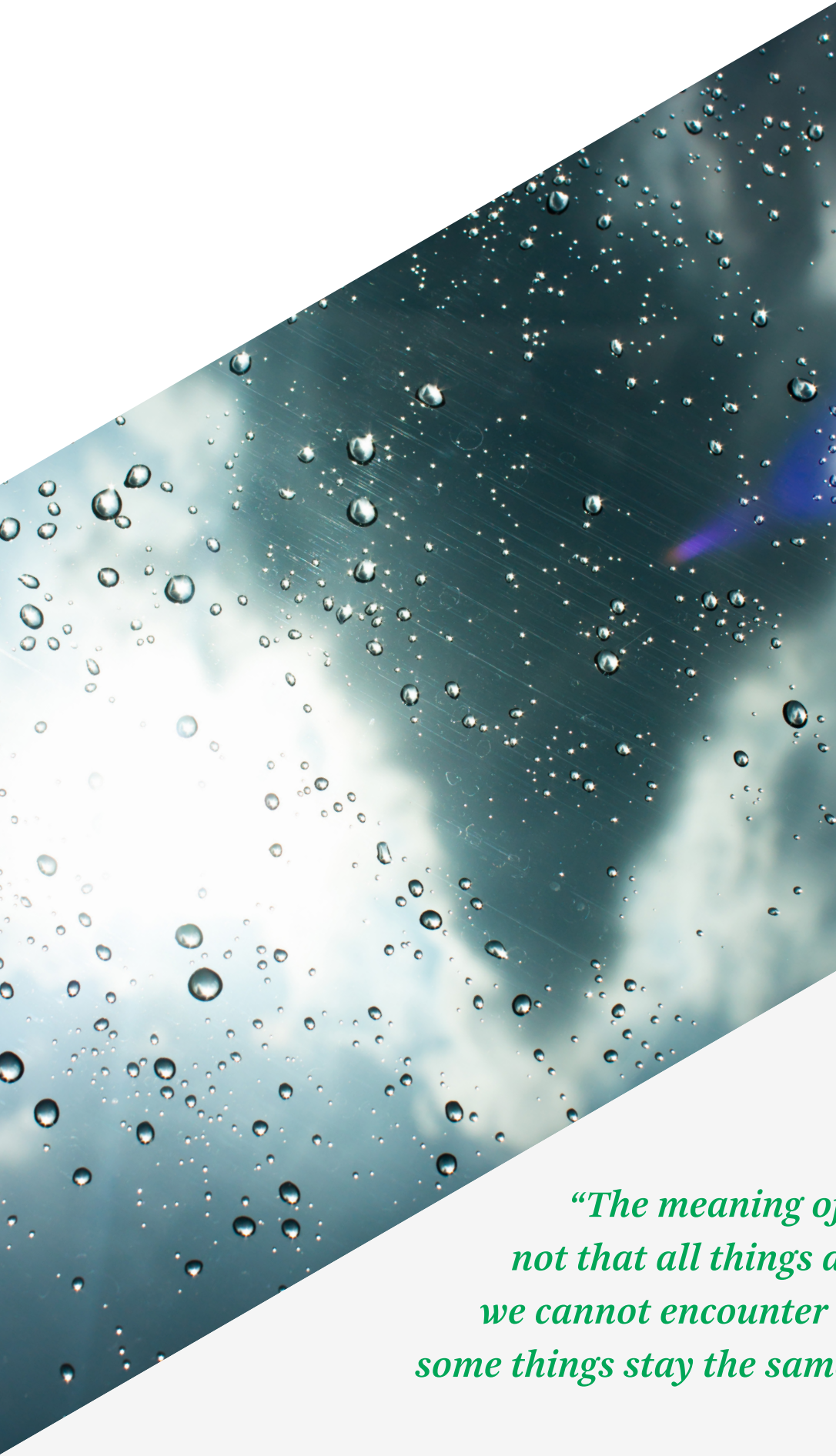


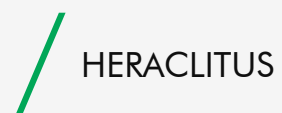
Sustainability and Climate Risk: What Can We Learn From the Nordics?

CBRE





“The meaning of the river flowing is not that all things are changing so that we cannot encounter them twice but that some things stay the same only by changing”



Nordic countries are often considered frontrunners in sustainability and, according to Moody’s ¹, they score highest on the overall sovereign ESG score. Nordic capital cities are likewise consistently being listed among cities being leaders in sustainable urban development, focusing on long-term resilience even when navigating through short-term change. Therefore, the Nordic urban model, founded on the values of environment, equality, openness and efficiency ², is often used as an example of resilient urban habitat.

Copenhagen, Stockholm, Oslo, and Helsinki were ranked among the top 35 cities in the world for quality of living in 2019, in major study by global consulting firm Mercer ³. Stockholm came second for sustainability in the Arcadis Sustainable Cities Index ⁴, while Copenhagen came ninth in the Economist Intelligence Unit’s Global Liveability Ranking ⁵. Although all these studies use slightly different criteria, they each highlight the perceived success of the Nordic urban planning model in prioritising quality of life and striving for a greener future.

Indeed, a resilience approach to sustainability applied in the Nordics focuses on how to build capacity to deal with unexpected change, allowing for a more successful mitigation of future impacts. Consideration of social, economic and environmental impacts when planning and managing cities has been pathing the way for developing a resilient habitat for both current and future generations.

From a commercial real estate (CRE) standpoint, the Nordics have established a strong reputation for being an appealing destination for global capital allocations. And for real estate investors, a positive relationship between sustainable urban development and investment performance is indeed an important consideration.

However, rising climate risks can prove to be disruptive not only for the quality of life of city residents but also for property values and returns on investments. Going forward, a proactive approach and continued focus on sustainability and climate risk mitigation strategies in the Nordics is believed to further strengthen the overall attractiveness of the region as an investment destination.

Therefore, the focus of this report is to understand the equation between sustainable urban planning, climate risks and real estate investment flows in the Nordics. Nowadays, tools and techniques are emerging across the CRE sector to help market stakeholders, particularly investors, assess risks better and help navigate potential climate change impacts. We seek to understand how the Nordic countries and cities tackle these challenges, how they allow their citizens to meet their needs, which in turn can prove to be more appealing to property investors in the long term.

These learnings can provide other key urban locations across Europe with best practices, which they may consider implementing.

We hope you will enjoy the report.

Contents

06 Introduction

- Why should we care about sustainable urbanisation?
- The economics of sustainable urbanisation
- The economics of climate change

17 Sustainable Urban Development

- Understanding what affects the development and areas
- Examples from Nordic capital cities

28 Good Density

- The concept of sustainable development
- Urban built environment
- Green and blue infrastructure
- Capitalisation of urban green and blue
- The value of placemaking

36 Climate Risks

- Impact projections
- Asset, portfolio and market level impact
- Market standardisation
- Response from financial institutions

46 Biodiversity and Economy

- Measuring urban biodiversity
- Measuring the impact

50 Conclusion

1/ Introduction

A combination of population growth, unparalleled urbanisation rates and a changing climate is posing complex resilience challenges. A range of high-level UN frameworks has been introduced to actively promote international actions for sustainable development and human wellbeing.

In addition to the Sustainable Development Goals (SDGs), the Sendai Framework for Disaster Risk Reduction (UNISDR), the Paris Agreement on Climate Change (UNFCCC) and the New Urban Agenda (UN-Habitat) have all been endorsed to help shape more resilient and eventually more sustainable urban development pathways.

In recent years, losses associated with natural events have increased considerably. In the US, damage due to catastrophes and disaster equalled USD 95bn in 2020, double than 2019 number ⁶, while there were USD 75bn in flood damage in the past three decades ⁷. In Asia, damage from natural disasters went up to USD 67bn in 2020, with only USD 3bn covered by insurance ⁸.

Going forward, the growth in the global population and urbanisation are expected to make these trends become even more pronounced ⁹. Decisions about investments into urban infrastructure, buildings and land use taken now can have tremendous implications for future development outcomes. Therefore, proactively investing in resilience represents a strategic shift and opens a new window of opportunities, placing the assessment and development of mitigation strategies to counter potential risks high on

the agenda. Failure to address these issues may result in increased exposure to loss, which is likely to impact property values negatively.

Why Should We Care About Sustainable Urbanisation?

Much has been written in recent years about the urbanisation of the global population. According to the UN, the urban population will increase from 56% to 60% of the total global population over the next decade. The expansion of urban areas will have profound implications for energy consumption, climate change, greenhouse gas emissions and environmental degradation ¹⁰.

Clearly, one of the driving forces in urbanisation is migration, both internal and external. UN defines internal migration as rural to urban migration within the country, while external migration is defined as the clustering of international migrants in large cities. According to the UN, one in every seven people on the planet is a migrant.

The demographic profiles of cities are also changing. Two major demographic trends have implications for urban areas: first is the relatively large proportion of the

Table 1: Nordic countries' migration figures

| | Urban population at mid-year (thousands) | | | | Average annual rate of change of the urban population (%) | | | Percentage of population at mid-year residing in urban country and area | | | | Average annual rate of change of the percentage urban (%) | | |
|---------|--|-------|-------|-------|---|-----------|-----------|---|------|------|------|---|-----------|-----------|
| | 2015 | 2020 | 2025 | 2030 | 2015-2020 | 2020-2025 | 2025-2030 | 2015 | 2020 | 2025 | 2030 | 2015-2020 | 2020-2025 | 2025-2030 |
| Denmark | 4,979 | 5,108 | 5,248 | 5,389 | 0.51 | 0.54 | 0.53 | 87.5 | 88.1 | 88.8 | 89.4 | 0.13 | 0.15 | 0.15 |
| Finland | 4,672 | 4,772 | 4,874 | 4,970 | 0.42 | 0.42 | 0.39 | 85.2 | 85.5 | 86.0 | 86.6 | 0.07 | 0.11 | 0.14 |
| Norway | 4,217 | 4,522 | 4,830 | 5,130 | 1.40 | 1.32 | 1.20 | 81.1 | 83.0 | 84.6 | 86.1 | 0.46 | 0.40 | 0.34 |
| Sweden | 8,451 | 8,905 | 9,309 | 9,669 | 1.05 | 0.89 | 0.76 | 86.6 | 88.0 | 89.2 | 90.3 | 0.33 | 0.28 | 0.24 |

Source: UN Habitat, 2021

youth population aged 15-24. Second, population ageing is one of the demographic megatrends that is expected to have significant implications for both economic and social development as well as environmental sustainability ¹⁰. As the global population is ageing and moves to or remains in cities instead of retiring to the countryside, more attention will have to be paid to the needs of the elderly population in urban design and planning. The megatrend of ageing has implications for the built environment, especially as it is related to housing, transportation, recreation and social services. The trend is also supported by the WHO's 'Age-friendly city initiative'.

Theoretical frameworks have explained the mechanisms by which agglomerations generate gains for cities. Because firms and urban residents recognise the economic value derived from cities, they are willing to compete for more expensive space in cities. By concentrating firms and urban residents in the same location, cities give access to more 'shared' services and better infrastructure. Cities allow companies to 'match' their need for talent, premises and suppliers. These effects are often being qualified as human capital spillovers and imply that cities with higher shares of often young, highly skilled and educated workers grow faster.

Table 2: Nordic countries and capital cities, population in age groups 15-24 and 65+

| | Total Population (thousand) | | 15-24 age group as % of total popu. | | 65+ age group as % of total popu. | |
|------------|-----------------------------|-------|-------------------------------------|------|-----------------------------------|------|
| | 2020 | 2035 | 2020 | 2035 | 2020 | 2035 |
| Copenhagen | 799 | 947 | 14% | 12% | 12% | 10% |
| Helsinki | 1,688 | 1,829 | 11% | 10% | 18% | 17% |
| Oslo | 692 | 794 | 11% | 10% | 13% | 11% |
| Stockholm | 2,398 | 2,901 | 11% | 9% | 16% | 13% |

| | Total Population (million) | | 15-24 age group as % of total popu. | | 65+ age group as % of total popu. | |
|---------|----------------------------|------|-------------------------------------|------|-----------------------------------|------|
| | 2020 | 2050 | 2020 | 2050 | 2020 | 2050 |
| Denmark | 5.83 | 6.25 | 12% | 12% | 20% | 25% |
| Finland | 5.53 | 5.44 | 11% | 10% | 23% | 27% |
| Norway | 5.39 | 6.29 | 12% | 11% | 18% | 24% |
| Sweden | 10.4 | 12.6 | 11% | 11% | 20% | 23% |

Note: Copenhagen is defined as City of Copenhagen, comprising Copenhagen, Frederiksberg, Tårnby and Dragør

Source: Oxford Economics, 2021

Urbanisation is often seen as a potential threat to environmental sustainability, as, if poorly managed, it can lead to irreversible land changes, biodiversity loss and environmental degradation. On the other hand, if well executed, urbanisation can create tremendous environmental value – by achieving balanced development, protecting biodiversity and preserving nature; simultaneously using resources more efficiently, i.e. with a lower environmental pressure per capita. Finally, planned urbanisation improves the quality of life, wellbeing and prosperity.

But the truth is that our cities must deal with many challenges. Climate change, based on greenhouse gas emissions, is by far the most pressing global environmental problem that we face today. Although the projections for future climate change are most often defined globally, the importance of assessing the impact on a city level is gaining focus. In 2015, the UN endorsed the new Sustainability Development Goal 11, which is to ‘Make cities and human settlements inclusive, safe, resilient and sustainable’. Therefore, cities can and will be climate-change leaders and the main drivers in implementing climate resiliency and mitigation, though not without

transformation. To continue being the engines of growth, cities need productive industries within the private sector that can benefit from the economies of scale and agglomerations that cities offer. Hence, the cities of the future will have to be planned strategically to support environmental and social wellbeing as well as economic productivity¹⁴.

The international climate science research community has concluded that human activities are changing the climate in ways that increase risks to cities¹². Therefore, understanding and anticipating changes are essential in enabling cities prepare for a more sustainable future. Despite the problems and challenges that cities in the Nordics have, they have performed well in many aspects related to urban sustainability. For example, several Nordic cities, Copenhagen included, have an ambitious goal of becoming carbon neutral in quite a short time frame while Oslo has made its city centre almost car-free.

Adaptation and mitigation actions are integrated into Nordic capital city’s strategies, especially the ones related to water issues, such as more frequently occurring torrential rains and sea-level rise. According to various

scenarios of climate change impacts, the amount of extreme rainfall can rise by up to 40% in the Nordics². Hence, of particular concern for the Nordic countries are water-related issues, with increased precipitation pattern, a rise in sea-levels and urban flooding projected by the Intergovernmental Panel on Climate Change (IPCC). In the long-term, the impact from sea-level rise is expected to overtake the risk from extreme rainfalls.

The Economics of Sustainable Urbanisation

Cities have an enormous impact on the climate, as they generate 70% of the global greenhouse gas emissions and consume two-thirds of the world’s energy. But when well-planned and managed, “cities create value, which is the totality of the economic, social, environmental and intangible conditions (institutional, governance, political, cultural and civic perception) outcomes that have the potential to impose quality of life of residents in meaningful and tangible ways”.¹⁰

- Economic value: economic output, property development.
- Environmental value: climate change, natural environment.
- Social value: quality of life, focus on equality.
- Intangible value: governance system, political institutions.

The importance of cities as points of economic growth has been argued for decades. Although urban areas account for 56% of the world population, they generate around 80% of the world’s GDP¹⁰. Indeed, sustainable economic growth seems to be directly linked to substantial and sustainable urbanisation. Not only that cities generate local economic growth, but they also attract foreign investment. At a macro level, the value

generated by urban growth, such as the appreciation of land, housing and real estate values, constitutes a key feature of the economic dimension of the value of urbanisation¹⁰. But the value of sustainable development should not be limited to measuring the economic realm, as this can lead to excluding the benefits that are not easy to measure, such as effective institutions, cultural diversity and similar.

In the discourse of sustainable development, decoupling economic growth from negative environmental impacts is often emphasised as the key strategy for achieving environmental sustainability. In the case of urban developments, the challenge of decoupling lies in successfully accommodating growth in the building stock and infrastructure networks while reducing potential negative environmental impacts resulting from the construction and the use of both buildings and infrastructure.

According to OECD¹³, the degree of decoupling between economic growth and negative environmental impacts can be measured by dividing a chosen decoupling indicator at the end of an investigated period by the same indicator at the beginning of the period. The decoupling indicator at a given time is measured as the environmental impact divided by GDP. For example, if the growth of urbanised land is lower than GDP, this indicates a decoupling between economic growth and land consumption. Since the 1990s, the rate of consumption of land for urban development has been lower than the economic growth rate in both Copenhagen and Oslo.

Decoupling occurs when the growth rate of an environmental pressure (for example, total greenhouse gas emissions) is less than that of its economic driving force (for example, GDP) over a given period. Decoupling can be either absolute or relative. Absolute decoupling is said to occur when greenhouse gas emissions growth

is stable or decreasing while the GDP growth is growing; whereas relative decoupling is when the growth rate of the greenhouse gas emissions is positive but less than the growth rate of the GDP.

All Nordic countries have shown evidence of absolute decoupling between 1995 and 2019, as the gross domestic product (GDP) grew, while total greenhouse gas emissions and energy consumption fell.

Figure 1: Economic decoupling in the Nordics (1995=100)

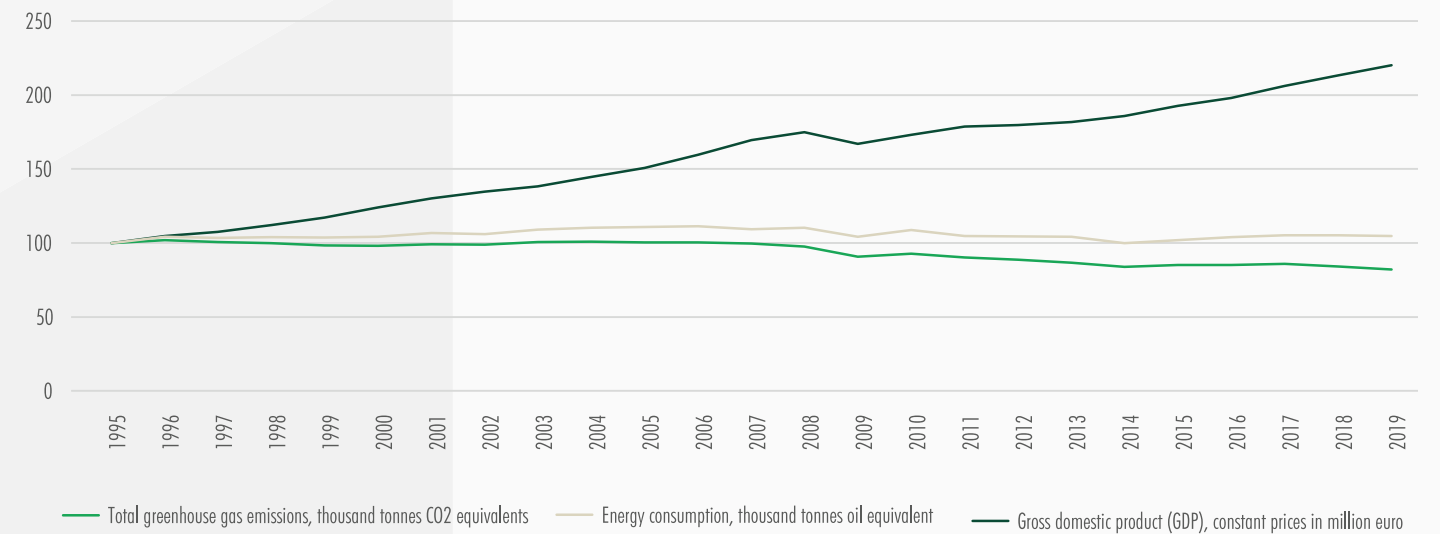


Source: Nordic Co-Operation and Eurostat, 2021

According to the European Environmental Agency, Europe consumes more and contributes more to environmental degradation than other regions. Efforts to mitigate climate change by reducing greenhouse gas emissions have become a common feature across European cities, and these are now increasingly combined with measures focused on climate change adaptation ⁶⁵. The EU 2020

Climate Action Progress Report outlines that in the EU, greenhouse gas emissions decreased by 3.7% in 2019 YoY while the EU economy continued to grow. Thus, the EU remains on track to achieve its target under the UN Framework Convention on Climate Change on reducing greenhouse gas emissions by 20% by 2020 ⁶⁵.

Figure 2: Economic decoupling in the EU-27(1995=100)



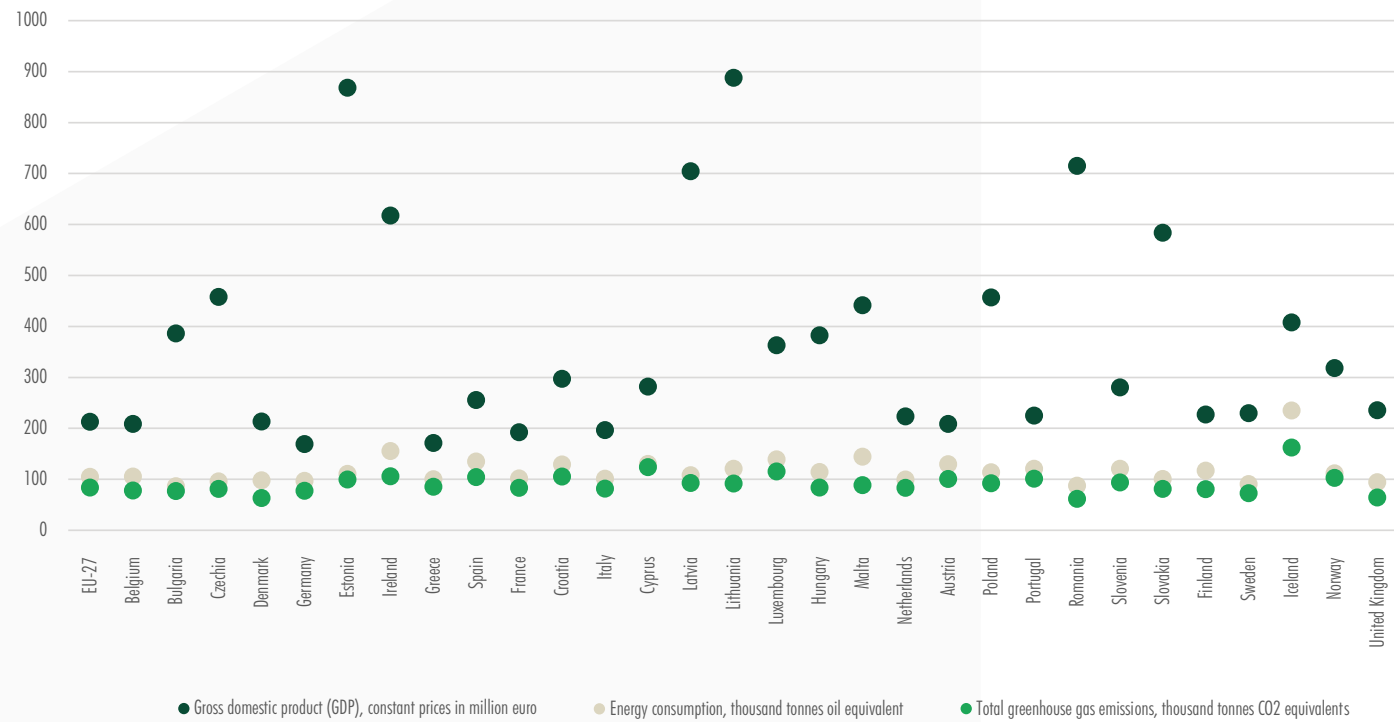
Source: Eurostat, 2021

Several UN documents point that it is unlikely that a long-lasting, absolute decoupling of economic growth from environmental pressures and impacts can be achieved at a global scale. It is, therefore, up to societies to rethink what is meant by growth and progress. In March 2020, the EU adopted a new proposal for a European Climate Law to make the climate neutrality target legally binding in the EU. Furthermore, in September 2020, European Climate Law was amended to include the new target of 55% reduction by 2030 from the 1990 level.

While some European countries achieved a reduction in some forms of pollution, the decoupling between growth and environmental footprints varies significantly between

countries. In 2019, all Member States prepared their final integrated National Energy and Climate Plans (NECP). These show that while the Member States have made significant progress in defining their respective paths to reaching the current 2030 climate and energy targets, further efforts are still needed ⁶². The implementation of the existing national policies and measures will allow for EU-27 total emissions to be reduced by 30% in 2030, according to aggregated national greenhouse gas emissions projections. Further implementation of the planned measures or stated ambitions in the final NECPs could lead to an estimated overall greenhouse gas emissions reduction of the EU-27 at 41%, thus reaching the current at least 40% reduction target.

Figure 3: Economic decoupling by country, 2018 (1995=100)



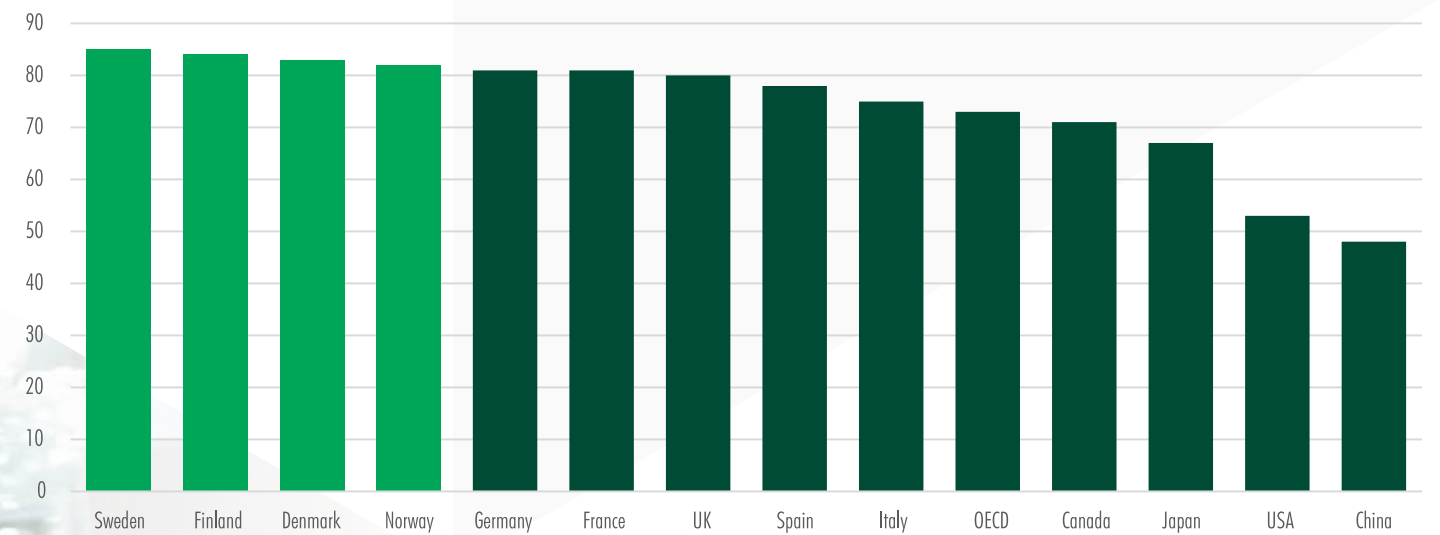
Source: Eurostat, 2021

The Economics of Climate Change

Climate change can have a material impact on sovereign risk through direct and indirect effects on public finances, raising the cost of capital and threatening debt sustainability. A report by Volz et al.¹⁵ presented new empirical evidence on the relationship between climate vulnerability, resilience and the sovereign cost of capital. The study has shown that exposure to climate risks is not statistically significant for the group of advanced economies being part of the study. On the other hand, resilience to climate risk is statistically significant in reducing bond yields across all countries being part of the sample.

Over the last years, credit rating agencies have started to flag climate change as a potential risk to sovereign credit ratings. IMF and the World Bank have recognised the macroeconomic and financial risks emanating from climate change. Research increasingly acknowledges that besides climate change, the depletion of natural capital and biodiversity loss also pose a sovereign risk threat. And climate change and depletion of natural capital are believed to be closely intertwined¹⁶. The PRI credit risk and rating initiative's statement (2019) on ESG in credit risk and ratings says that ESG factors are an important consideration in assessing the borrowers' creditworthiness. ESG factors can affect borrowers' cash flow and the likelihood that they will default on their debt obligations. According to Moody's¹, Nordic countries score highest on the overall sovereign ESG score.

Figure 4: Overall Sovereign ESG Score, 2020

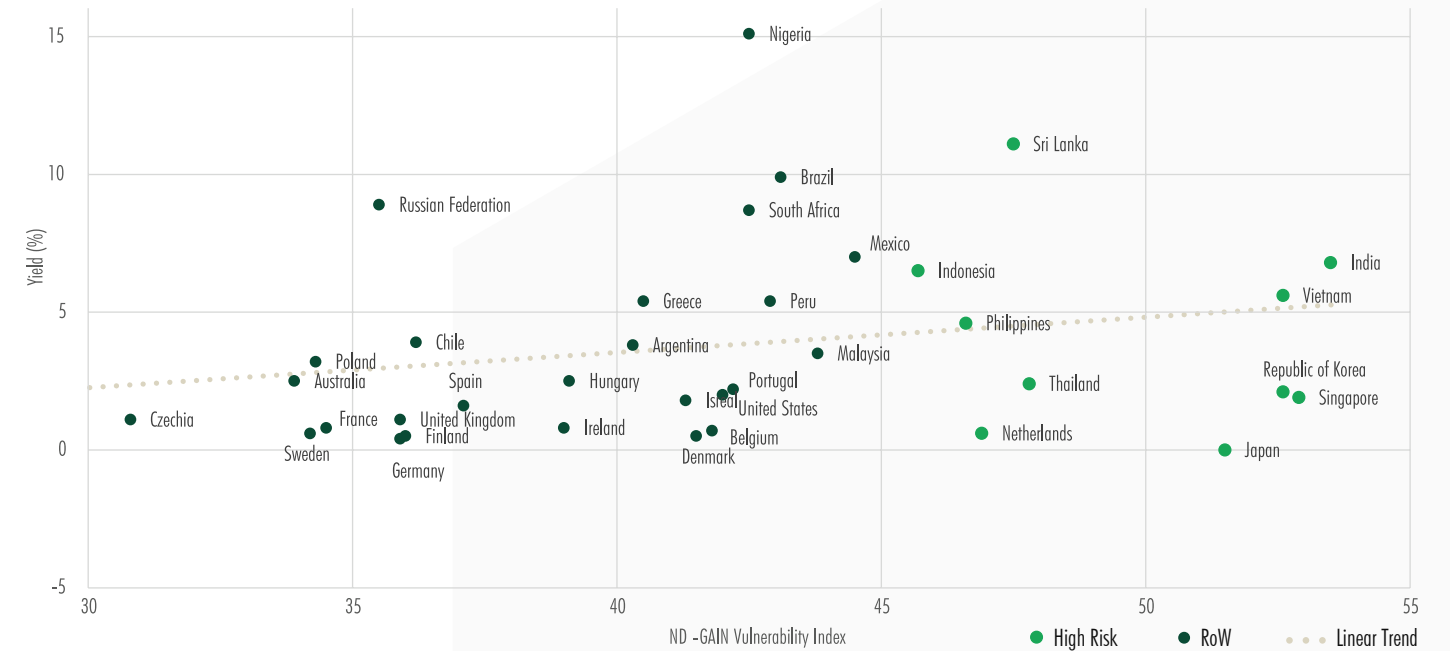


Source: Vigeo Eiris, 427, Moody's Analytics

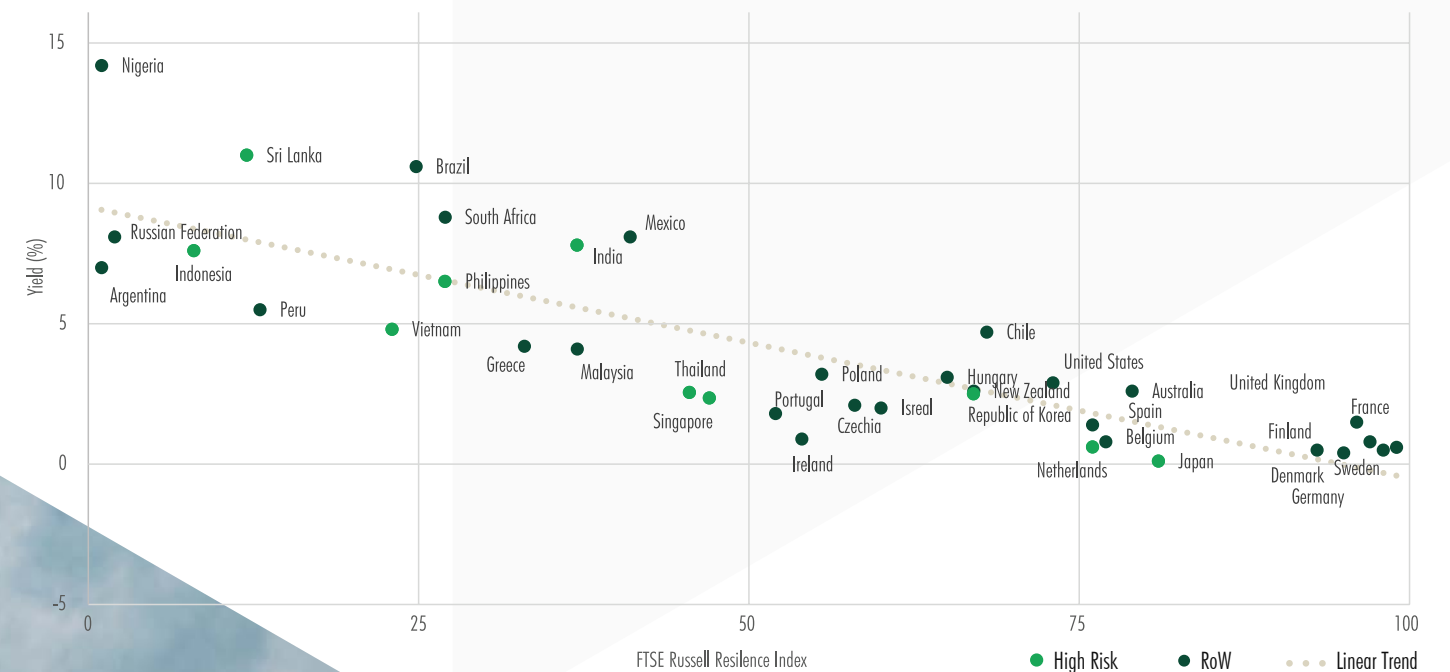
While there is a rich body of literature analysing the drivers of the price of sovereign risk, studies have mainly focused on macroeconomic fundamentals. It is only recently that new literature is trying to assess the link between climate change and the cost of capital. The IMF and the World Bank study ¹⁶ has demonstrated the link between bond yields and two measures of climate risk: climate risk vulnerability and climate risk resilience.

The figures show that vulnerability to climate risks is positively related to sovereign bond yields, while there is a negative correlation between climate risk resilience and yields. Economies that have measures in place that enable them to combat the negative effects of climate change tend to have lower bond yields. The positive relationship between bond yields and climate risk vulnerability and the negative relationship between bond yields and climate resilience also holds for the Nordic countries being part of the sample: Denmark, Finland, and Sweden.

Figure 5:
Cost of sovereign debt and climate risk vulnerability, 2017



Cost of sovereign debt and climate risk resiliency, 2018



RoW= rest of the world
Note: High risk countries denote those countries that are in the highest quartile for exposure to climate risk
Source: Volz et al. (2020), FTSE Russell, ND-GAIN (2020)



2/ Sustainable Urban Development

As carbon emissions emitted by urban areas are one of the root causes of climate change, urban sustainability has become a priority in countries across the globe.

The United Nations Sustainable Development Goals – SDGs, a key component of the new global sustainability 2030 Agenda, comprising 17 overarching goals and 169 targets of sustainable development to be achieved by 2030, guide the world in its ambitions to achieve urban sustainability. The SDGs accentuate the vital role cities have on a global scale. The importance of local governments (and local policies) is emphasized by SDG Nr. 11, ‘Make cities and human settlements inclusive, safe, resilient and sustainable’.

Targets to reach energy and climate standards are set at EU and national level, but cities are on the front line, ensuring that these targets are met. Buildings are responsible for 40% of the energy consumption and 36% of the CO₂ emissions in the EU (Energy Efficiency in Buildings - European Commission). Therefore, addressing complex challenges in urban environments, such as the energy end-use consumption in buildings, is a major factor.

When well-planned and managed, cities create value through the sum of the economic, social, environmental and abstract conditions (governance, political and cultural perception). Thus, having the potential to improve the quality of life of residents in meaningful and tangible ways.

As is increasingly understood by politicians at all levels of government, planned urbanisation leads to positive development outcomes and can be leveraged for improved quality of life. Cities are not simply locations where people gather, but rather the arenas of economic and cultural production as well as environmental and social development.

Urban areas are places of opportunity where goals are realised. This sense of possibility motivates people to migrate from rural areas to urban areas. Consequently, the debate on cities has shifted from the perspective that there are challenges to address the view that they are the keys to improve development. There is an increased understanding that cities create and sustain value.

For example, the report on the implementation of Agenda 2030 in Finland accentuates that the preconditions for making Finnish cities inclusive, safe, resilient and sustainable are excellent (Agenda 2030 in Finland, 2016). While Finland may have excellent preconditions to meet global urban sustainability 2030 targets, there are also goals still to work with – such as reducing the adverse per capita environmental impact of cities and implementing integrated policies and plans towards resource efficiency, mitigation and adaptation to climate change.

The contextual setting for urban sustainability in Finland can, in general, be described as challenging. Implementation of local work for sustainability is only to a limited degree binding for cities in Finland. The state has left the work to cities, at best steering this development with (positive) economic support and non-binding law. Until now, the local work for sustainability in Finland has been reliant on ad-hoc based activity, often driven by a group of proactive cities. Proactive cities engage voluntarily in local sustainability through participation in, e.g. project activity, which provide a just-in-time collaborative platform on which to enable sustainability activities and promote policy development. For example, only about 15% of Finnish cities work with local climate change goals, 12 larger cities within the European policy tool Covenant of Mayors.

When looking at the broader scale, the Nordics are forerunners in relation to sustainability activities and one of the first regions to adopt, on a country base, a National Strategy for Sustainable Development. The Nordics are praised for their broad-based multi-stakeholder participation process that aspires to engage the society in sustainability efforts. This is illustrated by the Nordic countries 2050 Commitment (in some cases 2045), where authorities, individuals, NGOs, associations and businesses are asked to commit to sustainability. Yet, when it comes to urban sustainability, the Nordics rely on only a few cities' voluntary engagement. The work on urban sustainability is not regular, involving the broad field of cities. There is a general scarcity of suitable local indicators in the Nordics and a lack of use of the available indicators. Systematic monitoring of the sustainability progress is a necessity if urban sustainability is to become a reality and not stay as an illusion.

Understanding What Affects the Development and Areas

Society is changing rapidly. When developing property and areas, it is a prerequisite that we better understand which factors influence the development – for the benefit of the developer, society and the individual. An important theme for a developer is sustainability.

Sustainable societal development must meet today's user needs (tenant, home buyer, residents) without impairing future generations' opportunities to get theirs covered and was first introduced as a concept in connection with the Brundtland Commission's final report published in 1987. The concept of sustainability from the 1980s includes social, environmental, and economic development. Equal focus on the three themes creates sustainable development. If the environmental and social dimension is safeguarded responsibly in connection with planning and development, the result will contribute to the economic dimension in sustainability. For the developer, the project will, among other things, be able to provide several competitive advantages. For society, it will be able to provide benefits through, for example, improved public health, new jobs and social inclusiveness.

The road map to sustainable urban development is not linear, but the method and focus must be customised. Sustainable urban site development is based on a width of complex and interdisciplinary themes, extends over a long period and can affect several landowners. Work with urban site development should always be based on the following, as well as a dialogue: 1) Identity, 2) Community, 3) Diversity, 4) Environment and 5) Economy.

There are ten quality principles for work with sustainable urban development:

1. Stimulate to contact, activity and experience

- To make an Identity, feeling of belonging there and pride for developer and users.
- Take care of the value embedded in this place, existing buildings, nature etc.
- Facilitate social interaction and social network in the local society.
- Contribute so that local users feel the community throughout the whole year.
- Contribute to a good mix of functions, landscape, typologies and users.
- Diversity makes attractive, safe and good areas.

2. Good lighting conditions and views

- Take solar studies to ensure good lightening conditions in living areas and secure day lightening and view to surrounding buildings. Access to good daylight promotes good health, learning, well-being and productivity.

3. Good air quality and low noise load

- Sufficient access to clean air and the right temperature.

4. Ensure safety

- Areas that prevent fire, fire spread, theft and damage.
- Safety for walking and cycling.

5. Ensure good access to and from the place

- Good access with environmentally friendly public transport.

6. Have long lifecycles – resilience

- Adapted to big and small needs changes.
- Construction and materials must withstand stress from normal use and expected change in climate without losing their function or aesthetic.

7. Smart exploitation of areas

- Area efficiency and facilitation of joint use.

8. Utilise the energy well

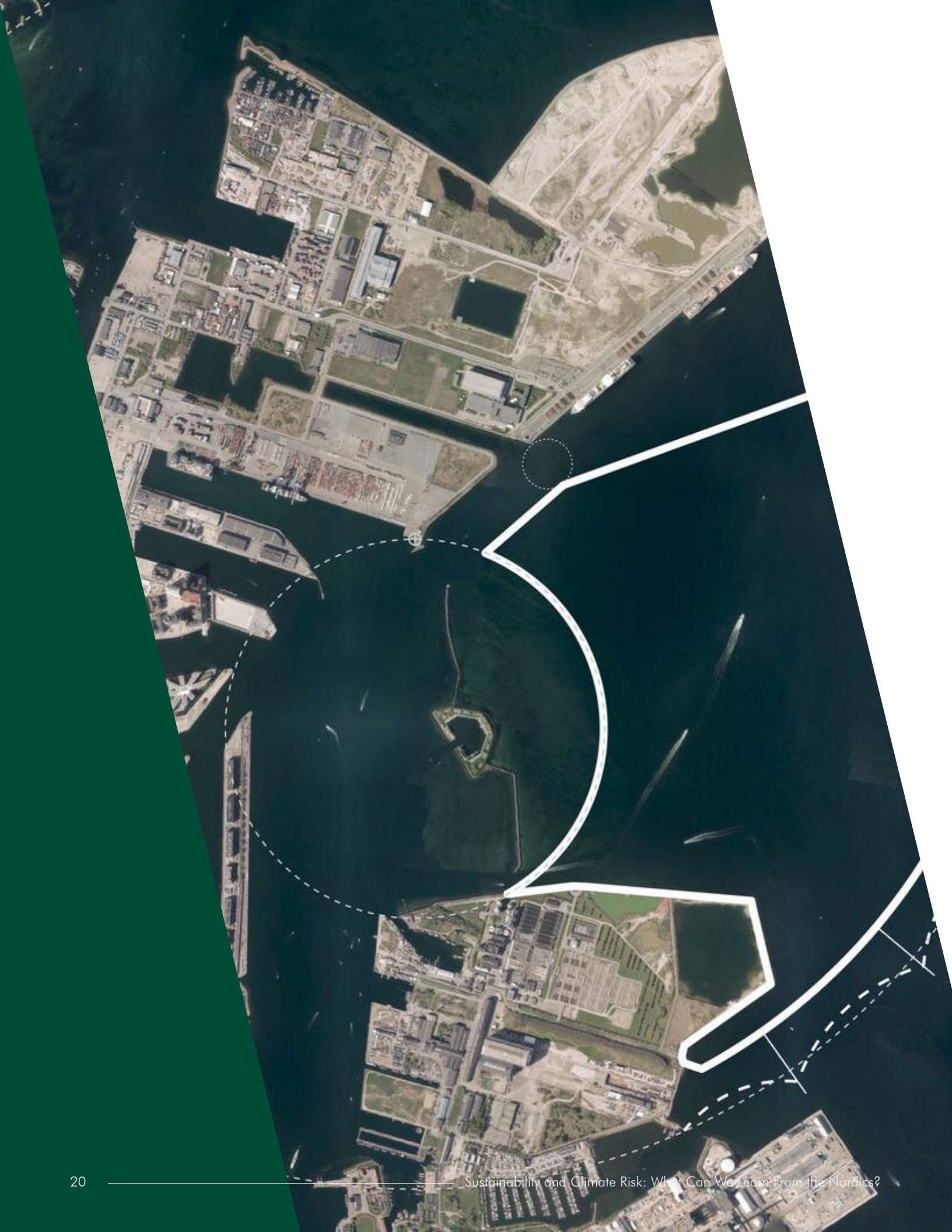
- Optimal local energy system with good interaction with the overall energy system.

9. Low carbon emissions and good resource utilisation

- We have only one earth and increasingly more people who must share the water and energy resources. We must use it wisely.
- Use renewable resources and materials.
- Avoid material resources that are in short supply.
- Reuse.
- Choose constructions that fit for the future and reuse.
- No waste of water.

10. Low maintenance costs

- Maintenance secured systems.
- Long lifetime systems.
- Energy efficiency.



EXAMPLES FROM NORDIC CAPITAL CITIES

Copenhagen – Lynetteholmen

Lynetteholm will be a completely new district in the middle of the Port of Copenhagen, which is intended to protect the city from storm surges from the north and create space for approximately 35,000 residents and just as many jobs. This new city district should be fully developed by 2070.

Population growth is putting pressure on Copenhagen with a shortage of housing and increased traffic volumes. At the same time, it is necessary to finish the major project of climate-proofing around the city against rising water levels. Sustainable, with green areas and a new long, green coastline towards Øresund, Lynetteholm should be a long-term contribution to the city's development. The vision for Lynetteholm is to ensure a green, sustainable Copenhagen with space for everyone – and provided with infrastructure that reduces traffic in the rest of the city.

According to official information, Lynetteholmen will contribute to solving four overall challenges for Copenhagen:

1/ Climate protection

Copenhagen's water level is projected to rise by about half a meter before 2100 (GEUS). Combined sea-level rise and stronger storm surges, both due to climate change, are estimated as 1 m higher than existing dykes in the protection system. Lynetteholm will be integrated into the protection system of Copenhagen, according to the revised risk assessment. This would eliminate the need to raise the quayside or build a wall to protect against storm surges along the inner part of the harbour, which will take the view along the inner harbour and impair access to the water.

2/ The city is growing, and housing prices are rising

Lynetteholm will create an opportunity for an urban development project with space for housing for 35,000 Copenhageners and as many jobs. This is believed to act as a cap on housing prices.

3/ Congestion

The congestion problems in Copenhagen are increasing in line with population growth. The sale of land on Lynetteholm will help finance new infrastructure, most importantly Østlig Ringvej (eastern city corridor) – the last missing part of the highway around the city.

4/ Excess soil from the city's construction works

Lynetteholm will primarily be established with surplus excess soil from construction works in the metropole region, including major constructions like the metro and Østlig Ringvej. The land reclamation of Lynetteholm is expected to cover the City of Copenhagen's need to get rid of excess soil for many years to come. The amount of excess soil created in the broader city area has followed the general level of construction activities in the past 20 years, and the same trend is expected for the next decade. Except from the footprint on the seabed, the new city area is not expected to use a substantial amount of raw materials like sea sand for land reclamation (80mn tons of soil and 28mn cubic meters of sand).

EXAMPLES FROM NORDIC CAPITAL CITIES

Oslo – Oslo Airport City

A completely new urban area will be developed from scratch next to Oslo's international airport. The masterplan covers 370 hectares, which is to be completely powered by self-produced energy and served by driverless electric vehicles. The new city district will run only on the renewable energy it produces, selling the excess electricity to nearby cities or using it to de-ice planes. The 4 million square meters city will take 30 years to build. The scheme is being developed by the Norwegian development vehicle Oslo Airport City.

The commercial park will have a dedicated sustainable strategy. It will also generate vast employment opportunities by creating over one million square meters of office spaces, commerce, recreation, hotels and conference halls. In addition to being a hub for technology and innovation, the airport city will cater for the airport's growing workforce in a variety of ways. The public park will be a destination with a range of sports and leisure activities.

According to official information, the following areas were of particular focus when developing the masterplan for the area:

1/ Hub Development

Oslo Airport City's location was chosen to facilitate extensive use of public transport by rail and bus for people living in South-eastern Norway.

2/ Adaptable Buildings and Areas

The buildings and surrounding areas are designed to be adaptable, so remodelling for new needs in the future will require fewer resources. Reuse and flexibility are part of the design, providing economical savings and requiring fewer resources.

3/ Energy

Geothermal heating and solar energy will supply the entire area with heat, cooling and electricity. The goal is to be self-sufficient and acquire all energy from renewable sources and export surplus energy.

4/ Space Efficiency

5/ Circular Economy

The principles of a circular economy will be used to design the buildings, infrastructures and in the development of the surrounding areas. This contributes to reducing the use of resources in the development, in future changes and in a potential dismantling.

6/ Smart Buildings

7/ Smart Mobility

There will be a transport plan specifically developed for the Oslo Airport City area based on emission-free transport, which facilitates the use of autonomous transport solutions. Pedestrian and bicycle access to and from Oslo Airport City will be optimised, alongside public transport solutions.

8/ Emissions Free Area

9/ Green and Attractive Outdoor Spaces





EXAMPLES FROM NORDIC CAPITAL CITIES

Helsinki – Kalasatama

Kalasatama, a former harbour of the Port of Helsinki, is currently under re-development and construction into a new kind of smart city for approximately 20,000 residents and about 10,000 jobs. Kalasatama is a model district for Helsinki's climate goals. Important themes are sustainable development, energy and utilisation of waste. Kalasatama is developed flexibly and with experiments through cooperation by residents, enterprises, the City organisation and other actors. The goal is to create such a resource-efficient city district that saves the residents one hour per day. New urban services, innovations and business are created at the same time, supported by ICT and open data.

The road towards sustainable urban lifestyles is paved with eco-efficient district cooling, a smart remote-controlled transformer station, a fault-tolerant system closed loop, a powerful electricity storage facility and demand response capabilities at properties. The vision for Kalasatama is to ensure a green, sustainable Helsinki with space for everyone – and provided with smart solutions that can reduce energy usage and waste amount in the city.²⁰

Kalasatama is intentionally designed as a pilot project with renewable energy, a smart grid relying on Internet of Things technology, electric cars and tech-driven traffic solutions to smooth the way. It is one of a handful of districts expected to drive more than half of Helsinki's population. Kalasatama will contribute to solving four overall challenges for Helsinki:

1/ Automatic waste collection through pipelines

Waste management is one example of pilot projects in Kalasatama. No one living in Kalasatama is waiting for a trash truck or wheeling out the recycling bin anymore because the entire community is connected to an underground air-tube system. Residents sort their waste into five different streams – food waste, paper and plastic among them – and then take it to the above-ground tube portal located on each block. The system whisks trash away at 70 kilometres per hour, taking it to a central processing facility for recycling or conversion to biogas.

2/ Smart Waste Containers

Sensors placed in waste containers monitor waste levels and send alerts to waste collectors when containers are filling up.

3/ Smart, Agile Piloting Programme

Kalasatama has since 2014 been developed into Helsinki's smartest district, and new methods have been created to implement smart solutions. Forum Virium is the city's development company, and it partners with the City of Helsinki to nurture the possibilities in Kalasatama and the region. That is done through co-creation projects and partners, and it moves beyond the 'smart city' devoted to urban planning and physical spaces that many think of. While the city has plenty of tech, it is focused on the more holistic version.²¹

4/ IoT

Kalasatama area of Helsinki is an experimental innovation platform to co-create smart urban infrastructure and services. As part of the EU-supported bloTope project, Kalasatama is also a place to run various Internet of Things trials and pilots related to smart metering, smart parking and shared electric vehicles, among others.

Stockholm – Hammarby Sjöstad

In the early 1990s, reputation was not Hammarby Sjöstad's forte. The area was used as industrial wasteland and was considered polluted and unsafe. Nowadays, Hammarby Sjöstad is one of the world's most famous eco-friendly neighbourhoods and a Swedish sustainability star.

And indeed, for masterminds behind the design and planning of Hammarby Sjöstad, sustainability was a clear focus area from the very beginning. Ambitions were set up high and integrated into the planning process, starting with the initial phases. Sustainable alternatives for managing water, energy and waste were carefully studied at the architecture and infrastructure level.

The total area under the district is some 200 hectares, but the architectural mix of apartments, shops, offices and small traders gives almost an inner-city atmosphere. According to Smart City Sweden, some of the environmental solutions implemented in the district are:

1/ Electricity

All the electricity used comes from renewable sources.

2/ Testing of new types of fuel cells, solar cells, and solar panels

3/ Energy

Energy from purified wastewater utilised in district heating and cooling.

4/ Biogas

Biogas extracted from sewage sludge and food waste and used as vehicle fuel.

5/ Digested sewage sludge used as fertiliser

6/ Combustable Waste

Combustible waste becomes district heating and electricity.

7/ Purified Rainwater

Rainwater from streets purified locally to avoid strain on the sewage treatment plant.

According to the same source, Hammarby Sjöstad has shown that an urban district can be built with a far lower environmental impact than usual. Specific differences are:

1. The environmental impact is 30–40% lower than for a typical 1990s district.
2. Car use is 14% lower than in comparable districts of Stockholm.
3. Daily water use is 150 l per person, compared with 200 l per person in the rest of Stockholm.
4. When the lakeside town is completed, it will produce half its own energy.



3/ What Is Good Density?

Ecosystems and socio-technical systems merge in cities. A human system of people, movement and activity is being carried out by the physical system with infrastructure and buildings.

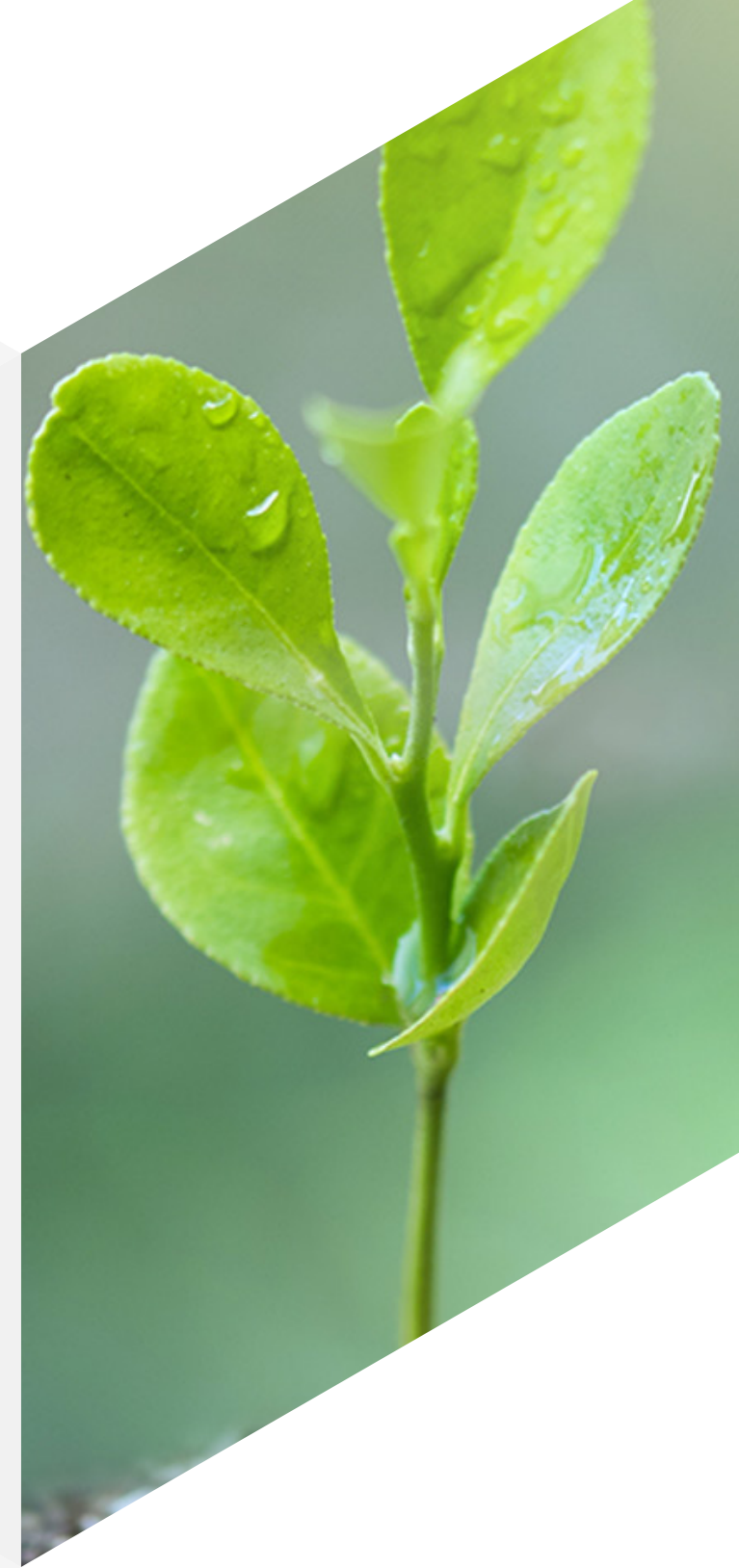
The continued urbanisation is increasing the need for goods and resources as well as infrastructure that can uphold the demand. At the same time, cities need to safeguard their green and blue zones. The challenge is, therefore, to create a dense and green city: the compact green city. And here, the Nordic capital cities are often being used as an example. Nordic cities are also good at doing regeneration within the existing city boundary to prevent urban sprawl ²².

For example, Copenhagen's relatively compact urban form is a result of its 1947 finger plan, which has largely concentrated development along the city's main transportation corridors. Maintaining this form plays an important role in meeting the city's green growth objectives ²³. Policy and investment frameworks are prioritising mixed-use, inner-urban/brownfield development areas. Besides, provisions under the Danish Planning Act also include the 'Station proximity principle', which generally requires new large offices of more than 1,500 sq m to be located within 600m of a rail station. Copenhagen's effective land use and spatial planning strongly influence its environmental performance and support low-carbon urban growth ²³.

The Concept of Sustainable Development

The textbook concept of sustainable development has three overlapping domains: Social, Environmental and Economic (People, Planet and Profit). The concept is process-centered, describing development towards sustainability: the project can only be bearable, equitable or viable if it fulfils the requirements of two domains until becoming sustainable, fulfilling the requirements of all domains. It is like a graph showing the development status.

This traditional concept evolved to different methods for accounting of sustainability, e.g. the CSR or the SDGs for companies. However, for accounting of urban development, many market stakeholders commonly use the Circles of Sustainability. It is a standardised gauging of development projects, now established in green building certificates, for example for buildings or entire neighbourhoods. This accounting method is product-centered, amended with the fourth domain of Culture, where all domains stand centred and weigh equally. Despite measuring project performance more accurately, this new, product-centered approach has lost the original intuitive basis for decision-making in ongoing projects by describing the development status as bearable, equitable or viable until eventually becoming sustainable.



Urban Built Environment

The built environment is a human development that has for purpose to alter the natural environment. Although the effect on nature cannot be reduced to zero, it can be reduced and can even generate environmental value. Sustainable urban development (environmentally sensitive planning) results in compact cities, high diversity, walkable neighbourhoods²⁴ and opportunities for active transportation¹⁰.

As the population grows, built density follows. But the densification must be done sensitively to ensure the existing communities are not left feeling overwhelmed by the scale of new development. Both physical and social connectivity networks need to be improved. The pressure on streets and open spaces will increase, requiring significant planning and development to release the city's full potential. However, urban environmental degradation can have negative implications not only on the quality of life of residents but also on property values and return on investment. Developers and property investors play a key role in this transition. By embracing the principles of good density, the investment community is supporting sustainable urban development, providing the foundation for making this a default future urban model.

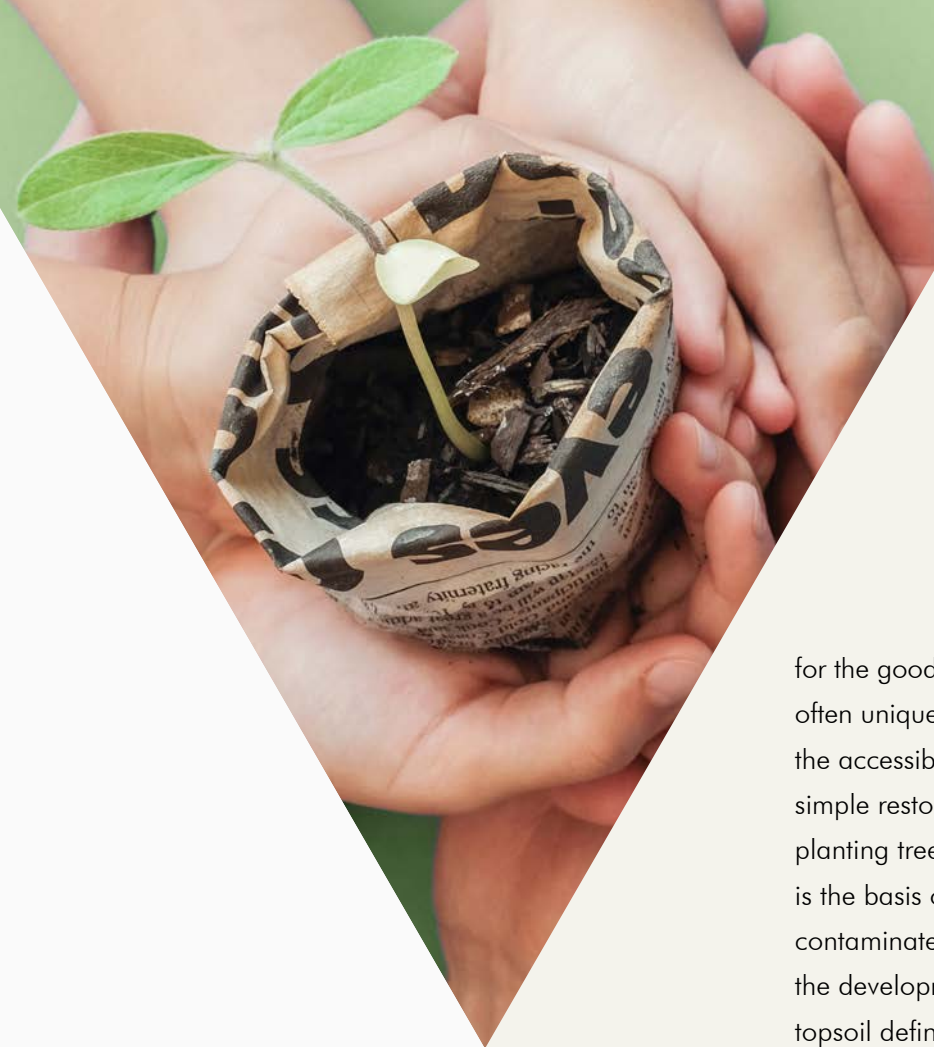
Research from the Urban Land Institute¹⁴ showed that well-designed, compact cities are better for investors as well as citizens and the environment. This was the first-ever study attempting to quantify the impact of the quality of place on real estate investment returns. The report finds that cities with what is defined as 'good density' are more resilient and prosperous in the long term. According to the report, these cities are more likely to provide higher risk-adjusted real estate investment returns than cities without 'good density'. Urban form and density directly influence the extent of energy consumption:

compact cities use less energy, are less dependent on motorised transport and contribute less to greenhouse gas emissions. Compact and well-regulated cities with environmentally friendly public transport systems have a positive environmental impact¹⁰.

Urban planning and design literature suggest that good density is not just a feature of quantity (i.e. higher density), but also the quality of the built form, including the matching urban form with work and lifestyle behaviour of city users and residents¹⁴. However, it is still very difficult to quantify the relationship between good density and urban form. Not only will the concept of city density vary depending on the perception of the city's residents, but it will also depend on the way all changes to the density are being integrated into the existing city fabric.

According to several theories on the influence of urban form on travel²⁵, dense and concentrated urban development is more conducive to sustainable mobility. Relationships between urban structure and mobility are, therefore, an important part of the arguments in favour of the compact city as a sustainable urban form. In measuring the environmental performance of urban development from a perspective of sustainable mobility, traffic growth and growth of urbanised area are among the most used. Both are associated with several negative environmental impacts: traffic growth with air pollution, noise and greenhouse gas emissions; urbanised land with a loss in natural areas and biodiversity. In Copenhagen, urban planners have embraced a widespread bicycle culture and have made cycling infrastructure central to urban planning and design. This has resulted in less car traffic and faster public transport, reduced noise, lower air pollution and greenhouse gas emissions.

Looking ahead, social as well as technological changes are likely to transform urban transport even faster than in



the previous decade²³. The medium to long-term impact of these innovations is difficult to predict, especially as lifestyles and the work nature are changing rapidly. In the future, it will be crucial ensuring cities are built and run in a way that enables accessibility without increasing carbon emissions, pollution and congestion.

Green And Blue Infrastructure

It is unanimously agreed that green and blue infrastructure has many benefits, including climate change mitigation. But here comes the dilemma: while a denser urban environment reduces traffic and building energy use, making climate change mitigation possible, more space for green and blue infrastructure is needed in the process of adapting to climate change.

The green/blue infrastructure is a carbon negative network of seminatural or natural areas (terrestrial, freshwater and coastal) intersecting urban areas. Its accessibility is crucial

for the good density of cities, and its existing features are often unique and of a high ecological value. Enhancing the accessibility of the green/blue infrastructure is a simple restoration process: expansion of green spaces, planting trees and cleaning up waterways. Critically, soil is the basis of urban nature; when sealed, replaced or contaminated in poor urban planning, it is useless for the development of the nature infrastructure above. The topsoil defines the type of nature both on land and in the water, and it is a critical, non-renewable resource. In Denmark, soil quality is often planned in entire new development areas according to the expected nature type, even atop old waste landfills.

There is a great body of literature concerned with the loss of urban green space due to urbanisation²⁸. The European Commission has launched urban green infrastructure as a strategic focus area in Europe, highlighting the importance of green infrastructure planning. Both the EU and the European Commission have identified urban sprawl as a serious planning problem and advocate the development of a more compact city as the only solution. But densification as a means of mitigating climate change is not without problems. Increasing density is an attempt to reduce energy consumption and thus greenhouse gas emissions, but this can lead to the loss of green spaces within the city. Besides being important for the general wellbeing of the city's inhabitants, green areas are vital as means for water infiltration (especially in areas prone to flooding) and the

reduction of the urban heat island effect. The soil in cities like Singapore, with classic grey infrastructure replaced by green/blue infrastructure, infiltrates more than the usual 20-30% of rainwater by freshwater areas, permeable pavements, green facades and roofs. In China, several cities use the so-called eco-friendly terraces, which basically allow land and water to meet. During the dry season, the terrace is a park for residents, but during the rainy season, it can flood, protecting the city without the need for grey infrastructure like floodwalls ²⁷. It is though clear that the need to keep the cities green and reduce greenhouse gas emissions can create tension between measures for adaptation to and the mitigation of climate change ².

The expanding green/blue infrastructure requires a more effective remaining grey infrastructure. Hence, high capacity and high quality of public transportation services should be given in a city with good density. Again, its accessibility is crucial for good density. It is now often achieved by smart bicycle infrastructure, adapted between existing buildings and public transportation stations or merged in open spaces.

There are clear positive aspects of taking the best parts from both the traditional and the new assessment method

for sustainable development – keeping the intuitive understanding of the decision-makers and allowing for standardised gauging of finished projects. The resident should be placed in the centre of such an approach, ‘consuming’ the urban area in the specified domains, thus holding the domains together. Resident’s future needs could be met by specifying risks in resident’s interactions: with state policies, urban nature/environment, other future residents, the local property market and the local culture.

Capitalisation of Urban Green and Blue

As discussed earlier, a positive relationship between sustainable urban development and investment performance is an important consideration for investors and investment managers. Several papers have investigated the capitalisation of urban green in real estate prices, particularly residential units. Green infrastructure has been widely proposed as a key element in sustainable urban planning as well as in resilience to the effects of climate change.

There is a great deal of attention in preserving the urban green in the Nordic capital cities. Stockholm has been selected as the European green capital in 2010, Copenhagen in 2014 and Oslo in 2019. There are though significant differences. According to official figures from 2018, Copenhagen’s green areas represent only about 25-30% of the city’s overall area, which is, despite Copenhagen city area being set 2-3 times smaller than the other city areas, well below the share of green urban areas in other Nordic capitals. In Stockholm, 47% of the total area is non-developed land (e.g green areas) and water. The same pattern can be seen in Helsinki where greenery covers over 40% of the city’s land surface ².

A case study ¹⁷ analysing more than 40,000 apartment transactions in the municipality of Helsinki has shown that three green types (forest, parks and fields) yield different effect on prices. However, the realisation of this potential into benefit also showed dependency on the distance from CBD. According to a report published by the Municipality of Copenhagen ¹⁸, the economic benefits of strategic urban planning in Copenhagen are:

1. Increase in land values.
2. Improvement of the quality of life for the citizens.
3. Reduced greenhouse gas emissions.

According to the Municipality of Copenhagen ¹⁹, urban life and urban quality are keywords in municipal visions for sustainable urban development. But the knowledge of the concrete, economic values that investments in urban life and urban quality create has so far been limited. Therefore, the Danish Ministry of the Environment has initiated several projects whose goal was to help to qualify the decision-making basis in connection with considerations about investments in urban life.

The analysis was based on almost 60,000 sales of apartments and single-family houses in a number of selected housing markets in and around Copenhagen and Aarhus, as well as on large amounts of data that in the form of hundreds of variables describe the urban space around the homes. According to similar principles, analysis has been carried out of approximately 17,000 commercial leases in and around Copenhagen and Aarhus. The analysis has shown that, for example, park and nature areas in the immediate vicinity of the home and in proximity to the coast have a positive effect on residential prices.

According to the Municipality of Copenhagen ¹⁸, cleaning the water in Copenhagen harbour in the 1990s has had a beneficial impact on the marine environment, business, tourism and real estate prices. Only two decades ago, the water in Copenhagen harbour was heavily polluted. The problem was addressed by the modernisation of the sewage system and an extensive attenuation of contaminants in the harbour sediment. The water quality was improved to the level that the City of Copenhagen was able to open the public harbour baths ¹⁸. This has resulted in an increased value of real estate, improved quality of life and tourism and revitalisation of the local business life.

The Value of Placemaking

Placemaking happens when buildings are transformed into vibrant urban spaces that offer wellbeing, pleasure and inspiration. Its success can be measured by improved lives, greater happiness and, when done successfully, an uplift in property values. Placemaking has many aspects, of which changes to the public realm are one of the most fundamental. Most cities devote a considerable amount of valuable land to the public realm, and many of the world's most iconic locations are public spaces ²⁹.

Urban area planners have long recognised the benefits of building and maintaining a good public realm, but this does not mean that the issue has always been given the priority it merits. For instance, during the period when many western cities were in decline, from roughly the late 1960s to the early 1980s, the role of public spaces was often neglected. Any development, however poor, was pursued to generate some economic activity. Perhaps understandably, this approach to urban development is still pursued by many emerging-market cities where the need to relieve poverty means that economic growth is given overwhelming priority.

Since the mid-1990s, though, when western cities began a widespread revival and repopulation process, the quality of public space has once again come into focus. As well as the need to promote social wellbeing in the context of rapid and high-density urbanisation, there are other reasons why placemaking is again an essential concern for those interested in property and planning. In the long period of deleveraging and low interest rates since 2008, property investment yields have fallen to a point where, in some markets, value can no longer be bought but must be created. And rapid technological innovation has produced greater mobility and fluidity in people's choice of workplace and residence than ever

before, creating a greater premium on the quality of places that they choose.

Despite this recent resurgence of interest in placemaking, the relationship between the design of public space and the creation of value in the post-industrial, post-modern urban area is not widely understood. Public space is clearly of value for the overall vitality and 'liveability' of an urban area, but it is also critical to the commercial success of public authorities and private-sector developers and ultimately to the economic success of the urban area itself.

In almost all cases, placemaking creates benefits, either in human terms or real estate values or both. The locations that achieve both tend to share characteristics or outcomes, including a change of image for the area and/or creating a new destination, potentially enhanced by a variety of public events that drive visitors there and encourage them to stay and spend. Engagement of the public in formulating plans for a placemaking project is key, both in terms of contributing to a positive initial reception and the project's long-term success.

Successful placemaking initiatives can revitalise an area and act as a magnet for people wanting to both live and work in a place that offers an attractive environment, with consequent benefits for property values.



4/ Climate Risks

THIS REPORT CONSIDERS CLIMATE RISK IN THE CONTEXT OF THE REAL ESTATE MARKET. TYPES OF CLIMATE RISK ARE:

1) Physical Risks – relate to the physical impact of climate change, such as severe storms, sea-level rise, extreme heat and wildfires.

2) Transitional Risks – are the broader risks associated with climate change and a transition to a low-carbon economy, such as regulatory change, resource availability and reputational and market shifts.

The 2021 edition of the World Economic Forum’s Global Risk Landscape³⁰ identified extreme weather, climate action failure, human environmental damage and biodiversity loss among the top five global risks being most likely to occur.

Additionally, climate action failure, biodiversity loss and natural resource crisis are among top five risks to have the greatest impact globally.

A 2020 report by HSBC Global Research³¹ ranks all four Nordic countries among the ten most resilient countries in the face of rising climate risks. In developing the index, HSBC assessed country vulnerability to the physical impacts of climate change, sensitivity to extreme weather and ability to respond to changes. The report suggests that a combination of three factors has done much to enable the relative success of the Nordic countries in this regard: namely, the implementation of strict and ambitious climate policies, supported by proactive governments; an embrace of cutting-edge technology and the development of an environment that rewards innovation; and regional cooperation and collaboration between the various Nordic countries (e.g. through the creation of councils and research institutes) to provide optimal conditions for knowledge-sharing.

Since risks associated with climate change can have substantial financial implications, the number of investors and investment managers that are developing a proactive approach to address climate risks is increasing. Physical risks, such as extreme weather conditions, flooding and storms, can result in upward pressure on insurance premiums, higher CAPEX and OPEX as well as a decrease in the liquidity and value of buildings¹⁴. On the other hand, transitional risks (including economic, political and societal response to climate change) can lead to a decrease in metropolitan areas’ appeal and, in worst cases, individual assets becoming obsolete.

Both the number and intensity of severe weather-related events have increased in the last decade, showing the magnitude of potential risks that climate change presents for real estate. We have seen events happening in places where we are not used to seeing them in the past. This has strong implications for insurance premiums as a means

for asset value protection. It is, therefore, imperative for the industry to be able to measure the value impact of climate risks better so that future decision-making can be based on a quantitative rather than qualitative understanding of the risks and the potential return from investing in mitigation strategies¹⁴. The challenge, though, is that it is very difficult to price something that is not precisely defined. Also, it is very difficult for investors to address some long-term risks, such as projected sea-level increase, as they will not become relevant during their hold cycle.

Impact Projections

A 2018 study by the Urban Climate Change Research Network¹² projected that thirteen cities worldwide could experience temperature increases above 2 degrees Celsius by as early as the next decade, including Trondheim in Norway and Helsinki in Finland. Finnish government estimates indicate that average precipitation will rise by 15-25%, which would increase the threat of floods and extreme weather events in many regions.

The rate of global mean sea-level rise during the 21st century will very likely be higher than during the period 1971-2015. Process-based models considered in the IPCC special report on the ocean and cryosphere in a changing climate project a rise in sea-level over the 21st century in the range of 0.29-0.59 m for a low-emissions scenario and 0.61-1.10 m for a high-emissions scenario. However, substantially higher values cannot be ruled out.

Nordic capital cities will not experience identical sea-level changes. For example, under ‘business as usual’ climate scenario (called RCP 8.5 by the UN IPCC), there is a 50% chance that local sea-level rise will exceed 22cm in Oslo. In Copenhagen, the same 50% chance is associated with more than 68cm by 2100. The reasons why the projected sea-level rise in Copenhagen is more severe than in Oslo are many and very complicated³². Coastal cities are indeed facing amplified challenges of managing risks. Many valuable assets are located along the waterfront, being thus potentially at risk for both short-term flooding and permanent inundation¹².



According to a report published by the Municipality of Copenhagen^{18,33}:

1. Peak summer temperature in Copenhagen is expected to rise by 2-3-degree Celsius by 2050.
2. Precipitation in winter months will increase 30-40% by 2100, while in summer months it will decrease 0-40%.
3. Sea water levels around Copenhagen will rise approximately 0.5 meters within the next 100 years.

Therefore, the adaptation plan rolled out by the municipality should help the city develop smart solutions to mitigate climate risks. The blue and green areas in Copenhagen will, therefore, have several functions:

1. Reduce stormwater flows by absorbing and detaining rainwater.
2. Moderate and balance temperature changes.
3. Reduce the city's energy consumption for cooling buildings by creation of shade and air circulation.
4. Increase biodiversity.
5. Reduce noise and pollution.
6. Create possibilities for recreation.
7. Storm surge protection.

New land reclamation areas in the shallow sea around the city will close the city's coastal protection ring as the major adaptation to the storm floods surges resulting from climate change.

Asset, Portfolio and Market Level Impact

An important consideration here is the ability to distinguish the potential impacts of climate risks on asset, portfolio and market level. While sustainability largely focuses on operations, climate risks can ultimately have a greater effect on property valuations. This implies that, in the future, assets and locations that are considered less affected by

climate change or more resilient to it could well benefit from pricing premium. To differentiate between cities with low and high climate risks, better data and analytic tools are needed. Ultimately, the objective is to understand how climate risks could affect asset liquidity and, as a result, returns in both income and capital growth.

According to ULI³⁴, there is a strong level of understanding of asset-level risk and resilience and an improving understanding of market-level risks. On the other hand, there



is only a limited understanding of market-level resilience. This includes, among others, a city's capacity to finance and implement resilience strategies, as well as how the city's infrastructure resilience can affect property values, taxes and credit rating.

Climate risk mapping tools will increasingly be used to screen current assets, portfolios and potential new acquisitions. These tools will allow investors to gain a better perspective of the risk profile and exposure of each asset and portfolio. Based on the data, vulnerable areas can be selected and, through further due diligence, determine if risk factors have been mitigated at property and municipal level. For assets flagged as high risks, a further due diligence process might assess the need for additional CAPEX, which then will be reflected in property valuation. The issue here is that investors might be inclined to use this only for high-performing assets in competitive locations identified as a long-term hold.

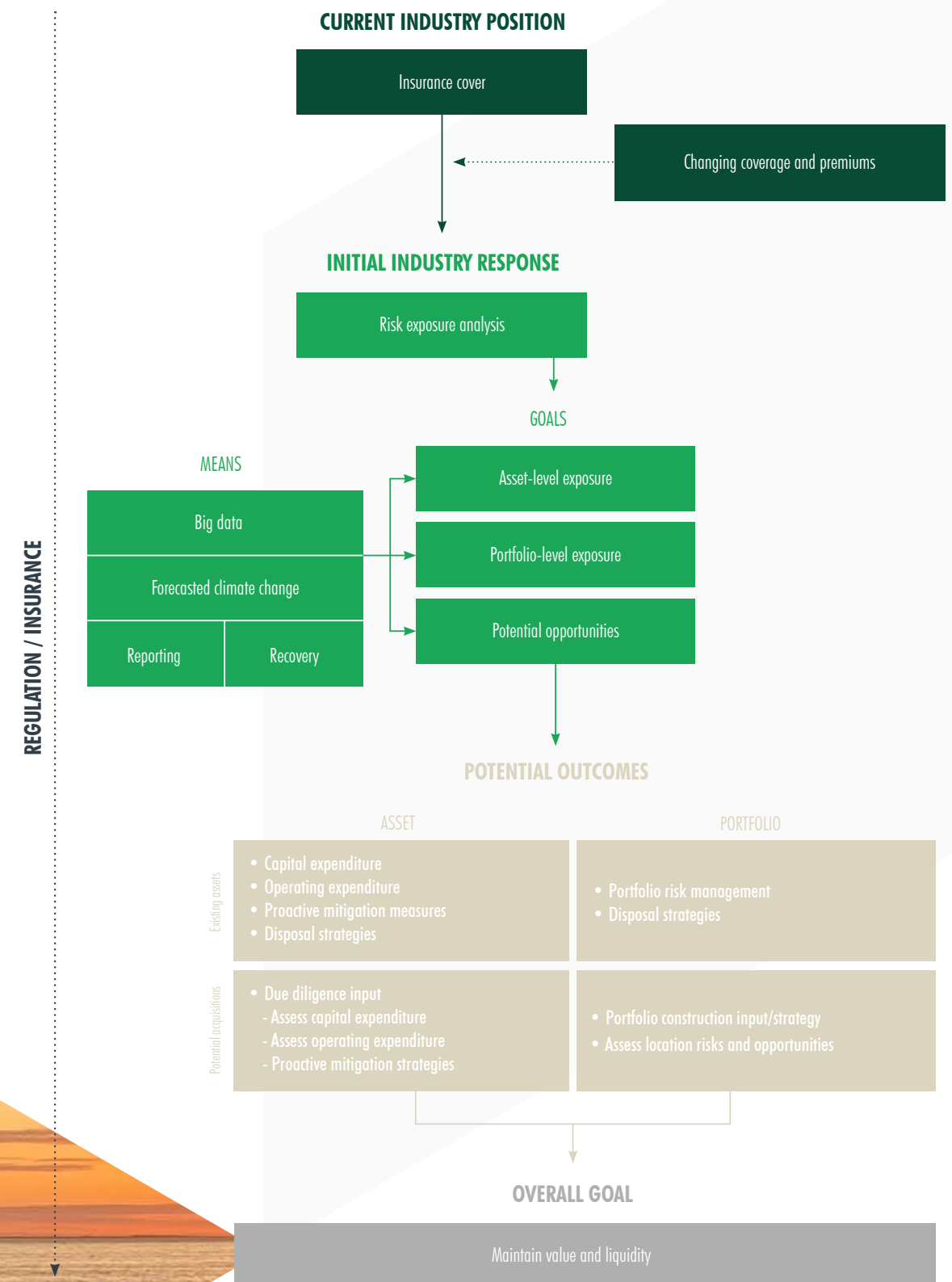
Ultimately, when constructing property portfolios, climate risk assessments will allow for a holistic approach. Not only that assets under management can be screened, but investors will also be able to make better informed decisions. This will lead to developing capabilities of

portfolio rebalancing through limiting new acquisitions and/or disposing of existing assets that are labelled as being exposed to a certain risk. As tools and techniques emerge, investment managers will get the help needed to assess their risks better and navigate the potential impacts of climate change.

According to ULI ³⁵, the possibilities for pricing in climate risk include, among others:

1. Mapping physical risk for current portfolios and potential acquisitions.
2. Incorporating climate risk into due diligence and other investment decision-making processes.
3. Incorporating additional physical adaptation and mitigation measures for assets at risk.
4. Exploring a variety of strategies to mitigate risk, including portfolio diversification, and investing directly in the mitigation measures for specific assets.
5. Engaging with policymakers on city-level resilience strategies and supporting the cities' investment in mitigating the risk of all assets under their jurisdiction.

The real estate industries current thinking on climate change risks ³⁵



Market Standardisation

What the CRE industry needs is a standardisation of the ‘currency of risk’. Because measuring something first requires the variable to be defined. And this is very challenging. There is an impact on property level, an impact on the related infrastructure that the property depends on and a market impact. If a whole neighbourhood is flooded and your property is up on a hill, you might avoid damages, but you are to take a hit in terms of the property’s ability to function, impacting thus its value. Currently, there are advanced practices in assessing the risk on a property level and rather limited ones on a market level. Understanding climate risk at a market level is indeed very complex and, therefore, a great challenge for investors. There are two essential considerations: 1) is the local market/city impacted by climate change; and 2) are the authorities doing enough to develop mitigation strategies?

How cities as such respond to the challenges caused by climate changes can translate into occupancy and rents, property operations and investor sentiment ³⁴. This would then be further reflected in property values and investment performance but rely upon the development of new assessment methodologies.

Currently, many industry stakeholders point out that the risk is either not being priced or not being priced accurately. Either way, this can lead to bad investment decisions. Once the market comes to the point that repricing needs to be done, the process can turn out to be quite painful for some. Therefore, the more gradual the transition could be, the better for all market stakeholders. Data and science will help in the process of gearing up from a brutal repricing, getting both governments, property owners and operators, investors and insurance companies on the same team. The challenge will be to have investors with short-term holding strategies focusing on long-term risks because this is not part of their theses.

On the other hand, if focusing only on risks, the industry may fail in incentivising everything that needs to happen from an adaptation point of view. Once the markets get a better understanding of the costs, it will become much more attractive to invest in adaption and resilience from a financial standpoint. And now, the fact that credit agencies like Moody’s are starting to incorporate physical risk in their ratings and the fact that investors are increasingly incorporating these data in pricing risk for their investment in terms of return expectations will eventually start affecting the market stakeholders that hold the leverage in regards to adaptation investments. Finally, banks have a critical role to play in financial adaptation.

Response from The Financial Institutions

The financial sector is increasingly focusing on climate risks. Banks are struggling to find an answer to what is the right approach and what is the right level of taxonomy that they need to use. Many financial institutions have the challenge of the physical and transitional risks management but are in the journey of adapting to climate risk integration into financial metrics ¹. A key question is related to costs, and this question is believed to be the main impediment for companies to act strategically.

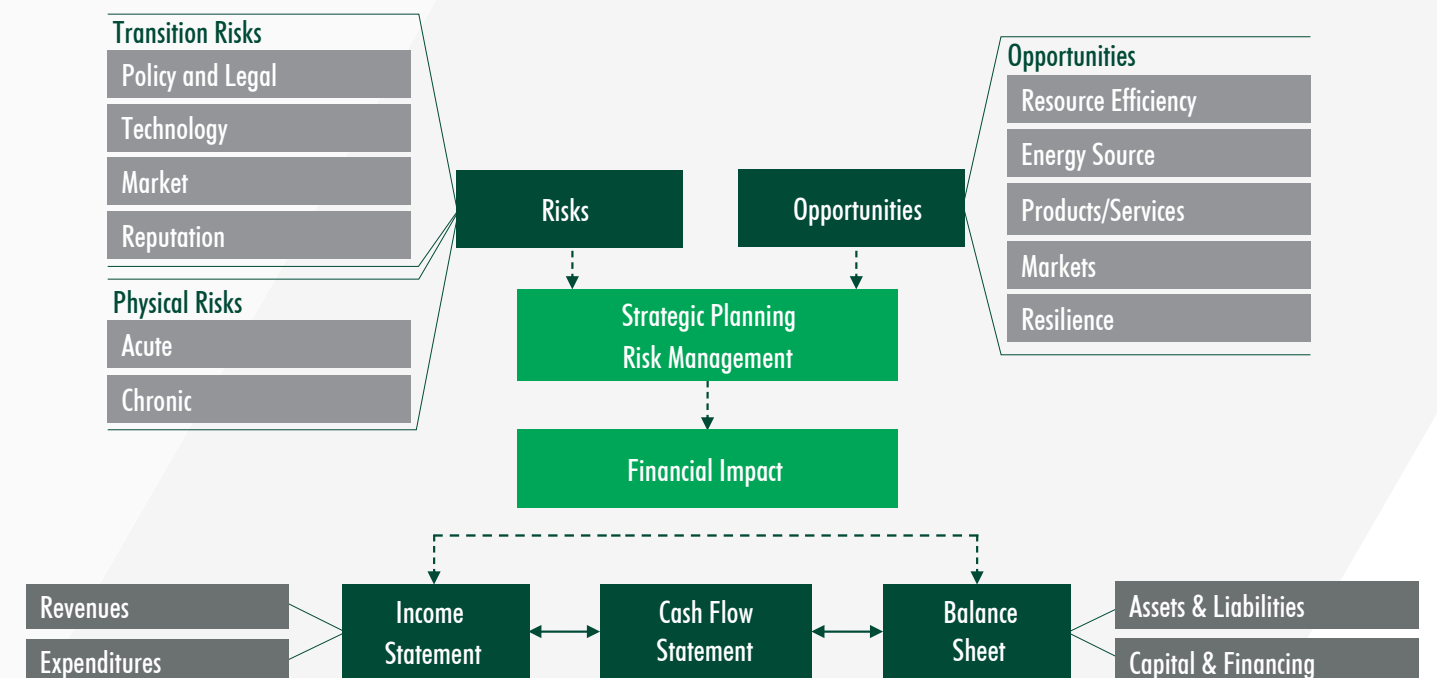
According to Nordic insurance companies ³⁶, one of the main challenges for the insurance companies in the Nordics is urban flood. For countries like Norway and Denmark, coastal flood damages could rise to 5% or more of national GDP by 2100 ³⁷. For example, heavy water damage in Copenhagen in 2010 and 2011 has resulted in insurance claims of over EUR 1bn. One of the core elements of insurance is damage prevention, which is why the industry focuses on the future and wishes to take an active part in the effort against damage caused by climate change. In coastal cities across the globe,

rising sea-levels along with storms and other weather events could force hundreds of millions of people from their homes, with a total cost to coastal urban areas of more than USD 1 trillion each year by 2050 ³⁸.

The TCFD recommendation ³⁹ identify climate-related physical risks as being one of the two main types of risks that financial and non-financial corporations should disclose, including both acute (event-driven) and chronic risks (those due to longer-term shifts in climate patterns).

The impact of climate change will vary depending on the type of operations and potential impacts in relevant locations. For example, as average temperatures rise, properties requiring strongly developed cooling systems (such as data centres) could see a surge in energy consumption. According to TCFD recommendations, a physical climate risk assessment should include projections for a 5 to 20-year timeframe. Beyond a 20-year timeframe, scenario analysis should be applied to account for the uncertainty in the climate policy.

TCFD Final Recommendations (2017)





According to TCFD recommendations ³⁹, the sensitivity to climate impacts of real estate as an industry are the following:

| | Storms and cyclones | Extreme rainfall and flood | Extreme heat | Variability in precipitation | Variability in temperature | Water stress | Sea-level stress | Other climate hazards |
|-------------|---------------------|----------------------------|--------------|------------------------------|----------------------------|--------------|------------------|-----------------------|
| Real Estate | High | High | Low | Low | Low | Low | High | |

There are also opportunities from climate change – for real estate industry listed below.

| | Opportunity to manage existing and emerging physical climate risks | Potential financial impact | Opportunity to respond to market shifts, develop or promote new products or cater for new markets | Potential financial impact |
|-------------|--|---|--|--|
| Real Estate | Consulting services on asset location to assess climate exposure. | Increased market valuation through climate resilience planning. | Investing in buildings that are both energy-efficient and climate-resilient. Commercial and retail property owners investing in technologies to cool buildings and retrofit existing properties. | Adopting a better competitive position that reflects shifting consumer preferences, resulting in increased revenues. |

Source: European Bank

Nature-related financial risks vary in type. Physical risks are related to human dependence on natural capital and refer to the financial impact of any potential change in natural capital. On the other hand, transition risks result from the process of adjustment towards a more sustainable economy. Finally, litigation risks arise from the breaching of legal frameworks and the company’s impact on natural capital. Both physical, transition and litigation risks affect economic activities, which in turn

influences financial institutions. This basically means that financial institutions can face credit risk in case they have clients that can default on their obligations. One of the sectors that are particularly vulnerable to credit risk is the insurance sector.

For financial institutions, the failure to include nature-related risks in their risk assessments can result in over-allocation to higher risk activities. Several tools have been developed to support the financial institutions in nature-related risk assessment, such as ENCORE, IBAT and SCRIPT. But the absence of effective methodologies hinders the financial institutions’ capacity from having a comprehensive view on impacts on nature ⁴⁰.



5/ Biodiversity and Economy

As defined by Dasgupta⁴¹, biodiversity is the diversity of life. In the Dasgupta Review, six sources of biodiversity value can be distinguished:

- 1 Human existence
- 2 Direct contribution to human health
- 3 Source of enjoyment
- 4 The use value of nature
- 5 The existence value
- 6 The intrinsic value

The classical definition says that biodiversity is a richness of indigenous species and richness of entire indigenous ecosystems.

The Global Assessment of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), published in 2019, shows that a large proportion of original biodiversity has been lost in many places worldwide. Biodiversity loss is, therefore, becoming an increasingly prominent issue on national and international policy agendas. The Climate and Nature Sovereign Index (CNSI), developed by WWF and Ninety-one⁴², assesses the countries' exposure to risks related to climate change and biodiversity loss that could impede their macro-economic performance. The framework assigns a single

risk score to each country, on a scale of 0-1, with 0 being the highest and 1 being the lowest risk. Sweden and Finland are ranked as countries with the lowest risk score, while Norway and Denmark are taking place number 16 and 19. The countries with the highest risk score are Cyprus and the Netherlands. The original biodiversity is already lost in core urban areas, and the IPBES report refers mainly to the loss in rural areas and the urban outskirts. Biodiversity is typically high in the transition zones like the outskirts, relevant for both macro-ecology and urban development. The current

trend in the development of outskirts is to massively support urban biodiversity through extensive immersion of new neighbourhoods into existing nature and intensifying favourable conditions for high biodiversity on green roofs and green facades. Grey infrastructure in new neighbourhoods relies increasingly on complex traffic models as the basis for good density. In mitigation of the climate change risk in existing areas, massive and intensive fitting of green infrastructure is becoming a standard by greening of the facades, which further decrease costs of rainwater discharge and potentially get quantified as CO2 quota for individual buildings.

In its European Green Deal, the European Commission presented a transition path leading to a climate-neutral Europe by 2050. A key part of this deal is the new biodiversity strategy⁴³. Considering that the loss of biodiversity can have a potentially major economic effect, it is imperative for financial institutions to build their capacity in time to manage the risks related to biodiversity loss⁴⁴. By financing companies that are dependent on ecosystem services, financial institutions are exposed to physical risk. Besides, financing companies that have a negative impact on biodiversity exposes financial institutions to transition and reputational risk. To prevent physical risks, measures need to be taken to prevent further decline in biodiversity and ecosystems.

A new report published with the UN Environment Programme sets out how banks, investors and insurers can understand their impact and dependency on nature⁴⁵. According to this report, more than half of the world's total GDP (USD 44 trillion) is moderately or highly dependent on ecosystem services. This dependence is maybe more obvious for industries like agriculture and forestry. However, secondary and even tertiary industries (such as tourism and consumer goods), also rely heavily on well-functioning ecosystems through their global supply chains.

Although the financial sector has limited direct dependencies on biodiversity, it is highly exposed to them through loans, investments and underwriting activities⁴⁵. Financial instruments such as green bonds, impact investing and blended finance have the potential to be expanded and scaled up to address biodiversity loss. The UN report⁴⁵ has classified industries as per their potential impact perspective. Here, distribution is, for example, classified as second – because distribution potentially has a very high impact on biodiversity through pollution and noise.

Over the past two decades, and especially since the adoption of the Paris Agreement on Climate Change in 2015, the finance sector has been increasingly focusing on implementing climate change into financial risk assessment, decision-making and disclosure. In 2020, the EU released a new Biodiversity Strategy for 2030, which includes legally binding targets for the restoration of carbon-rich habitats and states this will be among the top five key fiscal recovery policies⁴⁶.

The assessment and mitigation of risks is the foundation for integrating biodiversity considerations into decision-making in the financial sector. The Central Bank of the Netherlands became the first European bank to measure the impact of biodiversity-related financial risks on the Dutch financial sector⁴⁴.

Measuring Urban Biodiversity

If you cannot measure it, you cannot manage it. Past and present ecosystem services, their potential to recover and the potential to further develop should be measured from a perspective towards resilience and sustainability. Urban areas are not places where any global crisis – climate or biodiversity – will be solved. Nevertheless, these crises can be mitigated in cities, especially at crucial locations. Measurement and documentation of biodiversity can

make a statistical basis for biodiversity development. However, the statistics are without individual guarantees on a species level, which is an important constraint in public discussions.

Apart from species, the richness of ecosystems can also be measured. Quality of topsoil is the governing parameter for the development of ecosystem-rich, resilient urban nature, and topsoil management can be effectively applied to entire urban areas. There are different customised approaches to estimating the quality of urban nature. They should include quantification of the continuity of areas, the overall state of nature and, in particular, the state of protected species.

The blue/green infrastructure has documentable ecosystem services and effects on grey infrastructure. Documentation of those effects helps in the process of reaching the desired level of urban resilience.

Measuring The Impact

High urban biodiversity has measurable positive impacts on the economy, e.g. by improving human mental and physical health. Moreover, urban ecosystems and biodiversity have an important and expanding role in helping cities adapt to the changing climate¹². Biodiversity and ecosystems could be used as adaptation and mitigation solutions, enabling cities to achieve more resilient, sustainable and liveable outcomes. It is, therefore, needed to quantify the economic benefits of urban biodiversity and ecosystems so that they can be included in climate-related urban planning. The New Urban agenda³⁸ warns of the unprecedented threats to cities due to loss of biodiversity. The preservation of natural or seminatural ecosystems and the ecosystem services they provide are fundamentally linked to urban sprawl and land area expansion in cities³⁸.

Green and blue infrastructure provide important benefits for cities, including the wellbeing of residents, biodiversity and functioning ecosystem services²³. Urban nature serves a practical purpose in the form of ecosystem services that help cities adapt to future climate changes as well as securing a good micro-climate, preserving biodiversity and helping delay, evaporate and absorb rainwater. Therefore, leveraging urban ecosystems and green/blue infrastructure as adaptation and mitigation solutions will help achieve more resilient and sustainable cities. Changes in species richness have been found to affect the stability of ecosystems and their ability to deliver the needed services for mitigating and adapting to climate change. Biodiversity protection is, therefore, critical to maintaining a resilient supply of climate-relevant urban ecosystems in the face of climate change. Climate hazards and risks, such as elevated temperature, changes in precipitation patterns and sea-level rise, pose risks to urban ecosystems. For example, coastal flooding due to sea-level rise or storms can lead to increased soil salinisation resulting in changed habitats and decreased biodiversity³. Strategies for urban ecosystem adaptation and mitigation need to recognise that climate change may undermine the ability of urban ecosystems to provide critical ecosystem services. A development of a holistic approach, in which a city is understood as a dynamically interacting socio-ecological system, will increase the city's capacity to meet growing challenges.

6/ Conclusion

Climate change is one of the greatest challenges we face. Cities, being at the heart of that challenge, are also powerful agents of change. National governments have a vital role to play in helping cities reach their full potential in the fight against climate change. But in many markets, the link that is still missing is the vertical between national and city policies. As a result, we are not seeing the progress we may ⁶⁶.

Although the Paris agreement is a treaty between national states, it is only through actions on a city level that it can become a reality. Therefore, the action from cities is essential if countries are to meet their net-zero targets and build their resilience against climate change. So far, over 450 cities in the world have joined the net-zero campaign, committing to reach net-zero by 2050 at the latest. Furthermore, almost 100 cities across the globe have joined the C40 network, committing to take bold climate action and lead the way towards a healthier and more sustainable future. Eighteen European cities are part of this network, three of them from the Nordics (Copenhagen, Oslo and Stockholm).

The Nordic Urban Model

The Nordic urban model is highly appreciated internationally and acknowledged in academic, political and mass-media discourses ². The understanding of being a role model is very strong in the Nordics and is empowering Nordic cities

to engage with other European cities and share knowledge and solutions that other cities could implement locally.

The success of the Nordic urban model is often explained by the values embedded in the Nordic culture. An important common denominator for Denmark, Finland, Sweden and Norway is the so-called Nordic welfare model, which strives to secure a good quality of life for all citizens through redistribution of wealth. The welfare system and business models developed in the Nordics have proved so competitive that the Nordics top in many league tables of the world's most competitive nations and represent one of the world's most affluent regions. More importantly, the focus is greatly on developing the ability to innovate and produce value-creating solutions ⁴⁸. The Nordic countries have been working together for several decades to protect nature and the environment ⁵⁸. The cooperation has many layers – from protecting wetlands to business models for circular economy, which can be beneficial to many different sectors. The strong tradition



But probably one of the most important aspects of the Nordic Urban model is the people-centric approach. This builds upon a strong connection between individual behaviour and consciousness about environmental issues in the Nordics, which are then supported by urban policies and initiatives. The focus is not on profit but rather on shared prosperity. Popular movements in the Nordics have strengthened the feeling of collectivism, placing group interests over individuals while creating a shared recognition that all people are vulnerable to risks ². The belief relies upon the fact that joint efforts have a more positive impact on society than individual efforts. Furthermore, the concepts of efficiency and sufficiency are addressed as strategies complementing each other and are being used to reconcile economy and ecology. Efficiency implies doing more with less, leading thus towards lower consumption of resources and energy and, at the end, promotes decoupling. On the other hand, sufficiency means living well with less ⁶¹.

Compact, Connected, Clean And Resilient Cities

The compact green city

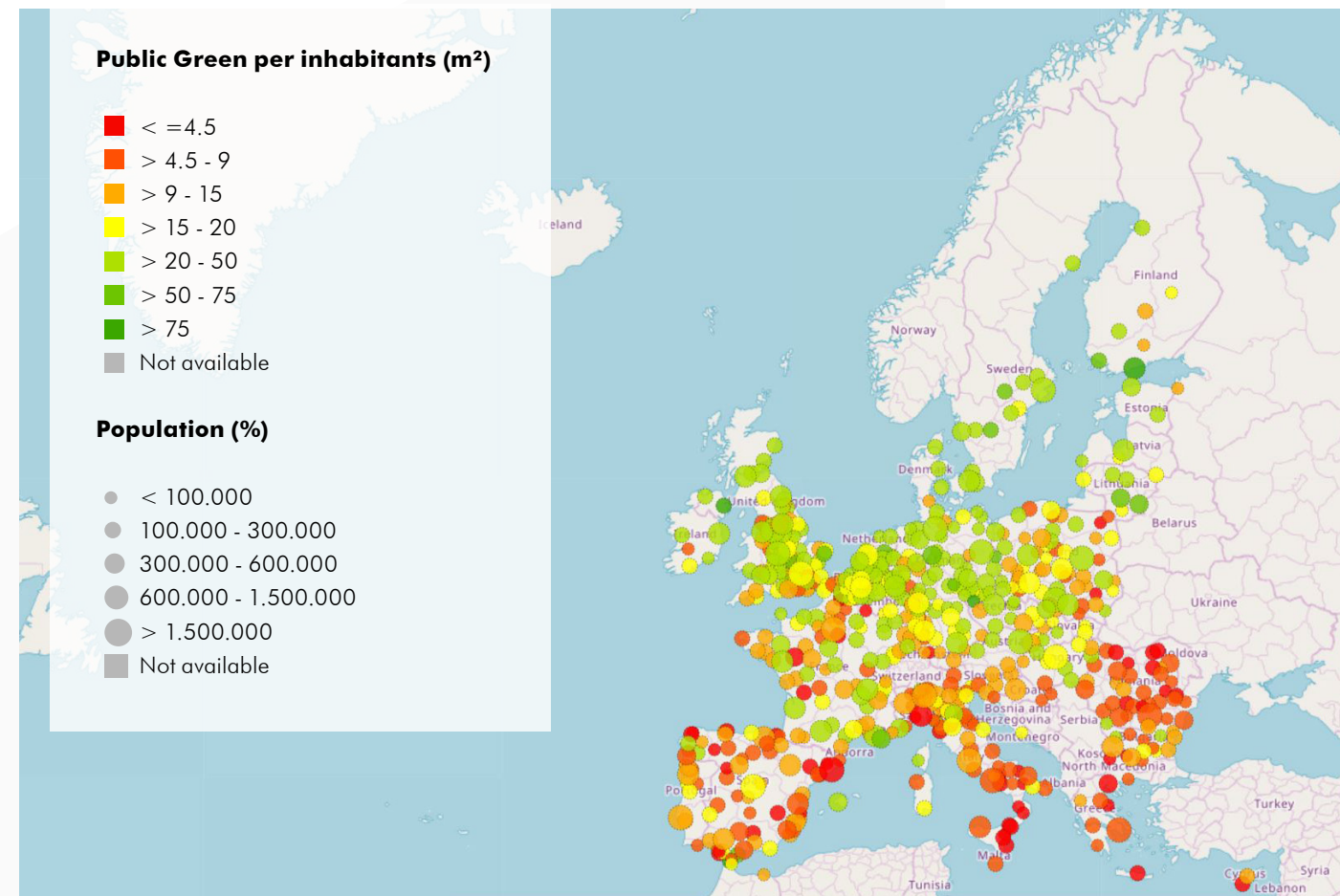
Nordic cities have managed to find a good balance between dense urban development and preservation of green and blue infrastructure. The issue of urban sprawl is being addressed by reconfiguring the existing structures rather than building new ones. This includes the regeneration of brownfield sites, intense transformation of old harbour areas, retrofitting existing housing areas and revitalising

in cooperation in the Nordic Region has resulted in the establishment of The Nordic Council of Ministers. Serving as a platform for bringing the competencies regarding sustainable urban development under one vision, the Council generates synergy between sectors that work on innovative urban sustainability solutions.

Furthermore, the Nordic Eight is the cooperation platform between eight Nordic cities ²², sharing knowledge and collaborating through jointly funded projects. The urban planning challenge is being addressed through several approaches:

- Regeneration within the existing city boundary to prevent urban sprawl.
- Enhanced urban mobility through improved access and transport nodes.
- Protection of resources as a key part of urban planning.

Figure 6: The available public green in European cities per inhabitant



Source: European Commission, 2021

certain sections in the inner city. Finally, urban areas identified as ‘underutilised’ have been developed for high-density housing, increasing the density and promoting the liveability of urban spaces². Attractive new residential areas in city centres, such as Hammarby Sjöstad in Stockholm or Pilestrædet Park in Oslo, are regarded as pioneering examples in this field.

In Europe, good examples of compact green cities are to be found in the Netherlands (The Hague, Amsterdam and Utrecht); Germany – with the transformation of the Ruhr district and urban renewal in Hamburg; France – Montpellier and Lyon; and Spain – Barcelona and Valencia. Urban dwellers in Europe have, on average,

18 sq m publicly accessible urban green space to their availability. This is double the standard recommended by the WHO⁶⁷. However, the presence of green areas (both public and private) in cities varies greatly. The greenness of European cities has increased by 38% over the last 25 years, while it has grown by 12% over the same period globally⁶³.

According to the European Commission⁶⁷, 46% of Europe’s functional urban areas (FUA), on average, have a low capacity to mitigate flood demonstrating that flooding risk is an increasingly important concern of cities. To address this challenge, the strategic implementation of urban green areas will prove to be an important nature-based solution.

The Mobility city

Cities where people can easily connect with one other, as well as with jobs, services and amenities, are essential to economic prosperity. Globally, transport is the single most important factor when it comes to businesses deciding on a suitable location⁶⁴.

There is strong evidence that dense and concentrated urban development is more conducive to sustainable mobility. Relationships between urban structure and mobility are, therefore, an important part of the arguments in favour of the compact city as a sustainable urban form. Land-use policy measures for sustainable urban mobility across the Nordics try to reduce the distance travelled in general, as well as limit the use of cars². These measures focus on mixed-use development and increased density. Besides, Nordic cities are favouring green mobilities – walking, biking and public transport. The use of cars is discouraged by introducing high parking fees, road pricing and congestion taxes. In Copenhagen, urban planners have embraced a widespread bicycle culture and have made cycling infrastructure central to urban planning and design. This has resulted in less car traffic and faster public transport, reduced noise, lower air pollution and greenhouse gas emissions.

An analysis of 44 European cities showed that denser cities have lower greenhouse gas emissions compared to less dense cities⁶⁵. Densification through smart planning is, therefore, believed to be one of the biggest opportunities to reduce transportation emissions, especially in fast-growing cities. Furthermore, the European Commission urges the optimisation of available space, defining public space as one of the key elements in making cities liveable within urban contexts⁶³. Nordic cities are built around a strong focus on placemaking, the creation of inclusive public spaces and the premise that the city belongs to the citizens.

The Resilient City

The resilience of cities is defined as the ability of urban systems to maintain or rapidly return to desired functions if facing a disturbance. The focus is on sustainable infrastructure, water, waste, energy, resource efficiency as well as mobility and transportation. There are mainly three pathways for reducing energy use and emissions: 1) the energy performance of buildings, 2) mobility and transportation and 3) low-carbon energy supply. Besides ensuring new buildings comply with the international green building standards, retrofitting the existing stock is a second line of energy reduction at a building level. The energy supply in the Nordics has a large share of renewables. This is one of the reasons why the associated CO₂ emissions are 50% lower than average in Europe – even though Nordic residents consume more energy per capita than the EU average⁶⁸.

Despite the challenges that Nordic cities have, they have been performing well in many aspects related to urban sustainability². Across the region, there are quite ambitious plans to slash greenhouse gas emissions and become carbon neutral. These efforts are mirrored in innovative technological developments, increased social awareness and many alternative solutions to urban challenges². Adaptation and mitigation actions, in particular those related to issues such as more frequent occurring storms, torrential rains and rising sea levels, are integrated into multifunctional spaces. Furthermore, the Nordic countries apply an integrative approach to climate change, emphasising the interaction between mitigation and adaptation. Indeed, adaptation through planning, construction and land use can help significantly reduce the negative impact of climate change, such as flooding. One of the first climate-change adapted urban spaces in Copenhagen was Tåsinge Plads – a square designed as a multifunctional space that can handle rising volume of rain at a street level. The land-

scape is raised above ground level and serves as a public space while directing and holding back as much rainwater as possible.

Innovation plays a significant role in enabling sustainable transition in the Nordics, channelling cooperation between various actors. Indeed, governing for sustainability implies bringing people with potentially dissimilar interests together. To find a joint solution, cooperation and negotiation are required. Furthermore, reaching the UN Sustainability Development Goals requires financing, which may not always be available. The private-public partnership, which has a long and strong tradition in the Nordics, is seen as means for bridging this gap and attracting new innovative financing, especially for new infrastructure projects. The effort and responsibility are thus shared between government and businesses.

Implications for the CRE Industry

The Paris agreement has opened a new chapter in political efforts to tackle climate change. For many CRE industry stakeholders, climate change action has become a business strategy. Investors and investment managers are increasingly focusing on developing and embracing tools and techniques to better assess risk and resilience at both asset, portfolio and market level. Going forward, markets

that have a proactive approach and are continually focusing on sustainability and climate risk mitigation strategies will be frontrunners in terms of attractiveness as investment destinations. This implies that, in the future, the assets and locations considered less affected by climate change or more resilient to it could well benefit from a pricing premium. In the Nordics, both historical legacies and future strategies are securing a solid foundation for ensuring the robustness of the commercial real estate market.

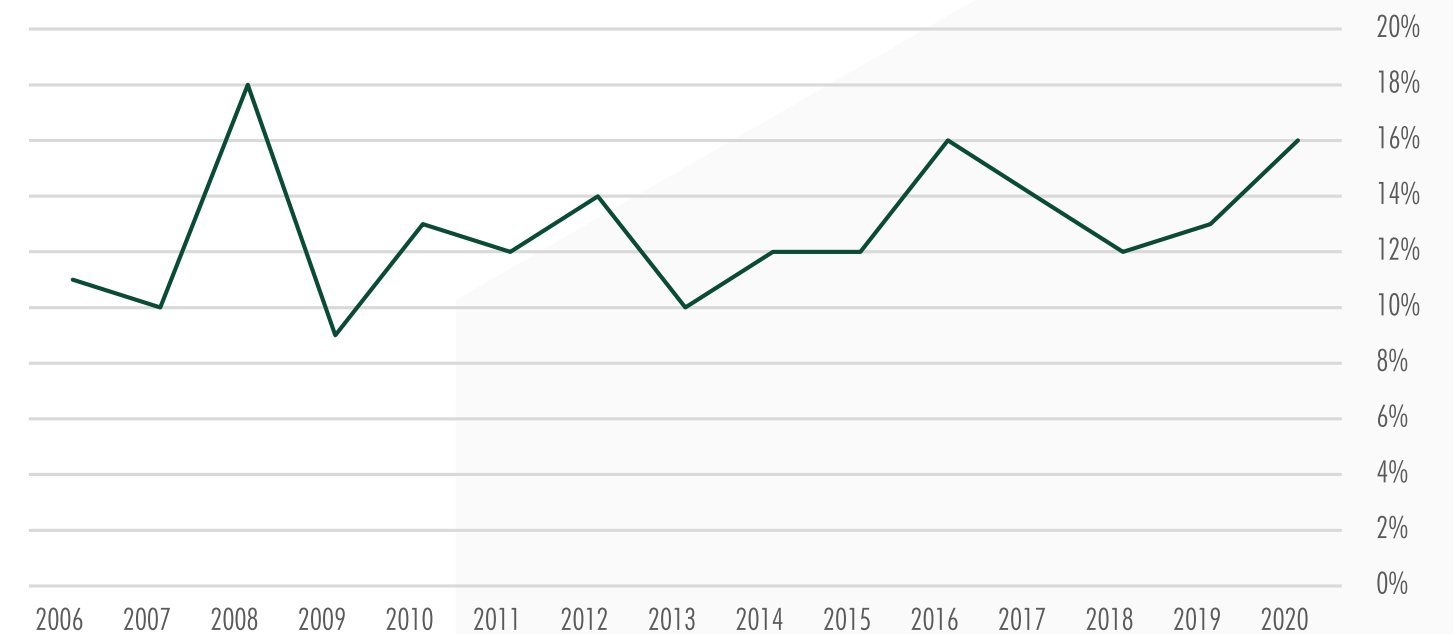
Indeed, the Nordics have established a strong reputation for being an appealing destination for global capital allocations. The Nordics are often perceived as a safe haven, supported by strong economic fundamentals. Only a handful of countries globally can boast of a AAA rating from all three top rating agencies; three of these are countries in the Nordic region.

Current market praxis has not many examples of investors' pulling back from entire markets completely because of climate risks. But following the investors' increased understanding of climate risks, their investment decisions will become more climate conscious. Ultimately, operational risk can result in lower valuations, which is particularly important for investors considering longer time horizons³⁴. While considering climate risks in valuation is still an emerging practice, it will eventually become more

Table 3: Ratings

| | S&P | Moody's | Fitch |
|---------|-----|---------|-------|
| Denmark | AAA | AAA | AAA |
| Finland | AA | AA1 | AA+ |
| Norway | AAA | AAA | AAA |
| Sweden | AAA | AAA | AAA |

Figure 7: Share of the Nordics in the total European CRE investment volume



Source: CBRE Research

granular and sophisticated. The tricky part will be to assess the value of the risk and to reflect it accordingly in valuations. Some investors are also looking at time horizons extending beyond their hold period, looking at the exit point for the new buyer. Regarding this, it will become possible to speak about the 'expiration dates' for some properties. But as shown in this report, pricing climate risk and resilience is far more complex than pricing energy efficiency and carbon reduction. This may constitute the object of future studies as the world evolves.

With the growth of cities, Nordic cities are increasingly recognising their pivotal role in achieving the SDGs⁵, setting their requirements higher than required by the state level. The New Urban Agenda³⁸ calls for building urban resiliency by reducing disaster risk, mitigating climate change and adapting to its impacts. SDG 11 sets a target for cities to adopt integrated mitigation, adaptation and disaster resilience plans.

At CBRE, we believe that citizens are the cities' most important resource and, therefore, support the UN's vision that our cities should not be the best in the world, but the best cities for the world¹⁰. Indeed, we believe that real estate investors, national and local governments and citizens can find a common cause in supporting a sustainable urban development for the benefit of all.

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