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The Effects of the EU Taxonomy on Municipal Energy Investment Plans

A qualitative study exploring the effects of the EU taxonomy in bioenergy investment strategies related to the energy plan of Gothenburg municipality

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Abstract

One of the most recent climate initiatives of the European Union (EU) is the Taxonomy Regulation (EU/2020/852), a tool to redirect capital towards sustainable investment and to achieve the goals set in Agenda 2030 and the Paris Agreement. The taxonomy's classification system is a predetermined and union-wide definition of sustainable economic activities, risking to be in conflict with different local perceptions of what is sustainable. In Gothenburg municipality's energy plan, bioenergy plays an important role in the local energy system and in the transition towards climate neutrality, with several investments being planned in the coming years. Bioenergy is one of the taxonomy's most controversial economic activities, recently reclassified from a transitional to a green economic activity. Previous literature illustrates a skepticism towards the taxonomy's effectiveness, suggesting that it might stifle innovation. The thesis therefore aims to assess whether the taxonomy is an effective regulation by identifying how the taxonomy influences municipal investment plans in bioenergy. By conducting interviews with municipal and private energy actors, it was discovered that all bioenergy investments in Gothenburg's energy plan are estimated to be in compliance with the taxonomy. However, regardless if bioenergy investments are compliant or noncompliant, the taxonomy imposes uncertainties as well as financial- and reputational challenges for the municipal and local actors' investment plans. By comparing the empirical data with concepts presented in the Porter Hypothesis, there are indications that the taxonomy is an ineffective regulation, at least regarding bioenergy investments. The empirical data further suggest an ambiguity within Gothenburg municipality whether it is important to strive towards taxonomy compliance or not.

Key words:

EU Taxonomy, Investment strategies, Bioenergy, Energy planning, Municipality, the Porter Hypothesis

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1. Introduction

Climate change is one of the world's biggest challenges going forward (UN, 2021). As a response to this growing concern, the Paris Agreement, a global and legally binding climate agreement, was formulated and entered into force in 2016 (UNFCCC, n.d.). The agreement strives to prevent global warming to exceed 2 degrees Celsius above pre-industrial levels, preferably keeping it below 1.5 degrees Celsius by reducing greenhouse gas emissions (UNFCCC, n.d.). To achieve this goal, it is critical that capital flows are channeled towards sustainable investments (IRENA, 2019). For instance, IRENA (2019) estimates that cumulative investment in renewable energy alone needs to reach $27 trillion in the 2016-2050 period to align with the objectives of the Paris Agreement.

TEG (2020) reports that due to a lack of transparency in the financial market, it can be difficult for investors to assess which economic activities are environmentally sustainable. TEG (2020) states that The European Union (EU) has recognized this issue and has, in commitment to the Paris Agreement, introduced the Taxonomy Regulation[1] (EU/2020/852). The taxonomy is a framework to facilitate sustainable investment within the EU and mitigate greenwashing in sectors such as manufacturing, transportation, construction, and energy (TEG, 2020). TEG (2020) explains that the basic idea of the taxonomy is that all economic activities in society have to comply with certain environmental criteria in order to be labeled as sustainable. By extension, the taxonomy is meant to work as a tool to redirect capital towards genuinely sustainable projects that, for example, mitigate climate change (TEG, 2020).

The energy sector plays an important role in the mitigation of climate change, accounting for more than two-thirds of global greenhouse gas emissions (Walton, 2020). This makes it particularly relevant to explore how the taxonomy impacts investments connected to this sector. For this reason, the thesis intends to look into the relationship between the taxonomy and the investment strategies formulated in a local energy plan of a Swedish municipality, namely Gothenburg's energy plan. One of Gothenburg's overall climate goals is to reduce its climate footprint by phasing out fossil energy and replace it with renewable alternatives such as bioenergy[2] (Göteborgs Stad, 2021). The course of action is described in Gothenburg's

[1] Henceforth, the Taxonomy Regulation (EU/2020/852) is merely called the taxonomy in this thesis.
[2] Bioenergy is defined as energy produced from renewable organic materials, and the term soley refers to district heating, gas and fuel sourced from biological materials or processes.

energy plan, linking measures and planned investments to municipal and private energy actors, e.g. Göteborg Energi, Renova, Gryaab, Preem and St1 (Göteborgs stad, n.d.b.). These local actors will be the focus of this thesis, as well as other actors with relevance to Gothenburg's energy planning, such as Stadsledningskontoret, Gothenburg European Office and Miljöförvaltningen.

Among the energy sources described in Gothenburg's energy plan, bioenergy is expected to have an increased importance in the future, and several bioenergy investments are planned (Göteborg stad, n.d.b). However, though bioenergy is considered a renewable source of energy, it is also a controversial one due to several reasons such as its impact on biodiversity (Cronin et. al, 2021). The views within the EU are divided on the use of bioenergy as something 'sustainable', which has further been reflected in the taxonomy (Borglund, 2021). This gives reason to believe that there could be a potential clash between the taxonomy and Gothenburg's view of sustainable bioenergy investments.

1.1 Problem discussion

The supposed inconsistency between local sustainability solutions and region-wide, uniform definitions of what exact economic activities lead to sustainability gives reasons to believe that the taxonomy might not bring the expected, and much needed, guidance for sustainable investments. The European Commission has taken both scientific and technical inputs from various stakeholders (such as permanent expert groups, industries, civil society, and academia) into consideration when formulating the criterias for sustainable economic activities (European Commission, n.d.b). Even if these measures were taken, the question remains whether the taxonomy is able to capture the different local contexts of sustainability. What is perceived to be sustainable in one place may be unsustainable in another, depending on local prerequisites. In that way, the taxonomy's criterias of what constitutes sustainable energy investments risks being in conflict with local sustainability efforts, such as planned investments in bioenergy.

Göteborgs Stadshus has identified the taxonomy regulation as an important basis for Gothenburg municipality's decision-making on local climate mitigation and adaptation (Göteborg Stadshus, 2021). As described in the energy plan (Göteborg Stad, n.d), several investments in bioenergy are both planned and in motion in order to achieve climate

neutrality by 2030. Knowledge of the taxonomy's potential effects on these investments are highly relevant, but yet unknown since the framework still is in the early stage of implementation (UNPRI, 2022). A municipal energy plan and its associated economic activities risk facing challenges if they are non-compliant with the taxonomy, but they also risk facing challenges if they strictly align with the taxonomy while ignoring the local context.

Identifying the taxonomy's local effects promotes a better understanding of whether the taxonomy itself can be considered an effective regulation as per Porter and van der Linde's definition (1995). According to Porter and van der Linde's (1995) Porter Hypothesis, an effective environmental regulation facilitates innovation and companies' competitiveness. As innovation and environmental competitiveness is vital for sustainable development (Hermundsdottir & Aspelund, 2021; Waltz, 2017), is it important to assess whether the taxonomy's predetermined criterias for sustainable economic activities facilitate this. In the worst case, according to Porter and van der Linde (1995), ineffective environmental regulation prevents risk taking and creates lock-in effects. This raises a question of whether the taxonomy is effective in its design or not.

1.2 Purpose

The taxonomy's effects on municipal energy plans is yet to be discovered. For this reason, the thesis' aim is to assess whether the taxonomy is an effective regulation[3] by identifying how the taxonomy influences municipal investment plans in bioenergy.

1.3 Research questions

This study intends to answer the following research questions:

1. *How do actors, with relevance to Gothenburg's energy plan, perceive their taxonomy compliance regarding bioenergy investments?*

2. *What are the supposed effects of aligning or not aligning the energy plan's investment strategies with the taxonomy?*

[3] According to Porter and van der Linde's (1995) definition, see 2.1.1.

By answering these questions, the ambition is to draw conclusions whether the taxonomy could be considered an effective environmental regulation, and whether it is important for investments in the energy plan to be compliant with the taxonomy.

1.4 Delimitations

Since the taxonomy is a complex and still emerging field of study, limitations have been made in order to make this thesis more comprehensible. The thesis primary focus will be on the first delegated act on sustainable activities for the objectives of climate change mitigation and adaptation. When this thesis is being written, the second delegated act is yet to be published and cannot be used as a basis for analysis.

When discussing Gothenburg's energy plan, an assumption is made that the energy plan reflects the energy actors' own investment strategies and plans for bioenergy, which is concretized in their respective annual- and sustainability reporting. Adjustments in an actor's investment strategy are therefore assumed to imply adjustments in the energy plan and vice versa. In that way, the actors' investment plans and the energy plan itself are shaped by each other.

1.5 Disposition

The thesis begins with a background on the taxonomy and Gothenburg's energy plan, contextualizing the main concepts of the thesis. In 3.1, the conceptual framework introduces the Porter Hypothesis by Porter and van der Linde (1995), whose definition of an effective regulation functions as a framework for the analysis of the empirical data. The conceptual framework further explains in 3.2-3.4 topics such as the taxonomy, stranded assets and strategic energy planning, as these are relevant for understanding the complexity of the taxonomy and its effects on a local scale. The method describes (4.1-4.3) and critically discusses (4.4) the gathering of the empirical data through qualitative and semistructured interviews with actors from Gothenburg municipality and actors mentioned in the energy plan. The empirical data divides into 5.1 and 5.2, respectively representing empirical data relevant to the first and second research question. The analysis and discussion section dissects the four major concepts (6.1-6.4) brought up in the empirical data, by using previous literature and the Porter Hypothesis. 6.5 clarifies and summarizes the points made on the

Porter thesis throughout 6.1-6.4, more explicitly discussing whether the taxonomy is an effective regulation or not. Lastly, the conclusion fortifies the thesis' findings and contributions, and presents suggestions for further research.

2. Background

2.1 The Taxonomy for Sustainable Activities

The taxonomy is a sustainability classification system for financial investments, classifying economic activities as either green, enabling, transitional, or non-sustainable, based on predetermined criteria described in delegated acts (European Commission, n.d.a). It was entered into force on 12 July 2020 and aims to provide companies, investors, and policymakers throughout the EU with science-based definitions of which economic activities categorizes as environmentally sustainable (European Commission, n.d.a). As a result, the European Commission (n.d.a) argues that it can serve as a useful tool in companies' decision-making, improve their environmental performance, and attract investors. They furthermore suggest that it creates security for investors as it reduces the risks of greenwashing and mitigates market fragmentation. The hope is that the framework will help redirect investments where they are most needed in order to accelerate sustainable development (European Commission n.d.b).

In order for an economic activity to be labeled green, i.e. environmentally sustainable, it has to be from an eligible sector (energy, transport, land use, etc.), comply with minimum safeguards, as well as making a *substantial contribution* to at least one of the EU's climate and environmental objectives *without significantly harming* any of the other objectives (EU/2020/852, Article 3). The objectives are stated in Article 9 (EU/2020/852) and are as follows:

1. Climate change mitigation
2. Climate change adaptation
3. The sustainable use and protection of water and marine resources
4. The transition to a circular economy
5. Pollution prevention and control
6. The protection and restoration of biodiversity and ecosystems

Together with a platform of sustainability- and industry experts, the European Commission is currently in the process of defining technical screening criteria for each environmental objective through delegated acts (European Commission n.d.a). It is further explained by the European Commission that the delegated acts will define what it means to make a substantial contribution as well as what it means to not cause significant harm. A first delegated act on sustainable activities for the objectives of climate change mitigation and adaptation was formally adopted on 4 June 2021, while a second delegated act will be published in 2022 covering the remaining objectives (European Commission n.d.a). According to the European Commission, both delegated acts will be living documents that will be updated over time when needed. They are further stated to both integrate and go beyond sectoral policies, such as the Renewable Energy Directive (European Commission n.d.b).

The first delegated act states that green investments must ultimately result in net zero emissions while enabling activities result in climate neutrality (Schütze & Stede, 2021). Schütze and Stede (2021) further explain that transitional activities do not necessarily result in climate neutrality, but are defined through certain thresholds of minimum requirements of sustainability, e.g thresholds for life cycle emissions. In reference to energy production, Schütze and Stede (2021) state that the draft of the first delegated act classified energy sources such as bioenergy, hydropower and geothermal energy as transitional activities. However, after intense criticism and revision of the first draft, the second version of the climate related delegated act changed its stance on bioenergy and reclassified it as a green economic activity (Finansdepartementet, 2022).

The taxonomy framework currently applies to financial market participants[4] that offer financial products and services within the EU, as well as the larger companies that are obliged to provide a non-financial statement according to the Non-Financial Reporting Directive (NFRD) (TEG, 2020). TEG (2020) states that companies that are included in the NFRD are obliged to report what percentage of their turnover, as well as capital- and operational expenditures, are aligned with the taxonomy. The taxonomy can further be used voluntarily by other actors not yet included in the regulation (TEG, 2020). However, it is worth noting that reporting taxonomy alignment will be mandatory for all large companies in the near future (not only publicly listed), when the Corporate Sustainability Reporting

[4] E.g. commercial banks, governments, brokers and dealers, etc. (Cook & LaRoche, 1998)

Directive (CSRD) is put into force (European Commission, 2021). According to the European Commission (2021) the CSRD intends to amend the existing reporting requirements of the NFRD and is planned to be adopted by the end of 2022. The implication is that all large companies will apply the taxonomy standards in their sustainability reports in 2024, covering the financial year 2023 (European Commission, 2021).

It is important to note, however, that the EU Taxonomy is not a mandatory list of economic activities for investors to invest in, nor does it set mandatory requirements on environmental performance for companies (European Commission n.d.a). Despite this, many consulting companies, such as Ramboll (2021), suggest that taxonomy compliance should still be strived for. The argument is that compliance can improve companies' reputation and be a way to get easier access to financing, as well as build resilience to climate change and associated risks (Ramboll, 2021).

2.2 Energy Plan of Gothenburg

In accordance with the Act on Municipal Energy Planning (1977:439), municipalities are obliged to establish an energy plan (Göteborg stad, n.d). Gothenburg's new energy plan, which describes how Gothenburg will reach its energy related climate goals, was published in 2022 and is currently under implementation (Göteborg stad, n.d). By 2030, Gothenburg aims to become climate neutral and a key aspect of this is the phasing out of fossil fuels and producing 100% renewable energy (Göteborg stad, 2021). As a municipal steering document, the energy plan and its described measures are mainly directed towards municipal actors and municipal corporations (Göteborg stad, n.d). The energy plan also mentions investment plans of the local refineries as they largely impact Gothenburg's energy system, but the energy plan puts no obligations upon the refineries since they are private corporations, i.e out of the municipality's direct influence (Göteborg stad, n.d).

The plan is periodically revised and updated to meet new challenges in the ever changing energy sector (Göteborg stad, n.d). Several investments in CCS[5], hydrogen and bioenergy are planned and currently in motion among the city's energy actors, both municipal and private (Göteborg stad, n.d). In regards to bioenergy, investments in biochar production, expansion of biorefineries, biogas production from sewage treatment and district heating from burning

[5] Carbon Capture and Storage

biomass is mentioned (Göteborg stad, n.d).

All in all, the energy plan testifies the importance of bioenergy as a means for reaching climate neutrality in sectors such as fuel- and electricity production as well as district heating (Göteborg stad, n.d). When the first draft of the first delegated act classified bioenergy as a transitional activity (Fischer, 2022), many of Gothenburg's energy actors were worried about the future of bioenergy as it is an important part of the city's renewable energy sources (Göteborg Energi, n.d.). Although the second draft reclassified bioenergy as a green investment, the criterias are still hard to interpret and stricter than the current EU-regulation, which might decrease the willingness to invest in bioenergy activities (Borglund, 2021). Therefore, the question remains how the taxonomy will influence Gothenburg's energy actor's bioenergy investments.

3. Conceptual framework

3.1 The Porter Hypothesis

As previously stated, the hope of the taxonomy is that it will serve as a tool in companies' decision-making, improve their environmental performance, and attract green investors in order to redirect investments to accelerate sustainable development (European Commission n.d.b). Companies that align their economic activities with the criteria of the framework could, by extension, increase their competitive advantage (Ramboll, 2021), at least in theory.

The idea that environmental regulation can foster competitiveness can be traced back to the Porter Hypothesis as it is described by Porter and van der Linde (1995). According to the authors, the idea that environmental regulation is unnecessary, or even harmful, to companies' competitiveness stems from false assumptions about how the competitive playfield works. If companies are to pick up on all profitable opportunities without the push of regulation, Porter and van der Linde (1995) argue that that wrongly suggests that all profitable opportunities for innovation have already been discovered, that all managers have perfect knowledge about these opportunities, and that organizational incentives are aligned with innovating. To counter this viewpoint, Porter and van der Linde (1995) describe that environmental regulation is needed for multiple reasons. For example, Porter and van der Linde (1995) describe that regulation can raise pressure to stimulate environmentally friendly innovation, and create a demand for environmental improvement. The authors further explain that it can alert and

educate companies about resource inefficiencies as well as prevent companies from increasing their profit by deliberately avoiding environmental investments (Porter and van der Linde, 1995).

However, Porter and van der Linde (1995) also make a clear distinction between good and bad regulation. The authors explain that regulation which discourages risk taking and experimentation, due to factors such as liability exposure and implementation inflexibility, is counterproductive and therefore considered bad. Good regulation, on the other hand, allows industries to discover how to solve their own problems by fostering continuous improvement, rather than lock in on a particular technology or status quo. For a regulation to be effective and well-designed, Porter and van der Linde (1995) argue that the possible benefits (i.e., spurred innovation, increased resource-efficiency and competitiveness) of compliance ultimately must exceed the costs of compliance. To concretize this even further, they list eleven principles of effective regulatory design that will promote innovation, resource productivity and competitiveness (Porter & van der Linde 1995):

1. *Focus on outcomes, not technologies:* Porter and van der Linde argue that regulations that emphasize a "best available technology" imply that one technology is best and therefore discourages innovation in other technologies.
2. *Enact strict rather than lax regulation:* Companies often respond to lax regulation incrementally, according to Porter and van der Linde. This means that regulation has to be stringent in order to facilitate innovation.
3. *Regulate as close to the end user as practical, while encouraging upstream solutions:* The authors suggest that this kind of regulatory design will normally allow more flexibility for innovation in all stages of production and distribution.
4. *Employ phase-in periods:* By having defined phase-in periods, the authors argue that companies are encouraged to develop innovative technologies and avoid implementing expensive solutions hastily.
5. *Use market incentives:* Porter and van der Linde state that market incentives draw attention to resource inefficiencies. Charges or tradable permits, for instance, can encourage innovation and use of technologies that go beyond current standards.
6. *Harmonize or converge regulations in associated fields:* Inconsistent regulation on alternative technologies can hinder innovation, according to Porter and van der Linde.

7. *Develop regulations in sync with other countries or slightly ahead of them:* Developing regulations in sync or slightly ahead of other countries is said to maximize export potential and allow for first-mover advantages.
8. *Make the regulatory process more stable and predictable:* The regulatory process is, according to Porter and van der Linde, just as important as the standards themselves. If regulators are transparent and commit to keeping standards in place for a dedicated period, the industry can lock in and develop root-cause solutions rather than hedging against unanticipated turns in political agendas.
9. *Require industry participation in setting standards from the beginning:* The authors suggest that the industry experts should participate in developing the contents of the regulation. The industry should provide useful information which the regulators in turn should take as serious input.
10. *Develop strong technical capabilities among regulators:* Porter and van der Linde suggest that it is important that regulators understand what drives competitiveness in an industry and not be ill-informed about the industry's economics.
11. *Minimize the time and resources consumed in the regulatory process itself:* Lastly, the authors describe that potential and actual litigation creates uncertainty and consumes resources which could lower the will to innovate.

By comparing energy actors' perception of taxonomy compliance and its effects with concepts presented in the Porter Hypothesis, one can hopefully draw conclusions about whether the regulation is an effective way to accelerate sustainable investments in the energy sector.

3.2 The taxonomy and sustainable investment

The taxonomy is still a relatively new field of study, however, more and more literature about the topic has emerged in recent years, mainly addressing the challenges of implementing the framework efficiently on a broad scale. Schoenmaker (2018), for example, argues that the classification system could stifle innovation in sustainable investment for a couple of reasons. First off, Schoenmaker (2018) states that the process of transitioning to a sustainable economy is a dynamic process that involves creative destruction, meaning that new technologies and approaches emerge, while others become obsolete. Technological change is therefore uncertain and cannot be driven by labeling some projects sustainable and others not,

according to the author. Shoenmaker (2018) further suggests that, although the taxonomy might provide much-needed transparency in some markets, such as the market for green bonds, sustainable investments should generally follow a market-driven approach. As investors and banks have their own money on the line, Schoenmaker (2018) believes that they are best positioned to assess which companies and technologies hold the most promise in the sustainability transition, not legislators. Moreover, Schoenmaker (2018) argues that large, incumbent companies might lobby the European Commission to classify their current economic activities as sustainable, in order to preserve the status quo. By contrast, the interests of smaller firms might be undermined by the framework (Schoenmaker, 2018).

Schütze et. al (2020) analyze to what extent the thresholds established in the taxonomy are compatible with the goal of EU climate neutrality by 2050. The authors are positive that the EU taxonomy can increase transparency for the sustainability assessment of different economic sectors and reduce greenwashing in private- and public investments. However, Schütze et. al (2020) also points out that the threshold criteria are insufficient in some sectors which can result in carbon lock-in, i.e., continued reliance on emission-intensive technologies and fossil infrastructure. According to Schütze et. al (2020), this issue is especially relevant for new investments. On the other hand, the authors argue that too strict thresholds could result in very few investments being classified as sustainable in the first place, causing a rise in financing costs for investments in sectors with high emissions. To further pinpoint this issue, Schütze and Stede (2021) analyze a large-scale public consultation to the specific thresholds from a variety of stakeholders. One of their conclusions is that the taxonomy threshold criteria should be stricter for new investments than for current activities of companies.

Studies have furthermore raised questions regarding the legitimacy of a taxonomy that fosters a “one size fits all” sustainability system, i.e., a taxonomy that fosters union-wide definitions of sustainability, regardless of local contexts (Millar et al., 2012). According to Fischer (2022), deciding a uniform and common framework for sustainable investments and hence deciding the direction of sustainable development, is a crucial and complex challenge for creating an effective taxonomy. For the taxonomy to be a useful decision-making tool for corporations and investors, the core content must represent their perceptions of sustainability, or corporations and investors must be willing to change their plans and operations (Fischer 2022). This aspect is further discussed by Millar et. al (2012), who describes how different

national and local inputs enable different sustainability systems and processes. In order to maximize the utility of climate financing efforts, such as the taxonomy, Merritt & Stubbs (2012) argues that a decentralized approach when deciding on sustainability investments is superior.

3.3 Low-carbon transition and stranded assets

Another concept with connection to sustainable investments is stranded assets. The definition of a stranded asset is "an asset which loses significant economic value well ahead of its anticipated useful life, as a result of changes in legislation, regulation, market forces, disruptive innovation, societal norms, or environmental shocks" (Generation Foundation, 2013). For assets to lose economic value, they need to exhibit some degree of irreversibility, meaning that investments in these assets cannot be shifted to other uses (van der Ploeg & Rezai, 2020). Assets can also become stranded when alternative uses for an asset exist but the transition cost is too high to be profitable (van der Ploeg & Rezai, 2020). For example, according to van der Ploeg and Rezai (2020), exploration and exploitation investments in oil- and natural gas resources face a risk of becoming stranded due to unanticipated climate policy or breakthroughs in renewable energy. They further explain that if capital stocks get stranded, it will have negative consequences for the market valuation of the companies holding them. In addition, downstream businesses, and producers of final goods that rely on the asset in question may also be exposed to forced write-offs (van der Ploeg & Rezai, 2020).

Stranded assets are often used with reference to climate change, linking it to the low-carbon transition, climate regulations, and climate-related stranding (Bos & Gupta, 2019). Generally, literature tends to interlink fossil fuel to stranded assets, but Bos and Gupta (2019) writes that stranded assets can also be related to forestry and agriculture, as well as first-generation biofuel assets. Alessi and Battiston (2021) explain that the concept of stranded assets is relevant to the taxonomy, namely because the framework promotes low-carbon transition by redirecting capital. Sectors with activities related to fossil fuels, such as the energy sector, are exposed to the risk associated with this transition, and therefore pose a risk of having relevant assets stranded (Alessi & Battiston, 2021). If the taxonomy changes its stance on bioenergy again, it could be argued that there is a future risk of creating bioenergy related stranded assets as well. All in all, the concept of stranded assets is deemed relevant when looking at

investments related to Gothenburg's energy plan and how the taxonomy might influence them.

3.4 Strategic energy planning and its challenges

Strategic energy planning is a field of study with several contributions, and as written below, many of the findings suggest it being a complex area that, similar to the taxonomy, faces several implementation challenges. Awareness of these challenges is important in order to understand how a framework such as the taxonomy might impact energy plans and, by extension, what strategic effects it might have.

The complexity of strategic energy planning is discussed in the article of Maya-Drysdale et al. (2020). The author's main point is that when energy systems become more integrated and decarbonized, strategic planning has to intensify, resulting in an increase in the strategic complexity. They suggest that efficient integration of visions and scenarios in the energy planning process is vital to achieve full, smart decarbonization (Maya-Drysdale et al., 2020).

Krog's (2019) paper brings knowledge into national and local framework conditions for strategic energy planning in Denmark as well as the green transition of the energy system. The author recognizes that there are strategic and practical barriers to municipal strategic energy planning. One of these barriers is the lack of connection between the national and local level. Another barrier is 'bad timing in relation to local political agendas' – an obstacle that can result in projects being turned down despite robust argumentation (Krog, 2019). This goes hand in hand with Petersen's (2018) study that demonstrates a challenge in linking technical energy scenarios with socio-economic realities when designing and implementing energy plans. Petersen (2018) suggests that there often is a gap between national policy and local practice which leads to non-attainable national targets.

Uncertainty is another aspect of energy strategy that has been brought to light in earlier studies. Moret (2017) describes that if uncertainty is taken into consideration, the energy strategy drastically changes. Moret (2017) demonstrates that robust solutions, such as using renewables and efficient technology, offer a higher level of reliability and stability compared to investment plans that do not account for uncertainty.

3.5 Summary of conceptual framework

Regarding municipalities' strategic energy planning, studies highlight the complexity of integrating visions and scenarios in the planning process (Maya-Drysdale et al. 2020). There are several potential barriers and uncertainties that can shape the outcome of energy planning (Krog, 2019; Moret, 2017; Petersen, 2018). The taxonomy can be argued to increase the complexity further as a 'one size fits all' sustainability framework might not be aligned with local investment strategies (Fischer, 2022; Merritt & Stubbs 2012; Millar et al., 2012). As Schoenmaker (2018), Schütze et. al. (2020) and Schütze and Stede (2021) warns, implementing the taxonomy framework might be at the expense of stifled innovation and a rise in financial costs in several sectors. As the taxonomy encourages redirection of capital flows, another potential effect of implementing the taxonomy framework is stranded assets (Alessi & Battiston, 2021; Bos & Gupta, 2019; van der Ploeg & Rezai, 2020). This is a prevalent risk for bioenergy if there are unanticipated changes in legislation and market forces (Alessi & Battiston, 2021; Bos & Gupta 2019). When comparing these suggested effects with the chosen theory, the Porter Hypothesis (Porter and van der Linde, 1995), one can question whether the taxonomy truly is an effective environmental regulation. Suggested by earlier literature, a framework such as the taxonomy is inflexible as it does not leave room for municipalities and corporations' own interpretations of what kind of investments are sustainable (Millar et al., 2012). This can potentially have consequences for companies' competitiveness and reduce incentives to develop bioenergy as an energy source (Porter & van der Linde, 1995).

All in all, it can be concluded that the relationship between the taxonomy and municipalities' strategic energy planning has not been explored in any greater detail before. Hence, there is a need for additional information and a local perspective on the taxonomy implementation. The contribution of this thesis' research questions will therefore intend to fill the gap in the existing literature by identifying local perceptions of taxonomy compliance and its effects on bioenergy investments.

4. Method

4.1 Research design

The research design of this study follows the six steps of the scientific method: identifying a problem (the taxonomy's influence on municipal energy investments), examining literature

related to the problem (the Porter Hypothesis, stranded assets etc.), creating research questions, collecting data (by interviewing actors), analyzing the data, and concluding the findings (Helmenstine, 2020). The process has not been linear and some steps were revisited and reevaluated as new information was acquired, for instance adjustments of the research questions. In accordance with Patel and Davidson's (2020) definition of an inductive and deductive scientific approach, it could be argued that the study is inductive in nature, since the research questions aim to generalize the results gathered from a specific case. Although, as our perception of the problem statement has been shaped by the existing literature, the study has deductive tendencies as well.

Since this thesis aims to explore an emerging field of study, where available quantitative information is scarce, a qualitative methodological approach was deemed most suitable (Corbin & Strauss 2008). Hence, a qualitative case analysis of the taxonomy, and its impacts on Gothenburg's energy plan, was conducted. The research questions were primarily answered by data gathered from qualitative interviews with relevant actors either mentioned in, or with connection to, Gothenburg's energy plan. These included: *Göteborg Energi*, *Gryaab*, *Preem*, *St1, Gothenburg European Office* and *Miljöförvaltningen*. Two actors, *Renova* and *Stadsledningskontoret*, gave written answers per mail. The reason for conducting interviews was to better understand how relevant local actors perceive the taxonomy's effects on local investment plans for bioenergy. This was complemented by analyzing the energy plan, annual sustainability reports, the taxonomy's delegated acts and peer reviewed articles.

4.2 Qualitative interviews

The semi-structured interview, characterized by lower levels of standardization and structure, was used as the primary data gathering method. This form of interview allowed a qualitative, rather than quantitative, analysis of the result (Patel & Davidsson, 2020). Three themes for all the interviews were formulated in an interview guide: 1) Gothenburg's bioenergy investments in relation to the taxonomy 2) Adjustments in local bioenergy investment strategies 3) Potential effects of the taxonomy. The themes were inspired by the thesis's research questions, and under each theme open questions were formulated. As the name 'interview guide' suggests, the predetermined questions were seen as a guide. The questions were tailored depending on the respondent, and unplanned follow up questions were accommodated in order to attain more detail (Bryman, 2016). The aim was not to obtain

equivalent answers from each interview, but to capture the different nuances in the problem area. Kristersson (2014) stresses the importance of gathering relevant data to the research questions, so, in order to minimize the risk of gathering irrelevant data, the interview guide was reviewed by a contact person at Miljöförvaltningen as well as the supervisor of this research, taking their feedback into consideration. The order of questions was approximately set with broader opening questions, the three chronological themes and concluding questions. The principle followed the so-called funnel technique where broader questions are followed by increasingly specific questions (Patel & Davidsson, 2020).

Table 1: List of interviewees

Actor	*Title of interviewee*	*Code name*
Gothenburg European Office	Branch director of Gothenburg European Office	GEO
Gryaab	Head of Department Staff	GRY
Göteborg Energi	Environmental strategist	GE1
Göteborg Energi	Public Affairs practitioner	GE2
Miljöförvaltningen	Energy strategist	MF
Preem	Manager of Investor Relation and Project Financing	PRE
Renova	Head of sustainability	REN
St1	Senior Business Developer & Public Affairs	ST1
Stadsledningskontoret	Portfolio Manager	SLK

The table above presents the interviewed actors, as well as their code names used when presenting the empirical data. The sample of interviewees was based on intentional sampling and relevant actors were identified by studying Gothenburg's energy plan. As the energy plan is a municipal steering document, it is primarily a document for municipal actors, such as Göteborg Energi, Renova and Gryaab, to comply with. Although, private actors, such as Preem and St1, are mentioned in the document as important stakeholders in the energy plan, even though they are not obliged to take the energy plan into consideration for their operations. Therefore, the private actors in this bachelor thesis have been relevant to

interview too. Through the actors' available contact info on their webpage, relevant interviewees such as department heads, investment managers, business developers etc. were contacted through phone or email. Interviews were booked with those willing to participate. The interviewees had different areas of competence and it was therefore important to conduct interviews with several organizations to gather as many perspectives as possible. An important note to make is that the thoughts, speculations, worries, opinions etc. of interviewees, might not represent the corporations or organizations as a whole.

The interviews took between 30 to 60 minutes to conduct and were recorded for transcription purposes. The interviews either took place on site at the interviewees' offices (then recorded using the app Voice recorder) or digitally through Zoom or Teams (then recorded using the computer program Quicktime player). During the interviews, the interviewers were consciously trying to be objective despite having prior knowledge about the subject. Total objectiveness was not aimed for two reasons: firstly it is considered impossible to achieve, and secondly, a low degree of subjectiveness and prior experience can amplify qualitative interviews when used to better understand the interviewees point of view (Patel & Davidsson 2020). Leading questions were avoided as much as possible.

The interview study took the four central principles of research ethics into consideration: autonomy, beneficence, nonmaleficence and justice principle. This implies that the interviewees had the inviolable right to participate or not, to refrain from answering the interview questions and cancel the interview at any time. The interviewers actively thought of treating respondents with respect, avoiding any risks of discomfort or harm (Kristensson, 2014). If not already informed from previous contact, the respondents would at the beginning of the interview be given information related to Patel & Davidssons (2020) four research requirements. This included information about the purpose of the interview, respondent's rights, usage of the gathered material and confidentiality. The gathered material was solely used for this report and handled with confidentiality. For the sake of the research credibility, the company is named in the report, but the interviewees themselves were allowed anonymity.

4.2.1 Data analysis

The analysis of the collected interview data was done according to Creswell and Creswell (2018), and included the following steps: transcribing, reading the data collected from the interviewed actors and coding the data and organizing it into themes. The transcription of the interviews were done in two steps. First, a rough draft of the transcription was provided by the Microsoft Office program Word. Secondly, the recorded interviews were listened to and errors made by Word in the transcription process were manually corrected. While transcribing no attempt was made to change the structure or meaning of the sentences. For this reason, the transcriptions were more challenging to read, but the trade-off was compensated by preserving the interviewees' integrity.

Coding was conducted in tabular form using Google Sheets. The column heading named the different actors interviewed, and the row heading named the themes and subcategories in which data was organized. The coding scheme consisted of three main themes: Compliance, Adjustments and Effects. These were inspired by the two research questions, and subcategories were created for the respective themes. Under alignment, data was organized under four subcategories: In alignment, Not in alignment, Ambiguous and Obstacles. Adjustments had the subcategories Arguments for and Arguments against. Lastly, effects were given subcategories which matched the conceptual framework, i.e., The Porter Hypothesis, Stranded assets etc. Thus, as Creswell and Creswell (2018) describes, the coding scheme facilitated the process of coupling the interview data to the research questions, capturing different aspects of the questions. The tabular form made the process of compiling the overall results easier to comprehend, providing a structure to the qualitative analysis. Shorter direct quotations have been used to strengthen the credibility of the result (Creswell & Creswell, 2018). Lastly, the Porter Hypothesis and concepts presented in the conceptual framework were applied when the empirical data was analyzed in order to draw conclusions.

4.3 Literary sources

As mentioned above, all interviews were tailored to fit the respective corporation and the respondent’s area of expertise. In order to optimize the data gathered from the interviews, questions needed to be operationalized and formulated in such a way that answers complemented, and did not repeat, public information. Corporate specific information from

annual- and sustainability reporting documents and homepages were gathered and used to tailor the interviews.

In order to build an understanding of the challenges imposed by the taxonomy, a selection of EU directives relevant to the taxonomy were studied before the interviews. Regulation (EU) 2019/2088, (EU) 2021/2139 and (EU) 2020/852 were studied, with a focus on bioenergy-related economic activities and its specific screening criterias. Regulations have thereby been studied and compared to the energy plan's strategies regarding bioenergy (see Appendix C).

When collecting relevant information for the conceptual framwork, Google Scholar, GreenFILE and Supersök have been used. The taxonomy is a relatively new area as mentioned before, which entails limited research on this. It has therefore been important to verify that the previous studies are peer reviewed to increase the reliability. In order to receive relevant articles for the thesis the following keywords have been implemented; EU, taxonomy, bioenergy, strategic energy planning, sustainable investments, investment strategy.

4.4 Method discussion

In agreement with Creswell and Creswell (2018), the choice of method suited our purpose and it made it possible to obtain a deeper understanding of the respondents' perceptions of the problem. It provided flexibility and opportunity to ask follow-up questions, enhancing the depth of answers - something that Dahlén (2015) mentions as the method's advantages. The data gathered from the interviews have naturally had a major impact on the thesis results and conclusions. Initially, using intentional sampling as a method for selecting respondents was necessary since the thesis is a case study of actors mentioned in the energy plan. Nevertheless, there have been challenges in reaching interviewees with relevant insight in all the thesis's three ground pillars, i.e., bioenergy, the taxonomy and the energy plan. This is understandable since the taxonomy is new to all municipalities and corporations. Although, since we interviewed various actors, the interviews were able to complement each other. In addition, the literary sources were used to fill any remaining gap.

According to Patel & Davidsson (2020), it is generally more difficult to provide a high level of reliability and validity in qualitative studies, since it cannot be measured in the same way

as quantitative studies. In order to increase the reliability and validity of the study, triangulation was applied in the data gathering process. That is, two different types of data gathering methods were used (primary and secondary information sources) in order to provide a richer interpretation (Patel & Davidson, 2020). In order to minimize the risk of misinterpretation of what the interviewees said, feedback from our contact person in Miljöförvaltningen and input from the interviewees themselves were sought and taken into consideration. This, by sending out a draft of the empirical data to get input before beginning our analysis.

Most of our interviews were done digitally, which is believed to have both advantages as well as disadvantages. A positive aspect of doing digital interviews, which is also highlighted by Gillham (2008), is the increased availability. We perceived the digital interviews to have been easier to schedule and also more time-efficient given the short time frame assigned to the thesis. It is further believed that it was necessary in order to reach certain actors that would not have had the time otherwise. On the other hand, the lack of a qualitative audio recording and other technical issues caused slight problems in some instances, sometimes during the interviews and sometimes afterwards when transcribing. As a precaution, all of us attended the interviews and we used multiple recording devices in case one of them had some technical issues. We were also aware that body language and other non-verbal information could be lost to some extent in digital interviews, but these qualitative aspects were believed to have had an insignificant impact on the result in this case.

5. Empirical data

The actor's code names used in the empirical data, analysis and discussion are explained in Table 1 in 4.2 as well as in Appendix B.

5.1 Actors' perception of taxonomy compliance

5.1.1 Compliance

Bioenergy is said to be an important resource, both nationally for Sweden and locally for Gothenburg (GE1; GE2; GEO; PRE; ST1). Bioenergy is for Gothenburg a source of fuel (GE1; GRY; PRE; ST1), district heating (PRE; ST1), a tool to lower dependence on Russian natural gas (GE1), job creation (PRE) and an efficient use of waste- and residual products (GE2; GRY; PRE; ST1). For many of the interviewed actors, bioenergy is more or less a

crucial part of their sustainability plans and a means of reaching net zero emissions (GE1; GE2; PRE; REN; ST1). Hence, when the EU changed stance and made bioenergy a green taxonomy activity, all the difference was made since this created a basis of coherence between the EU and Gothenburg regarding the future of bioenergy. "I dare not swear that everyone is happy, but the main point was solved by Sweden's pushing [for bioenergy being classified as a green activity]" (GEO).

Opinions on the taxonomy's criteria

As for the taxonomy's criterias for sustainable bioenergy investments, different points were made by the interviewees. Currently, since all interviewed actors are not publicly listed, no one has started to officially report on their taxonomy compliance. For many actors, no thorough assessment on current operations and planned investments in bioenergy have been made as the taxonomy is in its early stage of implementation. "Many of our plants use several different fuels and evaluating the plant according to taxonomy criterias requires a complex analysis and calls for many assumptions as for example which capital expenses belong to which fuel" (GE1).

Despite lack of information regarding actual taxonomy compliance, all interviewees make an early estimation that their planned bioenergy investments will, for the most part, live up to the taxonomy criteria. These assumptions are based on the fact that Sweden has a history of stern environmental laws which are now creating benefits for domestic actors when the rest of the world is working to improve their environmental standards (PRE). "In general /…/ we think that environmental requirements are good. It ensures that we always have a business that leaves as little imprint as possible" (PRE). GRY makes a similar point, planning to actively work towards taxonomy compliance. Although not entirely acquainted with the criterias yet, GRY expresses no apprehension about not achieving them, since adhering to Swedish environmental laws has resulted in already high environmental standards. For future investments, GE1 believes Sweden's energy system is doing well against the taxonomy's criterias, a claim supported by ST1 who says the taxonomy's requirements on biogas are accommodating and permissive. PRE says they will follow the taxonomy's guidelines as much as possible, but point out that it will not be possible for all investments since it will be difficult to meet the tough requirements. Regardless of the criteria's level of achievability, GEO stresses that the taxonomy does not pose any mandatory requirements of what to invest

in or dictate how large a share of company investments should be taxonomy compliant. "[The taxonomy] is not a law that forbids anything, it is rather an easier way to explain what you are doing" (GEO).

Estimated compliance

All in all, every interview respondents estimates their company's bioenergy investments to be in alignment with the taxonomy's criterias of green activities, and in turn the energy plan as well. The reason for this is highlighted by GE1, PRE, REN and ST1, explaining that the taxonomy criterias only allow biological waste and residuals as the source of sustainable biomass. The biomass used by the Gothenburg actors, i.e. organic waste and residuals from the food-, forest-, paper- and pulp industry, slaughterhouses, restaurants and gardens, are all taxonomy approved. For more explicit information about the respective actor's bioenergy investments and compliance, see Appendix C.

5.1.2 Non-compliance

Despite the unanimous assessment that current local bioenergy related operations and planned investments are in compliance with the taxonomy, see Appendix C, the subject's complexity is not to be discarded. Initially, actors were not in total agreement whether it is important to be taxonomy compliant or not.

No legal obligations

As the taxonomy does not pose any legal demands (except the requirement of sustainability reporting for listed companies), many of the interviewed actors stress their freedom to invest and operate in whatever sustainable activity as they see fit (GRY; GE1; GE2; GEO; MF). "It may be that we become obliged to report according to the taxonomy, but this still does not force us to do anything. /…/ The taxonomy does not really place any restrictions directly on what we want to do with the energy plan and it would not have done so no matter what was written in it" (GE2).

Influence on municipal investment plans

Secondly, according to MF, the taxonomy's framework has not been an influential part of the energy plan, since Gothenburg's municipality already has its own definitions of what

sustainability is. "If the taxonomy would state that natural gas is sustainable, then it doesn't mean that Gothenburg's municipality would suddenly say that natural gas is sustainable. We would still be concerned about phasing out fossil fuels. We do not follow the taxonomy in that way /.../ I think there is a skepticism towards the taxonomy. We can make our own assessments of what is sustainable" (MF). When formulating the different measures in the energy plan, compliance with the taxonomy's criteria for sustainable investments have, in other words, not been taken into consideration. MF further explains the energy plan is flexible and that if Gothenburg municipality makes the assessment that a certain type of bioenergy is diresable to invest in, they will try to implement appropriate measures in the energy plan, regardless of the taxonomy's notions of green economic activities.

As for the municipal and private corporations, some are in agreement with MF. Both GRY and REN declare that it would currently not be a problem if their bioenergy investments were not classified as green according to the taxonomy. ST1 further elaborates that the pressures to transition away from fossil fuels are becoming increasingly significant. Because of this, the demand and reliance on biogas and liquid biofuels will remain for a considerable amount of time. Therefore, regardless of the taxonomy, the predicted stable demand makes new- and reinvestments in bioenergy relatively low risk. With that being said, ST1 stresses that since huge investments are needed to accomodate the transition towards renewable fuel production such as biogas, the relevance of taxonomy compliance increases in order to attract investors, at least to a certain degree (ST1). GRY and GE1 are skeptical whether compliance would make any material difference in attracting investors and achieving favorable interest rates on loans. As for Gothenburg's municipal corporations, financing can be sought from the municipal bank's green bonds. According to GRY, taxonomy compliance is not estimated to lower the interest rate significantly. GRY describes that investments currently funded by green bonds have a lower interest rate of 0.03 percentage points - which does not have any significant impact on investment plans.

An important input was made by SLK, who confirms that from a financing perspective, the taxonomy is not crucial for Gothenburg's energy actors to work with at the moment. Although, "in the long run, it [the taxonomy] will have an impact on our and the energy companies' financing." In the next few years, SLK continues, it is estimated that Gothenburg's municipality will start taking the taxonomy into consideration for green loan

applications. “In 2-3 years, we may issue EU Green Bonds and will then have the taxonomy as a demarcation for what is green” (SLK).

The taxonomy as an evolving framework

Another aspect of non-compliance is the volatility of the taxonomy, i.e. the shifting criterias and classifications of bioenergy as a green economic activity. From previous vexations when bioenergy were classified as a transitional activity (GE2; PRE; ST1), to a present apprehension of future changes, the taxonomy as a living document is challenging from a business perspective (GE1; GE2; GEO; GRY; PRE; ST1). As described in Appendix C, all actors currently estimate their investments and current operations in bioenergy to be taxonomy compliant. Although, since innovation, politics (GEO) and lobbying (GE2) risk changing the taxonomy’s criteria and classifications in coming revisions, GE2 argues that it is impossible to know for sure whether investments will be in alignment. “The taxonomy does not provide any security for an investor, if I were to invest in a project that according to the taxonomy is sustainable right now, I do not know if it is sustainable or not in the future” (GE2).

Clashing opinions on sustainability

There were also differences of opinion between the taxonomy and some of the interviewees on what is considered sustainable or not. PRE and ST1 both express dissatisfaction over the taxonomy’s exclusion of crops as a sustainable source of biomass. “We see a potential conflict, we believe that there is wasted potential, especially in the EU's agricultural policy, to use our fields in a more efficient way” (PRE). According to ST1, the claim that farming biofuels lead to higher food prices is false, it is more likely to be a result of higher oil prices. As long as there is no shortage of food, crop-based biomass should not be discarded by the taxonomy (ST1).

Biodiversity criterias as an obstacle for compliance

A relevant aspect when talking about bioenergy and biomass is the topic of biodiversity, which is one of the four remaining taxonomy objectives that is yet to be defined in the coming second delegated act. As for now, actors such as PRE and GE2 are following existing frameworks and certifications for protection and restoration of biodiversity as far as possible,

but there are currently challenges in acquiring biomass that does not pose any threat to biodiversity. Even greater challenges are expected when the second delegated act puts forth additional criterias (GE2; PRE). Despite the biomass used in Gothenburg being waste and residues, there are still apprehensions that the second delegated act will jeopardize bioenergy investments to be classified as green. "Though I have not seen them, I believe that the criterias for biodiversity might be so draconic that nothing will be classified as sustainable. It is a guess, we will see" (GE2).

5.2 Effects of implementing the taxonomy framework

Since the framework of the taxonomy is not fully developed, as well as not being implemented in the local actor's sustainability reporting yet, the interviewees' assessments of its effects on their, and indirectly the energy plan's, investment strategies are mostly speculative. Overall, the interviewees seem to think that the implications of implementing the taxonomy in their practices is challenging to predict.

5.2.1 Effects of compliance

The interview data allows identification of four main effects, both positive and negative, from implementing the taxonomy and aligning business with it.

Financial opportunities and challenges

Aligning business with the taxonomy's criterias can have major impacts on financial matters. Firstly, GEO mentions that compliance can create opportunities to apply for EU investment funds, as Gothenburg was chosen to become one of the EU's first 100 climate neutral cities by 2030. Secondly, according to PRE, investors are already starting to ask for taxonomy compliance on investments. Being taxonomy compliant can therefore attract investors as well as increase access to capital available for renewable investments (GE2; PRE). Another benefit according to GRY, PRE and ST1 is lower cost of capital for those actors who invest in line with the requirements of the taxonomy than those who do not. On the other hand, PRE stresses that the transisional cost to become compliant may be high for some organizations. For instance, a refinery may experience high transitional costs if previous non-taxonomy compliant infrastructure or processes can not be used or converted into biorefineries (PRE).

Supply- and demand challenges

A common apprehension among the interviewees and a second effect of compliance revolves around supply and demand. The taxonomy presents specific criterias of what biological material that can be classified as sustainable or not. If actors invest in these specific materials, increased demand risks being followed by both shortages and exponentially higher prices. (GE1; ST1). While some actors are satisfied with today's biomass availability and positive that taxonomy-compliant biological materials used in Gothenburg seems to cover the demand, (GE2), others worry. According to PRE, there is already difficulty in gaining access to biomass that is produced in a way that guarantees protection of biodiversity for instance. GE1 stresses the possibility of quick changes, resulting in volatile prices and biomass shortages on the market.

Effects on development and innovation

In regards to development and innovation, almost none of the interviewees mention that they believe the taxonomy compliance will have any effects on innovation. If there is any effect, GE2 shows doubts on whether it will be a positive one. On one hand, GE2 explains that there have been cases where the market, and environmental movements, has placed certain requirements on products which in turn has 'forced' companies to find new solutions, i.e., breakthrough innovation. Such was the case of development of chlorine-free paper. However, GE2 argues that it can be dangerous to assume this will be the case with the taxonomy. Instead, GE2 argues that "innovation will be more about finding loopholes and finding something that might survive, but is actually the second best.''

When asking about the taxonomy's effect on the future development of bioenergy, some interviewees emphasize that not knowing the long term rules for bioenergy is challenging, demanding flexibility in both systems and infrastructure if wanting to be taxonomy compliant (GE1; ST1). This makes new and reinvestments more risky according to ST1, creating even higher stakes in larger investments. GE2 shares a similar view and further explains that since companies cannot be confident on whether a specific technology will always be considered sustainable, there is a risk that companies do not dare investing in certain activities if they want to be taxonomy compliant - thus stifling innovation.

Both ST1 and GE2 also bring attention to the problematic aspects of the taxonomy's 'one size fits all' and micromanaging that might increase the difficulty of developing bioenergy in the

future. For example, ST1 explains that the taxonomy is "quite permissive" when it comes to biogas production, labeling it as a green activity under certain circumstances. However, as manufacturing cars that run on biogas is considered unsustainable, the entire value chain becomes affected, which decreases the will to invest in, and develop, this kind of technology. The taxonomy favors electric cars and ST1 mentions that for this reason, the industry sees biofuels as a transitional solution despite biogas production being labeled as sustainable. ST1 raises the questions: "if it [biogas] is sustainable, must it be a transitional solution? Perhaps it should be seen as a sustainable solution, with no need to phase it out in the long run." That would probably increase the will to develop this kind of energy, ST1 concludes.

Effects on reputation

Lastly, implementing the taxonomy can lead to multiple positive effects on reputation (GEO; GRY; PRE). Since the taxonomy holds the potential of creating credibility for the company's sustainability claims, having a strong compliant organizational profile may have positive effects on stakeholders (GEO). Though not required to be fully compliant on all investments, PRE states that the taxonomy can be seen as the golden standard, and as previously mentioned, compliance can have positive effects on attaining favorable terms on loans and attracting investors (GRY; PRE; ST1). GRY also considers compliance as a way to promote the company as an attractive workplace and an opportunity to attract competent employees.

5.2.2 Effects of non-compliance

Even though the interviewees estimate that their planned bioenergy investments overall comply with the taxonomy's criteria, some still believe that adjusting their investments so that all economic activities are aligned with the taxonomy will be impossible (see 5.1.2). As previously mentioned, there are different opinions about what kind of effects non-compliance might have. Some actors do not presently view non-compliance as something problematic (GRY; MF; REN). Some believe it might have effects on financing opportunities (GRY; ST1) and some see several potential risks (GE1; GE2). It all depends on how the market adapts, and relates, to the framework (GE1; GE2; PRE; ST1).

PRE, for example, argues that it is not necessary to strive for complete taxonomy compliance as financial institutions, such as banks and funds, will view the taxonomy's criteria as a 'gold standard', meaning that they are not expecting all investments to line up with the framework. PRE claims that "investors realize that it is incredibly difficult to actually meet all the

requirements in the taxonomy" and that they have their own third-party evaluation criteria for sustainable investments which they also can choose to use instead. GE2 shares a similar opinion and argues that it is up to the market to decide whether the taxonomy is a legitimate way to certify economic activities as sustainable. Furthermore, GE1 believes that in time a praxis will emerge, clarifying what range of taxonomy compliance will be accepted within the energy industry. GE1 therefore suggests that it might be advantageous to not align more than necessary to the taxonomy framework. Instead, GE1 argues that it might be more resource-efficient to instead act similarly to other companies in the industry.

That being said, the actors also mention that investment plans that do not comply with the taxonomy's criteria for sustainable investments might be subject to risks (GE1; GE2; GEO; ST1). Three risks have been mentioned recurrently in the interviews: financial risks, risks related to changes in legislation as well as reputational risks.

Financial risks

The most prominent risk, judging by the answers from the interviews, is the financial risks such as increased cost of capital (GE1; GE2; GRY; PRE; ST1). For the private refineries (PRE; ST1) mentioned in Gothenburg's energy plan, this has already started to become evident regarding fossil investments. ST1 mentions that they have seen signs that banks want to reduce their investments in fossil fuels as well as force fossil actors to have a certain share of renewables in their portfolios. PRE shares a similar view and explains that "if you look at the different markets, there is a lot of capital available if you can make renewable investments, however, if you are going to make fossil investments, it is very difficult to get capital today."

Despite bioenergy being a renewable source of energy, investments in bioenergy that are not aligned with the taxonomy could also be subject to increased financing cost in the future, depending on how strict investors want to follow the taxonomy (PRE; ST1). For that reason, PRE argues that one of the biggest challenges going forward is to prove that their investment strategy is at least close enough to the taxonomy so that the financiers feel satisfied and want to invest.

For municipal energy corporations the financial risk is more of an indirect problem, as most of their financing comes from the municipal bank at Stadsledningskontoret in Gothenburg,

which lends the capital elsewhere (GE1; GRY). As previously mentioned, the taxonomy might have an impact on the city, and indirectly the municipal energy companies financing opportunities, 2-3 years in the future (SLK). For example, if Gothenburg municipality wants to apply for funds from the European Investment Bank or in EU funds for energy projects with low taxonomy compliance, it might prove to be an issue according to GEO which explains that the taxonomy affects what the European Commission wants to invest its money in: "The EU cannot say that they have an 'investment certification' but invest its budget in things that are not green. If you are going to apply for funds from the European Investment Bank or in EU funds, you have to take this into consideration" (GEO).

Risks related to changes in legislation

The second risk mentioned in the interviews, is that the taxonomy framework might find its way into legislation over time, making it less voluntary to comply with. GE2 mentions that they have seen indications that EU legislators already have started looking at the taxonomy framework, which according to the interviewee might have an "spillover effect" that has not been anticipated. GEO shares a similar view, saying that the taxonomy should be used as a trend spotter to show where EU legislation is headed in the near future. GEO explains that there is a fair chance that the taxonomy can inspire new - and lay ground for adjustment in existing - legislation, making environmental requirements stricter over time. "One should probably view the taxonomy as an indicator of what will come in legislation later," GEO suggests but further admits that "it will be very complex."

GEO highlights that this potential development might prove to be an issue for non-compliant companies that have resisted change and locked in their capital in 'unsustainable' economic activities - something that in turn increases the risk of stranded assets. Most actors would argue that stranded assets are not a risk they would necessarily link with bioenergy investments, mainly because it is a renewable source of energy. Rather, PRE, ST1 explain that it is their fossil assets that might be stranded in the transition to renewables.

Since the taxonomy is a living document that can be revised, and bioenergy is a controversial source of energy, there still remains a potential risk for stranded assets. GE2, for example, describes an uncertainty regarding changes in the public opinion and how that might affect the return of bioenergy investments. Parallels can be drawn to Göteborg Energi's biogas project, Gobigas, that had to be shut down due to bad timing: "Unfortunately, that facility will

probably not be taken back. It was very bad timing. Timing is very important for economic sustainability. We can not have an expensive production with no returns, it is not economically sustainable" (GE1). If the taxonomy changes its stance on bioenergy, the market can change its demand accordingly. This is a risk that has to be taken into consideration according to GE2.

Reputational risks

Overall, if it turns out that Gothenburg's energy actors have investment strategies with a low degree of taxonomy alignment it might not only have an effect on the respective energy actors, but rather have an effect on Gothenburg municipality as a whole: namely the city's ambition to be a pioneer in climate mitigation. GEO explains that as a way to work towards this ambition, Gothenburg municipality has applied, and been selected, to become one of 100 cities in the EU that are working to achieve climate neutrality by 2030. As a part of this initiative, the city has to produce an investment plan together with the EU. GEO points out that the European Commission might have opinions on investment plans that do not align with the taxonomy and even points out that going against the taxonomy completely, when being part of this initiative, might harm the city's 'green image': "If Gothenburg municipality thinks that bioenergy is sustainable, then they should stand by it and continue with it. But then you have to be prepared to get opinions /…/ You cannot say that you're the greenest in the world and at the same time go against the public debate that exists around bioenergy" (GEO). In other words, GEO pinpoints the complexity of relying on an energy source that may, or may not, be subject to criticism from the public debate.

6. Analysis and discussion

6.1 The taxonomy and its uncertainties

Porter and van der Linde (1995) express that in order for a regulation to be effective it is important that *the regulatory process is stable and predictable.* According to the empirical data, this principle has not been achieved. The taxonomy is seen as neither stable nor predictable in its design – making the taxonomy challenging for the interviewed companies to relate to, especially at this early stage when the taxonomy is still surrounded by several uncertainties will be discussed below.

6.1.1 Legal uncertainties

Through the interviews, it has been discovered that many of Gothenburg's energy actors view the EU taxonomy more as a challenge rather than an opportunity for sustainable investments. As previously mentioned in 5.1.2, one big challenge with the taxonomy is the fact that it is a "living document" that can, and will, be updated as time goes on due to factors such as innovation, lobbying, or political will. This volatility increases the uncertainty some actors express in achieving taxonomy compliance (GE1; GE2). For example, it is not safe to assume that bioenergy will continue to be classified as "green" in the future, just because it is today, making it difficult to assure that long-term bioenergy investments will be compliant in the future.

Another aspect of uncertainty related to the taxonomy and bioenergy is the difficulty in gaining access to biomass that is produced in a way that guarantees the protection of biodiversity (see 5.1.2). Since biodiversity often comes in conflict with biomass production (Cronin et. al, 2021), some actors argue that the second delegated act, setting the technical screening criteria for biodiversity, might completely jeopardize bioenergy investments to be classified as green by having standards that are impossible to reach (GE2).

An even bigger uncertainty regarding the taxonomy is the possibility that the taxonomy framework will find its way into legislation over time, by extension making it less voluntary to comply with. Several actors (GEO, GE2 and ST1) see this as a likely risk and express a worry about how to relate to this. GE2, for example, states that this would be an unanticipated turn of events, whilst GEO instead says that one should already be prepared for this development and view the taxonomy as a trend spotter on what is likely to come in future EU legislation.

6.1.2 Investment uncertainties and stranded assets

Due to uncertainties such as changes in legislation, public debate, and market demand, there is also an increased risk for stranded assets in the future – which in turn will have negative consequences on the market valuation of the companies holding these assets (van der Ploeg & Rezai, 2020). Van der Ploeg and Rezai (2020) further point out that there is a higher risk that investments in oil- and natural gas become stranded in the low-carbon transition, which PRE and ST1 concur with, saying that they are aware of this potential risk and that they therefore

strive to reuse much of their fossil infrastructure when transitioning to biorefineries, thus lowering investment cost and potential write-downs.

Some actors argue that stranded assets are not an especially big risk for bioenergy investments, however, as they see a demand for this kind of renewable energy regardless of the taxonomy's stance on the matter (PRE; ST1). Others believe this can happen if non-compliant companies are unprepared for eventual changes in legislation or public debate – which might have been influenced by the taxonomy in one way or the other (GEO). Earlier studies further suggest that stranded assets can be linked to biofuel- and forestry assets (Bos & Gupta, 2019), which contradicts that view. A previous example, demonstrating that bioenergy assets indeed can get stranded, is Göteborg Energi's biogas facility GoBiGas. As previously described by GE1 and GE2, this project was shut down due to an expressed 'bad timing', meaning that the project simply was not profitable due to low demand on biogas. Timing is an important aspect of energy planning, as mentioned by Krog (2019) and can have a big impact on whether an energy project will survive or not. It is therefore not too farfetched to assume that future bioenergy projects can meet similar fates if they are not viewed favorably by the taxonomy and the public debate.

6.1.3 Planning uncertainties

All these aspects can further be connected to what Moret (2017) states regarding uncertainties and how that shapes energy planning. Moret describes that, generally, it is safer to invest in renewable sources of energy, such as bioenergy – as renewable energy plans offer a higher level of reliability and stability compared to other investment plans. However, since the taxonomy introduces new kinds of uncertainties, as previously mentioned, this might no longer be completely true. Instead, bioenergy cannot be seen as a completely reliable source of energy due to potential updates in the taxonomy, as well as changes in the public opinion, that might create strategic- and practical barriers (Krog 2019) as well as further increase the strategic complexity of energy planning (Maya-Drysdale et al., 2020). A fair assumption is that uncertainties and complexities related to the taxonomy might both consume resources and time from the actors when trying to implement the framework in the planning process. This contradicts another of Porter and van der Linde's (1995) principle for effective regulation, namely the one stating that the regulation should be designed in a way that *minimizes the time and resources consumed in the regulatory process itself*.

6.2 The taxonomy's strictness and use market incentives

Another important aspect when discussing the taxonomy's effectiveness is how, and to what extent, the framework regulates sustainable investments. First off, the taxonomy has strict definitions of what constitutes as sustainable, even stricter than already existing EU regulation (see 1.1.1). Parallels can be drawn to Porter and van der Linde's (1995) principle that states that an effective regulation should be *strict rather than lax*. This concept is further brought up by Schütze and Stede (2021), highlighting the importance of sufficient taxonomy criteria that, on one hand, does not result in carbon lock-in but, on the other hand, are not so strict that few investments can be classified as sustainable in the first place. According to the interviewed actors (see 5.1) and earlier studies (see 3.1.2), the requirements regarding sustainable bioenergy are stringent and sometimes hard to interpret, but not unattainable. This suggests that the taxonomy's criteria for bioenergy are sufficient, and in turn that the taxonomy regulation follows Porter's 'strict rather than lax' principle.

However, something that the interviewed actors also stress is that it is not mandatory to be compliant (GRY; GE1; GE2; GEO; MF). Actors have room to do as they please, and invest in what kind of activities they want, as long as they disclose taxonomy alignment in their reporting and are prepared to bear the potential risks of non-compliance, such as financial- and reputational risks (see 5.2.2). In other words, there are no legal requirements to be compliant. One can therefore argue that the taxonomy, due to its voluntary nature, is not particularly strict at all, despite its stringent criteria. If a company chooses to be non-compliant, perhaps using other 'green' certifications to attract investors (as suggested by PRE) then there are currently no legalities stopping them from doing so.

After examining the design of the taxonomy, earlier literature, as well as the empirical data gathered in this study's interviews, it instead becomes evident that the intention of the taxonomy is to control sustainable development by creating specific market incentives for companies and investors. Using *market incentives* is another principle Porter and van der Linde (1995) lists as important in order to achieve effective regulation that stimulates innovation and resource-efficiency. The taxonomy uses market incentives by establishing a demand for taxonomy-certified investments, and as an effect lowering the cost of capital for investments that are compliant with the framework. This could in turn increase companies'

competitiveness. It is also mentioned that the taxonomy can have an effect on a company's reputation – something that is supported by the empirical data (see 5.2.1) as well as Ramboll (2021) – further implying that taxonomy uses market incentives which can have a positive effect on a company's competitiveness.

It can be suggested that most energy actors see these financial and reputational incentives as main reasons to start striving for taxonomy compliance. Private actors, such as PRE and ST1 have already seen signs that banks are demanding taxonomy compliance for certain investments. Municipal actors are also aware of the potential financial benefits that compliance can grant them, i.e., lower interest rates and access to EU funding (GRY; GEO). One could therefore assume that the taxonomy's way of controlling sustainable investments is working as intended. That is, the introduction of a union-wide certification system for sustainable investment has already increased the demand of 'taxonomy green' activities among investors. This ultimately encourages companies to overall align their economic activities with the framework's criteria. It can be said that this is mostly true for bioenergy investments too, as the interviewed actors express seeing benefits with aligning these types of investments with the taxonomy (GE1; GEO; GRY; PRE). However, ST1 also challenges this, stating that bioenergy investments are relatively low risk even if they are not compliant with the taxonomy's criteria for sustainable investment. Regardless of the taxonomy, ST1 argues that there is a stable market demand for biogas and liquid biofuels that will remain for a considerable amount of time - indirectly stating that the market incentives to align bioenergy investment with the taxonomy might not be that strong after all.

Furthermore, the taxonomy's second delegated act is still under development and if the market does not perceive the final design of the taxonomy as legitimate, the entire idea behind the framework could potentially fail. This idea is further strengthened by Schoenmaker (2018) who points out that banks and private investors are better suited than legislators to make decisions about which investments hold the most promise in the sustainability transition. One can therefore raise the question that if the market ultimately chooses to ignore the taxonomy's criteria and settle for other sustainability assessments, what purpose does the framework fill at all – other than produce administrative costs? If the opposite occurs, that is, if the market 'blindly' adapts to the framework and its definition of sustainability, one can question whether its framework truly is voluntary to follow, as it might have great effects on companies' profitability. For example, if the regulation changes its

stance on bioenergy and the market changes its demand accordingly, companies might have to suffer transitional costs as well as an increased risk of stranded assets in return (Bos & Gupta, 2019). As mentioned by GE1, however, there is a hope among actors that a praxis regarding taxonomy compliance will emerge within the energy industry, which in turn will dictate to what extent it is deemed necessary to align activities with the taxonomy. Perhaps then a middle-ground will appear, making the taxonomy easier to relate to for energy actors.

6.3 Effects on innovation and future development of bioenergy

A third aspect to discuss when discerning the effectiveness of the taxonomy regulation is its effects on companies' willingness to innovate. Judging by the empirical data, actors are unsure whether the framework will stimulate innovation, stating that innovation will mostly be about finding loopholes in the framework, or settle for 'the second-best' options (GE2). GE2 further expresses that there is a risk that energy companies, which want to be taxonomy compliant, do not dare to invest in specific energy sources, potentially hindering innovation within fields such as bioenergy.

Porter and van der Linde (1995) states that an effective regulation must *focus on outcomes, not technologies* in order to promote innovation. Since the taxonomy explicitly favors certain activities and technologies, one could argue that this is the main reason why energy actors feel discouraged by the framework. There is simply not enough room for risk-taking; the taxonomy itself being too inflexible with its 'one-size-fits-all' mindset, something that, for example, Fischer (2022) highlights.

It is clear that several energy actors share a skepticism towards the taxonomy as they do not completely agree with all of the criteria for sustainable bioenergy activities (GE1; GE2; MF; PRE; ST1). As previously mentioned in the empirical data (see 5.1.2) there is dissatisfaction over the taxonomy's exclusion of crops as a sustainable source of biomass (PRE; ST1). Simultaneously, actors such as GE2 and PRE express an uncertainty in gaining access to biomass that is taxonomy compliant (i.e., residual waste from forestry etc.) and whether this kind of biomass can meet an increasing demand when fossil assets are phased out. Some actors express that this challenge could be solved, at least partly, by increased investments in crop-based solutions (PRE; ST1). They argue that it is wasted potential to not consider agriculture-based biofuels as a sustainable option - though they are aware of the conflict that

exists between crop-based biofuels and food production. This highlights the complexity of bioenergy production once more, where climate mitigation comes into conflict with other interests (Cronin et. al, 2021), and further highlights how the taxonomy's focus on activities and technologies rather than outcomes might hinder development and innovation in certain bioenergy areas. Another example of this, mentioned by ST1, is that the taxonomy labels manufacturing of cars run by biogas unsustainable while still allowing biogas production to be categorized as green. The value chain is, by extent, affected by the strict definition that sustainable cars should only be run by electricity not biofuels – therefore indirectly undermining innovation and development in this particular field as well. This can be connected to another principle stated by Porter and van der Linde (1995), namely that effective regulation should *regulate as close to the end user as practical, while encouraging upstream solutions*. It can be argued that the taxonomy's way of regulating does not encourage upstream solutions in this particular case. As previously mentioned, ST1 explains that despite biogas production being labeled as a green activity, the industry still sees it as a transitional one due to biofuel cars being considered unsustainable. The will to invest in these technologies is therefore assumed to decrease.

Judging by the empirical data, it is fair to say that the local energy actors support Schoenmaker's (2018) argument that innovation ultimately cannot be driven by the taxonomy's 'one-size-fits-all' labels on what is sustainable and what is not. One could argue that technological innovation is uncertain and requires more room for trial and error than the taxonomy currently allows. Instead of fostering an environment where companies feel confident and inclined to find new sustainable solutions, the taxonomy is seen more as a burden to overcome and work around. This further implies that strict taxonomy compliance might not always be desirable for companies that want to develop and invest in bioenergy related activities.

6.4 The energy plan's current and future taxonomy compliance

6.4.1 Today's compliance

As demonstrated in Appendix C, all interviewed actors estimated their current bioenergy related operations and investments to be in alignment with the criterias of the taxonomy's first delegated act. Despite the many aspects of noncompliance which will be discussed later, this conclusion can primarily be drawn due to the criterias being hitherto designed in a way

that match the Gothenburg actors's source of biomass, i.e. biological waste and residual products. What is interesting is whether that compliance will sustain or not.

Initially, an important remark is that claiming compliance based on estimations is not waterproof. The interviewed actors are not publicly listed, meaning that they are not legally obliged to report on their investments until the new Corporate Sustainability Reporting Directive (CSRD) is enforced by the end of 2022. For this reason, it is reasonable to assume that any deeper assessments on bioenergy taxonomy compliance have not yet started, as GE1 pinpoints. The accuracy of these estimations is therefore to be put to the test in the future, leaving vague garanties of future compliance on current operations.

As discussed in 6.1-6.3, compliance or noncompliance boils down to being a question of how the market internalizes and weighs the taxonomy and the legal nature of the taxonomy, but also the design of the criterias. The criterias are a most complex issue where the interviewees had varying opinions on their achievability. Some were confident that the taxonomy is aligned with Gothenburg's energy system (GE1; ST1), while others stress the impossibility of full compliance due to the very tough requirements (PRE). With the second delegated act around the corner with additional criterias for the remaining objectives, a fear that nothing could be classified as sustainable was expressed (GE2; PRE), speculating that compliance will rather depend on loopholes (GE2).

However, these worries were partly mitigated due to the fact that Sweden's relatively stern national environmental laws are assumed to facilitate and ease taxonomy compliance (GRY; PRE). The fact that Sweden's environmental laws might ease the process of integrating the taxonomy framework into practice is a positive indication that the taxonomy, at least within the national context of Sweden, is in sync with the existing environmental regulation. Whether this is the case in other countries is not explored in this thesis, but according to Porter and van der Linde (1995) is this an implication of a well-designed regulation.

As discussed in 6.1, the taxonomy poses no legal obligations to be compliant. The freedom to invest in bioenergy related activities that are non-compliant, such as crop-based biomass or other primary sources of biomass, is therefore not legally hindered, undermining the necessity to become compliant. Although, to discard compliance based on this is not encouraged by actors such as GE2 and GEO, who mentions the possibility that the taxonomy in due time

might become more integrated with other laws and EU directives. An argument for compliance is therefore that it supports a proactive investment strategy against coming environmental legislation and encourages continuous improvements.

6.4.2 The importance of being compliant or not

It is obvious that actors think it is varyingly important whether one should be taxonomy compliant or not. From the actor's not being concerned whether their investments are compliant or not (GRY; MF; REN), to those who are already noticing taxonomy compliance as a requirement from investors (PRE), multiple inputs from the corporations have been noted. As this is a complex issue, not only do actors' opinions differ between themselves, but often the interviewees describe different aspects of an issue, making them almost contradict themselves. In the empirical data, an example of this is GRY talking about financial benefits of taxonomy compliance: on one hand compliance can give cause to lower interest rates on loans, but on the other hand, the lower interest rate is not estimated to be low enough to have a significant effect on investment plans (GRY). The taxonomy's effects and the significance of those effects are therefore hard to interpret, which in turn makes it more difficult to assess whether actors find it important to be compliant or not.

The ambiguity is also heightened by the varying responses from the municipal actors (i.e. GEO, MF and SLK) on the topic of taxonomy compliance. MF makes it plain that the taxonomy has not in any way been taken into account when formulating the energy plan, saying that if a certain type of bioenergy is desirable to invest in, they will try to implement appropriate measures in the energy plan, regardless of the taxonomy's notions. SLK and GEO on the other hand stress the growing importance of the taxonomy in the next few years. "In the long run, it [the taxonomy] will have an impact on our and the energy companies' financing /…/ In 2-3 years, we may issue EU Green Bonds and will then have the taxonomy as a demarcation for what is green." (SLK). "One should probably view the taxonomy as an indicator of what will come in legislation later" (GEO). Even though the interview respondents' opinions and understandings might not represent their whole organization, it highlights the missing coherence in the city whether Gothenburg municipality wants to strive towards compliance or not. SLK's and GEO's point of view align with the Porter theory of an effective regulation, claiming that compliance will lead to increased competitiveness owing to legal proactiveness and financing benefits. Simultaneously, from the perspective of MF, compliance will lead to a narrow outlook on sustainability, which speculatively can have

ramifications such as missed opportunities of innovation and lock-in effects on certain technology (Porter and van der Linde, 1995).

6.4.3 Local and regional sustainability

The taxonomy aims to serve as a tool in companies' decision-making, improve their environmental performance, and attract green investors in order to redirect investments to accelerate sustainable development. This is the ideal scenario, but the real outcome depends on local actors', investors' and the market's acceptance of the taxonomy's predetermined and region-wide definition of sustainability. If local and regional definitions of sustainability clash, the taxonomy risks, from a local perspective, to defeat its own purpose to redirect investments to accelerate sustainable development.

Based on the empirical data, there are no ongoing bioenergy-related activities that are openly noncompliant, but potential conflict can be identified regarding crop-based biomass that the taxonomy does not classify as sustainable. If cultivated and handled responsibly, PRE and ST1 claim crop-based biomass could be sustainable. As Petersen (2018) mentions, energy planning should take socio-economic realities into account, and risk of food shortages in Gothenburg due to technical agriculture is minimal (ST1). Should Gothenburg municipality and its actors therefore, with regards to what has been discussed previously, further develop and invest in crop-based biomass if the occasion arises?

Porter and van der Linde (1995) suggest that regulation that discourages risk taking and experimentation is considered bad. Since the taxonomy is currently voluntary, it could be argued that local sustainability should be prioritized when conflict occurs. Additionally, as GEO and GE2 note, innovation, politics and lobbying might change the taxonomy's criteria and classifications in coming revisions. GE2 argues that it is therefore impossible to know for sure whether investments in the future will be aligned with the taxonomy or not, which makes a strong case for local sustainability definitions when local and regional definitions clash.

When the taxonomy is too selective on what investments can be classified as sustainable, there might be a risk that differentiations between local and regional sustainability definitions will further be exposed. Millar et. al (2012) stresses that different national and even local ideas of sustainability enable multiple sustainability systems and processes. Not

accommodating ideas such as crop-based biomass, would decrease the effectiveness of the taxonomy (Merritt & Stubbs, 2012). All of the interviewed actors are said to be working toward sustainability, and potentially having an external framework that says otherwise makes the taxonomy disconnected with the local recipients.

From another perspective, Gothenburg municipality is said to strive towards becoming a precursor of climate neutrality, for instance by working towards becoming one of EU's first 100 climate neutral cities by 2030. This implies EU-funding and the taxonomy will be a central part of obtaining these funds. For the sake of financing and reputational credibility, bioenergy investments are encouraged to be taxonomy compliant in order to support Gothenburg's sustainability claims. From this standpoint, it should be in Gothenburg's interest to strive for a high degree of taxonomy alignment. Furthermore, this makes it relevant to discuss whether the energy plan (and other steering documents) should reflect the ambition of compliance to a greater extent, especially on a controversial topic such as bioenergy. At the same time, Schoenmaker (2018) warns that the interests of smaller firms might be undermined by the framework, which is something that the city ought to address as well if compliance will be the way forward.

6.5 The taxonomy as an effective regulation

Given the above discussion, it can be argued that several of Porter and van der Linde's (1995) principles of effective regulation have not been fulfilled. Seven out of eleven principles could be linked to the empirical data and a majority of these showed signs of the taxonomy not being effective as it is currently designed: The taxonomy focuses on technologies rather than outcomes. It has stringent criteria for sustainable activities, however these are mandatory to comply with, which makes it possible to argue that the overall regulation is lax. It regulates activities in the entire value chain, which in some instances does not encourage upstream solutions. Furthermore, the regulatory process is not considered stable and predictable by the interviewed actors, which in turn has created uncertainties that are deemed to consume time and resources, especially since energy planning in itself already is a complex field. However, the taxonomy does make use of market incentives by establishing a demand for taxonomy green investments, creating financial- and reputational incentives to align. The regulation can

further be argued to be in sync or slightly ahead of other countries, as it is described to be mostly in line with Swedish environmental laws.

7. Conclusion

The energy plan has not used the taxonomy as a framework for sustainable investments when formulating the energy actors' investments in bioenergy. Still, all interviewed actors estimate current and planned bioenergy related investments mentioned in the energy plan to be in compliance with the taxonomy – as it is designed today. This assessment is mainly based on the fact that all actors mentioned in Gothenburg's energy plan use secondary biomass in their bioenergy production and already comply with stringent national environmental laws. These estimations are sufficient enough to answer the research question "*How do actors, with relevance to Gothenburg's energy plan, perceive their taxonomy compliance regarding bioenergy investments?*". The accuracy of these estimations could more thoroughly be assessed in the coming years when the CSRD is implemented.

The majority of the actors responsible for the various measures in the energy plan are either slightly hesitant or positive that they will strive towards compliance in the future. For Gothenburg, bioenergy is an important means for reaching climate neutrality by 2030 and bioenergy operations and investments will probably not become deprecated if the taxonomy were to reclassify bioenergy or harden the criterias. However, both compliance and noncompliance implies uncertainties and challenges.

As previously stated in the empirical data, the interviewed actors' estimation of the taxonomy's effect on their bioenergy investments are mostly speculative since the taxonomy is still in the early stages of implementation. Uncertainties such as how the market will adapt to the framework affects the reliability of the interviewed actors' assessments. This means that it is difficult to draw any certain conclusions on the second research question "*What are the supposed effects of aligning or not aligning the energy plan's investment strategies with the taxonomy?"* Still, there are indications that there will be positive financial effects of complying, such as easier access to green funding and lower rates of interest. It is also suggested that taxonomy compliance can work as a reputational booster for companies that, for example, can attract competent employees and green investors. Naturally, the opposite is suggested to occur if plans do not comply, however to which degree is uncertain. Some of the

actors further express that strict taxonomy compliance might potentially result in supply shortages, i.e., difficulties in accessing enough sustainable biomass to meet an increased future demand. A few of the answers further suggest that strict taxonomy compliance can stifle innovation, or at least decrease the will to invest in certain bioenergy fields. Not aligning investment plans with the taxonomy might in turn be linked with future litigation risks. That is, if the taxonomy framework finds its way into EU legislation, companies that have not aligned their investments with the criteria might suffer challenges, such as transitional costs and stranded assets. There are furthermore potential reputational risks for companies, as well as Gothenburg municipality as a whole, to be non-compliant. Gothenburg municipality strives to be a predecessor in climate mitigation and having energy investment strategies that clash with the EU's definition of sustainable investments could potentially harm the city's 'green image'.

When comparing the results to the Porter Hypothesis and previous research, it can be concluded that the effectiveness of the framework is ambiguous at best. Many indicators even suggest it being ineffective in its design, mainly due to its uncertainties and inflexibility in implementation. The effects described by the actors' highlight that at least five of the eleven principles of an effective regulation are unfulfilled, which could indicate that the taxonomy's current design does not promote companies' will to innovate, nor contribute to resource-efficiency and competitiveness; at least not regarding bioenergy investments.

Despite the taxonomy not being completely effective, there are aspects that suggest that the taxonomy still is important to consider in future revisions of the energy plan. Whatever path that Gothenburg municipality and its local actors choose to follow in the future, compliance seems to be the current course. Gothenburg municipality's ambition is, as previously mentioned, to be a predecessor in climate mitigation and in this transition it is important to have the EU at its back. The empirical data suggest an ambiguity within Gothenburg municipality whether it is important to strive towards taxonomy compliance or not. Suggestively, Gothenburg municipality should therefore be more adamant in creating an overall coherence on taxonomy compliance within the municipality and its municipal corporations.

The thesis provides an overview of Gothenburg's local municipal energy actors' perceptions of their current and future taxonomy compliance, as well as their attitudes regarding its effects on bioenergy investment plans. Some findings suggest that the taxonomy is ineffective in its design. These findings are mostly aligned with previous studies, but further explored through the lens of municipal energy planning. This overview did not previously exist, and it is hoped that the thesis can provide information that can act as a puzzle piece in Gothenburg municipality's future work with the taxonomy. Since the taxonomy is a relatively new area, much is still to be discovered about its effects. A follow up on this thesis' results and conclusions are needed when the outcomes of taxonomy implementation can be verified and quantified, for example when the Corporate Sustainability Reporting Directive (CSRD) enters into force. To broaden this study further, a comparison between other municipalities could give different perspectives on how energy actors work with bioenergy in relation to the taxonomy implementation.

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Appendix

Appendix A - Interview guide

Opening questions

1. Introduce yourself and your role in the company.
2. What is the company's role in Gothenburg's energy plan?

Theme 1: Gothenburg's bioenergy investments in relation to the EU taxonomy

3. How does the company perceive the requirements the taxonomy has for 'green bioenergy'?
4. How does the company view the development of bioenergy after the introduction of the taxonomy?
5. Do you perceive that your investments in bioenergy are aligned with the taxonomy?
    a. Is it problematic for you if planned investments in bioenergy risk not being classified as sustainable according to the taxonomy?
6. Gothenburg's energy plan and the taxonomy are both frameworks to relate your business to: do these go hand in hand or are they contradictory?

Theme 2: Adjustments in local bioenergy investment strategies

7. Do you see a possibility of adjusting your investment strategies to become more in line with the taxonomy?
    a. Is taxonomy compliance something you want to strive towards?
8. In which areas do you see possible obstacles to your bioenergy investments being classified as sustainable?
    a. Do you experience issues regarding access to biomass that has been produced in a way that guarantees that biodiversity is not negatively affected?

Theme 3: Potential effects of the taxonomy

9. What challenges do you see in shifting investments in line with the taxonomy?
    a. Are there any risks that already invested capital will be stranded?
10. What opportunities do you see in investing in accordance with the taxonomy?
    a. E.g., legitimacy, innovation, profitability and/or competitive advantages?

Conclusion

11. Is there anything you want to add or comment on further?

Appendix B - List of interviewees and the interviews' time and date

Table 2: List of interviewees and the interviews' time and date

Code name	*Actor*	*Title of interviewee*	*Date*	*Length of interview*
GEO	Gothenburg European Office	Branch director of Gothenburg European Office	April 8th, 2022	40 minutes
MF	Miljö-förvaltningen	Energy strategist	April 12th, 2022	30 minutes
SLK	Stadslednings-kontoret	Portfolio Manager	May 2nd, 2022	Mail conversation
REN	Renova	Head of sustainability	April 13th, 2022	Mail conversation
GRY	Gryaab	Head of Department Staff	April 26th, 2022	45 minutes
GE1	Göteborg Energi	Environmental strategist	April 19th, 2022	60 minutes
GE2	Göteborg Energi	Public Affairs practitioner	April 5th, 2022	45 minutes
PRE	Preem	Manager of Investor Relation and Project Financing	April 4th, 2022	45 minutes
ST1	St1	Senior Business Developer & Public Affairs	April 19th, 2022	30 minutes

Appendix C - Bioenergy investments and estimated compliance

Table 3: Actor's planned bioenergy investments

Actor	**Economic Activities in Taxonomy**	**Bioenergy activities in Gothenburg's energy plan coupled with the taxonomy activity**	**Bioenergy activities in the latest annual- and sustainability reports**	**Actor's rough estimation of their compliance**
Göteborg Energi	a. Cogeneration of heat/cool and power from bioenergy	a. Bio-cogeneration power plant is under investigation. Biomass is said to be an important factor in future cogeneration and for the district heating sector. (Göteborgs Stad, n.d)	Is working to phase out fossil fuels. /…/ A permit application for a new biofuel-fired CHP plant and upgrading of renewable production in Rya heating plant in progress (Göteborg Energi, 2022)	Currently taxonomy compliant, but stress an overhanging uncertainty since the criterias might change.
Preem[6]	b. Manufacture of biogas and biofuels for use in transport and of bioliquids. c. Production of heat/cool from bioenergy	b. Biofuels (both gas and liquids) have an important role in achieving Gothenburg's climate goals. All municipal vehicles are said to be driven by biofuel or other equally relevant renewable fuels. c. District heating/cooling from biorefineries and industries. (Göteborgs Stad, n.d.)	At the refinery in Gothenburg, planning is underway for Sweden's largest production facility for renewable diesel and biojet fuel, the so-called HVO project (Preem, 2022)	Estimated to be taxonomy compliant.
St1[7]	b. Manufacture of biogas and biofuels for use in transport and of bioliquids. c. Production of heat/cool from bioenergy.	b. Biofuels (both gas and liquids) are designated to have an important role in achieving Gothenburg's climate goals. All municipal vehicles are said to be driven by biofuel or other equally relevant renewable fuels. c. District heating/cooling from biorefineries and industries. (Göteborgs Stad, n.d.)	The construction of a biorefinery in connection with our Gothenburg refinery is underway and the plant is expected to be completed in early 2023 /…/ The unit is aimed at producing renewable fuels, such as HVO diesel and biojet fuel. (St1, 2022)	Estimated to be taxonomy compliant.

[6] It is important to note that Preem is not a municipal corporation and therefore has no obligations in the energy plan. Nevertheless, they are mentioned in the plan as an important local actor since they largely affect the energy system.
[7] As mentioned above in footnote 6.

Actor	Economic Activities in Taxonomy	Bioenergy activities in Gothenburg's energy plan coupled with the taxonomy activity	Bioenergy activities in the latest annual- and sustainability reports	Actor's rough estimation of their compliance
Renova	c. Production of heat/cool from bioenergy d. Anaerobic digestion of biowaste	c. Start a pilot project to produce biochar from collected waste from gardens and parks, with the possibility of using excess heat as a resource in the district heating system. d. Collects Gothenburg's food waste, i.e material for digestion of biowaste. (Göteborgs Stad, n.d.)	Renova and Göteborg Energi are jointly investing in a biochar facility. Produces slurry out of food waste as a first step of anaerobic digestion. (Renova, 2022)	Estimated to be taxonomy compliant.
Gryaab	e. Anaerobic digestion of sewage sludge	e. Produces biogas as a by-product from the sewage treatment process. (Göteborgs Stad, n.d.)	Sludge is digested and formed into biogas which is then upgraded by Göteborg Energi and then sold on the biogas market. Reinvestment projects to maintain quality in the aging facility as well as new investment projects (Nya Rya) are planned. (Gryaab, 2022)	Estimated to be taxonomy compliant.

Table 3 summarizes the interviewed actors' bioenergy related activities in relation to the taxonomy. The first column names the interviewed actors and the second states what economic bioenergy activities that the actor is involved in. The third column describes already ongoing bioenergy related activities or planned measures that the energy plan ascribes to the actor, paired respectively with each activity (by using the letters a-e). This highlights the connection between the actors' operations and the taxonomy's economic activities. The fourth column mentions more specifically what actual operations the actor engages in regarding bioenergy. The last column states a rough estimate of whether the actors find themselves taxonomy compliant, i.e. whether operations and investments in bioenergy can be classified as green or not.