

Circular Business Models

Nordic opportunities and
challenges in the new
geopolitical landscape



Nordic Council
of Ministers

This report has been produced by the Haga Initiative within the vision project Climate Neutral Nordics. Climate Neutral Nordics consist of the Haga Initiative (SWE), Skift Business Climate Leaders (NOR), and Climate Leadership Coalition (FIN) and is financed by the Nordic Council of Ministers.

Produced by:



In cooperation with:



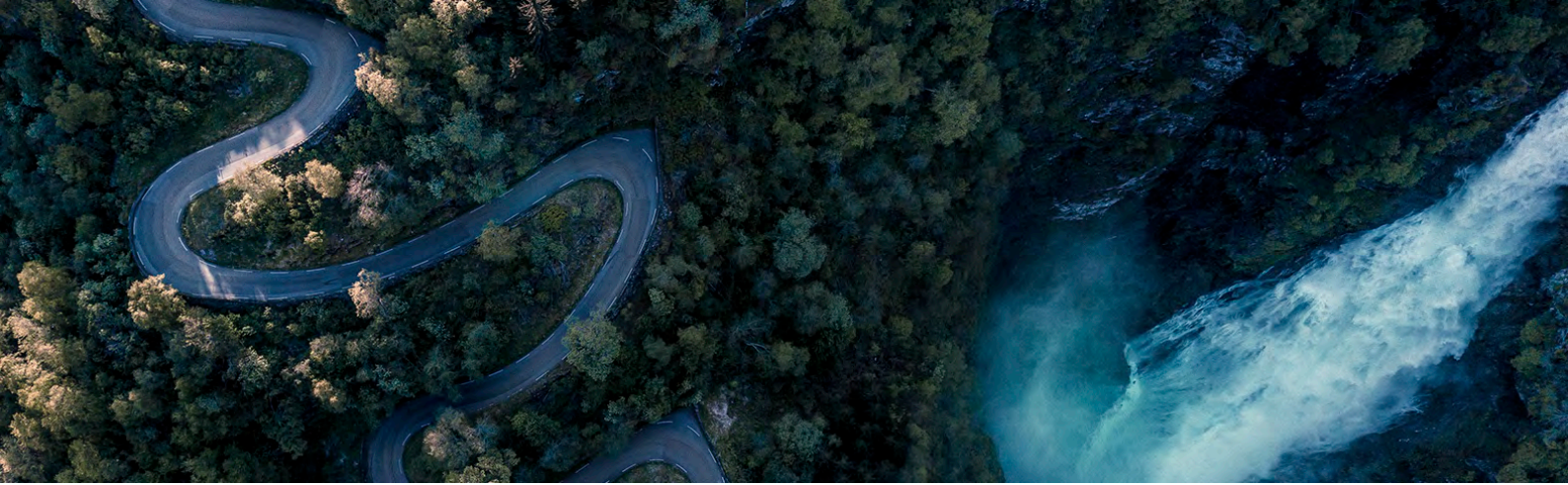
Part of a project funded by:

Nordic Council of Ministers

Contents

Executive Summary	4
Preface	7
1. Introduction: Circular economy explained	9
1.1 From linear to circular	9
1.2 The logic of circular business models	12
1.3 The multiple benefits of circular economy	13
1.4 The geopolitical imperative	14
1.5 Are we going circular – past progress and outlook	15
1.6 Policy interventions are needed to accelerate the circular transition	17
2. Circular economy in the Nordics	20
2.1 Denmark	23
2.2 Finland	24
2.3 Iceland	25
2.4 Norway	26
2.5 Sweden	27
2.6 Summary	28
3. Examples of Nordic circular business models in food, metals and rare earth elements and energy	29
3.1 Food	31
3.2 Minerals	33
3.3 Energy	36
4. An overview of Nordic policies for circularity	39
4.1 Denmark	41
4.2 Finland	44
4.3 Iceland	48
4.4 Norway	52
4.5 Sweden	54
5. Conclusions and the way ahead towards a more integrated, circular Nordics	58
5.1 Nordics opportunities and important barriers to the circular transition	58
5.2 Possible areas for closer Nordic cooperation on circular economy	59
About this publication	61

This publication is also available online in a web-accessible version at <https://pub.norden.org/temanord2023-507>.



Executive Summary

The linear – take, make, waste – approach to production and consumption that characterizes today's economic system is unsustainable. Rising income within this system is strongly correlated with increasing material consumption, waste generation, greenhouse gas emissions, biodiversity loss, water stress impacts and air pollution.

Increased material efficiency and circular economy are vital strategies to deliver economic growth and welfare while at the same time reducing negative environmental outcomes. Circular economy can be a key driver in the climate transition and is an indispensable component of any successful strategy to reach the Paris 1.5-degree target while preserving high standards of living and economic competitiveness.

The circular economy offers opportunities to reinvent the economy and can contribute to several socioeconomic benefits, such as¹:

- more innovative and efficient ways of producing and consuming,
- opportunities for local jobs and social integration, and
- protection for businesses against scarcity of resources and volatile prices.

Additionally, circular economy can be a key enabler of resilience and lower dependency on global supply chains that are easily disrupted during geopolitical crisis. One example is the current energy crisis in Europe, which is largely driven by our dependence on imports of Russian natural gas. It can effectively be, and to some degree already has been, addressed by developing domestic and regional alternatives such as biofuels and renewable electricity in combination with increased energy- and material efficiency as well as other circular economy solutions.

There is a large untapped potential for the Nordic region to take the lead in the global circular transition. There are many positive examples and promising circular business models in the Nordic region. In this report we outline three areas where Nordic business frontrunners have shown that circular business models can work and that they can deliver multiple benefits to all sectors of society: 1) food production, 2) rare earth elements, metals, and raw materials and 3) heat and renewable energy.

These, and other solutions, can offer many of the multiple benefits associated with

1. P. Lacy et al., (2020) The Circular Economy Handbook.

circular economy and thereby making the Nordic region more sustainable and robust: reduced material consumption and waste, reduced carbon emissions, economic growth and job creation and reduced geopolitical risk in critical value chains. However, several significant barriers limit the market share of these business models and national policies to support them are generally lacking or are not fully developed. A broad set of policies will be required to create the incentives and changes in behaviour that are needed to enable the private sector's role as the engine of circular economy.

Also, while circular economy policies in the Nordic countries are developing gradually, they are not coordinated to any significant degree. EU directives are interpreted and implemented in different ways, and national strategies differ in scope and ambition, creating barriers to cross-border value chains. To realize the 2030-vision to "become the most sustainable and integrated region in the world", more Nordic collaboration and harmonization is needed.

Conclusions and the way ahead – opportunities for increased Nordic cooperation

Deepened Nordic cooperation can speed up the circular economy transition and unlock multiple benefits and a sustainable, robust development path for the Nordic countries in coming decades. In this report, we highlight four areas where Nordic cooperation can play an important role:

A common Nordic circular economy strategy focusing on high potential solutions and critical value chains

Circular economy is a key component of the 2030 vision to "become the most sustainable and integrated region in the world". Since many of the circular value chains expand beyond national borders, the circular transition will move faster if the Nordic countries work together towards a joint strategy, that can facilitate policy collaboration and harmonization of regulatory design and implementation of EU directives.

Exchange experiences on circular economy tax reform

The negative externalities of the present linear model are not reflected in the relative prices of goods, which means that unsustainable products can still be price competitive and the demand for circular solutions too low. Getting the price right and levelling the playing field between linear and circular business models will be critical to the circular transition. The Nordic countries can work closer together to share experiences and best practices on circular economy tax reform, thereby creating a larger market for Nordic circular solutions.

Exchange experiences and harmonize standards, definitions and access to data

Regulatory lock-in effects and conflicts also present a major obstacle to circular business models. One example is the construction sector, which today uses almost no secondary materials. One main reason is that materials from demolished buildings are classified as waste because of health and safety regulations. This prevents their use as secondary material in construction of new buildings. Facilitating more circular solutions in the construction sector will therefore require a regulatory reform, where construction and demolition waste (CDW) is not being classified as waste material and instead would be covered by product regulation. Some countries in the EU have developed so called end-of-waste criteria for CDW, showing that it is possible. The Nordic countries could cooperate to make new

circular regulations as harmonized as possible – creating a larger market and greater opportunities for economies of scale.

Knowledge transfer and learning from the frontrunners

The Nordic countries have different strengths and weaknesses in terms of the circular economy, and significant improvements can likely be achieved by learning from best practices as well as a more coherent implementation of EU-regulation. One example is waste management, where Sweden stands out in its interpretation of the EU Waste Framework Directive, assigning ownership of waste only to municipalities². This can impede circular business model innovation such as re-use of waste from restaurants to generate biofuels for transports, and a Swedish government committee has suggested a revision of the interpretation of the EU directive. Here, lessons from the other Nordic countries can be valuable. There are many similar examples where there is a potential for improving the circular economy policies, simply by learning from best practices within the Nordic region.

2. Statens Offentliga Utredningar (2021) Åga avfall – en del av den cirkulära ekonomin. SOU 2021:24.



Preface

The Nordic countries have been leading the way in environmental and climate policies and has shown that environmental protection and climate ambitions can go hand in hand with economic growth, innovation and a competitive business sector. However, many challenges remain where environmental degradation, wasteful use of natural resources and harmful emissions still occur on a massive scale. The main cause is the current linear economic model, largely based on a take-make-use-dispose pattern. The solution is therefore a transition to a circular economy that eliminates waste and makes much more efficient use of our common resources.

The Nordic region aims to be a leader in this transition³, as it has the potential to bring not only environmental benefits such as reductions in greenhouse gas emissions, positive effects on biodiversity and a cleaner air, water, and soil, but could also facilitate business development, innovation and job creation.

This interim report is the first step in the project "Circular Business Models" and builds on a pre-study⁴ conducted within the initiative "Climate Neutral Nordics", where circular economy was highlighted as a key business opportunity for many businesses in the Nordic countries. Almost all responding companies (representing approximately 24 per cent of the GDP of the Nordic region) interviewed in the pre-study are working with circularity.

The interviewed companies also identified several significant barriers that limit the market share of circular economy business models, such as lack of recycled raw materials, hindering legislation, high costs, consumer behaviour and lack of collaboration in the value chains. In some cases, enabling technologies, consumer preferences, or new business risks can generate increased adoption of circular business models, but public policy also has a role to play to overcome these barriers.

The overall purpose of the project is to: a) examine the Nordic countries policies on circular economy to highlight and share best praxis, and b) showcase frontrunners within business, both SMEs and large companies to inspire more companies to become circular.

3. <https://www.norden.org/en/information/nordic-region-will-become-most-sustainable-and-integrated-region-world>

4. The Haga Initiative (2021) Nordic CEOs' view of raised climate ambitions in the Nordic countries.

Scope and methodology

This interim report aims to provide:

1. an overview of the benefits, status and progress so far on circularity in the Nordic countries,
2. an inventory of circular economy policies in the Nordic countries, and
3. a first outline of opportunities for deepened Nordic collaboration and coordination to accelerate the circular transition and building a more resilient, sustainable Nordic region

The report builds on the experiences from the fast growing and evolving literature on circular economy, and references work from research, previous Nordic Council of Ministers commissioned projects as well as from international institutions such as the OECD, Eurostat and the World Bank. In addition, many other reports from leading thinkers on various aspects of the circular economy, such as Ellen MacArthur Foundation and Material Economics, have been highly valuable in providing background and substance to the analysis.

This extensive knowledge base has been deepened through interviews with experts, policy makers and other stakeholder in all the Nordic Countries. At a workshop held in October 2022, key stakeholders and experts were informed about the project and invited to provide their views on main opportunities and barriers to the circular economy in the Nordics, and to discuss areas where deepened Nordic collaboration could accelerate the circular transition. Also, written comments to the country profiles have been gathered from national authorities and from the project's reference group, consisting of representatives from the environmental ministries in the Nordic countries.

In the next phase of the of the project, more in-depth analysis on the future role of circular economy in the Nordics will be conducted, based on the preliminary findings in this report. A key focus area will be the interplay and synergies between circular economy, resilient economic development, and the broader sustainability agenda.



1. Introduction: Circular economy explained

1.1 From linear to circular

Today's economic system is characterised by a linear – take, make, use, waste – approach to production and consumption. The value creation is based on the production and distribution of goods or services downstream in the supply chain and is underpinned by extraction and use of finite resources. At the end of the useful life, products are generally thrown away and regarded as waste with zero (or very small) economic value.



Figure 1. A simple illustration of the linear economic model

This linear model implies a strong correlation between income and material consumption. In a business-as usual scenario, global use of resource has tripled since 1970 and is expected to roughly double between today and 2050, while annual waste generation, according to the World Bank⁵, is predicted to increase by 70 percent during the same period. Almost half of the world's total greenhouse gas emissions are estimated to come from the use of land and the production of materials and products⁶. The use of resources is moreover responsible for more than 90 percent of biodiversity loss and water stress impacts as well as for one third of health impacts due to air pollution globally⁷.

5. The World Bank (2022) Squaring the Circle: Policies from Europe's Circular Economy Transition.
6. Hertwich, E.G. Increased carbon footprint of materials production driven by rise in investments. *Nat. Geosci.* 14, 151–155 (2021). <https://doi.org/10.1038/s41561-021-00690-8>
7. The World Bank (2022) Squaring the Circle: Policies from Europe's Circular Economy Transition.

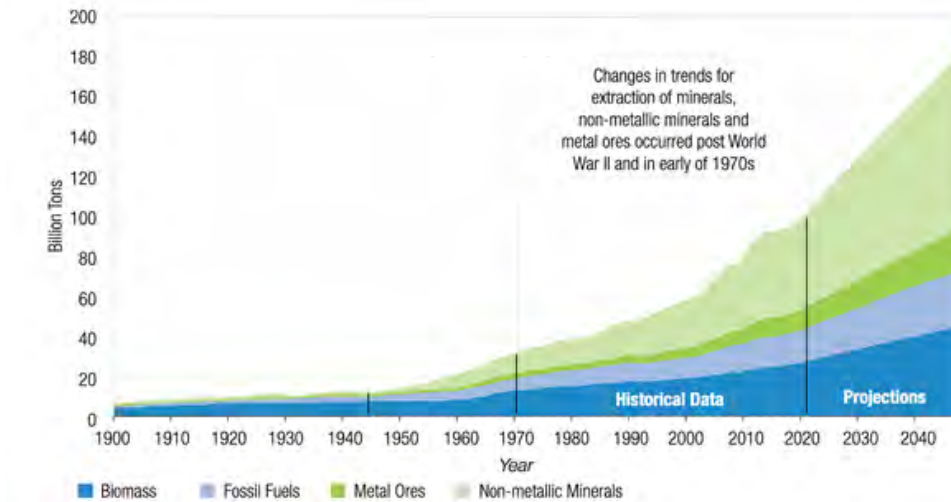


Figure 2. Business as usual will lead to a rapid increase in material extraction

Source: The World Bank (2022)⁸

Against this background, a transition to a more resource-efficient and circular economy has received increased attention from governments and policy makers across the globe in recent years. It offers an attractive response to the challenge of reducing the environmental impacts associated with material use while supporting further improvements in standards of living. On the societal level, circular economy is based on three basic principles⁹:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

8. The World Bank (2022) Squaring the Circle: Policies from Europe's Circular Economy Transition.

9. Ellen MacArthur Foundation: <https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview>

Many definitions of circular economy

European Commission¹⁰

"The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended."

Ellen MacArthur Foundation¹¹

[The circular economy is] "A systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution. It is based on three principles, driven by design: eliminate waste and pollution, circulate products and materials (at their highest value), and regenerate nature."

It is underpinned by a transition to renewable energy and materials. Transitioning to a circular economy entails decoupling economic activity from the consumption of finite resources. This represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits."

Circular Academy¹²

"A circular economy is a transformative economy redefining production and consumption patterns, inspired by ecosystems principles and restorative by design, which increases resilience, eliminates waste and creates shared value through an enhanced circulation of material and immaterial flows"

By applying these principles, the economy can move from the take-make-use-waste logic to a more efficient model where the industrial economy becomes restorative or regenerative by intention and design.

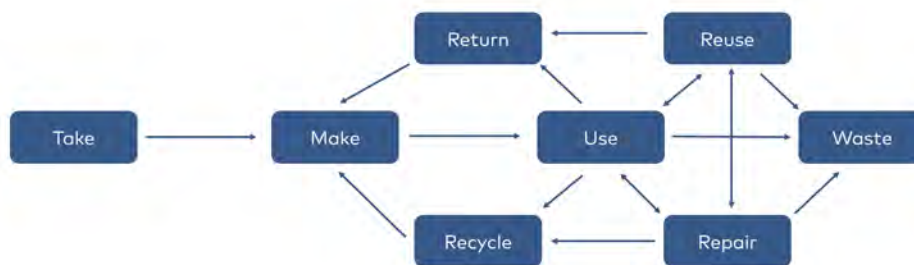


Figure 3. From linear to circular economies

Source: The World Bank (2022)¹³

10. <https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits>
11. <https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/glossary>
12. <https://www.circular.academy/circular-economy-some-definitions/>
13. The World Bank (2022) Squaring the Circle: Policies from Europe's Circular Economy Transition.

1.2 The logic of circular business models

On a firm level, the three principles are translated into an organizational logic of how to create, deliver, and capture value to its broader range of stakeholders. *Linear business models* are based on the following logic: take natural resources and make products for consumers that eventually become waste. *Circular business models* source products and materials from the economy, not from ecological reserves, create value for customers by adding value to existing products and materials and create valuable inputs for businesses beyond your customer.

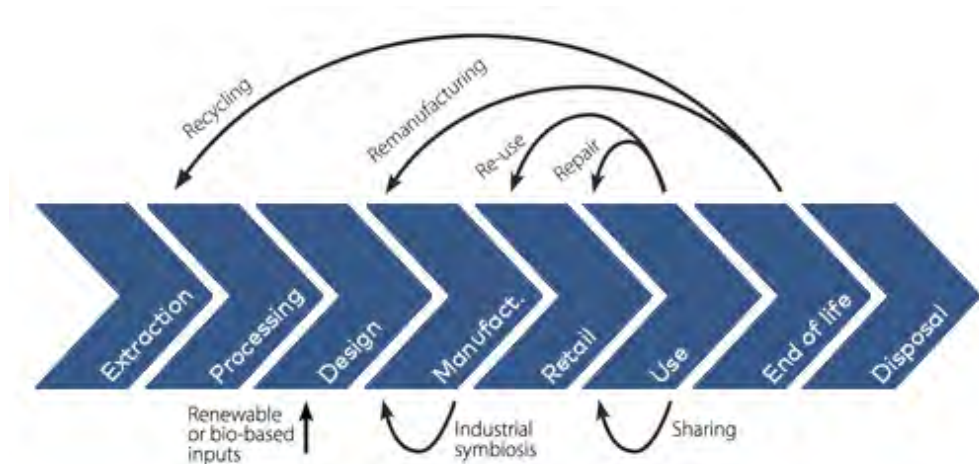


Figure 4. Circular business models operate in different parts of the value chain

Source: OECD (2018)¹⁴

This reduces the negative environmental side-effects resulting from the extraction, use, and eventual disposal of natural resources and materials, enabled by both firm level improvements in material productivity, and from more radical changes in production and consumption patterns. Instead of only using natural resource inputs more efficiently, renewable energy generation and the production of raw materials from scrap, circular business models can provide ways to not use them at all.¹⁵

14. OECD (2018) Business Models for the Circular Economy – Opportunities and Challenges from a Policy Perspective, RE-Circle Policy Highlight, October 2028.

15. OECD (2018) Business Models for the Circular Economy – Opportunities and Challenges from a Policy Perspective, RE-Circle Policy Highlight, October 2028.

Examples of circular business models

- **Sale of refillable parts:** Selling parts of modular products that can be refilled. E.g. [Coca-Cola Sverige](#).
- **Leasing, rental, pay per use:** Providing products through leasing, rental, or pay-per-use models instead of sales. E.g. [Tele2](#), [Beleco](#)
- **Peer-to-peer sharing:** Providing products through sharing between consumers, customers, etc. E.g. [Hygglo](#), [Skipperi](#)
- **Payment per use:** Providing services where customers are charged only when they use it. E.g. [Bilkollektivet](#), [Vakansa](#), [Whim](#)
- **Sale of durable, long-lasting goods:** Selling high-quality, long-lasting products. E.g. [Konecranes](#)
- **Subscription-based services:** Providing services through a subscription plan with regular payment schemes. E.g. [Netflix](#), [Spotify](#), [KINTO](#).

1.3 The multiple benefits of circular economy

Beyond environmental benefits, the circular economy also offers an opportunity to reinvent the economy, making it more sustainable and more competitive. It can open new markets, bring new innovative and efficient ways of producing and consuming and provide more value to consumers. Manufacturing firms in the EU spend approximately 40 percent of their expenses on materials. Circular business models can thus offer protection for businesses against scarcity of resources and volatile world market prices, while creating opportunities for local jobs and social cohesion.¹⁶

The many benefits of circular economy are increasingly being recognized also in the business community. In an interview study with CEOs from 40 large Nordic companies¹⁷, circular economy stands out as an important part of their long-term business strategy. Most companies have already developed circular business models in parts of their operations, both because it reduces their emissions and environmental footprint and because it makes business sense to increase material efficiency and reduce waste.

16. P. Lacy et al., (2020) The Circular Economy Handbook, page 331.

17. The Haga Initiative (2021) Nordic CEOs' view of raised climate ambitions in the Nordic countries.



Figure 5. Creating new jobs: examples of how circular business models can be beneficial in increasing the number of jobs.

Source: Sweco (2022)¹⁸

1.4 The geopolitical imperative

In addition, growing resource use intensifies risks from commodity supply shocks, with global economic security and trade implications. Even though many basic materials such as iron ore as well as non-metal minerals (NMM) generally remain abundant and available, concerns around resource constraints are increasingly becoming a real concern. In a world of ever higher rates of extraction and increased competition over resource access, both advanced and emerging economies face supply risks that may impact many different sectors.

Raw materials and critical minerals crucial to feed the green transition is expected to increase dramatically during the coming decades¹⁹. Supply from virgin resources will not be able to grow as fast, due to both physical and economic constraints. Access to these materials will therefore grow in importance and become a key geopolitical factor. Today, extraction and processing of many critical materials is concentrated to a few countries, such as Brazil, China, Russia and South Africa. This presents a real economic and political risk for the EU, and for the Nordic countries. Securing reliable supply of raw materials, but also of food, energy and other important products, will be critical to growth and sustainable development. Reducing demand for virgin materials by enabling circular solutions can be an important part of the solution.

18. Sweco (2022) Circular city transformation – 5 pathways and 15 actions towards circular urban environments.

19. See for example KU Leuven (2022) Metals for Clean Energy: Pathways to solving Europe's raw materials challenge.

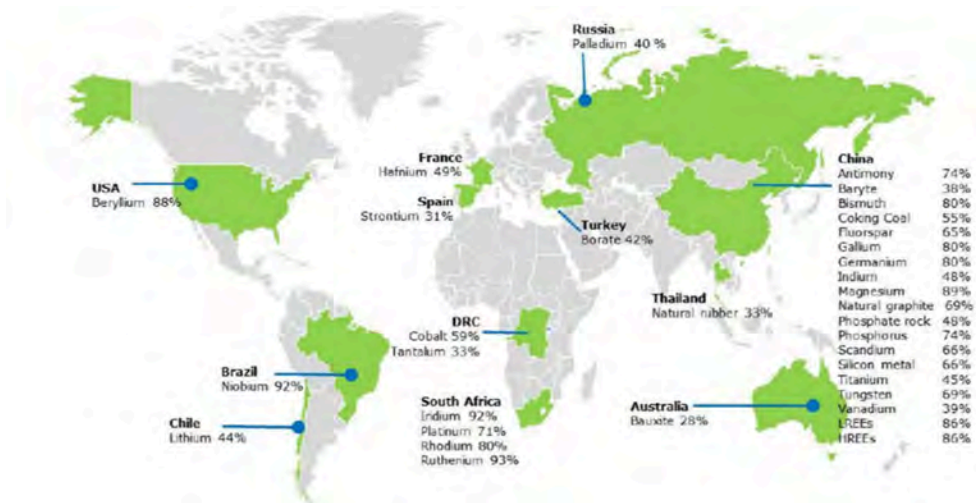


Figure 6. The global share of supply for critical raw materials.

Source: European Commission (2020)²⁰

1.5 Are we going circular – past progress and outlook

Despite the apparent multiple advantages outlined above, the transition towards circular economy is moving slowly. Globally the overall trend is in fact negative. As shown above, global material use has increased fourfold over the past 50 years and in the past two years the global circularity²¹ has in fact decreased from 9.1 percent to 8.6 percent²². The total amount of material consumed globally accounts to over 100 billion tonnes a year and over 90 percent becomes waste.

Looking ahead, the global use of resources is expected to roughly double between today and 2050²³. Demand for four key materials (steel, plastics, aluminium and cement) might increase 2 – 4-fold by 2100 (See figure 7), while annual waste generation, according to the World Bank²⁴, is predicted to increase by 70 percent by 2050.

20. European Commission (2020) Study on the EU's list of Critical Raw Materials – Final Report.

21. A measure of the share of materials used that is cycled back into the economy, see Circle Economy (2022) The Circularity Gap Report 2022 for details on the methodology behind the circularity index.

22. Circle Economy (2022) The Circularity Gap Report.

23. The World Bank. 2022. Squaring the Circle: Policies from Europe's Circular Economy Transition.

24. The World Bank. 2022. Squaring the Circle: Policies from Europe's Circular Economy Transition.

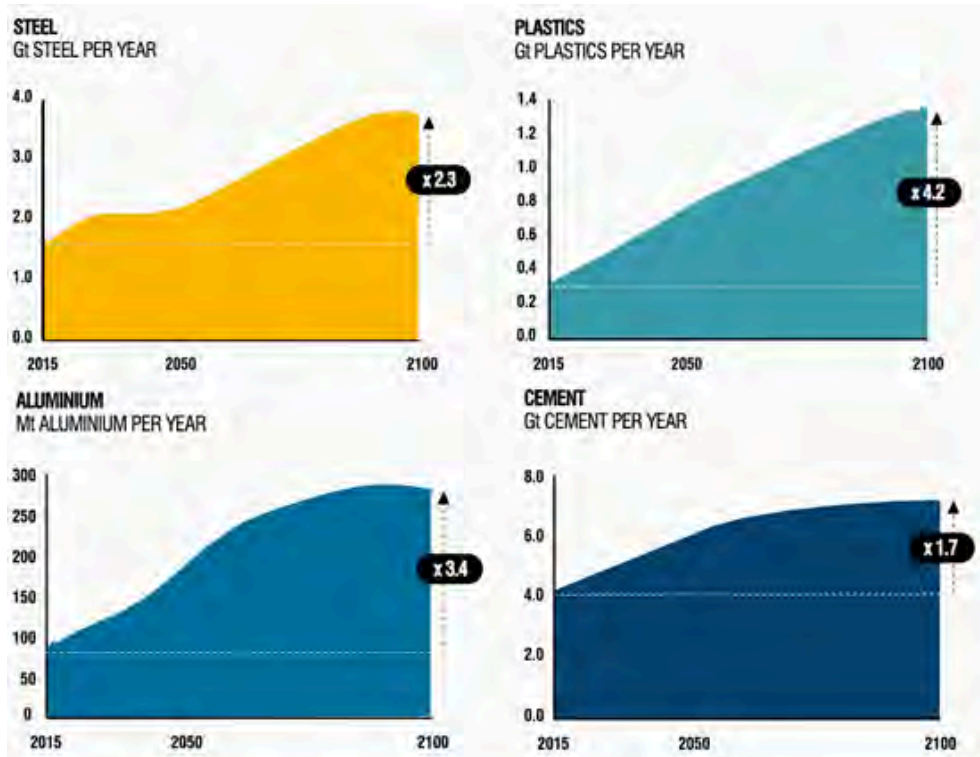


Figure 7. With current patterns of materials use, global demand for key materials will increase 2- to 4-fold

Source: Material Economics (2018)²⁵

In the EU (27) some progress has been made since the adoption of a comprehensive *Circular Economy Action Plan (CEAP)* in 2015. For example, the recycling rate of municipal waste has increased from 46 to almost 49 percent between 2016 and 2020, jobs related to circular economy has increased by 2.5 percent between 2015 and 2019 and the recovery rate of construction and demolition waste has increased from 87 to 89 percent between 2016 and 2020. However, the generation of municipal waste continues to increase, the recycling of overall packaging has fallen from 67 to 64 percent and the EU's self-sufficiency for raw materials has fallen from 17 to 10 percent between 2011 and 2018.²⁶

The market share of circular business models is also, with some exceptions in specific markets, limited. Examples of such niche markets where the market penetration is relatively high are product service systems in automotive coatings (50–80 percent market share) and the use of recycled materials in the steel industry (25 percent market share). In most markets the share of circular business models is below 10 percent (e.g. refurbishment of smart phones and remanufacturing of machinery), and in many cases it is below 1 percent (e.g. recycling of rare earth elements and car sharing services).²⁷

25. Material Economics (2018) *The Circular Economy – a Powerful Force for Climate Mitigation*.

26. <https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework>

27. <https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework>

The slow and partial uptake of circular business models can be largely explained by the fact that benefits of the circular economy are locked in by market failures and other barriers, making circular solutions more expensive and circular business models less attractive²⁸.

These barriers range from *external*, such as lack of circular economy targets, disincentivizing tax regimes, regulatory conflict, ownership norms and fragmented value chains, to *internal*, such as leadership commitment, access to finance, financial risk and lack of in-house expertise and R&D²⁹. These barriers must be addressed by circular economy policies if the circular transition is to pick up pace.

1.6 Policy interventions are needed to accelerate the circular transition

Substantial changes in norms and behaviour will be needed, and a key driver for that change is circular economy policy reform. A mix of policy instruments and other initiatives are needed to address different barriers, to level the playing field and unlock the full potential of the circular economy. Governments play a critical role in encouraging innovation and new initiatives, as well as promoting international cooperation by creating platforms for all stakeholders in the private and public sector for exchange of ideas and cooperation.³⁰

The role of policy in addressing the barriers to circular economy can be divided into 4 areas, illustrated in the figure below.

28. M. Hina et al. (2022) Drivers and barriers of circular economy business models: where are we now and where are we heading.
29. The World Bank (2022) Squaring the Circle: Policies from Europe's Circular Economy Transition.
30. Y. Liu and Y. Bai (2014) An exploration of firms' awareness and behaviour of developing circular economy: An empirical research in China.



Figure 8. Policy interventions for a wider adoption of circular business models and the circular economy

Source: Adapted from Swedish Climate Policy Council (2020)³¹

Circular visions and goals

Governments and other public authorities should deliver a common vision and set goals that are firmly anchored among stakeholders to create awareness and a sense of urgency as well as a positive momentum for a long-term transition towards a more circular economy. In addition, linking the circular economy agenda to other key global goals for welfare and prosperity increases the potential to anchor it with more stakeholders. It is crucial for governments to pursue circular initiatives with sufficient momentum, in its own efforts and in its governance of public agencies. Clear and strong leadership is a must.

Coordination and cooperation

The circular economy is a broad concept that requires coordination and collaboration across all sectors and policy areas as well as broad collaboration between actors in multiple sectors. To successfully do this, policy makers need to address the coordination problem on two levels: the first is horizontal coordination among different policy areas, and the second is vertical coordination among different levels of policymaking. To be as effective as possible, political efforts at home should also relate to both the global and the European circular economy agendas.

This coordination is crucial to enable different policy areas to support each other instead of counteracting each other, and to identify and handle conflicts of interest as well as synergies and multiple benefits of circular economy.

Circular incentives and economic policies

There is a lack of economic incentives for businesses to transition to circular practices and business models because the market pull is not strong enough.

31. 2020 yearly report of the Swedish Climate Policy Council: <https://www.klimatpolitiskaradet.se/en/report-2020/>

Subsidies, financial aid and tax regimes that do not consider the negative externalities of linear production processes directly support linear business models and disincentivize circular business models³². The most important step in designing effective circular economy policies is therefore to introduce or strengthen taxes on virgin materials. A general shift away from taxing labour and services to taxing resources/materials and material intensive products can create circular incentives while at the same time create jobs and stimulate economic growth³³.

General regulatory reform is needed, both to introduce new standards and regulations that enable circular solutions and business models, and to address conflicts with existing regulation and insufficient implementation. Examples of areas where there are significant regulatory gaps are the poor enforcement of recycling targets and landfill bans and the lack of quality standards for repair activities. Directly adversarial regulation, such as environmental legislation preventing the use of recycled material, needs to be examined and changed where possible. Better access to finance for development of circular innovations and targeted public R&D funding are also vital to support the expansion of the circular economy.

All policy instruments above (and others) will be needed, in different combinations across countries and sectors. Addressing regulatory gaps and conflicts before introducing other policy instruments will enhance the impact of the latter. Regulation will also have faster, and deeper impacts once circular products can compete with linear products on a level playing field based on true pricing.

International outreach and learning from best practices Achieving a more circular economy needs to be a global effort, and despite the negative overall trend there are many promising initiatives and examples of successful business practices all around the world. Many circular solutions are also part of global, or regional, value chains. Pushing for international standards and harmonization of regulation on circular economy is an important task for governments and authorities. Countries aspiring to lead the circular transition will benefit from cross-border cooperation and learning from best practice.

32. Statens offentliga utredningar (2021) En tryggad försörjning av metaller och mineral: SOU 2022:56.

33. The World Bank (2022) Squaring the Circle: Policies from Europe's Transition.



2. Circular economy in the Nordics

The Nordic countries share many significant similarities. The economies are open, the level of international trade is high, natural resources play a significant role in industry and export, and the overall social structure of the countries are similar.³⁴ The Nordic countries also all have a long history of ambitious environmental and climate policies. In the early 1990's Denmark, Finland, Norway, and Sweden were the first countries in the world to introduce a carbon tax, followed by Iceland in 2009. According to the OECD Environmental Country Reviews the Nordic region scores high on most environmental quality indicators.³⁵

Looking more closely at how the Nordic countries perform on circularity, the image however becomes bleaker. It is difficult to compare different countries in terms of their circularity performance statistically, due to lack of data and differences in reporting procedures. However, the available data suggests that the Nordic countries generally performs poorly compared to the EU and global average.

According to Eurostat (Circular Economy Indicators³⁶) the overall share of material recycled and fed back into the economy - thus saving extraction of primary raw materials - in overall material use for the Nordics is about 7 percent, compared with 12 percent for the EU. The Circular Gap Report³⁷ estimates that Sweden's circularity is 3.4 percent (2022) and Norway's 2.4 percent (2020), compared with 8.6 percent globally and with the global frontrunner Netherlands at almost 25 percent.

The energy usage for electricity, heating, transportation, and other energy industries accounts for approximately 58 percent of the total GHG emissions in the Nordics. Increasement in renewable energy sources are part of the process for reducing these emissions, which all Nordic countries are progressing in. The remaining 42 percent of the GHG emissions in the Nordics are material-related emissions. Without applying circular economy models to reduce these emissions, the Nordic countries ambitions on reaching net-zero targets would be hard to achieve.

A recent study³⁸ found that improved circularity could reduce CO₂ emissions by

34. P. Louma et al. (2021) Low-Carbon Circular Transition in the Nordics: Part I. Areas with significant circular transition potential. Nordic council of ministers.

35. <https://www.oecd.org/env/country-reviews/>

36. <https://ec.europa.eu/eurostat/web/circular-economy/indicators/monitoring-framework>

37. <https://www.circle-economy.com/circular-economy/resources-and-publications>

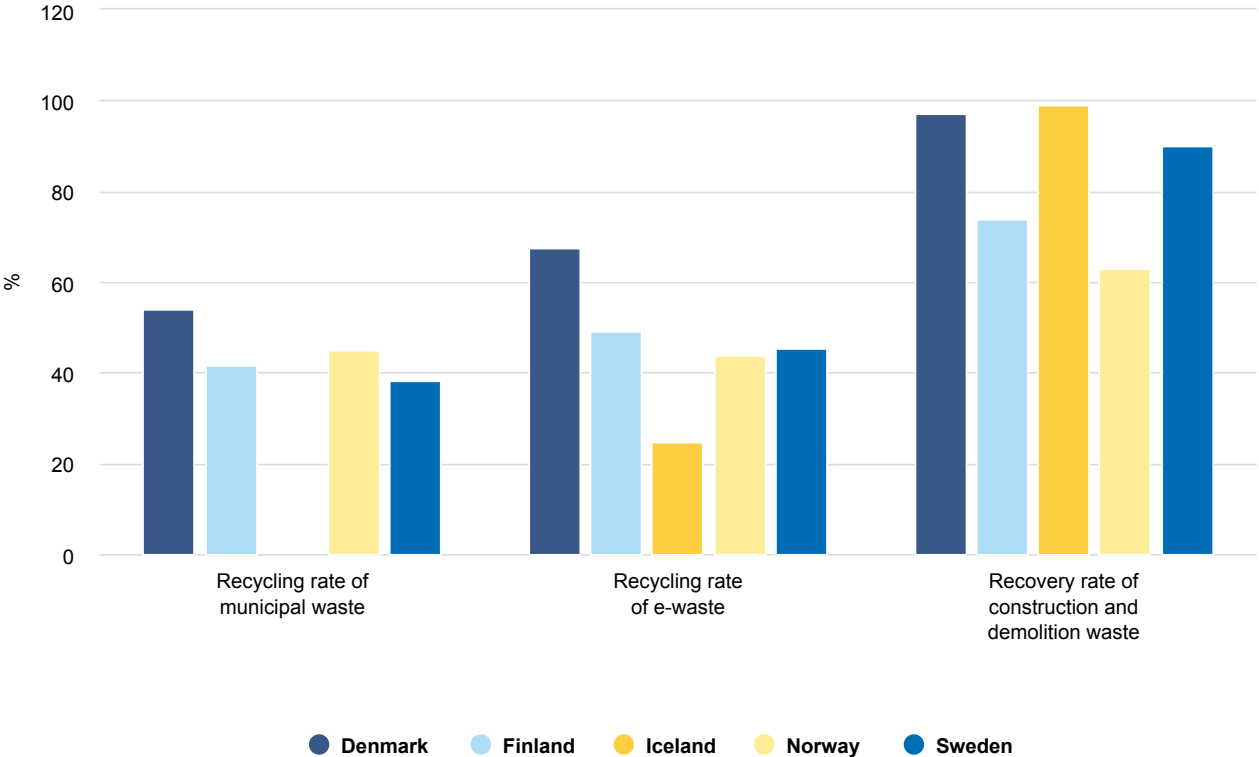
38. Material Economics (2019) Circular Nordics – How the circular economy can reduce greenhouse gas emissions in the Nordic region.

10–20 million tonnes in the Nordics by 2050. In 2017, 42 percent (corresponding to 90 MT CO₂e) of the total emissions in the Nordics came from material production. There is great potential to address material-related emissions in the Nordic region and the interest and willingness among businesses and policymakers regarding circular economy is relatively strong across the Nordic region.

There are also large differences between the Nordic countries on specific indicators of circularity. One example is generation of municipal waste, where Sweden is the leader with 431 kg per capita per year and Denmark is the laggard with 845 kg. The EU average is 505 kg. Looking at the recycling rate of e-waste, Denmark is the leader with 68 percent, and Iceland is the laggard with 24 percent. The EU average is 39 percent. The figure below shows the relative performance of the Nordic countries across several indicators of circularity.

Even though the data should be interpreted with some caution due to differences in scope and methodology between the countries, this indicates that there is a large potential for improvement. If all Nordic countries performed in line with the leader in each category, the material consumption and waste generation would be reduced by millions of tonnes - saving money, the environment and reducing greenhouse gas emissions. The following sections provides a brief overview of each Nordic country in terms of their circular economy performance today.

Waste management



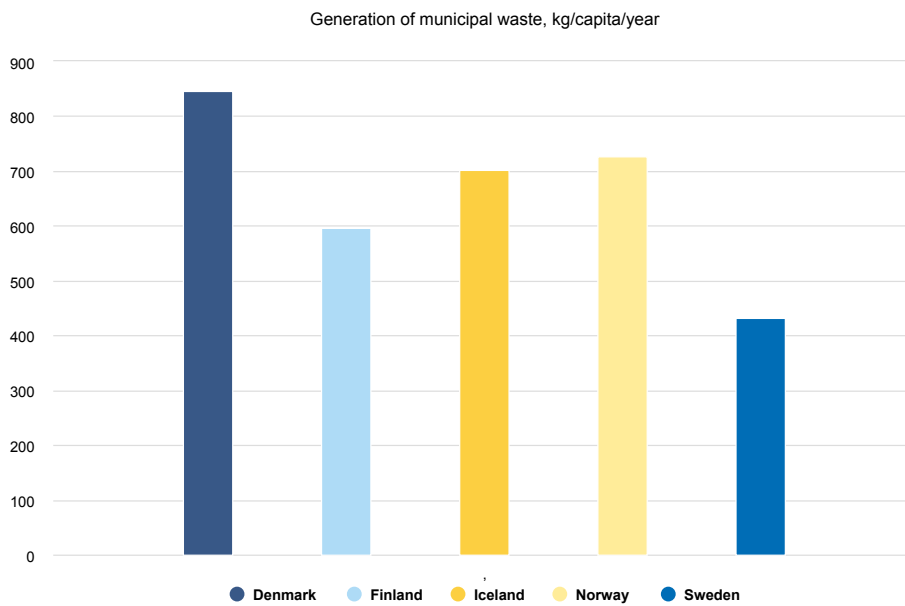
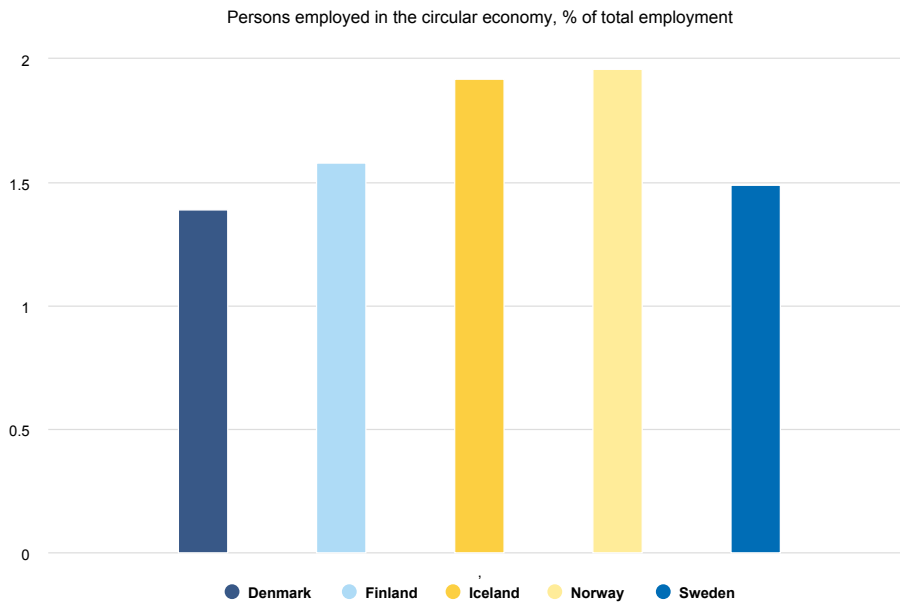


Figure 9. Circular economy performance in the Nordic Countries

Source: Eurostat Circular Economy Indicators Database

2.1 Denmark

Denmark consists of many islands with the densest population in the Nordics of approximately 5.8 million people. 60 percent of the land area is used for farming, and Denmark is thus viewed as one of the most intensively farmed countries in the world³⁹

The most dominating sources of revenue is oil and other forms of energy, medical industry, agricultural produce, shipping, and services in the IT industry.⁴⁰ The resource use in the Danish economy is rather high in relation to the EU average. In 2018, 23 tonnes of material consumption per capita was used when imports and exports were considered, compared with 15 tonnes per capita for the EU. Furthermore, Denmark holds the European record with regards to municipal waste generation per capita: approximately 800 kg per year.⁴¹

According to a study by the Ellen McArthur Foundation, the carbon footprint in Denmark is estimated to have the potential of being reduced by around 3–7 percent by applying more circular economy principles, while at the same time create 7 000 – 13 000 new jobs by 2035.⁴²

There is a willingness amongst the population to impose more circular economy principles. The proportion of the Danish population participating in the sharing economy increased from 14 percent in 2016 to 26 percent in 2018, which is above the EU average of 23 percent. According to a population survey, almost 8 out of 10 Danes have either bought or sold reused products in 2019 – an increase of 10 percentage points compared to 2018.

The amount of waste generated by citizens and companies in Denmark in 2019 amounted to 12.7 million tonnes. 44 percent of the waste was recycled, 29 percent was incinerated, 24 percent was used for other forms of recovery and 3 percent was sent to landfill.

Two-thirds of the electricity in Denmark comes from clean energy sources, and Denmark has the highest share of wind power globally. Denmark has made the decision to end oil and gas exploration in the North Sea by 2050.⁴³

39. M. Hjelt et al. (2022) Nordic working paper: Low-Carbon Circular Transition in the Nordics Part II: Potential impacts of circular economy in selected areas.

40. Nordic co-operation (2022) Facts about Denmark.

41. <https://www.en.mim.dk/media/223010/alle-faktaark-1.pdf>

42. DAKOFA (n.d.) Denmark and the Circular Economy.

43. State of green (2022) Denmark is once again ranked as the world's most sustainable region.

2.2. Finland

Finland's population accounts to approximately 5.5 million people with an economy mainly dominated by the forest industry⁴⁴, technical production, and metal industry. The industries have played an important role in the Finnish economy for a long time, which has been a major driver for the development of efficiency-driven energy systems.

Finland is one of the world leaders in utilization of renewable sources of energy, especially bioenergy. The energy consumption and need per capita in Finland is high, which is mostly due to its energy-intensive industry, cold climate, and high living standard. The domestic energy sources are dominated by wood-based fuels, rich reserves of peat and a living bio economy. There is no domestic production of fossil fuels.⁴⁵

Finland has been a frontrunner for circular economy, both in terms of launching roadmaps for circular economy, but also for incorporating sustainability subjects in the curricula for all levels of education. Circular economy is taught in primary school all the way up to higher educations, and during the professional life.⁴⁶

The domestic material consumption in Finland is more than double, in relation to the EU average of approximately 14 tonnes per person. 35 tonnes per person of materials are being consumed in Finland annually. The high material use in Finland is primarily due to metal ore and other mining operations.⁴⁷

The amount of municipal waste generated in Finland amounted to approximately 3.3 million tonnes in 2021, an increase compared to previous years. This corresponds to over 500 kg of household waste per person. The most common method for treatment of municipal waste is energy recovery.⁴⁸

44. Nordic co-operation (2022) Facts about Finland.

45. International Trade Administration (2022) Finland – country commercial guide.

46. <https://www.weforum.org/agenda/2021/06/transition-to-a-circular-economy-the-right-roadmap-can-help-sitra/>

47. <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220715-2>

48. https://www.stat.fi/til/jate/2020/13/jate_2020_13_2021-12-09_tie_001_en.html

2.3 Iceland

Iceland is the smallest country in the Nordic region with the smallest population of around 370 000 people. The economy is mainly dominated by the fishing industry, but aluminium production and tourism are also big economic industries. Approximately one percent of the land surface is arable land, as most of the country consist of large areas of lava fields and glaciers.⁴⁹

Industries accounts for approximately 77 percent of the electricity usage in Iceland. The electricity grid is dominated by renewable energy from hydro and geothermal energy sources, which attracts metal producers to Iceland to lower their carbon footprint. Aluminium smelters in Iceland, which accounts for a large part of the economy, has a significantly lower carbon footprint than the global average.

The level of renewable energy usage in the country is high, and Iceland can be viewed as one of the greenest economies globally. 70 percent of the electricity production in Iceland comes from hydropower, while the rest of the 30 percent comes from geothermal power.⁵⁰

The amount of waste generated by households in Iceland is considered the fifth largest in Europe. This implies that the country is one of the most wasteful ones in terms of solid waste and GHG emissions per capita. Compared with the other Nordic countries, Iceland is a laggard when it comes to reducing landfilling and municipal solid waste, as well as to increase recycling rates of such waste. The rate of landfill of municipal solid waste is approximately 60 percent, which is significantly above EU's goal of 10 percent.

The domestic material consumption in Iceland was estimated to 16.7 tonnes per capita in 2020. This is a reduction of 16 percent compared to 2019, when the domestic material consumption was estimated to 30.5 tonnes per capita. Non-metallic minerals in housing and road infrastructure construction are some of the main drivers for the high material consumption per capita in Iceland.⁵¹

Iceland is not part of the European Union, but European legislations and policies are adopted by Iceland to a high degree, mainly because of its membership in the European Economic Area (EEA).⁵²

49. Nordic co-operation (2022) Facts about Iceland.

50. Green by Iceland (n.d.) Metal production in Iceland.

51. Statistics Iceland (2021) Material consumption 16% lower in 2020.

52. Guðmundur Steingrímsson (2022) Iceland's Circularity Index.

2.4 Norway

Norway is famous for its oil industry, and the largest source of income is the extraction of oil and natural gas from the seabed. The metal industry, fishing, shipping, and tourism are other important sectors for the economy. The population of Norway is 5.3 million, and approximately 3 percent of the surface is arable land.⁵³

Approximately 235 million tonnes of materials are being consumed annually in Norway, constituting of metals, fossil fuels, biomass, and minerals. About 97 percent of these materials are not cycled back into the economy. The total amount of waste amounted to 11.58 million tonnes in 2021, while waste from households per capita was approximately 430 kg.⁵⁴

The consumption rate per capita is one of the highest ones in the world, where around 44.3 tonnes are consumed per person annually. More people tend to buy new products and only few consumers choose products made from recycled materials or services from sharing platforms. If all countries would consume as much as Norway, three and a half globes would be needed.⁵⁵

According to the Circular Gap Report, Norway is 2.4 percent circular. This is below the global average of 8.6 percent. However, the country has large potential to increase its circularity with up to twenty times by restructuring its businesses and industry.

Like Iceland, Norway is not a member of the European Union but a member of the EEA, meaning that EU policies are adopted nationally in the country.

53. Nordic co-operation (2022) Facts about Norway.

54. Nordic co-operation (2022) Facts about Norway.

55. Nordic co-operation (2022) Facts about Norway.

2.5 Sweden

Sweden is the third largest country in the European Union and the largest country in the Nordic region. The population is around 10 million people. The export industry is large in Sweden, in which electronics, cars, paper, iron and steel are the largest export sectors.⁵⁶ The export revenue from goods and services accounts for 44 percent of Sweden's GDP today, and nearly 50 percent of the export value comes from exports within the EU's internal market.⁵⁷

Since Sweden has a large export industry, a large quantity of raw materials is extracted in the country, putting a high demand on land and sea. The domestic resource extraction is the fourth highest in the world, corresponding to 265 tonnes annually. Sweden has a large quantity of natural resources and a sustainable production of many materials needed to enable a circular and fossil-free economy. Thus, Swedish companies have good possibilities to sustainably continue to develop value chains for Swedish natural resources.⁵⁸

The consumption rate in Sweden is high. More than 266 million tonnes of resources are flowing through the economy every year, corresponding to approximately 25 tonnes per person annually. As the population grows, so is the consumption levels.

Most of the extraction industries, especially mining, are in remote northern parts of the country. The waste compiled by these industries corresponds to a large quantity of the total waste composition in the country (approximately 90 percent). The amount of household waste collected in 2020 amounted to around 4.6 million tonnes, almost 450 kg per person. Around 54 percent of the household waste was energy recovered.⁵⁹

According to the Circular Gap Report from 2022, Sweden is 3.4 percent circular. This is below the global average, but slightly better than the Norwegian circularity index.

56. Nordic co-operation (2022) Facts about Sweden.

57. Svenskt näringsliv (2022) Skapa goda marknadsförutsättningar för den cirkulära ekonomins framväxt

58. Svenskt näringsliv (2022) Skapa goda marknadsförutsättningar för den cirkulära ekonomins framväxt

59. <https://www.naturvardsverket.se/en>

2.6 Summary

The Nordic countries share many attributes regarding, for example, (1) a willingness among businesses to transition into more sustainable and circular systems, (2) the significant role of natural resources in both industry and export, (3) the share of energy comes largely from sustainable energy sources, (4) the overall social structure among the countries and (5) the industry dominating economies. All countries have high consumption levels, well above the EU average. Thus, there is a large potential for behavioural changes in consumer patterns to achieve more circular ways of consuming.

The Nordic countries are exporting countries to a high degree with significant material-related emissions. Many key materials are produced and extracted across the Nordics. For example, aluminium production in Iceland, steel and iron extraction in Sweden, and paper production in Finland. The flow of trade from the Nordic countries and the rest of the world is large, and the potential for making better use of the already produced materials is therefore large. Increased collaboration on a Nordic level for extracted and produced materials would result in a more resilient Nordic market and reduce the need for extracting and producing at today's levels.

There is a significant need for increased collaboration in the Nordic region on many levels concerning material flows. The amount of waste generated in the countries have a large potential to be re-generated into the economy by more collaboration on the waste management level. There is an untapped potential to view waste as a resource in a circular way. However, there are policy barriers for creating a more open Nordic waste management system.

The available circular gap reports from the Nordic countries, studying the level of circular economy in the countries, imply that circularity in the Nordics is well under the global average. The countries are high consuming with industry-dominated economies, which offers potential to implement more circular systems in households, businesses and industry. This would, in turn, reduce emission levels in the countries, as well as have a positive impact by creating more jobs and keeping materials within the region's economy.

Sustainability is high on the agenda in the Nordic countries. Although the countries share many similarities regarding sustainability focus and values, the differences in the countries are complementing each other. The mining and mineral production in Finland, process industry in Norway and advanced industrial base in Sweden together create a system with the potential of building sustainable and circular value chains across the region.⁶⁰ There are already many positive examples and promising circular business models in the Nordic region. The next chapter provides several such examples within three sectors (food, metals and rare earth elements and energy) where circular value chains across the Nordics have the potential to provide benefits discussed in chapter 1.

60. <https://www.theexplorer.no/stories/energy/nordic-cooperation-powers-up-green-battery-ecosystem/>



3. Examples of Nordic circular business models in food, metals and rare earth elements and energy

There are many promising circular technologies and solutions in the Nordics that can bring environmental, economic, and social benefits and improve the region's resilience through reducing its dependence on global supply chains that are easily disrupted during geopolitical crisis. This chapter provides examples of circular business models within food, energy and metals and rare earth elements - three sectors where the frontrunners are in the Nordic countries and where the geopolitical benefits are particularly obvious.

Table 1. Examples of Nordic Circular Business Models within energy, food and minerals

Bioenergy	Orkey	Iceland
Bioenergy	Lantmännen Agroetanol	Sweden
Bioenergy	McDonald's	Sweden
Energy efficiency	Microsoft and Fortum	Finland
Energy efficiency	Löfbergs	Sweden
Energy efficiency	Stockholm Exergi	Sweden
Energy efficiency	EcoDataCenter	Sweden
Food	Matsentralen	Norway
Food	Allwin and Samhall	Sweden
Food	Axfood	Sweden
Metals and rare earth elements	PlusPack	Denmark
Metals and rare earth elements	REETec	Norway
Metals and rare earth elements	Hydrovolt	Norway
Metals and rare earth elements	Ovako	Sweden
Mineral fertilisers	LKAB	Sweden



3.1. Food

The Nordic countries differ in the land area used for farming and food production. Denmark is one of the most intensively farmed countries in the world, while only around 3 percent of the land surface area is used for farming in Norway, and 1 percent in Iceland. However, agriculture is central to Nordic food-supply chain, and a critical industry for food security in the region.⁶¹

Ukraine and western parts of Russia have often been referred to as the global breadbasket due to the global dependence on their grain production.⁶² In total Russia and Ukraine account for 25 percent of wheat produced and when the supply is disrupted, it impacts the international wheat market. However, the geopolitical insecurity due to the war in Ukraine has led to increased food prices due to higher energy prices, fuel shortages, and disrupted supply chains of fertilizers. Sweden, for instance, is heavily dependent on imported fertilizers, and imports approximately 15 percent of their fertilizers from Russia⁶³. These aspects have led to a spike in food prices in and outside the Nordic countries. Meanwhile, the world wastes about 40 percent of the food produce⁶⁴, which highlights the need to improve the circularity of food supply chains.

The increase in food prices during the past year, underlines the volatility and insecurity of our current linear food system. There is a pressing need to rethink our food production to build resilient supply chains and to increase self-sufficiency. One of the best ways to tackle food insecurity, is to ensure that we consume food that is already produced and decrease our food waste. There are many Nordic examples of businesses which successfully have designed business models to reduce food waste and hence lowered their emissions.

61. M. Hjelt et al. (2022) Nordic working paper: Low-Carbon Circular Transition in the Nordics Part II: Potential impacts of circular economy in selected areas.

62. Tan (2022), "How a Russian invasion of Ukraine, the 'breadbasket of Europe,' could hit supply chains"; OECD (2022), "The supply of critical raw materials endangered by Russia's war on Ukraine"

63. WWF (2022), "Varför höjs matpriserna?"

64. WWF (2022), "Varför höjs matpriserna?"

Food waste occurs in all stages of the food chain. One company that tries to combat this problem is Allwin. Allwin, in collaboration with Samhall, transports food that stores would otherwise throw away and delivers it to organizations that help vulnerable people. The company handles 1,000 tonnes of food per year and saves 500 tonnes of CO₂e per year, according to its own calculations. So far, emissions have been reduced by 10,000 tonnes of CO₂e. Through the collaboration with Samhall, the initiative also creates jobs for people who are outside the labour market.⁶⁵

Another example is Matsentralen, a network of food banks that redistributes surplus food from food industry to non-profit organizations that help disadvantaged people in Norway. Through their work, they help both the food industry to reduce food waste and non-profit organizations to help people in need. In 2021, Norwegian food banks saved more than 4,000 tonnes of food from going to waste and redistributed this to more than 480 non-profit organizations that help people in vulnerable life situations.⁶⁶

Another prominent problem is that animals and fishes are being fed food that could be used for human consumption. One project that attempts to tackle this is Axfood and the Swedish University of Agricultural Sciences (SLU)'s *Fem ton grön fisk i disk* (Five tonnes green fish). The project has resulted in Axfood launching the first circular rainbow salmon. Instead of feeding salmon soya and wild-caught fish, the fish are being fed circular feed made of mainly insects. The insects have in turn been fed food waste. By utilizing more waste streams, these types of projects can be scaled up and make seafood production more sustainable. There are multiple positive aspects to this, including avoided greenhouse gas emissions and less overfertilization in sea.⁶⁷

65. Read more about Allwin and Samhall [here](#).

66. Read more about Matsentralen [here](#).

67. Read more about Axfood's circular salmon [here](#).



3.2 Minerals

3.2.1 Metals and rare earth elements

Different metals and rare earth elements (REE) are vital components in many green technologies such as wind turbines and electric vehicles. In the EU alone, the supply of 27 non-energy and non-agricultural critical raw materials critical for the green transition are exposed to risk, due to a dependence from the Asian continent for importation of these materials.⁶⁸ Today, the domestic production of vital metals and REE in Europe and the Nordics is insufficient, and about 98 percent of Europe's supply of REE is imported – majority from China. Meanwhile, the demand for these elements increases due to investment in green technology. In addition, the supply of critical raw materials is put further at risk by Russia's war on Ukraine, which has exposed vulnerabilities of the supply of critical raw materials for the green transition. Once again, the current geopolitical insecurity underlines the importance of self-sufficiency to secure the green transition, independent of external geopolitical shocks disrupting supply chains.

There are examples of circular technologies that have large potential in bridging the gap between supply and demand of Nordic REE. For instance, the Norwegian company REEtec, is now building their first REE separation plant which is planned to be in operation during 2024. A key feature of the process is that virtually all inputs are recovered and recycled. The energy demand is also very low and electricity consumption is a 100 percent based on hydro-electric sources from Norway's green grid. The REEtec process combines high efficiency and competitive cost, with up to 90 percent lower carbon dioxide emissions.⁶⁹

Regarding other vital elements in the green transition, there are other business cases

68. European Parliamentary Research Service (2018), "Circular economy"

69. Read more about REEtec [here](#).

that have vast potential in increasing self-sufficiency and resilience. Hydrovolt, for instance, is the largest battery recycling plant in Europe and has started operations in Fredrikstad, Norway. The plant is a joint venture between two companies – Hydro, one of the world's largest aluminium companies, and Northvolt, a battery producer building battery factories in Sweden and Germany. The new battery recycling facility has the capacity to process 12,000 tons of battery packs per year, or around 25,000 EV batteries. Modules are crushed and shredded. The battery electrolyte is evaporated off and collected, and the remaining solid materials are sorted into fractions of plastics, aluminium, copper, and black mass. Black mass being the most valuable fraction – a powder containing metals of nickel, manganese, cobalt, and lithium. The battery recycling process is clean, efficient, and powered with 100 percent renewable energy. Hydrovolt's plant's capacity is enough for the entire end-of-life battery market in Norway currently, creating a circular flow of important materials and increased self-sufficiency.⁷⁰

The Swedish company Ovako's production is based on using recycled steel as input material instead of iron ore. Steel can be recycled an infinite number of times while maintaining its properties. By basing the production on steel scrap, Ovako can create high-quality steel with a lower climate impact without compromising the quality. By closely matching the quality of the scrap with the steel grade planned to produce, the amount of virgin alloys needed is reduced. That is one reason why Ovako achieve a "cradle-to-gate" carbon footprint of its products that is 80 percent lower than the global average.⁷¹

Moreover, Russia is a vital exporter of aluminium and key player in the mineral's global supply chain underlining the geopolitical risks in cases of sanctions⁷². However, aluminium can be recycled indefinitely without loss of properties. Aluminium is 100 percent recyclable, and 75 percent of all the aluminium ever produced is still in use today. By recycling rather than extracting new aluminium, you save 96 percent CO₂. The Danish Company Plus Pack is a frontrunner in circular aluminium and puts much effort into the development of new and stronger alloys with design optimization, which leads to achieving "more with less". Aluminium is considered a valuable material and should, therefore, ideally be sorted separately and collected for recycling⁷³.

3.2.2 Mineral fertilisers

Fertilisers are vital components of modern agriculture and as mentioned in section 3.1 on food production, the Nordic region depends on Russian supply of minerals used in mineral fertilisers. For instance, Russia accounts for 15 percent of the fertilisers used in Sweden. Due to the Russian invasion of Ukraine, the supply of these vital fertilisers has been halted which has contributed to the increased food prices⁷⁴. However, there is a rapid development in new projects that have large potential in increasing Nordic self-sufficiency in fertilisers.

70. Read more about Hydrovolt [here](#).

71. Read more about Ovako [here](#)

72. Tan, S. (2022), "Sanctions on Russia aluminum could send ripple effects through global supply chains"

73. Read more about PlusPack [here](#).

74. OECD (2022) "The impacts and policy implications of Russia's aggression against Ukraine on agricultural markets"

For instance, LKAB's new Per Geijer deposit contains up to eight times as much phosphorous compared to the orebodies currently mined by LKAB. With circular extraction of phosphorus and rare earth elements as by-products from iron ore mining, LKAB can potentially replace all imports of phosphorus to Europe from Russia. Phosphorus is one of three nutrients in mineral fertiliser and approximately half of today's agriculture is dependent on it. Life cycle analyses of a kilogram of wheat show that as much as a third of the carbon footprint comes from mineral fertilizers, which can be significantly reduced with LKAB fossil free production of phosphorus. Thus, by increasing Nordic circular production of phosphorus, the carbon footprint of agriculture can be reduced, export of minerals increases, and the Nordic region can develop more resilient food systems that is not dependent on Russian minerals.⁷⁵

Another example is Cinis that produces an environmentally friendly mineral fertilizer, a water-soluble potassium sulphate (Sulphate of Potash, SOP). The fertiliser is produced by recycling residual products from the pulp industry and the electric car battery industry in an innovative way. The potassium sulphate is produced using fossil-free electricity and the production also has no dangerous by-products. This results in a potassium sulphate that not only improves the size and flavour of the harvest but also reduces the carbon footprint.

By scaling these solutions to a Nordic market, the Nordic self-sufficiency and resilience to external market shocks can be increased.⁷⁶

75. Read more about LKAB [here](#).

76. Read more about Cinis [here](#).



3.3 Energy

The energy and heating prices have increased significantly since the Russian invasion of Ukraine. Due to disruptions in the EU's supply in Russian natural gas, energy shortages have led to a shock in the energy and heating systems around Europe. Since the Nordic energy grids are interconnected with continental Europe, we have been impacted as well, with energy prices increasing with more than thousands of percent in some energy zones, especially in southern Sweden and Denmark.⁷⁷

3.3.1 Energy efficiency

In 2022 Energiforsk, a Swedish research organisation, released a report stating that if the EU lowered its energy consumption with 5 percent, energy prices would go back to the same level as before the geopolitical situation⁷⁸. This underlines the importance of energy efficiency and its vast potential in tackling the energy crisis. Circular economy is one tool that can improve energy efficiency and there are many examples of businesses transitioning to circular business models with good results in lowering energy use.

For instance, the Swedish coffee company Löfbergs switched to a circular coffee roasting method to increase energy efficiency. By preheating the raw coffee with excess heat from the roasting process, the energy requirement at Löfbergs in Karlstad has been reduced by up to 20 percent since the technology was introduced in the early 2000s.⁷⁹

Moreover, there is large potential in transitioning heating to circular systems to utilise excess heating and improve energy efficiency. For instance, Stockholm residents can heat their homes thanks to the Swedish energy company Stockholm Exergi recovering the heat from the treated wastewater of showers, toilets and

77. Energi Danmark (2022), "New big price jump on the Nordic power market"

78. Energiforsk (2022), "Energieffektivisering bästa sättet att snabbt sänka elpriserna".

79. Read more about Löfbergs [here](#).

drains from across the capital. The heat generated this way is enough to keep about 100,000 apartments warm all through winter and powering quite a few additional hot showers.⁸⁰ Similarly, EcoDataCenter designed and built its facility in Falun according to circular principles. The residual heat generated by the data becomes heat for households and is also used in the production of pellets at Falun Energi och Vatten's plant next door.⁸¹

Moreover, Microsoft has announced plans to 'recycle' excess heat generated by a new data centre hub it is planning in Helsinki, Finland, by using it to serve a major district heating network. The business has partnered with the Finnish energy generation and infrastructure company Fortum to plan and deliver the project, as Fortum already operates a district heating network consisting of 900 km of pipes that serve some 250,000 homes across Espoo, Kauniainen and Kirkkonummi.⁸²

By planning critical infrastructure in this way, GHG emissions are avoided, energy dependence is reduced, leading to lower prices.

3.3.2 Bioenergy

The climate transition pushes a transition from fossil fuels to electricity and bioenergy. Bioenergy has been identified as especially important to reach our targets, especially in hard-to-abate transport such as aviation, heavy transport, and maritime. However, due to the ongoing geopolitical crisis effect on our food supply, it is suggested that agricultural production should prioritize food crops instead of energy crops. However, this suggest that there is a potential for circular biofuel, where bioenergy's raw materials from existing forestry and agricultural waste as well as society's waste and residual products are also taken care of in a circular bioeconomy. It provides employment, new income, and increased security of supply in the local community.

Lantmännen Agroetanol has developed a bio-based circular business, where wheat is processed into ethanol with extremely low climate impact, protein feed and carbon dioxide. The energy in the process is renewable and Lantmännen Agroetanol is working to achieve fossil-free transport until 2030. For a few years now, residual products from the food industry have also been used, such as bread leftovers and other starch-rich materials. Ethanol's low greenhouse gas emissions make biofuels an important product to reduce emissions in the transport sector. Lantmännen Agroetanol's feed raw material is produced from wheat protein and is an important locally produced protein source that replaces imported soy. The carbon dioxide released in the process is captured, converted to carbon dioxide, and replaces fossil-produced carbon dioxide.⁸³

Recycling frying oil has become increasingly common around the Nordics. For instance, the Icelandic company Orkey accepts used frying oil at no cost to recycle it into biodiesel. Their business model saves restaurants and canteens landfill fees and turn waste into a valuable product with a high added value because it also saves on importing fuel.⁸⁴ Similarly, the McDonald's in Sweden use their frying oil to produce the biofuel needed for their trucks. This is a project that has been on-going since

80. Read more about Stockholm Exergi [here](#).

81. Read more about EcoDataCenter [here](#).

82. Read more about Microsoft and Fortum [here](#).

83. Read more about Lantmännen Agroetanol [here](#).

84. Read more about Orkey [here](#).

2008, however, Sweden is the only country in the Nordics that has a municipal monopoly on a company's waste. In the other Nordic countries, it has been liberalized and companies can therefore choose for themselves how waste generated through operations should be handled. A Swedish Government Official Report has proposed a free choice solution but the proposal has not yet been picked up by the government.⁸⁵

85. Read more about McDonald's Sverige and the municipal waste monopoly [here](#) (pp. 35–36).



4. An overview of Nordic policies for circularity

Circular economy is high on the agenda in the European Union, and several important steps have been taken to accelerate the circular transition. In 2015, the European Commission adopted an ambitious 'Circular Economy Package'. An EU Circular Economy Action Plan, CEAP, established a concrete program of actions outlining measures that cover the entire product life cycle, from production and consumption to waste management and the market for secondary raw materials.

In 2020, the European Commission revised CEAP – as one of the main building blocks of the European Green Deal, Europe's new agenda for sustainable growth. The new Action Plan announces initiatives along the entire life cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible. It introduces legislative and non-legislative measures targeting areas where action at the EU level brings added value.

In addition, the circular economy has strong synergies with several other EU objectives and initiatives, for example EU's objectives on climate and energy and the Commission's package on 'Clean Energy for all Europeans'. The circular economy is also instrumental in supporting the EU's general commitments on sustainability, as outlined in the Communication 'Next steps for a sustainable European future'.

Example of EU Policy tools, programs and strategies on circular economy

- Circular economy action plan (2015 & updated in 2020)
- Green public procurement (2016)
- Plastic strategy (2018)
- Chemicals strategy (2020)
- Industrial strategy (2020)
- The European Green deal (2020)
- The European Taxonomy (2020)
- Zero pollution action plan (2021)
- EU strategy for sustainable and circular textiles (2022)

The EU circular economy agenda has been a major driver of increasing attention to circular economy also in the Nordic countries. The actions on the circular economy within the Nordic countries ties in closely with key EU policy priorities and with global efforts on sustainable development. Still, there is substantial variation in terms of scale, scope and ambition of the circular policies in the individual Nordic countries. This is partly a result of the fact that only three of the Nordic countries are members of the European Union (Sweden, Finland, Denmark), but as outlined in the previous chapter, there are many other important differences that influence circular economy policies. The following sections describes the main components of these policies in each country, focusing on goals and visions and implementation (see chapter 1).



4.1. Denmark

In 2018, Denmark published its first strategy for circular economy, constituting of 15 measures divided into six key areas to be implemented during 2018–2022. Denmark has, from early on, been viewed as a frontrunner for circular economy because of its strong innovative business culture and waste management strategies.

In 2021, Denmark launched an action plan for circular economy which constitutes the national plan for the prevention and management of waste for 2020–2032. The plan presents the Danish targets for circular economy, indicators, policies, and initiatives related to the entire circular value chain, ranging from design and consumption to waste management, where natural resources are recycled into new products and materials.

Three areas are highlighted as important for having a significant environmental and climate impact: i) biomass, ii) construction, and iii) plastics.

A total of 126 measures are covered in the plan, divided into five focus areas i) less waste and better use of natural resources, ii) increased and improved recycling, iii) better use of biomass, iv) a sustainable built environment, v) plastics in a circular economy. The areas include concrete efforts based on a circular value chain.

Many of the 126 initiatives can also be found in other Danish strategies regarding circular economy: Climate plan for a green waste sector and circular economy (2020), Strategy for Green Public Procurement (2020), National Strategy for a Sustainable Built Environment (2021), Strategy for circular economy (2018) and Action Plan on Plastics (2018).

Policy tools, programs and strategies for circular economy in Denmark

- The national plan for the prevention and management of waste for 2020–2032 (2021)
- Strategy for Green Public Procurement (2020)
- National Strategy for a Sustainable Built Environment (2021)
- Strategy for circular economy (2018)
- Action Plan on Plastics (2018)

4.1.1 Circular visions and goals

Denmark's overarching environmental goal is to reduce CO₂ emissions with 70 percent by 2030, compared to 1990. The overarching circular economy target is in accordance with the EU targets, for example:

- halving food waste generation by 2030, increasing the separate collection of plastic bottles to 70 percent by 2025 and 90 percent by 2029,
- reduce the amount of food waste in all parts of the food value chain,
- reduce the environmental impact of construction and demolition, and
- reduce consumption and improve reuse and recycling of plastics.⁸⁶

The vision is to bend the waste curve and achieve a climate neutral waste sector with 80 percent less incinerated plastic waste by 2030. The targets aim, among other things, to increase the recycling of municipal waste to 55 percent in 2025, 60 percent in 2030 and 65 percent in 2035.

The Danish Environmental Protection Agency predicts that the target for 2025 and 2030 will be closely met through already announced policy initiatives. However, further initiatives are expected to be needed to reach the goals for 2035, and for having 50 of plastic packaging being recycled by 2025. Furthermore, all public procurement must be eco-labelled until 2030.

The table below outlines three of Denmark's circular economy programs.

86. European Environment Agency (2021) Denmark waste prevention country profile 2021.

Plastic	National strategy for a built environment	Strategy for green public procurement
<p>Denmark's action plan against plastic pollution, along with 27 initiatives aimed to reduce the use of plastic, increase recycling, and prevent plastic littering in nature.</p>	<p>The strategy aims to set the direction for future regulation of sustainable construction.</p>	<p>Public procurement accounts for about 4 million tons of greenhouse gas emissions in Denmark. The strategy thus focuses on creating a shift for greener public procurement in the public sector.</p>
<p>The main elements are i) the establishment of a national plastic centre, ii) ban on lightweight plastic carrier bags, and iii) better sorting of plastic waste.</p>	<p>21 initiatives are spread across the five focus areas: i) more climate friendly buildings and construction, ii) durable, high-quality buildings, iii) resource-efficient buildings, iv) energy-efficient, healthy buildings, and v) digitally supported construction.</p>	<p>The strategy addresses three key objectives to reduce the carbon footprint: i) green action now, ii) long-term green development, and iii) green knowledge tools.</p>
<p>The Danish government will allocate DKK 50 million over four years to implement the plan.</p>	<p>The initiatives will be implemented during 2021–2030.</p>	<ul style="list-style-type: none"> • Green action now: Measures aimed to be adopted immediately. Examples of initiatives include to adopt a joint government food policy with 60 percent consisting of organic food, vegetarian food will be served twice a week in all governmental staff canteens, mandatory for government procurement officers to choose eco-labelled products.
<p>The measures within the action plan against plastic pollution focuses on:</p>		
<ul style="list-style-type: none"> • Solutions across the value chain. • Responsibility cradle to cradle. • Boosting recycling of post-consumer plastics. • Prevent plastic littering. • Smarter use of plastics. • Doing well informed decisions. • Single market for circular plastics. • Promoting common solutions for a global challenge. 		<ul style="list-style-type: none"> • Long term green development: Large-scale measures with potential to reduce the climate-footprint over a longer time period. Measures include, for example, conversion to emission-free vehicles for the entire public vehicle fleet (to be achieved in 2030), energy savings in government buildings, and to implement a green textile flow in the public sector. • Green knowledge and tools: Providing the basis for the knowledge needed to understand the climate footprint of public procurement. Examples of measures include, for example, annual calculation of the climate footprint from public procurement, and a developed knowledge portal for finding the right and relevant tools for Procurement Officers.*

*Fredrik Fogde (2022) Selskaber kritiserer manglende mål for offentlige indkøb på 380 mia. kr. BØRSEN.

4.1.2 Implementation and coordination

The efforts in the plan are aimed to be implemented by public institutions, industry, and households. The implementation process of the waste management plan is fragmented across the Danish Environmental Protection Agency at the national level, and the municipalities through their 98 local waste management plans are responsible for the implementation.

Overall, the implementation of the plan requires a participation of a broad range of stakeholders, from the Central Denmark Region to coordinate the regional government level to the coordination of municipalities and local authorities.

The Danish waste intensity will be monitored based on annual reports by the Danish statistical office, while the share of reusable packaging will be monitored annually through reports submitted in accordance with the Danish packaging law.

The evaluation of the plan for waste management applied for the period 2020–2032 will be conducted six years after the implementation process, at the latest, based on yearly monitoring processes along with additional measures to cover all targets.⁸⁷

87. <https://www.eea.europa.eu/themes/waste/waste-prevention/countries/denmark-waste-prevention-country-profile-2021/view>



4.2 Finland

In 2016, Finland designed a roadmap for a circular economy as the first country in the world, presenting how Finland could be a climate neutral society through circular economy. The roadmap was developed through cooperation between Sitra (The Finnish Innovation Fund, an independent public foundation operating directly under the supervision of the Finnish Parliament), ministries and other actors. This influenced the enabling of sustainable change on a national scale.

The circular economy roadmap outlines actions that can accelerate the transition towards a competitive and fair circular economy. A total of 70 measures were covered by the roadmap, which was updated with 30 new initiatives in 2019. The measures are aimed at the central government, municipalities, cities, companies and the everyday life of the Finnish population. As part of the roadmap, Finland has assigned a mission to the Statistics Finland to develop indicators to measure circular economy business.⁸⁸

In 2021 the Finnish government launched a strategic programme to promote a circular economy, with the target to transform the economy with the basis on circular economy principles by 2035. The program aims to accelerate the shift to circular economy and was prepared in cooperation between the central ministries and research institutes, as well as Sitra and Business Finland.

The program contains a total of 41 measures which are along with recommendations for which actor should take responsibility for the measures to be carried out to ensure that the implementation is promoted, and that a follow-up is carried out.

Finland recognizes that education has a central role in transforming the economic

88. Indicators for the circular economy business Statistics Finland

system. Circular economy principles are therefore part of the educational curricula in all educational levels in Finland. As a result, Finland has had the highest circular economy teaching provision in higher education, globally.⁸⁹

About five percent of the total GDP in Finland is predicted able to be covered by circular economy and material circulation. The effectiveness of resource use and circulation would mean that the national economy would have a yearly growth rate of 2–3 billion euro until 2030, if just counted on a few sectors. The effect would be even greater if circular economy was a strategic prioritization defining the whole of Finland's business policy.

In 2017, Sitra and the government of Finland founded the World Circular Forum which is an annual event for bringing together business leaders, policy makers and experts to present global circular economy solutions. The event brings up a new theme each year and serve as an opportunity to meet and discuss key opportunities and challenges for the global circular economy transition.⁹⁰

Policy tools, programs and strategies for circular economy in Finland

- Road map for a circular economy (2016 & updated in 2019)
- New directions – a strategic program for circular economy (2021)
- The Plastics Roadmap to Finland 2.0 (2018 & 2022)
- From Recycling to Circular Economy National Waste Plan to 2027 (2022)
- Road map for low-carbon construction (2017)
- Food waste monitoring programme (2019)
- National Public Procurement Strategy (2020)
- Competence Centre for Sustainable and Innovative Public Procurement KEINO (2020)
- Sustainable and knowledge-based textile industry - Roadmap for 2035 (2021)
- The Finnish Bioeconomy Strategy. Sustainably towards higher value added (2022)

89. <https://www.sitra.fi/sv/projekt/undervisning-cirkular-ekonomi-till-alla-utbildningsstadier/#projekt>

90. <https://www.sitra.fi/en/projects/wcef/#hosts-and-partners>

4.2.1 Circular visions and goals

Finland's overarching circular economy goal is to have an economy based on circular economy principles by 2035. This is in line with the Finnish governments' target to achieve carbon neutrality by 2035. This is guided by the steps and objectives of, by 2035: i) have the consumption of primary raw materials be lower than the levels in 2015, ii) double productivity and resources compared to 2015, and iii) double the circular material use rate.

The vision is to ensure, among other things, i) sustainable products and services being the mainstream of the economy, ii) a fair welfare society with sustainable choices, and iii) materials are being kept in circulation longer and in a safe way, while natural resources are being used in a sustainable way.

Finland's strategic program for circular economy addresses the issue of having the current policy documents being in line with a linear economy, with instruments such as, taxation and other incentives, public investment, and legislation. Thus, the Finnish government views it as relevant to develop policy instruments and strategies in line with a circular economy model, which in turn can help to steer production and consumption in line with the circular model and as a result, new markets for products can be created.

The national waste plan with the objective of preventing the creation of waste has an extended vision for 2030 to support the recycling and circular objectives. It furthermore focuses on halving food waste by 2030.

Finland has a strategy regarding mandatory collection of household textiles which will be applied in 2023, which is two years prior to EU's regulation. In addition, Finland launched a roadmap for a sustainable textile industry in 2021, with the aim to transform the textile industry. Several pilot projects and industrial production investments projects are ongoing which collectively will assist with pushing the transformation forward and to strengthen Finland's' role in the transition to a circular economy. A transformation in the textile industry is estimated to lead to almost 17 000 new jobs by 2035.⁹¹

Sitra has done extensive work on circular economy which covers, for example, a handbook on circular economy which offers all Finnish companies concrete help and tools to become more circular, along with a guide for countries wanting to take the steps into more circularity, including inspiration and guidelines. In addition, Sitra has identified 13 important measures and themes to promote more circularity in the administrative sector. The efforts aim to i) promote circular economy as a key governmental project, ii) setting ambitious goals for the use of raw materials, iii) develop regulations to support a sustainable use of raw materials, iv) establish a risk funding instrument for innovative public procurement, along with v) identifying and eliminating subsidies that are harmful to the environment.⁹² In addition, Sitra and Finland has worked to promote the linkage between circular economy, climate change and biodiversity by funding various studies.⁹³

The table below outlines three of Finland's circular economy programs.

91. https://cris.vtt.fi/ws/portalfiles/portal/52199670/Finland_as_a_forerunner_in_sustainable_and_knowledge_based_textile_industry_Roadmap_for_2035.pdf
92. https://cris.vtt.fi/ws/portalfiles/portal/52199670/Finland_as_a_forerunner_in_sustainable_and_knowledge_based_textile_industry_Roadmap_for_2035.pdf
93. <https://www.sitra.fi/en/publications/circular-economy-powerful-force-climate-mitigation/>

The Plastics Roadmap for Finland 2.0	The roadmap for low-carbon construction	From Recycling to Circular Economy National Waste Plan to 2027
<p>The Plastics Roadmap for Finland 2.0 is an updated roadmap from 2018. It contains measures aimed to reduce the harm caused by plastic waste and litter, help consumers deliver plastics to waste management, improve the efficiency of plastics recovery, recycling, and product design, creating conditions for investments and innovations in the circular economy, and reduce the dependency on fossil raw ingredients by increasing bio-based and biodegradable solutions.</p>	<p>The vision is to improve knowledge regarding sustainable construction and through the programme bring together major sustainable construction activities under one umbrella, by sharing practices, launch projects, create networks with actors working in sustainable construction.</p>	<p>The plan involves i) a plan to reduce the volume and harmfulness of waste, and ii) a waste management plan.</p>
<p>The strategy includes concrete targets for proceed progress for the measures.</p>	<p>The goal is to have the carbon footprint throughout a buildings entire life cycle being governed by legislation by the middle of the 2020s.</p>	<p>The plan covers the whole of Finland, except from the Åland Icelands.</p>
<p>A total of 10 key actions are included in the roadmap, aimed to, for example: i) reduce littering and avoid unnecessary consumption, ii) study the possibility to introduce a tax on plastics, iii) significantly increase the recovery of plastic waste, and iv) improve the identification of plastics in buildings and sorting of plastic waste at construction sites.*</p>	<p>The programme's three phases organized by the ministry of environment to steer the carbon dioxide usage throughout the buildings' life cycle. The cycles are divided as i) testing and methods (applied during 2017 and forward), ii) design of control system (applied during 2019 and forward), and lastly iii) having the governance to be applied no later than 2025.</p>	<p>The vision is to, among other things, i) save natural resources and mitigate climate change through material-efficient production and consumption, ii) reduce the volume of waste and increase the rate of recycling and reusing iii) make high-quality waste management a part of the sustainable circular economy, iv) recovering of valuable raw materials present in recycled materials even in small concentrations.</p>
		<p>The national waste plan with the objective of preventing the creation of waste has an extended vision for 2030 to support the recycling and circular objectives.**</p>

*<https://muovitielkartta.fi/wp-content/uploads/2022/06/Muovitielkartta-2.0.pdf>

**https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/163978/YM_2022_13.pdf?sequence=1&isAllowed=y

4.2.2 Implementation and coordination

The measures presented in the national plan target actions by public institutes, households, and industry.

Finland acknowledges that all sectors, businesses, municipalities, and central government needs to take measures to reach the goals for the circular economy program. The Ministry of Environment has the main responsibility for the implementation, although regions and municipalities are highlighted as key actors in the circular economy for promoting circular solutions for the society structure, and in procurements.

Measures within the national plan will be evaluated midway through the programme in 2024, and at the end of the programme in 2027. Indicators will be collected annually.⁹⁴

Measures and changes are required in all sectors, companies, and municipalities as well as in central government to achieve the goals within the action plan. To follow up the transition, several indicators are used, for example, eco innovations (Eurostat), innovative public procurements (Eurostat), and domestic material consumption DMC (Eurostat, resource productivity (BNP/RMC).

Through the strategic program for circular economy, a competence network, KiSu, has been launched to coordinate and strengthen the implementation of the program.⁹⁵

The waste plan will be monitored annually by the Finnish Environment Institute, in which the implementation and impact will be evaluated.⁹⁶

94. <https://www.eea.europa.eu/themes/waste/waste-prevention/countries/finland-waste-prevention-country-profile-2021/view>

95. <https://ym.fi/kiertotalousohjelma/kiertotalous-keskeisilla-sektoreilla>

96. <https://ym.fi/en/national-waste-plan>



4.3 Iceland

In June 2021, Iceland launched a programme for circular economy: Towards a circular economy. The programme is for the duration of 2016–2027.

The programme highlights the importance of handling waste in a way which promotes more circularity, and include Iceland's waste prevention program, and the general waste management policy.

In addition to the programmes for circular economy, the country has a strategy for Iceland's path to climate neutrality by 2040 in which circular economy is highlighted as the outcome by implementing the programmes. A new legislation concerning circular economy was enacted on January 1st 2023.

Iceland has a high access to natural resources such as clean water, geothermal hot water, and renewable natural electrical recourse production. Protecting them are of high priority and to ensure a sustainable use of them.

Every 12 years, the Icelandic Government is obliged to publish a waste prevention policy. The current policy was published in 2016 and runs until 2027. The focus is to prevent waste from occurring and promote more reuse of products.

In November 2022, Iceland formed a circular economy committee, on behalf of the Ministry of Environment, Energy and Climate, tasked to present proposals for the implementation of a circular economy. The proposals will, among other things, include how the implementation of circular economy could be sped up in Iceland, how collaboration to promote a more active circular economy among state, municipalities and private sectors could be enhances, and, how to foster an open and transparent waste market.

In addition, in January 2023, changes in national laws regarding, among other things, waste management, processing fees, and on hygiene and pollution prevention will come into place. The changes in the laws are expected to contribute to a more circular economy.⁹⁷

Although Iceland is not a member of the European Union, many of EU's legislations are adopted by Iceland, mainly because of Iceland's membership in the European Economic Area (EEA). The European Circular Economy Action Plan is therefore applied by Iceland as well, yet with a narrower scope than EU's policy.⁹⁸

Policy tools, programs and strategies for circular economy in Iceland

- Towards a circular economy (2021)
- On the path to a climate neutrality. Iceland's Long-Term Low Emission Development Strategy (2021)
- Waste management plan (2021)
- National policy on waste prevention (2021)
- Central Public Procurement, (2022)

4.3.1 Circular visions and goals

Iceland's overall goal is to reduce greenhouse gases by 55 percent by 2030 compared with 2005 levels, and reach carbon neutrality in 2040, in which circular economy is one of the key components for achieving the transition.

The Climate Neutrality Strategy is Iceland's main instrument to reach the commitments under the Paris Agreement and by committing to the goals – synergies with other environmental goals will occur, for example circular economy. Transitioning to a circular economy is especially highlighted to be achieved by applying the waste management plan and the waste prevention program.

The vision for the national policy on waste is to make Iceland one of the leading nations in the climate transformation and for using natural resources in a sustainable way for the benefit of future generations. The aim is to promote a recycling economy where waste generation will be significantly reduced, recycling increased and landfilling stopped.

97. <https://www.sjavarklasinn.is/en/circular-economy-in-the-spotlight-of-the-ministry-of-environment-energy-and-climate/>

98. Guðmundur Steingrímsson (2022) Iceland's Circularity Index.

The general goals for the Icelandic waste prevention program are:

- To reduce waste generation and greenhouse gas emissions.
- To improve the utilization of resources, with a focus on green innovation.
- To reduce the use of raw materials while reducing the environmental impact.
- To reduce the distribution of substances that are harmful to health and the environment.

More quantitative targets for the program include, among other things, to:

- Reduce food waste by 30 percent by 2025 and by 50 percent by 2030 in each part of the food supply chain, compared with the 2021 level.
- Reduce the proportion of fish waste from the fish catch processed in Iceland to 0.18 percent.
- The percentage waste from meat production should be a maximum of 30 percent.
- The number of plastic bags should not exceed 40 bags/inhabitant per year by 2025.
- The number of textiles and footwear should not exceed 10 kg/inhabitant per year.

The table below outlines two of Iceland's circular economy programs.

Waste prevention program	Central public procurement
<p>The Icelandic national policy on waste collection contains nine focus areas. The areas will be in focus during different time periods in brackets below.</p> <ol style="list-style-type: none">1. Food waste (2016–2017)2. Plastics (2018–2019)3. Textiles (2020–2021)4. Electronics (2022–2023)5. Construction (2024–2025)6. Paper (2026–2027) <p>Categories that will be prioritized throughout the whole programme is:</p> <ol style="list-style-type: none">7. By-products from the processing of meat and fish8. Beverage packaging9. Heavy industry <p>It is emphasized to have a clear and simple regulatory framework to promote the utilization of raw materials and to create increased opportunities for recycling. As well as the need for contentment, to make better use of and reduce waste, such as education to prevent waste generation.</p>	<p>Ecological procurement will be made a general rule for the procurement of government entities, according to the Icelandic governments plan for 2030. Environmental and climate considerations is thus central for sustainable public procurement.</p> <p>One key component for the public procurement is to reduce the carbon footprint by changes in the design of structures, the use of environmentally friendly concrete and other changes regarding more environmentally friendly inputs of construction products.*</p>

*RÍKSIKAUP (n.d.) Vistvæn inkaup

4.3.2 Implementation and coordination

Local authorities determine the arrangements for collecting household and industrial waste in their community and adopt regional waste treatment plans. The Environmental Agency is responsible for enforcement of the legislation on waste treatment, which is being decided on by the Minister of Environment, Energy and Climate by setting national policy on waste treatment and waste prevention for the country.

The monitoring of the waste prevention program occurs annually for selected key waste fractions. The progress is annually followed up through updates of indicators as well as activity- or action plans on each topic.



4.4 Norway

In 2021, Norway launched its first strategy for circular economy. The strategy emphasizes Norway's aim to be a pioneer in the transition to a green, competitive, value-creating circular economy both nationally and within the EU through policy development. Achieving circular economy is not a goal in itself, but instead part of a process to achieve more value-creating, green competitiveness and sustainability, along with reaching the countries own environmental targets and the UN targets (SDG's).

Norway has large potential for circularity, although as for now, Norway is only 2.4 percent circular, which is below the global average of 8.6 percent. Norway has one of the highest per capita consumption rates in the world and consumes 44.3 tonnes per person/ year. Few Norwegians choose products made from recycled materials or services, or products from sharing platforms that are circular. It is more common to buy new products than repair old ones.

Norway is not a member of the European Union but have close links to the EU and its implementation of the Circular economy action plan. The European Green Deal is one of the key drivers for the shift to circular economy in Norway.

Policy tools, programs and strategies for circular economy in Norway

- Norway's strategy for developing a green, circular economy (2021)
- Norway's strategy for plastic (2021)

4.4.1 Circular visions and goals

Norway's strategy for circular economy consists of actions for sectors identified as having the greatest potential for circularity and green competitiveness. These are: i) the bio-based sectors, ii) the process industries, iii) construction and buildings, and iv) service industries, including retail and wholesale trade.

Norway's strategy for plastics aims to increase the recycling of plastic waste, stop plastic waste from ending up in nature, and to promote more sustainable use of plastic products.

The main goals of the strategy are to i) reduce the amount of waste in the sea and coastal areas through clean-up measures, ii) avoiding the supply of waste and microplastic to the sea, iii) increase recycling of household waste with 55 percent to 2025, 60 percent to 2030 and 65 percent to 2035, and iv) increase the proportion of plastic packaging recovered from materials to 50 percent to 2025 and 55 percent to 2030. Four focus areas are addressed in the strategy:

1. Circular economy through sustainable production and product design.
2. Circular economy through sustainable ways to consume and use material, products, and services.
3. Circular economy through non-toxic circular circuits.
4. Circular economy and value creation.

The financial sector is emphasized as playing a key role by channelling capital to sustainable investments. Thus, Norway follows the development and implementation of the EU Taxonomy for sustainable economic activities.

4.4.2 Implementation and coordination

The four key sectors in the circular economy plan provides different implementation strategies, with examples of implementing activities below:

1. Developing common standards for the use and re-use of biological resources and ensuring that the legislation provide incentives for digital and technology development in the recycling sector (bio-based sector).
2. Support the development of expertise and of innovative business models within the sector to influence consumers to choose sustainable products (process industry and service industries).
3. Give better guidance on the re-use of building material (construction and building industry)

Digitalization is considered as important to reach the full potential in the shift to a circular economy. The Norwegian Government therefore aims to support the development of digital product passports, digital marketplaces and national ICT and data policies to promote the green transition further.

Local authorities such as counties and municipalities are emphasized to be supported in the circular economy transition. The local authorities are seen as having a key role for coordinating between the business sector and civil society, along with different administrative levels.

To promote circular economy throughout the whole country, the public agencies in the research, innovation and technology development systems will be asked to develop the area of circular economy as a cross-cutting focus area.



4.5 Sweden

In 2018, the Swedish government established a Delegation of Circular with the mission to support Sweden's transition to a circular economy. The delegation work as an advisory board for the government and has a key focus to i) contribute to businesses transition to a circular economy, ii) identify obstacles for business transitioning to a circular economy, and iii) communicate and highlight the opportunities for businesses to transition to a circular economy.⁹⁹

In 2020, Sweden launched its first strategy for circular economy with a specific focus on four areas. The strategy consists of measures and initiatives aimed to incentivise reduced production of waste and as well as support non-toxic and circular material cycles to achieve a more circular economy.¹⁰⁰

In 2021, an action plan based on the Swedish strategy for circular economy and the four focus areas established there, was launched. The action plan presents current policy instruments and decided or intended measures to speed up the development within four focus areas:

1. Circular economy through sustainable production and product design,
2. Circular economy through sustainable ways of consuming and using materials, products, and services,
3. Circular economy through non-toxic and circular cycles, and
4. Circular economy as a driving force for business and other actors through measures that promote innovation and circular business models.

99. <https://delegationcirkularekonomi.se/om-oss>

100. <https://www.regeringen.se/49096d/globalassets/regeringen/bilder/klimat--och-naringslivsdepartementet/klimat-och-miljo/cirkular-ekonomi---strategi-for-omstallningen-i-sverige>

According to The Circular Gap Report, Sweden is 3.4 percent circular, which is below the global average of 8.6 percent.

Policy tools, programs and strategies for circular economy in Sweden

- Circular economy – a strategy for change in Sweden (2020)
- Circular economy – action plan for the transformation of Sweden (2021)
- The government's action plan for plastics - part of the circular economy (2022)
- To do more with less – national waste management plan and waste prevention program 2018–2023

4.5.1. Circular visions and goals

Several resource streams are highlighted as prioritized in the transition to circular economy in the national strategy for circular economy. These are mentioned as important to create fast, comprehensive, and coordinated actions and consist of: i) plastic, ii) textiles, iii) food, iv) renewable and bio-based raw material, v) the construction and real estate sector, and vi) innovation-critical metals and minerals.

Specific action plans regarding prioritized streams for the circular transition are intended to be developed, in which a strategy for a circular use of plastics was developed and published in 2022. The government furthermore intend to develop an electrification strategy, a water strategy, and a national bioeconomy strategy to complement the circular economy strategy.

The vision for the Swedish strategy is to create a society where resources are used efficiently in non-toxic circular flows to replace virgin material. The overall goal is to create a shift from a linear economy to a circular economy, and thereby contribute to achieving the environmental and climate goals, as well as the global goals in Agenda 2030.

The transition to a circular economy and the measures within the strategy aim to remove obstacles, strengthen competitiveness, increase incentives, and contribute to long-term conditions for the circular social transformation that already under way.

The action plan comprises a total of 100 measures divided into four focus areas described above.

For each focus area, policy instruments or measures have been developed or are in the process of being implemented, to actively take a grip on the transition to circularity.

The strategy relates to several milestones which can be found in the Swedish environmental target system, regarding reduced emissions of greenhouse gases, reuse of packaging, reduced food waste, municipal waste, construction and

demolition waste, and food waste. Milestones for the prioritized streams are intended to be developed where deemed appropriate to supplement the environmental target system.

The Swedish government is furthermore strengthening the focus on circular and fossil-free public procurement with a budget initiative and a special assignment to the Procurement Authority, covering 15 million SEK in 2022. The plan shall be handed to the Government before 1 December 2022, and the end revision will be completed by 1 February 2025, at the latest. Further development and general guidance for all parts of purchasing and procurement will be taken.

The procurement authority shall, among other things, develop technology-neutral criteria for circular, non-toxic, and fossil-free products and services. Initially, the work will primarily focus on the most prioritized product and material flows in accordance with the Government's strategy for circular economy. Make public procurement circular, non-toxic and fossil-free will increase the pace of the green transition, stated by the government.

The table below outlines two of Sweden's circular economy programs.

Action plan for plastics	Waste prevention plan
<p>The national action plan for plastics involves measures aimed at the design of plastic products for better durability, increase of products lifespan through rental or return systems for reuse which in turn will reduce the need to manufacture new products.</p> <p>A total of 55 measures are covered by the with four key themes:</p> <ol style="list-style-type: none"> 1. production and product design of plastic and plastic products, 2. consumption and usage of plastic and plastic products, 3. non-toxic and circular cycles of plastics and plastic products, and 4. driving force for business and other actors who promotes innovation and circular business models for plastic and plastic products. <p>The action plan highlights the importance of promoting innovation and new business models.</p> <p>To achieve a sustainable use of plastic through the entire life cycle, a breath of solutions needs to be developed that enables more circularity and removes barriers to development. Innovation is therefore crucial and needs to be promoted along the entire value chain.</p>	<p>The goal for Sweden's waste prevention is connected to the environmental quality goal "Good built environment".</p> <p>The plan focuses of six key waste priorities.</p> <ol style="list-style-type: none"> 1. Food waste, 2. Construction and demolition waste, 3. Textiles 4. Electrical and electronic equipment 5. Plastic 6. Littering <p>Qualitative targets are, among other things, to: Reduce food waste by at least 20 percent by weight per capita from 2020 to 2025, and to increase the share of food production that reaches shops and consumers by 2025.*</p>

*<https://www.eea.europa.eu/themes/waste/waste-prevention/countries/sweden-waste-prevention-country-profile-2021.pdf/view>

4.5.2 Implementation and coordination

The Swedish strategy for circular economy establishes that a transition to a circular economy require a range of actors ranging from:

- Politics, for example, by creating conditions for long term instruments, including legislation to promote a circular economy.
- Trade and industry, in with for example actors such as the Delegation for circular economy, the organization Fossil Free Sweden, the Government's strategic cooperation program *Näringslivets klimatomställning*, the National Innovation Council, and the Committee on Technological Innovation and Ethics (KOMET) are mentioned as important.
- Public sector, in which for example actors such as The Swedish Environmental Protection Agency, the Chemicals Inspectorate, the Swedish Agency for Economic and Regional Growth, the procurement authority, IVL the Swedish environmental institute, Universities and research institutes, and the municipalities are mentioned as important.
- The civil society and private individuals, in which for example environmental and consumer organizations, associations among others conduct activities that are important to promote a circular economy.

The strategy and action plan for circular economy and the outlined measures will be followed up through the Swedish budget proposal. The waste management plan is to be followed up and monitored by annual revision of the intermediate targets.



5. Conclusions and the way ahead towards a more integrated, circular Nordics

The circular transition offers great opportunities and multiple benefits, but due to several key barriers progress is still slow. The Nordics is no exception, despite high environmental ambitions in general. This report aims to provide an overview of the benefits, status and progress so far on circularity in the Nordic countries, an inventory of circular economy policies in the Nordic countries, and a first outline of opportunities for deepened Nordic collaboration and coordination to accelerate the circular transition and building a more resilient, sustainable Nordic region in the new geopolitical context. Main observations and conclusions are summarised below.

5.1 Nordics opportunities and important barriers to the circular transition

The potential for creating a circular ecosystem in the Nordic region is big. There are already many examples of successful and high potential circular business models in all Nordic countries and the political and economic differences offer great possibilities of learning from each other and sharing best practices.

Access to raw materials, food and energy is critical to the green transition, as many critical raw materials are used in important green technologies. The Asian region is currently dominating the global market of critical raw materials of importance for the green transition, exposing the Nordic region to geopolitical risk. However, the Nordic region has the potential of creating a sustainable Nordic market for many of these raw materials and thereby building a more solid foundation for industries, such as battery manufacturing, wind and solar and food.

Education is an important aspect for an expanded circular market across the Nordic region. This includes for example technical knowledge regarding how to create circular production processes, as well as design and material knowledge for producing more long-lasting and recyclable products. But also, a workforce that can support the green transition will be necessary. According to recent studies, there will

be a deficit of educated workforce in the Nordic countries for e.g. engineering jobs. Finland has incorporated sustainable and circular economy principles in the curricula for all levels of education. This is a great example of how to increase sustainability knowledge at a broad scale across the Nordic region.

Policy plays a key role in enabling the circular economy and provide incentives to create change among businesses and societies at large. Nordic policies for promoting more circular systems are gradually maturing, but there are still significant gaps in all countries. For example, a lack of measurability, quantifiable goals, the concrete plans of implementing circular economy systems and end goals for the strategies (e.g., in the Swedish strategy). There is great potential in streamlining the Nordic policies for circular economy by replicating successful policies across the region. By harmonizing policies, the Nordic countries can push each other forward, thereby improving the overall conditions for circularity, while also strengthen specific areas in which the Nordics has a competitive advantage.

Businesses need clear directions and long-term policies to make long-term investments in circular business models. However, today, policies and institutions are lagging behind, while stuck in a linear mindset. Clear, harmonized, long-term targets for the circular economy across the region could enable strengthened cooperation and streamline circular economy ambitions across different policy areas.

5.2 Possible areas for closer Nordic cooperation on circular economy

A common Nordic circular economy strategy focusing on high potential solutions and value chains

Circular economy is a key component of the 2030 vision to "become the most sustainable and integrated region in the world". Since many of the circular value chains expand beyond national borders, the circular transition will move faster if the Nordic countries work together towards a shared strategy that can facilitate policy collaboration and harmonization of regulatory design and implementation of EU directives.

Exchange experiences on circular economy tax reform

The negative externalities of the present linear model are not reflected in the relative prices of goods, which means that unsustainable products can still be price competitive and lower the demand for circular solutions. Getting the price right and levelling the playing field between linear and circular business models will be critical to the circular transition. The Nordic countries can work closer together to share experiences and best practices on circular economy tax reform, thereby creating an expanded market for Nordic circular solutions.

Exchange experiences and harmonize standards, definitions and access to data

Regulatory lock-in effects and conflicts also present a major obstacle to circular business models. One example is the construction sector, which today uses almost no secondary materials. One main reason is that materials from demolished buildings are classified as waste because of health and safety regulations. This prevents their use as secondary material in construction of new buildings. Facilitating more circular solutions in the construction sector will therefore require a regulatory reform, where construction and demolition waste (CDW) stops being classified as waste material and instead is covered by product regulation. Some

countries in the EU have developed so called end-of-waste criteria for CDW, showing that it is possible. The Nordic countries could cooperate to make new circular regulations as harmonized as possible – creating a larger market and greater opportunities for economies of scale.

Knowledge transfer and learning from the frontrunners

The Nordic countries have different strengths and weaknesses in terms of the circular economy, and significant improvements can likely be achieved by learning from best practices and a more coherent implementation of EU regulation. One example is waste management, where Sweden stands out in its interpretation of the EU Waste Framework Directive, assigning ownership of waste only to municipalities¹⁰¹. This can impede circular business model innovation such as re-use of waste from restaurants to generate biofuels for transports, and a Swedish government committee has suggested a revision of the interpretation of the EU directive. Here, lessons from the other Nordic countries can be valuable. There are many similar examples where there is potential for improving the circular economy policies, simply by learning from best practices within the Nordic region.

101. Statens Offentliga Utredningar (2021) Åga avfall – en del av den cirkulära ekonomin. SOU 2021:24

About this publication

Circular Business Models

Nordic opportunities and challenges in the new geopolitical landscape

Martin Flack, Malin Redmo, Caroline Gränsbo, Nina Ekelund

<https://www.hagainitiativet.se/>

ISBN 978-92-893-7517-7 (PDF)

ISBN 978-92-893-7518-4 (ONLINE)

<http://dx.doi.org/10.6027/temanord2023-507>

TemaNord 2023:507

ISSN 0908-6692

© Nordic Council of Ministers 2023

Cover photo: Sophia Bergholm/VisitDenmark

Other photographs:

Executive Summary: Sverre Hjørnevik/VisitNorway

Preface: Niclas Jessen/VisitDenmark

1. Introduction: Circular economy explained: Mariana Proença/Unsplash

2. Circular economy in the Nordics: Febiyan

3. Examples of Nordic circular business models in food, metals and rare earth elements and energy: Mitch Wiesinger/VisitDenmark, Marta Logina/Momenti, Mitch Wiesinger/VisitDenmark, Becca Tapert/Unsplash

4. An overview of Nordic policies for circularity: Marten Bjork/Unsplash, Martin Heiberg/VisitDenmark, Vadim Morozov/Unsplash, Karin Beate Nøsterud/norden.org, Mattias Fredriksson/VisitNorway, Ola Ericson/imagebank.sweden.se

5. Conclusions and the way ahead towards a more integrated, circular Nordics: Markus SpiskeUnsplash

Published: 8/2/2023

Disclaimer

This publication was funded by the Nordic Council of Ministers. However, the content does not necessarily reflect the Nordic Council of Ministers' views, opinions, attitudes or recommendations.

Rights and permissions

This work is made available under the Creative Commons Attribution 4.0 International license (CC BY 4.0) <https://creativecommons.org/licenses/by/4.0>.

Translations: If you translate this work, please include the following disclaimer: This translation was not produced by the Nordic Council of Ministers and should not be construed as official. The Nordic Council of Ministers cannot be held responsible for

the translation or any errors in it.

Adaptations: If you adapt this work, please include the following disclaimer along with the attribution: This is an adaptation of an original work by the Nordic Council of Ministers. Responsibility for the views and opinions expressed in the adaptation rests solely with its author(s). The views and opinions in this adaptation have not been approved by the Nordic Council of Ministers.

Third-party content: The Nordic Council of Ministers does not necessarily own every single part of this work. The Nordic Council of Ministers cannot, therefore, guarantee that the reuse of third-party content does not infringe the copyright of the third party. If you wish to reuse any third-party content, you bear the risks associated with any such rights violations. You are responsible for determining whether there is a need to obtain permission for the use of third-party content, and if so, for obtaining the relevant permission from the copyright holder. Examples of third-party content may include, but are not limited to, tables, figures or images.

Photo rights (further permission required for reuse):

Any queries regarding rights and licences should be addressed to:
Nordic Council of Ministers/Publication Unit
Ved Stranden 18
DK-1061 Copenhagen
Denmark
pub@norden.org

Nordic co-operation

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland.

Nordic co-operation has firm traditions in politics, economics and culture and plays an important role in European and international forums. The Nordic community strives for a strong Nordic Region in a strong Europe.

Nordic co-operation promotes regional interests and values in a global world. The values shared by the Nordic countries help make the region one of the most innovative and competitive in the world.

The Nordic Council of Ministers
Nordens Hus
Ved Stranden 18
DK-1061 Copenhagen
pub@norden.org

Read more Nordic publications on www.norden.org/publications