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Crystal ball or wishful thinking?

Reference pathways as tools for net zero investing in pension funds

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Abstract:
This thesis will examine the premonitions and parameters of two models for sustainable finance development: the International Energy Agency (IEA) model *Net Zero by 2050*, and the Net Zero Asset Owner Alliance (NZAOA) model *One Earth Climate Model*. It will also share observations from my internship period in Norway's largest pension fund, KLP, where reference pathways are a part of their climate strategy. The thesis will briefly compare and contrast the two climate models and their reference pathways. After investigating the prerequisites for using these models, the thesis looks at some likely consequences of integrating them into organisations, as well as how these models/pathways work as market devices with agencies of their own. Some key questions this thesis will ask, are:

- What can these models provide us?
- What are some of the background parameters for the models?
- How are these models actually integrated and used?

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1. Introduction

Sustainable finance has been a topic of great importance in the finance sector the last few years (GFANZ 2022). Not only has it become increasingly important for consumers of financial products, it has also become increasingly transparent what type of power institutional investors with membership in the Glasgow Financial Alliance for Net Zero have, as they hold around 40% of private financial assets worldwide. According to this, institutional and diversified long-term investors own shares in companies in almost every

sector on all continents. With this many assets, comes power to steer development in the direction that the investors see most suitable.

Thus, it is important to discuss how to yield this power in a way that can help us limit climate change through integrating climate as a fundamental part of investment and management in institutional investors. While this has been attempted for some time with labels like ESG (environmental, social and governance) ratings, internal strategies within investors and international alliances between them, the bulk of the results have been bureaucratic and on paper. While this is an important step, the *missing link* between strategy and action could still take many different forms. Financial institutions are ill-advised in waiting for governments to be the rule-makers and instigators, instead these institutions must also work with their own financial devices to manipulate markets. However, there is a need for synergy between markets and government regulations to achieve sustainability.

1.1 Choice of topic

Through an internship with KLP I have spent a semester working on pathways for net zero portfolio management and other topics within sustainable finance and corporate responsibility. The topic of pathways in particular was important because of the real effects a choice of pathway could have for future business. The academic and practical work with pathways and roadmaps during the internship was central in deciding to write a thesis on the use of them in financial institutions.

While we can quantify what sustainability is in some terms in the natural sciences, chances are that these will need help from both the social sciences, humanities, and everything in between to be truly realised in the real world. Translating knowledge from the social sciences, for instance, can be very tough when combining it with the occasionally rigid framework of economics and business management. The issue of climate change is seldom prioritised, due to its lack of apparent urgency, unlike other natural disasters like earthquakes, or social issues like refugee crises and pandemics. The issue of making money is often a question of near-term survival for many, both individuals, but also short-term investors and companies. But what if it was turned into a long-term question instead? The long-term investors and financial institutions have money to lose, not gain, on fossil fuel reliance and climate change. This thesis will take a look at the tool of reference pathways in the finance

sector to achieve climate targets. Furthermore, it will explain some important factors in the integration process and success of these pathways.

1.2 Research question

The leading research question for this thesis, is as follows:
What can reference pathways contribute to sustainable finance and net zero targets, and what consequences and prerequisites does this entail?

2. Theory

2.1 Sustainable finance

"Transitioning to a net zero economy means rewiring the financial system to look at aligning investment to emissions pathways."(Knight 2023)

Financial institutions are inherently not very favourably positioned in the decision-making process connected to climate change. This is because the financial world is both internationally transactional, but also regulated by national laws. Another reason is that they seldom have high quality, large-scale information readily at hand, and that there is as of late such a large array of sustainable finance actors and measuring tools out there without overlap. This leads to an ostensibly unmanageable world of methods and membership options, which are lacking in both counter-measurability and in degree of coverage. Actors in the financial business have themselves also started gathering information and tools, like climate risk assessment teams and data on companies in their portfolio, so the membership in a climate investment organisation may not level the playing field for all actors.

Today, sustainable finance is often connected to different methods of measuring and reporting, as these methods have to some degree shaped the field of sustainable finance. Methods like the Scopes (1, 2 and 3) and ESG - numerical measurements that can be used for both analysis and decision-making - are both popular and controversial. The EU Taxonomy, the EU Corporate Sustainability Reporting Directive, the models presented later on and so many more, are all part of the development of the last years of extensive reporting, measuring and planning for the uncertain future. The responsibility for the future of the world is a large part of this shared concern, but so is the management of risk when handling large assets,

often on behalf of large groups of people. This balance of climate responsibility and risk is often called double materiality, and is central to methods in the sustainable finance universe.

This thesis will present two different models, their respective pathways to net zero and their differences and similarities. Later, it will explain how to understand the models in an investment setting, as well as discuss some other actions and devices needed for them to fully function as intended. Lastly, this thesis will look at some of the difficulties in applying a scientific model to an economic 21st century reality in terms of complexity, risk, and society.

2.2 Actor-network theory: The market as a network

Callon (2007) looks at the market as a network where buyers and sellers are actors with differing interests. Seeing the market as not only a meeting place, but one that extends through time as well. The actors' future depends on "calculating actions" by the actors themselves, but this becomes an issue when no stable information exists. In addition, the network and the actors leave out what is often referred to as externalities, consequences that are not traditionally taken into account in market transactions. A common example of an externality is CO_2 emissions, an externality that is so central to productivity that it has become a global problem. Externalities are neither networks nor actors, and so they have to be priced into the trading between the actors. The framework of actor-network theory is useful for markets because it assumes roles of the actors (sometimes referred to as agents) as well as it offers different ways to cope with issues. Here, pricing, contracting and information flows are mentioned as different (and as this thesis will show, relevant) ways of defining common future interests and current dynamics in the marketplace.

2.3 Roadmaps and their uses

In many ways, the models that this thesis will examine, are parts of roadmaps towards a future where climate change is acted on. KLPs roadmap is also a roadmap in both the sense of the word and of the content. These roadmaps have many similarities, and this is not a coincidence: roadmaps often have some common denominators. For this thesis, we will be utilising the concept of the "technological roadmap", as mentioned by Kappel (2001). The technological or scientific roadmap is one end of a spectrum, where the other end is product-focused. Since these models forecast industry- and economy-wide changes and implications, this leans more towards the technological roadmap side of the spectrum. In our "roadmaps", or rather in our pathways and overarching models, we see a similar structure and

components. But what sets them apart appears to be a difference in the mapping process and assumptions between the two, to achieve their differing results.

The purpose of the roadmap is multifaceted, Kappel argues (ibid). While it is used to try and influence industry standards, it is also an internal tool for forecasting and planning. The forecasting promise of the climate models is simple: forecast when, how and where emissions must be decreased to limit global warming to 1,5 degrees. The planning aspect of it is where companies and financial institutions get involved, as they are to plan their future operations, investments and of de-investments in line with at least one of these roadmaps. Roadmaps are good tools for this type of external threat, when the forecasting dimension is stable and thoroughly researched, like it is in the case of climate change. It is almost completely certain that it will occur if action is not taken. Roadmaps are also useful in cases within existing markets, which is why these models use existing structures. However, the influence these models, and subsequently the financial institutions, need to have on policy, nationally and internationally, is of concern when using the roadmap mould. The roadmap perspective is weak for exploring different scenarios, which is why roadmaps (or in our case, reference pathways and their accompanying climate model) present one specific path to follow (ibid, p. 44).

Roadmaps as used by Rommetveit et al (2019) as an organising tool across disciplines. This is also a common theme in roadmaps, that they often draw on other ways of knowing or theories from other disciplines to shape a way forward for their own sector. Roadmaps in the sustainable finance sector, for instance, show different variations of future law, politics, science and technology.

2.4 Roadmaps as part of a work process

As Kappel (2001) describes roadmaps, they have multiple possible uses, but are not always fit to include all issues. The roadmap at KLP is meant to cover their own portfolio management, and Kappel introduces a figure (see figure 2.1) to describe the influence that roadmaps can have.

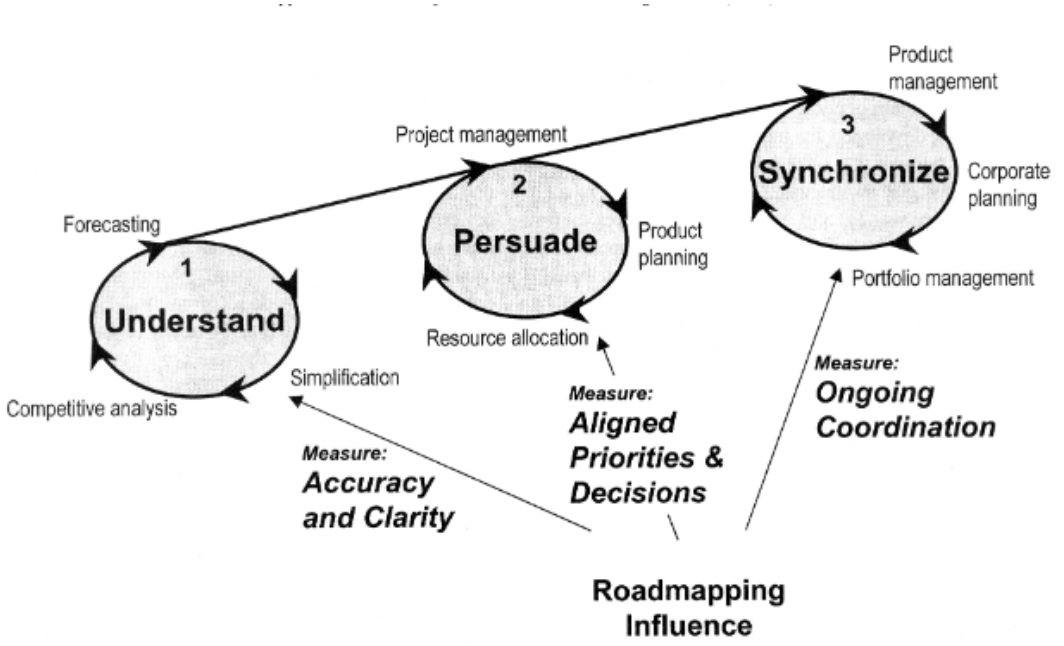


Figure 2.1: Influence from roadmaps in different stages and places (Kappel 2001, p. 48)

This also brings up the topic of reporting. Without thorough *global* reporting standards, there are no standardised ways of getting data like this. This means extra effort for those trying to control the emission levels in their portfolio. As mentioned above there are many different standards and reporting methods, which are often voluntary. Regulating and structuring the reporting requirements (and the presence of a taxonomy) is crucial to cross-measurability amongst financial actors.

Below, figure 2.2 is an adaptation of the figure found in Kappel (figure 2.1, 2001, p.48). To further explain just how important regulation is in these types of interactions, an alternative version of the model could be this:

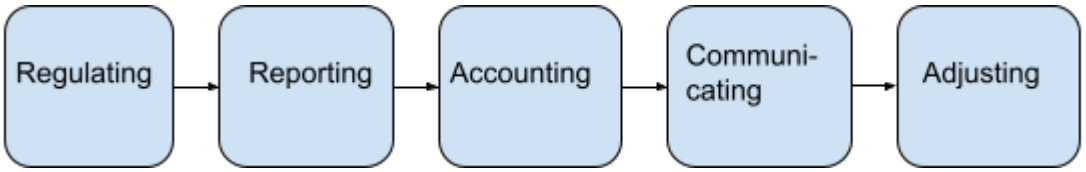


Figure 2.2: Evaluation process for portfolio management after using a roadmap, based on Kappel (2001)

This is a much simpler version than that of Kappel (2001). This exemplifies one of the ways that roadmaps can influence at every step in the process - both internal and external roadmaps, like government roadmaps and industry roadmaps. While the three first stages are somewhat external (as in demands are often set from external actors), the two last stages are mostly done within the organisation. This is why it is important to both have sturdy regulation, reporting standards and systems for data collection, but also internal roadmaps with the methodology that is the best fit for the organisation.

This is the understanding that the internship period left me with, although it is possible and sometimes necessary to rearrange the steps from time to time. For instance, some financial institutions have already excluded coal out of their portfolio, given the high carbon emissions produced by coal. This is not something that has to do with the coal companies' reporting or accounting, but because their business is coal, and coal (at least unabated) is not part of the energy future that investors imagine. This specific example of coal forfeits my models' steps, however this is not necessarily the case with other companies in other industries. The process described in figure 2.2 is also somewhat of a loop, as it generally loops back on itself after adjusting the portfolio, as well as at different points if needed.

2.5 On quantification and markets

> Calculation is neither a universally homogeneous attribute of humankind, nor an anthropological fiction. It is the concrete result of social and technical arrangements. (Muniesa et al 2007, p. 5)

While financial products are "abstractions" (ibid, p.6), the method of quantifying an otherwise qualitative object or situation may also be referred to as a sort of deductive abstraction. Quantification, or calculation, is not a "universally homogeneous attribute", and it most certainly is subject to human choice in many situations. Although there are many metrics and ways of measuring in statistics, the use of quantification can not always be warranted (although it can be "legitimised" (Sareen et al 2020, p. 2)) The qualitative can also be abstracted into summaries, abstracts, keywords and so on, leaving out much of the knowledge of the matter, in a similar way to quantification. Even if we approach the models and pathways with the mindset that quantification is not always the full picture, quantitative values can still be problem-solving and serve as tools and not solutions when solving large, complex problems.

“Much quantification carries the conundrum that, without representing context and purpose of production, numbers can obfuscate as much as illuminate” (Sareen et al 2020, p. 2). This especially points to the temperature scores and meta-values that are discussed earlier. These quantified versions are just qualitative enough to hide the data behind it, because it is not straightforwardly compounded. The pathways are somewhat similar in this regard. What future made of numbers and/or figures do they project, and what are the terms of their success? Because they are so different from each other the question might also yield different answers from them.

While it is true that the built-in need to quantify things in the financial sector is problematic, it is also subservient to the system structure. The financial system is based both on quantified amounts of assets, risk, stocks, sales, ESG ratings and so on, as well as written law, social interactions, networking, allocation of knowledge, power and opportunity. This is why the pathways are reflectant of this duality. They give out numbers and graphs as well as recommendations and communication advice. Operating within the framework of the system demands system knowledge and legitimacy, something that the actor-network dynamic of the market offers.

> *“This movement is not new, and has precedents in the decadal fight of sociologists and ecologists against the numerification of everything, whereby both society and the environment can be seen as subject to neat systems of prediction and control (Pereira and Funtowicz, 2015; Stirling, 2019, 2008). Whether it is representative or not, quantification provides an evidence base to make claims about how things are. In doing so, it impacts both public understandings and societal commitments to particular configurations of resource allocation.”* (Sareen et al 2020, p. 4).

Here, Sareen et al (2020) discusses the same trends as in Friedland and Robertson (1990), but with the implication of quantification. This is what many point to as a core issue in economics and the climate and environment cause at large. Because there is a need to quantify values to use information within the framework, the result of the process is of necessity also at least partially quantitative. Not everything can be measured in numbers, and this is a shortcoming of the current system. However, a “better” system of tracking emissions and climate impact would not necessarily mean a qualitative one - numbers serve a general

purpose in the framework of both the roadmaps/models/pathways, as well as in the emission and progress tracking process.

2.6 Marketplaces and the study of economics

"In the face of such robust competition, the other social science disciplines retreated from the capitalist marketplace. (...) Nevertheless, there were very few social scientists who were not strongly influenced, one way or another by economic paradigms." (Friedland & Robertson 1990, p. 6)

Scientists have studied the marketplace for many years, but it has not always been multi-disciplinary work, and economy as a discipline has influenced the work strongly. Although in the process of changing, the main weight of studies have been economic, because of the intricate dynamics in play. Many other disciplines have been affected by the methods in economics, and many of the social sciences dabble in statistics and mathematical thinking. This is, as Callon (2001) puts it, also due to technology and information systems in the later years, as well as economy influencing other diciplines. To understand the marketplace from this viewpoint, we have chosen the actor-network theory (ANT) perspective of institutions, actors, networks and influence. This is just to frame the shape and form the models need to fit into for financial institutions to integrate them.

In the book "Beyond the Marketplace" the market is described as an institution that does not limit itself in space or time (Friedland & Robertson 1990). If the market is the institution, the "traders", or financial institutions, are the actors, and the network is made up of their actions in this marketplace. Because its status as an institution establishes its agency, it also invites legitimate regulation and influence by actors both inside and outside the marketplace. We will discuss actor-network theory briefly below.

2.7 Pathways

2.7.1 Net Zero by 2050

The Net Zero by 2050 (NZ2050) model is made by the International Energy Agency, and . Focus areas include both governmental and personal investments, as well as patterns of behaviour and industry standards. These are referred to as the priority actions in the report,

and are meant to be highlighted for policy makers specifically. In this way, the document lends itself to a way of communicating to be able to get the most important things done. However, without the many molecular parts of the net zero strategy, results may vary. The NZ2050 projects a decline from 33.9 Gt CO_2 annually in 2020 to a net zero result in 2050. Given a carbon budget of 500 Gt CO_2 with carbon capture and storage, the NZ2050 envisions a gradual decline in all sectors, with very low net emissions in the years leading up to 2050.

This pathway has also set targets with time limits for policy changes. This includes phasing out coal, the phase-out of combustion engine automobiles, standards of equipment and other very technical changes. Although taking a highly technical and industrial approach to climate change, there is still some strong wording throughout. For instance, the need to stop investing in new fossil fuel supplies is stated many times (e.g. IEA 2021 p. 21). This sends a strong signal to the energy sector, as IEA is their own industry organisation. No more new fossil fuel extraction means two things: firstly, it means that those investments need to go elsewhere to sustain the world's energy needs. Secondly, it means that those resources not exploited, will remain “buried”. Countries with large fossil resources will never see the monetary resources that those could have brought in. These are very real economic and social implications of following an abstract model.

The NZ2050 is a proponent of technological carbon capture and storage for the future. However, relying on future carbon capture is a famous fallacy in climate politics. There are examples of carbon capture projects failing, as well as there are examples of them being postponed and more expensive than accounted for. However, in the NZ2050 model, the authors claim to not subscribe to this. Claiming that:

“All the technologies needed to achieve the necessary deep cuts in global emissions by 2030 already exist, and the policies that can drive their deployment are already proven.”

In figure 2.3 we can see the amount of technology, current and future ones, to be included in the pathways. While behavioural changes make up only a small percentage in both columns, the vast majority of 2030 emission savings are due to technologies that we already have. In the 2050 column however, more than 40% of emission savings are projected to be a result of technologies still under development.

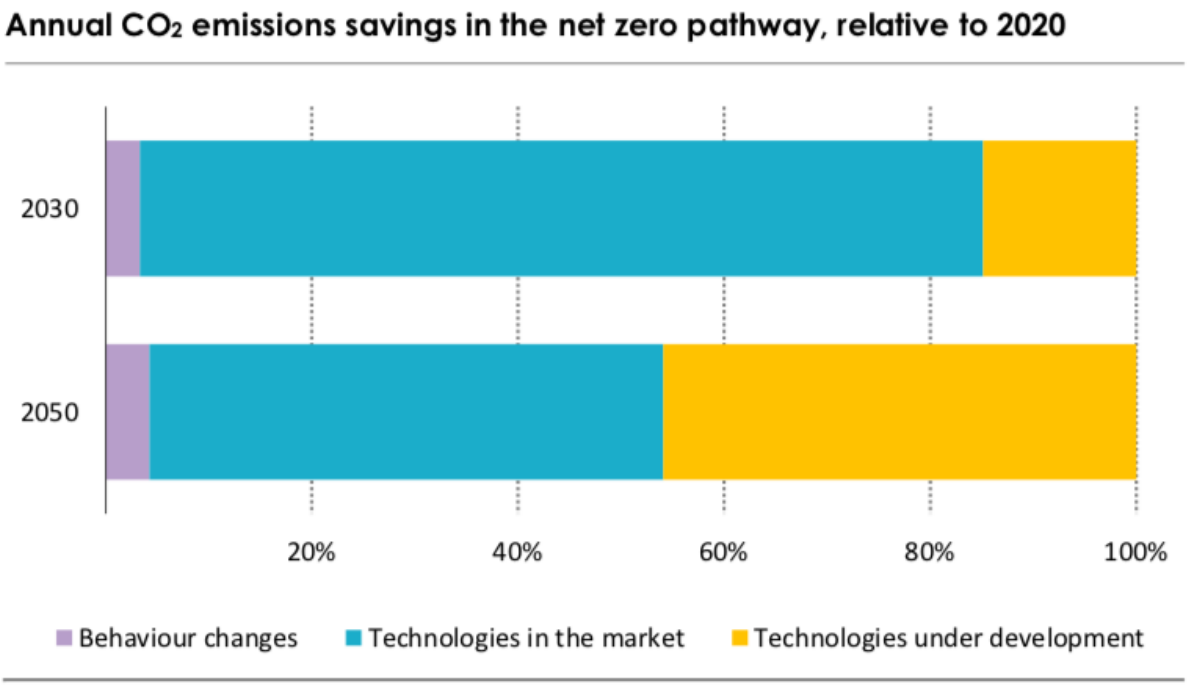


Figure 2.3: Distribution of emission savings in the NZ2050 pathway. (IEA 2021 p. 16)

While there are mixed opinions on how to tackle the climate crisis politically, the different pathways to zero lays a paved path with defined steps along the way.

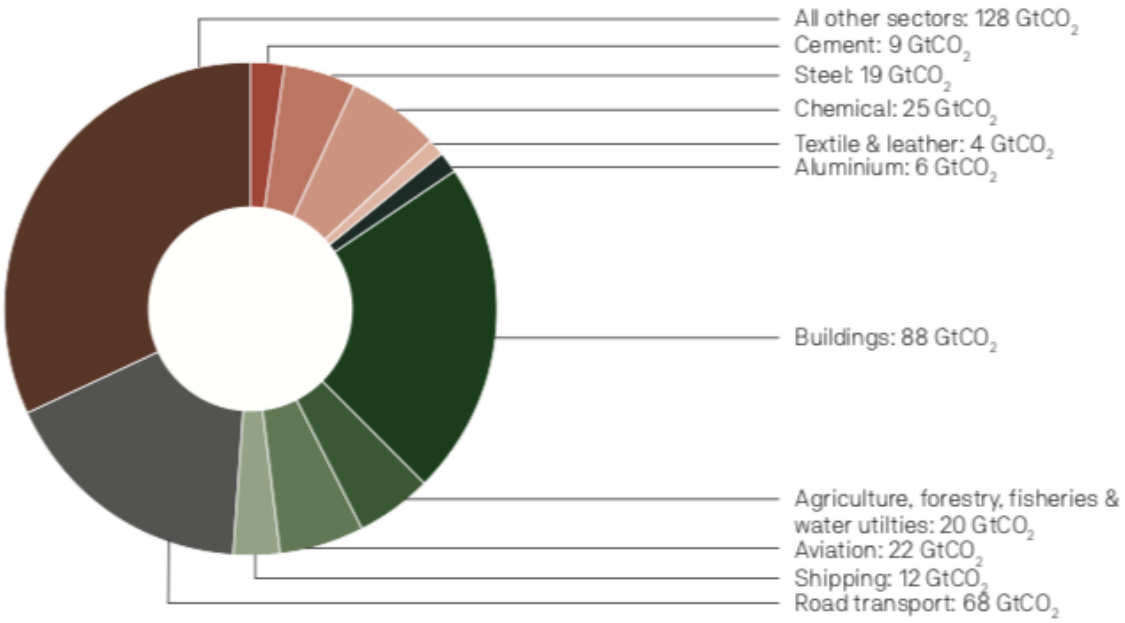
2.7.2 UTS/ NZAOA One Earth Climate Model

The University of Sydney has developed a model called the *One Earth Climate Model* (OECM) on behalf of the UN convened Net Zero Asset Owners Alliance (NZAOA). In this model, a different approach to the pathway system is taken. The most conspicuous is the lack of technological carbon capture and storage (CCS). The One Earth model was developed as a tool for the GFANZ constellation, which again is tied to the COP and the UN. The members of GFANZ (and NZAOA within GFANZ) are actors in the financial system, like pension funds and banks. (GFANZ 2022)

The OECM is based around dividing the carbon budget into different sectors, top-down. They divide industries into 12 sectors, for which they further specify a carbon budget. The carbon budget is located by referring to the IPCC, and the model is a no/low overshoot model, meaning that it does not include more emissions in total than this 1,5-degree carbon budget allows for. Some climate models are overshoot models, where they make different scenarios

based on the temperature goal, sometimes making pathways for 1,5 degrees, 2 degrees, 3 degrees and as high as 6 degrees temperature rise. The carbon budget defines the remaining global carbon budget as 400 Gt of CO_2. This carbon budget has a likelihood of 67% of staying with the 1.5 degree temperature rise target (Teske et al 2022). In categorising the different sectors, the University of Sydney employs the Global Industrial Classification System (GICS) as a framework to place emissions within defined sections. Because the OECM is a top-down model, the sector classification and budgeting has included simplification. The OECM utilises the Scope 1, 2 and 3 categories as a framework for emission accounting, which is different from the NZ2050.

FIGURE 1 GLOBAL CARBON BUDGET BY SUBSECTOR IN [$GTCO_2$] - 2020 - 2050



Figur 2.4: The different sectors in the OECM (Teske et al 2022, p. 5)

In the OECM, carbon emissions are reduced mostly by eliminating fossil fuels as energy sources, and it replaces them with renewable energy instead. This reaches across all scopes not just energy use, but transportation, production and end use. The model does this by dividing the carbon budget of 400 Gt CO_2 between the sectors seen in figure 2.4, before dividing the sector amounts into the three different scopes based on historical emissions. Figure 2.4 shows the cumulative value of all the emissions in the carbon budget of the OECM. Quite a lot of the emissions fall under the “Other” and “Buildings” sections, two sectors that might not be as obvious as to what they entail. Buildings take a lot of energy to heat and cool, as well as residential buildings - homes - use energy for cooking, lighting et

cetera. The cumulative section known as “Other sectors” is composed of all the emissions that do not fit into high-emitting sectors, but that would, if left out, create a large discrepancy between targets and results.

The model is developed by the University of Sydney and peer reviewed by other academic institutions. For now, the actors involved in NZAOA are not under pressure or sanctioned to use the guidelines given in this model, but the organisation will use the data to inform policies and investment decisions in their portfolios (Teske et al 2022, p. 6).

This pathway makes multiple concluding recommendations, all large in scale. These recommendations include the “immediate cessation of public and private investment in new oil, coal, and gas projects” as the very first recommendation. This would mean no future exploration of untapped fossil resources, which could be of considerable monetary value. However, it does offer “key performance indicators to make short- mid- and long-term investment decisions” (Teske et al 2022, p.6), something that is also echoed in investor publications. In addition, this pathway recommends many similar things to the other pathway analysed, the Net Zero 2050 pathway. These are carbon pricing, cessation of coal in some countries, electrification and efficiency standards and mandatory KPIs for companies. These recommended actions are far-reaching and demand high-stakes collaboration and unification. However, after these general recommendations, it makes specific recommendations for industries and financial institutions. These read as following:

“

1. Setting and disclosing decarbonization targets for the investment, lending, and underwriting portfolio sectors consistent with 1.5 °C no/low-overshoot sector models;
2. Cessation of investment in new oil, coal, and gas projects;
3. Ensuring the phase-out of coal by 2030 in OECD countries, and in 2030–2040 in all regions;
4. Scaling climate solution investments, especially in emerging economies;
5. Disclosure of climate mitigation strategies, short- and mid-term target setting (2025 + 2030), target achievements with respect to the decarbonization of investment portfolios, sector decarbonization, engagement outcomes, and progress of climate solution investments.” (ibid, p. 7)

For some investors, this might be possible presently. But for larger, diversified investors following world indexes (even with exclusions), the second point might be beyond reach right now. While many have already phased coal out of their portfolio, it is hard to pinpoint whether the investment in an oil company stock is the same as investing in a new oil project. This reaches back to the point about losing influence when retracting investments. However, to keep influence in oil companies and at the same time only support fully realised projects (which is in its own way the same as a reluctance to support new ones), options are limited. To do this, the financial institution either has to withdraw from those companies that are starting new projects, or convince them otherwise. The other targets, while important, are less intimidating; many financial institutions already have decarbonisation targets and have withdrawn from investing in coal. This is all to say that the goals themselves do not differ enough from best practice today to stand on their own, and must be further developed and refined.

2. 8 Pathway comparison: what are some important takeaways?

Key factor	Net Zero Energy 2050	One Earth Climate Model
Approach	Bottom-up	Top down
Carbon budget	500 Gt CO_2 with a 50% probability of 1,5 degree temperature rise	400 Gt CO_2 with a 67% probability of 1,5 degree temperature rise
Underlying data	IEA industry research and the World Energy Model	UTS peer reviewed research and integrated climate model
Carbon price in 2050	250 $ per ton CO_2 for advanced economies w/ net zero targets 200$ for emerging economies w/ net zero targets 180$ for emerging economies w/o net zero targets	180 $ per ton CO_2
Carbon capture and storage	Yes, technological	No, only land-based (planting of trees, mangrove forests and other natural carbon sinks)

Fossil fuels	80% less than 2019 in 2050	8% of 2019 levels in 2050
Industry level changes	Includes technology forecasts from industry insiders	Does not meet this level of granularity
Policy granularity	Policy milestone with year targets split across four sectors	None, only general recommendations
GHG granularity	Only CO_2	All GHGs (methane, nitrous oxide, etc)

Table 2.1: Pathway comparison (Teske et al 2022) (IEA 2021)

3. Methods

3.1 Participatory observation and field notes

For my internship period, I worked in the same office as the other members of the social corporate responsibility department ("Samfunnsansvarsavdelingen"). This is the method of participatory observation. As I worked closely with most of the members of the department, the observations were varied. There were no formal interviews conducted, nor informal ones, so the methods of observation are based on the day-to-day operations and processes that actually took place.

Grønmo (2016) describes different aspects of participatory observation, like positioning and focus. As a student of sustainability, my position was in one way to add new insights that were not already there. But my point of view was definitely not that of an objective outsider, as I felt the work process would be better and more constructive, were I to interact with the department as a part of it. Through trusting each other, critique and discussion felt more free-flowing. In many ways, the department also criticised itself in these discussions, as it saw some of its shortcomings. This trust helped alleviate what Grønmo (2016, p. 164) refers to as one-sided perspective and "going native". Academic viewpoints will also help in a practical setting, by creating a balance and a layer of separation between the subject matter and the researcher.

Although the access to data was mostly formal, and happened through digital channels as well as in-person meetings (in-house and external), there were also events that go beyond this. Considering the amount of time I spent in the department, there were many informal

meetings, such as eating lunch, but also social gatherings. Being able to partake in both the formal and informal life of a department contributed to the feeling of being an “insider”, although I was also observing as a biassed outsider. The observation was done intermittently, with a set time once a week for recapping the week, as what Grønmo (2016, p.162) refers to analytical notes. Having that time once a week forced reflection as well as structuring the work process more in my own head. In addition to tracking my own progress, I also looked at what influence I had on the department, and what influence the department had on me. This kind of double influence is hard to put into words, as I understood more and more the complexity of making the decision that the department made.

The most useful observations, though, were probably divided between two things: first, the project meetings, where one person presented a report or project they had been working on for feedback. Secondly, the department meetings, where the department members recapped their week, and the time often allowed for more loosely structured discussions, and acted as a forum for raising issues or topics of interest.

4. Analysis: Internship

4.1 About KLP

During the internship in KLP, I learned about sustainable finance, how to practise it, and how financial actors organise to fight climate change. The abbreviation KLP stands for Kommunal Landspensjonskasse (gjensidig forsikringsselskap), and it is the pension fund for municipalities and healthcare workers in Norway. KLP is Norway's largest pension fund, and has a special position as the pension fund for a large portion of the municipalities in the country. Thus, they must provide stable and long-term solutions for their investments, as their timeline is not short-term but generally over 20-30 years. This includes both bonds and securities as well as stocks, with a diversified portfolio, which is represented in most asset classes. In addition to their pension department, they also handle property, insurance and fund management for external customers.

At KLP, investments are handled by the capital management department. Because KLP has multiple different, separate entities of investments, different guidelines are also set based on what the goal of the particular set of investments are. There are different funds open to the public, and there are the investments tied to pensions, which is KLP’s main business. The investments tied to pensions are the most vulnerable, because they represent the livelihood of

people in their old age. Thus, the investment decisions tied to pensions must be safe. Investment safety is often tied to indexes, as they self-regulate and also follow the market. Because the time horizon is long (20-30+ years) the market will (historically speaking) grow in this timespan. This also means that KLP can make investment decisions that will be profitable in the long term, though they may not be in the short term. This sort of investment thinking mirrors that of climate change. Because climate change belongs to "the future", today's investment strategies rarely discount for the uncertain losses attributed to climate change. This point will be discussed further in the section on discounting. The point of this description is that KLP and other investors with longer time-horizons have more ability to and access to investing in long-term projects. While this may not sound like it automatically translates to climate friendly investing (it does not), risk assessment teams are creating the link more and more.

4.2 KLPs net zero target

The toolbox that KLP has made for their investment portfolio is called “The road to Paris”, which is their roadmap to net zero, and was published in 2021 (Mangset et al 2021). The chief goal of the roadmap is to be a strategy for investments in light of climate change, and to carve out the pathway to reach the goals in the Paris agreement: limiting global warming to 1,5 degrees. This roadmap includes information on some different areas of investment, like the renewable energy sector, as well as their “Paristilpasningsprosent”, the Paris alignment percentage. This measures how aligned one investment is at a certain time compared to the targets in the Paris agreement, as well as the portfolio as a whole. Their methodology for this is is outlined in figure 4.1, and is as follows: Investments in carbon intensive industries, like fossil fuels, steel, cement etc. are rated based on a methodology where investments receive a score between 0-100% alignment. This is how aligned to the 1,5 degree target the investments are based on their emission data. The alignment percentage is determined by how close or far the company is from the 1,5 degree reference pathway. Renewable energy and other green investments are fully aligned, as they are either on or below the curve of the reference pathway in that sector. The other investments fall somewhere in the middle. To help calculate what an investment or a sector has there are emission data available for purchase through financial data providers, companies that work with gathering knowledge and data on public companies. The roadmap is a mix of different methodologies that exist today, to try to mirror the best practice principle we often find elsewhere in finance.

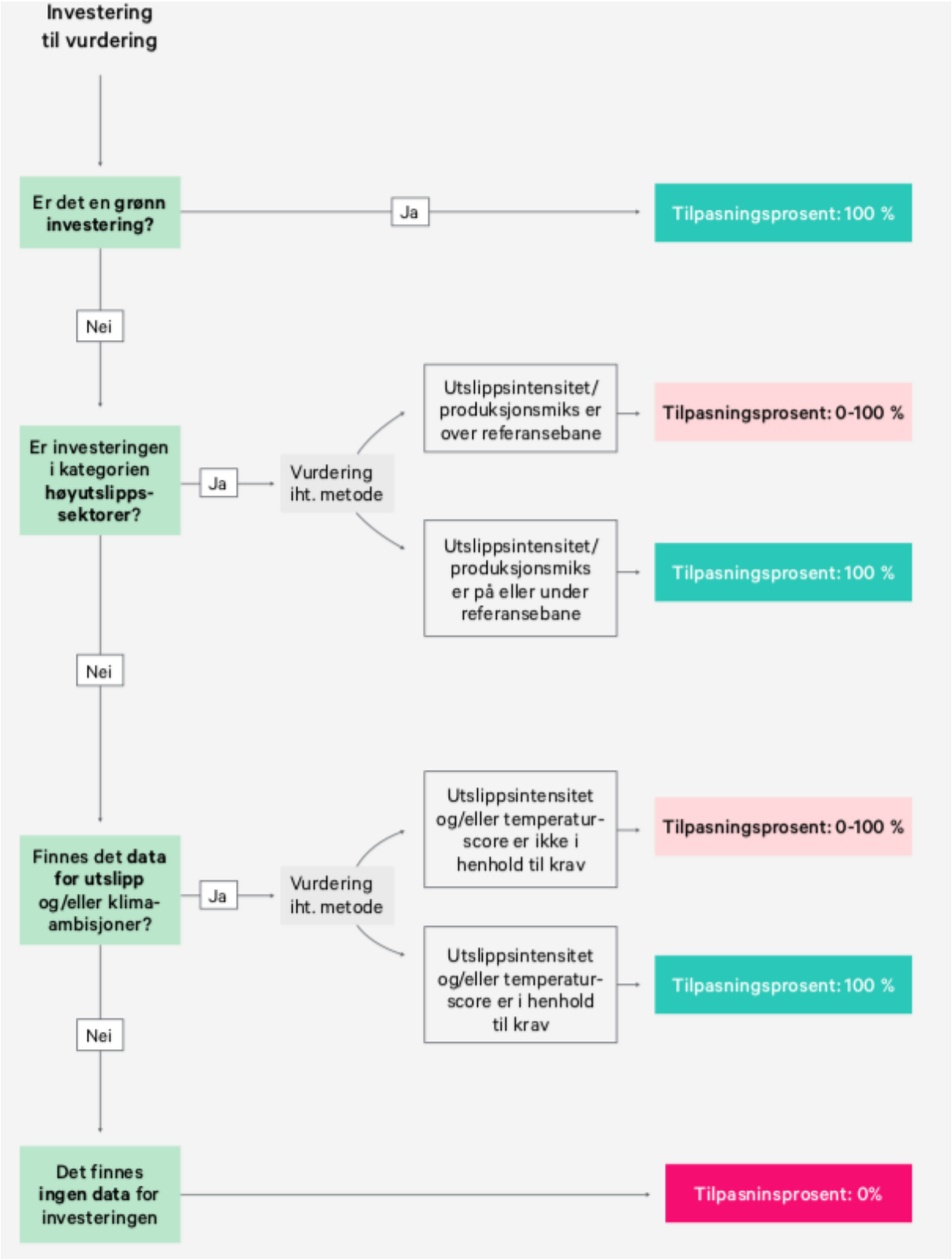


Figure 4.1: The process of investment evaluation at KLP (Mangset et al, 2021, p. 15)

The object of the roadmap is not just to reduce emissions, but rather to reduce the emissions that are in the highest emitting sectors first. This is done for two reasons: Firstly, it is an

attempt at inducing change in high emitting sectors, sectors that face the biggest transformation in the coming years. Secondly, the tools that are used - the reference pathways - are meant to show when these changes are reasonable and to be expected according to technological (presumed) progress. This is part of why the pathways are used in the net zero target toolbox at KLP, because it creates a theoretical framework for analysing and evaluating progress in emission reductions.

In some ways, yes - reductions in CO_2 emissions are not sector-specific when we are trying to reduce global warming. But some parcels of emissions will be much harder to reduce or eliminate than others. In heavy industry, for instance, much could be won by technological innovation or renewal of equipment. But in an office environment, one ton of carbon emissions may be much harder to reduce, because the emissions of these types of operations are low to begin with. The same is the case with commercial aviation emissions, which have also proven hard to decrease, due to late technological progression and complications in this sector. The roadmap saying “To ensure that we have a real impact on the environmental work in the companies, we have to be conscious of where and how we engage” (p.13) is emblematic of the current status of the climate effort in many financial institutions today. This applies not only on a sector level, but also on a company level. Those companies that have the most transition potential, are also often those that will produce the largest emission reductions when helped with transitioning, given that they cooperate and engage in genuine dialogue.

The roadmap also applies to other areas of sustainability within finance. In addition to the focus on a better performing portfolio in terms of emissions, KLP also employs different subtargets related to climate: Investing in clean energy, influencing the market and politics, as well as companies that lack climate targets and reporting. Their (and other investors’) net zero target is in some way a market device in more ways than one, because it seeks to influence other actors and devices in the market. KLP is seeking to influence the market as a whole in a more sustainable direction through their net zero methods and target, and will have to try to influence other actors to do the same to amplify the effects through cooperation and coordination, something that Kappel (2001) refers to as a strong attribute of roadmaps.

Another aspect of climate related investing are existing assets and value of investments. In today's portfolio, KLP has many assets that may be negatively (or sometimes, positively)

affected by climate change. This means that, given the devaluing of assets and investments given uncontrolled or inadequately controlled global warming, investors would seek to hinder the temperature rise above a certain degree, typically lower rather than higher. This type of risk analysis is becoming increasingly common, with big data actors like MSCI, Moody's, BlackRock, McKinsey and Ortec Finance offering risk assessment analysis packages tailored to show the climate-related gains and losses (MSCI 2023).

4.3 The work process at KLP

At KLP, the department I was in during my internship, worked with climate strategies and the overarching work in climate. In addition there are many other people in other departments working with climate. To help with interdisciplinarity and interaction between the different areas of responsibility, some regular meetings were held with all those working with climate. These meetings included people who worked with insurance, banking, operations and more, making the group very diverse in terms of challenges they each faced. This also served as a forum for theoretical issues, where one could discuss developments in current climate events as well as academic literature, if necessary.

In the beginning of my internship, I was tasked with working on researching the different existing pathways to net zero for financial institutions. The first couple of days were invitational, learning about the current structures for working with climate investing, as well as the status at KLP.

The meetings about the models and model selection were mostly structured around looking at the different assumptions given in the models, and discussing these. When discussing the different parameters that made up the model, the questions that would arise would often be "What is this based on?" or "Why is this only this much/why is this value so large?" and similar questions. The goal of using the pathway was also in the back of our minds, remembering that we needed not only something that would look good on paper, but also something that would be practicable and measurable for us. The chief reason the question of measurability is raised is because CO_2 emissions are measured in numbers and numerical systems. To be able to reduce CO_2 emissions, reduction methods also need to be measurable to some, preferably to a large extent.

After our initial discussion meeting, we went back to our work desks. In addition to working on understanding and piecing apart the models, my tasks at KLP included an environment standard recertification process, initial CSRD mapping for the company, as well as many day-to-day tasks in the department, for instance writing notes for the COP, working on mapping upcoming reporting standards, and making a weekly environmental newsletter. The width of the tasks represented the need for a multifaceted approach to sustainability, which can be a difficulty for a department of that size. Some of their tasks are surveilling and reporting on the emissions of all of KLP, as well as being a resource for other departments. This was very well taken advantage of, as they had many interdepartmental meetings. These meetings often explored different ways of knowing and different opinions on how to reach a common goal.

A meeting that stands out in this regard of different "Ways of knowing" (Öberg 2011 p. 25), is a meeting we had with the capital management department on how to minimise the tracking error on an index-related issue. Ways of knowing here represent the different viewpoints and approaches that different experiences and disciplines may cultivate, as well as different ways of structuring knowledge within disciplines. This also relates to quantification of units of knowledge. While the goal was firmly rooted in achieving sustainability and emission reductions in the portfolio, the meeting mostly revolved around the real economic and implemental considerations of the specific example. The economic structure of the portfolio knowledge was presented as graphs and different equations - all new to me. In doing this, my own education and expertise fell short, and I did not participate in the discussion. While this was difficult for me, another approach, such as that of social sciences, may have been limiting for the other participants and the source material. Economical quantities also worked as a tool of representation here, one that I happened to be unfamiliar with. Though an extreme example, this was not the norm, and the meeting did after all have a specific economic discussion as the main goal.

The outcome of this gradual habituation was that I got more confident in the language spoken in the office. After researching a couple of key definitions: ex-ante, capex, tracking errors and portfolio composition guidelines (among others), I quickly was able to use my own knowledge (and interdisciplinary way of knowing) to discuss and understand topics and issues that I did not before. The people in my department also made an effort to explain economic and climatic implications, and implications for the climate targets, especially where

they were not as pronounced. I interpret this as one of the most important outcomes and takeaways of the internship.

4.3.1 Is rhetoric important to financial actors?

"Being cynical about the future" is one way of describing climate and net zero investing strategies. Some might prefer another type of rhetoric tied to climate change - but is rhetoric really important? Investors with long term horizons have justification for wanting to limit climate change due to the devaluation of assets, and the usefulness of reducing emissions are far overarching to the process of attracting customers based on good sustainability ratings. Because of the previously described circumstances that long-term investors face, should climate change take action as described by current science, the outcome would be unfortunate. This is one of the things that I thought a lot about during my internship - the air of seriousness that clouded all of our discussions did not translate to frivolous "rhetoric" or PR.

4.4 Other financial actors: Meetings and experiences

While at KLP, there were some meetings with other financial institutions about climate strategy as well as pathway use in particular. In addition, there were internal meetings across departments. These meetings often included language tied closely to the study of economics, and not chiefly those typically tied to climate science and sustainability. In these meetings, the core of them was to find ways to integrate sustainability into the financial system within the institution.

In one meeting with another large financial actor in Norway, the goal was to find common denominators or a criteria framework for (pathway) models to be used in the financial sector. We were invited mostly to make a standard layout for choosing pathways to use in their respective institutions, to be published in a large financial network organisation. In the end, we compiled a list heavily inspired by the GFANZ and NZBAG version (NZBAG 2021), where the list left very few models with the desirable traits. "Desirable traits" is in this context the "right" carbon budget, longevity, amount of CCS, temperature goal (among others). The reason for deciding the benchmarks for choosing a pathway was initially to standardise the roadmaps that may be followed by the whole of the network that received this memo. To understand better what we were choosing to stick to - what these parameters meant in practice. This made the discussion clearer and less abstract, and the limits of immediate

action (e.g. what each financial actor could do right now without making large losses or unwilling concessions) gave a better image of realistic implementation.

Something that we often returned to in these discussions, was that “It was all more or less a very sophisticated guessing game, where it only mattered that as many as possible used the same guesses to instigate change”. This is like saying that the temperature target could be limiting global warming to 1.0, 1.3 degrees or 1.7 degrees, it would not really matter if no one took account of it or acted on it. If the model is the IEA one or the OECM one does not really matter all that much either, as long as actual guidelines, sanctions and cut-off points are implemented on a large scale for companies in the portfolio that do comply with emission reductions, as opposed to on-paper-only climate strategy. The two models both signal massive emission reductions, larger than we have ever successfully carried out in the given timeframe.Therefore, to stick to a model is so much more important than the model itself. This is not to downplay the true differences in content amongst different models, but more a zoom out on the problem itself.

In finance, there are both internal and external efforts related to climate reporting, methodology and certification.One of the topics I worked on was making oversights of the different standards and following the discussion on competing standards. Why are there multiple organisations working simultaneously on the same issues? This is definitely a hurdle worth discussing, as the private sphere of finance and investing is not very apt to tackle an issue such as climate change - it lacks the structure. Because of this, we get the same thing multiple times over, with minor variations. There are also, of course, some investors joining multiple organisations with ulterior motives of good PR. Below, some actors are mentioned that have either organised investors or contributed to methodology in the field of sustainable business.

4.5 Some actors and initiatives in the field of climate finances

United Nations Environmental Program Financial Initiative (UNEP FI) and OECM are through the lens of the United Nations given credibility. The Net Zero by 2050 model is given its credibility through the International Energy Agency, which is also internationally acclaimed, however with stronger industrial ties. For other organisations, credibility is often more network based, like that of the Science Based Targets Initiative (SBTI), which is a

widely used actor in sustainable finance because of their reputation as a science-first type of organisation. Other actors with different goals are the Partnership for Carbon Accounting Financials (PCAF), who work with carbon accountancy and reporting standards, and the Task Force on Climate-related Financial Disclosures, who work with climate risk and opportunity.

5. Analysis and discussion

5.1 How does one translate reference pathways to reality?

As these pathways serve as a way of envisioning the future with only 1.5 degrees temperature rise, they are hardly a description of what will happen. Rather, they pose a lot of different "ifs" to make up a scenario where the world does not (current science taken into account) have a warming more severe than 1,5 degrees. But as mentioned above, the pathways give advice that does not fulfil a net zero target. Setting a target, as well as specifying targets on a sector basis and disclosing them annually, will only go so far. One true use of pathways are as guides for the financial institutions in what exactly constitutes a break-off point when investing with a net zero target, and how to communicate this to the companies along the way. This is potentially the current most important aspect of a reference pathway: measuring companies against it and knowing when to make demands and when to exclude them.

5.1.1 The most important aspects of a pathway

In these net zero pathways, composition is important. As seen above, the energy use of oil, gas and coal is discussed in detail, as well as which sectors use the most energy in their operations. After this, each sector, i.e transportation is discussed as well as possible outcomes of recommended actions.

The puzzle comes together at the end, depending on the approach - bottom up or top down. In a top down approach, sectors are delegated a percentage of the emission equation. In a bottom up approach, the opposite is true. Sectors are analysed on the basis of technology and are added up to a net zero result. Different approaches are good for different uses, which will be discussed later.

5.2 Core assumptions for portfolios

To give both models the same starting point, we can assume that portfolios follow the MSCI world index. The index is described as "a broad global equity index that represents large and

mid-cap equity performance across 23 developed markets countries" (MSCI 2023). This makes up a large part of world markets. While many investors follow this most general world index, many already incorporate a range of different omissions. Some of the most common exclusions are tobacco, pornography, coal, unethical weapons and alcohol. Other exclusions that are not as common may be done on the basis of land use, environmental practices (such as the production of palm oil) and so on. However, it is both difficult and possibly unwanted to exclude actors contributing negatively towards climate change and environmental health. This is the baseline on which these models are meant to be used.

Why would investors include coal, oil, gas, steel, heavy industry and other carbon intensive sectors in their portfolios, if excluding these stocks could help them meet net zero goals? Selling stocks to achieve net zero emissions among stocks may look good in isolation, but it does very little in terms of actually slowing global climate change, because they might just be bought by someone else on the market. Even if every bank and investor sat down to collectively agree to sell every fossil fuel stock, it would probably produce a global energy and hunger crisis at worst, with only miniscule emission reductions at best. In this way, finance is in a unique position: it is a balancing act of the highly theoretical on one side, and the absolute reality of the world economy on the other. Since the world is dependent on fossil fuels, gradual outphasing is needed to keep food and energy supply from dropping, as well as massive investments in clean technology and renewable energy. But if investors are constantly waiting for someone else to take the first leap, how does progress happen? The invention and integration of pathways into investor strategy and market communication is a good first step.

5.3 Double counting

In the global climate accountings, the issue of double counting often comes up. Double counting here means counting the same emissions more than once due to oblique value chains and interconnected systems. It is not always obvious where emissions are to be located, especially when using the scope 1 (direct emissions - transportation), 2 (indirect emissions - like electricity) and 3 (purchased goods, services, and in finance: emissions in the portfolio) system. Depending on how one decides to divide up the emissions, different difficulties and challenges will come up. If the Scope (1, 2, and 3) terminology is utilised, there might be plenty of double counting between energy use, production, transportation and end-use with the consumer. It is practically impossible to solve this problem because of the massive scale

and complexity of the system, as well as the shortcomings of contemporary life cycle assessments. There are tools to prevent overcounting emissions in large systems, and some are provided by companies like MSCI (Teske et al 2022). Because the actual value chain allocation of emissions is not always available, a multiplier can be used to try and correct the double counting inherent in the Scope system.

Double counting will most likely always occur in a system so vast, but most likely emissions are left out in these accountings as well. The occurrence of double counting should never deter anyone from making a climate accountings or from trying to limit emissions. Nevertheless, it is an important mechanism to keep in mind.

5.4 Carbon budget

Even if this article assumes a sharp, instant drop in emissions, it is a good example of what happens when climate change is integrated fully into a portfolio. In this article, the first step is to find the total remaining carbon budget. This factors in a great deal of uncertainty, something we do not see in the models, which both utilise a similar carbon budget (400 versus 500 Gt CO_2). Secondly, the goal while including the carbon budget as a guideline for investments is to still maintain a low tracking error, compared for instance the MSCI world index, as well as a diversified placement with balance across sectors. Bolton et al (2022) argues that "Two main approaches can be taken to solve the portfolio problem: (i) first determine all asset allocations that achieve the carbon objective and then optimise the tracking error of the portfolio by optimally weighting the asset holdings that are consistent with the carbon objective, or (ii) optimise the tracking error of the portfolio subject to a carbon budget constraint". While this is on the side of model assessment and evaluation, it is important to keep in mind the integration aspect for institutional investors. Because the OECM and NZ2050 differ so much in their tempo of excluding oil and gas, the portfolio could end up being less evenly distributed and balanced in an OECM scenario, making it less favourable for investors. The principle of having a diversified portfolio to avoid risking retirement funds was something that we talked about many times during the process of evaluating the models during the internship, and is a very important principle in long-term investing. The OECM model seemed to be less attractive because of this de-diversifying quality, and as we were comparing them, this became more apparent (see figure 5.1 and 5.2). However, the lack of practical evidence and testing leads to this only being speculation. The carbon budget is important to the use of pathways, yes, but the distribution of emissions is

more important for implementation. These two aspects, carbon budget and budget distribution, are of course heavily linked.

5.5 Measuring climate performance at the company level

According to the Net Zero Banking Alliance (Germany) (2021), there are four ways of measuring the greenhouse gas (GHG) intensity of a company in your portfolio. The first is absolute GHG emissions, if they are available. The second way of measuring is the GHG intensity of the share or loan (in case of banking). Here, the notion of a benchmark is important to understand the number: "The benchmark value is the quotient of allowed emissions in the industry based on a given climate scenario and the estimated overall financing required in the industry" (NZBAG 2021, p. 25). The third option is the GHG intensity of the output. This could be a good metric for energy production, for instance, where one could use CO_2/kWh. The fourth and last option is to use an industry-specific variable or a percentage of output. This can be helpful in some instances, for example when rating auto manufacturers - how many electric versus combustion engine cars are produced and sold. There are also many industry standards like the specific real estate standards, Carbon risk real estate monitor (CRREM), Partnership for Carbon Accounting Financials (PCAF) and others. The EU taxonomy goes a long way in gathering standards in one common reporting scheme for many sectors. As the taxonomy is currently untested in the context of reference pathways, advantages of the taxonomy are hard to determine. However, having a large set of data and broader compulsory reporting points to easing issues related to the data side of pathway use.

5.6 Measuring portfolios

The issue with there being multiple options in measuring a portfolio is of course the lack of comparability to other portfolios with similar net zero targets, given that they measure companies in their portfolio in different ways. This also applies for investors like KLP, who make their own metrics like the Paris alignment percentage, even if, in principle, they are the same as the ones listed above. Many types of financial information are secret or classified to avoid insider trading and competition issues, and so it might be difficult to gain access to the foundation of a financial institution's sustainability and net zero measurement.

As we see in the pathways, the emission reductions needed to contain the temperature rise to 1.5 degrees is not something that can be measured in the percentage of electric cars, but in tonnes of CO_2. Some climate actors, like the SBTI, use what is known as a temperature score.

This is where the available data is measured in different ways, as well as against a benchmark of 1.5 degrees, obtaining a score of the implied temperature rise the company is currently at (SBTI 2021). This is a very abstract and oblique way of measuring companies (and portfolios), as there is little insight into the determining factors of the score, but given the same methodology applied, it would also simplify the communication needed. If your temperature score is higher than 1,5 degrees, your company needs to make changes. But again, simplicity makes it difficult to pinpoint what exactly those may be.

5.7 Carbon taxes

The reasoning that lies behind needing tools and strategies for reducing and managing climate change are not only publicity-related. A stable world economy is a necessity to all financial actors relying on long-term investments, e.g. pension funds. In the future, this also applies to the environment - everything, whether it be services or production of goods - will be affected by a changing climate.

In *Climate Casino*, the assumption is made that climate targets like the 1.5 degree target cannot be set without accounting for two factors (Nordhaus 2013, p. 204). These are the costs of slowing climate change and the benefits of avoiding the damages. In terms of long-term investors, these unknowns (and "unknown unknowns") are of great concern due to their need for stability. Both of these factors include many subjective factors as well as time-space factors that change and adapt. Before we explore the two factors in the equation, we are going to discuss discounting, and the innate effect of loss of value over time.

5.7.1 Carbon pricing in the models

Though carbon pricing is not implemented through a worldwide standardised system, the pathways discussed earlier all suggest a future carbon price. There is reason to discuss the differences, as they are part of a recommended policy proposal. Carbon tax and price will be used interchangeably, though with the same intent. Carbon pricing is initially a way of pricing the externalities of production and consumption. There have been some attempts at this, but mostly it has been through a quota system and not a base cost for carbon.

While the two models compared above have different predictions as to what the carbon price needs to be, they agree on a much higher cost than we see today. Taking what we discussed about discounting, we can apply a carbon tax to heighten the costs of investing in fossil and

carbon intensive technology today, and attach an interest rate that follows the patterns of investment we want to see to control for inevitable inflation. The potential of an expected rise in carbon pricing is also a good deterrent from building carbon intensive infrastructure. This will also proportionally make green technology cheaper.

Carbon pricing is a part of the polluter-pays principle, which means that it is the company responsible for the emissions who pay. This is meant as a market mechanism or device, to make the market regulate itself into a lower carbon version (Nordhaus 2013).

However, it is self-explanatory that this should not be done without forethought. Increasing prices on basic food items and luxury goods are two quite different actions with different outcomes. No matter how many of the low- and no-carbon services you can afford, the market cannot only rely on enhancing the low-carbon products and services. This is why carbon pricing is so important for shifting and innovating within the high-carbon sectors. Many different attempts have been made at directing the taxes, for instance the polluter-pays principle or the consumer-pays principle (Nordhaus 2013). In either case, the externality of carbon would be accounted for in monetary terms, but the uncertainty of the actual social cost is difficult to determine. Either way, it would deter activities emitting carbon.

Strictly practically, this is not the hardest change to make, but it might be a very unpopular one if it is applied directly to the consumer directly. This might feel “unfair”, as consumers cannot themselves change the fuel or materials used in the production process, and producers might not feel the same pressure to shift their methods. It would be wisest to apply the carbon tax upstream from the customer, at a set level of responsibility (a set of rules for who the polluter is), which is the point of the cap and trade system (Nordhaus 2013). Because democratic political elections are so frequent, additional taxes on the public are very hard to win favour for (Tanzi 2022, p. 33). Without company carbon taxes, private companies have little incentive to change, in their search of cutting costs.

The range of future carbon prices in the different models is not representative of an ideological disagreement about whether high carbon taxes should apply in theory, it reflects the uncertainty and difference in data between models. The reason why we see such different values in the different models are based on which approach they take to pricing carbon.

Whether they are using a carbon taxing method or a cap and trade method is important. Today, no international cap and trade systems exist. The most encompassing is the EU trading system, which includes many, but not all, sectors and emissions.

5.8 Discounting

How much are investments worth in the future? This is one way of understanding why financial institutions might want to combat climate change and to make investments in green technology and business. Though most will know that a car is worth less in a couple years than it is today, the effect must also be coupled with interest. In Climate casino, Nordhaus argues that the main reason for interest is to "reflect the fact that investments are productive" (p. 184).

This is of course not limited to physical investments. The problem with discounting immediately arises when we are talking about climate change - is it possible to estimate the current and future value of clean air, a species, or a forest? Perhaps not. But if we can state that "the discount rate should be determined by the opportunity cost of capital, which is determined by the rate of return on alternative investments" (Nordhaus p. 187), we can (for example) compare investments in clean energy to those in oil and gas, which may not grant returns in a world where carbon tax is applied. Discounting would thus, given a lump sum, give better returns in clean energy. However, if we apply the discounting principle to those things (e.g. nature) affected by climate change, the loss is smaller in the future than right now. It also applies to investments already made that are in jeopardy due to climate change, which gives institutional investors yet another incentive to contribute.

This is the problem of a) an uncertain future policy landscape, as well as b) scarcity in projects and investments that fit the bill for investors that are proven to effectively slow climate change. Thus, we should create mechanisms not only to tax CO_2 emissions, but to induce both private and institutional investors to be able to support climate change combating technologies and projects.

However, as we have discussed, this is not easily translated into practice, since it includes the whole economy, from big corporations and governments to individual consumers. However, the question is not a dichotomy between taxes and regulations, but rather about finding a balance between them. Because the regulatory governmental approach is so overarching and

sizable, the financial approach may help these regulations along the road by applying pressure both individually and collectively to companies that do not meet their emission targets. “In this environment, regulatory emission limits will ensure that businesses continue to move towards a low-carbon economy through the changing political weather. “ (Nordhaus 2013, p. 272). Having this as the basis for planning creates uncertainty. The changes in the cost of carbon is a value that reverberates throughout a system of many different interlinked processes - making it hard to paint a clear picture.

5.9 Benchmark portfolios and pathways

Though standardisation of a specific pathway is still in the early stages, targets are becoming more and more standardised, and benchmarks more available. In Net Zero Banking Alliance Germany’s publication, *Lending to a climate neutral Germany by 2045*, multiple pathways to net zero emissions are analysed and categorised, as well as targets are put into one of four types. The science behind the pathways are, as shown above, important for the nature of the recommended actions. One can imagine it as a map with a common point of finish, but different routes to get there. To start measuring and adjusting, benchmarks are needed, both benchmark portfolios and benchmark values for pathways and companies are needed, and this is demonstrated by trying to find common ground in the available science (NZBAG 2021).

5.10 Example: Fossil fuels in the pathways

The two climate models differ in their future use of fossil fuels. The figures below (5.1 and 5.2) show the utilisation of natural gas and oil in each projection. Coal investments in OECD economies are not included past 2030 in either model, as it is the most pollutant (in terms of carbon dioxide) of the fossil fuels per unit. Keep in mind that the NZE2050 pathway uses technological carbon capture and storage (CCS), while the OECM does not (they only include land-based emission reductions, such as tree planting).

The two datasets show this type of discrepancy in more than one area. The OECM on is much more pessimistic in relation to the level of fossil fuels that can be used in 2050. In figure 5.2 especially, the NZ2050 pathway and OECM pathway have large distances on where they aim to be at certain points in time.

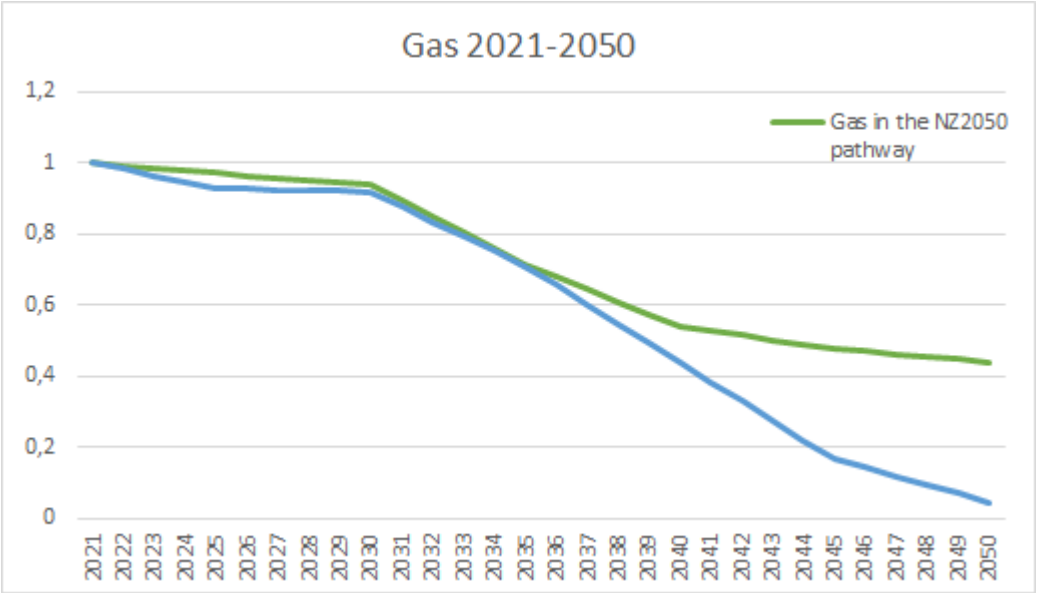


Figure 5.1: Development of gas use in the pathways

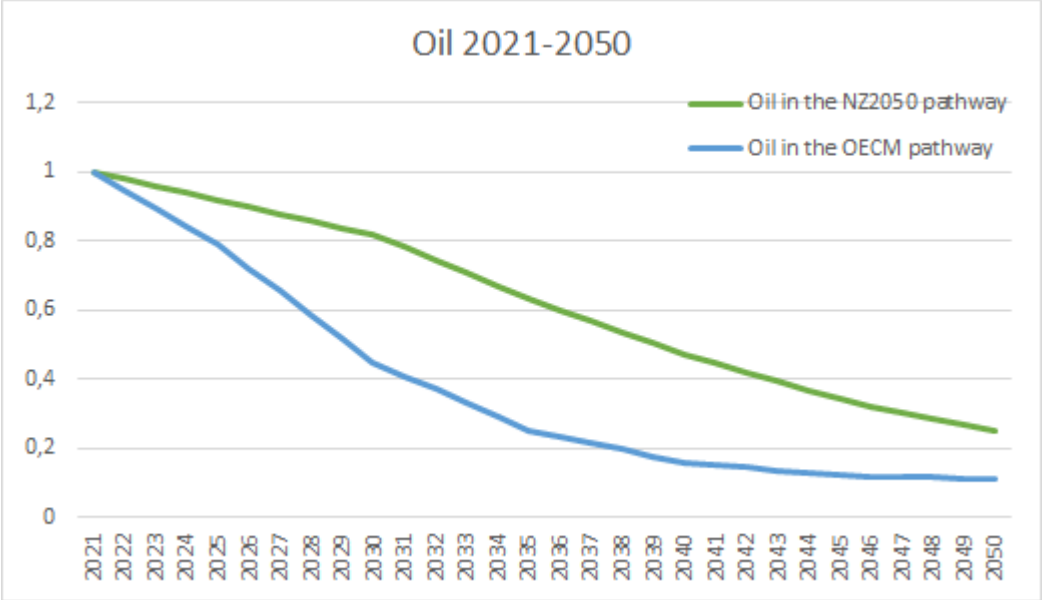


Figure 5.2: Development of oil use in the pathways.

5.11 Difficulties for institutional investors

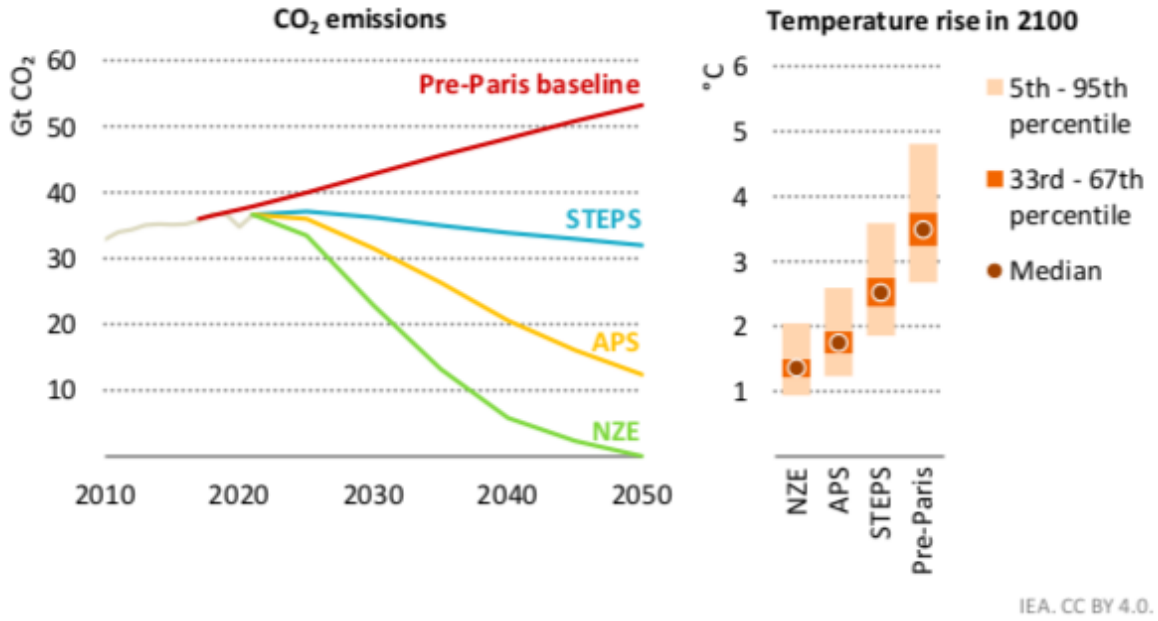
The availability of data is a large roadblock for the development of proper benchmarks as well as integration of pathways. This can sometimes even lead to greenwashing of a company's portfolio, as there might not be enough data to say something on behalf of the portfolio as a whole, which often is where targets are situated. For instance, take hedge funds. Hedge funds are nearly untrackable in terms of emissions, as they do not follow the normal investing protocols, and often engage in so-called "shorting". Because shorting and hedge funds have such a short investment horizon, the emission intensity of a hedge fund is not

easily found. Or take the instance of investing in a bank. Do you calculate only based on the bank's own emissions through its operations? Or do you also include all the loans and stocks and scope 3 emissions that the bank does business with? Data and quantification is difficult, and having a sector pathway to measure against will not solve some of the most pressing issues. They can only be solved in conjunction with standardised, quantifiable reporting regulations and increased availability in both content and methods.

5.12 APS and STEPS: Two alternative scenarios to 1.5 degrees

Two scenarios mentioned in the Net Zero Energy model (IEA 2022), in addition to the scenario designed to reach net zero, are the Announced pledges Scenario (APS) and the Stated Policies Scenario (STEPS). These build on the emission reduction pledges made by nations and the existing policies in those nations, respectively. These two scenarios are made to show the discrepancy between a world where global warming is limited to 1.5 degrees, a world which we want to have based on our pledges, and the world as it is right now. To show the difference between a net zero roadmap like the NZ2050, these are mapped against it in several areas. These three variations are based on data from analyses of current policies around the world, as well as climate plans and agreements of different scales (IEA 2022).

Figure 1.19 ▷ Energy-related and process CO_2 emissions, 2010-2050 and temperature rise in 2100 by scenario

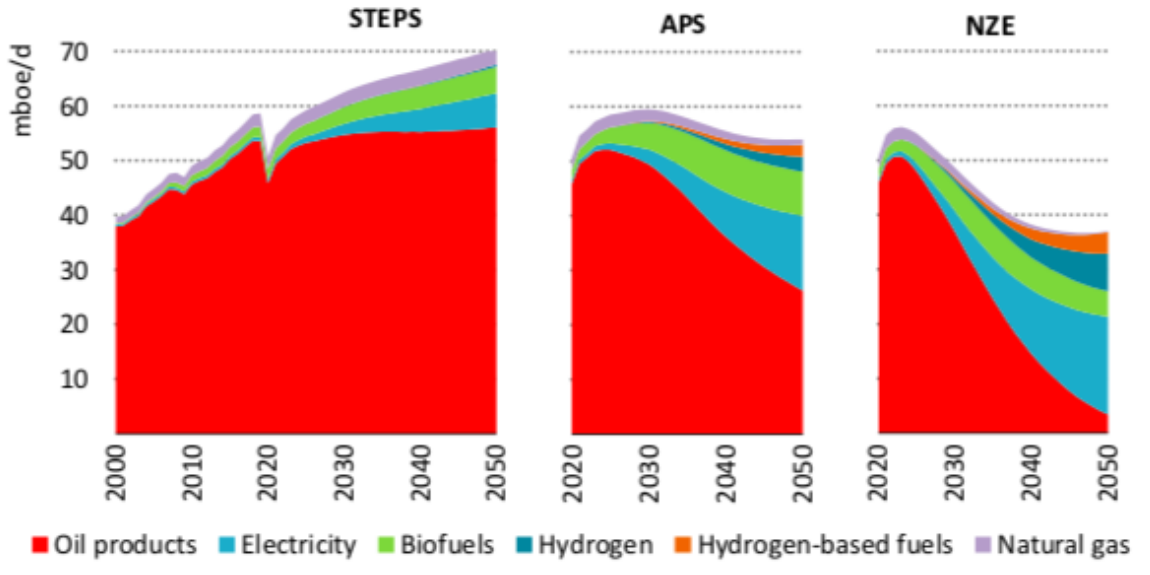


IEA. CC BY 4.0.

Policy and technology advances since 2015 have shaved 1 °C off the temperature rise in 2100 but stated policies still lead to a temperature rise well above the Paris Agreement goals

Figure 5.3 STEPS, APS and NZE in (IEA 2022, p. 64)

Figure 1.13 ▷ Energy use in transport by scenario, 2000-2050



IEA. CC BY 4.0.

Transport has long been the bedrock of oil demand, but its role weakens in the APS and NZE Scenario as electricity displaces very large volumes of oil

Figure 5.4 STEPS, APS and NZE in (IEA 2022, p. 52)

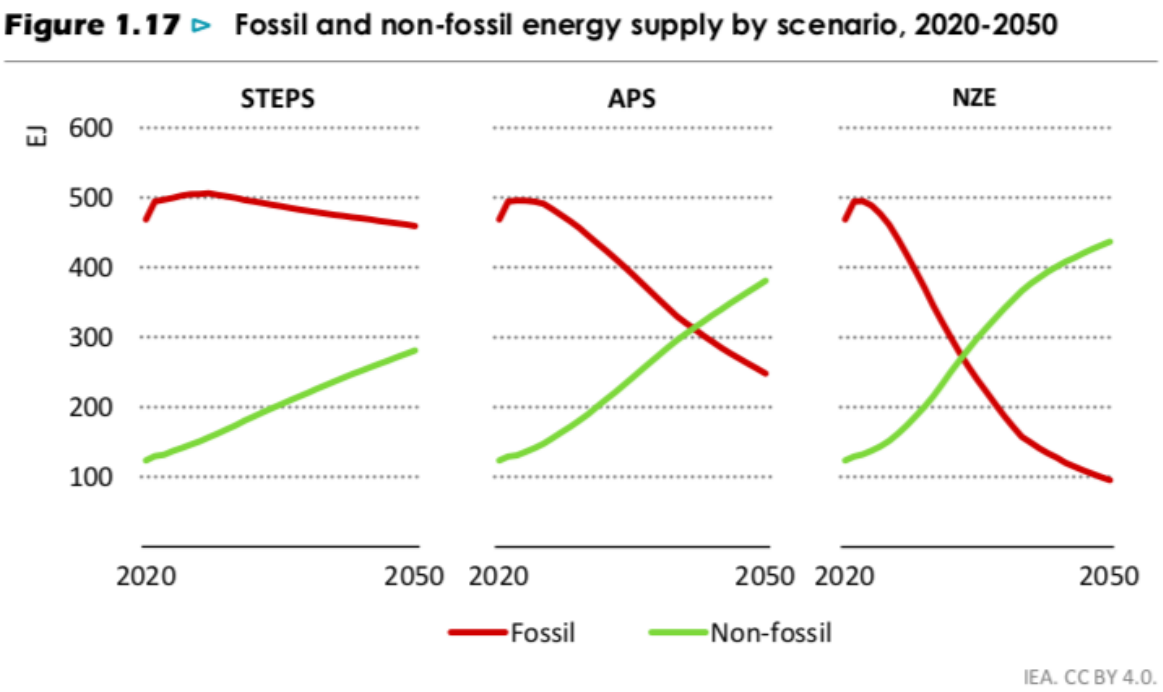


Figure 5.5: Different projections for energy supplies based on scenarios (IEA 2022 p. 58)

Many scholars suggest that the only way to reduce global warming is to integrate a global carbon tax or cap and trade system, as well as international binding agreements with measurable emission reduction targets, as well as sanctions to go with failing to reach these targets (Nordhaus, Tanzi). In practice, we have a Conference of the Parties (COP) every year, where countries and organisations come together to discuss climate and environmental issues. The goal is to make targets that are agreed upon by the global diplomatic community, that also are sufficiently ambitious.

5.13 Carbon offsets as mentioned in the models

Some investors are trying to offset the emissions in their stock portfolio with carbon sinks, such as forests, mangrove plantations, conservations and investments in carbon capture. There are multiple problems that may arise in this process. For instance, when investing in forest properties, what type of trees are planted, and how long is the lifespan of these trees? Is this harmful to the biodiversity in the area? The biggest issue however, is probably being able to trust that the carbon offset truly does offer a ton of CO_2 equivalent removed from the

atmosphere. Even with good intentions and scientific methods, this can be both under- and overestimated when including outside factors.

5.14 Financial implementation

While the pathways carve out a route for financial institutions to follow going forward, there are also some financial aspects that might complicate (or accelerate) the changes that are needed. Blended finance, where the risk is spread between private and government actors, is one. Here, environmental projects and climate mitigation projects can be realised without having to take the full risk of financing them alone. Examples of these projects could be carbon capture and storage facilities, battery production facilities, or renewing the equipment fleet to mirror the net zero pathway progression.

While investor portfolios are one thing, what about banks? Lending money is also tied to climate change, as banks also take part in financing projects that might be carbon-intensive. While some banks have incorporated measures to combat this, such as ESG rating scores, it is difficult to gain a full overview of the ramifications of a loan. However, the development of reference pathways for banks will be something to pay attention to going forward.

Investments in carbon sinks and land-based carbon capture, like forestry, mangrove forests and so on, can be good ways of investing assets in resource management. However, as discussed above, the diversification of the portfolio is acutely important, and these investments rarely make up large parts of a portfolio.

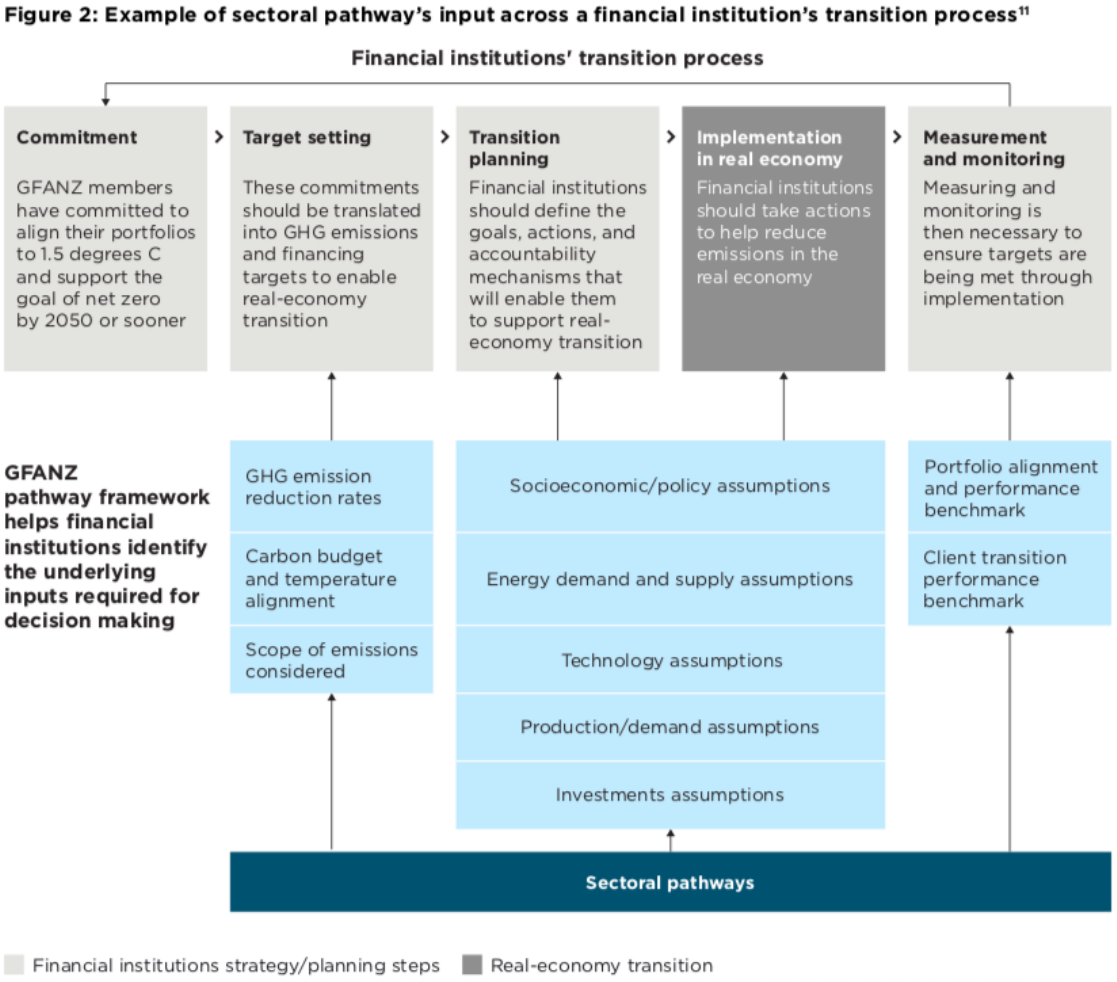


Figure 5.6: Example of pathway use in the transition process.

5.14.1 Technological advances and industry standards

Another part of the Net Zero model that sets it apart from the OECM, is the focus on industrial updates and new technologies. This is informed by being a bottom-up model that works with representatives in companies in all the respective industries.

Figure 5.7: A common setup of different approaches to net-zero investing (MSCI 2023)

Phasing out technologies, changing energy sources, material use, the need for new materials, all challenges that the industries face both internally and between each other. Figure 5.7 shows some different tools for financial institutions to influence the pace and direction of this change.

5.14.2 Personal implementation in an individualised economy

Not all individuals will have the same discounting rate of future costs and benefits, and will make different choices in preparing for climate change (Tanzi 2022, p. 164). In addition, not all individuals have the same, large carbon footprint to reduce. For instance, the emission per capita inis estimated to be 75 % higher in the US than in China (ibid, p.177). This means that naturally, the biggest emitters will have to cut their per capita emissions the most to achieve emission reductions at the necessary scale.

However, individualising the issue of climate change has never been successful (as it is a global issue), so it is natural that the pathways do not put emphasis on this. Other than the change in energy efficiency, energy source and consumer patterns (i. e. transportation patterns) this is not mentioned much, and the power is given to other entities than the individual. See "behaviour changes" in figure 2.3. However, it is important to note that some factors, like income inequality and the democratic wave-cycle may bring forth a set of populistic, and sometimes far-right, governments. These are not known to prioritise climate change action, and the Trump presidency is an example of a populistic government that removed many safeguards and regulations for the environment (ibid.). It is also important to

mention that the intention of this argument is not to minimise the importance of other areas of public spending, like healthcare, but to highlight the lack of action tied to global warming.

5.14.3 Plan economy and competition in markets

An economy where emissions, a product of productivity, is controlled and allotted does not align with a free market. The laissez-faire approach exists in some form or other in many national and regional economies, but is hardly a fit system for controlling climate change. This is seen both in our historical inability to control emissions, but it is also unfit in theory, as explained earlier when discussing externalities. Markets fail, thus they are imperfect. According to Tanzi (2022, p. 22) market failure itself has served as historical groundwork for government spending and government regulation of the markets. This is a sound argument for carbon taxation as well as strict regulation, similar to that of a reference pathway. To avoid markets from failing, the laissez-faire approach must be foregone, assuming that perfect markets do not exist (Tanzi 2022). This means that the government, the controlling force of the markets in this case, must make adjustments to avoid risks, without creating a dwindling economy in the process.

A system that follows a reference pathway can sometimes be likened to that of a planned economy, as the productivity goals in each industry are realistically defined by sector emissions (currently). But the reference pathways are meant to act like its own market mechanism, set on adjusting the market, not to control it. This is why they also explain that it is one scenario of an infinitive amount of scenarios, but it is based on current and historical development trends. Low international cooperation is a large risk, just as low cross industry cooperation sets temperature targets at risk.

5.15 Current status

There are no current sanctions towards a financial institution that does not fulfil their emission goals, nor for those who have yet to make them. This aligns with the lack of sanctions for countries internationally, and is a prerequisite for success (Tanzi 2022). Some governments even work against there being a threshold for finance and banking.

A critique is that it is hard to tell exactly what financial institutions are doing in this field, as the most effective methods and actions are not always the ones that translate to PR.

Standardisation, as discussed above in the NZBAG (2021) article, is extremely important. It is so important to make a difference that even nationally in Germany, banks have found it helpful to team up to make a framework for pathways. If investors follow different pathways to zero, communication is nearly impossible, as one company will be met with vastly different demands. This is ok in relation to other metrics - fluidity, yearly , discounting - but it is not going to be an effective remedy for climate change. Standardisation is at odds with market competition. Tanzi (2022, p.31) writes:

"(...) the current pandemic and ongoing climate change point to a major failure of the world's institutional architecture - namely, the lack of a global government, or of an effective global institution, capable of coordinating global responses. Some public "goods" and public "bads" have become increasingly global and can no longer be addressed by uncoordinated national responses."

The public goods and bads Tanzi is referring to are usually the same externalities that were mentioned earlier by Callon (2001). This is why the framework of bottom-up action in different industry sectors is useful, as there are many institutions and organisations, but none that can get the sorely needed attention and success in the timeframe that is at hand. This framework can manage grass roots action, rather than relying on top down regulations to guide change, and thus have more focus on detail. Later Tanzi (2022, p.165) writes that the needed response to a global problem is public national action as well as enforceable global agreements. A recurring issue with climate agreements, e.g. the Kyoto protocol, is that they fail because there are no sanctions tied to inaction (Nordhaus 2013).

5.16 The economics of a crisis

In the writings of the International Panel on Climate Change (IPCC) (Teske et al 2022), the events and occurrence of climate change and global warming is very likely. Let us assume that we are within likeliness, as this is the most likely result. The economy has been through many crises before, and each time there has been both turmoil and different consequences, for instance after the 2008 financial crisis and after the corona pandemic recently. The economy and the market has had to adapt vastly in a short time, and many were unprepared. With climate change, the events are not far away nor unlikely - in fact the effects of climate change are very likely to start appearing quite soon. What does that mean for risk management?

In the book “Fragile Futures” (2022, p. 18), Tanzi explains that current events often make future mishappenings take a backseat: “There are always some urgent needs claiming the use of scarce, available resources”. Climate change has neither of the factors that these events have, it is neither urgent nor episodic and concrete. But acting on climate change can not be boiled down to the lack of information - in fact, there is plenty of information on both climate change and how to prevent it, given to us by experts in their fields.
“The difficulties that democratic governments and private enterprises in market economies face in dealing with uncertain events might be considered both a market failure and a political failure for these kinds of societies” (ibid, p. 26).

So what does the future of sustainable finance look like? Finance is a massive sector, compounding roughly one third of all profit in the US (Tanzi 2022, p. 213). The NZAOA alone have roughly 40 percent of the world's private assets (GFANZ 2022). This is a prime reason to expect the financial sector, especially large, well established institutions, to act on behalf of the public interest. This is well beyond the corporate responsibility sphere, where corporations are expected to do good with their profits, and at the very least avoid bad consequences of their actions. With increasing amounts of tools, education in sustainability, interdisciplinarity in planning and roadmap use, we can expect to see more sophisticated versions of the roadmaps presented here, with more detailed methodology as well as more defined timeframes for investment decisions as we near 2030.

6. Conclusions

As the models have proven, the future is uncertain. Not only is the world system so large that mapping it numerically with correct relationships is inherently impossible, but it is also filled with values and reactions that are hard to quantify.

The models try to offer a solution to this. As simplified as they are complicated, the tools in the reference pathways are not necessarily useful for a large portion of the world, as well as for most people. Large amounts of data are necessary to use the model, preferably in a standardised way - things that are not necessarily available at the moment. For quantified solutions like these pathways, quantifying frameworks needs to be in place, to make sure assumptions and actions are made with the correct foundation.

At KLP, I learned that sustainable finance has many facets, and that there is an interplay between different parts of the regulatory ecosystem, both the formal and informal ones. However, the complexity of integrating climate considerations into a large and diversified portfolio is far from a solved issue. This will take time, trial and error, as well as dialogue between both financial actors, governments and companies. Perhaps (and quite likely) there will be a better method for managing emissions within the investment portfolio down the line. Climate investing, as a quite new and recent field, created out of necessity, is on the cusp of gaining many new tools in addition to the pathways, like the EU Taxonomy, the Corporate Social Responsibility Directive and the current research being done.

Making decisions for the future will always be an uncertainty, and the parameters of long-term time horizons are never fully known. With coinciding targets of limiting global warming, the push to cooperate should be taken advantage of.

To investors, the models make some recommendations; amongst the most common is to invest in green energy and avoid new fossil fuel projects. With announced pledges of expanding green energy in the EU amongst others, the stage should be set for investors to help finance the transition, given that the renewable energy ownership and operation is in line with regulations. Not everyone in the world has either energy access nor energy security. Apart from the renewable projects themselves, efficiency and accessibility can be further improved by financing energy infrastructure and safety. Blended finance and partial governmental intervention can be a new area of investment that lowers risk in these types of projects, which work towards social change as well as climate change mitigation.

Some further studies are needed, especially when considering the regional and geographic effects of the simplicity in the models. The regional division of continents and OECD countries is a good start, but to make meaningful progress in both social and climate issues, adjustments must be made. There are also social targets included in the models, seeing as they are not designing a wretchedly unfair world for less developed countries. Although the climate crisis can seem unhandleable, just as the world with all its large and small constant interactions, the available data shows us that it is possible to handle it, if things happen as projected.

While this thesis will hopefully add to the practical knowledge about how sustainable finance can be multifaceted, it will also, hopefully, highlight the necessity of tools that match this trait. Tools like the pathways presented above are powerful if used to its full extent, and with intent to both investigate its underlying assumptions, as well as to trust the general direction of the pathways. Although not a solution itself for climate change, the writing on the wall is clear. Finance has massive power over its assets, which it must yield in unity with each other through tools such as these models. The models themselves and their contents are not the most important aspect of roadmap use, it is the action that follows that will contribute to radical change.

It will not come without contention, political action and massive financial rearrangement, but nor will any large social change of significance. Perhaps the tools we need are already right in front of us.

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8. Annex

Data for figures 5.1 and 5.2 is found at Transition Monitor:
https://www.transitionmonitor.com/pacta-for-banks-2020/methodology-and-supporting-materials/

Spreadsheets used are the IEA WEO & NZE Fossil Fuels Power Auto (Start year 2021) and the ISF NZ Fossil Fuels Power (Start year 2021).

Values are global oil and gas from their respective net zero projections, 2021-2050.