AN ANALYSIS OF THE EFFECTS OF DECARBONIZATION POLICY ON THE EUROPEAN COMMERCIAL REAL ESTATE SECTOR

Tesi di Laurea Magistrale

NELLY EGGERT
Matricula n. 3167515

Contents

1. Introduction 1

2. The commercial real estate market in Europe 3

2.1 Basic definitions within the real estate markets 3

2.2 Market players 4

2.3 Important recent developments 5

3. Decarbonization of the European commercial real estate sector 8

3.1 Status quo of GHG emissions in the sector 8

3.2 Decarbonization requirements for the sector 11

4. Decarbonization efforts already in place 14

4.1 Reporting requirements from commercial real estate 14

4.1.1 Summary of the current legislative context 14

4.1.2 Effect of the current legislative context and market practices 18

4.2 Effort Sharing Regulation 21

4.2.1 Summary of the revision 21

4.2.2 Effect of the latest revision 23

5. Future Decarbonization efforts 24

5.1 Revision of the Energy Performance of Buildings Directive 24

5.1.1 Summary of the proposed revision 24

5.1.2 The reaction of the sector to the revision 26

5.1.3 Potential effects of the revision on the commercial real estate sector 27

5.2 EU ETS including the building sector 31

5.2.1 Background and summary of the proposed revision 31

5.2.2 Reaction to the announcement of the revision 36

5.2.3 Effects of the proposed revision on the commercial real estate sector 38

6. Impacts on the commercial real estate sector through the dependency on the financial sector 41

6.1 Overview of current EU Taxonomy 41

6.2 Overview of the current SFDR 43

6.3 Impact of Taxonomy and SFDR on the commercial real estate industry 45
7. Resulting recommendations for actors in commercial real estate 50
7.1 Overall action recommendation 50
7.2 Ensuring compliance with current regulation 51
7.3 Portfolio steering 53
7.1 Decarbonization strategy 56
7.2 Explore green financing options 57
8. Conclusion 59

List of Figures

Figure 1: Classification of carbon emissions in the building sector 8
Figure 2: Exemplary whole life carbon emissions of a building 9
Figure 3: Energy and GHG-intensity of building types by usage type 10
Figure 4: Sectorial coverage by instruments for reaching EU emission reduction goals 21
Figure 5: Office stock EPC labels in five exemplary countries 28

List of Abbreviations

CSRD	Corporate Sustainability Reporting Directive
DCSR	Debt service coverage ratio
ECB	European Central Bank
EDS	Effort-sharing Decision
EPBD	Energy Performance of Buildings Directive
EU	European Union
GHG	Greenhouse gas(-es)
CRREM	Carbon Risk Real Estate Monitor
EFRAG	European Financial Reporting Advisory Group
ESG	Environment, Social, Governance
ESR	Effort Sharing Regulation
ESRS	European Sustainability Reporting Standards
ESD	Effort Sharing Decision
ETS	Emission Trading System
GRI	Global Reporting Initiative
IPCC	Intergovernmental Panel on Climate Change
IEA	International Energy Agency
LTV	Loan-to-Value
MEPS	Minimum Energy Performance Standards
NFRD	Non-Financial Reporting Directive
PCAF	Partnership for Carbon Accounting Financials
REIT	Real Estate Investment Trust
RTS	Regulatory Technical Standards
SFDR	Sustainable Finance Disclosure Regulation
SMEs	Small and medium enterprises

ZEB	Zero-emission building

1. Introduction

Ursula von der Leyen said on Renovate Europe Day in 2022: "Faced with war, with a fossil fuel crisis, the arguments in favour of the Renovation Wave have only become more pressing. Investing in renovation is a no-regret option." The same is true for constructing new energy-efficient buildings.

The decarbonization path of the building sector in the EU is extremely important to achieve the goals for limiting global warming that were set in the Paris Agreement. At the same time, the topic is highly political and a pain point for European social politics. The decarbonization path threatens to add to the problem of the increased rarity of affordable housing in recent years fuelled by quick urbanization in Europe as well as socioeconomic problems like the increased gap between the rich and poor.

So far, the sector has lagged behind other sectors in reducing its carbon emissions. One of the reasons for this is the huge set of regulatory frameworks for the building industry which partly provides mixed incentives. But today, increased regulatory attention and rising energy prices make it necessary for the sector to play its part. The thesis wants to analyse the current policy environment and its development and analyse the expected effects it will have on European investors in real estate. This is because the increased regulatory attention has culminated in a set of new regulations as well as drafts for new legislation which will have tremendous effects on the building sector as well as its investors.

The thesis focuses on the commercial real estate sector solely and excludes the residential one. A combined analysis would provide little insight as the challenges faced by both market segments, although similar, are by no means similar enough to provide a detailed analysis of the recent regulatory framework. The thesis instead focuses on the commercial real estate sector because, in a lot of countries in the EU, residential buildings are owned by the user itself. (Eurostat 2023) This makes it very hard to develop common regulations and recommend sensible action plans to people with different socioeconomic and wealth backgrounds. Additionally, the residential sector has gained a lot of attention in the past as its renovation also touches upon

a lot of social issues like energy poverty, the increased cost of housing and the ability to finance renovations on an individual level.

Therefore, a lot of studies and reports have focused on the residential sector without taking into consideration the commercial real estate sector which is however still accountable for a large proportion of emissions in the EU. It therefore also faces enormous challenges in the renovation wave ahead. Oftentimes there are more ambitious goals set for the commercial real estate sector than for the residential one. (Recast proposal of EPBD Directive 2010/31/EU)

The realization of green construction and a renovation wave requires incentives by policymakers. In the European Union, the legislation around reaching the GHG emission targets for each sector is developing in rapid peace. (Fuerst, Gabrieli, and McAllister 2017, 137-146) The building sector has experienced especially high attention with a lot of the new legislation analysed in the work below just being updated or discussed within the first months of 2023.[1] New regulations that will put pressure on the real estate sector to decarbonize include the introduction of carbon prices, increased building/energy efficiency standards and thorough sustainability reporting requirements. A synopsis of the current regulatory environment and its effect on commercial real estate investors is therefore more relevant than ever.

The main goal of this thesis is to present a market analysis of the commercial real estate sector with regard to current regulatory decarbonization efforts.[2] Aggregating the most important new legislative efforts and interconnecting their potential effects, recommendations for institutional investors in the commercial real estate market in Europe will be deducted.

---

[1] The Effort Sharing Regulation (ESR) has been updated in March 2023. The Emission Trading System II (ETS II) has been decided to be adopted in April 2023. The draft for a recast of the Energy Performance of Buildings Directive (EPBD) has been submitted for discussion with the Council in March 2023. The EU Taxonomy has published its latest Technical Screening Criteria for biodiversity, circular economy, pollution prevention and control and conservation of seas in April 2023.

[2] This thesis takes new legislation up to the 31st of July 2023 into account.

The thesis can therefore be of value to real estate investors active in the commercial real estate market by providing guidance in a new regulatory environment. It will also help the decarbonization efforts of the EU generally by supporting real estate firms in advancing their sustainability agenda.

As an introduction, an overview of the commercial real estate markets and their investors will be given before reviewing the amount of current GHG emissions and the emission reduction requirements for the future. Then, the current regulatory environment, starting with current regulations, will be explored and legislation that is being drafted right now explained. Eventually, as the regulation of the financial sector has effects on the commercial real estate sector as well their influence via new regulation will be discussed. Eventually, recommendations for investors will be deducted.

2. The commercial real estate market in Europe

2.1 Basic definitions within the real estate markets

Commercial real estate buildings serve as raw materials for the production of services and products by a company. This is in contrast to the residential sector which consists of properties that are used by consumers for their private purposes. (Morri and Paolo 2019) The market of commercial real estate can be further segmented into the type of usage of the building: offices, retail, industrial, Logistics, Multi-family and hospitality. (Morri and Paolo 2019) The European market of those buildings has an estimated total size of € 8.92 bn. (Pekdemir et al. 2023)

The real estate investment market can additionally be segmented by the flexibility of their type of usage: non-flexible, flexible and trade-related properties. Non-flexible properties are those that can barely be traded because they are of such specific type that their usage for another purpose than the current one is not possible or requires costs that make their conversion too expensive. An example of these are industrial buildings. These buildings are typically owned by the occupiers who also use them. (Morri and Paolo 2019)

The contrast to non-flexible buildings is marked by flexible properties which are traded more commonly and therefore more liquid– those are for example most office buildings as well as retail and to some extent logistics

buildings. An office building is a typical example of the flexible building type, as it could for example be used for back-office activities of banks or the marketing team of a fashion company. Both would be able to use the office space with little to no adaptations to the space necessary. Flexible buildings are often owned by an investor who rents the space out to the user. (Morri and Paolo 2019) A subgroup of this type of building is called "trade-related buildings". Oftentimes their rental payments are connected to the revenues that the user can generate with them. Examples of those can be commercial buildings like shopping malls, but also hotels. (Morri and Paolo 2019)

Another segmentation important for the work is the differentiation between owners and users of space. Owners have the option of using the space for themselves or renting them out to users. They are therefore active in both the investment market and the space market. The investment market brings together market players who own, buy and sell properties without using them for their operational purposes. In a typical transaction, one owner of a real estate property is transferring ownership rights of the property to the buyer. The users' market instead brings together owners of properties and users of space. The owners look for financial benefits by renting their space to users of the property. In a typical transaction, the owner of a real estate property is transferring the rights for the usage of the space to the tenant. (Morri and Paolo 2019)

2.2 Market players

This thesis will focus on the owners of real estate that are active in the users' market and therefore look at the financial profitability of their held investments. In the following, the owners of properties which rent out the space will be called "*investors*". This also signifies that the type of investor analysed within this work will be those who invested equity into commercial real estate as those are the owners of the property. The effects of the policy on debt capital investors, as well as developers and tenants, will only be analysed if needed in order to explain the chain of reactions that can also lead to action by the side of commercial real estate equity investors.

Additionally, the work mostly covers both, flexible as well as trade-related buildings while excluding non-flexible buildings. This leaves as use of

buildings the categories of office buildings, retail, logistics, multi-family and hospitality as well as medical properties.

In order to be able to give recommendations to investors understanding the ownership structure of the real estate landscape in Europe is crucial. Overall, the market in EMEA is characterized by a low share of listed portfolios compared to other regions like the Americas or APAC. (Neshat, Patkar, and GG 2022) Only 4.3% of the market is held by listed real estate companies. (Pekdemir et al. 2023) Blackstone is the world's largest commercial real estate investor and only holds unlisted real estate. (Oliver 2023)

Investors in the real estate market include Real Estate Investment Trusts (REITs), "sovereign wealth funds, specialist open and closed-end real estate funds, investment banks, specialist real estate investment managers, private equity groups, insurance and pension funds and endowment funds". (Fuerst, Gabrieli, and McAllister 2017, 137-146)

Within Europe insurance companies and pension funds like Swiss Life Asset Managers, AXA Investment Managers are big investor groups of unlisted real estate. There are also a lot of banks like Credit Suisse Asset Managers, UBS Global Asset Managers, but also PE funds like Blackstone and Brookfield are very active. There are also classical asset managers in the market like Deka Immobilien Investment and CBRE Global Investors. (DeChaine et al. 2020; Neshat, Patkar, and GG 2022)

Fuerst, Tommaso and McAllister (2017, 137-146) have found that a group of eco-investors already exist, which positively screen eco-certified office assets. They, therefore, have focused their acquisition efforts on eco-certified assets – some even exclusively acquiring assets of that type.

2.3 Important recent developments

In order to give thorough recommendations to equity investors in commercial real estate it is important to analyse other aspects which have recently characterised the market. Therefore, a short overview of the most important factors will follow.

The Covid-19 pandemic had effects like increasing vacancy rates in buildings like offices when employees largely switched to working from home. During the pandemic, the market expected to see this effect reversed once work from the office would start to pick up again. (Oliver 2023; Filippino, Kynge, and Aliaj 2023) However, the pandemic has had long-term impacts on the way of working and therefore office spaces are still short of pre-covid occupancy rates. (Elisei and Ranasinghe 2023) As a result, investment in office real estate assets in Europe is at an 11-year low at the beginning of 2023. (Howcroft 2023; Elisei and Ranasinghe 2023) Also, retail real estate is still suffering – as online sales have surged and therefore, retail locations are registering fewer revenues. (Elisei and Ranasinghe 2023) Meanwhile, the logistics real estate sector has mostly benefited from this trend as there is a lot of demand for more logistics properties to store and ship deliveries from online purchases. (Dangl, Smith, and Chadwick 2022)

Another important feature is the effect of inflation and the increase in interest rates of central banks in order to fight it. (Schweizer et al. 2023) In Europe, the European Central Bank (ECB) has increased rates by 3.25 per cent points from September 2022 to May 2023. (European Central Bank 2023b)

The real estate market is especially hit by this as it has always largely depended on high rates of leverage with usual rates varying between 60% and 80%. (Lux and Skouralis 2023; Morri and Mazza 2014) The increase in interest rates implies a higher cost of debt for renewing debt or acquisition debts. Additional concerns are being raised by the recent insolvencies of banks. Commercial property loans make out a big part of the total loan portfolio of banks. (Elisei and Ranasinghe 2023) And especially small regional banks are often the biggest debt financiers for commercial real estate. The increased trouble of other smaller banks has led to a more wary stance of other banks on new lending. This in turn is additionally increasing the cost of funding for commercial real estate investors which once again decreases demand as interested investors delay or cancel possible new acquisitions. The effect of this is an overall decline in the valuation of real

estate, leading in turn to higher Loan to Value (LTV) ratios[3]. (Oliver 2023; Filippino, Kynge, and Aliaj 2023)

Additionally, owners that either rely on funding which is adjusting its interest rate terms with prime interest rates or have to refinance the debt of their projects might struggle to pay the required debt service anymore. This then leads to increased pressure to sell buildings, which in turn contributes to an increased supply in the investment market. Again, this is an effect which decreases commercial real estate property valuations. It is projected that valuations for lower-grade offices in less popular locations will drop heavily. (Oliver 2023) Also, real estate asset managers expect this type of further price decrease for near-term transactions. (Schweizer et al. 2023)

As a reaction to these developments, some real estate funds have limited withdrawals for their investors.[4] (Howcroft 2023) Equity market valuations of commercial REITs trade at substantial discounts from their asset value. Generally, investors who are still active in the current turbulent market are equity-strong or on the higher end of willingness to take on risk. (Elisei and Ranasinghe 2023; Schweizer et al. 2023)

However, real estate markets in Europe are still more stable than their counterparts in the USA. This is because tighter banking regulation led to stronger reserves for absorbing potential losses. (Elisei and Ranasinghe 2023) Due to the constant uncertainty about inflation and central banks' stance on rate increases it is to be expected that the market environment will remain as unstable as it is for now in the near term. (Colliers 2023)

---

[3] The loan to value measures how much of the value of the property is financed with loans or the residual amount due of the debt. (Morri and Mazza 2014) It therefore provides a good measure of the leverage of an asset.

[4] Investment funds often limit redemption when too many investors want to redeem their shares in a too short amount of time. Especially in a market with non-liquid assets like real estate, funds can have trouble to sell their assets fast enough at a valid price.
When real estate investors demand redemption of their shares in the fund, this might lead to forced liquidation of real estate assets – additionally increasing supply and therefore decreasing market prices. (Elisei and Ranasinghe 2023)

3. Decarbonization of the European commercial real estate sector

3.1 Status quo of GHG emissions in the sector

In 2021, the real estate sector accounted for about 33% of global energy and process-related carbon emissions. About 15% of those emissions stem from end-use sectors, while the other 18% stem from indirect emissions from electricity and heat production. (Delmastro 2022; International Energy Agency 2022b) Therefore, the decarbonization of the building sector is extremely important to reach the 1.5°C target as defined in the Paris Agreement.

In order to understand the emissions of the sector better, it is necessary to define some common terms which will be useful during the course of the thesis. The first concept to be explained is the one of whole-life carbon. Whole-life carbon means that the calculation of the carbon footprint of a building includes all the emissions that are produced over its whole period of life – from the construction to use and eventually, demolition. Whole life carbon is formed of two elements: embodied carbon and operational carbon. (London Energy Transformation Initiative 2020; Adams, Burrows, Richardson, Drinkwater, Gamboa, Collin, Le Den, Ostenfeld Riemann, Porteron, and Qvist Secher 2019)

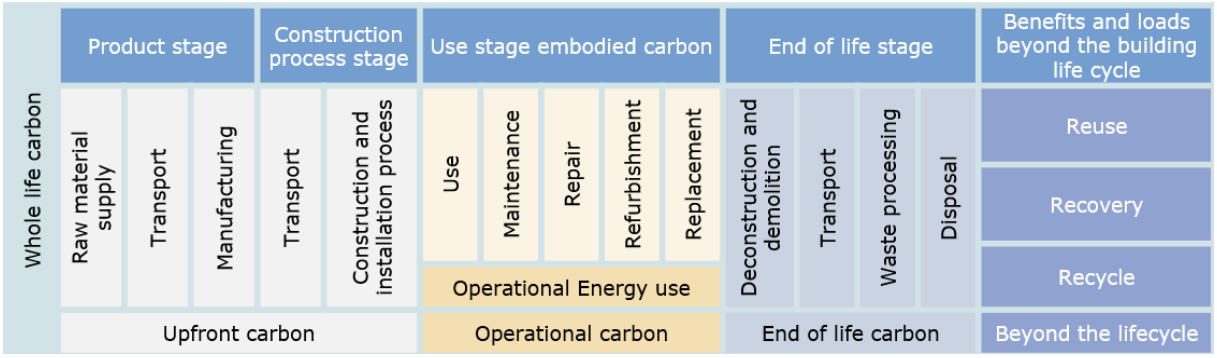

Figure 1: Classification of carbon emissions in the building sector
Source: Adams et al. 2019

Embodied carbon describes carbon emissions that are caused by the production of a building's material, the transport and installation of this material as well as the building's maintenance, replacement, refurbishment, deconstruction and the disposal of the leftover material. For a more comprehensive overview, we can see that all the emissions in Figure 1 apart from the operational carbon emissions which refer to the use of energy make up embodied carbon. (London Energy Transformation Initiative 2020;

Adams, Burrows, Richardson, Drinkwater, Gamboa, Collin, Le Den, Ostenfeld Riemann, Porteron, and Qvist Secher 2019; Weinfeld, Wiejak-Roy, and Booth 2023)

Operational carbon on the other hand comprises emissions produced by the energy used to operate the building. This includes for example GHG emissions produced through heating and cooling or the usage of electricity. (London Energy Transformation Initiative 2020)

To make the distinction clearer one can see in figure two the distribution of the two different emission types over the lifetime of a building. Embodied carbon emissions are produced during the building stage of a property and the phases of renovation and maintenance – they therefore usually only occur once every couple of years. Operational carbon however is produced over the whole lifetime of the building while it is in use. (Carbon Leadership Forum 2020)

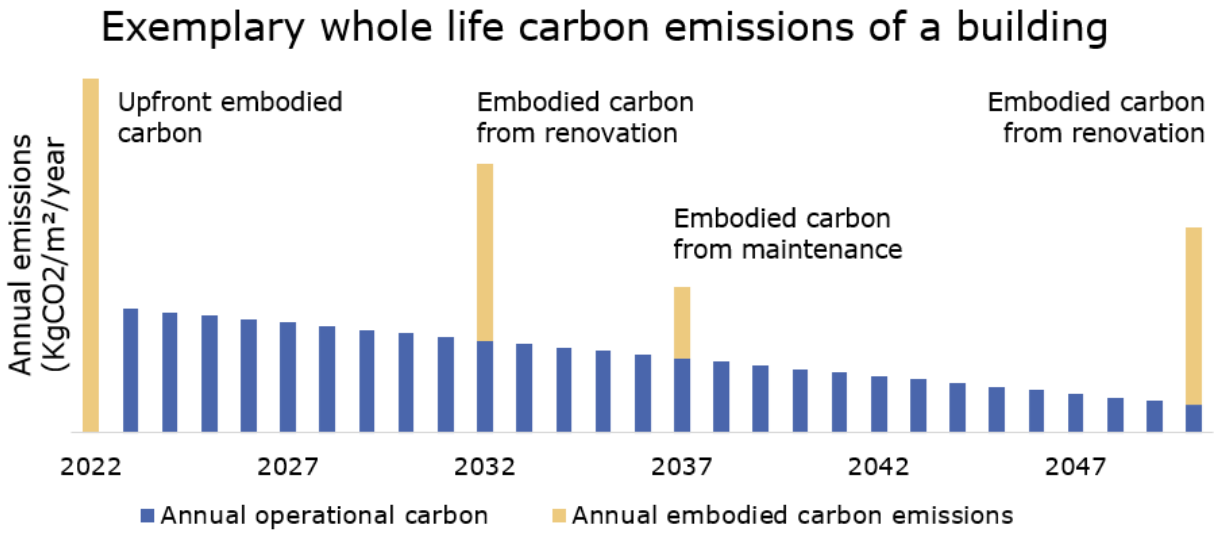

Figure 2: Exemplary whole life carbon emissions of a building
Source: Cabon Leadership Forum 2020

The WGBC has found that today about 71% of energy-related whole-life global carbon emissions come from operational carbon while 29% come from embodied carbon. (Adams et al. 2019) Other sources estimate only 10%-20% of total whole-life carbon emissions to be stemming from embodied carbon. (Pantsar et al. 2018) Additionally, highly energy-efficient buildings with less operational carbon emissions usually have a much higher share of embodied carbon emissions. (Weinfeld, Wiejak-Roy, and Booth 2023; Röck et al. 2020, 114107) Embodied carbon emissions are therefore

not to be underestimated even though most of them will be produced in regions outside of Europe and America, instead in the regions with the highest increase in floor area.[5] (United Nations Environment Programme 2022)

This change in relation is also applicable when examining the absolute amount of embodied carbon emissions to be released in the near future. This number is expected to increase because of increased construction activity. The global floor area of buildings is expected to double compared to 2019. 80% of floor area growth is expected to take place in emerging and developing economies though. (Dulac et al. 2022; United Nations Environment Programme 2022)

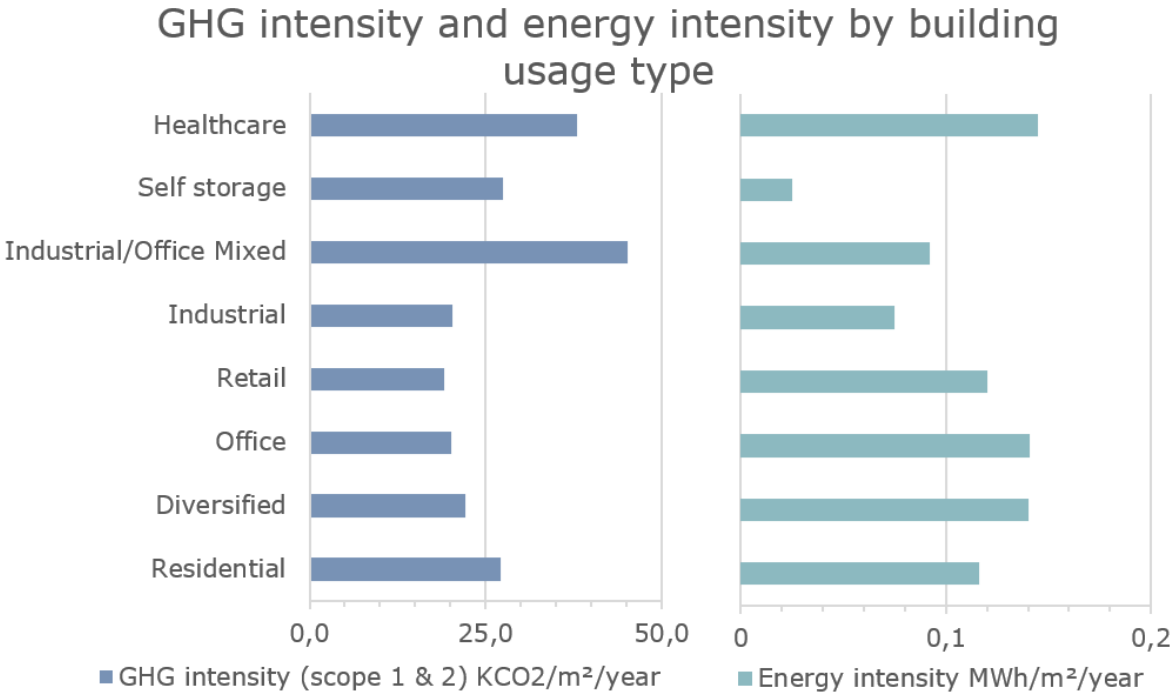

Figure 3: Energy and GHG-intensity of building types by usage type
Source: Clery et al. 2021

In Figure 3 we can see that commercial real estate like offices, diversified-use real estate as well as retail and healthcare have a higher energy efficiency than residential real estate. Instead, the GHG intensity of commercial real estate like healthcare, mixed industrial/office use, as well as self-storage, is higher than that of residential buildings. (Clery et al.

[5] More information with regards to this follow in chapter 2.2.

2021) This proves again that the decarbonization of commercial markets has to be taken as seriously as the one of residential buildings.

3.2 Decarbonization requirements for the sector

With the legally binding Paris Agreement from 2015, a total of 195 countries have committed to keeping "global warming well below 2 °C above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels". (Article 2, United Nations Framework Convention on Climate Change, the Paris Agreement 2016)

This is in line with climate research showing that overshooting the climate targets of 1.5°C to 2°C increases the risk of triggering climate tipping points. The disintegration of these tipping elements would have severe consequences like further amplifying global warming as well as large-scale sea-level rise and the collapse of biomes. (Wunderling et al. 2022) By 2022, the earth has already warmed by 1.2°C. (Climate Action Tracker 2022)

An important role falls upon the building sector for the signatories to fulfil their legal duty. In order to decarbonize the sector, the initiative Carbon Risk Real Estate Monitor ("CRREM") guides the global real estate sector by producing climate pathways. In the latest pathways, it is projected that global carbon emission intensities of the real estate sector must be reduced by 63% from 2020 to 2030 to comply with the 1.5°C-target. (CRREM 2023)

However, as of now, the sector keeps overshooting its carbon targets. (Graf 2021) This is closely related to the increase in the buildings' decarbonization gap. It means that the gap between what has to be achieved versus what needs to be achieved is widening. (United Nations Environment Programme 2022)

The sector has certain challenges that limit its ability to reach the required decarbonization as fast as required. The challenges include among others the ongoing electrification of properties. This would imply increased carbon emissions if the energy grid itself is not decarbonized at a faster pace. (McKinsey & Company 2022; International Energy Agency 2022b)

Furthermore, floor area is expected to increase. The IEA estimates floor area to increase by about 20% from 2021 to 2030. However, only 20% of

this increase is expected to take place in developed countries. (International Energy Agency 2022b; Adams, Burrows, Richardson, Drinkwater, Gamboa, Collin, Le Den, Ostenfeld Riemann, Porteron, and Qvist Secher 2019; CRREM 2023) For Europe and developed economies generally therefore the problem of renovating and retrofitting the existing building stock will be the dominating challenge. (Graf 2021; International Energy Agency 2022b) It is estimated that 90% of Europe's building stock was planned and constructed before 1990, while about 50% was built before 1970. This is problematic as there were barely any energy performance requirements in place before 1970. Buildings from that time period tend to be energy-inefficient if a big energy-efficiency renovation has not been performed yet. (Filippidou 2019)

In order to achieve net zero by 2050 operational carbon emissions have to be decreased by tackling four different areas: building envelopes, heating or cooling, building transition and a smart electrification transition. In terms of actions that can be taken directly within the building sector, this includes foremost the construction of zero carbon-ready buildings as well as the retrofitting of old buildings. (International Energy Agency 2022b, 151; Graf 2021)

For a deeper understanding of required actions in the building sector let us first have a look at the construction of zero-carbon-ready buildings. At this point, it is useful to define two terms. "*A zero-carbon-ready building is highly energy efficient and either uses renewable energy directly or uses an energy supply that will be fully decarbonised by 2050, such as electricity or district heat. This means that a zero-carbon-ready building will become a zero-carbon building by 2050, without any further changes to the building or its equipment.*" (International Energy Agency 2021, p. 144) The IEA estimates for example that all new buildings to be constructed have to be zero-carbon-ready by 2030 in order to reach decarbonization goals. (International Energy Agency 2021)

Another term commonly used describes a similar concept. "*A 'Net Zero (Whole Life) Carbon' Asset is one where the sum total of all asset-related GHG emissions, both operational and embodied, over an asset's life cycle*

[…] is minimized, meet local carbon, energy and water targets, and with residual 'offsets', equals zero." (London Energy Transformation Initiative 2020, p. 6)

A definition in a recent legislative proposal for the Energy Performance of Buildings Directive (EPBD) defines a zero-emission building (ZEB) as "*a building with a very high energy performance […] which contributes to the optimisation of the energy system through demand-side flexibility, where any very low residual amount of energy still required is fully covered by energy from:*

> *(a) renewable sources generated or stored on-site;*
> *(b) renewable sources generated nearby off-site and delivered through the grid […];*
> *(c) a renewable energy community […]; or*
> *(d) renewable energy and waste heat from an efficient district heating and cooling system […]*"
> (Recast proposal of EPBD Directive 2010/31/EU)

The current state of the building stock is a totally different one and most buildings are far from reaching the above definitions. The IEA estimates that 50% of existing buildings need to be retrofitted to zero-carbon-ready levels by 2040 and 85% by 2050. (International Energy Agency 2021) In order to reach this goal comprehensive measures with deep renovations starting with the worst performing buildings are suggested. Retrofitting rates of old buildings would have to increase to yearly 2.5% of building stock in advanced economies by 2030 in comparison to the current yearly 1%. (International Energy Agency 2022b)

It is to be noted that next to the decarbonization of the building stock itself the decarbonization of the energy market is essential. While the decrease in the amount of energy used for buildings makes the energy transition easier, a quicker decarbonization of the energy mix would imply that not as many renovation measures would be necessary. (Oligschläger and Mahieu 2023)

The main tool for reaching the net zero target in the EU by 2050 is the European Green Deal. It is a regulatory package tackling several sources of

emissions – one of them being the building sector. To reach the intermediary goal of the Green Deal as described in the European Climate Law– to reduce emissions by 55% by 2030 compared to 1990 levels - the European Commission has published the "*Fit for 55*" legislative package. (Article 4 (1), Regulation 2021/1119/EU) Resulting of it was a strategy paper called "*A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives*". The paper includes concrete regulatory, financing and enabling measures which should essentially "*double the annual energy renovation rate of buildings by 2030. […]*" In order to reach this goal a revision of the Energy Performance of Buildings Directive (EPBD) was necessary. (European Commission, Communication 2020/662; European Commission 2020; European Commission, Communication 2021/550; Recast proposal of EPBD Directive 2010/31/EU)

While there are already some policies in place, in order to achieve the above-described pathways new policies will be needed reach the 1.5°C target. The current policies implemented by the European Commission are projected to reduce emissions by 26% in the building sector between 2020 and 2030. (Graf 2021; United Nations Environment Programme 2022) Therefore, apart from the current policies in place, one would expect further development of these policies as well as the creation of fully new ones, which will tremendously impact the real estate industry. That is the reason for the analysis of current as well as future policies of the European Union and their potential in this thesis.

4. Decarbonization efforts already in place

4.1 Reporting requirements from commercial real estate

4.1.1 Summary of the current legislative context

The thesis first wants to give an overview of current reporting requirements with regard to decarbonization that are already in place. Additionally, an especially important tool to make decarbonization measurable is carbon accounting. This is why current market practices for it will be analysed.

The current legislation regarding sustainability reporting for real-estate companies such as REITs is the Non-Financial Reporting Directive (NFRD) which was published in 2014. It applies to large public interest companies employing more than 500 people. The concept of public-interest entities

means mostly publicly listed companies, insurance companies and credit institutions. Meanwhile, non-listed private companies and small and medium enterprises (SMEs) are exempted. (Article 19a (1), Article 20, Directive 2014/95/EU)

The NFRD requires companies to report on sustainable core matters (environmental, social and employee-related matters, respect for human rights, anti-corruption and bribery matters). "*Such statement should include a description of the policies, outcomes and risks related to those matters and should be included in the management report of the undertaking concerned*". However, the companies are also free to choose to fulfil this disclosure requirement by publishing a separate report with the same content. We will mostly focus on the environmental matter here, as those would be the ones who also include decarbonization. The NFRD requires disclosure of the operations on the environment as well as the use of renewable and non-renewable energy, water use, air pollution and GHG emissions among others. (Recital 6, Recital 7, Directive 2014/95/EU)

For a long time, the European Commission planned on updating the NFRD to improve corporate sustainability reporting and bring it to a similar level as financial reporting. The planned legislative changes were subsumed under the name of the "*Corporate Sustainability Reporting Directive*" (CSRD). The CSRD itself was adopted in 2022, coming into effect in January 2023 and to be translated into national legislation within 1.5 years. (Directive 2022/2464/EU)

The main goal of the revision is to enable comparability between different firm's sustainability reports as a fixed structure in electronic format is now required. Also, the reports will need to be audited, which should provide more reliability of sustainability information. (Deutscher Nachhaltigkeitskodex 2023; Recital 13, Recital 61, Recital 64, Article 29d Directive 2022/2464/EU)

The CSRD first changed the syntax of the legislative landscape as "*non-financial information*" implied that the information was of no financial relevance, which is not the case. The syntax was changed to "*sustainability information*". Apart from that it was noted that many companies do not yet

disclose material information such as GHG emissions. (Recital 6, Recital 13 Directive 2022/2464/EU)

Another material change was the increase of the application frame of the directive as it was noticed that companies of which investors require sustainability information were not required to disclose those so far. Now, there are three criteria which need to be fulfilled in order for companies to be obliged to disclose.[6] The European Parliament estimated that this would raise the number of disclosing companies from 11,700 to 50,000. However, not all companies will need to comply with the CSRD immediately, instead, the requirements will be phased in for different types of companies with different timeframes.[7] (EFRAG 2022b; Yakimova 2022; Directive 2022/2464/EU)

The CSRD is based on the European Sustainability Reporting Standards (ESRS) which are developed and published by the European Financial Reporting Advisory Group (EFRAG). It contains one standard for each of the Taxonomy environmental objectives[8], and additionally also Social and Governance Standards as well as basic rules. Within the standard for climate change mitigation and adaptation, the requirement to disclose GHG emissions as well as behaviour like GHG removals is included again. (EFRAG 2022b) The Delegated Act on the first set of ESRS has been adopted by the

---

[6] The CSRD will apply to big companies who fulfil at least two out of three criteria:
(1) Net turnover of more than € 40 mm.
(2) Balance sheet assets greater than € 20 mm.
(3) More than 250 employees.
Additionally listed companies and SMEs on the EU regulated markets have to comply as well as non-EU-based corporations with either:
(1) more than € 150 mm. turnover p.a.
(2) subsidiaries in the EU and
(3) securities listed on EU-regulated markets. (Recital 20 Directive 2022/2464/EU; Deutscher Nachhaltigkeits Kodex 2023)

[7] Companies which were already reporting under the NFRD will have to start applying the CSRD for the first time for the fiscal year 2024. Large companies which do not currently fall under the NFRD but do fall under the new criteria will need to report for the fiscal year 2025 under CSRD for the first time. Listed SMEs will need to report for fiscal year 2026 for the first time under CSRD. Unlisted SMEs can opt-out altogether until 2028. (EFRAG 2022b; Yakimova 2022; Article 5 Directive 2022/2464/EU)

[8] Climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, pollution prevention and control, protection and restoration of biodiversity and ecosystems and lastly the transition to a circular economy. Climate change mitigation and climate change adaptation were covered together in one standard. (EFRAG 2022b)

European Commission in July 2023 with up to four months remaining for the European Parliament or the European Council to veto the rules entering into force. The new draft is essentially reducing the reporting requirements on sustainability matters for companies compared to the original draft.[9] (European Commission 2023c) Additionally, there will be a second set of standards developed, which will cover specific sectors as well as companies from countries outside of the EU and listed SMEs. (EFRAG 2022b) For this second set, a specific standard for real estate companies can be expected.

As we could see already the NFRD required the disclosure of the company's GHG emissions and the CSRD is continuing this path. However, as of now, there are no legislative rules put into place guaranteeing a comparative landscape for GHG emissions accounting. However, some EU countries like Denmark, Finland and Sweden are starting to consider implementing rules for life-cycle assessment and the topic is also on the agenda of the EU. (Weinfeld, Wiejak-Roy, and Booth 2023; Kurmayer, Nikolaus 2021)

The current market standard[10] used is the "*greenhouse gas protocol*" which is a framework developed by the World Resources Institute and the World Business Council for Sustainable Development. The protocol is developed in consultation with governments, industry associations, NGOs, businesses among others. It does not only provide accounting methodologies for companies but also policy and action standards. It mainly covers direct equity investment.[11] (WRI and WBCSD 2023) The ESRS of EFRAG refer to the GHG Protocol standards, the Global Reporting Initiative (GRI) as well as

[9] One example for the reduced reporting burden is that less standards have to be reported mandatorily by all of the regulated entities. Instead, more standards are only applicable after the materiality analysis deems them of high enough relevance for the company. Furthermore, the phase-in of some reporting requirements has been delayed. Some data points don't need to be reported upon by certain groups of the regulated entities.

[10] It is used by about 92% of Fortune 500 companies which proves its wide market acceptance. (WRI and WBCSD 2023)

[11] For indirect equity investment, Partnership for Carbon Accounting Financials (PCAF) has developed a standard which was recently specified in association with Global Real Estate Sustainability Benchmark and CRREM. They provide technical guidance and specifications for the PCAF carbon accounting standards to ensure the measurement and reporting of financed emissions from operations in the commercial real estate sector. These associations are still contributing to global harmonization efforts beyond the borders of the EU. (PCAF 2022; Landry et al. 2023)

the ISO 14064-1:2018 and leaves it open to the company to choose with which standard to comply. (EFRAG 2022a)

4.1.2 Effect of the current legislative context and market practices

One of the challenges the European Commission had to overcome while drafting the CSRD was to balance the interest of compliance efforts of the reporting companies as well as the need for information by investors. (Gesamtverband der Versicherer 2023)

The first effect of these reporting directives is, therefore, the increased administrative effort and the increased reporting burden that come with the move from the NFDR to the CSRD. This will come along with increased costs. The departments of marketing, sustainability, communication, as well as human resources and quality, are commonly working on putting together the sustainability reporting and therefore need additional resources to fulfil the tasks. (Carmo and Miguéis 2022; Stubbs and Higgins 2018, 489-508) However, the final draft of the ESRS for the CSRD was less strict than originally expected, therefore making the compliance of companies easier – at least within the first years. (Gesamtverband der Versicherer 2023)

However, by requiring integrated reporting, companies will eventually dedicate the needed resources to the disclosure of sustainability information. They would then prioritize the disclosure with the appropriate urgency and attention to detail. (Stubbs and Higgins 2018, 489-508) Also, the additional requirement to get the sustainability report audited means that companies will need to be very accurate about the information they put in their reports.[12] This increase in the reliability of information will lead to a more efficient market in which investors can more easily evaluate the

[12] A study of multifamily rental rates has found for example – that also companies which indicate that their properties were green without being able to prove this via a certification can rent their properties with a premium. (Bond and Devine 2016, 117-140) In the future it would not be possible to simply claim that the rented real estate is green without having significant prove for this. Tenants will more strictly enquire about the details of the rented buildings as they know the required information has to be available due to reporting requirements.

potential risks their portfolio companies are exposed to. (Recital 14 Directive 2022/2464/EU)

Still, the CSRD will only start to cover SMEs and unlisted companies at a later time – which means that the Directive can only provide more transparency to investors who are looking to acquire a *listed* company active in the commercial real estate field like for example REITs. The regulation, therefore, only covers a small part of the commercial real estate investment universe for now. (Article 5 Directive 2022/2464/EU; European Commission 2023c; Directive 2014/95/EU)

However, it is not to be underestimated how regulation for publicly listed companies can also influence the behaviour of private companies. It is proven that the closer a company is to its customers the more likely it is to publish a voluntary sustainability report. (Carmo and Miguéis 2022) Sustainability companies usually rent out their properties directly to the tenant. Therefore, there is a high level of proximity between the owner and the user of the space. However, as client demands shift towards more energy-efficient buildings, it can become more important for a landlord to also publicly disclose sustainability metrics for their company. (Chithambo et al. 2022, 159-172) Additionally, governments have been proven to be one of the most important stakeholder groups for pressuring voluntary GHG emissions disclosures. (Chithambo et al. 2022, 159-172)

Now, the CSRD revision to the NFRD will enlarge the number of companies publishing sustainability reports anyway. Also, non-listed companies will be covered. (European Commission 2023b; Duijzer, Sinke, and Pott 2022) This enlargement of the scope will also have impacts on the market environment generally. It can additionally shift tenants' demand towards greener buildings. This is because a lot of tenant companies will also have to publish sustainability results according to the NFRD. (Directive 2014/95/EU) Scope 2 emissions[13] include operating carbon emissions from the use of (also

[13] Scope 2 emissions are emissions "*from the generation of **acquired and consumed** electricity, steam, heat, or cooling (collectively referred to as "electricity"). These emissions […] are considered an indirect emissions source (along with scope 3), because the emissions are a consequence of activities of the reporting organization but actually occur at sources owned or controlled by another organization*". (Sotos et al. 2015)

leased) real estate. Scope 3[14] emissions can include embodied carbon emissions of (leased) buildings. (Sotos et al. 2015; Bhatia et al. 2011; Huysmans 2017; Pittard 2023) Both are often included in the sustainability reports of big companies nowadays. (Lloyd et al. 2022; International Energy Agency 2022a) Their disclosure will also become mandatory through the CSRD. (EFRAG 2022a)

Being required to externally report about sustainability information leads to decision making which creates higher sustainable value – implying firms will use the sustainability information as a basis for their decision-making process. (Esch, Schnellbächer, and Wald 2019, 599-610) This can then have effects on two levels: an increase in the demand for sustainable space as well as a more strategically planned decarbonization pathway for investors. The first effect is that through the additional external pressure of the public disclosure coming along with the CSRD of sustainability information, it is therefore likely, that tenant companies will prefer (the lease of) high energy-efficient buildings. Second, a real estate company will be able to monitor the buildings in its portfolio and their relevant environmental performance better by being required to collect data on the company level about it to then disclose it. They will also be more likely to think and plan ahead for needed environmental and energy-related renovations. (Directive 2022/2464/EU; European Commission 2023c; Directive 2014/95/EU; Strathon et al. 2021; Dangl, Smith, and Chadwick 2022; Freshfields Bruckhaus Deringer 2021)

While regulation demanding disclosure of sustainability information has largely been responsible for companies adopting sustainability reports (La Torre et al. 2018, 598-621), there are some problems that were not addressed in the NFRD. One of them is that the NFRD is very unspecific about how the information on the above matters has to be reported. This was producing issues in terms of comparability as well as the quality of the disclosed information. (Testarmata and Ciaburri 2022, 309-331; La Torre et al. 2018, 598-621; Stubbs and Higgins 2018, 489-508; Directive

[14] Scope 3 emissions are those emissions that are neither scope 1 or scope 2 and occur in the company's value chain. (Bhatia et al. 2011)

2022/2464/EU) There is a multitude of frameworks that can be used by the concerned companies including OECD guidelines for multinational enterprises, ISO 26000 for Social Responsibility, the EC's non-binding guidelines, GRI as well as SASB. (OECD 2011; International Organization for Standardization 2010; International Sustainability Standards Board 2018; Global Sustainability Standards Board 2022; European Commission 2019; Rolo 2022, 191-216)

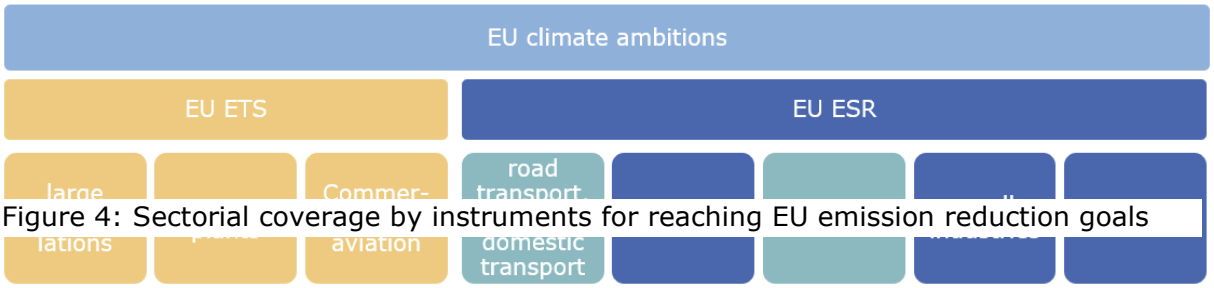

Figure 4: Sectorial coverage by instruments for reaching EU emission reduction goals
Source: Council of the European Union 2023b; Council of the European Union 2022

The missing regulation in carbon accounting, however, provides big gaps that were previously criticized by investors before integrated reporting became mandatory via the NFRD. This is because there were no independent institutions responsible for checking whether the accounting guidelines were used appropriately by the reporting entities. (Stubbs and Higgins 2018, 489-508) With the CSRD at least this problem will be solved by requiring an audited report. However, the problem of non-comparability due to allowing the use of different frameworks remains unresolved.

Some academic research proposes that sustainability performance reporting is voluntary and lacks a standardised approach. Especially, for carbon accounting the multitude of frameworks for voluntary disclosures creates an environment lacking detailed guidance on systematic EC reporting. This in turn leads to a poor availability and quality of carbon emission data for companies. (Weinfeld, Wiejak-Roy, and Booth 2023)

4.2 Effort Sharing Regulation

4.2.1 Summary of the revision

An important decarbonization tool setting a framework for the real estate sector is the Effort Sharing Regulation (ESR). The ESR is a mechanism setting out reduction targets for the sectors covered by the ESR for each of the Member States within the EU. This means that the ESR is currently not

covering the sectors that are already covered by the Emission Trading Scheme (ETS)[15]. The distinction is clarified in Figure 4, which shows the sectorial coverage of ESR and ETS respectively as of today. (Council of the European Union 2023b; Council of the European Union 2022)

The ESR sets targets for each Member State. The task of reducing GHG emissions according to the Paris Agreement is shared among Member States under principles of cost-effectiveness, fairness and solidarity. However, Member States are free to choose the measures they implement to fulfil the commitments and set sectorial targets for the sectors of road transport, agriculture, buildings, small industries and waste. These sectors together are responsible for 60% of the EU's GHG emissions. (Council of the European Union 2023b; Council of the European Union 2022) When the regulation talks about "*buildings*" it includes only the operational carbon emissions produced by heating and leaves out embodied carbon emissions as well as any other operational carbon emissions like the use of electricity. (Runge-Metzger and Van Ierland 2019, 95-116)

The ESR was adopted in June 2018 as a successor to the Effort-sharing Decision (ESD) from April 2009. The ESD set national targets for the period from 2013 to 2020 to reach the goal of reducing GHG emissions by 10% compared with 2005.[16] (Yougova 2023; European Commission, Communication 2021/550) This goal was achieved as emissions have fallen by 15% compared to 2005 – 6% of those were achieved between 2019 and 2020 and therefore associated with the measures in order to contain the Covid-19 virus. Half of the overall reduction from 2005 to 2019 can be associated with the building sector. However, overall these goals still fall short of the Paris Agreement. (Bozsó et al. 2022; Yougova 2023)

An update to the regulation was agreed upon in November 2022. It was adopted in March 2023 and increased Member States' current emissions reduction targets for 2030 which would previously have amounted to an

[15] The EU ETS currently covers large installations, power plants and commercial aviation. (Council of the European Union 2023b; Council of the European Union 2022)
[16] This is corresponding to a reduction of 20% of GHG emissions from all sectors from 1990 t0 2020. (Yougova 2023)

emission reduction of 29% until 2030 compared to the level of 2005. The new commitments contribute to achieving the goal of reducing GHG emissions in the ESR sectors by 40% until 2030.[17] (Council of the European Union 2023b; Regulation 2018/842/EU)

The ESR's national targets are due for another update in 2025 in order to account for unforeseen events that could influence emissions – therefore adapting annual emissions allocation for the years 2026-2030. (Council of the European Union 2022) Additionally, it can be said that goals for the period after 2030 are needed in order to give regulation safety to market players of the ESR sectors. (Bozsó et al. 2022)

4.2.2 Effect of the latest revision

The effect of the ESR on the building sector in Europe is of indirect nature, as the concrete goals for each sector have to be defined by each Member State as it was described above. Therefore, a common effect of the ESR on the building sector can barely be predicted. However, studies have found that previously sectoral national targets stemming from the ESR were an "*important factor for the buildings sector emissions taking a downwards, albeit slow, trend since 2005*". (Bozsó et al. 2022)

Now, the impact of the revision of the ESR will trigger an increased need for quick action by the Member States as most of them are currently not on track to meet the ESR targets and would need tremendous additional measures in order to be compliant. (Vasse 2022) These additional measures, which every Member State can decide upon by themselves, will then be the ones with a direct impact on the building sector in the EU. Part of them we will analyse in the following.

[17] It is to be noted that according to the Paris Agreement, which demands emission reduction of 50% compared to 2005, the goals for the ESR sectors are not sufficient in order to play their part in reaching those targets. (United Nations Framework Convention on Climate Change, the Paris Agreement 2016) They also fall short of the Fit for 55 goals of 55% emission reduction until 2030, which the EU gave itself. (Proposal for a Regulation on European Green Bonds, 2021) The lower emission targets mean that other emitting sectors would have to decrease their emissions stronger, such that an overall reduction of 50% would become reachable. Alternatively, faster emission reduction post 2030 would be suitable. (Bozsó et al. 2022)

5. Future Decarbonization efforts

5.1 Revision of the Energy Performance of Buildings Directive

5.1.1 Summary of the proposed revision

In the EU energy efficiency was first promoted in the 1970s within the environment of the EU energy policy agenda. The EPBD was then introduced in the year 2002 and marks the primary legislation regulating buildings across the EU. It was recast in 2010 to ensure more clarity and revised in 2018. (Economidou et al. 2020; Directive 2002/91/EC; Directive 2010/31/EU; Regulation 2018/844/EU)

In December 2021, a proposal for a third recast was published by the European Commission. In March 2023, the European Parliament adopted its position on the proposal, which will be followed by further negotiations about details of the proposal in the European Council. (Recast proposal of EPBD Directive 2010/31/EU)

The overarching revision goal is that "*All new buildings should be zero-emission buildings, and all existing buildings should be transformed into zero-emission buildings by 2050.*" (Recital 16, Recast proposal of EPBD Directive 2010/31/EU) To achieve this, several initiatives have been bundled into the proposal for the recast of the directive. The most important changes are the introduction of minimum requirements for energy performance through applying minimum energy performance standards (MEPS) to existing as well as new buildings. By using MEPS, the EU seeks to overcome "*key barriers to renovation such as split incentives and co-ownership structures, which cannot be overcome by economic incentives*". (Recital 22, Recast proposal of EPBD Directive 2010/31/EU)

Other changes include the introduction of a "*framework for a methodology for calculating the integrated energy performance of buildings*" as well as the revision of energy performance certifications (EPCs) [18] of buildings in

[18] EPCs indicate the amount of energy that is consumed by a building during its operation. Examples for energy usage include climatization (heating and air-conditioning), hot water and the electricity consumed by the property (for home appliances, lighting and technical equipment). The aggregated energy consumption during a year in kWh is then by the heated surface of the building in m². Energy performance is then expressed in kWh per

order to harmonize the currently heterogeneous landscape of energy performance classification. Furthermore, a database for the energy performance of buildings is to be set up, which enables the collection of data on the energy performance of individual buildings and the complete national building stock. Another important point is the introduction of national building renovation plans. (Recital 9, Recital 50, Article 3, Article 15 (1), Article 19, Recast proposal of EPBD Directive 2010/31/EU)

The measures of minimum requirements to the energy performance through MEPS have a high expected effect on the commercial real estate market, which justifies a more in-depth look into new regulations planned to be adopted. The MEPS are defined in Article 2 as "*rules that require existing buildings to meet an energy performance requirement as part of a wide renovation plan for a building stock or at a trigger point on the market (sale or rent), in a period of time or by a specific date, in line with the energy efficiency first principle, thereby triggering renovation of existing buildings.*" (Article 2, Recast proposal of EPBD Directive 2010/31/EU) The MEPS are introduced in Article 9 of the Directive which demands non-residential buildings and building units not owned by the public body to achieve energy performance class E from 2027 onwards, and energy class D from 2030 onwards. (Article 9, Recast proposal of EPBD Directive 2010/31/EU)

Article 7 requires Member States to ensure that starting from 2028 all new buildings to be constructed confirm the standards of a ZEBs[19]. Existing buildings have to be transformed into ZEBs by 2050 as required by Article 3. (Article 7, Recast proposal of EPBD Directive 2010/31/EU)

The European Commission, European Parliament and European Council still have to agree on a final version of the draft. While European Commission and European Parliament have already worked on producing the current version and have approved of it, it is very likely that the European Council

---

m2 and per year. Energy Class A stands for low energy consumption, and Energy Class G stands for high consumption. Energy classification give a base for comparing different buildings.

[19] The definition of a ZEB can be found above in Chapter 2.2.

with all its Member States will still have a large influence on the final outcomes of the recast of the EPBD. Ministers from Germany and Italy have already mouthed different degrees of dissatisfaction with the proposal. After a final proposal for the EPBD, final decision-making is expected to take place in the second half of 2023. Afterwards, as the EPBD is a directive, the framework still has to be translated into national law by each Member State which is expected to take another 18 months. This leaves the recast to come into effect in early 2025. (Tagesspiegel 2023; Kurmayer, Nikolaus J. and Romano 2023; Oligschläger and Mahieu 2023)

5.1.2 The reaction of the sector to the revision

Generally, a lot of industry associations active in the building sector have reacted to the successful vote of the European Parliament concerning the recast proposal for the EPBD. However, important investor associations for real estate remained silent on the matter. The sentiment towards different aspects of the proposal was very mixed among the different associations and their agenda. However, the general revision of the EPBD was welcomed by the sector. (European Commission, Public Consultation on Updating the EU ETS 2021)

A common positive is the fact that the harmonization of the EPCs will facilitate a homogenous landscape which will also pave the way for the European Taxonomy. (European Builders Confederation 2023; World Green Building Council 2023; European Construction Industry Federation 2023) The ECB argues, however, that the currently planed revision does not meet this goal as for example the EPC class "G" means the worst-performing building stock of a country, not by the EU overall. Additionally, Member States keep a lot of definitional freedom in the rest of the energy classes. (European Central Bank 2023a)

The general introduction of MEPS was received well. Additionally, the ZIA Zentraler Immobilien Ausschuss criticized that the higher standards of MEPS for commercial real estate suggested that those renovations were easier to attain than those of residential buildings, while in reality commercial real estate is more complex and heterogenous than residential real estate. (ZIA Zentraler Immobilien Ausschuss e.V. 2023)

Another important aspect commonly referred to was the financing that would be needed to realize the renovations. Associations agree that enough financial means have to be allocated in the form of governmental aid in order to make conforming to the directive possible. (ZIA Zentraler Immobilien Ausschuss e.V. 2023; Hauptverband der Deutschen Bauindustrie e.V. 2023; BFW Bundesverband Freier Immobilien- und Wohnungsunternehmen 2023)

However, a point particularly criticized by the associations involved in building and renovation was that the set time frames for establishing the MEPS and reaching the newly set goals concerning ZEBs were too tight and hardly reachable in terms of technical and economic resources. (European Construction Industry Federation 2023; European Builders Confederation 2023; ZIA Zentraler Immobilien Ausschuss e.V. 2023; BFW Bundesverband Freier Immobilien- und Wohnungsunternehmen 2023; Gu et al. 2023) The European Construction Industry Federation expects that the strict goals are hardly attainable for the diverse Member States with disparate current building stock within the set time frame. (European Construction Industry Federation 2023)

Generally, different agents disagree on the level of ambition of the MEPS. The World Green Building Council announced for example that: "*The proposed agreement is a huge step forward for Europe's building stock that will enable EU citizens to enjoy lower energy bills, reduced energy poverty, whilst also tackling the Whole Life Carbon impact of the building stock.*" (World Green Building Council 2023)

Also criticized was the rule that for newly constructed buildings larger than 2000 sqm from 2027 and all newly constructed from 2030, the calculation of the global warming potential would be necessary. This kind of data is hardly obtainable with the current tools and means at hand even though there are considerable differences in progress towards the reportability of these data between different EU countries. (Weinfeld, Wiejak-Roy, and Booth 2023; German Sustainable Building Council et al. 2021)

5.1.3 Potential effects of the revision on the commercial real estate sector

Generally, one can say that the recast of the EPBD is a prime example of regulatory risk in real estate. The final version of the directive and therefore the correct adjustments to the new regulatory environment cannot be predicted and therefore further steps have to be evaluated carefully.

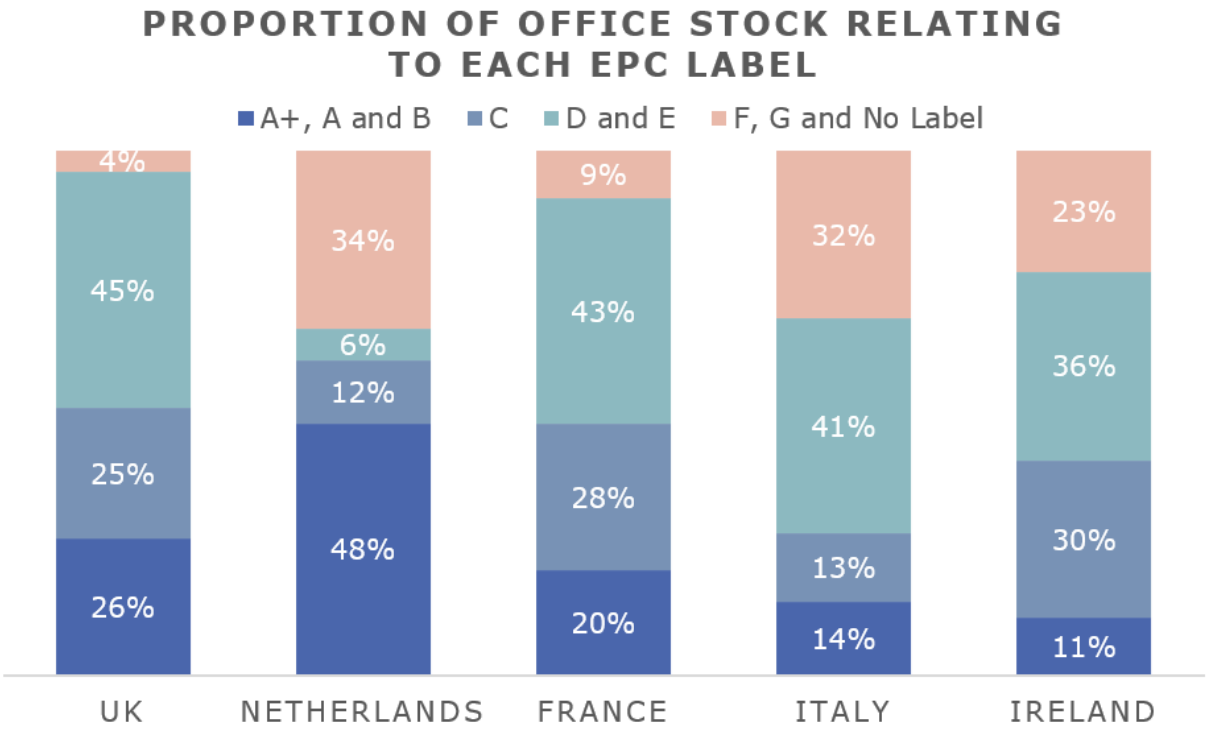

Figure 5: Office stock EPC labels in five exemplary countries

Source: Ferries, Barnes, and Edgley 2022

In addition to the European legislative development, there are some countries like the Netherlands[20] and France[21] which have their own rules with regard to MEPS. These possible individual moves by Member States pose an additional regulatory risk to real estate investors. (McAllister and Nase 2023)

Figure 5 shows the exemplary EPCs of office buildings in the UK, the Netherlands, France, Italy and Ireland. It is clear that a lot of buildings either have to quickly obtain an EPC or, in case they already have one,

[20] In 2018, a decree was adopted by the Dutch government, which concerns the energy performance labels of offices. According to the decree office buildings need to have an EPC of C or better by 2023 and an EPC of A by 2030. There are some exceptions granted to monuments and limited floor area office buildings. Additionally, new buildings have to be net-zero by 2021. (Bijna Energieneutrale Gebouwen)

[21] (République Francaise 2019)

initiate thorough renovations that enable compliance with the planned MEPS.[22] (Ferries, Barnes, and Edgley 2022)

If a company already owns spaces that are affected by the recast of the Directive and/or new national regulations, the concerned buildings would be due for energy-efficiency deep renovations. These renovations require additional investments. (Ferries, Barnes, and Edgley 2022) They, therefore, present a risk for the expected capital returns of investors. (Gu et al. 2023) It follows that the renovations will only be done if the measure is profitable for the concerned investor. In case it is not the real estate might turn into a "*stranded asset*". The term stranded asset in the context of the real estate market describes the obsolescence of a building due to failure to comply with new regulations or market expectations. (Ferries, Barnes, and Edgley 2022)

At the same time, the increased demand for sustainable building materials, planning and construction capacity will strain the market's capacities for deep renovations for increased energy efficiency. The already existing shortage of qualified workforce as well as the prices for sustainable materials which are especially needed for the renovations increase and make the measures even more expensive. The "*green cost premium*" which describes the additional cost incurred to use sustainable construction practices instead of conventional ones, could therefore rise in the coming years. The term, therefore, refers to a cost premium in the primary market – i.e. during the construction or renovation of a building. (Nazirah Mat Russ, Mahanim Hanid, and Kho Mei Ye 2018, 1715-1725)

In the secondary market, the increase of a green cost premium could then increase the "*green premium*" which describes the higher prices of buildings that incorporate sustainability elements like higher energy efficiency and therefore often obtain a sustainability certification[23] or some other kind of

[22] Additionally, it remains unclear how EPC which were issued before the application of the new version of the EPBD will be coherent with the newly issued EPC, given EPCs are usually valid for ten years. (European Central Bank 2023a)

[23] Typical examples for Eco certifications of buildings are the ones of LEED and Energy Start in the US, BREEAM in the UK. They are usually awarded by a third party when a

element with a signalling effect.[24] (Copiello and Coletto 2023) This price increase is due to the enhanced demand for green buildings, as well as lower management costs and higher comfort levels which will require no or fewer renovations to be compliant with the newest regulation. (Copiello and Coletto 2023)

Under the hypothesis of efficient markets, the market itself should make the price premium of these green buildings exactly as high as the potential cash flow benefit that it could yield in the future, be. But the commercial real estate does not conform to perfect market assumptions due to "*Thin trading, high search costs, information asymmetries, heterogeneous assets and expectations*".[25] (Fuerst, Gabrieli, and McAllister 2017, 137-146)

Both of these phenomena – the green premium and green cost premium – have been sufficiently proven to exist in certain markets. However, the exact magnitude of the price increase is still debated. (Copiello and Coletto 2023; Copiello and Donati 2021, 111371; Das and Wiley 2014, 64-86; Hwang et al. 2017, 67-79; World Green Building Council 2013; Chegut, Eichholtz, and Kok 2014, 22-43; Eichholtz, Kok, and Quigley 2013, 50-63; Leahy 2022; Ferries, Barnes, and Edgley 2022)

At the same time a "*brown discount*" for buildings, which describes the discount for buildings that are not currently conforming to expected regulations with additional refurbishments due, is expected to arise. Market research agencies in real estate expect investors to become very ESG-conscious and to avoid investing in buildings at risk of stranding or incurring penalties by failing to conform to new regulations. (Ferries, Barnes, and Edgley 2022)

---

building has a significant reduced environmental impact compared to conventional properties. (Nazirah Mat Russ, Mahanim Hamid, and Kho Mei Ye 2018, 1715-1725; Fuerst, Gabrieli, and McAllister 2017, 137-146; Holtermans and Kok 2019, 685-722)

[24] Whether or not a premium for green buildings is really solely produced by their greenness proved via an eco-certification is still hard to prove. This is because often times assets with eco-certification are often above average quality assets within their class. (Fuerst, Gabrieli, and McAllister 2017, 137-146; Akin et al. 2013, 506-537; An and Pivo 2020, 7-42)

[25] Also, the different types of investors (core, value and opportunistic) contribute to these market inefficiencies. (Fuerst, Gabrieli, and McAllister 2017, 137-146)

Another important aspect is the introduction of zero-emission buildings[26] (ZEB) as previously only net-zero emission buildings[27] (NZEB) were defined in the EPBD. Therefore, investors had planned green projects according to the standard of NZEB available at the time of planning. However, the adjustment does not only mean that buildings that were previously classified as "*green*" in terms of NZEB have to be renovated again until 2050 to meet these new standards, but it additionally raises concerns of investors to plan new green projects, which could by their time of completion, again not be up to the latest standard and require additional investments.[28] Generally, a quick decision on the Directive is preferable, as it would leave more time for investors to adapt to the new standards. (Oligschläger and Mahieu 2023)

5.2 EU ETS including the building sector

5.2.1 Background and summary of the proposed revision

The ETS currently in place covers about 40% of the EU's GHG emissions which are related to the sectors of large installations, power plants as well as commercial aviation as can be seen in Figure 4. (Erbach 2023; Meadows, Vis, and Zapfel 2019, 95-116; Liese et al. 2021)

The ETS was introduced in 2005 via Directive 2003/87/EC and has developed throughout the years in different phases[29]. The latest revision of the ETS has been adopted in 2018 to reduce EU ETS-covered emissions by 43% by 2030 compared to 2005[30]. Another update has been proposed by the European Commission to account for the increased emission reduction

[26] As defined by the European Commission 2020.
[27] As defined by the European Commission 2020.
[28] An example or this can be found in the newest draft of the revision: the EPC A+ are therein described as buildings which are net positive and therefore absorb emissions from the atmosphere. In an evolving regulatory environment like this it is possibly that this definition will at some point be the new standards that buildings have to comply with.
[29] Phase 1 (2005-2007) was a pilot phase used to create the needed infrastructure for the trading system. Phase 2 lasted from 2005-2007, phase 3 from 2013 to 2020. The current phase is the fourth and lasts from 2021 to 2030. (Ellerman, Convery, and De Perthuis 2010)
[30] A recent analysis by the European Commission has found that with current legislation an emission reduction of 51% in 2030 compared to 2005 would be reached. This is falling short of the goal to reach a reduction of 55%. Therefore, the new update is necessary in order to increase ambition up to 55% reduction. (Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 202)

targets of the Fit for 55 package which were explained above. (Erbach 2023) To understand the meaning of introducing an ETS in the building sector the tool of the current ETS in Europe will be briefly explained.

The ETS is a so-called "*cap-and-trade*" system[31]. Each year, the governmental entity auctions[32] "*emission allowances*" or gives them away for free. Each allowance enables the holder to emit one tonne of CO_2e and the allowance must be "*surrendered*" to the authority once the emissions are released. Before surrendering allowances, they can be traded among the emitters covered by the ETS. Regularly the emitters must prove to governments that they own sufficient allowances for the scope of their emissions. This way the EU can define the overall volume of GHG emissions to be emitted within the covered sectors by limiting the number of emission allowances for a given point in time. This number of emissions is then called a "*cap*". By decreasing the cap every year, the EU has a tool to ensure that total emissions decrease gradually over time. (European Commission 2021c; Meadows, Vis, and Zapfel 2019, 95-116; Energy Policy Group 2022; Mariani and Heinzel 2021)

For several years after the financial crisis of 2008, there were too many emissions allowances issued to the market, which implied a sharp decrease in prices for secondary market trade. (Ellerman, Convery, and De Perthuis 2010) The EU, therefore, introduced the Market Stability Reserve in 2015 which came into operation in 2019. It is a volume-based mechanism that can absorb outstanding emission allowances according to current supply and demand. The price mechanism of the allowances follows the economic cycle: In phases of recession economic activity decreases. This is connected to a decrease in emissions. Therefore, because of the decreased demand

[31] The ETS is one of the market-based economic possibilities of a government entity to prevent market failure, influence the amount of emitted GHG emissions and force an internalisation of the produced externalities. Other possibilities include carbon taxation as well as legal caps for emissions applying for all companies. The advantage of the ETS as a market-based tool is that the entities covered are then incentivized to decrease overall emissions in the most cost-efficient way possible for the covered sectors. Emissions are therefore cut where the cost of abatement is lowest, while emitters with high cost of abatement will instead buy more carbon allowances. (Meadows, Vis, and Zapfel 2019, 95-116)

[32] The proceeds earned with these auctions can then be used by the state to additionally invest in climate friendly policies. (Meadows, Vis, and Zapfel 2019, 95-116)

the price of emission certificates decreases. In phases of economic boom, this mechanism reverses. As the price of emission allowances varies with the economic cycle it can become necessary to adjust the amount of emission allowances outstanding to maintain an appropriate level of liquidity in the market and to establish compatibility with other policy measures and their influence on the ETS market. (Ellerman, Convery, and De Perthuis 2010; Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021)

The price of emission allowances increased sharply after the introduction of the Market Stability Reserve circa 900 million allowances were taken out of the market and absorbed by the mechanism between 2014 and 2016. They were gradually released again once the surplus fell below 400 million allowances. (Ellerman, Convery, and De Perthuis 2010)

This price development during the financial crisis and the establishment of the Market Stability Reserve is important because the same mechanism could be used for the ETS II which comprises the building sector. The effectiveness of the new ETS will depend on how well the new ETS implements a similar mechanism which can provide more effectiveness and predictability for market players. (Ellerman, Convery, and De Perthuis 2010)

Despite this adjustment of the past, the EU ETS has been very successful. From 2005 to 2017 the emissions of the EU ETS sectors have decreased by 26%. If we compare it to the numbers of the ESR above, which could not reach 20%, we can see that the sectors covered by the ETS were more effective in decreasing emissions. (Meadows, Vis, and Zapfel 2019, 95-116; Bozsó et al. 2022; Ellerman and Buchner 2008, 267-287)

Now, an update to the ETS has been proposed. It includes the additional introduction of an ETS II for the buildings sector as well as fuel distribution for the transport sector. This implies that both of these sectors would then be covered by an ETS as well as the ESR. It is important to note that when the regulation talks about the building sector’s emissions it means emissions from heating. (Erbach 2023; European Commission 2021c;

Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021)

The new ETS is supposed to start in 2027[33] with a fixed amount of emission allowances which would initially be auctioned[34] separately from the emission allowances of ETS I. To decrease emissions the cap of allowances would be decreased yearly by a linear factor[35] to eventually reach the emission reduction goal of 43% by 2030 compared to 2005. There was also a price cap of € 45 per tonne set which will be abandoned by 2030 so that a market price can form. It was decided that the two sectors were introduced as separate but adjacent ETS to not disturb the currently well-functioning ETS. However, a merging of the two systems in the future is not excluded and will be evaluated.[36] For this reason, the proposal also includes the goal of the price of emissions allowances in ETS II to convert to the prices of allowances of ETS I. (Erbach 2023; European Commission 2021c; Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021; Council of the European Union 2023a)

There is a large number of smaller market participants which each emit a small amount of emissions in the building and road transport sector. This would imply an enormous administrative effort in case those market participants would be the participants in the ETS II market. This is why the compliance obligation applies to companies further upstream in the supply

[33] In case energy prices are particularly high during the time of introduction in 2027, the start of the new ETS can even be delayed to 2028. (Council of the European Union 2023a)
[34] The emission allowances will be auctioned as the free distribution of allowances is usually done in order to decrease the risk of carbon leakage. Carbon leakage describes the effect that a carbon price can have on the imposing entity – some of the companies will then produce in countries without a carbon price. In order to benefit local market players free allowances can be allocated to them in order to avoid this process. Another way of avoiding carbon leakage is the introduction of a carbon border taxation, which ensures that also the products and services originating in countries without a carbon price will be offered at a competitive market price to the players in the local region. However, in the case of the emissions by heating – it is hardly possible to move production elsewhere. Therefore, the way of auctioning emissions was chosen. (Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021; Energy Policy Group 2022)
[35] The linear factor will be 5.15% until 2028 and then increase to 5.43%. (Council of the European Union 2023a)
[36] A common ETS or two ETS with the option of trading emissions allowances bi-directionally imply a uniform carbon price which leads to the usage of most (economically) efficient decarbonization options being used. Other advantages include higher liquidity and therefore higher resilience of the ETS in the long term. (Perner and Peichert 2021)

chain – to the companies responsible for the release of fuels for consumption which are used for combustion in the building sector. Under the ETS II, they will be the regulated entities and participate in the initial auctioning of allowances and their ongoing trade. The price for the emissions is then passed on to the final consumers. (Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021; Energy Policy Group 2022)

Also, this new ETS would benefit from a separate section within the Market Stability Reserve starting from September 2027 in addition to other mitigation measures to avoid excessive price volatility. Additionally, article 30h of the proposal prescribes measures to be taken in case the prices of emissions allowances in the sectors get too high, as the authorities do not want to overburden households in case of a steep increase in prices for heating. (Article 30h, Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021)

The revenues of the auctioning of allowances will be used for different purposes. Some of them will be made available for the Innovation Fund. The fund was established together with the ETS in 2005 and nowadays is one of the largest funds for innovation with regard to low-carbon technologies. (European Commission 2022) Another important measure is the introduction of a new social climate fund which can among others provide income support to balance out the social impacts that the EU ETS can have on vulnerable households, smaller enterprises and transport users in danger of energy or transport poverty. It will also be funded from revenues of the ETS II as well as some allowances of the ETS I in total amounting to up to € 65 bn. (Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection 2022; Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021)

The current result of the update is a provisional trialogue agreement reached by the end of the year 2022. The revision was largely debated after the energy crisis as it was feared that the adoption for the building sector would additionally increase heating costs. However, a final version which

included the postponed start of the ETS II to 2027 published in February 2023. Now it needs to be formally adopted. (Council of the European Union 2023a; EPF - European Property Federation 2022)

5.2.2 Reaction to the announcement of the revision

Remarkably, very few industry organisations reacted to the revision of the ETS – especially the latest version of it. It can be assumed that this is due to the fact that before the latest revision of the ETS public consultations, targeted interview programmes as well as bilateral and multilateral stakeholder meetings were held to gain an impression of the industry sentiment towards the revision. (Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021)

The consultation ended in February 2021 and allowed stakeholders to actively provide feedback on the first drafts of the revision. The general sentiment was mostly negative towards extending the EU ETS to the buildings and transport sectors even though there were also some approving associations. While some organisations generally felt opposed to a new ETS (European Trade Union Confederation 2021) others mainly criticised the integration of the two sectors into the existing ETS (which was the original idea) instead of introducing a separate ETS. The consultation of the European Commission was for example still based on this assumption. (European Commission, Public Consultation on Updating the EU ETS 2021; Energie Baden-Württemberg 2021; EPF - European Property Federation 2021; EPF - European Property Federation 2022) Scientific sources as well as environmental associations welcomed the new ETS and even saw it as a "*necessary addition*". (Energy Policy Group 2022; European Commission 2021d; Maj et al. 2021)

Problems mentioned in the consultation was an insufficient price signal due to the low price elasticity of the transport and building sector[37]. The two sectors were too different from the currently covered sectors. Therefore, emission abatement would only succeed in the latter sectors. Also, a possible negative effect on the stability of the current ETS was feared. To

[37] Studies like the one of Maj et. al prove the low price elasticity. (Maj et al. 2021)

sum it up, the introduction of the new sectors to the trading scheme was preferred to happen as a separate system. (European Commission, Public Consultation on Updating the EU ETS 2021; Energie Baden-Württemberg 2021; European Trade Union Confederation 2021) Also, stakeholder groups appreciated the application of a market stability reserve for ETS II as they already did for ETS I. (Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021)

Industry initiatives like the ZIA demand that revenues which are generated by the auctioning of the emission allowances should be primarily used for the building sector in turn – especially for the renovation of the building stock, but also for social payments for low-income households. Additionally, concerns about already existing ETS covering the buildings sector[38] and their co-existence or integration with the ETS II were brought up. The association feared a double financial burden for the building sector in Germany concerning those pre-existing systems. (ZIA Zentraler Immobilien Ausschuss e.V. 2020) Additionally, the Union of Property Owners criticises the fact that the sector will be covered by the ESR as well as the ETS going forward. Generally, it complains about an overburdening of the sector with responsibility for decarbonizing Europe. (International Union of Property Owners 2020)

At the same time, it preferred a separate ETS for sectors which would however still introduce a common price for emission allowances. It instead welcomed the system of the regulated entities being the ones releasing fuels for consumption which decreases the administrative burden. It also noted how important it is to closely monitor the effects of the ETS II on owners of buildings. (ZIA Zentraler Immobilien Ausschuss e.V. 2020)

[38] There is for example a national ETS in Germany which started operating in 2021 in accordance with the Fuel Emissions Trading Act (Brennstoffemissionshandelsgesetzes). The newest proposal of the ETS II introduces an exemption for those fuel distributors – the Member States can exempt them from the duty to purchase emission allowances when they are already covered by a national trading system. Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021)

It can be said that most of the concerns of the respondents have thereby been addressed by altering the proposal for the new ETS II by including price stability mechanisms, a price cap for the first couple of years, a market stability reserve and introducing the new ETS as a separate system. (Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021; Energie Baden-Württemberg 2021)

5.2.3 Effects of the proposed revision on the commercial real estate sector

It is to be noted that as of now, the existing ETS I already covers circa 30% of GHG emissions made up of district heating emissions as well as emissions from electricity used for heating purposes. What is not included in the combustion of fossil fuels to directly heat buildings.[39] (Proposal amending Directive 2003/87/EC, Decision 2015/1814/EU and Regulation 2015/757/EU 2021) At this point, it is important to distinguish again that this thesis treats the effects that the revision will have on investors in the commercial real estate sector even though large effects, including socially relevant ones, are expected to impact the residential sector as well. But commercial buildings such as offices are also heated and should therefore be taken into consideration.

The ETS II covering the heating of buildings sector will especially have an impact on operational carbon – which as we said above makes up 71% of total GHG emissions of the building sector. Its effect in combatting climate change should therefore not be underestimated. (Adams, Burrows et al. 2019) Multiple studies have proven ETS to be a successful tool in decreasing GHG emissions in the past. (OECD 2022; Cludius et al. 2019, 145-162; Teixidó, Verde, and Nicolli 2019a, 106347; Teixidó, Verde, and Nicolli 2019b, 106347; Bayer and Aklin 2020, 8804-8812; Cadez, Czerny, and Letmathe 2019, 1-14) However, most carbon trading systems did not live

[39] It is for example the case that heating systems such as heat pumps increase a building's use of electricity. Therefore, this heat production would have already been covered by the EU ETS which covers emissions from power pants and therefore would have been part fo the 30% already covered. (Council of the European Union 2023b; Council of the European Union 2022; European Environment Agency 2022)

up to their full potential due to too low prices as was also the case with the EU ETS I. (OECD 2022)

A study by Cambridge Econometrics has predicted that by including transport and the buildings sector in the ETS the emission reductions in those sectors would decrease quicker than by not introducing them. However, it is still expected, that both of the sectors would not be able to deliver their share of emissions reductions, and other sectors would overcompensate. (Stenning, Bui, and Pavelka 2020) The European Commission's impact assessment model predicts significant emissions reductions between 2.9% and 11.7% in buildings by 2030 depending on the assumed carbon price. (European Commission 2021d) Some even argue that the new ETS II is expected to be as efficient as the ETS I was before. (Perner and Peichert 2021) Adversely, there are also papers relativizing the findings of the impact assessment. Stenning, Bui and Pavelka (2020) found smaller emissions reductions under the scenario of linked prices from ETS II to ETS I – as the Commission is aiming for in the medium term. To have good results with the ETS II a very high carbon price of € 170 per tonne would be needed.[40] (Maj et al. 2021)

However, most research agrees that the new ETS can provide sufficient price signals for carbon mitigation. (Anke and Möst 2021, 112125; Pollitt and Dolphin 2020; Maj et al. 2021; European Commission 2021d; Perner and Peichert 2021) Therefore, investors in commercial real estate should be aware of this trend and move along with it.

However, it is estimated that current real estate value will not significantly be affected by the introduction of the new ETS. Instead, it is only the energy companies as well as tenants or owner-occupiers who will pay the additional price imposed for the heating. (Chadwick et al. 2021) This is in contrast to the argument of tenants preferring houses with a more energy-friendly heating system which could lead to the development of a green rental and valuation premium for houses that meet those preferences. As long as the

[40] This would however not be possible to reconcile with social objectives. Revenue distribution to socially equilibrium funds like the social climate fund on the other hand would make the ETS less efficient again. (Maj et al. 2021)

overall rent increase via the green premium does not surmount the savings in heating costs including the passed-on carbon price from energy producers. (Chadwick et al. 2021)

A more detailed look at the German ETS for building system which started operating in 2021 however reveals an important twist for real estate investors with regards to this responsibility of tenants. The ETS in question covered, just like the ETS II will do, the transport and building sector. The regulated entity was defined similarly to the one of the ETS II and initially set a fixed price of € 21 per emission allowance. The price was gradually increased to € 55 in 2025 after which there would only be a price corridor for the emission allowances. The price corridor will be set after an evaluation of the functioning of the system in the years before. (Mariani and Heinzel 2021)

A notable discussion point in the establishment of the Act was who would cover the additional price for heating costs. Initially, it was discussed whether tenants and landlords should share the price increase. Some associations were calling for landlords to cover the full additional cost. At first, the final decision fell upon the tenant being obliged to pay the full price. (Mariani and Heinzel 2021) But later on, the new government has amended the act with a new law which is in operation from January 2023. For all rental contracts signed for non-residential properties before 01.01.2023, the landlord has to cover at least 50% of the additional cost incurred due to the carbon price. The share of the landlord can be decreased by performing a significant renovation to increase energy efficiency. Then the initially determined percentage can be cut in half. This mechanism will ensure that sufficient incentives for real estate owners exist to push the renovation wave. (Bundesregierung, Kohlendioxidkostenaufteilungsgesetz 2022)

A similar adjustment may be made to the EU ETS at some point regulating the sharing of the carbon price. This would then change the impact that the new EU ETS would have on investors in real estate as it would then become a relevant change in financial models and therefore impact the valuations

of buildings. (Mariani and Heinzel 2021; Bundesregierung, Kohlendioxidkostenaufteilungsgesetz 2022)

6. Impacts on the commercial real estate sector through the dependency on the financial sector

6.1 Overview of current EU Taxonomy

The financial sector has a huge influence on the real estate sector. Already when analysing current market trends in the commercial real estate sector this thesis touched upon the high importance of leverage in the commercial real estate market. With this dominant market characteristic comes a high influence on providing real estate investors with incentives to transition their portfolio assets into net-zero assets. (De Oliveira Neves 2022, 249-266; European Commission, Communication EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties 2021)

The most important legislation covering all industries – therefore non-financial as well as financial companies - is the Taxonomy Regulation published in the summer of 2020 and came into force at the beginning of 2022. It is still being updated with new Delegated Acts detailing every aspect of the regulation. It was the response of the EU legislative body to the need for a common classification of sustainable activities. This common classification should decrease the amount of greenwashing in the financial services industry and instead increase comparability for consumers of financial products and overall help in achieving the Green Deal objectives. (Recital 14, Recital 20, Regulation 2020/852/EU; European Commission, Communication EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties 2021; Freshfields Bruckhaus Deringer 2021)

The Taxonomy is built upon six sustainability-related objectives – one of them being climate change mitigation.[41] The Taxonomy classifies economic activities as contributing to sustainable activity if the economic activity is

[41] The other five objective are climate change adaptation, sustainable use and protection of water and marine resources, pollution prevention and control, protection and restoration of biodiversity and ecosystems and lastly the transition to a circular economy. (Regulation 2020/852/EU)

supporting at least one of the environmental objectives while not doing significant harm to any of the other ones. Additionally, the economic activity has to adhere to minimum social safeguards to support the just transition and leave no one behind. [42] (Recital 6, Recital 25, Article 3, Regulation 2020/852/EU) The Taxonomy has also built up Technical Screening Criteria[43] (TSC) in Delegated Acts, which help to determine whether or not an activity supports one of the environmental objectives and/or does significant harm to any of the other objectives.[44] (European Commission, Communication EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties 2021)

The Delegated Act for Climate Change Mitigation and Adaptation also covers Construction and Real estate activities[45]. (Delegated Regulation 2021/2139/EU) Some of the criteria for an activity to be classified as sustainable are for example that any property which was built before 2020 will be required to achieve an EPC class A or higher. Alternatively, it can fall under the top 15% of the respective national building stock. Buildings built after 2021 need to be energy efficient enough to be at least 10% below the NZEB standard of their respective country. For existing buildings,

[42] On the other hand, the non-classification as environmentally sustainable does not mean that an activity or a company is environmentally unsustainable, The Commission is aware that a number of economic activities are not yet defined in the TSC and therefore cannot be classified as environmentally sustainable. The TSC are not yet detailed enough and will need to develop further in order to cover all economic activity. The Taxonomy currently does not define how activities other than environmentally sustainable are to be labelled. It also does not prescribe specific ratios of environmentally sustainable economic activities that investors need to meet in their portfolios. (European Commission, Communication EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties 2021)

[43] The TSC were based on the work of the Technical Expert group and were tested by collecting public feedback by the Platform on Sustainable Finance. (European Commission, Communication EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties 2021)

[44] The TSC for climate change mitigation and climate change adaptation were already published in April 2021. (Delegated Regulation 2021/2139/EU) For the other four goals a draft as an amendment to the current version was published in 2023. (Commission Delegated Regulation C/2023/3851 supplementing Regulation 2020/852/EU)

[45] The activities for which TSC exist are the construction of new buildings, the renovation of existing buildings (individual renovation measures consisting of installation, maintenance and repair of energy efficiency equipment, of charging stations for electric vehicles in buildings, of instruments and devices for measuring, regulation and controlling energy performance of buildings, as well as of renewable energy technologies) and the acquisition and ownership of buildings. (Delegated Regulation 2021/2139/EU)

renovations must decrease the primary energy demand by at least 30%. However, there are more criteria to be fulfilled for commercial real estate to be classified as sustainable. (Gross 2022; Annex 1 – 7.1, 7.2 , 7.7 Delegated Regulation 2021/2139/EU; EPRA 2022)

It is important to note that by basing the criteria on the EPC standards, the ensures that it will have control over the exact scope of the legislation as it can keep influencing the definition of the EPCs in the future. Some actors like the International Capital Markets Association have criticised the EU for not including green building certifications instead. (Backenroth and Lindqvist 2021)

The Taxonomy is used by non-financial companies covered by the CSRD which are required to report on climate-related KPIs in their non-financial statement in terms of the proportion of turnover, capital expenditure and operating expenditure that are aligned with environmentally sustainable economic activities. Meanwhile, financial companies offering financial products in the EU have to report several KPIs[46]. The Taxonomy with its TSC will therefore also act as a guide for investment decisions as companies wanting to improve the KPIs to be disclosed will need to adhere to these rules. (Recital 22, Article 8 (1), Regulation 2020/852/EU; De Oliveira Neves 2022, 249-266; Brühl 2023, 57-83)

For this chapter we will not be analysing the sector's response to the Taxonomy – as the Taxonomy did not come with one single legislative act, but rather with an abundance of regulations, directives and delegated acts. An analysis of industry participants' reactions to every single one of these would not be in the interest of this thesis.

6.2 Overview of the current SFDR

Another important Directive related to sustainability reporting is the Sustainable Finance Disclosure Regulation (SFDR). It was introduced in the contect of the Sustainable Finance Action Plan which also initiated the

[46] An example for one of these KPIs is the green asset ratio, which is computed by taking the proportion of a credit institution's assets related to taxonomy-compliant economic activities compared to the total assets. (European Banking Authority 2021; Brühl 2023, 57-83)

development of the Taxonomy and is demanding sustainability reporting from financial market participants and financial advisors including investment firms, fund managers and insurance companies – which also invest equity on behalf of others. (Recital 7, Recital 8, Article 1, Article 2, Regulation 2019/2088/EU; Rolo 2022, 119-216) Also, investors and asset managers as part of the commercial real estate universe meet the requirement to be classified as financial market participants or financial advisors under the SFDR. (Loyens & Loeff 2023)

The regulation has requirements for the company level but also on the product level for sustainability transparency. Typical services or products offered include asset management in a classical sense, but also insurance products as well as retirement plans. The required reporting asks for "*integration of sustainability risks, on the consideration of adverse sustainability impacts, on sustainable investment objectives, or on the promotion of environmental or social characteristics, in investment decision-making and in advisory processes*". (Article 1, Regulation 2019/2088/EU) It, therefore, is based on the principle of "*do no significant harm*"[47] which is implemented with the disclosure of the so-called Principal Adverse Impact (PAI) which at this point need to be disclosed with the current measures put into place to avoid these. (Recital 17, Recital 18, Recital 20, Article 4, Regulation 2019/2088/EU)

The SFDR included specific rules for the classification of real estate investments. The term "*inefficient real estate asset*" was introduced and means those buildings that were built before the end of 2020 with an EPC of C or below and all assets built thereafter with an EPD below NZEB according to Directive 2010/31/EU. A high share of investment in energy-inefficient real estate assets was then added to adverse sustainability indicators companies could report on. Additionally, the waste production in operations, the GHG emissions, as well as resource consumption and land

[47] This principle means "*that neither the environmental nor the social objective is significantly harmed*". (Recital 17, Regulation 2019/2088/EU)

artificialisation, were indicators to report on. (Annex 1, Delegated Regulation 2022/1288/EU)

6.3 Impact of Taxonomy and SFDR on the commercial real estate industry

On one hand, big players in the commercial real estate industry will need to comply with the disclosure requirements that stem from the EU Taxonomy. They will, therefore, need to apply the TSC and figure out which of their economic activities classify as environmentally sustainable and disclose their turnover, capital expenditure and operational expenditure. The current problem is that these companies are as of now struggling to collect the required data which is needed to apply the TSC. A study by the Green Building Association has shown that by 2021 non-residential building construction projects had insufficient data to assess around 45% of the Taxonomy criteria. (Regulation 2019/2088/EU; Regulation 2020/852/EU; German Sustainable Building Council et al. 2021)

However, this chapter wants to focus mainly on the effects that the disclosure requirements of the Taxonomy, as well as the SFDR, have through financial institutions on real estate companies, as those effects are expected to be the main ones to come into play, which will also additionally pressure disclosing real estate companies to increase their efforts to decarbonize.

To start off, it can be claimed that the SFDR had a similar problem of undefined ways of disclosure just like the NFRD did above. There is still a lot of flexibility on how to report on the different topics demanded by the regulation. (Humphreys 2021) The EBA, ESMA and EIOPA now developed Regulatory Technical Standards (RTS) which define more closely the methodologies, presentation and relevant information to be disclosed. (Rolo 2022, 191-216) However, the publication and adoption have been repeatedly postponed and underly a constant process of update and adaptation. There is, therefore, little regulative security for market

participants.[48] (Joint Committee of the European Supervisory Authorities 2023)

At the same time, the SFDR, as well as the NFRD, will both be able to decrease the level of greenwashing and therefore demand real sustainable investment practices. This means that all sectors, including the commercial real estate sector, will aim for higher ambitions concerning sustainability action and decarbonization. This means in turn a decrease in the potential effect of transition risk in the future. (German Sustainable Building Council et al. 2021)

Another aspect, which was already brought up for the NFRD and CSRD is the cost which will be incurred by real estate companies to comply with the reporting requirements. Especially in the first years market actors need to act quickly to keep up to date with upcoming reporting requirements. They need to collect data and therefore adjust internal processes, understand the alignment requirements, make sure employees understand the new rules and find a suitable auditor. (EPRA 2022; Freshfields Bruckhaus Deringer 2021; Feng and Wu 2021, 1-35)

Another problem lies in the practicability of some of the regulations. For the Taxonomy some of the TSC laid out are still hardly applicable and leave wide information gaps. For example, the determination of the top 15% energy-efficient buildings within the building stock of a country up to now is left to be defined by the nations themselves and there is no EU-wide methodology for this yet, even though the criteria are already being applied. (EPRA 2022; German Sustainable Building Council et al. 2021; Regulation 2020/852/EU) This is in turn leading to an unlevel playing field for real estate companies. Some of the companies also act in different countries within the EU and own real estate property across different countries. They, therefore, need to consider different thresholds for different nations.

[48] In July 2022 the final RTS were eventually published as Commission Delegated Regulation (EU) 2022/1288 in the Official Journal of the EU. However, there are still efforts to revise and update them accordingly. For example, in April 2023, there was a draft for a thorough review and update of the RTS published. (Joint Committee of the European Supervisory Authorities 2023; European Commision 2022)

Eventually, the two regulations will have impact valuations of real estate properties. (Freshfields Bruckhaus Deringer 2021; Pivo and Fisher 2010, 243-270; Strathon et al. 2021; Fuerst and McAllister 2011, 45-69; Fuerst, Gabrieli, and McAllister 2017, 137-146; Mangialardo, Micelli, and Saccani 2019)

The valuation will be impacted by rental value, as for the valuation of commercial real estate mostly income capitalisation methods – like for example the direct capitalisation approach or the discounted cash flow (DCF) model - are used. (Strathon et al. 2021; Morri and Paolo 2019; Pivo and Fisher 2010, 243-270)

$$\text{Direct Capitalisation approach: } V = \frac{I}{r}$$

$$\text{DCF Model: } V = \sum_{i=1}^{n} \frac{F_t}{(1+k)^t} + \frac{R_{n+1}}{GOCR}$$

where V = valuation; I = R = income; r = cap rate[49]; F = cash flow at time t; k = discount rate; n = last period in the time horizon; GCOR = going-out cap rate[50]; T = time.

While detailing which valuation methodology to apply in which use cases, goes beyond the scope of this thesis the formulas above are useful, to understand the influence that rental value and cost of capital have on the price of properties. The valuation gets higher the higher the rental payments which flow into the numerator are.

The valuation will decrease the higher the cost of capital. In the Formula for the direct capitalisation approach this would influence both the numerator and denominator as the income in the numerator decreases with higher interest payments and the denominator increases with a higher expected return by capital givers due to the higher risk. In the DCF the weighted average cost of capital (WACC) and therefore the denominator would increase with the higher expected return by capital givers and the cash flow would not be influenced, as line times like interest payments do not influence the cash flow described in the numerator.

[49] The cap rate is the expected market income yield. (Morri and Paolo 2019)
[50] This describes the projected expected market income yield at the time of exiting, i.e. selling the real estate property. (Morri and Paolo 2019)

Getting back to the influence of the decarbonization policies, the increase in rental income is induced via two factors: an increase in demand by tenants for sustainable buildings as well as a limited supply of this type of building on the market. (Strathon et al. 2021; Dangl, Smith, and Chadwick 2022; Freshfields Bruckhaus Deringer 2021) As of today, the pressure on companies and people to decrease their carbon footprint keeps rising. (De Oliveira Neves 2022, 249-266) Therefore, also tenants will want to decrease their carbon footprint and prefer to sign rental contracts for sustainable buildings. Meanwhile, the savings of operating expenses in LEED-certified buildings do not outweigh the premium paid on rent for it. This gives rise to the reasoning that intangible effects like reduced staff turnover and absenteeism as well as image and reputation benefits weigh strongly for tenants. (Reichardt 2014, 413-433) Already 95% of asset managers agreed that space with low energy efficiency is getting harder to rent out.[51] (Schweizer et al. 2023)

This effect, however, depends also on the market power that occupiers have in the market. While there is a general shortage of industrial properties, occupiers do not get to freely pick which space to rent and therefore might need to step back from their wish to rent an especially sustainable building. Other property types like offices currently have more of an occupiers' market with abundant office space available and therefore the tenants have more decisive power over which space to eventually rent out. (Dangl, Smith, and Chadwick 2022; Strathon et al. 2021)

Research has found that sustainability certifications of buildings like LEED and Energy Star contribute to higher rental rates. (Bond and Devine 2016, 117-140; Fuerst, Gabrieli, and McAllister 2017, 137-146) The increase in cash flow is due to the fact that real estate properties with high sustainability ratings enjoy better tenant retention rates – and even when tenants do change, the higher demand for sustainable space will mean that the time to rent will be reduced and the buildings will not stay vacant for a

[51] 95% of respondents agreed strongly or a little with the statement "*Spaces with low energy efficiency are increasingly harder to rent out.*" (Schweizer et al. 2023)

long time. (Strathon et al. 2021; Pivo and Fisher 2010, 243-270; Holtermans and Kok 2019, 685-722)

Let us now come to the second effect: the decrease in risk means that the cost of capital, the exit cap rate and the cap rate will decrease, therefore increasing valuations. (Pivo and Fisher 2010, 243-270; Hsieh, Claresta, and Bui 2020; Strathon et al. 2021) One of the effects is the above-mentioned fact that real estate companies that can show off higher alignment with the Taxonomy will have a competitive advantage when it comes to securing new financing or refinancing older findings. This effect can depend on the current market environment – in the case of the current market environment with debt funding for commercial real estate getting harder to secure as it was mentioned above – the sustainability factor might just help to secure any financing at all. (Loyens & Loeff 2023; Strathon et al. 2021)

However, studies have found that green buildings carry less default risk – with some studies arriving at 34% less default risk. As of 2020, the interest rate reduction was found to be about 15 basis points with earlier studies arriving at higher discounts of about 24 to 60 basis points for REITs. Also, the related cost of debt is adjusting accordingly with increasing speed over time – with more recent data showing higher reductions in the cost of debt. Additionally, the better the certification for the property in question, the higher the reduction in the cost of debt. (An and Pivo 2020, 7-42; Eichholtz et al. 2015; Eichholtz et al. 2019, 19-32; Fonseka, Tian, and Al Farooque 2020, 195-221) While some research says, that debt capital givers do not fully price in the full decrease in default risk yet (An and Pivo 2020, 7-42) others argue that at least the environmental risk is efficiently priced in. (Eichholtz et al. 2019, 19-32)

The main reason for this increase in default risk is for once the green rent premium which is explained above. This effect can also lead to a decrease in typical financial covenants used by investors to evaluate whether and to which conditions to grant a loan. One of the examples of this is the debt

service coverage ratio[52], which increases with increased rent. (An and Pivo 2020, 7-42)

But also, the increase in value itself affects this type of financial covenant – mainly the LTV ratios. The ratio increases with increased valuation and therefore has positive effects on the terms of financing. (An and Pivo 2020, 7-42) This is therefore creating a virtuous cycle of additionally increasing the valuation of sustainable real estate.

Additionally, an abundance of studies has shown that having sustainability certifications for buildings decreases the cost of equity for them. (Hsieh, Claresta, and Bui 2020) One of the reasons for this is that companies that report sustainability information already do not risk being negatively screened by investors which require at least some form of transparency. (Duijzer, Sinke, and Pott 2022)

7. Resulting recommendations for actors in commercial real estate

7.1 Overall action recommendation

In the past chapters, we have analysed different European policies that already exist, have come into effect by now or will become effective within the next years as well as policies that are still being drafted. We have analysed their content as well as the possible effects that they will have on investors in the commercial real estate market. Now, it is time to aggregate the collected information and paint a picture of which actions players in the commercial real estate market should take to adapt to the new regulatory environment. This will be done, by also considering the current market environment. (Oliver 2023)

For the regulations which are already detailed, published and in effect most companies which are regulated entities are already complying with them. However, the regulations which are coming into effect later even though already developed will need most work for the players to be compliant with

[52] The debt service coverage ratio is calculating how many times the debt service (made up of principal repayment and interest payments) can be covered by the operating cash flow generated by a project. (Morri and Mazza 2014)

them. The drafted future regulations with a further need for negotiation pose an additional layer of uncertainty to investors.

However, the regulatory attention when it comes to decarbonization stresses the importance of reaching the climate goals for the EU. One can be sure at this point that climate change is here to stay as one of the most important topics for the next holding periods of real estate investors. It is therefore of utmost importance for investors to dedicate sufficient attention to the topic and wage its influence on their business model. Asset Managers of real estate have realized this and see the incorporation of ESG topics as their biggest challenge and have grasped the importance of a timely energetic transformation. (Schweizer et al. 2023; Chadwick et al. 2021)

In the chapter below the action fields of a current investor in commercial real estate are explained in more detail.

7.2 Ensuring compliance with current regulation

The most important action point that real estate investors need to be able to ensure is to comply with current legislation, which will come into effect later to keep their license to operate. The legislation covered by this would be especially the Taxonomy, the CSRD as well as the SFRD. That compliance is not as easy as it seems can be seen by the fact that only 11% of real estate asset managers thought they could fully comply with the reporting and disclosure requirements of the EU Taxonomy.[53] (Schweizer et al. 2023)

For the Taxonomy as well as the SFDR a whole new approach is necessary to fulfil the new requirements. As the CSRD is building on the NFRD some investors might already have a basic process they followed within the last years to apply for the upcoming reporting years. But with the widening scope of companies that will have to comply with the disclosure requirements, many new companies will adjust additionally. (Communication EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties 2021; Directive 2022/2464/EU)

[53] 11% of respondents strongly agreed with the statement: "*We can fully comply with the reporting and disclosure requirements of the EU Taxonomy*" (Schweizer et al. 2023)

Investors should first analyse which regulatory framework they fall within and will have to comply with in the future. For those regulations, the investors should understand the alignment requirements and begin to set aside sufficient resources in the upcoming periods to ensure their compliance. As there is currently a big lack in data availability and data reliability additional data capture will be necessary for the new disclosure legislation. Market participants also need to take into consideration the overlap of regulations and the impact of such cross-over effects on information disclosure. (Attal et al. 2020; German Sustainable Building Council et al. 2021)

An example of this is one of the TSC of property constructed before the end of 2020 needing an EPC class "A" or higher or falling within the top 15% of the national building stock which is required in the EU Taxonomy. With the revision of the EPC through the EPBD and their harmonization on a European level the buildings which fall under taxonomy aligned or which are not aligned might change within some years. (Annex 1 – 7, Delegated Regulation 2021/2139/EU; Directive 2022/2464/EU; Gross 2022; EPRA 2022)

Investors in commercial real estate should then start to prioritize according to the different timelines and start to set up internal processes to generate (find the baseline), manage and disclose the required data. This will be a challenge for some market players, as 73% of asset managers have not yet fully collected the required data for the calculation of the carbon emissions for their portfolio according to a survey of EY Real Estate.[54] (Schweizer et al. 2023)

In the beginning, this might also entail additional consulting from specialists as well as additional training for employees for them to understand the new rules. Eventually, companies will need to find a suitable auditor – at least

[54] Only 27% of respondents of the survey strongly agreed hat the "*collection of data for the calculation of the carbon emissions for the full portfolio were collected and evaluated*". (Schweizer et al. 2023)

for the reporting according to the CSRD. (EPRA 2022; Freshfields Bruckhaus Deringer 2021; Feng and Wu 2021, 1-35; Attal et al. 2020)

Another possibility is to build a strategic partnership or just use the services of start-ups, which focus on real estate, decarbonization and compliance with the newest legislative requirements. (Dulac et al. 2022) There are several start-ups like Alasco or Building Minds which have focused on software that supports real estate investors to collect data, analyse and visualize them and plan and prioritize their decarbonization measures. (Alasco 2023; Building Minds 2023) Also, companies like IDS data, a subsidiary of Allianz, support with complying to SFDR and EU Taxonomy. (IDS data n.d.)

7.3 Portfolio steering

To recommend fitting actions for investors in a structured way the thesis wants to use two different points of view. The first one is an investor who is looking at how to improve the management of his current portfolio (which also includes the possible selling of portfolio properties) and the second one is an investor wanting to acquire new portfolio properties. The second layer of the analysis concerns whether the investor is focusing on green buildings or conventional buildings. A cluster showing how those four categories interact is created.

	Management of portfolio properties	**Acquisition of new portfolio properties**
Green buildings	Holding/selling of green buildings	Analysis of acquisition options of green buildings to hold
Conventional ("*brown*" buildings	Management of stranded asset risk and analysis of potential renovation options	Analysis of acquisition options of conventional buildings to renovate

By looking at the current market environment with increased interest rates and devaluations in real estate markets, there are fewer transactions to be found on the market – instead, companies are focussing on the optimization of their current portfolio. (Schweizer et al. 2023) The acquisition perspective

might still become relevant for investors wanting to take advantage of the current market. Investors looking to acquire new buildings can, therefore, consider engaging in development projects of green commercial real estate. The outperformance of total returns on green buildings as compared to conventional properties will especially keep being a valid argument, while the supply of green buildings cannot meet the demand for them. (Pivo and Fisher 2010, 243-270) In the upcoming year policies like the EU ETS for the building sector might still further increase the demand for energy-efficient buildings – as the additional energy cost through heating will then make it more profitable to spend more on space rent and save on operation costs. (Chadwick et al. 2021)

Therefore, moving quickly now promises to make the capital expenditures on building new buildings or renovating buildings and improving their energy performance yield more than investing later on. As of now, investors can still benefit from subsidies, as regulators are willing to support those that are contributing to accelerating decarbonization. Investors should still work closely with the developers and construction professionals to correctly evaluate additional costs incurred to develop a zero-emission building. (Dangl, Smith, and Chadwick 2022)

Later on, legislation on energy performance requirements will become so strict that real estate owners will hardly have any other choice than to invest in green buildings. But by then, the market might have outbalanced the undersupply of green buildings and therefore nullify current premiums in rent and capital values over time. (Dangl, Smith, and Chadwick 2022; Freshfields Bruckhaus Deringer 2021; Akomea-Frimpong et al. 2022, 131869)

Timing is therefore key and one needs to consider the different maturity of the investment market as of now. For new acquisitions of real estate including ESG criteria in the due diligence process is already increasingly becoming the new normal – therefore the green premium could soon start to diminish. (Schweizer et al. 2023; Jackson and Orr 2021, 362-380; Anghel and McGreal 2017, 2-3) Collecting data on supply and demand should therefore be a priority in inefficient markets like commercial real estate, to

find correct timing and imbalances that lead to green premiums at a convenient level for the player in question. (Dangl, Smith, and Chadwick 2022) Working closely with former, current and future tenants can be a key source of information for the development of demand and willingness to pay. (Schweizer et al. 2023)

For investors who already own a lot of sustainable real estate and are looking to increase the share of green buildings in their portfolio, they have to be mindful not to fall into a trap which Fuerst, Gabrieli and McAllister (2017, 137-14) called the "*green winner's curse*". It describes the phenomenon that eco-investors are willing to pay a higher premium for eco-certified investors than other investors are willing to.

Instead of acquiring or constructing green buildings one could also follow a value-add path and renovate buildings oneself. This way paying a green premium on buildings that were developed to be green – however, the green cost premium would still need to be paid. However, "*studies have found that the present value of the reduced operating costs alone is sufficient to cover the construction cost premium*" (Fuerst and McAllister 2011, 45-69) This becomes even more relevant when one considers that landlords might have to pay for climate certifications like it is the case for the Brennstoffemissionshandelsgesetz in Germany. This would demand to consider not just the willingness to pay of tenants but also of landlords.[55] Hence, for commercial real estate investors, it would But once again investors need to work closely with construction professionals to correctly evaluate the renovation costs to be incurred to make the building more energy-efficient or even a zero-emission building. (Dangl, Smith, and Chadwick 2022)

If a renovation for existing buildings is not an option, market players need to observe markets closely to phase out obsolete buildings in a timely manner and avoid unexpected, stranded assets in their portfolio. This calls for a thorough risk management approach, which is also required by the

[55] Up to now, real estate investors had always agreed that the current carbon price is too low to invoke any real action – especially with them only indirectly concerned with the increased cost of heating. (Chadwick et al. 2021)

SFDR to be disclosed by financial market players falling under its scope. Nowadays, physical and transition risks are only collected and evaluated by 19% of real estate asset managers.[56] (Schweizer et al. 2023) This is especially relevant considering transition and physical climate risk can have a significant impact on real estate valuations. (Robson 2021; Reid 2020)

Implementing sustainability risk management is however still a relatively new field in the real estate investment industry. Risk management should entail that investors keep up to date with recent legislative developments and follow closely regulations that are still being drafted as of today like the ETS for the building sector and the EPBD will only come into effect later. (Robson 2021) Investors should build thorough competence and know-how to adequately assess risk stemming from building obsolescence in case the buildings cannot be renovated and refurbished to meet the new regulatory requirements. It is important to monitor exactly when the best time for renovations is possible. (Dangl, Smith, and Chadwick 2022)

Especially when it comes to the modelling of emission trading systems and their potential impact on real estate cash flows. "*For alternative investments such as real estate, risk modelling is generally challenging and, both, highly data-sensitive and -dependent. […] The data scarcity and methodological uncertainty surrounding new risk factors in the field of sustainability increase the challenge to implement risk management systems even more.*" (Oertel et al. 2022; Oertel 2019)

Also, solutions already exist. There are several companies that for example innovate building energy management systems and building battery storage which could prove to be very helpful for improving one's climate performance. (Dulac et al. 2022)

7.1 Decarbonization strategy

Another important point that every player should consider is how to decarbonize their business in a detailed plan, as at some point in time decarbonization will become mandatory through various legislative

[56] Only 19% of respondents of the survey strongly agreed that the "physical and transition risk were collected and evaluated for the full portfolio". (Schweizer et al. 2023)

requirements. The decision to decarbonize does not need to imply immediate decarbonization in the fastest way possible and at whatever cost. Investors should just generally include the current legislative environment and the changes in consumer behaviour in their investment strategy. (Attal et al. 2020; CBRE n.d.)

Having a long-term decarbonization plan with a clear strategy in terms of operations and capital expenditures is essential for managing the new market environment. This can include building a team of knowledgeable employees, understanding one's carbon footprint baseline and setting targets. For target setting it is advisable to certify them by a market-renowned organization like the Science Based Targets initiative.[57] as well as building a strategy out of this information. Tracking progress over time while carrying out the action plan can be important to monitor whether one is on track with its commitments. (Dulac et al. 2022; CBRE n.d.)

As there are also a lot of asset managers active in the commercial real estate market also those should find a way of incorporating climate risks into their investment processes. (Science-based Targets Initiative 2023)

7.2 Explore green financing options

The need for financing when investing in real estate comes inherently with the fact that the building's price is to be paid upfront, while the building's cash flows only start flowing in afterwards. Green buildings increase this effect as the upfront cost is even higher while renewable-energy renovations add the need for financing during the building's lifetime. (He et al. 2022, 112973) This additional up-front cost is also called add-on cost and is an obstacle to the further development of green buildings. (Ying Liu, Pheng Low, and He 2012, 50-63) This is because the reward in terms of operational cost saving or the achievement of a green premium when selling the building is only realized afterwards. (He et al. 2022, 112973) Therefore, green financing has a huge role to play in the further development of green real estate. (Backenroth and Lindqvist 2021)

[57] The Science-based targets initiative is an association which helps companies define an emission-reduction path in line with the requirements of climate science in order to achieve the Paris Agreement- by limiting global warming to 1.5°C above pre-industrial levels.

Apart from the de-risking benefits that come inherently with a real estate investor that has a high ratio of green buildings in its portfolio and the benefits of using green finance to develop new buildings or refurbish old ones is a way of achieving favourable lending conditions as we have explored before in chapter 6.3. This can then in turn lead to superior economic investment returns and generate additional shareholder value. (An and Pivo 2020, 7-42; Eichholtz et al. 2015; Eichholtz et al. 2019, 19-32; Fonseka, Tian, and Al Farooque 2020, 195-221; Dulac et al. 2022; Akomea-Frimpong et al. 2022, 131869; Gilchrist, Yu, and Zhong 2021, 478)

Another reason to use green financing options for financing the transition of one's portfolio is the reputational advantage of advancing quickly in the market. This comes with green competitive advantages over other companies as well as a positive impact on one's ESG score or sustainability rating. (Dangl, Smith, and Chadwick 2022; Akomea-Frimpong et al. 2022, 131869; Patterson and Ramkumar 2021)

However, companies using green financing instruments should be careful about which instruments they use specifically so as not to get into an uncomfortable position of defending against green-washing accusations. (Akomea-Frimpong et al. 2022, 131869) Instruments that are generally less prone to fall under greenwashing accusations are green loans[58] and green bonds[59]. This applies if the use of proceeds[60] is correctly carried out according to a green financing framework with according documentation

---

[58] "*Green loans are any type of loan instrument made available exclusively to finance or re-finance, in whole or in part, new and/or existing eligible Green Projects.*" (Loan Market Association and International Capital Market Association 2018; International Capital Markets Association 2022)

[59] "*Green Bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects […] and which are aligned with the four core components of the GBP.*" (International Capital Markets Association 2022) A new definition for green bonds emerged from the EU Green Bond Standards, which includes the standards of the ICMA definition, but requires additionally the alignment with the EU Taxonomy. (European Commission 2021e)

[60] The term "*use of proceeds*" means that the additional financial means generated through green financings will be used for the financing or refinancing of green projects. For the different green financing instruments the concrete projects need to be defined in a finance document as well as reported upon regularly. (Loan Market Association and International Capital Market Association 2018)

and reporting. (Patterson and Ramkumar 2021; Backenroth and Lindqvist 2021)

However, the green finance market is still under development when one excludes government-provided green finance options. He et al. call for "*efforts from both the green finance market and the GB property market to form a virtuous circle in between.*" (He et al. 2022, 112973) Therefore there is also a lack of coverage of the topic by academic research. (Debrah, Chan, and Darko 2022, 108443)

8. Conclusion

The thesis sheds light on current regulatory challenges that impact investors in commercial real estate.

By first having a look at the commercial real estate market environment as of now as well as important market players the addressees of this thesis were clarified. Also knowing the background of the current strained market situation can help put into perspective new regulatory changes and the additional burden it might imply for commercial real estate investors and asset managers.

The thesis then described the current state of GHG emissions in the sector and introduced important concepts like embodied and operational carbon. The distribution of GHG emissions across both emission types as well as between residential and commercial real estate properties was explored just like their GHG intensity. It was then presented which requirements for decarbonization were introduced by intergovernmental organizations like CRREM to fulfil the 2° as well as the 1.5°-scenario.

The thesis started then by analysing the most influential decarbonization regulations – separated within the ones already published (in effect or to be in effect) as well as draft regulation which will be published after further negotiations. The legislative pieces were split into the ones that would directly influence the real estate industry and the ones with dependency on the financial sector. The analysis of both is important to underline how past legislation has already influenced current market behaviour and how future

legislation, which sometimes also builds on old ones, will influence the market in the future.

The first directives analysed were therefore the NFRD as well as the CSRD as reporting requirements as well as the ESR. NFRD and CSRD will have direct influences on real estate players, especially REITs, which are listed companies and therefore will be directly required to publish their corporate sustainability information. However, the reporting requirement can influence tenant's demand for green buildings – as a lot of tenants will also need to report on their sustainability. Meanwhile, the ESR is mainly a macro-mechanism that also influences the decarbonization requirements of the real estate sector and can therefore increase the speed of the decarbonization of the sector.

As future decarbonization efforts in the commercial real estate sector, we analysed the EU ETS for the building sector as well as the draft EPBD. Both of the legislation's final version still needs to be negotiated. The EU ETS will as of the current draft mostly affect tenants and their cost of operation for their buildings in terms of heating costs. However, the increased cost of heating of tenants could then influence the willingness to pay on their side and additionally add to the increased demand for green buildings. The EPBD on the other hand will largely also influence building owners, as there are new strict requirements of energy performance classes for existing as well as new buildings.

Eventually, the impacts the financial sector has on the commercial real estate sector through regulations like the EU Taxonomy as well as the SFDR were analysed. While the EU Taxonomy will partly also directly influence real estate companies like REITs, as it has the same scope of application as the SFDR, the main effect will come via the requirements it imposes on financial market players. Investors in real estate will therefore still largely be affected by it - the SFDR and the EU Taxonomy will make those actors more concerned about their financial performance and put pressure on developing thorough risk management processes for physical and transitional climate risk. This will again increase the decarbonization of the sector.

As a last step, action recommendations for commercial real estate players were deducted – thinking about the effects of all the different legislations combined. The main fields of action identified were active portfolio steering, the development of a decarbonization strategy and seeking access to sustainable finance. Generally, a process to ensure general compliance with the current legislation is necessary.

The main conclusion that can be drawn from this thesis is that in times of higher regulatory attention towards decarbonization – also in the real estate space – it is advisable for investors in commercial real estate space to focus on decarbonization and risk management of non-green assets to avoid obsolescence in the form of stranded assets.

Bibliography

Adams, Matthew, Victora Burrows, Stephen Richardson, James Drinkwater, Cristina Gamboa, Christine Collin, Xavier Le Den, Lars Ostenfeld Riemann, Samy Porteron, and Qvist Secher. 2019. "Bringing Embodied Carbon Uprfont. Coordinated Action for the Building and Construction Sector to Tackle Embodied Carbon." World Green Building Council, accessed 17.01.2023, https://worldgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/09/22123951/WorldGBC_Bringing_Embodied_Carbon_Upfront.pdf.

Adams, Matthew, Victora Burrows, Stephen Richardson, James Drinkwater, Cristina Gamboa, Christine Collin, Xavier Le Den, Lars Ostenfeld Riemann, Samy Porteron, and Qvist Secher. 2019. "Embodied Carbon. Embodied Carbon in Buildings and Building Materials." World Green Building Council, accessed 12.01.2023, https://worldgbc.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/09/22123951/WorldGBC_Bringing_Embodied_Carbon_Upfront.pdfww.iccsafe.org/advocacy/embodied-carbon/.

Akin, S. Nuray, Val E. Lambson, Grant Richard McQueen, Brennan C. Platt, Barrett A. Slade, and Justin Wood. 2013. "Rushing to Overpay: Modeling and Measuring the REIT Premium." *The Journal of Real Estate Finance and Economics* 47 (3): 506-537. doi:10.1007/s11146-012-9372-1. https://doi.org/10.1007/s11146-012-9372-1.

Akomea-Frimpong, Isaac, Augustine Senanu Kukah, Xiaohua Jin, Robert Osei-Kyei, and Fatemeh Pariafsai. 2022. "Green Finance for Green Buildings: A Systematic Review and Conceptual Foundation." *Journal of Cleaner Production* 356: 131869. doi:10.1016/j.jclepro.2022.131869. https://www.sciencedirect.com/science/article/pii/S0959652622014792.

Alasco. 2023. "Ihre Erfolgreiche ESG-Strategie Beginnt Mit Alasco. All-in-One Lösung Für Praxisnahes ESG-Management." Alasco, accessed 15.04.2023, https://www.alasco.de/esg-management/.

An, Xudong and Gary Pivo. 2020. "Green Buildings in Commercial Mortgage-Backed Securities: The Effects of LEED and Energy Star Certification on Default Risk and Loan Terms." *Real Estate Economics* 48 (1): 7-42. doi:10.1111/1540-6229.12228. https://doi.org/10.1111/1540-6229.12228.

Anghel, Ion and Stanley McGreal. 2017. "Insights on Central and Eastern European Real Estate Markets." *Journal of European Real Estate Research* 10 (1): 2-3. doi:10.1108/JERER-01-2017-0002. https://doi.org/10.1108/jerer-01-2017-0002.

Anke, Carl-Philipp and Dominik Möst. 2021. "The Expansion of RES and the EU ETS – Valuable Addition Or Conflicting Instruments?" *Energy Policy* 150: 112125. doi:10.1016/j.enpol.2020.112125. https://doi.org/10.1016/j.enpol.2020.112125.

Attal, Elise, Toby Belsom, Alyssa Heath, Will Martindale, Hazell Ransome, Betina Vaz Boni, and Catie Wearmouth. 2023. "Testing the Taxonomy. Insights from the PRI Taxonomy Practitioners Group." Principles for Responsible Investment, accessed 23.04.2023, https://www.unpri.org/download?ac=11662.

Backenroth, Sanna and Casper Lindqvist. 2023 "A Green New World: How the Real Estate Sector is Working with Sustainable Financing in Regard to the EU Taxonomy." accessed 26.04.2023, http://kth.diva-portal.org/smash/get/diva2:1572516/FULLTEXT01.pdf.

Badache, Anne-Marie, Sebastian Heimbach, Mark Verheyden, Helge Brinkmann, Mazen Abdulbaki, Sofia Wiklund, and Parth Tripathi. 2023. "Seizing the Net Zero Opportunity for Buildings". Boston Consulting Group, accessed 12.06.2023, https://mkt-bcg-com-public-pdfs.s3.amazonaws.com/prod/strengthening-sustainable-building-operations.pdf.

Bayer, Patrick and Michaël Aklin. 2020. "The European Union Emissions Trading System Reduced CO2 Emissions Despite Low Prices." *Proceedings of the National Academy of Sciences* 117 (16): 8804-8812.

Beltran, Daniel O., Hannah Bensen, Amy Kvien, Erin McDevitt, Monica V. Sanz, and Pinar Uysal. 2023 "What are Large Global Banks Doing about Climate Change?" Federal Reserve, accessed 13.01.2023, https://www.federalreserve.gov/econres/ifdp/files/ifdp1368.pdf.

BFW Bundesverband Freier Immobilien- und Wohnungsunternehmen. 2023. "Der BFW Bundesverband Freier Immobilien- und Wohnungsunternehmen kommentiert die geplante EU-Gebäuderichtlinie, die am 14. März 2023 dem EU-Parlament zur Abstimmung vorlag." BFW Bundesverband Freier Immobilien- und Wohnungsunternehmen, accessed 25.04.2023, https://www.bfw-newsroom.de/bfw-eu-gebaeuderichtlinie-ueberfordert-immobilienbesitzer/.

Bhatia, Pankaj, Cynthia Cummis, Andrea Brown, David Rich, Laura Draucker, and Holl Lahd. 2022 "Corporate Value Chain (Scope 3) Accounting and Reporting Standard. Supplement to the GHG Protocol Corporate Accounting and Reporting Standard." World Business Council for Sustainable Development, World Resources Institut, accessed 24.03.2023, https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf.

Bond, Shaun A. and Avis Devine. 2016. "Certification Matters: Is Green Talk Cheap Talk?" *The Journal of Real Estate Finance and Economics* 52 (2): 117-140. doi:10.1007/s11146-015-9499-y. https://doi.org/10.1007/s11146-015-9499-y.

Bozsó, Brigitta, Veljko Vorkapic, Katerina Davidova, Maarja Tiik, Johanna Johanna, Piret Vainsalu, Neil Makaroff, Audrey Mathieu, Wojciech Szymalski, Barbara Kvac, Taj Zavodnik, David Howell, and Ana Márquez. 2022. "Implementing the Effort Sharing Regulation at the National Level. Lessons Learned and Recommendations from the Life Unify Project." LIFE Unify Project, accessed 05.04.2023, https://caneurope.org/content/uploads/2022/03/LIFE-UNIFY_ESR-Report-2022-1.pdf.

Brühl, Volker. 2023. "The Green Asset Ratio (GAR): A New Key Performance Indicator for Credit Institutions." *Eurasian Economic Review* 13 (1): 57-83.

Building Minds. "ESG Ganz Mühelos." Building Minds, accessed 01.06.2023, https://www.buildingminds.com/de.

Bundesregierung. 2022. "Gesetz zur Aufteilung der Kohlendioxidkosten (Kohlendioxidkostenaufteilungsgesetz - CO2KostAufG)." *Bundesgesetzblatt I 2022, S. 2154*. http://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl&jumpTo=bgbl122s2154.pdf.

Buschan, Oliver and Remo Kübler. 2022. "Klimaeffiziente Hypotheken – Wie Geht Das? Wege Zu Einer Klimaschonenden Immobilienfinanzierung." Swiss Banking, accessed 21.12.2023, https://www.swissbanking.ch/_Resources/Persistent/0/1/0/7/0107d9f329d8762cb9c3ec57b23716283d9a6a67/SBVg_Nachhaltige%20Hypotheken%20Diskussionspapier_DE.pdf.

Cadez, Simon, Albert Czerny, and Peter Letmathe. 2019. "Stakeholder Pressures and Corporate Climate Change Mitigation Strategies." *Business Strategy and the Environment* 28 (1): 1-14.

Câmara, Paulo, and Filipe Morais. *The Palgrave Handbook of ESG and Corporate Governance.* Springer Nature. 2022. https://link.springer.com/book/10.1007/978-3-030-99468-6#bibliographic-information.

Camarasa, Clara, Érika Mata, Juan Pablo Jiménez Navarro, Janet Reyna, Paula Bezerra, Gerd Brantes Angelkorte, Wei Feng, Faidra Filippidou, Sebastian Forthuber, Chioke Harris, Nina Holck Sandberg, Sotiria Ignatiadou, Lukas Kranzl, Jared Langevin, Xu Liu, Andreas Müller, Rafael Soria, Daniel Villamar, Gabriela Prata Dias, Joel Wanemark, and Katarina Yaramenka. 2022. "A Global Comparison of Building Decarbonization Scenarios by 2050 Towards 1.5–2 °C Targets." *Nature Communications* 13 (1) (jun): 3077. doi:10.1038/s41467-022-29890-5. https://www.nature.com/articles/s41467-022-29890-5.

Carbon Leadership Forum. 2020. "Embodied Carbon 101." Carbon Leadership Forum., accessed 14.01.2023, https://carbonleadershipforum.org/download/13878/.

Carmo, Cecília and Mercedes Miguéis. 2022. "Voluntary Sustainability Disclosures in Non-Listed Companies: An Exploratory Study on Motives and Practices." *Sustainability (2071-1050)* 14 (12). doi:10.3390/su14127365. https://doi.org/10.3390/su14127365.

CBRE. n.d. "Decarbonizing Commercial Real Estate. A Guide to Making Your Carbon-Reduction Strategy a Reality." CBRE, accessed 15.04.2023, https://www.cbre.com/insights/reports/decarbonizing-commercial-real-estate.

Chadwick, Emily, Louisa Spittler, Honoré A. Simo, Kevin Gromoll, Hassan Sabir, Gloria Duci, and Zoe Bavavea. 2021. "Impact of EU ETS & ETD on Real Estate Values." JLL and EPRA, accessed 17.04.2023, https://www.jll.co.uk/content/dam/jll-com/documents/pdf/views/jll-epra-white-paper-2021-eu-policy-proposals-impact-on-value.pdf.

Chegut, Andrea, Piet Eichholtz, and Nils Kok. 2014. "Supply, Demand and the Value of Green Buildings." *Urban Studies (Edinburgh, Scotland)* 51 (1) (Jan 1,): 22-43. doi:10.1177/0042098013484526. https://www.jstor.org/stable/26145695.

Cheng, Baoquan, Ruidong Chang, Quanhua Yin, Jianchang Li, Jianling Huang, and Huihua Chen. 2023. "A PSR-AHP-GE Model for Evaluating Environmental Impacts of Spoil Disposal Areas in High-Speed Railway Engineering." *Journal of Cleaner Production* 388: 135970.

Cheng, Baoquan, Jianling Huang, Jianchang Li, Shuhang Chen, and Huihua Chen. 2022. "Improving Contractors' Participation of Resource Utilization in Construction and Demolition Waste through Government Incentives and Punishments." *Environmental Management* 70 (4): 666-680.

Chithambo, Lyton, Venancio Tauringana, Ishmael Tingbani, and Laura Achiro. 2022. "Stakeholder Pressure and Greenhouses Gas Voluntary Disclosures." *Business Strategy and the Environment* 31 (1): 159-172. doi:10.1002/bse.2880. https://doi.org/10.1002/bse.28880.

Clery, Jim, Darina Barett, Conor Holland, and Hassan Sabir. 2021. "Overview of Real Estate Companies' Environmental Performance." KPMG, accessed 12.03.2023, https://assets.kpmg.com/content/dam/kpmg/ie/pdf/2021/10/ie-overview-of-real-estate-companies-environmental-performance.pdf.

Climate Action Tracker. 2023. "The CAT Thermometer." Climate Action Tracker, accessed 14.01.2023, https://climateactiontracker.org/global/cat-thermometer/.

Cludius, Johanna, Vicky Duscha, Nele Friedrichsen, and Katja Schumacher. 2019. "Cost-Efficiency of the EU Emissions Trading System; an Evaluation of the Second Trading Period." *Economics of Energy & Environmental Policy* 8 (1): 145-162. https://www.jstor.org/stable/27030648.

Colliers. 2023. "EMEA Capital Markets. Market Snapshot Q1 2023." Colliers, accessed 03.05.2023, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiruqzJotyAAxUVHuwKHS0aAOoQFnoECBAQAQ&url=https%3A%2F%2Fwww.colliers.com%2Fen-ge%2Fnews%2F20230509-emea-q1-2023-emea-capital-markets-snapshot&usg=AOvVaw0wXTy3zu-JmESYMFrBFxCv&opi=89978449.

Copiello, Sergio, and Edda Donati. 2021. "Is Investing in Energy Efficiency Worth it? Evidence for Substantial Price Premiums but Limited Profitability in the Housing Sector." *Energy and Buildings* 251: 111371. doi:10.1016/j.enbuild.2021.111371. https://www.sciencedirect.com/science/article/pii/S0378778821006551.

Copiello, Sergio, and Simone Coletto. 2023. "The Price Premium in Green Buildings: A Spatial Autoregressive Model and a Multi-Criteria Optimization Approach." *Buildings* 13 (2). doi:10.3390/buildings13020276. https://www.mdpi.com/2075-5309/13/2/276.

Council of the European Union. 2022. "'Fit for 55': EU Strengthens Emission Reduction Targets for Member States." Council of the European Union, accessed 20.04.2023, https://www.consilium.europa.eu/en/press/press-releases/2022/11/08/fit-for-55-eu-strengthens-emission-reduction-targets-for-member-states/.

Council of the European Union. 2023a. "Fit for 55 Package: Council Adopts Regulations on Effort Sharing and Land use and Forestry Sector." Council of the European Union, accessed 20.04.2023, https://www.consilium.europa.eu/en/press/press-releases/2023/03/28/fit-for-55-package-council-adopts-regulations-on-effort-sharing-and-land-use-and-forestry-sector/?utm_source=dsms-auto&utm_medium=email&utm_campaign=Fit%20for%2055%20package%3A%20Council%20adopts%20regulations%20on%20effort%20sharing%20and%20land%20use%20and%20forestry%20sector#:~:text=13%3A10-,Fit%20for%2055%20package%3A%20Council%20adopts%20regulations%20on%20effort%20sharing,2030%20compared%20to%201990%20levels.

Council of the European Union. 2023b. "'Fit for 55': Council and Parliament Reach Provisional Deal on EU Emissions Trading System and the Social Climate Fund." accessed 26.04.2023, https://www.consilium.europa.eu/en/press/press-releases/2022/12/18/fit-for-55-council-and-parliament-reach-provisional-deal-on-eu-emissions-trading-system-and-the-social-climate-fund/.

Council of the European Union. 2023c. "Infographic - Fit for 55: Reducing Emissions from Transport, Buildings, Agriculture and Waste". Council of the European Union, accessed 15.04.2023, https://www.consilium.europa.eu/en/infographics/fit-for-55-effort-sharing-regulation/.

Croker, Richard and Siobhan Cross. 2022. "The Legal Drivers for Net Zero Carbon Real Estate." Pinsent Masons, accessed 21.12.2023, https://www.pinsentmasons.com/out-law/analysis/legal-drivers-net-zero-carbon-real-estate.

CRREM. 2023. "CRREM Global Pathways." CRREM, accessed 11.01.2023, https://www.crrem.org/wp-content/uploads/2023/01/CRREM_Global_Pathways-V2_11-01-2023.xlsx.

Dangl, Vanessa, Stuart Smith, and Emily Chadwick. 2023. "Valuing Net Zero & ESG for Industrial & Logistics. Global Market Trends and Valuation Methodology." JLL, accessed 29.03.2023, https://www.us.jll.com/content/dam/jll-com/documents/pdf/views/jll-valuing-esg-and-net-zero-carbon.pdf.

Das, Prashant and Jonathan A. Wiley. 2014. "Determinants of Premia for Energy-Efficient Design in the Office Market." *Journal of Property Research* 31 (1): 64-86. doi:10.1080/09599916.2013.788543. https://doi.org/10.1080/09599916.2013.7885443.

De Oliveira Neves, Rui. 2022. "The EU Taxonomy Regulation and its Implications for Companies." In *The Palgrave Handbook of ESG and Corporate Governance*, edited by Filipe Morais, 249-266: Springer.

Debrah, Caleb, Albert Ping Chuen Chan, and Amos Darko. 2022. "Green Finance Gap in Green Buildings: A Scoping Review and Future Research Needs." *Building and Environment* 207: 108443. doi:10.1016/j.buildenv.2021.108443. https://www.sciencedirect.com/science/article/pii/S0360132321008398.

DeChaine, Denise, Larry Gray, Susan Sharpe, Karen Palma, Linda Ward, Jane Fear, and Lizzy Buckle. 2020 "Global Investment Managers 2020. Special Report." Property funds research and Institutional Real Estate, accessed 08.05.2023, https://irei.com/wp-content/uploads/2020/09/2020_PFR_IREI-REPORT-Euros.pdf.

Delbeke, Jos and Peter Vis. 2019. *Towards a Climate-Neutral Europe: Curbing the Trend*. London: Routledge.

Delmastro, Chiara. 2022. "Building Envelopes." International Energy Agency, accessed 21.12.2023, https://www.iea.org/reports/building-envelopes.

Delmastro, Chiara. 2023. "Buildings." International Energy Agency, accessed 11.01.2023, https://www.iea.org/reports/buildings.

Deutscher Nachhaltigkeits Kodex. 2023. "Der DNK bereitet Sie auf die Corporate Sustainability Reporting Directive (CSRD) vor." Deutscher Nachhaltigkeits Kodex, accessed 27.04.2023, https://www.deutscher-nachhaltigkeitskodex.de/de-DE/Home/Berichtspflichten/CSRD#:~:text=Die%20Corporate%20Sustainability%20Reporting%20Directive%20(CSRD)%20ist%20die%20Weiterentwicklung%20der,mit%20der%20Finanzberichterstattung%20zu%20stellen.

Duijzer, Gijsbert, Gerben Sinken, and Mathijs Pott. n.d. "CSRD: Booster for a Sustainable Real Estate Industry." Deloitte, accessed 27.04.2023, https://www2.deloitte.com/nl/nl/pages/real-estate/articles/csrd-booster-for-a-sustainable-real-estate-industry.html.

Dulac, John, Ludwig Labuzinski, Jori Van der Meulen, and Monica Troilo. 2023. "Buildings." International Energy Agency, accessed 12.01.2023, https://www.iea.org/reports/buildings.

Marina, Economidou, Valeria Todeschi, Bertoldi Paolo, Delia D'Agostino, Paolo Zangheri, and Castellazzi Luca. 2020. "Review of 50 years of EU Energy Efficiency Policies for Buildings." *Energy and Buildings* 225: 110322. doi:10.1016/j.enbuild.2020.110322. https://www.sciencedirect.com/science/article/pii/S0378778820317229.

EFRAG. 2022a. "Draft European Sustainability Reporting Standards. ESRS E1 Climate Change." EFRAG, accessed 30.04.2023, https://www.efrag.org/Assets/Download?assetUrl=%2Fsites%2Fwebpublishing%2FSiteAssets%2F08%2520Draft%2520ESRS%2520E1%2520Climate%2520Change%2520November%25202022.pdf.

EFRAG. 2022b. "First Set of Draft ESRS." EFRAG, accessed 30.04.2023, https://www.efrag.org/lab6.

Eichholtz, Piet, Roger Holtermans, Nils Kok, and Erkan Yönder. 2015. "Environmental Performance and Cost of Capital: Evidence from Commercial Mortgages and REIT Bonds." *Journal of Banking and Finance* 102: 19-23. doi:10.2139/ssrn.2714317. https://www.researchgate.net/publication/314605337_Environmental_Performance_and_the_Cost_of_Capital_Evidence_from_Commercial_Mortgages_and_REIT_Bonds.

Eichholtz, Piet, Rogier Holtermans, Nils Kok, and Erkan Yönder. 2019. "Environmental Performance and the Cost of Debt: Evidence from Commercial Mortgages and REIT Bonds." *Journal of Banking & Finance* 102: 19-32. doi:10.1016/j.jbankfin.2019.02.015. https://www.sciencedirect.com/science/article/pii/S0378426619300470.

Eichholtz, Piet, Nils Kok, and John M. Quigley. 2013. "The Economics of Green Building." *The Review of Economics and Statistics* 95 (1): 50-63. doi:10.1162/REST_a_00291. https://doi.org/10.1162/REST_a_00291.

Elisei, Chiara, and Dhara Ranasinghe. "Crisis Radar Falls on Fault Lines in Europe's Commercial Property." Reuters, accessed 20.04.2023, https://www.reuters.com/markets/europe/crisis-radar-falls-fault-lines-europes-commercial-property-2023-04-20/.

Ellerman, A. Denny, and Barbara K. Buchner. 2008. "Over-Allocation Or Abatement? A Preliminary Analysis of the EU ETS Based on the 2005–06 Emissions Data." *Environmental and Resource Economics* 41: 267-287. https://doi.org/10.1007/s10640-008-9191-2.

Ellerman, A. Denny, Frank J. Convery, and Christian De Perthuis. 2010. "Pricing Carbon: The European Union Emissions Trading Scheme.", Cambridge University Press, accessed 15.04.2023, https://hdl.handle.net/1814/15503.

Energie Baden-Württemberg. 2023. "Statement of EnBW Energie Baden-Württemberg AG on the Revision of the European Emissions Trading System (ETS Directive)." accessed 20.06.2023, https://www.enbw.com/media/sustainability/politisches_engagement/enbw-position-statement-on-reform-of-the-ets.pdf.

Energy Policy Group. 2023. "The Impact of the Proposed EU ETS 2 and the Social Climate Fund on Emissions and Welfare. Evidence from Literature and a New Simulation Model." accessed 26.04.2023, https://www.euki.de/euki-publications/eu-ets-2/.

EPF - European Property Federation. 2023. "EPF's Position on Extending the ETS to Buildings." accessed 20.07.2023, https://www.epf-fepi.com/news/epfs-position-on-extending-the-ets-to-buildings.

EPRA. 2023. "EPRA Guide. EU Taxonomy Alignment in Listed Real Estate. A Practical Guide to Determining if Listed Real Estate Activities are Environmentally Sustainable as Per the Criteria of the EU Taxonomy." accessed 27.04.2023, https://www.epra.com/application/files/3316/6540/6020/EPRA_EU_Taxonomy_Guide.pdf.

Erbach, Gregor. 2023. "Revision of the EU Emission Trading System (ETS)." European Parliament, accessed 03.05.2023, https://www.europarl.europa.eu/legislative-train/package-fit-for-55/file-revision-of-the-eu-emission-trading-system-(ets).

Eren, Egemen, Floortje Merten, and Niek Verhoeven. 2023. "Pricing of Climate Risks in Financial Markets: A Summary of the Literature", accessed 13.01.2023, https://www.bis.org/publ/bppdf/bispap130.pdf.

Esch, Martin, Benedikt Schnellbächer, and Andreas Wald. 2019. "Does Integrated Reporting Information Influence Internal Decision Making? an Experimental Study of Investment Behavior." *Business Strategy & the Environment (John Wiley & Sons, Inc)* 28 (4): 599-610. doi:10.1002/bse.2267. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=bsu&AN=135775168&site=eds-live&scope=site&custid=s2944713.

European Banking Authority. 2023. "EBA Report. Advice to the Commission on KPIs and Methodology for Disclosure by Credit Institutions and Investment Firms Under the NFRD on how and to what Extent their Activities Qualify as Environmentally Sustainable According to the EU Taxonomy Regulation." accessed 15.08.2023, https://www.eba.europa.eu/sites/default/documents/files/document_library/About%20Us/Missions%20and%20tasks/Call%20for%20Advice/2021/CfA%20on%20KPIs%20and%20methodology%20for%20disclosures%20under%20Article%208%20of%20the%20Taxonomy%20Regulation/963616/Report%20-%20Advice%20to%20COM_Disclosure%20Article%208%20Taxonomy.pdf.

European Builders Confederation. 2023. "EBC Reaction to the Vote on the Energy Performance of Buildings Directive (EPBD) in the ITRE Committee of the European Parliament." accessed 02.04.2023, https://mailchi.mp/b4837fc929c6/ebc-reaction-to-the-vote-on-energy-performance-of-buildings-directive-epbd-in-the-itre-committee-of-the-european-parliament.

European Central Bank. 2023. "European Central Bank Opinion on the Energy Performance of Buildings Directive." accessed 28.03.2023, https://www.epf-fepi.com/news/european-central-bank-opinion-on-the-energy-performance-buildings-directive.

European Central Bank. 2023. "Key ECB Interest Rates." accessed 01.06.2023, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html.

European Commission. 2019. "Communication from the Commission - Guidelines on Non-Financial Reporting: Supplement on Reporting Climate-Related Information" *EUR-Lex C/2019/4490.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019XC0620(01).

European Commission. 2020a. "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: EU Biodiversity Strategy for 2030: Bringing Nature Back into our Lives." *EUR-Lex*

COM/2020/662. https://eur-lex.europa.eu/resource.html?uri=cellar:0638aa1d-0f02-11eb-bc07-01aa75ed71a1.0003.02/DOC_2&format=PDF.

European Commission. 2020b. "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Renovation Wave for Europe - Greening our Buildings, Creating Jobs, Improving Lives." *EUR-Lex COM/2020/660.* https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662.

European Commission. 2021a. "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions. EU Taxonomy, Corporate Sustainability Reporting, Sustainability Preferences and Fiduciary Duties: Directing Finance Towards the European Green Deal." *EUR-Lex COM/2021/188*. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52021DC0188.

European Commission. 2021b. "Emissions Cap and Allowances." European Commission, accessed 10.05.2023, https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/emissions-cap-and-allowances_de.

European Commission. 2021c. "Possible Extension of the EU Emissions Trading System (ETS) to Cover Emissions from the use of Fossil Fuels in Particular in the Road Transport and the Buildings Sector." accessed 27.04.2023, https://op.europa.eu/en/publication-detail/-/publication/f496ee25-353a-11ec-bd8e-01aa75ed71a1#.

European Commission. 2021d. "Proposal for a Regulation of the European Parliament and of the Council on European Green Bonds". *EUR-Lex COM/2021/391*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0391.

European Commission. 2021e. "Summary Report on the Public Consultation on Updating the EU Emissions Trading System." accessed 24.04.2023, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12660-Updating-the-EU-Emissions-Trading-System/public-consultation_de.

European Commission. 2021f. "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions Empty: 'Fit for 55': Delivering the EU's 2030 Climate Target on the Way to Climate Neutrality." *EUR-Lex COM/2021/550.* *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0550*.

European Commission. 2022b. "What is the innovation fund?" accessed 26.03.2023, https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund/what-innovation-fund_en.

European Commission. 2023a. "Corporate Sustainability Reporting." accessed 10.08.2023, https://finance.ec.europa.eu/capital-markets-union-and-financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en.

European Commission. 2023b. "Daily News 31/07/2023." accessed 10.08.2023, https://ec.europa.eu/commission/presscorner/detail/en/mex_23_4044.

European Commission. 2023c."Commission Delegated Regulation C/2023/3851 supplementing Regulation 2020/852/EU of the European Parliament and of the Council by Establishing the Technical Screening Criteria for Determining the Conditions Under which an Economic Activity Qualifies as Contributing Substantially to the Sustainable use and Protection of Water and Marine Resources, to the Transition to a Circular Economy, to Pollution Prevention and Control, Or to the Protection and Restoration of Biodiversity and Ecosystems and for Determining Whether that Economic Activity Causes no Significant Harm to any of the Other Environmental Objectives and Amending Delegated Regulation 2021/2178/EU as Regards Specific Public Disclosures for those Economic Activities." *EUR-Lex C/2023/3851*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM%3AC%282023%293851.

European Commission, Joint Research Centre, F. Filippidou, and J. Jimenez Navarro. 2019. *Achieving the Cost-Effective Energy Transformation of Europe's Buildings: Combinations of Insulation and Heating & Cooling Technologies Renovations: Methods and Data.* Publications Office. doi:10.2760/278207.

European Commission, Joint Research Centre, C. Maduta, G. Melica, D. D'Agostino, and P. Bertoldi. 2023. *Defining Zero-Emission Buildings: Support for the Revision of the Energy Performance of Buildings Directive* Publications Office of the European Union. doi:10.2760/107493.

European Construction Industry Federation. 2023. "Fiec Reaction to the Vote in the Committee on Industry, Research and Energy (ITRE) on its Position on the Proposal for a Recast Energy Performance of Buildings Directive." Accessed 04.05.2023, https://www.fiec.eu/application/files/8416/7638/7154/2023-02-14_FIEC_Reaction_to_ITRE_vote_recast_EPBD.pdf.

European Council. 2022. "Fit for 55 Package: Council Reaches General Approaches Relating to Emissions Reductions and their Social Impacts." accessed 21.12.2023, https://www.consilium.europa.eu/en/press/press-releases/2022/06/29/fit-for-55-council-reaches-general-approaches-relating-to-emissions-reductions-and-removals-and-their-social-impacts/.

European Environment Agency. 2022. "Greenhouse Gas Emissions from Energy use in Buildings in Europe." accessed 21.12.2023, https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-energy.

European Parliament. 2023. "Energy Performance of Buildings (Recast). Amendments Adopted by the European Parliament on 14 March 2023 on the Proposal for a Directive of the European Parliament and of the Council on the Energy Performance of Buildings (Recast) COM(2021)0802 – C9-0469/2021 – 2021/0426(COD))." accessed 29.03.2023, https://www.europarl.europa.eu/doceo/document/TA-9-2023-0068_EN.html#top.

European Parliament and the Council. 2002. "Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the Energy Performance of Buildings." *Official Journal of the European Union L 1/65.* https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:en:PDF#:~:text=The%20objective%20of%20this%20Directive,climate%20requirements%20and%20cost-effectiveness.

European Parliament and the Council. 2010. "Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the Energy Performance of Buildings (Recast)." *Official Journal of the European Union L 153/13.* https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:en:PDF.

European Parliament and the Council. 2014. "Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 Amending Directive 2013/34/EU as Regards Disclosure of Non-Financial and Diversity Information by Certain Large Undertakings and Groups Text with EEA Relevance." *Official Journal of the European Union L 330/1.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095.

European Parliament and the Council. 2018. "Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 Amending Directive 2010/31/EU on the Energy Performance of Buildings and Directive 2012/27/EU on Energy Efficiency." *Official Journal of the European Union L 156/75. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.156.01.0075.01.ENG.*

European Parliament and the Council. 2019. "Regulation 2019/2088/EU of the European Parliament and of the Council of 27 November 2019 on Sustainability-related Disclosures in the Financial Services Sector." *Official Journal of the European Union L317/1.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32019R2088.

European Parliament and the Council. 2020. "Regulation 2020/852/EU of the European Parliament and of the Council of 18 June 2020 on the Establishment of a Framework to Facilitate Sustainable Investment, and Amending Regulation 2019/2088/EU." *Official Journal of the European Union L 198/13.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32020R0852.

European Parliament and the Council. 2021. "Commission Delegated Regulation 2021/2139/EU of 4 June 2021 Supplementing Regulation 2020/852/EU of the European Parliament and of the Council by Establishing the Technical Screening Criteria for Determining the Conditions Under which an Economic Activity Qualifies as Contributing Substantially to Climate Change Mitigation Or Climate Change Adaptation and for Determining Whether that Economic Activity Causes no Significant Harm to any of the Other Environmental Objectives." *Official Journal of the European Union L 442/1.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32021R2139.

European Parliament and the Council. 2021. "Proposal for a Directive of the European Parliament and of the Council Amending Directive 2003/87/EC establishing a System for Greenhouse Gas Emission Allowance Trading within the Union, Decision 2015/1814/EU Concerning the Establishment and Operation of a Market Stability Reserve for the Union Greenhouse Gas Emission Trading Scheme and Regulation 2015/757/EU." *EUR-Lex COM/2021/551.* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0551.

European Parliament and the Council. 2021. "Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC Establishing a System for Greenhouse Gas Emission Allowance Trading within the Union, Decision 2015/1814/EU Concerning the Establishment and Operation of a Market Stability Reserve for the Union Greenhouse Gas Emission Trading Scheme and Regulation 2015/757/EU." *EUR-Lex COM/2021/551. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0551.*

European Parliament and the Council. 2021. "Regulation 2021/1119/EU of the European Parliament and of the Council of 30 June 2021 Establishing the Framework for Achieving Climate Neutrality and Amending Regulations no 401/2009/EC and 2018/1999/EU (European Climate Law)." *Official Journal of the European Union L 243/1.* https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119#:~:text=This%20Regulation%20sets%20out%20a,Article%207%20of%20the%20Paris.

European Parliament and the Council. 2022a. "Directive 2022/2464/EU of the European Parliament and of the Council of 14 December 2022 Amending Regulation no 537/2014/EU, Directive 2004/109/EC, Directive 2006/43/EC, and Directive 2013/34/EU, as Regards Corporate Sustainability Reporting." *Official Journal of the European Union L 322/15. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022L2464.*

European Parliament and the Council. 2022b. "Commission Delegated Regulation 2022/1288/EU of 6 April 2022 supplementing Regulation 2019/2088/EU of the European Parliament and of the Council with Regard to Regulatory Technical Standards Specifying the Details of the Content and Presentation of the Information in Relation to the Principle of 'do no Significant Harm', Specifying the Content, Methodologies and Presentation of Information in Relation to Sustainability Indicators and Adverse Sustainability Impacts, and the Content and Presentation of the Information in Relation to the Promotion of Environmental Or Social Characteristics and Sustainable Investment Objectives in recontractual Documents, on Websites and in Periodic Reports." 2022. *Official Journal of the European Union L196/1. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32022R1288&qid=1693485852736*.

European Parliament and the Council. 2023. "Regulation 2023/857/EU of the European Parliament and of the Council of 19 April 2023 amending Regulation 2018/842/EU on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, and Regulation 2018/1999/EU." *Official Journal of the European Union L 111/1. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R0857*.

European Trade Union Confederation. 2021 "ETUC Position on the Creation of a Second ETS on Road Transport and Building and of a New Social Climate Fund." accessed 27.04.2023, https://www.etuc.org/en/document/etuc-position-creation-second-ets-road-transport-and-building-and-new-social-climate-fund.

Eurostat. 2023. "Distribution of Population by Tenure Status, Type of Household and Income Group - EU-SILC Survey." accessed 26.04.2023, https://ec.europa.eu/eurostat/databrowser/view/ILC_LVHO02__custom_3553007/bookmark/table?lang=en&bookmarkId=2457e44e-df35-4995-aacc-e79684402691.

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection. 2022. "Energy and Environment Councils Set the Course for a Climate-Neutral European Economy." accessed 25.04.2023, https://www.bmuv.de/en/pressrelease/energy-and-environment-councils-set-the-course-for-a-climate-neutral-european-economy.

Feng, Zifeng and Zhonghua Wu. 2021. "ESG Disclosure, REIT Debt Financing and Firm Value." *The Journal of Real Estate Finance and Economics*: 1-35. https://doi.org/10.1007/s11146-021-09857-x.

Ferries, Georgia, Mike Barnes, and Jess Edgley. 2022. "Spotlight: European Office Obsolescence." Savills, accessed 18.03.2023, https://www.savills.de/research_articles/260049/336539-0.

Filippidou, Faidra. 2019. "Achieving the Cost-Effective Energy Transformation of Europe's Buildings. Combinations of Insulation and Heating & Cooling Technologies Renovations: Methods and Data." accessed 14.01.2023, https://op.europa.eu/en/publication-detail/-/publication/c7a897dc-0050-11ea-8c1f-01aa75ed71a1/language-en.

Filippino, Marc, James Kynge and Ortenca Aliaj. 2023. "Is Commercial Property the 'next Shoe to Drop'?" Financial Times, accessed 05.06.2023, https://www.ft.com/content/731b91b5-8e25-4e2a-a38e-fd5d72262a70.

Fonseka, Mohan, Gao-Liang Tian, and Omar Al Farooque. 2020. "Impact of Environmental Information Disclosure and Real Estate Segments on Cost of Debt: Evidence from the Chinese Real Estate Industry." *Economics of Transition and Institutional Change* 28 (1): 195-221. doi:10.1111/ecot.12238. https://doi.org/10.1111/ecot.12238.

Fotiou, Theofano, Alessia de Vita, and Pantelis Capros. 2019. "Economic-Engineering Modelling of the Buildings Sector to Study the Transition Towards Deep Decarbonisation in the EU." *Energies* 12 (14). doi:10.3390/en12142745. https://www.mdpi.com/1996-1073/12/14/2745.

Freshfields Bruckhaus Deringer. 2021. "Effects of the Sustainable Finance Disclosure Regulation and the Taxonomy Regulation on the Real Estate Industry." accessed 06.06.2023, https://www.freshfields.de/4ac39f/contentassets/0a7e3e610dd2406487d491ea3b623502/esg-and-real-estate-21-oct-2021---freshfields-bruckhaus-deringer.pdf.

Pierre Friedlingstein, Michael O'Sullivan, Matthew W. Jones, Robbie M. Andrew, Luke Gregor, Judith Hauck, Corinne Le Quéré, Ingrid T. Luijkx, Are Olsen, Glen P. Peters, Wouter Peters, Julia Pongratz, Clemens Schwingshackl, Stephen Sitch, Josep G. Canadell, Philippe Ciais, Robert B. Jackson, Simone R. Alin, Ramdane Alkama, Almut Arneth, Vivek K. Arora, Nicholas R. Bates, Meike Becker, Nicolas Bellouin, Henry C. Bittig, Laurent Bopp, Frédéric Chevallier, Louise P. Chini, Margot Cronin, Wiley Evans, Stefanie Falk, Richard A. Feely, Thomas Gasser, Marion Gehlen, Thanos Gkritzalis, Lucas Gloege, Giacomo Grassi, Nicolas Gruber, Özgür Gürses, Ian Harris, Matthew Hefner, Richard A. Houghton, George C. Hurtt, Yosuke Iida, Tatiana Ilyina, Atul K. Jain, Annika Jersild, Koji Kadono, Etsushi Kato, Daniel Kennedy, Kees Klein Goldewijk, Jürgen Knauer, Jan Ivar Korsbakken, Peter Landschützer, Nathalie Lefèvre, Keith Lindsay, Junjie Liu, Zhu Liu, Gregg Marland, Nicolas Mayot, Matthew J. McGrath, Nicolas Metzl, Natalie M. Monacci, David R. Munro, Shin-Ichiro Nakaoka, Yosuke Niwa, Kevin O'Brien, Tsuneo Ono, Paul I. Palmer, Naiqing Pan, Denis Pierrot, Katie Pocock, Benjamin Poulter, Laure Resplandy, Eddy Robertson, Christian Rödenbeck, Carmen Rodriguez, Thais M. Rosan, Jörg Schwinger, Roland Séférian, Jamie D. Shutler, Ingunn Skjelvan, Tobias Steinhoff, Qing Sun, Adrienne J. Sutton, Colm Sweeney, Shintaro Takao, Toste Tanhua, Pieter P. Tans, Xiangjun Tian, Hanqin Tian, Bronte Tilbrook, Hiroyuki Tsujino, Francesco Tubiello, Guido R. van der Werf, Anthony P. Walker, Rik Wanninkhof, Chris Whitehead, Anna Willstrand Wranne, Rebecca Wright, Wenping Yuan, Chao Yue, Xu Yue, Sönke Zaehle, Jiye Zeng, and Bo Zheng. 2022. "Global Carbon Budget 2022." *Earth System Science Data* 14 (11) (nov): 4811-4900. doi:10.5194/essd-14-4811-2022. https://doi.org/10.5194/essd-14-4811-2022.

Fuerst, Franz, Tommaso Gabrieli, and Patrick McAllister. 2017. "A Green Winner's Curse? Investor Behavior in the Market for Eco-Certified Office Buildings." *Economic Modelling* 61: 137-146. doi:10.1016/j.econmod.2016.11.007. https://www.sciencedirect.com/science/article/pii/S0264999316306836.

Fuerst, Franz and Patrick McAllister. 2011. "Green Noise Or Green Value? Measuring the Effects of Environmental Certification on Office Values." *Real Estate Economics* 39 (1): 45-69. doi:10.1111/j.1540-6229.2010.00286.x. https://doi.org/10.1111/j.1540-6229.2010.00286.x.

German Sustainable Building Council, Danish Green Building Council, Green Building Council España and Austrian Sustainable Building Council. 2021. "EU Taxonomy Study - Evaluating the Market-Readiness of the EU Taxonomy Criteria for Buildings." accessed 16.08.2023, https://c2e2.unepccc.org/wp-content/uploads/sites/3/2021/03/green-building-council-denmark-evaluating-the-market-readiness-of-the-eu-taxonomy-criteria-for-buildings-30-march-2021.pdf.

Gesamtverband der Versicherer. 2023. "Nachhaltigkeitsberichterstattung: Die EU-Kommission Machen Die ESRS Startklar." accessed 24.04.2023, https://www.gdv.de/gdv/themen/nachhaltigkeit/nachhaltigkeitsberichterstattung-die-eu-kommission-machen-die-esrs-startklar-137208.

Gilchrist, David, Jing Yu, and Rui Zhong. 2021. "The Limits of Green Finance: A Survey of Literature in the Context of Green Bonds and Green Loans." *Sustainability* 13 (2): 478.

Global Sustainability Standards Board. 2022. "Consolidated Set of the GRI Standards." Accessed 29.04.2023, https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/.

Graf, Andreas. 2021. "Transitioning to a Climate-Neutral EU Buildings Sector: Benchmarks for the Success of the European Green Deal." Agora Energiewende, accessed 13.01.2023, https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021_04_EU_Ff55-Benchmarks/A-EW_246_Transitioning-climate-neutral-EU-buildings_WEB_V1.1.pdf.

Graf, Andreas. 2021. "Transitioning to a Climate-Neutral EU Buildings Sector: Benchmarks for the Success of the European Green Deal." accessed 21.12.2023, https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021_04_EU_Ff55-Benchmarks/A-EW_246_Transitioning-climate-neutral-EU-buildings_WEB_V1.1.pdf.

Gross, Sabine. 2022 "Wie Kann Ich Die EU-Taxonomie Einhalten?" deepki, accessed 27.04.2023, https://www.deepki.com/de/blog/wie-kann-ich-die-eu-taxonomie-einhalten/.

Gu, Jianglin, Feng Guo, Xiaojing Peng, and Bin Wang. 2023. "Green and Sustainable Construction Industry: A Systematic Literature Review of the Contractor's Green Construction Capability." *Buildings* 13 (2). doi:10.3390/buildings13020470. https://www.mdpi.com/2075-5309/13/2/470.

Hasan, Lisa N., Stefanie D. Kibsey, Cary Krosinsky, and Thomas Walker, eds. 2019. *Sustainable Real Estate: Multidisciplinary Approaches to an Evolving System*. 1st ed. 2019 ed. Cham: Springer International Publishing: Imprint: Palgrave Macmillan.

Hauptverband der Deutschen Bauindustrie e.V. 2023. "Sanierungspflicht Braucht Anschub." accessed 12.04.2023, https://www.bauindustrie.de/pm/sanierungspflicht-braucht-anschub.

He, Lihua and Liyan Chen. 2021. "The Incentive Effects of Different Government Subsidy Policies on Green Buildings." *Renewable and Sustainable Energy Reviews* 135: 110123.

He, Wenhua, Pei Liu, Borong Lin, Hao Zhou, and Xuesheng Chen. 2022. "Green Finance Support for Development of Green Buildings in China: Effect, Mechanism, and Policy Implications." *Energy Policy* 165: 112973. doi:10.1016/j.enpol.2022.112973. https://www.sciencedirect.com/science/article/pii/S0301421522001987.

Hirsch, Jens, Maximilian Spanner, and Sven Bienert. 2019. "The Carbon Risk Real Estate Monitor—Developing a Framework for Science-Based Decarbonizing and Reducing Stranding Risks within the Commercial Real Estate Sector." *Journal of Sustainable Real Estate* 11 (1): 174-190. doi:10.22300/1949-8276.11.1.174. https://doi.org/10.22300/1949-8276.11.1.174.

Holtermans, Rogier and Nils Kok. 2019. "On the Value of Environmental Certification in the Commercial Real Estate Market." *Real Estate Economics* 47 (3): 685-722. doi:10.1111/1540-6229.12223. https://doi.org/10.1111/1540-6229.12223.

Howcroft, Elizabeth. 2023. "European Commercial Real Estate Investment Slumps to 11-Year Low in Q1 2023." Reuters, accessed 24.04.2023, https://www.reuters.com/markets/europe/european-commercial-real-estate-investment-slumps-11-year-low-q1-2023-2023-04-27/.

Hsieh, Hui-Ching, Viona Claresta, and Thi Minh Ngoc Bui. 2020. "Green Building, Cost of Equity Capital and Corporate Governance: Evidence from US Real Estate Investment Trusts." *Sustainability* 12 (9). doi:10.3390/su12093680. https://www.mdpi.com/2071-1050/12/9/3680.

Humphreys, Nadia. 2021. "Die Sustainable Finance Disclosure Regulation (SFDR)." Bloomberg, accessed 04.05.2023, https://www.bloomberg.com/professional/blog/die-sustainable-finance-disclosure-regulation-sfdr/.

Huysmans, Kyna. 2017. "Whose Carbon is it?" GRESB, accessed 27.04.2023, https://www.gresb.com/nl-en/whose-carbon-is-it/.

Hwang, Bon-Gang, Lei Zhu, Yinglin Wang, and Xinyi Cheong. 2017. "Green Building Construction Projects in Singapore: Cost Premiums and Cost Performance." *Project Management Journal* 48 (4): 67-79. doi:10.1177/875697281704800406. https://doi.org/10.1177/875697281704800406.

IDS data. n.d. "ESG-Datenintelligenz Für Investment Profis.", accessed 01.06.2023, https://www.idsdata.com/solutions/de/esg.

International Capital Markets Association. 2022. "Green Bond Principles. Voluntary Process Guidelines for Issuing Green Bonds." accessed 04.06.2023, https://www.icmagroup.org/assets/documents/Sustainable-finance/2022-updates/Green-Bond-Principles_June-2022-280622.pdf.

International Energy Agency. 2021. "Net Zero by 2050. A Roadmap for the Global Energy Sector." accessed 15.01.2023, https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf.

International Energy Agency. 2020. "Number of Companies in the S&P 500 Reporting Energy- and Emissions-Related Metrics." accessed 01.06.2023, https://www.iea.org/data-and-statistics/charts/number-of-companies-in-the-s-and-p-500-reporting-energy-and-emissions-related-metrics.

International Energy Agency. 2022. "World Energy Outlook 2022." accessed 11.01.2023, https://iea.blob.core.windows.net/assets/830fe099-5530-48f2-a7c1-11f35d510983/WorldEnergyOutlook2022.pdf.

International Organization for Standardization. 2018. "26000 Guidance on Social Responsibility." accessed 02.05.2023, https://www.iso.org/files/live/sites/isoorg/files/store/en/PUB100258.pdf.

International Sustainability Standards Board. 2018. "Real Estate Sustainability Accounting Standard." accessed 03.05.2023, https://www.sasb.org/wp-content/uploads/2018/11/Real_Estate_Standard_2018.pdf.

International Union of Property Owners. 2020. "Emission Trading System (ETS) and/Or Effort Sharing Regulation (ESR): What's on the Cards for the Building Sector?" accessed 25.04.2023, https://www.uipi.com/emission-trading-system-ets-and-or-effort-sharing-regulation-esr-whats-on-the-cards-for-the-building-sector/.

Jackson, Cath and Allison Orr. 2021. "The Embeddedness of Sustainability in Real Estate Investment Decision-Making." *Journal of European Real Estate Research* 14 (3): 362-380. https://www.emerald.com/insight/content/doi/10.1108/JERER-09-2020-0050/full/html.

Jankovic, Ivan, Armin Mayer, Dan Staniaszek and Xerome F. Álvarez. 2021. "Ready for Carbon Neutral by 2050? Assessing Ambition Levels in New Building Standards Across the EU." Buildings Performance Institute Europe, accessed 21.12.2022, https://www.bpie.eu/wp-content/uploads/2021/12/BPIE_Assessing-NZEB-ambition-levels-across-the-EU_HD.pdf.

JLL. 2022. "How Real Estate is Starting to Embrace Green Finance." accessed 21.12.2022, https://www.us.jll.com/en/trends-and-insights/investor/how-real-estate-is-starting-to-embrace-green-finance.

Joint Committee of the European Supervisory Authorities. 2023. "Joint Consultation Paper. Review of SFDR Delegated Regulation regarding PAI and Financial Product Disclosures." accessed 27.04.2023, https://www.eba.europa.eu/sites/default/documents/files/document_library/Publications/Consultations/2023/JC%20Consultation%20on%20Review%20of%20SFDR%20Delegated%20Regulation%20regarding%20PAI%20and%20financial%20product%20disclosures/1054506/JC_2023_09_Joint_consultation_paper_on_review_of_SFDR_Delegated_Regulation.pdf.

Kessler, Irma, Michael Trübestein, and Matthias Daniel Aepli. 2022. *Nachhaltigkeit Und Infrastruktur Im Immobilienportfolio: Eine Theoretische Und Empirische Untersuchung Des Anlageverhaltens Von Schweizer Institutionellen Investoren*. 1st ed. 2022 ed. Wiesbaden, Wiesbaden: Springer Fachmedien Wiesbaden Springer Gabler.

Kukovec, Sara and Christoph Jakob. eds. 2022. *Auf Dem Weg Zu Einer Nachhaltigen, Effizienten Und Profitablen Wertschöpfung Von Gebäuden: Grundlagen – Neue Technologien Innovationen Und Digitalisierung – Best Practices*. Wiesbaden: Springer Vieweg.

Kurmayer, Nikolaus. 2021. "EU to Start Measuring 'embodied' Carbon Emissions from Buildings." EURACTIV, accessed 22.04.2023, https://www.euractiv.com/section/energy-environment/news/eu-to-start-measuring-embodied-carbon-emissions-from-buildings/.

Kurmayer, Nikolaus J. and Valentina Romano. 2023. "Italian Politics Threatens to Torpedo EU Buildings Directive." EURACTIV, accessed 24.04., 2023, https://www.euractiv.com/section/energy-environment/news/italian-politics-threatens-to-torpedo-eu-buildings-directive/.

La Torre, Matteo, Svetlana Sabelfeld, Marita Blomkvist, Lara Tarquinio, and John Dumay. 2018. "Harmonising Non-Financial Reporting Regulation in Europe: Practical Forces and Projections for Future Research." *Meditari Accountancy Research* 26 (4): 598-621. https://doi.org/10.1108/MEDAR-02-2018-0290.

Landry, Erik, Larry Gray, Susan Sharpe, Karen Palma, Linda Ward, Jane Fear, and Lizzy Buckle. 2023. "Technical Guidance for the Financial Industry." GRESB, PCAF, CRREM, accessed 03.05.2023, https://carbonaccountingfinancials.com/files/downloads/ghg_emissions_real_estate_guidance_1.0.pdf.

Leahy, Tom. 2022. "London and Paris Offices: Green Premium Emerges". MSCI, accessed 16.03.2023. https://www.msci.com/www/quick-take/london-and-paris-offices-green/03510893060.

Liese, Peter, Mohammed Chahim, Emma Wiesner, Michael Bloss, Danilo O. Lancini, Alexandr Vondra, and Silvia Modig. 2023. "Briefing EU Legislation in Progress. Review of the EU ETS." European Parliament, accessed 22.04.2023, https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/698890/EPRS_BRI(2022)698890_EN.pdf.

Lloyd, Shannon, Maida Hadziosmanovic, Kian Rahimi, and Pankaj Bhatia. 2022. "Trends show Companies are Ready for Scope 3 Reporting with US Climate Disclosure Rule." World Research Institute, accessed 23.04.2023, https://www.wri.org/update/trends-show-companies-are-ready-scope-3-reporting-us-climate-disclosure-rule.

Loan Market Association and International Capital Market Association. 2018. "Green Loan Principles. Supporting Environmentally Sustainable Economic Activity." accessed 06.08.2023, https://www.lma.eu.com/application/files/9115/4452/5458/741_LM_Green_Loan_Principles_Booklet_V8.pdf.

London Energy Transformation Initiative. 2020. "LETI Climate Emergency Design Guide. How new buildings can meet UK climate change targets" accessed 11.01.2023, https://www.levittbernstein.co.uk/site/assets/files/3494/leti-climate-emergency-design-guide.pdf.

Loyens & Loeff. 2023. "ESG - how does the EU Taxonomy Regulation Impact the Real Estate Sector?" accessed 01.06.2023, https://www.loyensloeff.com/insights/news--events/news/esg---how-does-the-eu-taxonomy-impact-the-real-estate-sector/.

Ürge-Vorsatz, Diana & Lucon, Oswaldo & Akbari, Hashem & Bertoldi, Paolo & Cabeza, Luisa F. & Eyre, Nick & Gadgil, Ashok & Harvey, Danny & Jiang, Yi & Liphoto, Enoch & Mirasgedis, Sebastian & Murakami, Shuzo & Parikh, Jyoti & Pyke, Christopher & Vilariño, Maria. 2014. Climate Change 2014: Mitigation. Chapter 9: Buildings. Report by the Intergovernmental Panel on Climate Change, https://www.researchgate.net/publication/262048802_Climate_Change_2014_Mitigation_Chapter_9_Buildings_Report_by_the_Intergovernmental_Panel_on_Climate_Change.

Lux, Nicole, and Alexandros Skouralis. 2023. "European CRE Lending, 2022." Bayes Business School, accessed 24.04.2023, https://www.bayes.city.ac.uk/__data/assets/pdf_file/0005/725585/Eurpean-CRE-Lending-Report-YE2022.pdf.

Maduta, Carmen, Giulia Melica, Delia D'agostino, and Paolo Bertoldi. 2023. "Defining zero-emission buildings, EUR 31382 EN", Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-61615-3, doi:10.2760/107493, JRC129612. https://dx.doi.org/10.2760/107493.

Maj, Magdalena, Wojciech Rabiega, Aleksander Szpor, Stefano Cabras, Andrei Marcu, and Dora Fazekas. 2021. "Impact on Households of the Inclusion of Transport and Residential Buildings in the EU ETS." Polish Economic Institute, accessed 05.06.2023, https://pie.net.pl/wp-content/uploads/2021/06/PIE-Raport_ETS.pdf.

Mangialardo, Alessia, Ezio Micelli, and Federica Saccani. 2019. "Does Sustainability Affect Real Estate Market Values? Empirical Evidence from the Office Buildings Market in Milan (Italy)." *Sustainability* 11 (1). doi:10.3390/su11010012. https://www.mdpi.com/2071-1050/11/1/12.

Mariani, Barbara, and Caroline Heinzel. 2022. "Lessons from the German Emissions Trading System for Buildings and Road Transport." Europe Environmental Bureau, accessed 27.04.2023, https://eeb.org/wp-content/uploads/2022/03/German-Emissions-Trading-System-for-buildings-and-transport.pdf.

Matisoff, Daniel C., Douglas S. Noonan, and Mallory E. Flowers. 2016. "Policy Monitor—Green Buildings: Economics and Policies." *Review of Environmental Economics and Policy* 10 (2): 329-346. doi:10.1093/reep/rew009. https://doi.org/10.1093/reep/rew009.

McAllister, Pat, and Ilir Nase. 2023. "Minimum Energy Efficiency Standards in the Commercial Real Estate Sector: A Critical Review of Policy Regimes." *Journal of Cleaner Production* 393. doi:10.1016/j.jclepro.2023.136342. https://www.sciencedirect.com/science/article/pii/S0959652623005000.

McKinsey & Company. 2022. "Global Energy Perspektive 2022." accessed 13.01.2023, https://www.mckinsey.com/~/media/McKinsey/Industries/Oil%20and%20Gas/Our%20Insights/Global%20Energy%20Perspective%202022/Global-Energy-Perspective-2022-Executive-Summary.pdf.

Meadows, Damien, Peter Vis, and Peter Zapfel. 2019. "The EU Emissions Trading System." In *Towards a Climate-Neutral Europe*, edited by Jos Delbeke and Peter Vis, 95-116: Routledge.

Mercader-Moyano, Pilar and Paula M. Esquivias. 2020. "Decarbonization and Circular Economy in the Sustainable Development and Renovation of Buildings and Neighbourhoods." *Sustainability* 12 (19) (sep): 7914. doi:10.3390/su12197914. https://www.mdpi.com/2071-1050/12/19/7914.

Minutiello, Valentina and Patrizia Tettamanzi. 2022. "The Quality of Nonfinancial Voluntary Disclosure: A Systematic Literature Network Analysis on Sustainability Reporting and Integrated Reporting." *Corporate Social Responsibility and Environmental Management* 29 (1): 1-18. doi:10.1002/csr.2195. https://doi.org/10.1002/csr.2195.

Molotsky, Brad A., Deborah Cloutier, and Annette Michelle Willis. 2022. "ESG at a Tipping Point for Real Estate: Background, Recent Developments, and ESG Trends and Opportunities." *The Practical Real Estate Lawyer*. https://www.troutman.com/images/content/3/2/325985/PREL2211-Cloutier-Molotsky-Wilis.pdf.

Moring, Andreas and Christin Inholte. 2022. *Nachhaltigkeit Und Digitalisierung in Der Immobilienwirtschaft: Real Sustainability*. Wiesbaden: Springer Gabler.

Morri, Giacomo and Antonio Mazza. 2014. *Property Finance: An International Approach* John Wiley & Sons.

Morri, Giacomo and Benedetto Paolo. 2019. *Commercial Property Valuation. Methods and Case Studies*. Wiley Finance Series.

Munich Re. n.d. "Risks Posed by Natural Disasters." Accessed 13.01.2023, https://www.munichre.com/en/risks/natural-disasters-losses-are-trending-upwards.html.

Nazirah Mat Russ, Mahanim Hamid, and Kho Mei Ye. 2018. "Literature Review on Green Cost Premium Elements of Sustainable Building Construction." *International Journal of Technology* 9 (8) (Dec 1,): 1715-1725. doi:10.14716/ijtech.v9i8.2762. https://explore.openaire.eu/search/publication?articleId=doajarticles::cd752dd5ad879971ca2eefa7188cd507.

Neshat, Razia, Rishikesh Patkar and Hariharan GG. 2022. "Real Estate Market Size Report 2021/2022." MSCI, accessed 27.04.2023, https://www.msci.com/documents/10199/8f62c2a3-8374-cbf9-a7d2-a8c2c5e63e62.

OECD. 2021. "OECD Guidelines for Multinational Enterprises.", accessed 03.05.2023, https://www.oecd.org/daf/inv/mne/48004323.pdf.

OECD. 2022. "Pricing Greenhouse Gas Emissions.", accessed 10.04.2023, https://doi.org/10.1787/e9778969-en.

Oertel, Cay. 2019. *Quantitatives Risikomanagement in Der Immobilienwirtschaft* Springer.

Oertel, Cay, Ekaterina Kovaleva, Werner Gleißner, and Sven Bienert. 2022a. "Stochastic Framework for Carbon Price Risk Estimation of Real Estate: A Markov Switching GARCH Simulation Approach." *Journal of Property Investment & Finance 40.4 (2022): 381-397.*

Oligschläger, Paul and Vincent Mahieu. 2023. "European Parliament Votes for Ambitious New Energy. EPBD IV Impacts Real Estate and Financial Sectors Towards Net Zero Carbon in 2050" KPMG, accessed 12.03.2023, https://kpmg.com/nl/en/home/insights/2023/03/ep-votes-for-ambitious-new-energy-performance-of-buildings-directive-epbd-iv.html.

Oliver, Joshua. 2023. "European Commercial Real Estate: The Cracks are Starting to Show." Financial Times, accessed 05.05.2023, https://www.ft.com/content/733a24d7-056d-4f02-8b20-8ba9f566e9f7.

Pantsar, Mari, Potočnik, Janez, Porter, Martin, Turner, Adair, Blériot, Jocelyn, Wolff, Christoph, Wolf, Simon, and Anders Wijkman. n.d. "The Circular Economy - A Powerful Force for Climate Mitigation. Transformative Innovation for Prosperous and Low-Carbon Industry." SITRA; International Resource Panel; European Climate Foundation; Energy Transitions Commission; Ellen MacArthur Foundation; European Climate Foundation; Climate-KIC, accessed 01.06.2023, https://materialeconomics.com/Materialeconomics//s/s.com/s/s.com//s//s/s.com/s/s.com/s//s/s.com/s/s.com/s//s/s.com/s/s.com/publications/the-circular-economy-a-powerful-force-for-climate-mitigation-1.

Patterson, Scott and Amrith Ramkumar. 2021. "Green Finance Goes Mainstream, Lining Up Trillions Behind Global Energy Transition." Wall Street Journal, accessed 14.04.2023, https://www.wsj.com/articles/green-finance-goes-mainstream-lining-up-trillions-behind-global-energy-transition-11621656039#:~:text=Some%20of%20the%20world%27s%20biggest,than%20tripling%20in%20three%20years.

PCAF. 2022. "The Global GHG Accounting and Reporting Standard Part A: Financed Emissions. Second Edition." accessed 30.04.2023, https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf.

Pekdemir, Dilek, David Moreno, Lourdes C. Luiz, and Iskren Marinov. 2023. "Global Eeal Estate Total Markets Table Q1-2023." European Public Real Estate Association, accessed 10.05.2023, https://prodapp.epra.com/media/EPRA_Total_Markets_Table_-_Q1-2023_1681460716641.pdf.

Percoco, Marco. 2014. "The Impact of Road Pricing on Housing Prices: Preliminary Evidence from Milan." *Transportation Research Part A: Policy and Practice* 67: 188-194. doi:10.1016/j.tra.2014.07.006. https://www.sciencedirect.com/science/article/pii/S0965856414001712.

Perner, Jens and Patrick Peichert. "Assessment of Reform Options for the EU ETS." Frontier Economics, accessed 26.04.2023, https://www.frontier-economics.com/media/4706/reforming-the-eu-ets.pdf.

Petreski, Aleksandar. 2022. "Green Finance in Real Estate, Housing Price Volatility and Rental Swaps." JIBS Dissertation Series No. 150. https://www.diva-portal.org/smash/get/diva2:1711207/FULLTEXT01.pdf.

Pittard, Caroline. 2023. "Why Embodied Carbon should be Prioritized Alongside Operational Emissions in Sustainability Disclosure and Emission Reduction Efforts." GRESB, accessed 26.04.2023, https://www.gresb.com/nl-en/why-embodied-carbon-should-be-prioritized-alongside-operational-emissions-in-sustainability-disclosure-and-emission-reduction-efforts/.

Pivo, Gary and Jeffrey Fisher. 2010. "Income, Value, and Returns in Socially Responsible Office Properties." *Journal of Real Estate Research* 32 (3): 243-270. doi:10.1080/10835547.2010.12091281. https://doi.org/10.1080/10835547.2010.12091281.

Pollitt, Michael and Geoffroy Dolphin. 2020. "Feasibility and Impacts of EU ETS Scope Extension. Road Transport and Buildings." accessed 03.05.2023, https://cerre.eu/wp-content/uploads/2020/12/CERRE_Feasibility-and-impacts-of-EU-ETS-scope-extension_December2020.pdf.

Premier ministre français. "Décret n° 2019-771 du 23 juillet 2019 relatif aux obligations d'actions de réduction de la consommation d'énergie finale dans des bâtiments à usage tertiaire." *Journal officiel n° 0171 du 25 juillet 2019.* https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000038812251.

Reichardt, Alexander. 2014. "Operating Expenses and the Rent Premium of Energy Star and LEED Certified Buildings in the Central and Eastern US." *The Journal of Real Estate Finance and Economics* 49: 413-433. https://doi.org/10.1007/s11146-013-9442-z.

Reid, Bryan. 2020. "Measuring Climate Risk in Real Estate Portfolios." MSCI, accessed 15.04.2023, https://www.msci.com/www/blog-posts/measuring-climate-risk-in-real/01973063966.

Robson, Will. 2021. "Real Estate's Climate-Transition Risk: The Path to Net-Zero." MSCI, accessed 13.01.2023, https://www.msci.com/www/blog-posts/real-estate-s-climate/02516394049.

Röck, Martin, Marcella Ruschi Mendes Saade, Maria Balouktsi, Freja Nygaard Rasmussen, Harpa Birgisdottir, Rolf Frischknecht, Guillaume Habert, Thomas Lützkendorf, and Alexander Passer. 2020. "Embodied GHG Emissions of Buildings – the Hidden Challenge for Effective Climate Change Mitigation." *Applied Energy* 258: 114107. doi:10.1016/j.apenergy.2019.114107. https://www.sciencedirect.com/science/article/pii/S0306261919317945.

Rolo, Antonio Garcia. 2022. "ESG and EU Law: From the Cradle of Mandatory Disclosure to More Forceful Steps." In *The Palgrave Handbook of ESG and Corporate Governance*, edited by Filipe Morais, 191-216: Springer.

Runge-Metzger, Artur and Tom Van Ierland. 2019. "The Effort Sharing Regulation." In *Towards a Climate-Neutral Europe*, edited by Jos Delbeke and Peter Vis, 95-116: Routledge.

Runge-Metzger, Artur, Stefaan Vergote, and Peter Vis. 2019. "The EU Emissions Trading System." In *Towards a Climate-Neutral Europe*, edited by Jos Delbeke and Peter Vis, 117-138: Routledge.

Santamouris, M. and K. Vasilakopoulou. 2021. "Present and Future Energy Consumption of Buildings: Challenges and Opportunities Towards Decarbonisation." *E-Prime* (oct): 100002. doi:10.1016/j.prime.2021.100002. https://linkinghub.elsevier.com/retrieve/pii/S2772671121000024.

Schweizer, Oliver, Angermeier, Christina, Gehre, Moritz and Nicolaus, Sophie-Helen. 2023. "EY Real Estate. Asset-Management-Studie 2023. Asset Management in Der VUCA-Welt (Volatile, Uncertain, Complex, Ambigous)." EY Real Estate, accessed 01.06.2023, https://assets.ey.com/content/dam/ey-sites/ey-com/de_de/noindex/ey-real-estate-asset-management-studie-2023.pdf?mkt_tok=NTIwLVJYUC0wMDMAAAGL65kx2nWhZ_pHJuTITKJES__UHLEyjROYYx4Ra1AlU9r6OcWFsr6hfXV_L1XKa6gP6XAvFaMsiuHMZidfvO97hmMeph8x7wQqp_iX_L__2nPIozfILg.

Science-based targets initiative. 2023. "Lead the Way to a Low-Carbon Future.", accessed 23.08.2023, https://sciencebasedtargets.org/how-it-works.

Sotos, Mary, Bhatia, Pankaj, Cummis, Cynthia, Didden, Mark, Kovac, Alex, Ryor, Josh and Stevens, Amanda. 2015. "GHG Protocol Scope 2 Guidance. An Amendment to the GHG Protocol Corporate Standard." World Business Council for Sustainable Development, World Resources Institut, accessed 30.03.2023, https://ghgprotocol.org/sites/default/files/2023-03/Scope%202%20Guidance.pdf.

Stenning, Jon, Ha Bui, and Alexandra Pavelka. 2020. "Decarbonising European Transport and Heating Fuels - is the EU ETS the Right Tool?" Cambridge Econometrics, accessed 24.04.2023, https://europeanclimate.org/wp-content/uploads/2020/06/01-07-2020-decarbonising-european-transport-and-heating-fuels-full-report.pdf.

Strathon, Chris, Evan Lester, Honoré A. Simo, Emily Chadwick. 2021. "Valuing Net Zero & ESG for Offices. Global Market Trends and Valuation Methodology." JLL, accessed 30.03.2023, https://www.jll.co.uk/content/dam/jll-com/documents/pdf/research/jll-global-valuing-esg-net-zero-office-buildings-valuation-insights.pdf.

Stubbs, Wendy and Colin Higgins. 2018. "Stakeholders' Perspectives on the Role of Regulatory Reform in Integrated Reporting." *Journal of Business Ethics* 147: 489-508. https://doi.org/10.1007/s10551-015-2954-0.

Tagesspiegel. 2023. "Geplante EU-Regeln: Bauministerin Geywitz Gegen Sanierungszwang Für Gebäude." accessed 10.05.2023, https://www.tagesspiegel.de/wirtschaft/geplante-eu-regeln-bauministerin-geywitz-gegen-sanierungszwang-fur-gebaude-9565442.html.

Teixidó, Jordi, Stefano F. Verde, and Francesco Nicolli. 2019. "The Impact of the EU Emissions Trading System on Low-Carbon Technological Change: The Empirical Evidence." *Ecological Economics* 164: 106347. doi:10.1016/j.ecolecon.2019.06.002. https://www.sciencedirect.com/science/article/pii/S0921800918308139.

Teske, Sven. 2022. *Achieving the Paris Climate Agreement Goals. Part 2, Science-Based Target Setting for the Finance Industry - Net-Zero Sectoral 1.5°C Pathways for Real Economy Sectors*. Cham, Switzerland: Springer.

Testarmata, Silvia and Mirella Ciaburri. 2022. "Harmonisation Or Standardisation of Non-Financial Reporting in European Union: The Role of Regulation." In *Non-Financial Disclosure and Integrated Reporting: Theoretical Framework and Empirical Evidence*, 309-331: Springer.

United Nations Environment Programme. 2022. "Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector." accessed 21.12.2022, https://globalabc.org/sites/default/files/2022-11/FULL%20REPORT_2022%20Buildings-GSR_1.pdf.

United Nations Framework Convention on Climate Change. 2016. "The Paris Agreement." accessed 11.01.2023, https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf.

United Nations Treaty Collection. 2016. "Chapter XXVII. Environment. 7. D Paris Agreement." accessed 11.01.2023, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en.

Vasse, Thibault. 2022. "EU Climate Goals: Few Countries on Course to be "Fit for 55"; further Reforms Needed." Scope Ratings Group, accessed 20.04.2023, https://www.scopegroup.com/dam/jcr:89fea023-f310-4022-bc50-444380b409b1/EU%20climate%20mitigation_Report_Final.pdf.

Weinfeld, Sandra, Grazyna Wiejak-Roy, and Colin A. Booth. 2023. "Embodied Carbon Reporting by German Real Estate Institutional Investors." *Journal of Sustainability Research* 5 (1): e230003. doi:10.20900/jsr20230003. https://sustainability.hapres.com/htmls/JSR_1520_Detail.html.

World Economic Forum. 2023. "The Global Risks Report 2023. 18th Edition. Insight Report." accessed 13.01.2023, https://www3.weforum.org/docs/WEF_Global_Risks_Report_2023.pdf.

World Green Building Council. 2013. "The Business Case for Green Building—A Review of the Costs and Benefits for Developers, Investors and Occupants" UKGBC, accessed 31.03.2023, https://ukgbc.org/wp-content/uploads/2017/09/World-GBC-Business-Case-for-Green-Buildings.pdf.

World Green Building Council. 2023. "WorldGBC Reacts to the Result of EPBD Plenary Vote." accessed 02.04.2023, https://worldgbc.org/article/worldgbc-reacts-to-epbd-vote/.

WRI and WBCSD. 2023. "Greenhouse Gas Protocol Provides Standards, Guidance, Tools and Training for Business and Government to Measure and Manage Climate-Warming Emissions." accessed 23.03.2023, https://ghgprotocol.org/about-us.

Wunderling, Nico, Ricarda Winkelmann, Johan Rockström, Sina Loriani, David I. Armstrong McKay, Paul D. L. Ritchie, Boris Sakschewski, and Jonathan F. Donges. 2022. "Global Warming Overshoots Increase Risks of Climate Tipping Cascades in a Network Model." *Nature Climate Change* 12 (12) (Dec 22,). doi:10.1038/s41558-022-01545-9. https://www.nature.com/articles/s41558-022-01545-9.

Xiang, Xiwang, Minda Ma, Xin Ma, Liming Chen, Weiguang Cai, Wei Feng, and Zhili Ma. 2022. "Historical Decarbonization of Global Commercial Building Operations in the 21st Century." *Applied Energy* 322 (sep): 119401. doi:10.1016/j.apenergy.2022.119401. https://linkinghub.elsevier.com/retrieve/pii/S0306261922007383.

Yakimova, Yasmina. 2022. "Sustainable Economy: Parliament Adopts New Reporting Rules for Multinationals." European Parliament, accessed 05.06.2023, https://www.europarl.europa.eu/news/de/press-room/20221107IPR49611/sustainable-economy-parliament-adopts-new-reporting-rules-for-multinationals.

Ying Liu, Jung, Sui Pheng Low, and Xi He. 2012. "Green Practices in the Chinese Building Industry: Drivers and Impediments." *Journal of Technology Management in China* 7 (1): 50-63. https://doi.org/10.1108/17468771211207349.

Yougova, Dessislava. 2023. "Revising the Effort-Sharing Regulation for 2021-2030: 'Fit for 55' Package" European Union, accessed 12.04.2023, https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698812/EPRS_BRI(2021)698812_EN.pdf.

ZIA - Zentraler Immobilien Ausschuss e.V. 2021. "Verantwortung Übernehmen: Eine Studie Des ZIA Zur Sozialen Verantwortung Der Immobilienwirtschaft." accessed 01.04.2023, https://zia-deutschland.de/wp-content/uploads/2021/12/Verantwortung-uebernehmen-Gutachten.pdf.

ZIA Zentraler Immobilien Ausschuss e.V. 2021. "Stellungnahme Des ZIA Zentraler Immobilien Ausschuss E.V. Klimawandel: Aktualisierung Des EU-Handelssystems (ETS) - Folgenabschätzung in der Anfangsphase." accessed 25.04.2023, https://zia-deutschland.de/wp-content/uploads/2021/05/2020-11-25-ZIA-Stellungnahmen-EU-ETS-Gebaude.pdf.

ZIA Zentraler Immobilien Ausschuss e.V. 2023. "ZIA Sieht in Europäischer Gebäudeenergierichtlinie Die Gefahr Von Überforderung. Und: „Gewerbeimmobilien Nicht Schlechter Stellen"." accessed 10.05.2023, https://zia-deutschland.de/pressrelease/zia-sieht-in-europaeischer-gebaeudeenergierichtlinie-die-gefahr-von-ueberforderung-und-gewerbeimmobilien-nicht-schlechter-stellen/.