



Socio-technical Imaginaries of BECCS in Sweden: Climate Mitigation and the Role of the Swedish Forest

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Abstract

Sweden has become a key actor in the instrumentalisation of natural resources as substitutes for fossil fuels. One of the most recent developments is the planned deployment of Bioenergy with Carbon Capture and Storage (BECCS), currently developed by the bioenergy company Stockholm Exergi. As BECCS relies on forest biomass for energy and electricity production while removing carbon dioxide from the atmosphere (i.e., producing negative emissions), it is closely intertwined with the Swedish forest both as a resource and as an alternative carbon sink.

This thesis examines socio-technical imaginaries of BECCS in Sweden, drawing on the concept of socio-technical imaginaries developed by Jasanoff and Kim (2009). It focuses on how these imaginaries shape the development and political legitimacy of BECCS. Specifically, it asks *how BECCS is imagined within Sweden's climate mitigation efforts and how these imaginaries reflect and shape views on the Swedish forest and its role in climate mitigation*.

Based on seven interviews with key actors involved in the development and governance of BECCS, the analysis shows that BECCS in Sweden is embedded in a socio-technical imaginary that links technological capability, market-based profit generation, and social consensus. The findings demonstrate how this imaginary supports the materialisation of BECCS while marginalising alternative ways of imagining climate mitigation and the role of the Swedish forest within it. The analysis further shows how imaginaries of an undesirable future without BECCS, together with crisis framings, are mobilised to generate political support for the technology.

These dynamics connect profitable business cases to specific problem definitions and sustainability solutions, helping explain why certain technological futures become politically and materially viable while others remain marginal or unthinkable.

Keywords: Socio-technical Imaginaries, Negative Emission, Technology, Carbon Dioxide Removal, BECCS, Sweden, Stockholm Exergi, Bioenergy, Forest, Climate Mitigation, Future

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Abbreviations

Abbreviation	Description
A/R	Afforestation and Reforestation
BECCS	Bioenergy with Carbon Capture and Storage
CCS	Carbon Capture and Storage
CDR	Carbon Dioxide Removal
CO ₂	Carbon Dioxide
DACS	Direct Air Capture and Storage
EU	European Union
GHG	Greenhouse gas
I	Interviewee
IAM	Integrated Assessment Models
IPCC	International Panel for Climate Change
LULUCF	Land-Use, Land-Use Change and Forestry
NE	Negative Emission
NET	Negative Emission Technology
UN	United Nations

1. Introduction

The global climate is approaching the critical threshold of 1.5 °C warming, which is expected to bring severe and potentially irreversible consequences for life on Earth (Calvin et al. 2023:4ff.). In response, international treaties, like the Paris Agreement, have been signed by the international community, committing states to significantly reduce greenhouse gas emissions and to rapidly strengthen climate mitigation efforts (e.g., Swedish Environmental Protection Agency 2021; European Commission 2023). Despite these commitments, a majority of countries are not close to meeting their established targets, and current projections indicate that global warming may exceed 3.2 °C within the coming 75 years (Calvin et al. 2023:68). Climate scientists therefore warn of a future marked by increasingly frequent and intense climate events, such as extreme heat, prolonged droughts, and large-scale flooding (ibid.).

Against this background, states have begun recalibrating their climate mitigation strategies. Sweden has positioned itself prominently as a climate leader and is frequently presented as an international example of ambitious environmental policy (Christiansen & Carton 2021; Lefstad et al. 2024). One central reason for this image is Sweden's substantial reduction in emissions in the energy, heating, and waste-management sectors, supported by Sweden's extensive district heating system, largely fuelled by bio-based feedstocks from forestry waste products (Naturvårdsverket 2024; *Annual and Sustainability Report 2024* 2024:15; International Energy Agency 2025).

Moreover, in early 2025, the Swedish Energy Agency allocated SEK 20 billion¹ to Stockholm's energy and heating provider, Stockholm Exergi, to develop what is planned to become one of the world's largest Bioenergy with Carbon Capture and Storage (BECCS) facilities (Persson 2025; Swedish Energy Agency 2025). BECCS belongs to a broader group of carbon dioxide removal (CDR) technologies designed to capture CO₂ and store it permanently in ocean sediment. The plant is intended to remove approximately 800 thousand tonnes of CO₂ from the atmosphere annually from 2028 onward (Persson 2025).

To understand the significance of this development, it is necessary to look beyond BECCS as a technical solution and consider the broader social and political context in which it is emerging and through which it is materialised. Technological systems are not appearing out of nowhere; they are shaped by political decision-making, economic interests, power relations, and broader societal visions of Sweden's future (Jasanoff & Kim 2015). BECCS, therefore, does not arise as a neutral response to climate change but is embedded in shared understandings of

¹ Approximately €1.7 billion.

which climate mitigation strategies are seen as possible, desirable, and politically acceptable.

The deployment of BECCS in Sweden intersects in this context with ongoing debates concerning the role of the Swedish forest in future climate mitigation pathways. On the one hand, BECCS and the forest both contribute to carbon dioxide removal (Calvin et al. 2023:87). On the other hand, BECCS at Stockholm Exergi relies primarily on forest-based biomass, meaning that forest resources are used to generate energy, and the occurring emissions are subsequently captured by BECCS technology (*Annual and Sustainability Report 2024* 2024:15).

This connection is highly contested. Environmental organisations and non-governmental organisations frequently criticise Swedish forestry practices as environmentally harmful, arguing that they diminish ecosystem functions and undermine the forest's capacity for natural carbon storage (e.g., Greenpeace Sweden 2024; Lexén et al. 2025; WWF Finland 2025).

However, with the materialisation of the Stockholm Exergi project, BECCS is moving towards becoming an integral part of Sweden's low-carbon transition. These developments raise questions about how visions of effective climate mitigation shape broader societal understandings of Sweden's climate action and how these visions influence the role assigned to the forest within it.

1.1 Research Gap and Contribution

Previous research has examined the implications of CDR and BECCS deployment for climate mitigation and global carbon budgets (e.g., Anderson & Peters 2016; Fuss et al. 2018; Calvin et al. 2023; Günther et al. 2024). Furthermore, attention has been given to the discourses and drivers behind forest use in Sweden, highlighting close links between economic interests, industry, and forest production (e.g., Björheden 2006; Laszlo Ambjörnsson et al. 2016). In addition, a growing body of literature examines how futures are imagined and how these imagined futures shape actions in the present (e.g., Cantó-Milà & Seebach 2024b; Delanty 2024; Featherstone 2024).

One important strand of literature in this context is the concept of *sociotechnical imaginaries* developed by Jasanoff & Kim (2009), which tries to explain how technological developments are linked to collective sense-making processes and visions of desirable futures. For Sweden, previous research has shown that such imaginaries are strongly shaped by ideas of climate leadership and green industrial development (Christiansen & Carton 2021; Lefstad et al. 2024). However, it has not yet been examined in detail how ideas about effective climate mitigation shape these imaginaries, and how this, in turn, influences understandings of the Swedish forest. This also came to the attention of Christiansen & Carton (2021:7), who called for further research into the relationship between carbon dioxide removal and forestry.

To investigate these dynamics, this thesis examines how BECCS is imagined within Sweden's climate mitigation efforts and how these imaginaries shape and reflect understandings of the Swedish forest and its role in future climate mitigation efforts. More specifically, the thesis addresses the following research questions:

- *How is BECCS imagined within Sweden's climate mitigation efforts?*
- *How do BECCS imaginaries reflect and shape views on the Swedish forest and its role in climate mitigation?*

To explore these questions, the thesis draws on the conceptual framework of *sociotechnical imaginaries*, which provides an analytical lens to understand how collectively held visions of desirable futures are linked to technological development. The analysis is based on seven qualitative interviews with Swedish stakeholders involved in, or connected to, the Stockholm Exergi project, through which patterns of collective sense-making are examined.

The thesis is structured as follows: Chapter 2 provides an overview of Sweden's climate mitigation strategies, BECCS, and the role of the Swedish forest, alongside key debates around CCS and CDR. Chapter 3 outlines the theoretical framework and introduces the concept of sociotechnical imaginaries, followed by Chapter 4, which presents the methodological approach. Chapters 5 and 6 present the findings and discussion, respectively, exploring the socio-technical imaginary of BECCS in Sweden. Chapter 7 synthesises this thesis and provides an outlook for further research.

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2. Background – BECCS, climate mitigation and the Swedish forest

The following section establishes the context for this thesis by outlining Sweden's climate mitigation efforts. These include the goals and targets set by the Swedish government and the EU, as well as Sweden's strategy for achieving them (Section 2.1). Sweden's inability to meet its goals underpins the latest developments against which BECCS was developed, as discussed in section 2.2. Furthermore, section 2.3 illustrates the role of the Swedish forest in current and future climate mitigation efforts.

2.1 Frameworks, Goals and Targets

Sweden's climate policies are shaped by national targets, EU regulations and international commitments. Under the 2015 Paris Agreement, Sweden, alongside other signatory nations, pledged to contribute to the goal of keeping global temperature rise to "well below 2 degrees Celsius" (Swedish Environmental Protection Agency 2021:8; Ministry of Climate and Enterprise 2024).

This is also reflected in the EU climate framework, under which Sweden is required to reduce its emissions by 50% between 2005 and 2030 in the sectors governed by the EU's Emission Sharing Regulation (European Commission 2023). This applies to sectors not included in the European Emission Market, such as heating and transportation, and is intended to be carried out in a "cost-effective and fair manner" (ibid.). In addition, Sweden is obligated to increase net carbon removal in its Land Use, Land-Use Change, and Forestry (LULUCF) sector by ~4 million tonnes (Mt) to -47.3 Mt by 2030 (Regulation (EU) 2023/839 2023; European Commission 2025; Klimatpolitiska Rådet 2025:25).

At the national level, Sweden, following the Paris Agreement, aims to achieve climate neutrality by reducing domestic emissions by at least 85% compared to 1990 levels (Swedish Environmental Protection Agency 2021). The focus lies on electrification, energy efficiency, and the use of renewable resources (ibid.). The remaining 15% may be offset through carbon dioxide removal (CDR) measures, including forest and soil sequestration (i.e., the LULUCF sector), investments in emission reductions abroad, and Bioenergy with Carbon Capture and Storage (BECCS) (ibid.).

However, the independent Swedish Climate Policy Council, evaluating Sweden's alignment with its climate goals, shows that Sweden is falling behind both: its ambitious national goals and the EU's climate commitments (Klimatpolitiska Rådet 2025:46f.). Sweden's emission reduction of 2 % in 2022 is insufficient and falls short of the 13.5% reduction required to meet commitments

under the Paris Agreement (Naturvårdsverket 2024; Stoddard & Anderson 2024). Moreover, instead of increased sequestration in the LULUCF sector, carbon uptake has declined by about 12.15 Mt CO₂ equivalents (CO₂e) since the European reference year, likely due to increased droughts caused by climate change (Laudon et al. 2024; Naturvårdsverket 2024).

Sweden is not the only country that falls short of its climate goals. Currently, only 10 EU countries are meeting their commitments, and worldwide emissions are still increasing (Klimatpolitiska Rådet 2025). Moreover, even with the current climate commitments, the global temperature is likely to rise to 3.2 °C by the end of the century (Calvin et al. 2023:68). These developments underpin the growing emphasis on carbon dioxide removal techniques, which will be explored in the next chapter.

2.2 Carbon Dioxide Removal

In 2014, one year before the Paris Agreement, the IPCC's Fifth Assessment Report put, for the first time, a stronger emphasis on Carbon Dioxide Removal (CDR) as part of their mitigation pathways (Carton et al. 2020:3). The IPCC, the United Nations (UN) Intergovernmental Panel on Climate Change, synthesises scientific research on global warming. Hence, the attention to CDR in the IPCC report was due to the increasing use of negative emissions (NE) in the scientific climate literature, mainly through integrating them into the scenario-building Integrated Assessment Models that assess potential climate mitigation pathways (Anderson & Peters 2016; Carton et al. 2020).

Negative emissions (i.e., *Negative greenhouse gas emissions*) are human-induced atmospheric GHG removals that happen in addition to natural processes (Reisinger et al. 2023). NE or NETs describe actions that absorb higher volumes of GHG from the atmosphere than they emit, causing a net GHG removal due to human activities. CDR, on the other hand, highlights the long-term storage of carbon emissions and encompasses human-driven enhancement of carbon sinks, Carbon Capture and Storage (CCS), afforestation and reforestation (A/R) and Direct Air Capture and Storage of carbon dioxide (DACs) (ibid.). The difference between negative emission technologies (NET) and CDR is merely made by describing an effort on the one hand (i.e., CDR) and the factual output of the effort on the other hand (i.e., NET). Nonetheless, in the literature, CDR and NET are mostly used synonymously as both describe the processes of reducing atmospheric CO₂ or GHG, respectively.

2.2.1 IPCC and Mitigation Pathways

As atmospheric carbon levels continued to increase at the beginning of the century, NET rose in popularity within Integrated Assessment Models (IAMs). By implementing carbon removal technologies in mitigation pathways, scientists could

model effective climate actions while remaining committed to current policy interests, such as cost-effectiveness (Carton et al. 2020:6; Haikola et al. 2021:8; Lefstad et al. 2024:2). Particularly, BECCS is chosen in IAMs based on the comparison of various CDRs' cost-effectiveness with the direct elimination of all fossil emissions (Smith et al. 2016).

In the IPCC Sixth Assessment Report from 2023, large volumes of NE are most important for the C1a and C2 mitigation pathways. Both aim to limit global warming to 1.5 degrees, while the C2 models incorporate scenarios that entail carbon overshoot and a return to 1.5 degrees (Riahi et al. 2023:330). For C1 scenarios, the focus lies more on immediate emission reduction, and NE are mostly implemented to offset emissions of hard-to-abate sectors (ibid., p. 316 & 319). On the contrary, C2 scenarios rely more on CDR technologies to offset historic emissions after an overshoot.

Climate scientists have critically discussed the importance of CDR in mitigation scenarios. Criticism is mostly directed towards an overreliance on CDR that might lead to delayed climate actions (i.e., *mitigation deterrence*) and other sustainability issues (e.g., Anderson et al. 2023; Riahi et al. 2023:323f.; Dooley et al. 2024).

This thesis will focus on the CDR bioenergy with carbon capture and storage (BECCS), and the Swedish forest as a natural carbon sink. The next introduces BECCS and Stockholm Exergi as the Swedish case study.

2.2.2 BECCS and Stockholm Exergi

BECCS, or bioenergy with carbon capture and storage, is a form of CDR that is applied to facilities with large volumes of biogenic emissions, such as bioenergy plants and paper mills (Fajardy & Greenfield 2024).

BECCS generates negative emissions by capturing CO₂ in the chimney before it enters the atmosphere, which is then stored underground, for example, in depleted oil fields and other geological formations (Lindbäck 2025). Biogenic emissions are considered carbon-neutral when using renewable biomass, as this biomass is replanted and can capture the emitted carbon again. Hence, BECCS actively removes carbon from the atmosphere by capturing and storing biogenic emissions (Gough & Upham 2011). By storing CO₂ in geological formations, it is transferred from the short-term to the long-term carbon cycle (IPCC 2023). In the case of forest biomass, this entails removing CO₂ accumulated over decades in the tree biomass stock.

The potential of BECCS to generate negative emissions in the next years varies and ranges between 0 and 13 MtCO₂/year globally (Everson et al. 2024). Meanwhile, the projected median of cumulative negative emissions needed by the end of the decade to meet the IPCC scenarios C1 and C2 are estimated to be between -220 Gt and -360 Gt of CO₂, respectively (Riahi et al. 2023:330, Table 3.2). Besides that, BECCS has faced criticism because its large-scale deployment

could intensify current land use and pose risks to other sustainability goals, such as food security and ecosystem services (Fuss & Johnsson 2021; Dooley et al. 2024). However, BECCS is attractive for further decarbonisation efforts because it generates energy rather than consuming it (Smith et al. 2016:6). Additionally, bioenergy production often coincides with electricity generation.

Sweden is one of the few countries that significantly invests in BECCS. In early 2025, the Swedish Energy Agency announced a major funding of 20 billion SEK (approximately €1.7 billion) to support what is set to become one of the world's largest BECCS facility by *Stockholm Exergi* (Persson 2025). Funding was allocated via a reverse auction within a 36 billion SEK budget designated for BECCS development in the next 20 years (2026 – 2046) (Swedish Energy Agency 2025).

The implementation of BECCS in Sweden is often rationalised by the favourable conditions found in the Nordic countries: Large biogenic point emitters, such as district heating and pulp and paper plants, alongside access to coastal areas that facilitate transportation (Lefstad et al. 2024:5). In Sweden, BECCS is also considered in other sectors, especially in the pulp and paper industry, highlighting the broader relevance of biomass-based NET beyond energy production (Karlsson et al. 2021).

Stockholm Exergi is Stockholm's main district heating provider, delivering heat and electricity to around 800,000 people (Persson 2025). The biomass used is carbon-neutral and largely derived from forestry residues (Stockholm Exergi 2024:15). Construction of the capture unit at Stockholm Exergi's district heating facility in Värtahamnen began in 2025. The company aims to capture and permanently store up to 783 thousand tonnes of biogenic CO₂ annually starting in 2028, utilising CapsolEoP (end-of-pipe) technology (Persson 2025).

As a result, Stockholm Exergi will operate the world's largest BECCS plant, implementing CapsolEoP (end-of-pipe) carbon-capture technology (Bergh 2025). This technology targets hard-to-abate industries with point source CO₂ emissions (Capsol Technologies n.d.a). It functions by directing flue gases into an absorber tower containing hot potassium carbonate (HPC). HPC chemically reacts with and liquefies CO₂ in the gas mixture, enabling the capture of approximately 90-95% of the CO₂ (Capsol Technologies n.d.b). By heating, the chemical reaction can be repeated to extract CO₂ from the HPC once more. Consequently, CO₂ is separated from the gas mixture. In the current BECCS application, the HPC is recycled, while the CO₂ is dried and compressed for storage underground. Using an external capture unit, CapsolEoP has been shown to be cost- and energy-efficient (ibid.). Stockholm Exergi has already shown the method's effectiveness through experiments at its district heating plants (European Commission 2024).

2.2.3 Emission Trading and Funding

In addition to support from Sweden, the EU has expressed interest in Stockholm Exergi's BECCS facility. In 2024, Stockholm Exergi secured €180 million in EU funding through the European Innovation Fund (European Commission 2024).

Another revenue source for implementing and operating Stockholm Exergi's BECCS facility is the voluntary market. Emitting companies can utilise negative emissions generated by BECCS to offset emissions and achieve climate neutrality targets in their companies. Through the voluntary market, Stockholm Exergi has entered into the world's largest negative-emissions contract, committing to 3.3 Mt of permanent carbon removals for Microsoft over several years (Persson 2024).

Furthermore, the EU has tasked the European Scientific Advisory Board on Climate Change with examining the potential benefits and risks associated with CDR in the EU. In 2025, the board published a report advocating for the incorporation of negative emissions into the EU Emission Trading System to achieve climate neutrality within the EU - provided that certification frameworks are met (European Scientific Advisory Board on Climate Change 2025).

The cost of negative emissions or permanent carbon removals varies significantly across methods. According to Fuss et al. (2018:14), the estimated cost of carbon removal through BECCS ranges from \$100 to \$200 per tonne of CO₂ sequestered by 2050, reflecting both fixed investment costs and marginal costs related to biomass supply, capture, transport, and storage.

In contrast, afforestation and reforestation (A/R), which removes CO₂ through the growth of new forest biomass, cost US \$5 - 50 per tonne, soil carbon sequestration through practices like no-tillage or cover cropping costs US \$0 - 100 per tonne, and biochar, produced by heating biomass and applying it to soils, stores carbon at US \$90 - 120 per tonne (Fuss et al. 2018).

Despite the higher costs, BECCS is considered more "permanent" in carbon storage, as it sequesters carbon in geological formations for thousands of years, whereas afforestation stores carbon in the short-term carbon cycle, making it more vulnerable to disturbances such as wildfires or disease (IPCC 2023). Moreover, A/R is associated with larger land use than BECCS (Smith et al. 2016).

2.3 Decarbonisation and the Swedish Forest

Sweden's forests have a dual function in mitigating global warming. They act as a carbon sink, capturing CO₂ in biomass, and serve as a renewable resource that can substitute fossil fuel products, including those used in bioenergy production, such as BECCS.

For the latter, the concept of bioeconomy has been frequently used in the EU, underscoring the relative decoupling of economic growth and material use while maintaining European competitiveness (D'Amato et al. 2017:723; European

Commission: Directorate-General for Research and Innovation 2018). Furthermore, the provision of resources for the bioeconomy is associated with rural jobs and alignment with the climate objectives of the Paris Agreement (European Commission: Directorate-General for Research and Innovation 2018:5).

The role of the forest-based bioeconomy in Sweden's decarbonisation efforts is particularly evident when examining the success of the energy sector. On average, heavy-emission energy sources such as coal, oil, and natural gas continue to dominate the energy mix in Europe. In contrast, Sweden has achieved a 92% reduction in emissions in the heating sector between 1990 and 2023, thanks to investments in district heating and the utilisation of biofuels (Naturvårdsverket 2024; International Energy Agency 2025). Furthermore, using waste to produce energy has led to a 75% reduction in emissions in the waste treatment sector (Naturvårdsverket 2024). Moreover, Sweden's Land Use and Land Use Change (LULUCF) sector functions as a net carbon sink², although its potential has diminished due to droughts in recent years (Laudon et al. 2024).

2.3.1 Clear-Cutting and Biodiversity

The forestry sector in Sweden plays a significant role in the national economy. According to the Swedish Forest Industries (2024), the sector employs approximately 2% of all employees in Sweden (140,000 people). Furthermore, in 2024, exports of forest products contributed 9% to Sweden's total exports (Official Statistics of Sweden 2024)³.

A dominant forest management strategy in Sweden involves, hereby, monocultures combined with clear-cutting (Swedish Forest Industries 2025). This method is widely adopted as it maximises timber growth rates and is often regarded as effective for economic returns and rapid carbon uptake⁴ (Lundmark et al. 2016). Clear-cutting generates large amounts of harvest residues, particularly branches and tops, which are an important feedstock for bioenergy production and, hence, for BECCS (Thiffault et al. 2015).

However, clear-cutting and monocultures are considered controversial and have been criticised by environmental organisations (e.g., Greenpeace Sverige 2024; Lexén et al. 2025; WWF Finland 2025). Moreover, Sweden's current forestry practices are not in line with EU standards as they have been linked to biodiversity

² However, according to the definition of net zero, carbon sequestration from pre-existing tree stock or the forestry industry cannot be used to offset other emissions. For this, single A/R projects need to be issued (Carton et al. 2020:5; Dooley et al. 2024).

³ Based on the following CN codes: 44 (*Wood and Articles of Wood; Wood Charcoal*), 47 (*Pulp of Wood or of other fibrous cellulosic material; recovered paper or paperboard*), 48 (*Paper and Paperboard, Articles of Paper Pulp, of Paper or of Paperboard*) (Official Statistics of Sweden 2025).

⁴ However, it has been pointed out that, in addition to the tree stock, a forest's carbon pool also includes other sinks, such as soil carbon and dead organic matter, which may suggest that alternative forestry methods could sequester more carbon (Pukkala 2022).

loss, soil degradation, and weakened long-term carbon sequestration capacity (Swedish Environmental Protection Agency 2021; Holmgren et al. 2022). Yet, public narratives around the Swedish bioeconomy often downplay these concerns, focusing instead on “amenity values, carbon storage, and substitution effects” (Holmgren et al. 2022:53f.).

Despite criticism, private forest owners in Sweden generally resist changing their clear-cutting practices (Danley et al. 2021). Meanwhile, ecological challenges grow: carbon uptake in Swedish forests has declined recently, and tree growth has slowed due to drought and weakened forest health (Laudon et al. 2024). The IPCC Sixth Assessment Report projects these trends may worsen with continued global CO₂ emissions, potentially reducing the effectiveness of forests as carbon sinks (Calvin et al. 2023:82). This uncertainty complicates the role of forests in Sweden’s decarbonization plans.

The previous chapter has outlined the Swedish policy context, the role of BECCS in climate mitigation strategies, and the controversies surrounding forest-based biomass. These developments do not emerge in a political or technical vacuum. Instead, they are embedded in social values and interests along with visions of the future about how Sweden should achieve its decarbonisation goals.

In the following chapter, I therefore turn to the concept of *socio-technical imaginaries* as a tool to analyse how different actors envision the role of BECCS, the forest, and carbon removal in Sweden’s climate transition. This analytical lens helps to unpack not only what is technically proposed, but also how legitimacy, power, and desirable futures are constructed around these technologies.

3. Theoretical framework

The following section introduces the theoretical framework of this thesis. The framework serves as the analytical lens for exploring how BECCS is imagined within Sweden's climate mitigation context and how the Swedish forest is shaped through the imaginary. To do so, the thesis draws on the concept of *sociotechnical imaginaries*, which helps explore how technological developments and collective sense-making mutually inform one another.

In this section, I firstly introduce and define the concept of sociotechnical imaginaries, originally developed by Jasanoff & Kim (2009), and the related idiom of co-production. Secondly, I briefly situate these concepts within existing research. Finally, I explain how this theoretical framework is applied in the analysis.

3.1 Sociotechnical Imaginaries & Co-production

This thesis builds on the concept of sociotechnical imaginaries, coined by Jasanoff & Kim (2009) in their comparative work on nuclear power in the United States and South Korea. Originating in science and technology studies (STS), the concept concerns how visions of the future connect social and material worlds and how these visions contribute to the institutionalisation and materialisation of technologies. It therefore highlights the reciprocal relationship between society and technology: how science and technology shape social orders, and how social values, norms, and political contexts shape technological development and science (Lefstad et al. 2024).

The definition used in this thesis follows Jasanoff's later refinement in *Dreamscapes of Modernity*:

“Sociotechnical imaginaries are collectively held, institutionally stabilised, and publicly performed visions of desirable futures (or of resistance against undesirable ones), animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology.” (Jasanoff 2015).

Socio-technical imaginaries are therefore not only material artefacts but also function as anchors of desirable futures, embedded in belief systems, values, and historical experiences (ibid.). This resonates with broader understandings of *imaginaries* in social and political theory, which understand the societal imaginaries as a dialogue between the construction of society and ‘futures in the making’ (Cantó-Milà & Seebach 2024). Socio-technical imaginaries, however, extend on this conceptual framework by engaging with how materiality (i.e., technological systems) shapes and is shaped by imaginaries, from the generation of knowledge to the materialisation of technology (Hendriks et al. 2025:11).

Socio-technical imaginaries are thereby understood as emerging through the *co-producing* relationship of science and technology with nations or societal actors (Jasanoff 2015:3). The co-production idiom acknowledges that science and technology are never neutral and sees them as shaping and being shaped by societal sense-making processes. Socio-technical imaginaries extend on this idiom by adding an explanatory element to the exploration of the link between materiality, sense-making and the construction of society. Hence, tries to describe and interpret how specific future visions are materialised through these processes (ibid.).

The concept is used analytically to reveal how ideas of desirable futures and social order are embedded in technological visions, including implicit assumptions about what is possible, legitimate, and necessary. The *desirability* of a future vision is stressed in socio-technical imaginaries, as it describes how society, or specific groups within it, long for and try to form this future through technological or scientific achievements. The conceptual framework is hereby built on the assumption that envisioning the future shapes the present and the materiality within it (Cantó-Milà & Seebach 2024:304).

Divergent sociotechnical imaginaries can exist around the same technological system, as shown in Jasanoff and Kim's analysis of nuclear power, where contrasting notions of state responsibility and risk produce different national imaginaries (Jasanoff & Kim 2009). However, an imaginary needs to be *collectively held*, hence, "communally adopted" in order to emerge as a socio-technical imaginary and not only as an individual or 'vanguard vision' of the future (Jasanoff 2015:4). Power relation, as well as societal established imaginaries, play an important role in this process, through heightened influence, which allows for some imaginary to be institutionalised and materialised. Socio-technical imaginaries can also be used strategically by defining struggles in the present-day and solutions in the future to build coalitions and mobilise popular support for different political and technological projects (Jessop 2010:345f.).

Sociotechnical imaginaries, therefore, go beyond discursive tools such as narratives and framings. While these describe how actors talk about technologies, imaginaries help uncover the deeper values, hopes, power relations, and understandings of order that such discourses express (Cantó-Milà & Seebach 2024; van Hulst et al. 2025).

3.2 Conceptualising BECCS, climate mitigation and the role of the Swedish forest

3.2.1 BECCS imaginaries and the place of the Swedish forest

The use of the concept of socio-technical imaginaries has increased substantially in recent years, with broad application across disciplinary boundaries - even though energy and social sciences remain the largest corpus (Hendriks et al. 2025:5).

For Sweden and Scandinavia, scholars have begun to investigate how BECCS is imagined in a regional context. Lefstad et al. (2024) focus on CCS imaginaries in Scandinavian scientific articles, while Christiansen & Carton (2021) examine Swedish stakeholders' visions of negative emission technologies (NETs). Christiansen & Carton (2021) compares hereby emerging imaginaries of several NETs, including both the LULUCF sector and BECCS. They found that the BECCS imaginary enjoys relatively strong support among societal elites, which suggests a high likelihood of institutional stabilisation. In contrast, imaginaries related to LULUCF measures, such as rewetting and forest conservation, appear more contested because they challenge political-economic interests.

In this thesis, I focus on the BECCS imaginary, which is currently undergoing materialisation through the Stockholm Exergi project. Even though the Swedish forest as a carbon sink could be understood as a NET counter-imaginary – as in the case of Christiansen & Carton (2021) - I do not treat it as a separate imaginary. Instead, I am interested in how the Swedish forest is depicted within the BECCS imaginary itself.

Previous research has found that BECCS and its relationship with the Swedish forest are often linked through the materiality of the bioenergy sector, with a broader national vision of Sweden as a sustainable country (Christiansen & Carton 2021; Lefstad et al. 2024).

Other research on narratives and socio-technical imaginaries of BECCS has examined how the IPCC has often been identified as the main authority shaping the BECCS imaginary (e.g., Beck & Mahony 2018; Carton et al. 2020b; Haikola et al. 2021; Lefstad et al. 2024). This has been critically discussed, as the IPCC relies heavily on integrated assessment models that are built upon assumptions of cost-efficient climate pathways (Carton et al. 2020:6; Haikola et al. 2021:8; Lefstad et al. 2024:2). Authors therefore argue that this scientific imaginary “naturalises” BECCS and makes it appear politically inevitable, thereby narrowing future climate options and constraining political imagination (Beck & Mahony 2018; Lefstad et al. 2024),

3.2.2 Climate imaginaries and BECCS

Another important strand of literature for this thesis concerns climate imaginaries, which are used to position the BECCS imaginary within climate mitigation. Levy

& Spicer (2013:662) define climate imaginaries as idealised visions of the future that are contested and used to mobilise political support. This perspective is particularly relevant because BECCS imaginaries in Sweden have previously been shown to emerge within a relatively small elite group (Christiansen & Carton 2021). By situating BECCS within the broader field of climate mitigation, we can analyse how broader climate imaginaries shape understandings of BECCS and, in turn, how this elite group helps define what counts as effective climate mitigation through the BECCS socio-technical imaginary.

Moreover, focusing on climate imaginaries, Watson (2025) highlights how the concept of a crisis constructs technological futures, showing that the imperative to innovate is tied to how people make sense of crisis. In their work, technological opportunities are framed in parallel with crises, particularly through shared narratives of speed and complexity. This provides one angle on how the climate crisis can be mobilised to normalise and legitimise technological development, such as BECCS.

Turning to Sweden, Marquardt & Nasiritousi (2022) show that many stakeholders struggled to imagine climate policy beyond technological solutions and green growth. Haikola et al. (2021:8) nuance this finding, illustrating that while BECCS is frequently framed as part of an economically sustainable transition, other narratives portray it as a matter of technological fatalism, positioning it as a “mathematical necessity” rather than a political or societal choice. Taken together, these studies indicate that BECCS, as a technological system, is shaped by the perception that the capitalist system will prevail and that decarbonisation efforts are not compatible with the growth paradigm.

3.3 Analytical angle

Within interpretative social theory, socio-technical imaginaries function as second-order concepts (Jasanoff 2015:5; Cantó-Milà & Seebach 2024:304; Hendriks et al. 2025:2). They enable researchers to identify patterns of meaning-making embedded in language, symbols, and cultural narratives. Rather than simply reflecting actors’ understandings, imaginaries are interpreted through the researcher’s analytical lens, revealing how societal and technological visions mutually inform one another.

Building on Jasanoff’s fourth problem formulation - *how science and technology connect individual self-understanding to a shared social or moral order* - this thesis examines how social perceptions shape the understanding of a second element, the Swedish forest, through the lens of the BECCS imaginary (Jasanoff 2015:5 & 23f.). This thesis, therefore, emphasises that socio-technical imaginaries of BECCS are not merely carriers of vision; they are co-constitutive, shaping how climate mitigation and the role of the forest are collectively understood.

In this way, socio-technical imaginaries provide a framework for understanding how technology, society, and nature are co-constituted through shared visions and

values, offering a reflective lens for examining the emergence and implications of BECCS in Sweden.

4. Methodology

This chapter outlines the methodological approach used to explore the socio-technical imaginary of BECCS. The study centres on the Stockholm Exergi BECCS project, currently the most advanced and visible BECCS initiative in Sweden, which provides a concrete site for articulating broader imaginaries. Given the exploratory character of the study and its focus on societal sense-making, I adopted a qualitative research design (Jasanoff 2015:5; Cantó-Milà & Seebach 2024:304; Hendriks et al. 2025:2). To develop a deeper understanding of how BECCS is imagined in relation to climate mitigation and the Swedish forest, the thesis draws on interviews with seven stakeholders positioned close to the BECCS discourse and deployment in Sweden.

This chapter first presents the research design and rationale, followed by the data collection process, interview design, ethical considerations, analytical approach, and finally, a reflection on methodological limitations.

4.1 Research design

This study employs a qualitative research design to investigate the Swedish socio-technical imaginary of BECCS. Qualitative methods are well-suited for examining how meanings are constructed and negotiated (Fossey et al. 2002:871; Savin-Baden & Howell Major 2023:5). To collect empirical material, elite interviews were chosen as the primary method. These interviews enable the exploration of diverse interpretations, expectations, and perspectives among influential stakeholders (Doody & Noonan 2013), thereby contributing to an understanding of how the socio-technical imaginary of BECCS is shaped and maintained.

Earlier research on climate and NET imaginaries has typically drawn on policy documents, scientific publications and interviews (e.g., Levy & Spicer 2013; Christiansen & Carton 2021; Lefstad et al. 2024). In this thesis, I focus specifically on stakeholders around BECCS, and therefore, I chose to do elite interviews. Elites are here defined as individuals working within organisations that hold power to influence debates, decision-making, and meaning-making surrounding BECCS (Harvey 2011).

This choice was motivated by several considerations. Firstly, the status of BECCS as imaginary in Sweden and the role of power in the socio-technical imaginary (see section 3). Interviews, therefore, provided access to stakeholders, who actively shape or indirectly support imaginaries surrounding BECCS - especially at a moment when institutionalisation is still unfolding. Through these interviews, I aim to identify overlapping themes, tensions, and recurring values in how BECCS is imagined.

Secondly, interviews were prioritised over policy documents to address the relationship between BECCS and the Swedish forest, which appeared underexplored in publicly available materials. A preliminary review of relevant stakeholder websites suggested that this intersection was rarely discussed or addressed, mainly in relation to bioenergy rather than to BECCS specifically. Interviews, therefore, enabled a more direct exploration of how actors understand the link between BECCS, climate mitigation, and the forest.

4.2 Data collection

4.2.1 Sampling Strategy

The research design is based on expert interviews. The aim was to speak with actors positioned close to policy processes, political debates, and institutional negotiations surrounding BECCS, and who play a role in shaping or responding to emerging sociotechnical imaginaries. Stakeholders were therefore selected based on their institutional relevance and involvement in BECCS-related governance, rather than on statistical representativeness.

The intention was to capture perspectives from national agencies, municipal actors, advisory bodies, and industry (see Table 1). Accordingly, interviews were conducted with one representative from Stockholm Exergi and one representative from the Swedish Energy Agency, which funds the Stockholm Exergi BECCS project. In addition, two interviews were carried out with employees of the Environmental Administration of the City of Stockholm, where the BECCS plant will be located. Finally, three interviews were conducted with representatives of organisations involved in national climate mitigation policymaking and debate.

4.2.2 Interviews

In total, seven elite interviews were conducted in February and March 2025. Experts were identified through internet searches and mapping of relevant institutions connected to Stockholm Exergi. The final sample comprises actors relevant to current and future developments of BECCS in Sweden (see Table 1).

Interviewees were contacted via my SLU student email. Responses were generally positive, with only one of eight contacted individuals not replying.

Table 1: Interviewees

No.	Institution	Description
<i>Interview 1</i>	Stockholm City's Environmental Administration	Municipality
<i>Interview 2</i>	Stockholm City's Environmental Administration	Municipality
<i>Interview 3</i>	Greenpeace	Environmental NGO
<i>Interview 4</i>	Fossil-free Sweden	Governmental industry-based initiative
<i>Interview 5</i>	Swedish Energy Agency	Funding Stockholm Exergi
<i>Interview 6</i>	Swedish Climate Policy Council	Independent governmental advisory body
<i>Interview 7</i>	Stockholm Exergi	Constructing Europe's largest BECCS plant

Six interviews were conducted in person. Five took place at participants' workplaces in Stockholm, and one was conducted in a café in Uppsala. One interview was carried out digitally via Zoom. Interviews lasted between 35 and 54 minutes, with an average duration of approximately 47 minutes.

4.2.3 Interview Guide

The interviews followed a semi-structured format. A flexible interview guide was developed to capture environmental, social, and climate-related understandings of BECCS while allowing participants to elaborate on issues they considered important. This structure enabled comparability across interviews while at the same time creating space for new insights, particularly regarding the relationship between BECCS and the Swedish forest (Doody & Noonan 2013).

The guide was based on a brief review of the literature and background material on negative-emission technologies, BECCS, and the Swedish forest. Questions were organised into thematic areas, beginning with easy questions about how the interviewee defined and understood BECCS, to build trust (Doody & Noonan 2013). Further questions addressed how BECCS relates to Sweden's climate and societal goals, to the Swedish forest, to climate mitigation, and to broader

sustainability implications. Participants were also asked to reflect on uncertainties, utopian futures, risks, and Sweden's global responsibility and identity.

All questions were open-ended to encourage elaboration. The interview guide was used flexibly, with spontaneous follow-up questions to encourage elaboration (Doody & Noonan 2013). Support in Swedish was received to ensure clarity in Swedish phrasing.

4.2.4 Ethical Considerations

In accordance with the European Code of Conduct for Research Integrity (ALLEA 2023), all interviewees provided informed consent, either in writing or digitally. Consent forms were sent in advance and reviewed at the beginning of each interview. Participants were informed that they could withdraw until 16 May 2025, shortly before the intended thesis submission date. All were aware that interviews would be analysed in relation to visions and imaginaries of BECCS, and the theoretical framework was explained upon request.

In line with SLU requirements, confidentiality was ensured. No unnecessary personal data was collected, and all communication took place via my SLU student address. Participants were asked whether their institutions could be named, and pseudonyms were used if consent was not granted. Institutional affiliation was considered important to contextualise interviewees' positions (Savin-Baden & Howell Major, 2023). In the results, participants are referred to by numbers (1–7) in no particular order.

All interviews were conducted in Swedish. Although Swedish is not my first language, I did not experience significant difficulties in understanding participants. Conducting interviews in Swedish was prioritised to ensure participants' comfort, while remaining aware of the risk of losing subtle nuances (Harvey 2011).

4.3 Analysis

Most interviews were transcribed using Microsoft Word's transcription tool and subsequently reviewed and corrected while listening to the recordings. Two interviews were largely transcribed manually. All material is securely stored on a password-protected laptop.

The analysis was based on coding the material to identify recurring themes, meanings, and interpretative patterns related to BECCS and imagined futures. The coding process combined inductive and abductive elements within an iterative qualitative approach.

Coding was conducted in Taguette, an open-source software for qualitative coding. In a first step, two interviews were coded inductively, allowing themes to emerge from the material without imposing predefined analytical categories. In comparison to deductive research, which seeks to demonstrate or falsify a rule, this approach tries to find a rule that applies to several cases (Timmermans & Tavory

2012:170f.). This resulted in a relatively large number of initial codes, including some capturing only single statements. It therefore helped me develop a sense of data coding and repetitive statements.

In a second step, the analysis was developed as an abductive and iterative process, involving continuous movement between theory, empirical material, and writing. *Abduction* refers to an analytical approach in which hypotheses emerging from theory and data are repeatedly tested and recalibrated to generate new insights grounded in existing theory (Timmermans & Tavory 2012:171). The analysis, therefore, focused on logical explanation rather than frequency, directing attention to how narratives were constructed, which assumptions were mobilised, and how BECCS was framed as desirable or problematic in relation to climate mitigation and the forest.

This empirical analysis forms the basis of the Findings chapter, while a second, interpretive step synthesised connections and tensions from the material at a meta-level. Since socio-technical imaginaries are used as a second-order analytical lens (see Theoretical Framework), this step focused on how participants make sense of society, technology, and the future, discussed further in the discussion chapter. Throughout the process, I functioned as an analytical instrument (Savin-Baden & Howell Major 2023), and the analysis is therefore shaped by my positionality, personal standing, and interpretive ability.

4.4 Limitations and risks

This study recognises the subjective and relational character of qualitative research. The interaction between me as an interviewer and the interviewees may therefore have influenced the responses, for example, through assumptions about my expectations of specific answers. In addition, some actors may benefit institutionally, politically, or economically from presenting BECCS in particular ways. This is not necessarily a limitation, however, as imaginaries can also be strategically mobilised (Jessop 2010).

Moreover, relying solely on elite interviews entails both strengths and risks. On the one hand, it shows how the BECCS imaginary can be mobilised by elites to gain political traction. In addition, it reveals the kinds of desirable futures imagined by actors with influence over decision-making and the formation of the future.

At the same time, this focus may obscure collective sense-making among other relevant groups, such as the general public or forestry actors. Although forestry actors were initially excluded to keep the empirical scope centred on Stockholm Exergi, further research revealed that they could have provided additional insights. This absence is therefore acknowledged as a limitation.

5. Findings

The following sections present the findings from seven expert interviews, focusing on how BECCS and the Swedish forest are presented in relation to climate mitigation in Sweden and each other. The results are hereby organised according to the research questions: the first section shows how BECCS is described within and connected to climate mitigation in and beyond Sweden. The second section focuses on the role of the Swedish forest in relation to BECCS, both as a resource and as a potential negative emission tool.

In general, the result sections aim to show patterns and uncertainties in the material, providing a description that can later inform the discussion of overarching imaginaries and their implications (see Discussion). Differences between more optimistic and more sceptical views of BECCS are noted, without making evaluative claims. The result presents the empirical material in a logically structured way; statements mentioned by only a few interviewees are marked with an “I” followed by the interview number.

The interviewees express their varying perspectives. Five provide generally positive views of BECCS, emphasising its potential to address residual emissions and support climate targets, while Interviewees 1 and 3 offer more sceptical perspectives, highlighting potential limitations and risks.

5.1 Climate mitigation with BECCS in Sweden

This section summarises how interviewees describe BECCS in the context of climate mitigation, including its perceived role, limitations, and potential. The analysis highlights how BECCS is discussed as a tool to address residual emissions, support the transition of industrial sectors, and contribute to Sweden’s and Europe’s climate goals. Interviewees differ in their views on technological reliance, potential climate deterrence effects, and public acceptance of BECCS, reflecting a range of expectations and concerns.

5.1.1 BECCS as a tool to address excess carbon dioxide

Across the interviews, there is broad agreement that negative emissions are necessary in addition to emission reductions. Interviewees refer to both technological options, such as BECCS, and natural carbon sinks. This necessity is commonly explained by current atmospheric carbon dioxide levels and the need to reduce them. As one interviewee explains, negative emissions are important in order to “*get the right concentration in the atmosphere again*” (I4).

Several interviewees further connect the need for negative emissions to Sweden’s climate targets and international commitments. In this context, developing negative emission technologies is framed as a matter of responsibility,

linked to keeping political promises and taking climate change seriously. This sense of obligation is reinforced by references to urgency. Interviewee 6, for example, notes that “*there are these promises to achieve quite substantial negative emissions here in Sweden, within a fairly short time frame.*”

At the same time, many interviewees emphasise that negative emission technologies should not replace emission reductions but rather function as a complementary measure. BECCS and other NETs are described as supporting tools within a broader mitigation portfolio. However, there are differences in how far interviewees consider technologically engineered solutions to be acceptable or desirable. Interviewees 1 and 3, for instance, mainly describe small-scale CCS as a possible future necessity, while explicitly rejecting large-scale BECCS deployment. Their reservations are linked to concerns about mitigation deterrence and the risk of unsustainable reliance on biomass.

Interviewees who are more favourable towards BECCS highlight the technology’s availability, perceived safety, and capacity to deliver large volumes of negative emissions. In these arguments, the Stockholm Exergi project serves as a concrete reference point, making the potential of BECCS tangible. Interviewee 2 contrasts BECCS with other mitigation options by emphasising differences in scale:

“That’s 800,000 tons. If we were to build more in wood, for example, it might give 5,000 tons. Now, I don’t know the exact numbers, but these potentials differ a lot. Or if we were just to restore wetlands, which is so much talked about, that would perhaps yield a potential of 300 tons here in Stockholm. Put that in relation to 800,000 tons. It’s all the way... it’s more than the entire transport sector. That’s a lot.” (Interviewee 2)

Such comparisons indicate that high volumes of negative emissions are valued because they are seen as capable of compensating for emissions from sectors that are described as difficult to decarbonise. In this framing, BECCS is primarily discussed as a means to offset ongoing emissions rather than as a measure aimed at fundamentally reducing atmospheric carbon. This is one point where Interviewees 1 and 3 differ to the rest, when talking mainly about historical emissions that need to be removed from the atmosphere again.

5.1.2 BECCS and the continuation of industrial sectors

A recurring theme across the interviews is the close connection between BECCS and the continuation of the industrial sector. Negative emission technologies are frequently described as a precondition for maintaining an industrialised society while pursuing ambitious climate goals. As interviewee 7 states: “*We cannot have an industrialised society and net-zero goals without negative emission technologies.*”

In these accounts, BECCS is linked to the idea of a fossil-free or climate-neutral industry, where residual emissions from certain sectors are compensated for during and after the transition. Interviewees mention sectors such as aviation, shipping,

cement production, and waste incineration as examples of activities that are expected to remain part of society despite their high emissions.

The importance of maintaining these sectors is often justified by reference to other societal objectives, including employment, welfare provision, economic growth, and Sweden's technological competence (I4, I6, I7). In this context, negative emission technologies are described not only as climate mitigation tools, but also as mechanisms that help safeguard the Swedish welfare state while addressing climate change. Interviewee 4, for instance, links this type of climate action to the prospect of "*having a better life than before.*"

Several interviewees also situate the role of Swedish industry within a broader European context. Sweden is described as having a particular responsibility to use its technological capabilities and material conditions to contribute to European climate mitigation efforts. This includes compensating for residual emissions beyond national borders. Interviewee 4 articulates this perspective as follows:

"It's about seeing that this is the future of Europe and Sweden — not being scared by it, but instead getting excited and realising that this is something we need to work on even faster to keep up with the competition. And keeping up with the competition doesn't mean deviating from environmental legislation but rather seeing this as the way forward and investing in it because it strengthens us." (Interviewee 4)

In this framing, climate mitigation is closely intertwined with competitiveness, technological leadership, and economic strength. BECCS is associated with the possibility of maintaining Europe's industrial position while responding to climate change.

Another line of argument that relates to the continuation of industry concerns social stability. Some interviewees express concern that climate policies based primarily on regulation and restrictions could trigger social resistance. Interviewee 2 refers to the risk of a "*yellow vest*" movement in the context of climate transformation, while interviewee 6 emphasises the importance of compensation mechanisms for those most affected by ambitious climate policies. In these accounts, technological development is portrayed as politically more feasible because it aligns BECCS deployment with a smooth and non-disruptive climate transition. At the same time, interviewee 6 points out that technological pathways are politically contingent and depend on societal changes, citing recent shifts in climate technology funding in the United States.

Not all interviewees share this view. Interviewees 1 and 3 criticise the idea of offsetting industrial emissions, arguing that it risks the continuation of fossil fuel use and delaying more fundamental changes. From this perspective, BECCS is described as prolonging existing production and consumption patterns rather than enabling what these interviewees consider effective climate action, which they mostly defined as systemic change towards a low-carbon and low-material

economy. This argumentation illustrates that BECCS is conflicted within the material.

5.1.3 Market-based approaches to negative emissions

A further recurring theme concerns the integration of negative emissions into market-based climate governance, particularly within the European carbon market. Several interviewees describe emissions trading as a pragmatic and fair way to finance the costly transition to a climate-neutral economy.

Most interviewees expect BECCS to be incorporated into the European emissions trading system in this context. The financing of negative emissions is framed as a matter of responsibility and fairness, in which high-emitting industries are expected to bear the costs of their environmental impact by purchasing negative-emissions credits. Interviewee 4 describes this as a logical alternative to state-led financing schemes:

“Developing BECCS requires capital, and there needs to be a business case for the companies involved - unless the state decides to step in completely and say: ‘We’re investing in this technology and covering all the costs to meet our climate targets.’ But that would be extremely expensive. I mean, 36 billion is already a huge sum, and even more will be needed” (Interviewee 4).

Within this framing, BECCS is discussed as producing a tradable good that fits into existing market logics, with the state acting primarily as a regulator of these markets. Several interviewees indicate that expensive negative emissions might motivate industries to initially opt for more affordable mitigation measures, like switching fuels or boosting efficiency, instead of relying solely on negative emission trading.

At the same time, some interviewees express uncertainty about whether polluting companies would be willing to purchase negative emission credits in practice. Interviewees 2 and 4 highlight the importance of public trust and clear regulatory frameworks, arguing that scepticism towards emissions trading could undermine demand for negative emissions. Communication and societal acceptance are therefore seen as important factors for the viability of market-based approaches.

Across these accounts, climate mitigation is repeatedly described as dependent on societal approval and political legitimacy. BECCS is considered a mitigation strategy aimed at reducing impact on daily life and current economic systems, while still supporting progress toward climate objectives.

5.2 The Swedish Forest

This section summarises how interviewees describe the Swedish forest in relation to BECCS and climate mitigation. The analysis highlights multiple ways in which the forest is discussed, including its role as a renewable biomass resource, its contribution to bioenergy and the bioeconomy, and its function as a carbon sink. Interviewees differ in their understanding of sustainability, biodiversity, and limitation on biomass use, reflecting contrasting perspectives on the potential and trade-offs of forest-based mitigation strategies.

5.2.1 Sustainable forestry

The Swedish Forest is consistently described as important for BECCS due to its role as a renewable resource. This renewability is presented as essential for BECCS to generate negative emissions, linking biological processes to the technical production of carbon removal.

Several interviewees suggest that this characteristic distinguishes BECCS from fossil-based CCS, arguing that biomass-based systems can achieve net carbon removal because the captured carbon originates from the natural carbon cycle. This renewability is associated with the use of “*sustainable biomass*” (I7), thereby presenting BECCS as a sustainable technology.

When asked specifically about biodiversity and forestry practices, responses become more differentiated. Some suggest that sustainability could be improved through alternative management approaches, such as selective logging, longer rotation periods, or reduced extraction levels. This indicates a flexible definition of sustainable forestry, in which one part can be the renewability of biomass, while the other means sustaining complex ecosystems through management. At the same time, several interviewees argue that bioenergy production is not directly responsible for biodiversity loss, as it primarily relies on residual materials such as branches, treetops, and by-products from timber harvesting. In this framing, biogenic emissions are not part of current forestry management and are rather described as a form of waste management, even though renewability remains an important part.

This interpretation is strongly challenged by interviewees 1 and 3. Both question current forestry practices, arguing that a substantial share of harvested biomass is classified as a byproduct and used for energy purposes. Interviewee 1 states that “*we cannot fell trees if we already know we are only planning to use half of them,*” thereby questioning both the efficiency and sustainability of current forestry practices that lead to biogenic emissions. Interviewee 3 furthermore links the scale of the bioenergy sector to the forestry industry's management practices, suggesting that current harvesting and growing techniques made large-scale bioenergy possible, “*because the industry did not know how to handle their waste.*”

They suggest that bioenergy was shaped more by industry interests than by sustainability considerations. These contrasts illustrate divergent understandings of what constitutes future visions of the Swedish forest.

5.2.2 Bioenergy and forest biomass

Several interviewees emphasise that Sweden is well-positioned to develop and deploy BECCS at scale. These conditions are linked to a combination of factors: the availability of the Swedish forest as a resource, financial means, technical expertise, and large biogenic point emitters. For the latter, interviewee 6 states that the Swedish industry produces “*up to 30 Mt of biogenic emissions,*” which could be captured by BECCS. BECCS is thus seen as a promising option for achieving negative emissions, earning profit from the negative-emissions market, and providing bioenergy and other vital products for Swedish society.

The national significance of bioenergy is further underlined by references to Sweden’s geographical conditions and security considerations. Interviewee 5 highlights the importance of bioenergy in “*a cold country*” and emphasises that domestic forest resources provide a level of energy security that other energy sources may not offer. Dependence on foreign energy supplies is considered a risk, particularly during periods of geopolitical instability or crisis. Alternative energy sources, such as solar power, as suggested by Interviewees 1 and 3, are generally not regarded as viable substitutes for bioenergy, mainly due to limited sunlight during winter and the high costs associated with energy storage. Hence, utilising the Swedish forest as a resource for energy supply and export goods that support biogenic point emitters necessary for BECCS further reinforces its position in this argumentation. In this context, the Swedish forest is portrayed as a stable and reliable national resource. Moreover, BECCS is associated with efforts to make bioenergy systems more circular (I2, I5).

At the same time, some interviewees express concerns that the expansion of bio-based industries, due to increased climate mitigation efforts, could increase overall demand for forest resources. This is associated with a fear of rising prices for residual forest products, making bioenergy and other biogenic emitters too costly and thereby decreasing the potential for BECCS deployment. This provides a clear picture of the Swedish forest again as a resource sold to the highest-paying industry.

Critical perspectives are articulated by Interviewees 1 and 3, who question the assumption that a transition towards BECCS-enabling bioindustries would be smooth or sustainable. Interviewee 3 points to overlooked aspects such as energy losses during carbon capture and the material and carbon intensity of BECCS infrastructure, including transport and shipping. Interviewee 1 stresses the importance of respecting ecological limits, arguing that Sweden “*currently uses two years’ resources in under a year.*” From this perspective, BECCS is part of a system marked by excessive material consumption, which conflicts with broader

sustainability goals and planetary boundaries. Forest use, in this argument, is regarded as unsustainable, and this view shapes the claim that other materials are also overused.

5.2.3 Forests as carbon sinks

The role of the Swedish forest as a carbon sink is discussed in varied and sometimes conflicting ways across the interviews. Interviewee 3 emphasises forests as natural carbon sinks with immediate mitigation potential, highlighting their capacity to absorb carbon dioxide through growth. In contrast, interviewee 6 describes forests as “*not permanent carbon sinks; they are a flow,*” underscoring the view that carbon sequestration in forests is temporary and dependent on continuous growth. Similar concerns about declining growth rates and saturation effects are raised by other interviewees

Against this background, BECCS is frequently framed as a solution that offers more permanent carbon removal. Several interviewees describe carbon capture and geological storage as a way to transfer carbon from the short-term biological cycle to long-term geological storage, with time horizons ranging from 1,000 to 10,000 years. Interviewees 4 and 6 emphasise the perceived security of underground storage compared to forests, which they describe as vulnerable to disturbances such as wildfires, pests, and climate-induced stress. These risks are presented as factors that could lead to the re-release of stored carbon from forests.

At the same time, some interviewees question the extent to which BECCS can be considered independent of forest carbon sinks. Interviewee 1 argues that “*it is the Swedish forest that takes care of emissions,*” suggesting that the effectiveness of BECCS ultimately depends on the forest’s capacity to absorb carbon in the first place. This highlights an underlying tension in the material between viewing forests as a standalone climate solution and seeing them as an enabling component of technological carbon removal.

Many interviewees who support BECCS emphasise in this context the important role of the Swedish forest in combating climate change, stating that the forest assists in decarbonisation initiatives by “*replacing fossil feedstock with biomass*” (I2) rather than acting as an unreliable carbon sink. In this depiction, the forest is more useful for combating climate change when felled than when left standing.

Taken together, the interviews depict the Swedish forest as a multifunctional resource within BECCS-related climate mitigation. It is simultaneously described as a renewable biomass source, a foundation of the bioeconomy, a national asset linked to energy security, and a natural carbon sink. However, these roles are not uncontested, and interviewees differ in their assessments of trade-offs among biomass use, biodiversity, material limits, and long-term climate effectiveness.

6. Discussion

The analysis of socio-technical imaginaries helps us understand how and why certain visions of the future materialise by revealing the underlying societal mechanisms that support the invention and development of technological systems. In this discussion section, I interpret and analyse the findings of this thesis in relation to the two research questions: *How is BECCS imagined within Sweden's climate mitigation efforts? How do BECCS imaginaries reflect and shape views on the Swedish forest and its role in climate mitigation?* Thus, I explore how the identified imaginaries of BECCS can be situated within the broader context of Sweden's climate mitigation and the role of the Swedish forest in this context.

In the following sections, I will firstly discuss how BECCS is understood as an efficient technological response to climate change. This is followed by the imaginary of BECCS as a market-based tool stabilised and legitimised through collective sense-making of the role of the Swedish forest and social stability. The last section synthesises this chapter by discussing tensions and contradictions found in the socio-technical imaginaries of BECCS.

6.1 Technological response to climate change

This section discusses how BECCS is shaped by ideas about what climate change is and by the co-production processes between the understanding of climate change, BECCS, and the Swedish forest.

A key distinction among different visions of BECCS concerns how interviewees define the causes of climate change. The material suggests that a desirable future with BECCS is constructed by framing the climate crisis primarily as an excess of atmospheric carbon dioxide, whereas interviewees who oppose BECCS understand the economic system itself as the underlying cause. Consequently, the latter defines effective climate mitigation as requiring systemic change, whereas the former considers BECCS to be an appropriate solution.

By constructing climate change mainly as an excess of carbon, measurable in tonnes and governable through targets, BECCS, as a human-engineered solutions that promise calculability and control, emerges as a particularly suitable response. The majority of the interviewees construct BECCS thereby as a sufficient technological tool, predictable, controllable, and plannable, that can safely remove and store carbon dioxide in the fight against climate change. Other approaches, such as relying on forests as natural carbon sinks, strengthening regulatory frameworks, or changing energy sources, are acknowledged as necessary but seen as insufficient on their own.

This illustrates how societal sense-making processes shape and construct technology, as suggested by Jasanoff's idiom of co-production (Jasanoff 2015).

CCS technology, originally developed to capture CO₂ for industrial purposes, becomes, in this process, a climate mitigation technology through how the causes and solutions of climate change are defined in society. In line with Watson (2025) it furthermore shows how the conceptualisation and understanding of a crisis links to the understanding and the framing of the technological system, creating a moral imperative to deploy a specific technology for this specific crisis.

Furthermore, it signifies an intriguing shift in how forests are perceived in climate mitigation. While forests were included in the Kyoto Protocol in 1997 as a cost-effective method of offsetting emissions – compared to direct decarbonisation (Carton et al. 2020b:5) – the material in this thesis presents them as vulnerable and greatly affected by climate change, rendering them unreliable and justifying technological solutions over natural ones.

Interestingly, previous research indicates that similar cost-efficiency arguments also underpin the development of BECCS (Carton et al. 2020b:6; Haikola et al. 2021:8; Lefstad et al. 2024:2), highlighting parallels with earlier justifications for including carbon sinks in climate policy.

This suggests that the BECCS imaginary is not solely driven by perceptions of the climate crisis, but that market logics also play a significant role. This will be discussed further in the next chapter.

6.2 Market-based climate mitigation

One dominant imaginary of BECCS is a desired future in which market-based climate action is efficient and taken seriously. The findings show that most interviewees assume that either other European countries or polluting industries will pay for negative emissions to compensate for sectors that have not been decarbonised in time and that need to meet regulations or climate targets. Within this framing, a socio-technical imaginary of BECCS emerges as a promising long-term investment expected to generate economic returns from the sale of negative emissions.

This imaginary is legitimised through notions of fairness. Most interviewees suggest that green industries should be rewarded for their sometimes-costly climate efforts, while those that do not comply should be punished and forced to change by high carbon offset prices. Interestingly, BECCS is therefore not primarily imagined as a technology that removes carbon, but rather as a mechanism that enforces industrial decarbonisation through high carbon prices.

This aligns with previous research on climate imaginaries, which identifies a dominant vision of climate mitigation as “techno-optimistic” or situated within a “green growth economy.” Authors demonstrated imaginaries where climate action is compatible with existing economic and political structures, allowing actors to access new markets (Levy & Spicer 2013; Marquardt & Nasiritousi 2022). Furthermore, the BECCS imaginary has been described as being “not necessarily

about climate change mitigation, but rather about maintaining the industrial regime” (Lefstad et al. 2024:4). In line with this, the dominant imagery in this material perceives BECCS as transforming climate change into a business opportunity, where negative emissions become an economically valuable commodity rather than a societal burden. Furthermore, it portrays Sweden as a leading nation, taking responsibility and supporting the European industrial sector, demonstrating how closely this imagery is connected to stabilising Sweden’s current position and image in the world.

At the same time, this imaginary remains contested. Interviewees describe risks such as rising resource costs or a lack of willingness to pay among polluting industries for negative emissions. This aligns with the socio-technical imaginary of BECCS as a business case tied to market risks.

Moreover, it presents the future of BECCS as open and uncertain, rather than fixed or deterministic, and highly dependent on profitability. These uncertainties raise the question of whether climate efforts that are not profitable - such as reducing consumption - are likely to be pursued when climate mitigation is mainly understood as requiring profit. Furthermore, this vision constructs climate mitigation as a long-term process in which technologies can be tested, adapted, and potentially abandoned, which does not align with the urgency highlighted in much of the climate research discussed in Section 2.

A central aspect of this imaginary is its association with social stability, which will be discussed in the next section, followed by implications for the Swedish forest.

6.2.1 Social stability

Building on the market-based imaginary, BECCS is not only imagined as a profitable climate technology but also as a tool that supports social stability, allowing ambitious climate mitigation to proceed without fundamentally disrupting everyday life.

Most interviewees present BECCS as a desirable future, partly because it avoids disruption and preserves current lifestyles. Alternative visions of climate efforts, on the other hand, are associated with chaos or the loss of societal cohesion. This is important because imaginaries that respond to shared fears or societal vulnerabilities can mobilise collective support and contribute to their institutionalisation and materialisation (Jessop 2010).

In the material, market-based financing mechanisms are generally described as preferable to stricter regulations, which some interviewees link to the risk of societal backlash or resistance. The emphasis on unity and consensus also appears when interviewees stress the need for clear and strategic communication about BECCS, reinforcing the idea of the technology as a tool for maintaining social stability.

This aligns with Levy & Spicer (2013) observation that a techno-market imaginary helped forge agreements among societal groups in the late 1990s by framing technology as a climate mitigation tool that both facilitates market expansion and reduces emissions. More recent research similarly argues that technology can function as the “lowest common denominator” between competing visions of climate politics in Sweden, allowing stakeholders to support climate measures without engaging in more disruptive societal changes (Marquardt & Nasiritousi 2022: 637).

Within the dominant BECCS imaginary, societal dissent is treated as a political hazard: it not only threatens the materialisation of BECCS, but also the effectiveness of climate mitigation more broadly. This raises questions about the role of democratic decision-making in shaping climate policy (Jasanoff & Kim 2009; Lefstad et al. 2024).

6.2.2 The Forest

The forest plays an important role in the socio-technical imaginary of BECCS as a market tool. On the one hand, it represents a sustainable resource that legitimises BECCS as a green technology and stabilises its position as a sufficient climate mitigation tool. On the other hand, the market logic behind BECCS reinforces the role of the Swedish forest as an economic asset. This dual role is discussed in this section.

One role of the Swedish forest is to stabilise the socio-technical imaginary of BECCS as a sustainable technology. The natural attribute of tree growth is used by most interviewees to frame BECCS as fuelled by sustainably sourced biomass, thereby legitimising the technology as green.

However, tensions emerge when interviewees are asked about the sustainability of current forestry practices. At this point, sustainable forestry is increasingly contested, indicating that it is often understood within the narrow frame of the “renewability” of biomass rather than the protection of complex ecosystems. In this tension, bio-feedstock is suddenly framed as “waste,” making the direct connection between bioenergy, BECCS, and ecological concerns less visible.

Christiansen & Carton (2021:5) explain this finding through the concept of Swedish exceptionalism, in which BECCS may pose risks to biodiversity globally but is not perceived to do so in Sweden. Lefstad et al. (2024:6) extend this by arguing that BECCS makes conflicts, such as reduced carbon uptake and biodiversity concerns, less visible. Building on that, the findings further suggest that sustainability is instrumental in the BECCS imaginary for upholding a green image.

Another role of the Swedish forest is as a resource for BECCS. Within the market imaginary, the forest is continuously constructed as an economic resource that can be mobilised to produce sustainable goods at comparatively low cost.

Interestingly, this is even mobilised when discussing solar energy, which appears to be somewhat disconnected from Sweden's self-image and national identity, portrayed as foreign. Hence, the depiction of the forest is closely linked to ideas of Swedish sovereignty, where the forest is valued both as a domestic energy source and as an export commodity that underpins economic strength (Christiansen & Carton 2021; Haikola et al. 2021; Lefstad et al. 2024). As a result, the forest becomes integrated into a profitable climate crisis imaginary, where mitigation is closely tied to value creation.

This imaginary reinforces the continued or even intensified use of bio-products through the green transformation, driven by the emission market and, by extension, BECCS. As a result, forest products are valued substantially higher than fossil fuel alternatives. Sweden's large forest stock further contributes to the region's green image, supporting the legitimacy of climate mitigation efforts.

6.3 Implications of the BECCS Socio-Technical Imaginary

This section synthesises the findings by discussing how the dominant socio-technical imaginary of BECCS shapes understandings of climate mitigation, economic order, and the role of the Swedish forest. It highlights key tensions within this imaginary and reflects on how these tensions both enable and constrain future climate action.

A key area of tension concerns the openness of the future. On the one hand, the future of BECCS as a profitable business opportunity is imagined as open and dependent on societal and economic developments. On the other hand, BECCS in its role as a technology is often framed as highly important, and at times even inevitable, in line with previous findings (Marquardt & Nasiritousi 2022; Lefstad et al. 2024). This produces a future horizon that appears open in economic terms but closed in political and technological ones. Ideas of technological inevitability may therefore function to mobilise political support and justify the materialisation of BECCS, illustrating how imaginaries can normalise particular political actions and stabilise specific technological pathways (Jasanoff 2015). However, this changes as soon as BECCS is no longer seen as profitable.

Thus, in line with Marquardt & Nasiritousi (2022), the findings suggest that many interviewees struggle to imagine effective climate mitigation beyond the current market-based system. Profitability becomes a key criterion for success, raising questions about how climate action is envisioned if BECCS - or similar technologies - fails to deliver at scale. This highlights how the dominant imaginary may limit societal preparedness for alternative or more transformative responses.

In line with other researchers (e.g., Anderson et al. 2023; Riahi et al. 2023:323f.; Dooley et al. 2024), I therefore also see a risk of climate deterrence if the

institutionalisation and materialisation of BECCS as a climate mitigation tool stand solely on this market-focused socio-technical imaginary.

Tensions also emerge in how the Swedish forest is positioned within the dominant BECCS imaginary. The forest is simultaneously framed as an unreliable and vulnerable natural carbon sink and as a stable economic resource that can underpin climate mitigation through bioenergy and BECCS. This dual framing appears to serve a stabilising function: by constructing the forest as too uncertain to rely on carbon sequestration alone, its continued mobilisation as a bioresource is justified and legitimised. At the same time, concerns about sustainability and biodiversity are acknowledged but rarely translated into visions that would fundamentally challenge profit-driven and biodiversity-intensive forestry practices.

This tension reveals how different sustainability goals are prioritised within the dominant imaginary. Climate mitigation is consistently foregrounded, while biodiversity protection is treated as secondary, becoming politically relevant mainly when it aligns with economic objectives and a green image. Within the BECCS imaginary, sustainability is therefore not a normative goal but a selective one, shaped by compatibility with markets, industrial continuity, and Sweden's self-image as a responsible and leading climate actor.

Alongside the dominant imaginary, counter-visions of BECCS appear in the material. However, it remains uncertain whether they will gain momentum, as they currently lack the institutional support and material grounding that characterise the dominant imaginary. While not considered fully developed socio-technical imaginaries in this thesis, these counter-visions nonetheless reveal how BECCS is stabilised not only through its desirability but also through the construction of alternative pathways without BECCS as unreliable, unwanted, or destabilising. This suggests a form of imaginary closure, where multiple approaches to climate mitigation are not seen as simultaneously viable.

Overall, the socio-technical imaginary of BECCS and the role of the Swedish forest within it mainly emerges through market logics. This raises questions about testing climate solutions that are not aligned with the current economic system. Simultaneously, it restricts the scope for alternative approaches to addressing the climate crisis and reimagining the forest's role. Understanding how this socio-technical imaginary of BECCS functions helps to illuminate not only the direction of Swedish sustainability policy but also which possibilities for transformation are being constructed as unfeasible.

7. Conclusion

Sweden has long presented itself as a global climate leader. However, despite extensive forest resources, national carbon sequestration is declining, and both national and European climate targets are currently not met. In this context, Bioenergy with Carbon Capture and Storage (BECCS) has emerged as a central negative emissions technology in Sweden's climate mitigation strategy. Supported by substantial national and EU investments, this has led to the first large-scale deployment of BECCS at Stockholm Exergi's district heating plant in early 2025.

The materialisation of BECCS in Sweden does not occur in isolation. Rather, it emerges through complex interactions between shared visions of desirable climate futures, political and economic power relations, and existing material and institutional infrastructures. This thesis, therefore, examined BECCS through the lens of socio-technical imaginaries, with the aim of understanding how BECCS is collectively imagined in Swedish climate mitigation and how this imaginary shapes - and is shaped by - depictions of the Swedish forest.

Based on seven elite interviews, the analysis shows that BECCS is primarily imagined within an economic and technological framing of emission trading. Within this dominant imaginary, BECCS is understood as a profitable, efficient, and reliable climate mitigation instrument that can be integrated into existing market structures and the bioenergy system. Climate change is largely conceptualised as a problem of excess atmospheric carbon dioxide, measurable in tonnes and governable through targets, which positions BECCS as a suitable and precise response. At the same time, this imaginary is stabilised by a strong emphasis on social stability and consensus, portraying BECCS as enabling ambitious climate action without fundamentally disrupting economic structures or everyday life.

Within this framing, the Swedish forest takes on a dual role. It is positioned as the organic feedstock of BECCS and embedded in a circular bioeconomy, where BECCS represents the "final stage" of a renewable resource system. At the same time, the forest is increasingly depicted as a vulnerable and unreliable natural carbon sink due to climate change. This dual depiction serves to legitimise the continued mobilisation of forest resources for bioenergy and BECCS, while weakening arguments for relying on forest growth and conservation as a primary climate strategy.

The analysis further shows that tensions within the material are often resolved through narratives of undesirable futures without BECCS. Stronger regulatory approaches and increased reliance on the forest as a carbon sink are frequently associated with risks such as social unrest, economic instability, or ecological climate catastrophes. Through these narratives, BECCS is stabilised as a comparatively safe and reliable option, while alternative pathways are constructed as unrealistic, destabilising, or insufficient. In this way, the BECCS imaginary is

not only built on positive visions of technological progress but also on the strategic devaluation of competing climate futures.

As the dominant BECCS imaginary is increasingly institutionalised - through policy targets, emission markets, and the material deployment at Stockholm Exergi - this raises important questions about the future direction of climate mitigation and forestry in Sweden. While interviewees often acknowledge that multiple strategies are needed, the analysis shows that the dominant imaginary narrows the space for pursuing alternatives. This is problematic given the urgency and uncertainty of the climate crisis and biodiversity loss, which arguably call for a broader portfolio of responses.

This thesis contributes to socio-technical imaginaries research by illustrating how depictions of nature - here, the forest - play a central role in stabilising technological visions. It shows how imaginaries are not only future-oriented but also deeply embedded in national identities, economic models, and historical resource relations.

Moreover, the analysis highlights the importance of examining how dystopian narratives and fears are mobilised to generate political support for specific technologies. By linking crisis framings to profitable business cases, the BECCS imaginary demonstrates further how solutions become tightly coupled to particular conceptualisations of the problem itself. This underscores the value of socio-technical imaginaries as an analytical lens for understanding why certain technological futures materialise while others remain unthinkable.

7.1 Limitations and Future Research

This study has several limitations. First, the analysis is based on a small sample of seven stakeholder interviews, primarily representing elite perspectives from policy, industry, and research. Although suitable for exploring dominant imaginaries at the decision-making level, this approach restricts understanding of how BECCS is perceived by wider societal groups.

Second, although alternative visions of BECCS appear in the material - often associating the technology with mitigation deterrence or delayed systemic change - it was not possible to determine whether these perspectives constitute a fully developed counter-imaginary. These views were mainly articulated by interviewees with environmentalist positions and broader critiques of Swedish climate and forestry policy. Further research could explore whether and how such perspectives gain wider societal traction and attempt to mobilise political support.

In addition, the observed parallels between earlier framings of forests as cost-efficient carbon sinks and current framings of BECCS point to the need for historical research on how imaginaries of forests as climate solutions evolve over time and how they interact with changing economic, ecological and technological conditions.

Overall, this thesis shows that understanding climate mitigation requires attention not only to technologies and policies, but also to the imaginaries that shape how societies define problems, evaluate solutions, and understand nature. In the case of BECCS in Sweden, these imaginaries play a crucial role in directing climate effort - while simultaneously foreclosing other possible futures.

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Popular Scientific Summary

BECCS in Sweden: A Story About Gathering Support for a Profitable Project

Sharing dreams about the future is always a political act. Desirable visions can move people, make them long for something better, and create support for political change. The deployment of BECCS, short for **bioenergy with carbon capture and storage**, is one of these dreams. Tied to the materialisation of Sweden's first BECCS plant is a hopeful imaginary of a future where Swedish society can move beyond the climate crisis without losing its industries or having to dramatically change everyday life. However, a closer look reveals that this implementation is driven not only by hope but also by fear of an undesirable future without BECCS.

The year is 2025, and Sweden is investing heavily in BECCS, a technology designed to actively remove carbon dioxide from the atmosphere. What sounds almost futuristic is achieved by extending the natural carbon cycle. In Sweden, energy production is usually considered carbon-neutral: raw materials are burned, and the forest stock is replanted. The regrowing forest reabsorbs through this CO₂, storing it in wood, and balancing emissions from activities like heating. BECCS adds to this by capturing and storing carbon underground, creating "negative emissions." In many ways, this is comparable to simply leaving more carbon in forests rather than harvesting them, which has already sparked heated debate in Sweden about whether the future should rely more on technology or on the forest.

A central hope linked to BECCS is that these negative emissions can compensate for sectors which are seen as difficult to decarbonise, such as aviation and cement. To understand why BECCS is gaining so much political traction, this thesis uses the concept of *sociotechnical imaginaries*, which examines how visions of desirable futures, values, and expectations shape technological choices. My analysis, in line with other research, shows that BECCS is attractive largely because it promises a future in which the basic economic and social order can remain intact. Negative emissions can be traded on carbon markets, rewarding those who invest early and penalising those who fail to reduce emissions.

Yet this dream is also built through a nightmare. When imagining a future without BECCS, interviewees often describe scenarios of chaos caused by hard regulation or depict Sweden's forests as too vulnerable to rely on, potentially collapsing under climate stress. These narratives, however, partly obscure the strong economic interests behind both BECCS and continued forest extraction. They suggest that forests will continue to be treated primarily as resources, and they reveal a deeper tension: when different sustainability goals collide, the one that generates profit tends to win.

The findings highlight that climate technologies are never just technical solutions - they are deeply political choices about what kind of future society wants.

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