SustainaWeekly

Acute physical risks have larger impact in the new NGFS scenarios

- **Economist: The fourth vintage Network for Greening Financial Services (NGFS) climate scenarios were just published. Compared to the previous set, orderly scenarios now include disorderly elements. New scenarios communicate the risks of lack of coordination, and role of behaviour adaptation. Acute physical risk estimates are larger and more granular.**

- **Policy: The revised and recast Energy Performance of Buildings Directive (EPBD) aims to accelerate energy efficiency improvements - one of the sub-initiatives under the EPBD is the Energy label/EPC harmonisation. The harmonisation will hardly change the labelling for German, French and Belgian properties, despite a generally weaker quality of properties in the former two countries. Yet, Dutch properties with strong labels currently could face downgrades under the harmonisation proposal.**

- **Sectors: In our SustainaWeekly of 20 November (see here), we did a deep dive into technologies and techniques of carbon capture. We now focus on the transport of the captured CO2. To transport CO2, the state is important. CO2 is mainly transported via pipeline, as this is a mature technology and other transport methods are not yet mature enough. Risk of corrosion and effect of impurities in CO2 on the infrastructure are the main challenges for transporting CO2. Transport costs may vary significantly.**

- **ESG in figures: In a regular section of our weekly, we present a chart book on some of the key indicators for ESG financing and the energy transition.**

In November, the fourth vintage Network for Greening Financial Services (NGFS) climate scenarios were published. In this week's SustainaWeekly, we compare these scenarios to the previous set. Orderly scenarios now include disorderly elements. New scenarios communicate the risks of lack of coordination, and role of behaviour adaptation. Acute physical risk estimates are larger and more granular. In our next note, we turn to the revised and recast Energy Performance of Buildings Directive (EPBD) to evaluate the potential impact it can have in the European building sector and more specifically, for green bond issuers. Our final note continues where our carbon capture note in the SustainaWeekly of 20 November left off: how to transport the captured CO2.

Enjoy the read and, as always, let us know if you have any feedback!

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Acute physical risk impact is larger and more granular in new NGFS scenarios

Anke Martens – Senior Climate Economist | anke.martens@nl.abnamro.com

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- **Compared to the previous set, orderly scenarios now include disorderly elements**
- **New scenarios communicate the risks of lack of coordination, and role of behaviour adaptation**
- **Acute physical risk estimates are larger and more granular**

Introduction

On 7 November, the Network for Greening Financial Services (NGFS) published the fourth of its climate scenarios. This is an update from the third vintage, which was published in September 2022. The scenarios are updated to reflect realised developments & commitments. The scenarios have been revised and there are two new scenarios, while one scenario has been discontinued. Also, there is additional coverage of acute physical risk, to include more hazards and additional geographical and sectoral granularity. In this round, the use of Carbon Dioxide Removal (CDR) methods has been limited due to lower availability of these technologies

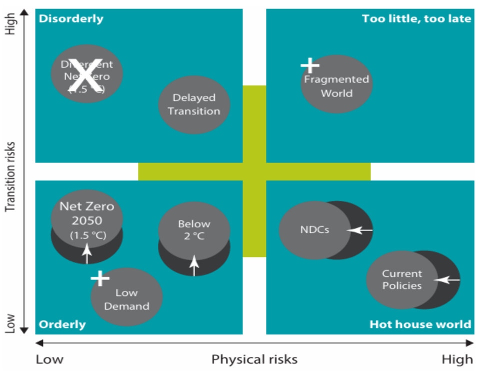
The scenarios show slow progress being made in lowering temperature outcomes

Compared to last year's scenarios, lower 2100 temperature outcomes are associated with each scenario (with the exception of the delayed transition scenario, which remains unchanged). Current Policies for the world as a whole now leads to 2.8°C compared to 3.2°C in the third vintage scenarios. Nationally Determined Contributions (NDCs) now lead to 2.1°C, against 2.6°C last year. This makes sense as over the past year some progress has been made, particularly in implementing the NDCs in current policies. An important example is the EU's Fitfor55 plans, and the US's Inflation Reduction Act. However, the shifts also show the slow pace that change is taking, while another year has gone by.

Net Zero scenario now has some disorderly elements

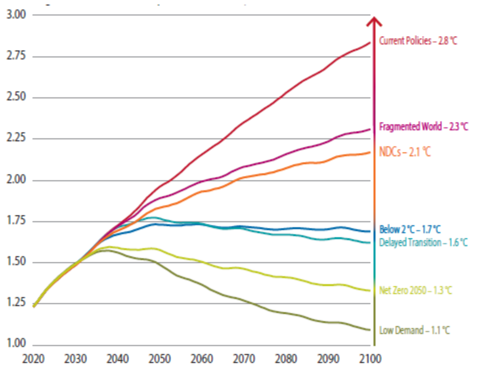
The *Net Zero 2050* scenario was a 100% orderly transition scenario in last year's set of climate scenarios. In the fourth vintage the orderly scenarios have more disorderly elements, reflecting climate policy delays and the energy crisis following the war in Ukraine. The (shadow) carbon price is higher compared to the previous Net Zero scenario, reflecting the need to reach the same climate goal in a shortening time frame. Energy demand is higher compared to the previous one, reflecting a higher starting point. Energy investments lag behind what is required in the period until 2030 and are thus much higher starting in 2030, to meet the 2050 goal.

NGFS scenarios and changes compared to Phase III



Source: NGFS. Positioning is approximate, based on an assessment of physical and transition risks out to 2100

Temperature evolution by scenario, °C



Source: NGFS, MAGICC with REMIND emission inputs, 50th percentile temperature path

New scenarios communicate the risks of lack of coordination, and role of behaviour adaptation

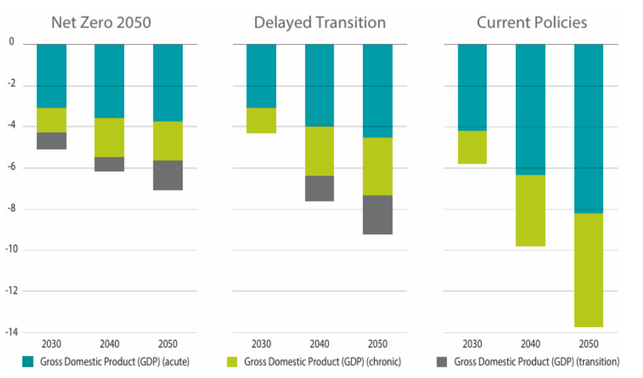
Previous vintages of the NGFS scenarios included a scenario in which Net Zero was reached, but in a disorderly and uncoordinated fashion. This *Divergent Net Zero* scenario is cancelled in the new vintage "given the reduced likelihood of a successful uncoordinated transition”. In its stead, there is a new scenario in the previously empty “too little, too late” quadrant, where both physical and transition risks are high. The *Fragmented World* scenario assumes delayed and divergent climate policy ambition globally, leading to elevated transition risks in some countries and high physical risks everywhere due to the overall ineffectiveness of the transition. This is a relevant scenario for the EU. As a frontrunner in the transition, the EU would be one of the regions in which high transition and high physical risk would combine. The scenario also assumes divergence of abatement ambition per sector, as evidenced in different carbon prices for transport and buildings compared to industry and supply. The combination of these divergent efforts across countries and sectors leads to even higher transition risks than in the Delayed Transition scenario, in which transition risks are subdued by efficient inter-regional and inter-sectoral distribution of transition efforts. The other new scenario, *Low Demand***,** scenario is an orderly scenario which combines a lower temperature pathway and a less progressive (shadow) carbon price. Significant behavioural changes in energy generation and consumption activities are the key distinguishing feature of this scenario and it is meant to emphasize the role that behavioural changes play.

Acute physical risk impacts are larger and more granular

Acute physical risk modelling has been enriched to include more hazards and increasing geographical granularity. In the previous version, there was some coverage on a global scale of acute physical risk. The fourth vintage expands the coverage of acute physical climate risks and specific hazards, such as heatwaves, droughts, floods, wildfire, and storms, and their impact on the macro economy. This is in addition to the chronic physical risk, which is the effects of the trend temperature change on for instance labour and agricultural productivity. The following chart shows the GDP deltas for 3 scenarios in comparison to a baseline scenario. This baseline scenario represents a world without climate change. From the chart it is clear that climate change has a negative impact on GDP in every plausible scenario, but the magnitude of the losses differs among them. As in the previous vintage, physical risk is the most pertinent of the types of climate risk. And it has grown in importance: acute physical risk associated with the four modelled hazards (cyclone, drought, heatwave, flood) is estimated to result in GDP losses of 8% by 2050 in the Current Policies scenario. For comparison, in phase 3 the overall acute risk GDP losses were estimated to be about 1.4% relative to the baseline for the Current Policies scenario by 2050.

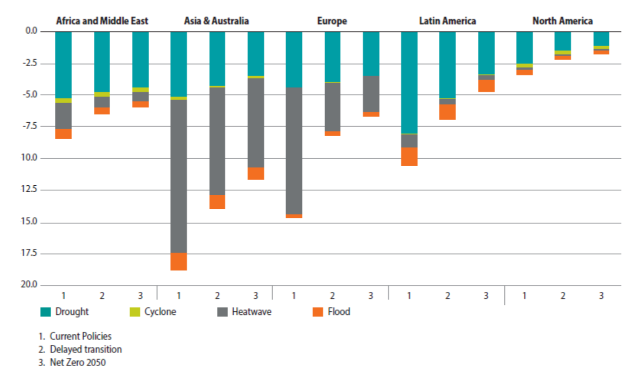
While the new numbers bring the total physical risk impact (chronic and acute together) to an almost 14% global GDP loss to the global economy by 2050 in the Current Policies scenario, it is good to realise that these estimates are still likely to be an underestimation. Second round effects (for instance mass migration), potential tipping points (such as in permafrost thaw) and the fact that the climate change currently appears to be happening more quickly than anticipated have not been taken into account. Of the four hazards, drought and heatwaves represent the largest sources of risk across regions. Increased geographical granularity shows that Europe and Asia are mostly exposed to heatwaves, while Africa and North America is primarily exposed to drought.

Global GDP impact by Climate Risk Source



Source: NGFS. % difference from baseline (hypothetical scenario with no transition or physical risk

Regional acute GDP impact by hazard and scenario,



Source: NGFS. % difference from baseline (hypothetical scenario with no transition or physical risk

Harmonisation of EPC labels could affect Dutch housing stock more

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- **The revised and recast Energy Performance of Buildings Directive (EPBD) aims to accelerate energy efficiency improvement - one of the sub-initiatives under the EPBD is the Energy label/EPC harmonisation**
- **The harmonisation will hardly change the labelling for German, French and Belgian properties, despite a generally weaker quality of properties in the former two countries**
- **Yet Dutch properties with strong labels currently could face downgrades under the harmonisation proposal**

Two weeks ago we published a first take on the recast of the Energy Performance Buildings Directive (EPBD – see here), summarizing the key action points of this recast, which is deemed necessary to accelerate transition in the built environment and ultimately will contribute to a large reduction in greenhouse gas emissions. One of the action points in the EPBD recast is harmonisation of energy labels, also called EPC's, as minimum energy intensity guidelines per energy label differ considerably, even in closely neighboured countries in North-West Europe. The use of EPC's has already been quite common across European countries, but standards and requirements differ per country. From various national sources we were able to obtain the country defined energy intensity bandwidth distribution for residential real estate in various North-west EU countries. Clearly there are major differences between what kind of intensity criteria are being applied between the countries. For example, less than 160 KWh psqmpa (= per square metre per annum) energy intensity would currently qualify as an A-label in the Netherlands, but only as an E-label in Germany. The F-label in Germany would require an intensity less than 200 KWh psqmpa, yet the French and Belgian F-labels are clearly more generous with a threshold sitting at more than double the rate being applied in Germany. One could perhaps argue that the measurement in France and Belgium through primary energy demand (i.e. including transmission losses) could be a reason for allowing higher intensities, yet only 8% of electricity and difference between primary and secondary usage for heating in Germany, which largely pertains to natural gas, is 9%. Both differences show that the definition of primary or final usage is not the main logic behind larger allowed intensities in France and Belgium. Other sources also confirm a weaker quality of the building stock in these countries, as shown in the right hand chart. Should Belgium or France then manage to achieve large steps under their current framework, such as improving their F-labelled stock to a C-label, the improvement could still be very limited in EU perspective and drive regional difference across Europe in reducing energy intensity and thereby also limit progress at EU level. Clearly harmonisation is required

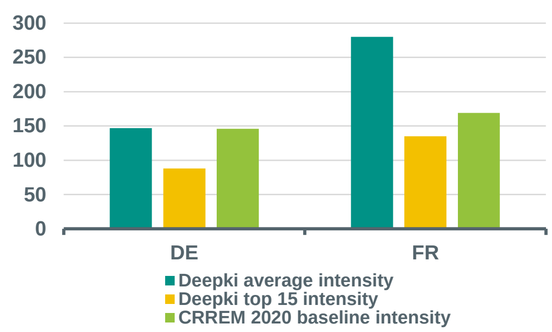
EPC bandwidths today are very disparate

	NL	DE	FR	BE-FL
Intensity calculation	Final-fossil fuel	Final energy	Primary energy	Primary energy
A++++	less than zero			
A+++	<50			
A++	<75			
A+	<105	<30		0
A	<160	<50	<50	<100
B	<190	<75	<90	<200
C	<250	<100	<150	<300
D	<290	<130	<230	<400
E	<335	<160	<330	<500
F	<380	<200	<450	>500
G	>380	<250	>450	
H		>250		

Source: Various national sources, ABN AMRO Group Economics, BE-FL = Flanders, numbers represents KWh psqmpa

Other sources confirm weaker state of French stock

KWh sqmpa



Source: Deepki, CRREM, ABN AMRO Group Economics

How would harmonisation work?

To ensure comparability across the EU, EPCs shall be based on a harmonised scale of energy performance classes by the end of 2025 at the latest. These energy performance classes will be rescaled from A (best) to G (worst). Buildings in label A need to meet the zero emission building standard (ZEB; described below), while buildings in label G shall correspond to the 15% worst-performing buildings in the national building stock at the time of the introduction of the scale. The remaining classes (B-F) have an even bandwidth distribution of energy intensity of the difference between the ZEB and worst 15%.

What is a Zero Emissions Building (ZEB)?

Under the revision of the EPBD, a new definition of Zero Emissions Building (ZEB) would be introduced as the standard for all new buildings from 2027 and for all renovated buildings from 2030. ZEB is defined a building with a very high energy performance. For residential buildings in North West Europe, total annual primary energy use should be less than 60 KWh psqmpa. The residual energy use should be covered fully by renewable energy sources that are generated on-site or are locally produced.

How to create the new harmonized scale? – let's take the Netherlands as an example

We first need to define the worst 15% of stock. Using the existing EPC distribution as a representative sample of the Dutch building stock, 4% sits in the G-label band, 3% sits in the F-label band, 5% sits in the E-label band and 7% sits in the D-label band. Cumulatively, this adds to 19% and is the closest combination to 15%. The current energy intensity threshold for D-label is 290 KWh psqmpa, so the new G-label would have an energy usage threshold higher than this. As explained in the box above, the new A-label would equate to less than 60KWh psqmpa intensity. We then calculate equally sliced energy intensity distributions between the 60- and 290 KWh psqmpa for the remaining EPC letters B to F. Since the difference is 230 KWh psqmpa and we need to distribute that within the 5 remaining letter grades, this means that energy intensity thresholds decline by 46KWh for each letter grade until we reach 60 KWh psqmpa. Finally, to get to the new distribution of the stock, we re-allocate the percentages based on their current usage to the new bands. For example the new D threshold is 198KWh psqmpa. The old B's had been assigned a threshold of 190 KWh psqmpa so these, which currently represent 13% of the total building stock. These would then fall into the new D label.

We replicated such a harmonised scale on EPC's across our earlier chosen countries, as shown in the chart below.

EPC bandwidths after harmonization

	NL	DE	FR	BE - FL
New A	<60	<60	<60	<60
New B	<106	<98	<138	<148
New C	<152	<136	<216	<236
New D	<198	<174	<294	<324
New E	<244	<212	<372	<412
New F	<290	<250	<450	<500
New G	>290	>250	>450	>500

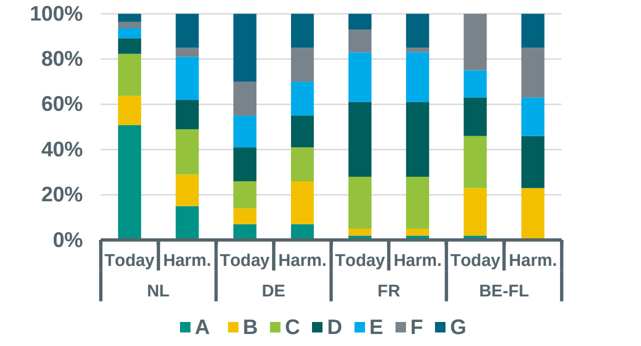
Source: Various national sources, ABN AMRO Group Economics estimates, BE-FL = Flanders, numbers represents KWh psqmpa

Dutch stock slides from strong A into weaker bands after harmonisation

We also show the distribution of the stock before- and after harmonisation in the two charts below. The largest change in EPC label distribution after harmonisation is clearly visible in the Dutch residential building stock, while the distribution in the other countries will remain roughly the same. This makes sense as currently the A-label in the Netherlands seems to be defined too generously, plus has many properties populating this label. With a more stricter definition of the A-label as proposed under the harmonization/ZEB, these properties are bound to be down casted to lower rankings. On the flipside, Germany currently has 17% of its housing stock in a H-label and 29% in the combined H & G label. Given the application of a bottom-15% the old H labels will become the new G-label and the combination of H & G shown today will obviously disappear. This looks more like an optical switch and large share of properties in Germany will continue to bungle at the lower end of the scale.

EPC distribution before and after harmonization (1)

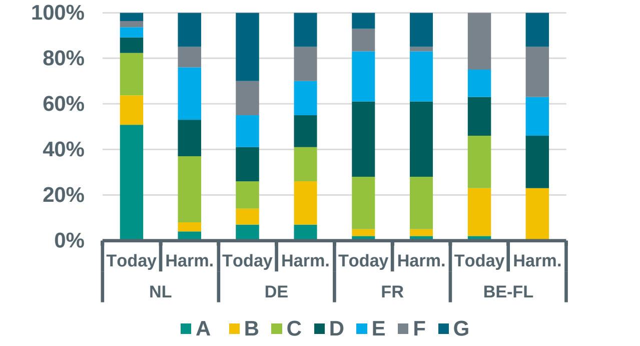
Distribution of residential stock per label



Source: Various national sources, ABN AMRO Group Economics, Harm. = Harmonized, A today includes A up to A++++ labels (relevant for NL), G today includes G & H labels (relevant for DE)

EPC distribution before and after harmonization (2)

Distribution of residential stock per label



Source: Various national sources, ABN AMRO Group Economics, Harm. = Harmonized, A today includes A up to A++++ labels (relevant for NL), G today includes G & H labels (relevant for DE)

We show two charts because of the difference in how energy labels in the Netherlands are captured. The left hand chart distribution is based on the NTA 8800 sample of energy labels for residential. This sample currently has 1.4mn observations (despite NTA 8800 being introduced only recently) and a staggering 16% of the sample comes from properties with less than 50 KWh psqm intensity. The NTA 8800 reflects a more rigid way of measuring energy intensity at properties, in line with EU criteria, including site visits and measurements by professional surveyors.

In the right hand chart we applied the distribution based on all Dutch registered EPC's for residential, which then suddenly shows a lower share of the current Dutch stock in the new A-label. Yet the total registered Dutch EPC's largely contain observations based on simple heuristics, i.e. without a proper on-site assessment and frequently desktop based through simple property characteristics. It is therefore remarkable that the sample based on stricter NTA 8800 methodology actually reveals a better shape of the Dutch residential building stock than the overall sample using also simple heuristics to define a property label.

Given the ongoing discussions between the European Commission, -Council and -Parliament, the results are certainly not to be taken as granted, but could provide a rough sketch as to what might materialize if the current proposal for harmonisation is enacted.

Carbon dioxide transport

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- **To transport CO2, the state is important**
- **Pipelines are a mature technology to transport CO2, but other technologies are not mature enough**
- **Risk of corrosion and effect of impurities in CO2 on infrastructure are the main challenges to transporting CO2**
- **CO2 transport costs vary due to transport method, onshore/offshore, scale, distance to CO2 storage, regional variation, CO2 source and pressurized or purified for transport**

Introduction

The goal is reaching net zero by 2050 and staying within the carbon budget aligned to a pathway to stay below 2°C degree above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. There are several ways to achieve this goal. First, limiting and mitigating CO2 and other greenhouse gas emissions. Second, capture emissions from combustion. Third, trap CO2 and other emissions from the atmosphere. To reach the goal a combination of these three ways are necessary. In our Sustainaweekly of 20 November we did a deep dive into carbon capture (see here). We focussed on technologies that capture emissions from combustion. This is the CC (carbon capture) of CCUS (carbon capture, utilisation and storage). In this note, we focus on how to transport CO2. In future publications we will focus on how to store CO2, how to utilise the captured CO2 and the technologies that trap CO2 and other greenhouse gasses from the atmosphere.

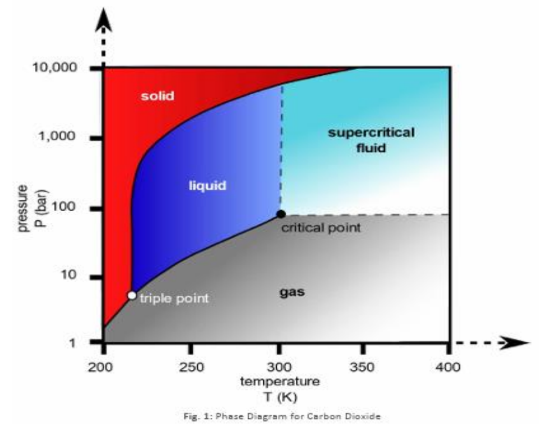
The states of CO2

For transporting CO2 the state of CO2 is very important. CO2 usually behaves as a gas in air at standard temperature and pressure or as a solid called dry ice when frozen. CO2 in gas state is transported at close to atmospheric pressure and occupies such a large volume that very large facilities are needed. Gas occupies less volume if it is compressed, and compressed gas is transported by pipeline. Moving gas through pipelines is based on pressure. Gas travels from high pressure to low pressure. Compressing a gas to high pressure allows it to flow to other locations. Gas takes up less volume when it's compressed and even less when it is liquified, solidified or hydrated. Therefore, CO2 is often compressed and liquefied to supercritical state. There is also the possibility of transport CO2 at a liquid state with the right temperature and pressure conditions. This solution requires a good isolation of the pipes (more on this below).

Supercritical state of CO2

Supercritical CO2 is a state of CO2 where it is held at or above its critical temperature and critical pressure (see graph below). In supercritical state it can adopt properties midway between a gas and a liquid; the CO2 has the density of a liquid but with a viscosity (thickness) of a gas (see here). It is a state where distinct liquid and gas phases do not exist. This is done at a pressure greater than 74 bar and a temperature higher than 31°C (304 Kelvin, see graph below).

Phases of CO2



Source: National Renewable Energy Laboratory (NREL)

Ways to transport CO2

CO2 can be transported via pipelines, ships, road and rail. To transport CO2 via pipelines is a mature technology. It is most common and is less costly. The CO2 is preferably dry and free of hydrogen sulphide because at this state corrosion to the pipeline is then minimal. Pipeline transportation of CO2 over longer distances is most efficient and economical when the CO2 is in the dense phase. The feasibility of repurposing natural gas pipelines for CO2 transport is not practical for transporting large quantities of CO2 over long distances. This is because CO2 requires a higher pressure than natural gas to be kept in a liquid state for pipeline transport, and thus thicker pipelines are generally needed.

CO2 also can be transported as a liquid in ships, road or rail tankers that carry CO2 in insulated tanks at a temperature well below ambient, and at much lower pressures. The average-sized LPG tanker could carry approximately 45,000 tonnes of CO2. Shipping is a mature technology for liquefied natural gas (LNG) and liquefied petroleum gas (LPG) but is not widely used for CO2 transport today. LPG tankers are a closer analog for CO2 transport via ship than LNG tankers because liquefied CO2 must be transported at elevated pressures like LPG, whereas LNG is transported at atmospheric pressure. LPG tankers can be repurposed for CO2 or dual-purpose transport, but in general, tankers specifically designed for CO2 transport can be better optimized for maximum capacity and investment cost (see **here**).

Challenges to transport CO2

Corrosion

Dry carbon dioxide does not corrode the carbon-manganese steels, that is generally used for pipelines, as long as the relative humidity is less than 60%. Moisture-laden CO2, on the other hand, is highly corrosive, so a CO2 pipeline in this case would have to be made from a corrosion-resistant alloy, or be internally clad with an alloy or a continuous polymer coating. Some pipelines are made from corrosion-resistant alloys, although the cost of materials is several times larger than carbon-manganese steels. So the pipes (and the tanks) must be kept free from corrosion. This problem can be easily solved by purification, a thorough dehydration and the use of corrosion suppressant. Dehydrating the CO2 entails removing the water from the gas mixture stream (see **here**).

Impurity

The captured CO2 is never 100% pure. Purity depends on the nature of the fuel (oil, natural gas or coal) and the capturing technique (postcombustion, oxycombustion or precombustion). Different heavy metals can be found in the gas mix with CO2. The presence of certain impurities in CO2, such as methane and nitrogen, can lead to reduced pipeline capacity. Indeed, higher methane levels require greater pumping/compression. The presence of impurities shifts the boundary towards higher operating pressures to keep the CO2 in the supercritical or dense phase. Furthermore, the impurities can lower the density of CO2, which also lowers the storage capacity for the CO2. In addition, impurities in CO2 have an impact on pipeline transportation and injection into enhanced oil recovery (EOR) reservoirs and saline geologic formations. For example water can lead to corrosion while higher hydrogen sulfide levels reduce the minimum miscibility pressure (MMP) in EOR and could lead to hydrogen-induced cracking in the pipeline. So every impurity has its own set of impacts and a combination of impurities only increases the challenge.

Infrastructure

According to the IEA transport and storage infrastructure, CO2 is the backbone of the carbon management industry. Planned capacities for CO2 transport and storage surged dramatically in the past year, with more than 370 Mt CO2 of new annual storage capacity announced since January 2022, with similar capacities for connecting infrastructure. Based on the existing project pipeline, dedicated CO2 storage capacity could reach over 420 Mt CO2/yr by 2030, causing the balance between dedicated CO2 storage supply and the planned demand based on capture capacities for 2030 to level globally. However, this is insufficient to meet the around 1200 Mt CO2/yr by 2030 called for in the Net Zero Emissions (NZE) Scenario.

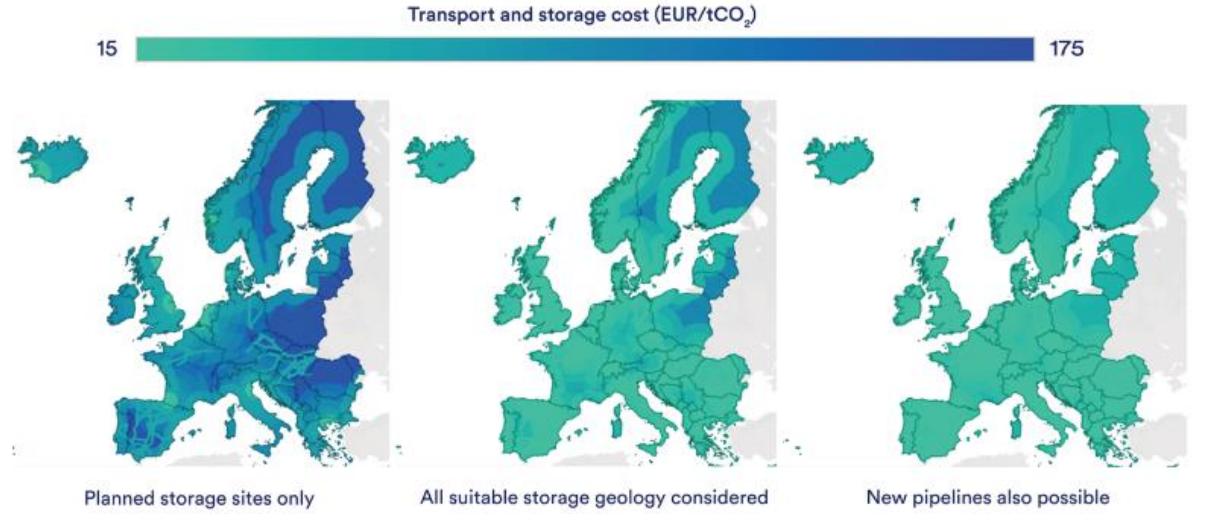
Costs

CO2 transport costs vary due to transport method (i.e. pipelines versus ships); whether CO2 is transported onshore or offshore; scale (quantity of CO2 transported); distance to CO2 storage; regional variation; and the CO2 source and whether or to what degree it is pressurized or purified prior to transport.

Pipelines are generally the most cost-effective CO2 transport option in most regions, though shipping can be cost effective for transporting CO2 over long distances. But it is less convenient as it requires important buffer stocks to face variability of supply. It is currently in a phase of development. According to a study published in the International Journal of Greenhouse Gas Control in July 2021, the practical cost range for the transport and storage of CO2 via pipeline is $4 to $45/tCO2. For the combined cost of transporting CO2 via ship for offshore storage the estimates are between $30 to $64/tCO2 (see **here**).

The Clean Air Task Force has made an estimation (see **here**) for Europe CO2 transport and storage costs. The graph below shows an overview of their findings.

Transport and storage cost (EUR/tCO2)

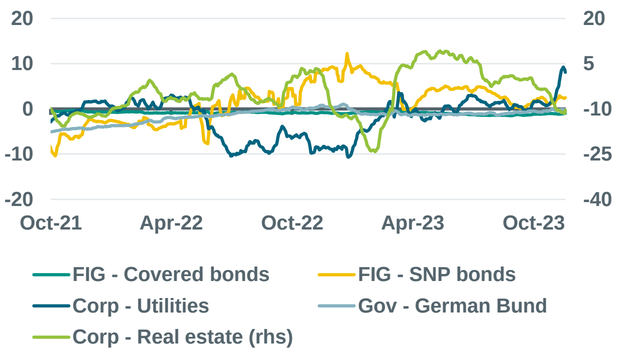


Source: Clean Air Task Force

ESG in figures

ABN AMRO Secondary Greenium Indicator

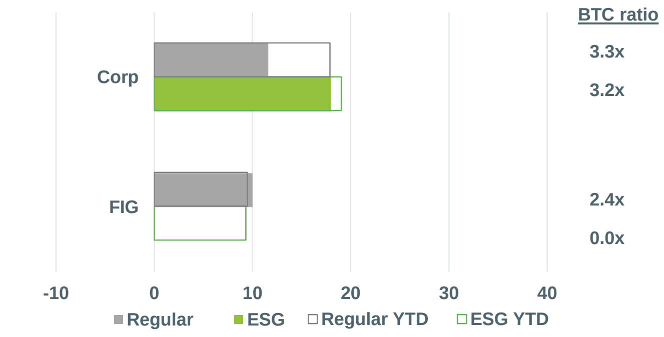
Delta (green I-spread – regular I-spread)



Note: Secondary Greenium indicator for Corp and FIG considers at least five pairs of bonds from the same issuer and same maturity year (except for Corp real estate, where only 3 pairs were identified). German Bund takes into account the 2030s and 2031s green and regular bonds. Delta refers to the 5-day moving average between green and regular I-spread. Source: Bloomberg, ABN AMRO Group Economics

ABN AMRO Weekly Primary Greenium Indicator

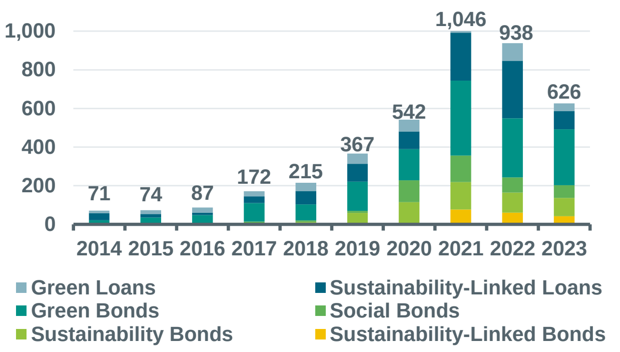
NIP in bps



Note: Data until 29-11-23. BTC = Bid-to-cover orderbook ratio. Source: Bloomberg, ABN AMRO Group Economics

Sustainable debt market overview

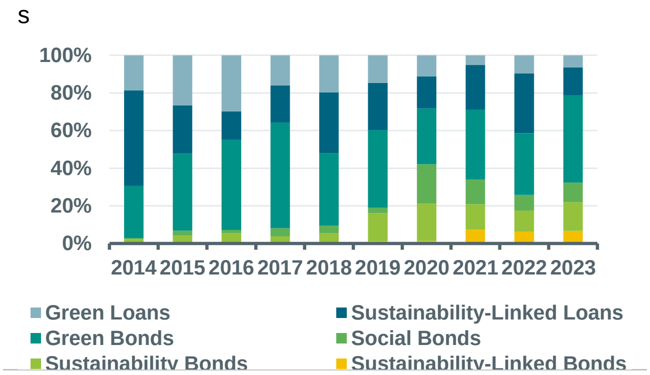
EUR bn



Source: Bloomberg, ABN AMRO Group Economics

Breakdown of sustainable debt by type

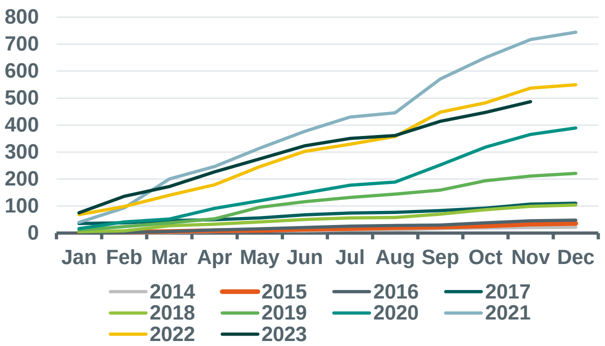
% of total



Source: Bloomberg, ABN AMRO Group Economics

YTD ESG bond issuance

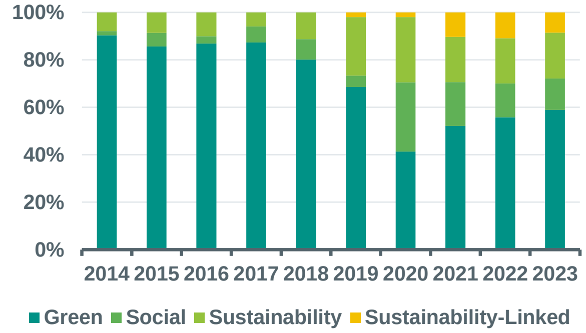
EUR bn (cumulative)



Source: Bloomberg, ABN AMRO Group Economics

Breakdown of ESG bond issuance by type

% of total

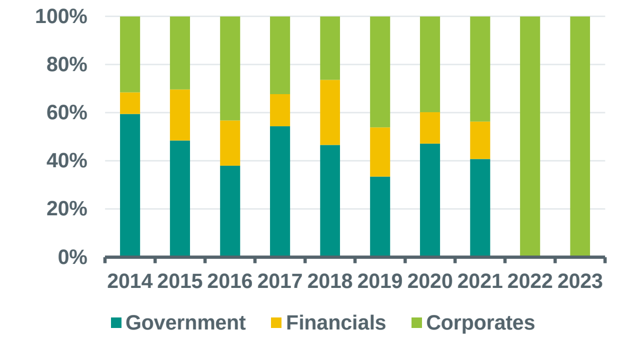


Source: Bloomberg, ABN AMRO Group Economics

Figures hereby presented take into account only issuances larger than EUR 250m and in the following currencies: EUR, USD and GBP.

Breakdown of ESG bond issuance by sector

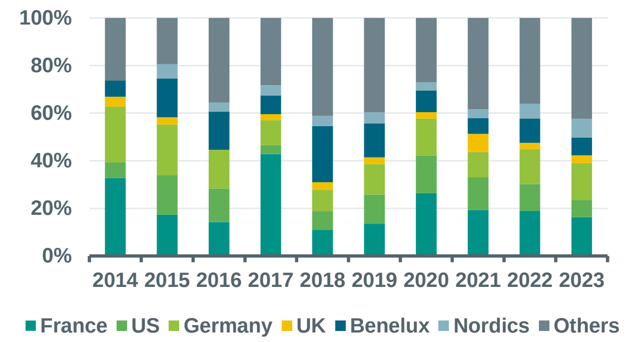
% of total



Source: Bloomberg, ABN AMRO Group Economics

Breakdown of ESG bond issuance by country

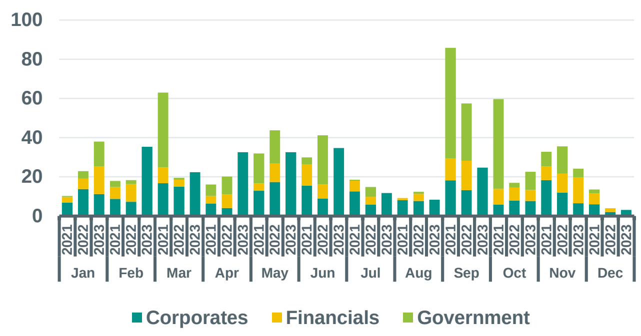
% of total



Source: Bloomberg, ABN AMRO Group Economics

Monthly Green Bonds issuance by sector

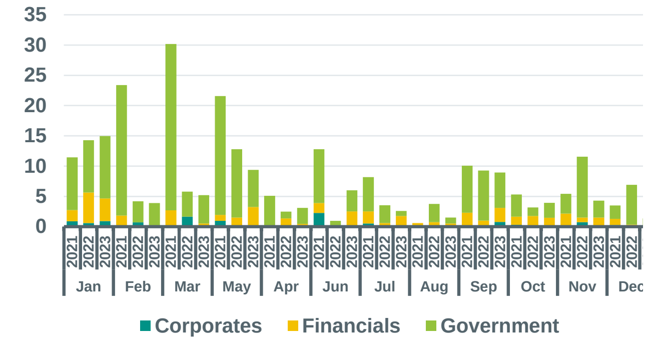
EUR bn



Source: Bloomberg, ABN AMRO Group Economics

Monthly Social Bonds issuance by sector

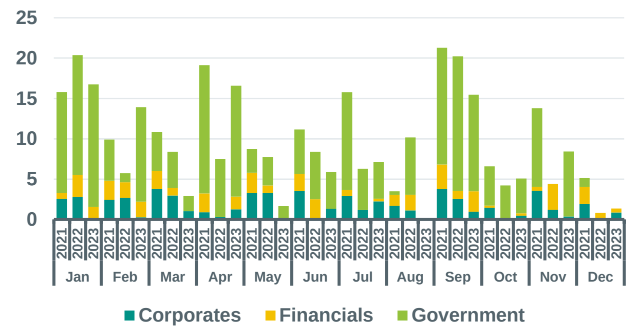
EUR bn



Source: Bloomberg, ABN AMRO Group Economics

Monthly Sustainability Bonds issuance by sector

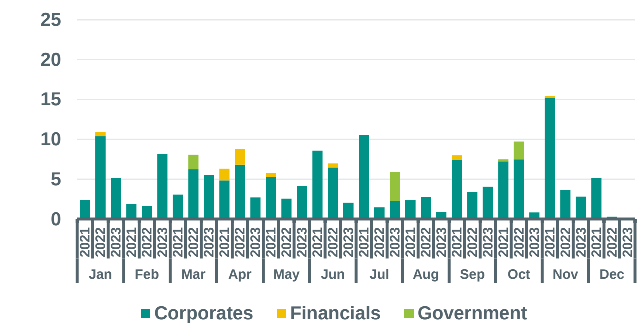
EUR bn



Source: Bloomberg, ABN AMRO Group Economics

Monthly Sust.-Linked Bonds issuance by sector

EUR bn



Source: Bloomberg, ABN AMRO Group Economics

Figures hereby presented take into account only issuances larger than EUR 250m and in the following currencies: EUR, USD and GBP.

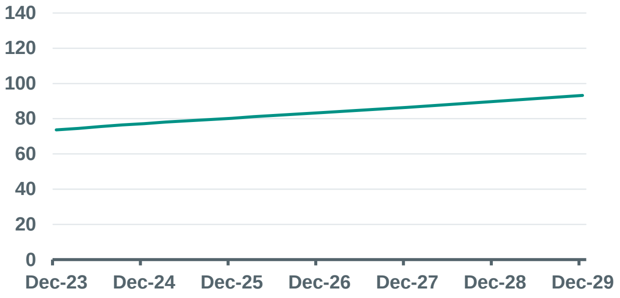
Carbon contract current prices (EU Allowance)

EUR/MT

Source: Bloomberg, ABN AMRO Group Economics

Carbon contract futures curve (EU Allowance)

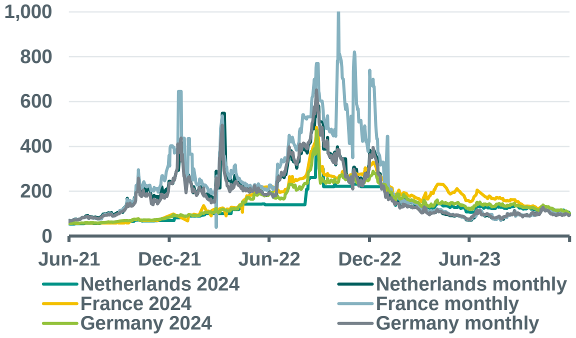
EUR/MT



Source: Bloomberg, ABN AMRO Group Economics

Electricity power prices (monthly & cal+1 contracts)

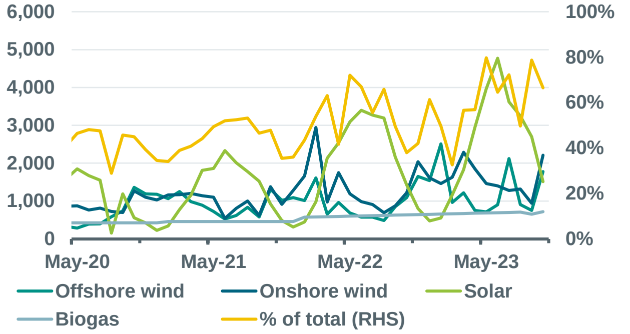
EUR/MWh



Source: Bloomberg, ABN AMRO Group Economics. Note: 2024 contracts refer to cal+1

Electricity generation from renewable sources (NL)

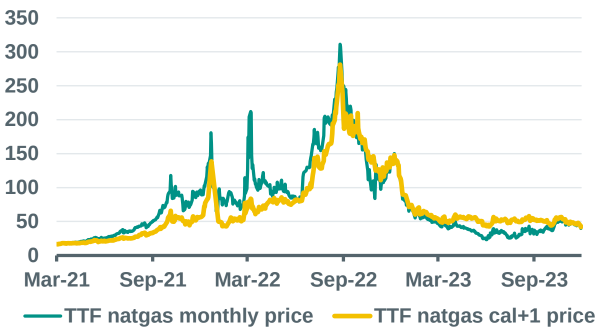
GW % of total



Source: Energieopwek (Klimaat-akkoord), ABN AMRO Group Economics

TTF Natgas prices

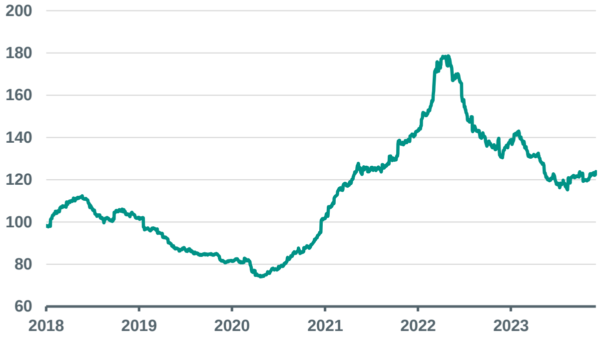
EUR/MWh



Source: Bloomberg, ABN AMRO Group Economics

Transition Commodities Price Index

Index (Jan. 2018=100)



Note: Average price trend of 'transition' commodities, such as: corn, sugar, aluminium, copper, nickel, zinc, cobalt, lead, lithium, manganese, gallium, indium, tellurium, steel, steel scrap, chromium, vanadium, molybdenum, silver and titanium. Source: Refinitiv, ABN AMRO Group Economics

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