus	6,3	34,4	19	Poland	2,3	9,8
6	Slovakia	5,8	31,3	20	Greece	2,2	9,2
7	Finland	5,3	28,2	21	Ireland	2,1	8,6
8	Luxembourg	5,3[125]	28,2	22	Spain	2,1	8,6
9	Slovenia	5,3	28,2	23	Belgium	1,7	6,1
10	Netherlands	4,2	21,5	24	Portugal	1,5	4,9
11	Sweden	3,9	19,6	25	UK	1,4	4,3
12	Bulgaria	3,4	16,6	26	Denmark	0,8	0,6
13	Czech Republic	3,3	16,0	27	Germany	0,7	0,0
14	Austria	3,2	15,3	28	Malta	..[126]	..

Source: EurObserv'ER (2016) Year: 2015

[124] When the EU-28 average and median cannot be calculated due to a lack of data, the average and medium is calculated for the remaining countries.
[125] The data on Luxemburg dates from 2014 instead of 2015.
[126] There was no data available on Malta.

GEEEI$_{Soc}$

Energy accessibility
(% population)

3.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	100	100		EU-28 Average	100	100
1	Austria	100	100	15	Italy	100	100
2	Belgium	100	100	16	Latvia	100	100
3	Bulgaria	100	100	17	Lithuania	100	100
4	Croatia	100	100	18	Luxembourg	100	100
5	Cyprus	100	100	19	Malta	100	100
6	Czech Republic	100	100	20	Netherlands	100	100
7	Denmark	100	100	21	Poland	100	100
8	Estonia	100	100	22	Portugal	100	100
9	Finland	100	100	23	Romania	100	100
10	France	100	100	24	Slovakia	100	100
11	Germany	100	100	25	Slovenia	100	100
12	Greece	100	100	26	Spain	100	100
13	Hungary	100	100	27	Sweden	100	100
14	Ireland	100	100	28	UK	100	100

Sources: World Bank (2017a & 2017b)

Year: 2014

GEEEI$_{Soc}$

Energy availability (toe per capita)

4.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	2,1	16,0		EU-28 Average	2,5	22,7
1	Luxembourg	7,1	100	15	Slovakia	2,1	15,3
2	Finland	4,6	58,5	16	Lithuania	2,1	15,0
3	Belgium	4,0	47,1	17	Cyprus	2,0	14,3
4	Netherlands	3,8	44,7	18	Italy	2,0	14,3
5	Austria	3,4	38,0	19	Latvia	2,0	13,4
6	Sweden	3,4	36,8	20	Hungary	1,9	13,1
7	Germany	2,9	28,7	21	Spain	1,8	10,6
8	Czech Republic	2,6	24,2	22	Poland	1,8	9,9
9	Ireland	2,5	22,7	23	Croatia	1,7	8,7
10	Denmark	2,5	22,4	24	Portugal	1,7	8,6
11	France	2,4	21,0	25	Greece	1,6	7,1
12	Slovenia	2,3	19,7	26	Malta	1,4	4,0
13	Estonia	2,3	18,8	27	Bulgaria	1,4	3,2
14	UK	2,2	16,6	28	Romania	1,2	0,0

Source: EU (2017)

Year: 2015

GEEEI$_{Soc}$

Estimated average electricity unit cost (€ per kWh)

5.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	0,200	65,4		EU-28 Average	0,168	57,3
1	Belgium	0,085	100	15	Latvia	0,154	64,6
2	Italy	0,102	91,3	16	France	0,165	59,0
3	Lithuania	0,103	90,8	17	Estonia	0,167	57,9
4	Czech Republic	0,108	88,2	18	UK	0,172	55,4
5	Romania	0,110	87,2	19	Sweden	0,180	51,3
6	Poland	0,123	80,5	20	Netherlands	0,190	46,2
7	Germany	0,127	78,5	21	Luxembourg	0,209	36,4
8	Bulgaria	0,134	74,9	22	Denmark	0,221	30,3
9	Slovakia	0,141	71,3	23	Finland	0,225	28,2
10	Slovenia	0,141	71,3	24	Portugal	0,225	28,2
11	Ireland	0,148	67,7	25	Greece	0,233	24,1
12	Hungary	0,150	66,7	26	Croatia	0,256	12,3
13	Malta	0,150	66,7	27	Austria	0,260	10,3
14	Spain	0,151	66,2	28	Cyprus	0,280	0,0

Sources: Eurostat (2017b & 2017c)   Year: 2016, 2nd semester

GEEEI$_{Soc}$

Estimated average gas unit cost (€ per kWh)

6.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	0,050	68,7		EU-28 Average	0,049[127]	69,5
1	Bulgaria	0,026	100	15	Greece	0,051	66,7
2	Estonia	0,030	94,7	16	Ireland	0,051	66,7
3	Romania	0,032	92,0	17	Finland	0,052	65,3
4	Hungary	0,036	86,7	18	Germany	0,052	65,3
5	Latvia	0,037	85,3	19	Austria	0,055	61,3
6	Lithuania	0,037	85,3	20	Spain	0,055	61,3
7	Croatia	0,038	84,0	21	Portugal	0,058	57,3
8	Poland	0,038	84,0	22	France	0,059	56,0
9	Luxembourg	0,039	82,7	23	Italy	0,059	56,0
10	UK	0,042	78,7	24	Netherlands	0,065	48,0
11	Belgium	0,043	77,3	25	Denmark	0,069	42,7
12	Czech Republic	0,046	73,3	26	Sweden	0,101	0,0
13	Slovakia	0,049	69,3	27	Cyprus	..[128]	..
14	Slovenia	0,050	68,0	28	Malta	..	..

Sources: Eurostat (2017e & 2017f) Year: 2016, 2nd semester

[127] When the EU-28 average and median cannot be calculated due to a lack of data, the average and medium is calculated for the remaining countries.

[128] There was no data available on Cyprus or Malta.

GEEEI$_{Soc}$

Energy dependence (%)

7.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	52,8	49,9		EU-28 Average	56,1	46,2
1	Estonia	7,4	100	15	Hungary	53,4	49,2
2	Denmark	13,1	93,7	16	Slovakia	58,7	43,3
3	Romania	17,1	89,3	17	Austria	60,8	41,0
4	Poland	29,3	75,8	18	Germany	61,9	39,8
5	Sweden	30,1	74,9	19	Greece	71,7	29,0
6	Czech Republic	31,9	72,9	20	Spain	73,3	27,2
7	Bulgaria	35,4	69,1	21	Italy	77,1	23,0
8	UK	37,4	66,9	22	Portugal	77,4	22,7
9	France	46,0	57,3	23	Lithuania	78,4	21,5
10	Finland	46,8	56,5	24	Belgium	84,3	15,0
11	Croatia	48,3	54,8	25	Ireland	88,7	10,2
12	Slovenia	48,7	54,4	26	Luxembourg	95,9	2,2
13	Latvia	51,2	51,6	27	Malta	97,3	0,7
14	Netherlands	52,1	50,6	28	Cyprus	97,9	0,0

Source: EU (2017) Year: 2015

GEEEI$_{Soc}$

Renewable energy exports (μtoe per unit of GDP)

8.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	0,7	1,7		EU-28 Average	3,8	8,8
1	Latvia	42,9	100	15	Germany	0,6	1,3
2	Estonia	23,5	54,9	16	Belgium	0,3	0,6
3	Lithuania	8,8	20,6	17	Sweden	0,2	0,6
4	Croatia	6,8	15,9	18	UK	0,1	0,3
5	Bulgaria	4,9	11,4	19	France	0,1	0,2
6	Hungary	3,7	8,6	20	Italy	0,1	0,2
7	Netherlands	2,4	5,7	21	Cyprus	0,0	0,0
8	Czech Republic	2,4	5,5	22	Denmark	0,0	0,0
9	Portugal	2,3	5,4	23	Finland	0,0	0,0
10	Austria	1,6	3,8	24	Greece	0,0	0,0
11	Romania	1,4	3,3	25	Ireland	0,0	0,0
12	Slovakia	1,3	3,1	26	Luxembourg	0,0	0,0
13	Poland	1,2	2,8	27	Malta	0,0	0,0
14	Spain	0,8	2,0	28	Slovenia	0,0	0,0

Source: EU (2017)

Year: 2015

GEEEI$_{Soc}$

Renewable energy turnover (% GDP)

9.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	1,00	16,4		EU-28 Average	1,22	21,8
1	Denmark	4,69	100	15	Romania	0,98	16,4
2	Latvia	2,63	53,6	16	Czech Republic	0,95	15,8
3	Estonia	2,52	51,1	17	France	0,91	14,9
4	Austria	2,04	40,3	18	Hungary	0,76	11,5
5	Lithuania	1,74	33,6	19	Slovenia	0,76	11,5
6	Finland	1,68	32,2	20	UK	0,76	11,5
7	Croatia	1,52	28,6	21	Slovakia	0,64	8,8
8	Bulgaria	1,50	28,2	22	Greece	0,61	8,1
9	Sweden	1,31	23,9	23	Netherlands	0,53	6,3
10	Portugal	1,25	22,5	24	Belgium	0,42	3,8
11	Spain	1,25	22,5	25	Malta	0,38	2,9
12	Poland	1,19	21,2	26	Cyprus	0,37	2,7
13	Italy	1,14	20,0	27	Luxembourg	0,28	0,7
14	Germany	0,98	16,4	28	Ireland	0,25	0,0

Source: EurObserv'ER (2016) Year: 2015

GEEEI$_{Soc}$

Green Jobs
(number per thousand capita)

10.

	Country	Value	Score		Country	Value	Score
	EU-28 Mean	1,60	12,9		EU-28 Average	2,38	23,1
1	Denmark	7,93	100	15	Italy	1,60	12,3
2	Finland	5,73	69,5	16	Netherlands	1,59	12,2
3	Sweden	5,36	64,4	17	Czech Republic	1,55	11,6
4	Austria	4,33	50,1	18	Croatia	1,50	10,9
5	Estonia	4,03	46,0	19	Spain	1,43	10,0
6	Germany	3,97	45,2	20	Greece	1,19	6,6
7	Luxembourg	3,73	41,8	21	Poland	1,14	6,0
8	Latvia	3,32	36,1	22	Bulgaria	1,04	4,6
9	France	2,44	24,0	23	Ireland	1,02	4,3
10	Portugal	2,18	20,4	24	Malta	0,93	3,0
11	Belgium	1,98	17,6	25	Romania	0,87	2,2
12	Lithuania	1,87	16,1	26	Slovakia	0,86	2,1
13	Slovenia	1,82	15,4	27	Hungary	0,77	0,8
14	UK	1,68	13,4	28	Cyprus	0,71	0,0

Sources: EurObserv'ER (2016), Eurostat (2017g)

Year: 2015