No time to waste

Unlocking the circular potential of the Baltic Sea Region

Preface

This Report **“No time to waste. Unlocking the circular potential of the Baltic Sea Region”** has been prepared for the **10th Forum of the European Union Strategy for the Baltic Sea Region** in Gdańsk on 12–13 June 2019.

The main topic of the Forum is: **“Circular and sharing economy as an answer for demographic challenges and environmental problems in the Baltic Sea region”.**

The Report you are about to read aims to analyse the current state and possible future development of the circular economy in the Baltic Sea Region. It proves that policies relating to the circular economy have existed in the Baltic Sea Region for years, but they have been dispersed between different policy areas, such as waste management, environmental protection and climate change.

The Report presents also some demographic and migration transitions as well as evolution of social attitudes which influence our daily life and their relation to circular economy. It gives us a clear conclusion: consumers who stop replacing household goods or clothes constantly can be a powerful source of change from linear to circular production.

I believe the Report is going to be a useful input for the Forum in Gdańsk. It should be also treated as a preparatory step towards revision of the EUSBSR Action Plan and the next EU multiannual financial framework 2021–2027.

I have no doubts that circular economy is an emerging area for a long-term and future-oriented cooperation in the Baltic Sea Region. I am looking forward to be a part of it!

Have an interesting and inspiring reading!

Mieczysław Struk
Marshal of the Pomorskie Region

Executive summary

Increasing the circularity is the only way to keep Baltic Sea Region (BSR) economies' growing without hampering the environment and inducing further climate change. The questions we answer in this report are:

- what have BSR countries already achieved?
- what still needs to be done?
- what targeted policies can accelerate the transformation?

In this report we analyse the transition of Baltic Sea Region (BSR) countries from a linear to a circular economy.

Linear economy relies on extensive mining and harvesting in order to carelessly produce goods of short lifespan, which are later disposed and treated as waste. It may be described by take-make-consume-dispose sequence of actions.

Circular economy is based on recursive movement of goods and materials through remanufacture, retake, reuse, repair and recycle. Demand for raw resources is met by recycled materials or renewable sources, production is highly energy and resource efficient, products' lifespan is long and consumption – limited and more responsible.

For over a decade BSR countries are slowly transforming their economies towards including more circular business models, investing in renewable energy generation and making waste management more efficient and ecological. However, for many countries there is still a long way to go and a slow advancement in introducing circular solutions might put a too heavy burden for the environment.

NOW

The EU Strategy for the Baltic Sea Region formulated in 2009 will be updated with a new Action Plan this year, giving the participating countries a chance to reorganise its priorities and fostering circularity in BSR economies.

Circularity meets many challenges in BSR countries:

- Environmental (climate change, extractive mining, air pollution, soil degradation, waste treatment);
- Economic (unsustainable production and consumption patterns, premature obsolescence);
- Social (migration pressure, rampant consumerism in the North Europe, ecological unconcern in the postcommunist countries, lost jobs in linear economy).

Different starting point between its countries are an obstacle for developing a common strategy for the macroregion. While some of them struggle mainly with coal mining and air pollution, other should focus rather on diminishing energy use. All of them, however, need to accelerate introduction of circular economy policies.

Only Finland and Germany adopted a circular economy strategy. Poland, Estonia and Sweden are in progress of formulating one. On the other hand, in almost every BSR country there is circular economy education/promotion provided or planned, with the exception of Lithuania and Latvia.

IN THE FUTURE

Various economic trends support the transition towards circularity:

- Growing importance of services in the economy reduces the demand for natural resources;
- Digitalisation facilitates products' leasing, sharing and renting, extends products' lifespan, and helps to increase waste recyclability;
- Resource price increases enhance need to improve production efficiency and incentivise for materials reuse.

The impact of social trends, however, is ambiguous.

While an aging European society increases the demand for services instead of products, immigration mounts pressure on consumption growth and hampers a change in attitudes toward higher ecological awareness. The latter however is happening across the BSR countries which will stimulate introduction of circular economy policies, both at national and supra-national level.

What will happen? The baseline scenario

The transition to a circular economy will only happen partially. Cooperation between the BSR countries will remain on a roughly the same level, with EU policy as the main unifying factor. The most significant changes will be visible in the production sector.

EUR 1.8 trillon per year

that much Europe could save, if it adopts the circular economy business models.

RECOMMENDATIONS

GENERAL

- Circularising green public procurement, to adopt EU-widely stricter environmental policies,
- Introducing EU-wide Pigouvian taxes, to impose efficient taxation on companies with a high CO_2 footprint and those creating non-recyclable products,
- Introducing ecological conditionality when allocating EU funds, to increase incentives to introduce circular modes of production on a wide scale,
- Providing incentives for introducing circular economy business models, e.g. through tax credits for service companies that offer sharing platforms or products-as-a-service solutions,
- Creating a green bond union, to provide funding opportunities for circular economy investments,
- Extending the EU green taxonomy, which would help to get access to financing for investments in circular economy business models.

FOR EUSBSR

- Introducing circularity as horizontal action, which would allow the strategy to channel funding into projects that can benefit many policy areas,
- Creating a regular forum on the circular economy for the BSR, which would foster the development of networks and allow for the dissemination of knowledge and best practices,
- Establishing a working group on the circular economy in the BSR, to monitor progress, share experiences and obstacles for problems with circular economy policy implementation as well as ensure a regular dialogue with national and EU policymakers,
- Unlocking additional funding for circular economy projects, to meet the requirement of substantial investment with higher efficiency than currently,
- Identifying sectors with potential for creating competitive advantage in BSR, like blue economy, sustainable tourism or maritime transport innovation,
- Better stakeholder engagement, to foster the circularity with the help of business allies,
- Strengthening governance in the BSR, to facilitate the implementation of circular policies in the macro-region.

POLITYKA
INSIGHT

POMORSKIE
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Interreg
Baltic Sea Region

EUROPEAN UNION

EUROPEAN
REGIONAL
DEVELOPMENT
FUND

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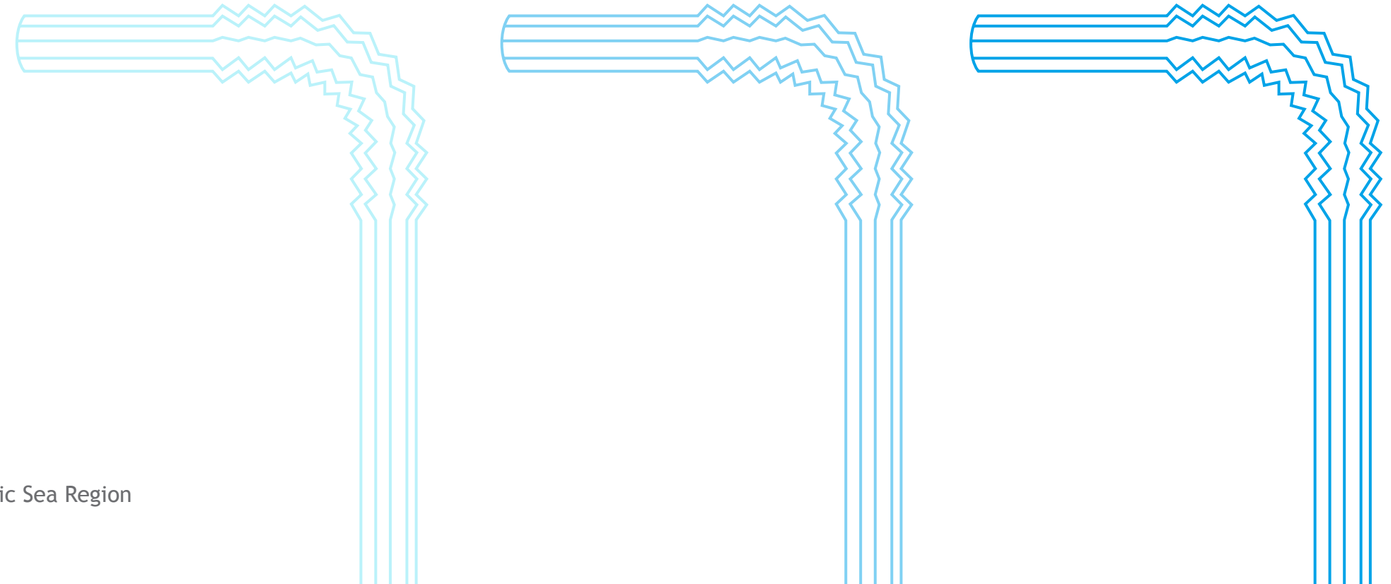
Table of abbreviations

BAS Basel Action Network
BSR Baltic Sea Region
CE Circular Economy
CO_2 Carbon dioxide
COP24 24th Conference of the Parties to the United Nations Framework Convention on Climate Change in Katowice
ECB European Central Bank
EEA European Environmental Agency
EEB European Environmental Bureau
EU European Union
EUSBSR EU Strategy for the Baltic Sea Region
FAO Food and Agriculture Organization of the United Nations
GDP Gross Domestic Product
GHG Greenhouse gases
GPP Green Public Procurement
HELCOM Helsinki Commission
LTRO Long Term Refinancing Operation
nCEAP National Circular Economy Action Plan
NGO Non-governmental organisation
NO_x Nitrogen oxides
OECD Organisation for Economic Co-operation and Development
PA Paris Agreement
PBDEs Polybrominated diphenyl ethers
PM 2.5 particulate matter with a diameter of 2.5 µm or less
R&D Research and Development
SMEs Small and Medium Enterprises
TBT Tributyltin
TFP Total Factor Productivity
UN United Nations
WEEE Waste electrical and electronic equipment



1. Introduction

This report has been prepared for the 10th Annual Forum of the EUSBSR in Gdańsk on 12–13th June 2019. There are three principal aims of this report. Firstly, it attempts to assess the challenges and opportunities connected with the circular economy for the EUSBSR countries. Secondly, it analyses the current state of circular economy in the EUSBSR countries. This particular aim is achieved through a policy analysis of the relevant countries, as well as through a set of indicators allowing to compare the state of the transition in each country. Thirdly, the report looks into the future, trying to identify key trends that will impact the BSR countries until 2030, and on that basis project the future development of the circular economy, along with alternative scenarios.

What is the circular economy?

The prevalent economic model in today's world can be described as a straight line. Most materials undergo a similar process. First, a raw resource is mined or harvested. This resource then undergoes several transformations, mixed with other resources, developed and processed until it becomes a marketable product. The product is then sold and consumed, usually over a short period of time. When the product's functionality falls below a certain point, it becomes waste and is disposed of, often to a landfill or an incineration plant.

Advocates of the circular economy claim that this linear model is unsustainable. It is not just the amount of waste it produces; in 2016, the world generated 2 billion tonnes of municipal solid waste, or 0.74 kilograms of waste per person every day, on average. Every step in the linear process (often referred to as take-make-consume-dispose) is wasteful in one way or another. The resources used are mostly non-renewable; at some point, they will run out. The production processes are inefficient and harmful for the environment, as well as people's well-being. Consumption is excessive and products are disposed of quickly due, in part, to planned obsolescence.

The solution to the linear economy's shortcomings is to close the loop. In a fully circular economy, demand for raw resources would be met almost entirely by recycled materials or renewable sources. To realise this vision, the entire economy must be transformed. Production should be made more efficient and products' lifetime extended. Consumption should be more responsible and supply chains shorter. Finally, for products that are no longer fit for purpose, recycling schemes should be implemented to retain as much value as possible.

The concept of the circular economy has been debated since the 1970s, but the world has hardly budged from the linear model. According to a 2019 report by prominent Dutch think-tank Circle Economy, the global economy is currently just 9 percent circular, meaning that 91 percent of mate-

rials come from extracted resources. Worse still, the trend seems to be downwards due to growing demand for resources (Circle Economy 2019).

There is no silver-bullet solution to making the economy circular. The process will take decades and require a drastic transformation of the economy and society. A sweeping set of policies at every level of governance – from the local to the national and supranational (for example, the EU level) – is needed. This will require substantial investment, only achievable with both private and public money.

Despite the high costs, supporters of the idea argue that the transition to a circular economy is not only worth it, but necessary. The current linear model puts unsustainable pressure on the environment; the most urgent example is potentially catastrophic climate change. Yet the economic model based on extractive growth is in danger, too. Faced with the limited availability of natural resources, making the economy more circular is the only way to sustain advanced economies' standard of living and allow developing economies to catch up.

What is the EU Strategy for the Baltic Sea Region?

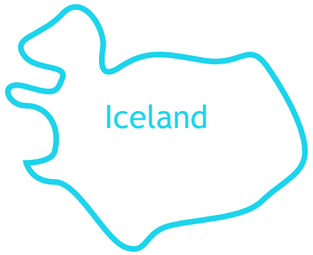
The EU Strategy for the Baltic Sea Region (EUSBSR) was the first of its kind. It was launched by the European Council in October 2009 to address the common challenges faced by the countries around the Baltic Sea. Its goal was to promote cooperation between governments, but also between regions, municipalities, NGOs and businesses.

Eight countries are involved: Estonia, Denmark, Finland, Germany, Latvia, Lithuania, Poland and Sweden. Four non-EU states cooperate in some areas of the strategy: Norway, Iceland, Belarus and Russia. Like all EU macro-regional strategies, the EUSBSR does not come with additional institutions or funding. Its goal is to use existing structures and funding more efficiently, promoting synergies between various actors.

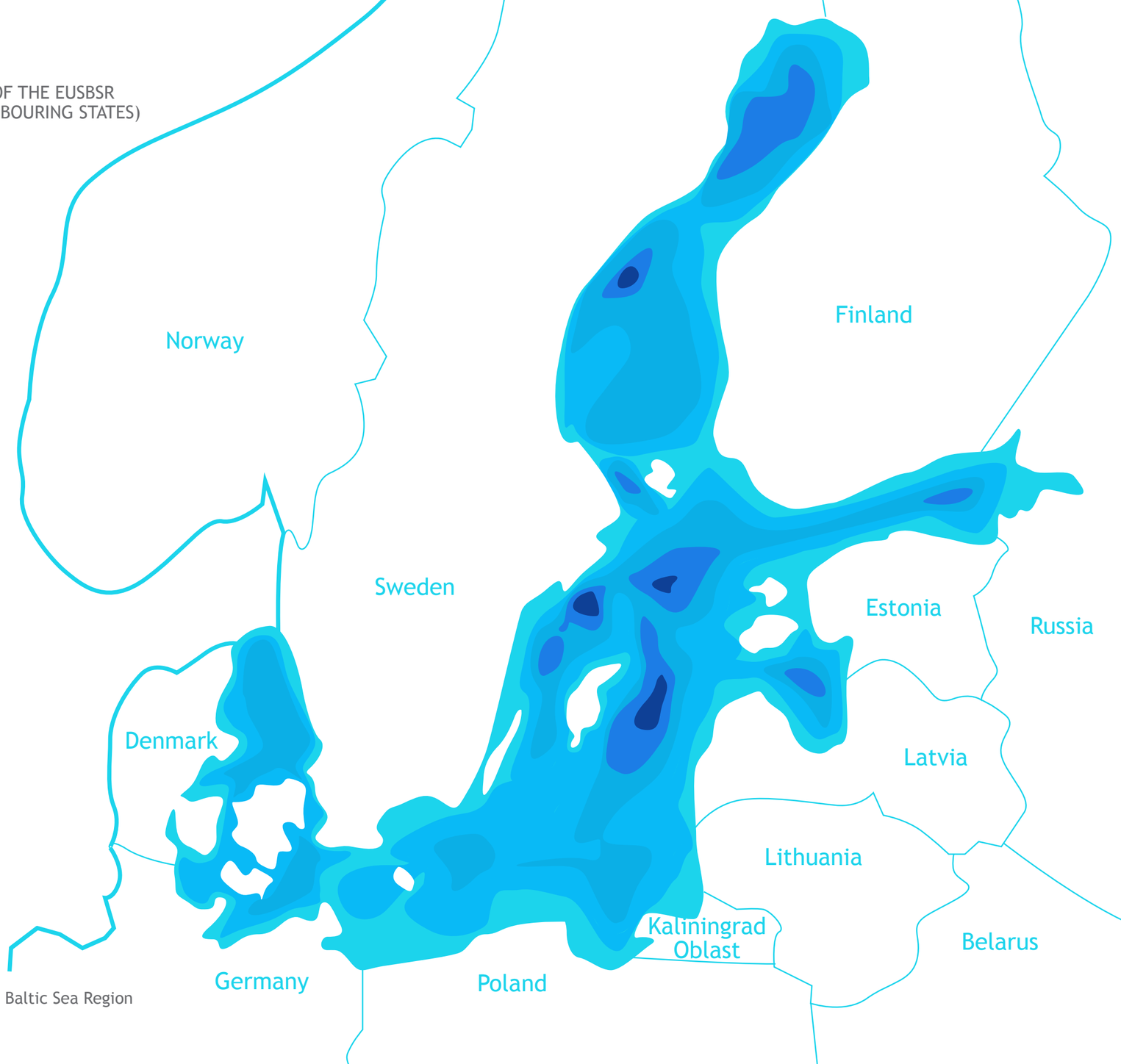
The EUSBSR has three main objectives. The first, "Save the Sea", focuses on actions to protect the sea connecting all the countries in the macro-region. Specific goals include reducing eutrophication, protecting water from hazardous substances, making shipping more sustainable and increasing maritime safety and security.

The second objective, "Increase Prosperity," is much broader. Goals range from promoting health to supporting innovation. Other areas include capacity building for societal security, cooperating in the tourism sector and advancing culture and education.

The third objective, "Connect the Region," focuses on infrastructure. It consists of two main pillars: transport and energy. They cover all modes of transport; both connecting BSR member states and linking them to third countries. Energy goals involve improving interconnectivity, ensuring security of supply and creating a level playing field for market participants. There are also horizontal actions which add broader perspective to the EUSBSR main objectives: spatial planning, relations with neighbours, capacity building and climate policy.



COUNTRIES OF THE EUSBSR
(INCL. NEIGHBOURING STATES)

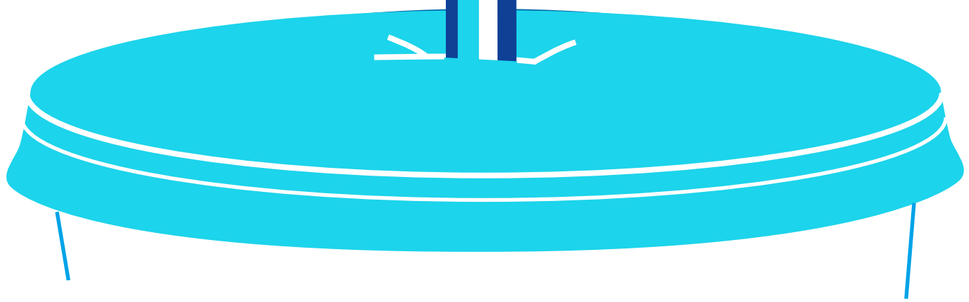


Despite limited resources and decentralised governance, the EUSBSR has delivered in many areas over the past decade. Many of the projects involved research, while others improved cooperation between actors in different states or implemented EU legislation (especially in the field of maritime policy).

Several projects were more or less directly linked to the circular economy. For example, a project “BEST” aims at improving the efficiency of industrial wastewater treatment. Another, entitled “PROMISE” analysed the contamination levels of disposed phosphorus-based fertilisers, with a view to advance the development of recycled fertilisers in the BSR countries.

The EUSBSR Action Plan, outlining the priorities and functioning of the macro-region, is set to be updated this year (2019), giving the participating countries a chance to reorganise its priorities.

2. Environmental and economic challenges for the circular economy



2.1 Environmental challenges for the circular economy in the BSR

Protecting water ecosystems

The Baltic Sea is at the heart of the BSR cooperation, providing important environmental services for all the countries in the macro-region. Fishing still plays a significant role for economies in coastal states, but the Baltic is connected with numerous other activities, too: from leisure, tourism, shipping and transport to energy production, with growing investment in offshore wind farms. Many of these activities are threatened by the state of the marine environment. The Baltic is one of the most polluted seas in the world (OCEANA, WWF). In many ways, it is a unique ecosystem: a shallow basin with significantly less salty water than the neighbouring North Sea. Most of the environmental threats it faces are linked to human activity.

One of these threats is the excessive loading of nutrients into the Baltic (eutrophication) linked to phosphorous- and nitrogen-rich fertilisers used in agriculture. Nutrients foster algae growth, which means that less light and oxygen reach the seafloor, destabilising marine ecosystems. While nutrient inputs have been

decreasing in recent years, over 97 percent of the Baltic Sea is classified as eutrophied (HELCOM 2018).

Non-organic materials can be equally threatening for the Baltic Sea's fragile ecosystem. Researchers at the Helsinki Commission found excessive levels of heavy metals, including mercury, cadmium and lead, in most parts of the sea. They also found high levels of substances that have already been phased out in Europe, such as TBT (a biocide formerly used in the paint on the bottom of vessels) and PBDEs (flame retardants). There is growing concern about human pharmaceuticals and veterinary drugs reaching waters, mainly through wastewater treatment plants, as their impact is not yet fully understood.

Another Baltic Sea's problem and the most visible one is marine litter, which can be seen washed up on beaches across the macro-region. Plastic, which constitutes around 70 percent of marine litter in the Baltic Sea, is the most worrying due to its longevity, which makes it accumulate over the years. The items most frequently found on Baltic beaches relate to individual consumption (straws, cups, packaging and cigarette butts). Also fishing gear abandoned or lost at sea are a significant problem. Marine litter is dangerous for animals, but it can also make tourism less profitable or even make navigation less safe.

The environmental challenges for the Baltic Sea do not end there. Ecosystems suffer from invasive species (introduced inadvertently by marine traffic), underwater sound pollution, shipping traffic pollution and overfishing. Another danger comes from the approximately 40,000 tonnes of chemical munitions dumped in the Baltic Sea during and after the Second World War. While incidents involving humans are rare, the impact of these substances on marine ecosystems is unknown. Through various initiatives (notably the Helsinki Commission), the BSR countries are working together to minimise these threats and repair the damage already done. The impact of these policies can only be seen after years or even decades, which is why traces of toxic substance that were phased out long ago can still be found in the Baltic Sea.

These threats share a common denominator. They are all inseparably linked to the linear economy; the unsustainable extraction of resources that it requires and the uncontrollable mass of waste and pollution that it produces. Not only the Baltic Sea suffers; rivers and lakes in the BSR are exposed to many of the same threats. In many ways, it is more important to protect them than the Baltic, as they provide fresh water to people in the macro-region.

GHG emissions and air pollution

Mitigating climate change

All the countries in the BSR, as well as neighbouring states, signed the 2015 Paris Agreement (PA), which aims to keep the increase in the average global temperature well below 2°C above pre-industrial levels, while striving to limit it to 1.5°C. The Agreement's signatories have submitted Nationally Determined Contributions outlining their plans. BSR countries are members of the European Union, with its own climate policy and emission reduction targets. It was the European Commission that

submitted Nationally Determined Contributions on behalf of the whole European Union.

Reaching the current emission reduction targets required by the PA will be a tall order, requiring considerable investment, drastic policy changes and complete transformation of some sectors of the economy. Worst of all, the current EU targets are not enough to achieve the PA's goals, putting the world on track for an increase of almost 3°C (Climate Action Tracker 2018) or even above 4°C in the case of Russia. While the BSR countries are responsible only for a fraction of global GHG emissions, they too will have to scale up their efforts if the most catastrophic effects of climate change are to be avoided.

There is a growing body of research on the role that the circular economy can play in reaching these targets. According to one report commissioned by the Finnish Innovation Fund Sitra, a more circular economy could reduce EU industrial GHG emissions by 56 percent by 2050, compared to the baseline scenario (Material Economics 2018). The largest reductions would come from the recirculation of materials (such as steel, aluminium and plastics), improving material efficiency in production processes and using circular business models.

Reducing air pollution

According to the European Environmental Agency, air pollution leads to around 400,000 premature deaths in Europe. It is considered the continent's single largest environmental health risk. Exposure to polluted air can lead to heart disease and cancer. It has proven adverse effects on fertility and has been linked to many diseases, from type 2 diabetes to Alzheimer's (EEA 2018). Most air pollution in Europe is caused by fossil fuel combustion in cars, to produce electricity or to heat households and businesses. In many ways, combating air pollution is closely linked to the struggle to reduce GHG emissions.

As with climate policy, the circular economy has considerable potential to reduce air pollution. In many cities in Poland (the country with worst air pollution in the BSR), the main source of pollution is domestic heating, resulting from buildings' subpar energy performance, inefficient heating furnaces and low-quality fuel. A circular approach would focus on improving efficiency, promoting the use of renewables and installing more cost-efficient district heating or smaller but sustainable heat pumps. Similar steps could be taken in other polluting sectors. In transport, the circular policy would focus on electrification and promoting public transportation and ride-sharing services over private cars.

Soil degradation

Soil is a crucial resource for agriculture and sustaining the biosphere. It is important from a climate policy perspective, as it holds more carbon dioxide than the atmosphere and all plants combined. It is also considered a non-renewable resource; it takes hundreds of years to form, while its stock is quickly depleting. At the same time, it does not attract the same kind of media coverage as other threats to the environment. As pointed out by the UN's agricultural agency (FAO), this may be because

most humans in urbanised, developed countries do not interact directly with soil degradation as much as with air or water pollution (FAO 2015).

The most widespread threat to soil quality in Europe is soil sealing. Urbanisation, especially uncontrolled urban sprawl, transforms vast areas of land into built environment. In most BSR countries, the population is stable or even declining, yet land take for cities continues. Soil sealing has consequences beyond the loss of fertile land that could have been used for agriculture. It affects water resources by preventing ground filtering and increasing the risk of floods. It contributes to the "heat island" effect in cities and reduces biodiversity. Land take for cities is greater in countries with high economic growth (EEA 2018), so it can be considered another aspect of the linear economy.

Contamination, another threat to soil quality, is also linked with the current,take-make-consume-dispose economic model. According to the EEA, industrial production and commercial service is a leading cause of soil contamination, followed by municipal waste treatment and the oil industry. Heavy metals and mineral oil are the most common pollutants. Cleaning up contaminated sites can be expensive, which costs are often covered by the public authorities, in violation of the "polluter--pays" principle (EEA 2017).

While agriculture can also lead to contamination, its main impact relates to the nutrient balance in the soil. It can deplete nutrients, which must then be replaced by fertilisers maintain productivity. These fertilisers make their way into the Baltic Sea through groundwater and rivers, causing eutrophication, as described earlier in this chapter.

The environmental impact of waste

Although the circular economy is a complex notion, involving transforming all stages of production and consumption, waste treatment is undeniably its crucial element. In 2016, EU countries produced more than 2.5 billion tonnes of waste. Households were responsible for just 8 percent of it. Construction and demolition produced more than a third of the total (Eurostat 2016), which points to the limits of focusing exclusively on municipal waste.

Waste can affect the environment in numerous ways. In 2016, 48 percent of municipal waste in the BSR countries was landfilled (CHART 1.). Landfills have disastrous effect on the environment. Leachate (a liquid containing toxic materials resulting from the degradation of waste) gets into groundwater, creating a threat to human health and agriculture. Waste degradation is also an important source of GHG emissions (especially methane), as well as air pollution. Locally, landfills damage ecosystems and are a nuisance for nearby inhabitants (Danthurebandara et. al. 2013).

A growing proportion of waste in Europe is incinerated – in the BSR countries about 18 percent of municipal waste is burned. While this is an effective way of recuperating energy from rubbish that is unsuitable for recycling, it has a significant impact on the environment. Modern incineration plants can prevent most of the dangerous mercury emissions. Nevertheless, they are still major sources of NO_x and dust emissions, which have proven adverse effects on human health (EEB 2018). Incinerating non-recyclable waste is considered a renewable energy source and

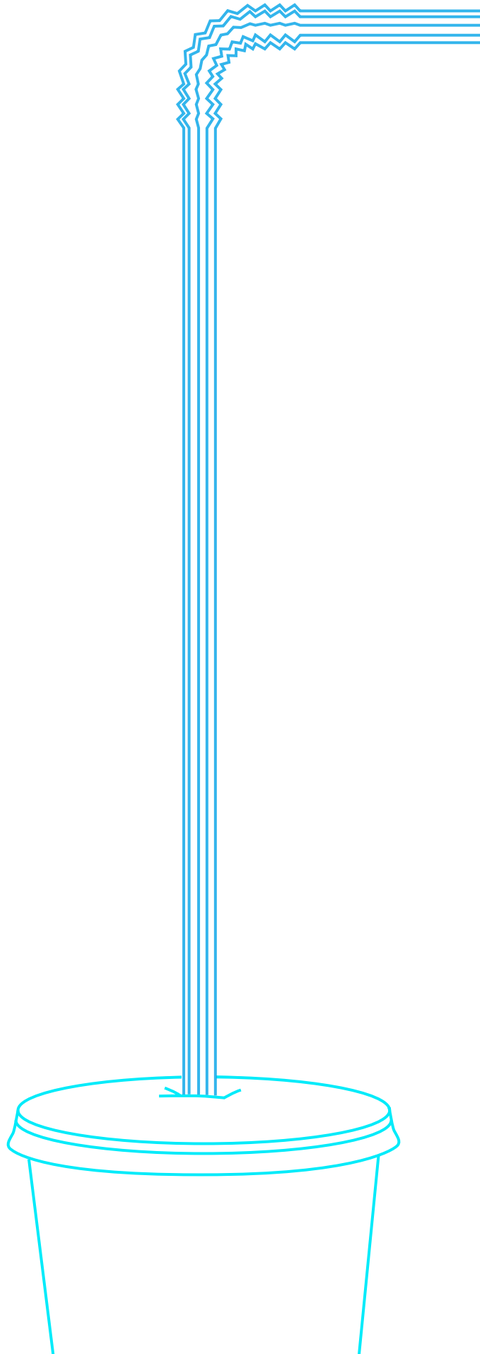
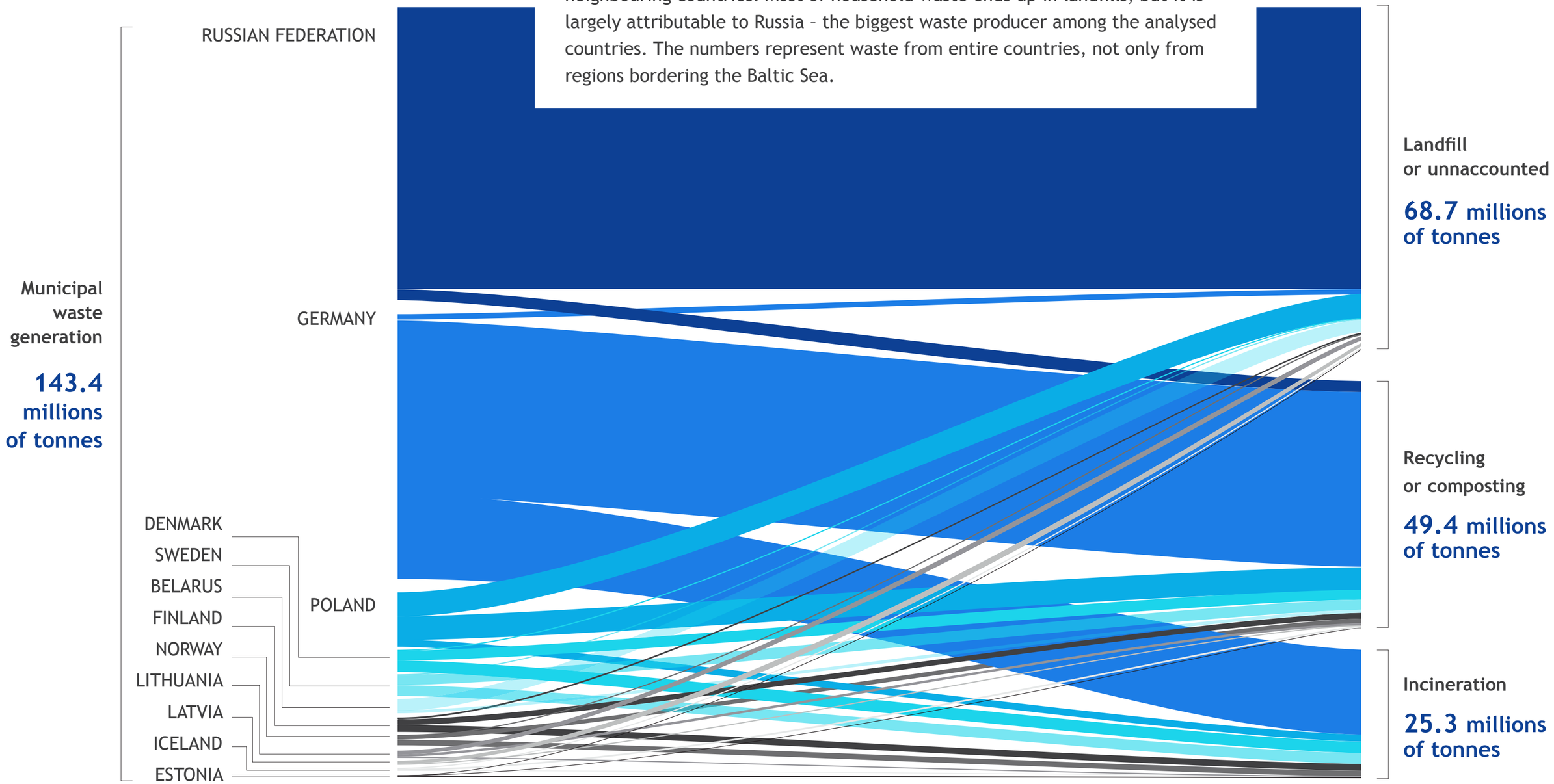


CHART 1. WHAT THE BSR COUNTRIES DO WITH THEIR MUNICIPAL WASTE?

The graph illustrates the end destination of municipal waste in the BSR and neighbouring countries. Most of household waste ends up in landfills, but it is largely attributable to Russia – the biggest waste producer among the analysed countries. The numbers represent waste from entire countries, not only from regions bordering the Baltic Sea.



Source: World Bank (2016).

often used for district heating. However, environmental organisations oppose incineration as it may divert investment from renewables, while creating demand for waste.

Around 40 percent of waste in the EU is recycled. The rate varies widely between member states, from 13.3 percent in Romania to 67 percent in Germany (Eurostat 2016). Recycling is considered the most environmentally-friendly method of treating waste. It also makes economic sense, as it creates value from materials that would otherwise be wasted. For example, producing aluminium and plastic has a significant carbon footprint, so the environmental benefits of recycling go beyond preventing materials from being sent to landfill or incinerated. An especially beneficial variation of recycling is upcycling, whereby discarded items are reused in a completely different way, creating value beyond material extraction. The concept of upcycling is especially popular in Germany, where recycling rates are already high.

While food waste constitutes a relatively small part of overall waste production in Europe (88 million tonnes overall, or 173 kg per person), its environmental impact is significant, because negative externalities accumulate along the supply chain (Fusions 2016). Food production puts pressure on soil and requires significant amount of water. According to one study, 92 percent of water worldwide is used to produce food (Hoekstra & Mekonnen 2011). The distribution of food can lead to GHG emissions from transport. In addition, while food products themselves are usually biodegradable, it cannot be said of the packaging, which is usually made of plastic.

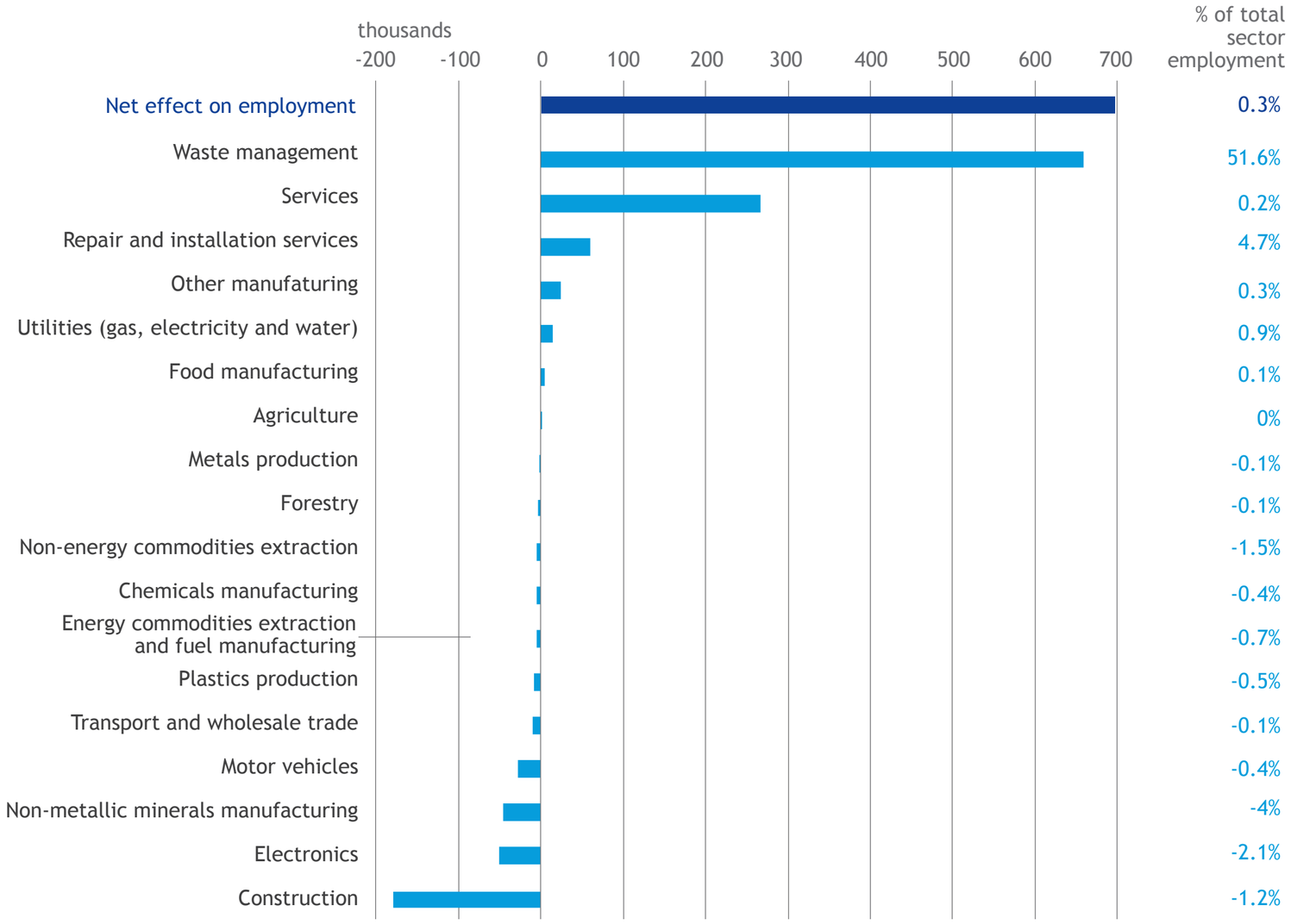
European waste can damage the environment in other countries, too. In 2018, 35 million tonnes of waste were shipped outside the EU. Exporting hazardous waste to non-OECD countries is prohibited, but there is evidence to suggest that dangerous materials are still being exported illegally from Europe. The Basel Action Network, an NGO specialising in the transparency of e-waste treatment, tracked hundreds of defunct electronics and found that some of them (6 percent) were exported to developing countries, mostly in Africa (BAS 2018). While these results cannot be extrapolated to calculate how much e-waste is actually exported, it proves that the problem exists, despite EU regulations.

2.2 Interrelation between the circular economy and economic development

Impact of economic development on the natural environment

Since the 19th century it has been argued that economic growth, mainly measured by an increase in Gross Domestic Product (GDP), has natural limits as it has negative externalities for the natural environment. Thomas Malthus argued that unconstrained population growth cannot be sustained as land, and therefore the supply of food, is limited. According to the Malthusian Trap theory, an increase in population will lead to global famine and epidemics linked to food scarcity on an unprecedented scale, resulting in a fall in population and lasting recession.

CHART 2. CHANGE IN EMPLOYMENT BETWEEN 2015–2030 DUE TO INTRODUCING OF A CIRCULAR ECONOMY



Source: European Commision (2018).

Economic history proved the Malthusian Trap wrong, as economic growth potential after the industrial revolution started to rely on an increase in capital and, even more importantly, an increase in total factor productivity (TFP). This boosted the crop yield from one hectare of land several times. Both population and GDP growth could be sustained beyond the thresholds set by Malthus. However, the increase in TFP brought other negative external effects.

In 1972, Donella Meadows and her colleagues (Meadows et al. 1972) developed a Malthusian-type model of economic development that accounted for accelerating industrialization, rapid population growth, widespread malnutrition, the depletion of non-renewable natural resources and the deteriorating environment, which were widely visible in the second half of the 20th century. They argued that all five factors are interrelated as the population cannot grow without food, food production has to be linked to capital growth, which requires more resources, generating pollution, which have an adverse effect on population and food supply growth. Basing on their results, they argued that if global GDP growth is not to be halted by public policies, it will be stopped in 2100 by the system dynamics, as in the Malthusian Trap; through famine, diseases and pollution.

Additionally, Meadows et al. pointed out that GDP growth must stop long before the tipping point, when pollution, land contamination and exploitation, as well as the depletion of non-renewable resources, take place. According to their model, GDP growth can continue for some time after these planetary boundaries are crossed, resulting in disease and

famine. The institutional, social and economic structure of the economy needs time to adjust to the new circumstances. Once the devastation of the environment is acknowledged, it will be too late to counteract. In short, the human economic system's behavioral mode is to overshoot and then collapse.

These days, researchers argue that four of the nine planetary boundaries have already been crossed (Steffen et al. 2015). Climate change, the effect on biosphere integrity, land-system change and altered biochemical flows show that human activity is driving the Earth into a new state of imbalance (Asara et al. 2015). Some countries and groups of countries (like the EU) have already envisioned a new model of economic development that might mitigate the negative externalities caused by GDP growth. However, policies' efficiency is highly dependent on the economy's structure and the country's stage of development.

One of the major issues addressed by public policy since the 1980 is carbon leakage and countries' carbon footprint (i.e. how much CO_2 is generated by the whole value chain when developing a product). Industry-intensive states, with a high share of value added from mining, manufacturing and conventional energy generation in GDP, have a high negative impact on the environment. As a result, some countries have pursed a policy of deindustrialization, closing down coal burning power plants, investing in nuclear energy and renewables generating from wind, sunlight and water. However, as in the US, decreasing the domestic carbon footprint coincided with large CO_2 production offshoring, as the parts of the value chain with high negative impact for the environment were moved to less developed countries. This mechanism is called the Pollution Haven Hypothesis (Taylor 2004) and exists also in some BSR countries. Empirical analysis (Wagner, Timmins 2009) indicate that such kind of offshoring of CO_2 happened in the German chemical industry, but another research (Kander, Lindmark 2006) has shown that in Sweden the decrease of pollution was made through a domestic advancement in circular economy.

After the global recession of 2008–2009, most countries decided to reindustrialize their economies, as depending on financial and other highly volatile types of services made them more susceptible to swings in the business cycle. This meant bringing back home economic activities that produce more non-recyclable waste and deplete non-renewable resources, reverting the trend to offshore carbon leakage.

Sustainable development, post-development, degrowth and the circular economy

In their *Limits to growth*, Meadows et al. asked rhetorically whether it is better to live within the natural boundaries of a finite ecosystem by accepting a self-imposed restriction on growth, or keep growing in the hope that technological progress will help overcome these barriers, as has been the case over the past few centuries. They argued that faith in technology prevents people from taking decisive action to limit the negative effects of GDP growth. In their opinion, we should bring a deliberate, controlled end to growth. This means that at least three conditions should be

met: (1) capital and population growth should stabilize, i.e. the birth rate should become equal to the death rate and the gross investment rate should equal the depreciation rate; (2) all these rates should be set at the lowest possible level; (3) the amount of capital per capita should be set in line with the available technology and social structure.

Drawing on their research, André Gorz coined the term *décroissance*, French for "degrowth," for questioning the capitalist system. He underscored the importance of reducing consumption and promoting values like frugality, autonomy and conviviality. Since then, many ecologists, cultural theorists and even left-wing economists have built on that concept, extending it fields from inequality to social philosophy, via consumerism. The cornerstone of their theory was that economic growth cannot be decoupled from material and energy flows. Hence any concept of sustainable growth, which became very popular after the 1992 Earth Summit, has a flawed axiology and is in fact an oxymoron. Moreover, supporters of Meadows and her colleagues pointed out that even concepts of green growth or economic dematerialization will not produce the desired outcome, as eco-efficiency gains are usually reinvested in further consumption or degradative investment. There needs to be an ontological paradigm shift to downscale consumption and production, increasing human well-being and improving environmental conditions locally and globally in both the short and the long term.

Despite its correct diagnosis of the state of humankind and the problems caused by policies aimed at boosting GDP growth, the *décroissance* stream of research failed to provide any consistent and realistic proposals for how to downscale consumption and production without hampering human well-being. Most texts by proponents of degrowth focused on critiquing modern capitalism and consumerism; some put forward utopian concepts (Asara 2015). For example, Gerber (2015) proposed to replace money "created by commercial banks" with alternative monetary systems, structured around mutual credits with negative interest rates, along with the socialization of investment outlays and a universal basic income combined with a ticketing system. Kunze and Becker (2015) focused on the energy provision system, advocating replacing big power plants with small-scale renewable energy cooperatives with collective ownership and a collective benefit-allocation scheme. Some researchers (Escobar 2015) examined how to apply the concept of degrowth to underdeveloped countries, which still strive to increase GDP per capita to eradicate poverty and provide their inhabitants with a decent standard of living. In opposition to the global development paradigm, they proposed the concept of post-development, which should increase social well-being in poorer countries without actual economic growth.

None of these utopian concepts were introduced as public policy in developed or underdeveloped countries. Instead, the circular economy, which does not exclude economic growth, is "now an irreversible, global mega-trend" (European Commission, 2019) and shapes how we think about the relationship between the economy and the natural environment. It is probably the only way to overcome the fallacies highlighted by Meadows et al. without abandoning the path of further GDP growth.

Impact of the circular economy on economic development

A fully circular economy not only benefits the environment without hampering economic development, but can bring additional value added by increasing an economy's productivity and international competitiveness.

According to a report by the Ellen MacArthur Foundation (2015), in 2012 the linear take-make-consume-dispose economic system cost Europe EUR 7.2 trillion per year; this only includes the mobility, food and construction sectors. In general, the average European uses 16 tonnes of materials per year, 60 percent of which were either sent to landfill or incinerated. The loss of material value was even bigger: just 5 percent of the original raw material value was recovered.

Shifting to a more circular economy – or, as the Ellen MacArthur Foundation calls it, a "growth within" model – will reduce the European cost of using resources by 32 percent by 2030, or EUR 0.6 trillion per year compared to 2012. This can be achieved by shifting toward circular economy business models (e.g. sharing economy, enhanced product services, resource recovery models) and adapting new resource efficient technologies (e.g. electric cars, predictive maintenance, precision agriculture – see chapter 5 for a discussion on new technologies and their impact on the circular economy) in three areas: transportation, agriculture and food processing as well as construction.

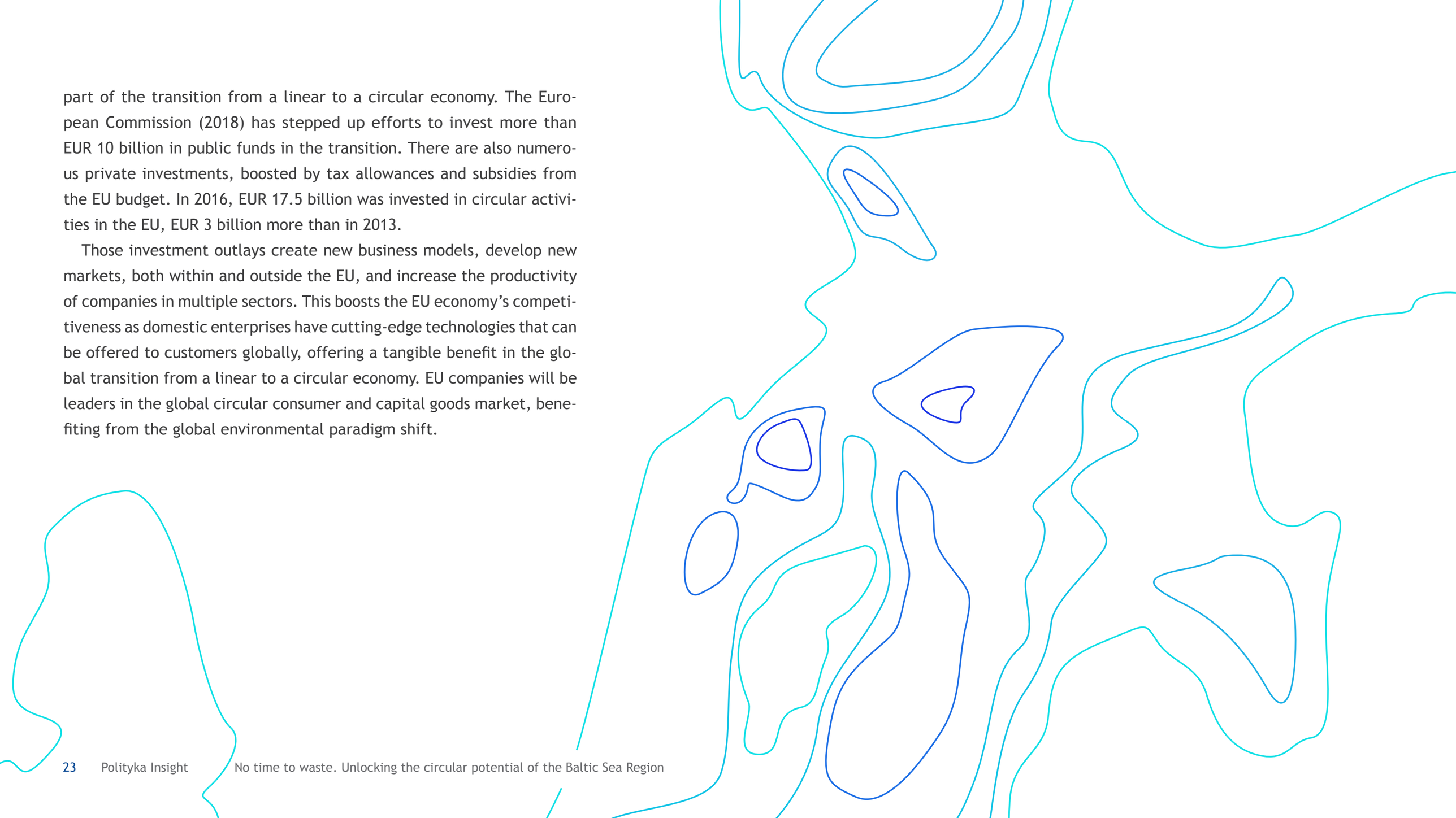
Adapting these changes would induce significant multiplier effects and positive externalities. In total, moving away from a linear economy could save Europe EUR 1.8 trillion per year. This in turn would increase households' disposable income by 11 percentage points and GDP by 7 percentage point in 2030 compared to the linear development scenario. These calculations are already adjusted for the rebound effects described by degrowth theorists (i.e. higher consumption and investment spending on non-recyclable goods), amounting to EUR 0.3 trillion per year.

Higher GDP would push up employment, mainly in the circular economy sectors, as increased spending fueled by lower prices and additional green investment would increase demand for labour. According to a report by the European Commission (2019), implementing the EU Action Plan for the Circular Economy increased employment in circular sectors by more than four million workers, a 6 percent increase compared to 2012 (CHART 2.). Simulations by the Commission (2018) suggest that implementing this strategy in full would bring net increase in employment of 700,000 by 2030, compared to the baseline scenario; over 600,000 of which would be in the waste management sector, almost 300,000 in the service sector and more than 50,000 at repair and installations enterprises. This increase would be partially offset by a drop in employment in construction by almost 200,000 jobs and over 100,000 in various branches of manufacturing. This process should be of benefit, both to the economy and to workers, as the newly created jobs involve also many highly-paid, non-routine cognitive tasks and knowledge intensive positions. These benefits will come, however, only under the condition that the government strengthens labour market information, help workers to move from declining firms and sectors to growing ones, while providing income security, and assure worker rights in growing green sectors (OECD 2012).

Investment outlays on designing circular products, as well as renewable energy generation and waste management facilities, are a crucial

part of the transition from a linear to a circular economy. The European Commission (2018) has stepped up efforts to invest more than EUR 10 billion in public funds in the transition. There are also numerous private investments, boosted by tax allowances and subsidies from the EU budget. In 2016, EUR 17.5 billion was invested in circular activities in the EU, EUR 3 billion more than in 2013.

Those investment outlays create new business models, develop new markets, both within and outside the EU, and increase the productivity of companies in multiple sectors. This boosts the EU economy's competitiveness as domestic enterprises have cutting-edge technologies that can be offered to customers globally, offering a tangible benefit in the global transition from a linear to a circular economy. EU companies will be leaders in the global circular consumer and capital goods market, benefiting from the global environmental paradigm shift.



3. Circular approaches to resources

The standard old-fashioned way of resource use in an economy is linear: take-make-consume-dispose. In a circular economy, all these steps are inter-related, recurring continuously. In an ideal world, none of the materials used are wasted and everything disposed of is reused in the “make” part, so that the “take” part fully disappears. This requires altering the means of production and consumption at each stage of the process. In our research on the circular economy in the Baltic Sea Region (BSR), we assess the extent to which the structure of each country’s economy resembles the perfectly circular movement of materials and how this process is achieved through environmental, consumption and energy policies. For that purpose we created our own and innovative Circular Economy Advancement (CEA) index that measures the shifts from linear to a circular economy of BSR countries in four categories: retake, reuse, deconsume and recycle. The goal of this exercise is not to praise some countries and reprehend others, but to enhance the discussion on the progress that was already made in the BSR region and what more has to be done to provide more circular economy business model across this macroregion, i.e. to identify best practices and areas in which a faster transition is needed.

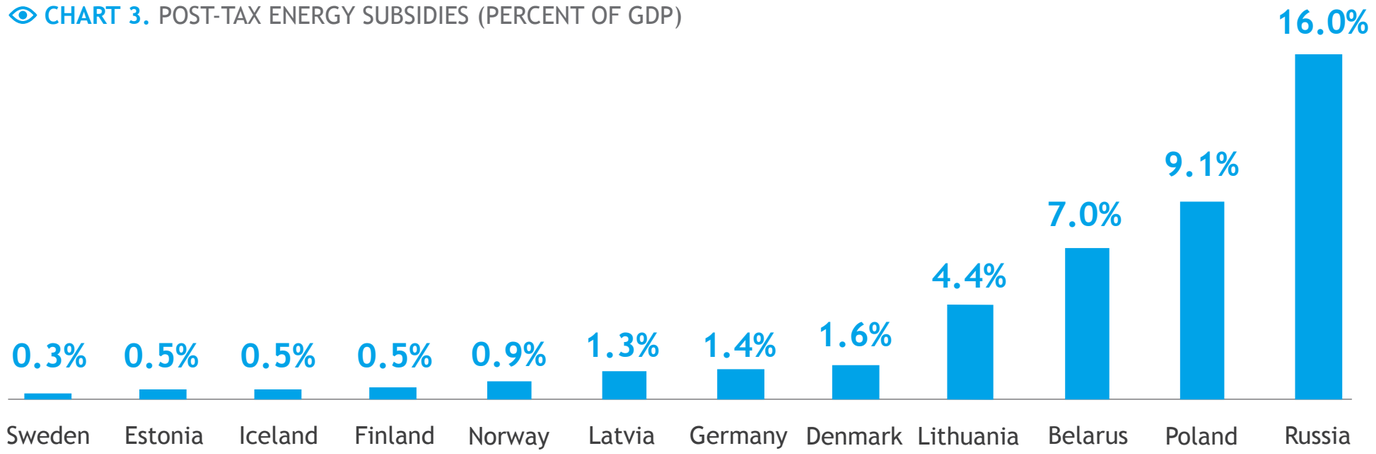
3.1 Retake

The most important yardstick of a circular economy is how much we take from the natural environment and use in the production process. In a perfect world, enterprises would not use any materials – of domestic or foreign origin – to create goods that are later sold to consumers and then disposed of. This would be a non-material economy without growth and without GDP as we know it. Of course, this is an utopian vision. Still, we can try to minimize the use of materials in the production process and – if they are indispensable for creating goods that people truly need – use only recycled or easily renewable ones, i.e. simply retake again what has already been taken from the natural environment.

The state can catalyze this process or hold it back through various incentives and legal regulations. Some of them can be measured (e.g. subsidies), while others can only be assessed through their effects (e.g. recycling obligations). A key part of these regulations concern conventional energy generation, as coal mining is one of the worst uses of materials for the environment. The scope of state subsidies for the coal sector (from mines to electricity distributors) is an important characteristic of the linear economic model. In countries where this sector is heavily subsidised the transition to a circular economy is largely impeded.

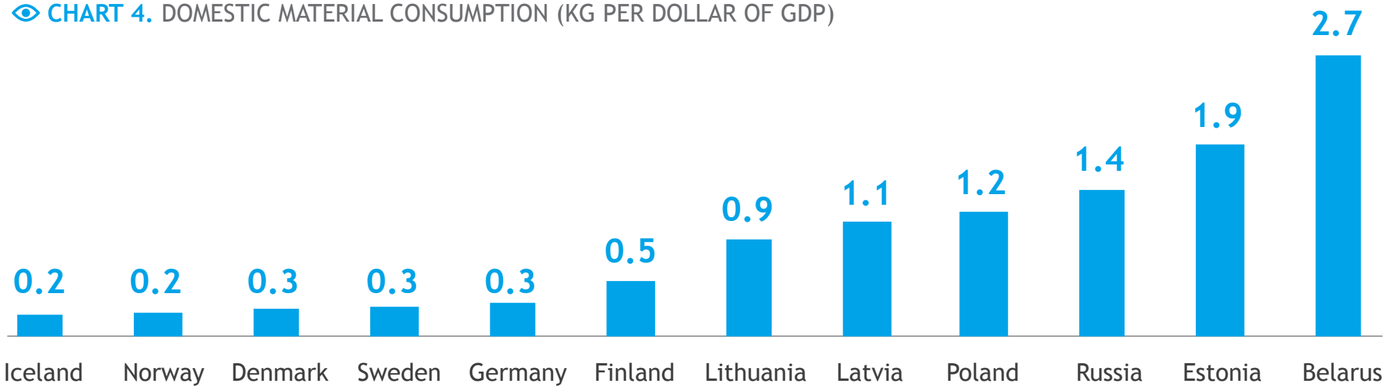
Another important part of government policy that needs to be considered is the protection of the natural environment. In the modern economy, use of wood, coal, oil and water remains inevitable, but the state can offset the negative externalities through various actions, from planting trees, through reclaiming mining landscapes, to preserving areas crucial to maintaining ecosystems' self-regeneration. This can be grasped by analyzing spending on protecting the environment and industrial zoning laws.

CHART 3. POST-TAX ENERGY SUBSIDIES (PERCENT OF GDP)



Source: OECD (2015).

CHART 4. DOMESTIC MATERIAL CONSUMPTION (KG PER DOLLAR OF GDP)



Source: UN (2016).

Also entrepreneurs can accelerate the circular economy transition by themselves through applying new business models, like the circular supply model in which companies replace in the production process traditional material inputs derived from virgin resources with bio-based, renewable or recovered materials (OECD 2018). This especially includes enhanced efforts in product design, so that new products can to a larger extent be based on circular goods (see next subsection).

To measure this key dimension of the circular economy, we consider domestic material consumption in kilogrammes per USD 1 of GDP (negative), the share of circular material in total material use in a given economy (positive), post-tax energy subsidies as percentage of GDP (negative) and the share of spending on environmental protection in total national expenditure (positive). Based on these, we construct the "retake" index, which ranges from 0 to 100 percent. It is 100 percent in countries with the highest (or lowest, for negative indicators) value for each variable in the whole BSR group. This means that the "retake" part of the economy is closest to the circular model (among the countries analysed). See the Appendix for data sources and the computational algorithm.

3.2 Reuse

The production process in a given economy is key to achieving a circular movement of materials between consumers and producers. The energy efficiency, carbon footprint and recyclability of goods directly affect other stages of material usage and disposal. Low-material and low-energy production – in which intermediate goods are used efficiently and companies generate a high value added from every unit of material and energy used – create lower demand for commodities and are better for the environment. This can be achieved by introducing norms, production targets or taxes on the production of goods with a high CO_2 or material footprint, along with public R&D spending on research on more circular means of production, that are based on reusing and remanufacturing of the materials that are already circulating in the economy.

These policies offer significant benefits in the long run, but disrupt existing business models in the short run. Stakeholder involvement is essential at every step of the process, from policy design to implementation. There is high potential for cross-sectoral synergies, through which businesses and governments (both local and national) can benefit from the transition to more circular production. One example is promoting green public procurement, in which companies with more sustainable business models have a competitive advantage over more polluting ones when applying for public contracts. This encourages market participants to invest in R&D into green technologies, which can be supported through government or EU funding.

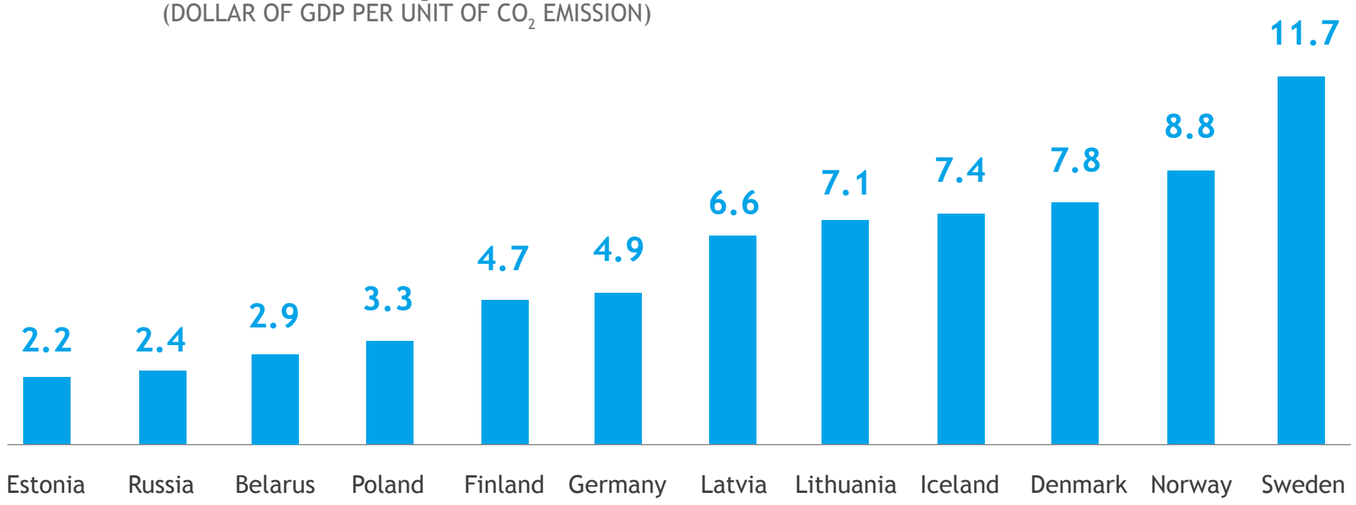
As described in Chapter 2.2, the circular economy can be a large and highly profitable part of the value chain, increasing a country's competitive advantage. Circular economy business models boost productivity, pushing up margins, especially as conventional energy and raw material price increases steadily. Countries with a high share of GDP, investment and employment in the circular economy are usually more productive, yield higher profits and excel in other parts of the retake-reuse-deconsume-recycle cycle.

Reused materials play a crucial role in production. Entrepreneurs have variety of manufacturing technologies to choose from, some of which use more secondary materials than others. In a perfectly circular economy, waste and renewable inputs (such as water) are the only intermediate goods. This kind of manufacturing is still largely unavailable, except for narrow parts of industry, but R&D spending on it should be increased. Countries where entrepreneurs are focused on increasing recycled material use can benefit from positive externalities, but also from synergies and higher productivity in the whole economy. After new circular modes of production are introduced, something that was treated as waste and had to be disposed of responsibly, incurring transaction costs, can be now used as material input, which decreases the unit cost of production and eliminates the transaction cost of disposal. This makes public spending more efficient (lower spending on waste management) and increases private entrepreneurs' profits, while generating additional employment in the circular economy sector.

Another important aspect of moving towards a circular economy in the "reuse" dimension is product design. Although extracting raw materials from waste through recycling is beneficial, significant value is lost in the process. Policy can therefore be designed to prevent products from becoming waste, stimulate their reusage or at least delay their disposal. This can be done by making products reparable, lasting and upgradeable, i.e. by introducing product life extension business models. Possible policy measures include developing product requirements and increasing producer responsibility for a product until its end-of-life, preventing planned obsolescence.

We calculated the "reuse" index based on nine variables. Three of them describe the circular efficiency of the whole economy (non-energy material productivity, production-based CO_2 productivity (CHART 5.) and share of renewable energy in gross final energy consumption), while six measure the size of the circular economy and entrepreneurial activity in that area (value added, investment and employment shares relating to the circular economy sector, circular economy activities undertaken by companies, declared investment in resource efficiency and the share of patents relating to recycling and secondary material usage). The better a country does in each area, the higher the index. The best performer in all nine categories at the same time scores 100 percent.

CHART 5. PRODUCTION-BASED CO_2 PRODUCTIVITY (DOLLAR OF GDP PER UNIT OF CO_2 EMISSION)



Source: OECD (2016).

3.3 Deconsume

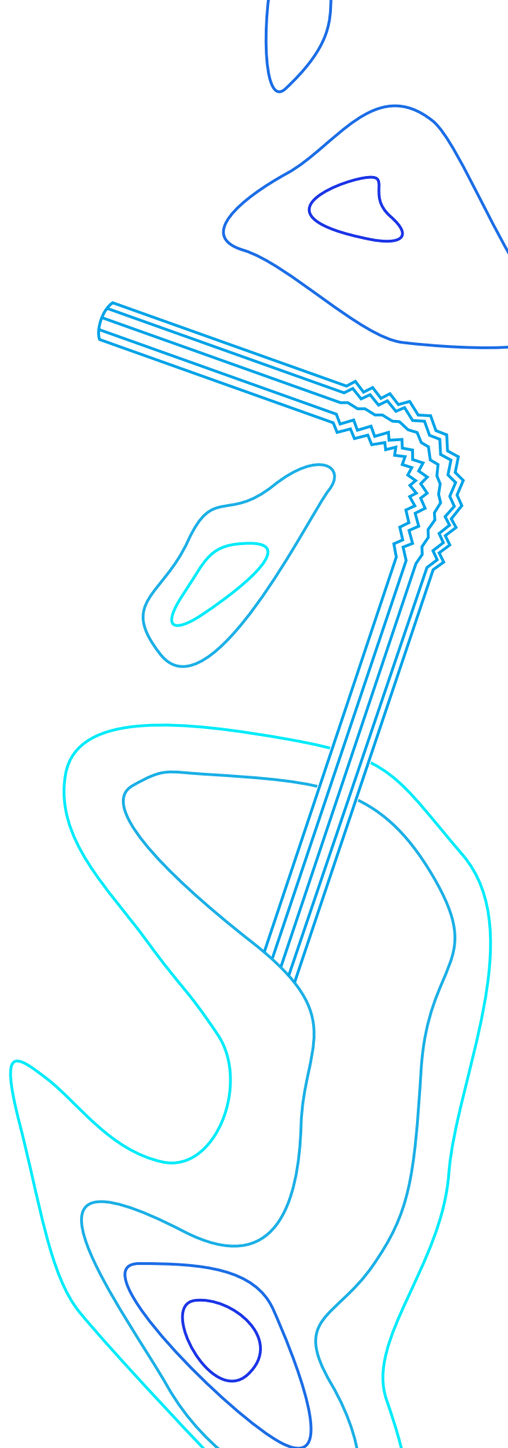
Every analysis of the circular economy eventually leads to consumer attitudes, habits and unintended actions, as the recursive flow of materials in a country largely depends on the individual consumers' decision. If they decide to consume less, use less energy and buy goods made of secondary materials that are easily degradable and have a low CO_2 footprint, producers and the state will adjust and increase their supply. In contrast, if consumers ignore how goods are produced, focus solely on increasing their consumption and do not care about waste disposal, almost no environmental policy can transform the economy from linear to circular. Moving towards responsible consumption requires a long-term strategy of building incentives and ecological awareness. Two complementary policies can be used: (1) regulatory and tax-based measures and (2) educational and subsidy-based measures.

The regulatory approach draws on how prices are the main driver of consumer behaviour. At least initially, recyclable products with longer lifecycles and a low carbon and environmental footprint will be more expensive than their "linear" equivalents, if one leaves out the costs of negative externalities. There are two basic ways to include externalities in the price. Firstly, taxes can be used. The most common conception is the Pigouvian tax, which raise the price of "linear" equivalents by imposing a tax proportional to the estimated cost of negative externalities. Pigouvian taxes and other regulatory measures are most common for GHG emissions and waste management.

Secondly, allowances, cap and trade schemes and quotas can be used to limit the supply and therefore consumption of products with a high carbon footprint and that are not easy to recycle. One example is the EU Emissions Trading System, which increases the price of energy production from fossil fuels imposing a cost on CO_2 emissions. This eventually drives electricity prices and creates incentives to use less energy and buy more energy efficient durable goods. The most radical option is to ban or phase-out certain types of products. This is the case with the EU directive on single-use plastics, which bans certain plastic products for which non-plastic equivalents exist.

For regulatory measures to be fully efficient, there must be synergies both internally (with production stakeholders) and across borders, through macro-regional cooperation. A carbon footprint, negative externalities and waste disposal can easily be shifted across borders, especially within the single market. Taxes, allowances and quotas must be introduced across the EU, ideally in cooperation with third countries.

The second group of policies mainly involves spreading environmental awareness. This places more responsibility for the transition to a circular economy on consumers. Policymakers should merely create an institutional environment that allows behavioural change. Education is key. Introducing the concepts of circularity, sustainability, responsible growth and care for the environment must start at primary school. Funding for these kinds of programmes must be ensured. Public universities and research centres can be incentivized to launch programmes on the circular economy, like in the Netherlands.



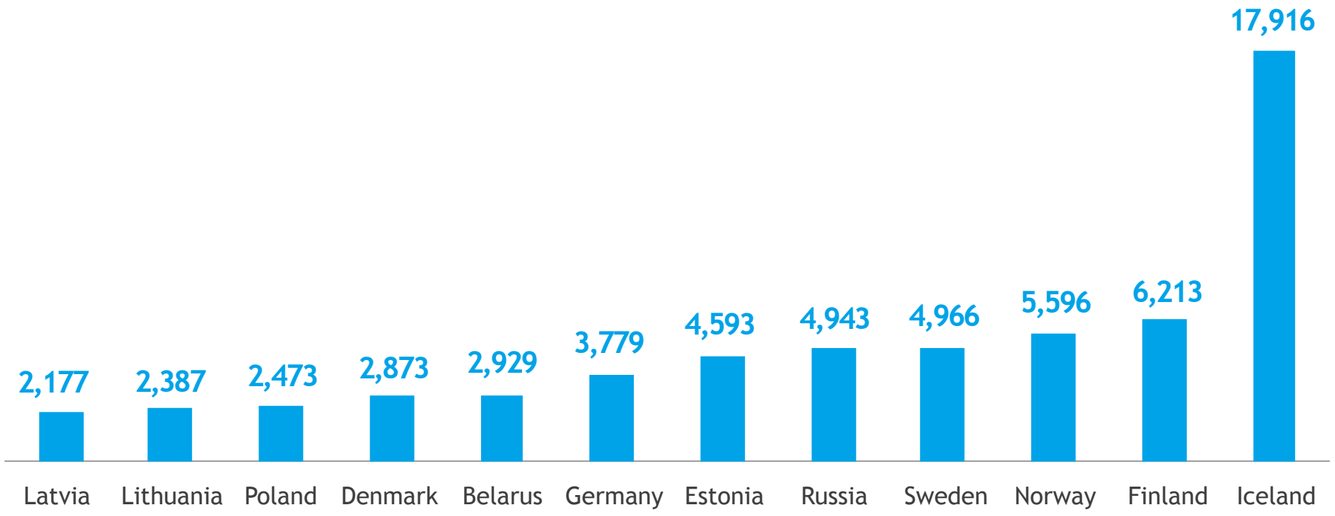
This concept's second pillar involves providing information on products, their carbon footprint, their recyclability and negative externalities. Awareness can be raised through publicity campaigns, access to information (for example, through government websites) and events. Labelling can also help transform customer behaviour. A good example is EU eco labelling of new products making them more energy efficient. This not only targets green-minded consumers, but also people who want to save money on energy or choose durable goods (in that case, not only the price matters).

Consumers can also be incentivized to reuse or repair, rather than consume new products, which enhances the circular movement of goods in the economy. This type of policy works best at the local level. Initiatives include organizing repair workshops and second-hand shops in cities, which can be subsidised through tax exemptions or lower rent. Local authorities or non-profits established with support from municipalities can also coordinate online resale platforms and garage sales. There is considerable potential for synergy, as these actions involve cooperation between local authorities, NGOs and SMEs.

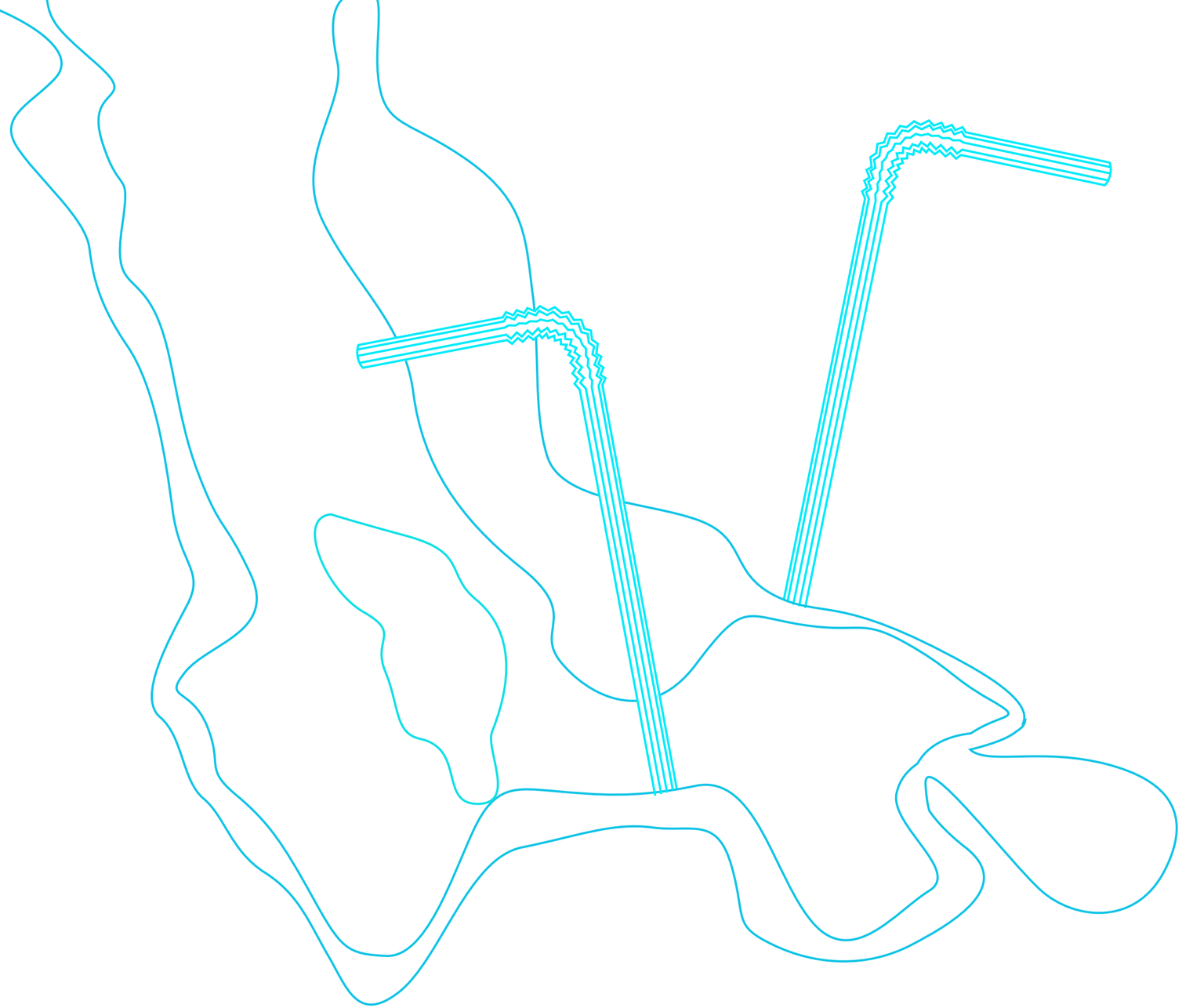
Consumers can facilitate the transition to a circular economy through closer cooperation through sharing, which is a crucial circular economy business model. Thanks to new technologies, like e-platforms, consumers can co-use goods and resources, from tools to cars and apartments or parking lots. This makes the use of resources more efficient and decreases the demand for new goods, virgin raw materials and extends the life-time usage efficiency of goods (e.g. a typical European car is parked 92 percent of time and despite having 5 seats carries on average 1.5 passengers per trip [Ellen MacArthur Foundation 2015]). Governments can create a regulatory environment in which these business models can thrive.

There is a caveat, though: sharing economy platforms can have unintended consequences as they sometimes lead to a decrease in prices and hence an increase in consumption. In the US, where ride-sharing apps are most widespread, they have contributed to the decline in public transport, which remains the most environmentally efficient way of travelling, increasing congestion in urban areas. Urban planning policies are needed to make public transport and non-polluting vehicles (e.g. bicycles, electric scooters) faster and minimise commuting time for pedestrians.

CHART 6. ENERGY CONSUMPTION (KG OF OIL EQUIVALENT PER CAPITA)



Source: World Bank (2014).



Another dimension of the sharing economy is prosumption, especially in the energy sector, were individual consumers can become producers and sell their excessive supply in the market, reducing global production capacity requirements. For example, investing in small wind energy turbines can reduce the demand for large and CO_2-intensive power plants, especially in BSR countries that exhibit a high share of coal in the energy generation mix.

Implementing incentive-based instruments requires complementary action at the national and local level. High synergy can be achieved when municipalities execute strategies created by the central government. As a result, incentive-based policies are best introduced in highly coordinated institutional environments; in countries with centralised governments (China) or with close collaboration between local government units (Switzerland).

Even with these conditions and synergies, fostering greener attitudes and, eventually, consumer actions takes time. The latter requires a certain level of economic development and a favourable institutional environment, as attitudes are not turned into actions automatically. The goods desired by consumers must be available at reasonable prices.

To measure the “deconsume” index, we used a variety of social indicators that are a yardstick for green attitudes (willingness to pay for environmental protection, awareness of the negative externalities of human activity) and actions (joining NGOs that protect the environment, volunteering for environmental conservation projects), as well as macroeconomic variables that measure the demand-based carbon footprint of an economy and energy use by consumers.

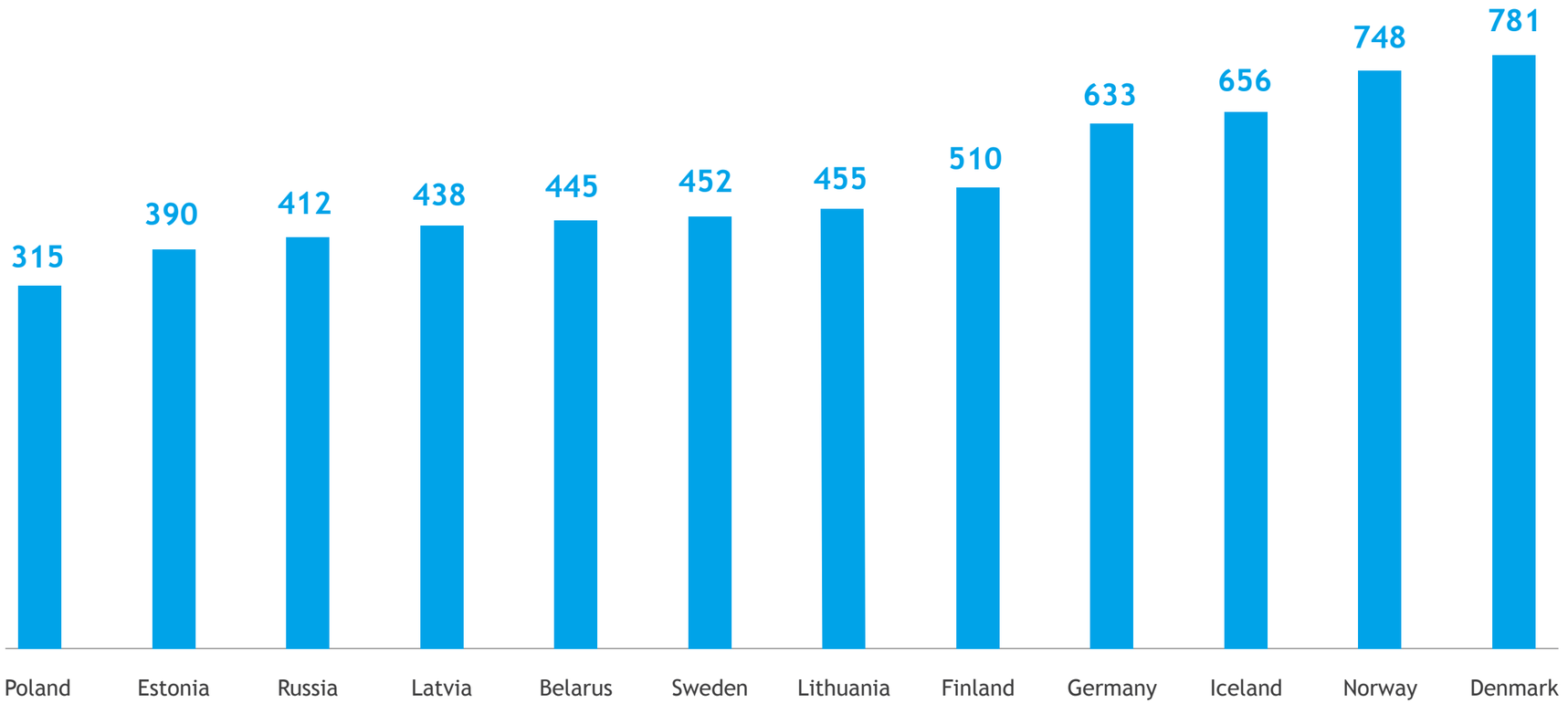
3.4 Recycle

In the linear-model economy, everything that is consumed is disposed of as waste. In contrast, in a circular economy, everything is recycled and almost no waste is generated. In reality, BSR countries' economies are on the continuum between these two models. Some goods are reused in the production process as materials, while others are disposed in a more or less harmful way for the environment. To establish an economy's place on this continuum, its waste treatment must be considered. Firstly, this involves looking at how many materials are recycled from disposed products; both final and intermediate goods, from municipal waste to packaging, via e-waste, bio-waste and construction waste. The scope of material recycling is highly influenced by regulatory public policy, as the sorting of waste, its treatment and fines for illegal waste disposal are largely in the hands of municipalities. They have to provide appropriate infrastructure and waste-handling services, as well as enforce recycling rules.

Secondly, it means examining how much waste is generated (CHART 7.) and how this affects the natural environment. This can be analysed in terms of elements, as the disposal of by-products or consumer goods can affect water, air and land. Again, public policies that affect this part of the circular economy are mostly controlled by municipalities, but they can be improved through synergies – both on the local-national-macro-regional axis and state-business axis. Water and air pollution must be controlled at the EU level, as air pollution in one member state often affects the environment in another, as was the case on the Polish-Czech border for many years. GHG emissions contribution to climate change affects all countries, irrespective of national borders. Businesses must be made more aware of the negative externalities of their mode of production, so that they can work with local officials to decrease pollution.

The "recycle" index was constructed using the data on six factors: urban wastewater treatment, three indicators of air pollution (GHG, CO_2 and PM 2.5 emissions), the share of total waste that is recycled or composted, and municipal waste per capita. All of these, except the data on wastewater treatment and recycling, have a negative effect on the index; a higher indicator means a lower index value.

CHART 7. GENERATION OF MUNICIPAL WASTE (KG PER CAPITA)



Source: World Bank (2017).

4. The current state of circularity in the BSR

4.1 Introduction to EU initiatives for developing the circular economy

The EU started prioritizing the circular economy in legislative terms in December 2015, when the European Commission adopted the Circular Economy Action Plan. It listed 54 actions aiming to improve waste management and introduce a more sustainable production, consumption and cycles of secondary raw materials in the EU. They were divided into five priority sectors: plastics, food waste, biomass and bio-based products, critical raw materials, and construction and demolition. These actions have been systematically implemented then. The process was finalized by the adoption of the Final Circular Economy Package by the Commission in March 2019. Some of the initiatives relating to the Circular Economy implemented by the Commission are listed in the annex.

CHART 8. EXAMPLES OF CIRCULAR ECONOMY POLICIES AND THEIR IMPLEMENTATION IN THE BSR*

 implemented  in progress  not implemented

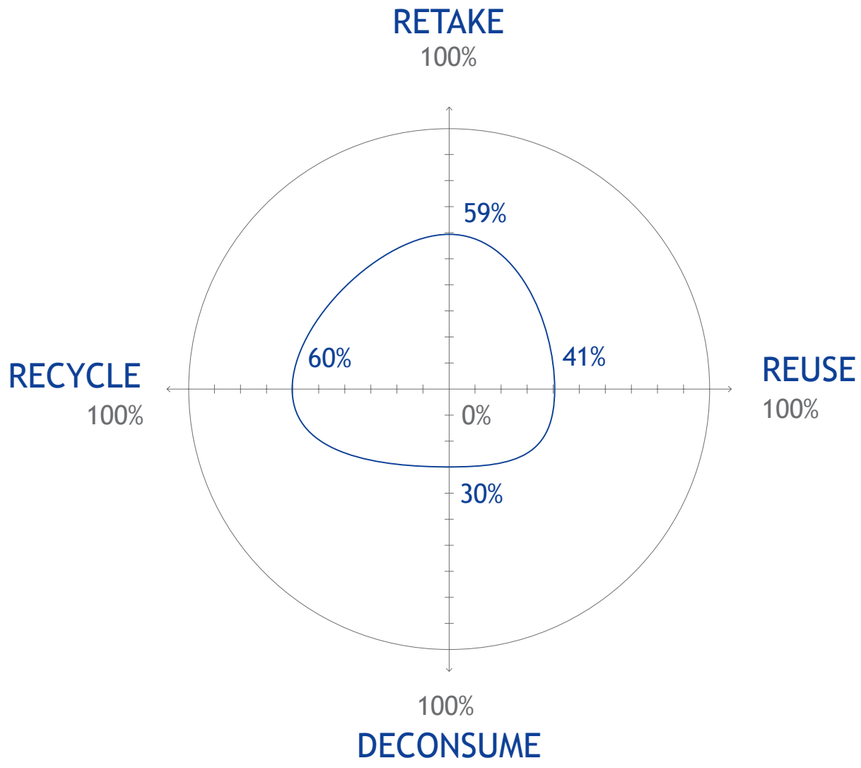
	Poland	Germany	Estonia	Latvia	Lithuania	Denmark	Finland	Sweden	Norway	Iceland	Belarus	Russia
Circular economy strategy												
Deposit schemes for plastic bottles												
Circular economy promotion/education	 planned											
Coal phaseout announced/no coal plants		coal phase out in 2038 or 2035	(no coal)	(no coal)	(no coal)	(2030)	(2029)	(2022)	(no coal)	(no coal)		
Internal combustion engine phaseout announced						(2030)		(2030)	(2025)	(2030)		

*As of March 2019

4.2 Poland

Overview of key indicators

Poland scored 42 percent in our CEA index. It has the best results in the "recycle" and "retake" index, scoring 60 and 59 percent respectively. In the "reuse" and "deconsume" index, it received 41 and 30 percent.



Poland's otherwise satisfactory result in the "retake" index is lowered by the relative material-inefficiency of its economy: it takes about 1.22 kg of material to produce USD 1 of Polish GDP, compared to just 0.24 kg in Norway. In addition, it has high levels of post-tax energy subsidies compared to other countries in the BSR due to extensive state assistance for coal mining.

Poland's "reuse" index result was calculated based on variables such as the percentage of companies that undertake circular economy activities. 62 percent of companies surveyed confirmed that they do. Yet the share of renewable energy in gross final energy consumption is a low 11.3 percent, compared to 72.6 percent in Iceland and 69.4 percent in Norway.

For the "deconsume" index, Poland's results are based on measures such as the share of environmental taxes in total tax revenue (7.9 percent, in line with other countries) and energy use, which is 2,473.4 kg of oil equivalent per capita, much lower than Germany's 3,779.46 kg.

Poland's score in the "recycle" indicators is divergent. The result for urban waste water treatment is meagre, with just 58.9 percent of waste water undergoing tertiary treatment (in Germany, it is 92.9 percent). 42.5 percent of all waste is recycled or composted, far behind Germany (66 percent) and Iceland (5.7 percent). At the same time, Poles generate just 315 kg of municipal waste per capita, less than a half the amount in Denmark (781 kg) and Norway (748 kg).

Overall, Poland has a long way to go before becoming a circular economy. The Polish government claims to be taking steps to improve some of the indicators. The key initiative will be adopting the "Roadmap for

transformation in the direction of a circular economy". Based on it, individual ministers will draft new regulations relating to the water, environmental protection and mining laws.

Legislation

Like most EU member states, Poland has not yet implemented the legislative acts proposed by the Commission as part of its Circular Economy Action Plan. However, it has already implemented earlier EU legislation. A recent example is the Plastic Bags Directive, which was implemented through obligatory fees for plastic bags.

Over the next few years, the Polish legal system will be adapted to moving towards a circular economy. The government established a working team for the circular economy on June 24, 2016. It is supposed to identify opportunities and threats in the context of moving towards a circular economy, along with Poland's strengths and weaknesses. This work resulted in the 2019 "Roadmap for transformation in the direction of a circular economy" which still has to be approved before the Parliament's current term ends. According to the Roadmap, moving towards a circular economy is a crucial part of creating a low-emission, resource-efficient, innovative and competitive Polish economy. It will require action at all stages of the life cycle, from acquiring the raw material to waste management, via design, production, consumption and waste collection.

In addition to the Roadmap, the Government is working on a draft "Productivity Strategy" as part of creating conditions for the development of innovative industry, "The State's Environmental Policy 2030", which is waiting to be adopted by the government. The "National waste management plan 2022" adopted by the cabinet on July 1, 2016, which entered force on August 12 that year, also relates to the strategy. These documents mention the need for Poland to move towards a circular economy.

The Polish government intends to take legislative steps in certain areas to start moving towards a circular economy. One idea is to change the tax law to help companies operating based on circular business models to become more competitive. The government also plans to amend the law on public procurement, which would generate demand for products and goods created based on circular business models. The next initiative will focus on establishing a National Smart Specialisation for the circular economy. It will help companies grant public aid in compliance with EU law. The government is mulling a system of incentives for universities to introduce research programmes and teaching relating to the circular economy. It is also considering designing a support ecosystem for companies with circular business models, spanning funding, education, promotion and the commercialisation of green technology.

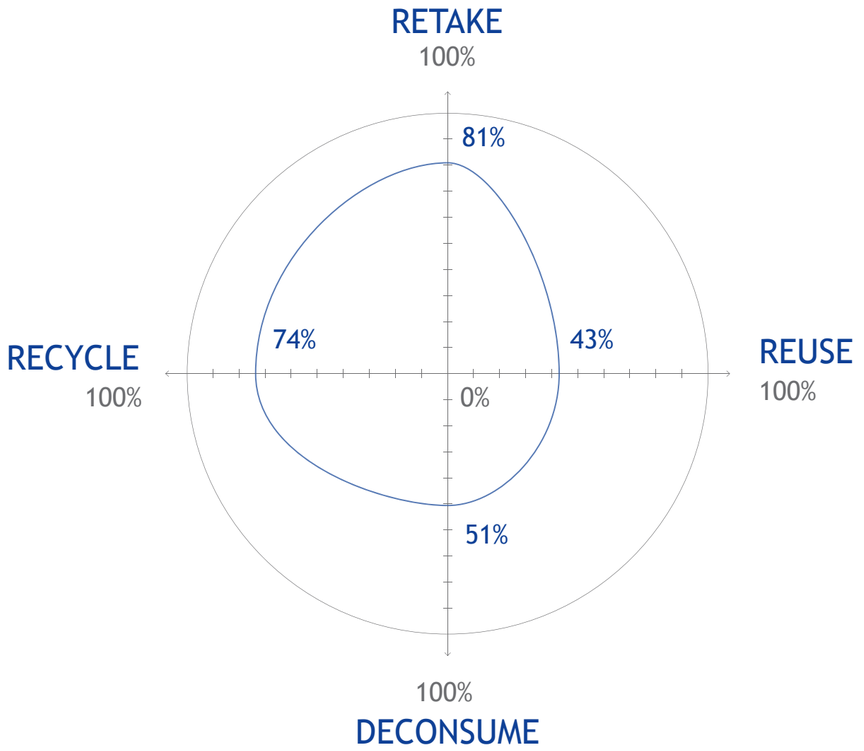
4.3 Germany

Overview of key indicators

Germany scored 48 percent in our CEA index. It did best in the “retake” and “recycle” indicators, scoring 81 and 74 percent respectively. It did worse in the “reuse” and “deconsume” indicators; 43 and 51 percent.

When it comes to the circular use of materials in the “retake” indicator, Germany is doing well compared to other countries in the BSR. 11 percent of total material use is circular, just behind the leader, Estonia (12 percent). Poland (10 percent) and Denmark (8 percent) are close behind. The German economy is very material-efficient: it takes about 0.32 kg of material to produce USD 1 of GDP. Iceland (0.22 kg), Norway (0.24 kg), Denmark (0.26 kg) and Sweden (0.30 kg) are slightly better. There is room for improvement on post-tax energy subsidies, which constitute 1.4 percent of German GDP. Countries such as Sweden, Iceland, Finland and Estonia have a lower percentage.

However, Germany could improve in the “reuse” and “deconsume” indicator. For example, just 0.01 percent of patents relate to recycling and secondary raw materials. In 2016, the share of renewable energy in gross final energy consumption was just 14.8 percent, significantly behind the Baltic and Nordic states. However, renewable energy production has been growing rapidly in Germany in recent years. A striking 78 percent of German companies undertake circular economy activities. The German economy is also rather energy-consuming: energy use is 3,779.46 kg of oil equivalent per capita, much more than Poland’s 2,473.41 kg.



In the “recycle” indicator, Germany is the best at recycling and composting waste; 66 percent of all waste is processed in that way. The country is even ahead of Iceland (58.7 percent). It also recycles bio-waste efficiently (117 kg per capita). Only Lithuania is close to this level, with 109 kg per capita.

Overall, Germany's circular transition is under way in many areas. The biggest challenge for policymakers will be to overcome huge levels of consumption and demand for energy.

Legislation

The key legal act regulating Germany's move towards a circular economy is the Circular Economy Act (KrWG), which entered force on June 1, 2012. It implements Directive 2008/98/EC of the European Parliament and Council of November 19, 2008 on waste. It seeks to promote the circular economy to protect natural resources, health and the environment for future generations. The German law establishes a five-stage hierarchy setting out the basic sequence of waste prevention, reuse and recycling, including recovering energy from waste and disposal. KrWG also specifies the rules for producers taking responsibility during the life cycle of their products, with incentives to produce durable items. The law also states that 65 percent of municipal waste should be reusable or recyclable by 2020.

The law on packaging (VerpackG) in place since January 1, 2019 is also relevant. It aims to promote recycling and reduce the volume of packaging waste. It raises the targets for the percentage of plastic packaging that should be recyclable to 63 percent by 2022 (it is currently 36 percent). For metal, glass and paper, the target will be 90 percent. The new regulations apply to domestic producers, importers and online traders. The law also established a Central Packaging Registry (Zentrale Stellemit dem Verpackungsregister – LUCID), which enables citizens to check whether producers comply with obligations to respect recycling standards.

On June 1, 2017, an amendment to the Electrical and Electronic Equipment Act (ElektroG) entered force, requiring producers of electronic equipment to take in electro-waste. The provisions serve to reduce it and regulate how it can be reused. It introduces categories of electronic products, with rules for dealing with them.

Germany ranks third in the EU's 2017 Eco-innovation Scoreboard. Yet according to the Commission, it has arrears in moving towards a circular economy. The German government has prepared a series of documents that seek to introduce a circular economy in various areas of economic and social life. The main document setting out Germany's general aims on sustainable development, which the circular economy is part of, is the German Sustainable Development Strategy (Die Deutsche Nachhaltigkeitsstrategie) adopted by the federal government on January 11, 2017. Its aims include applying sustainable consumption and industrial production formulas based on a closed production cycle. In February 2018, the federal government adopted the National Programme for Sustainable Consumption (Das Nationale Programm für nachhaltigen Konsum), which is significant from the circular economy's perspective as it points to a need to consider the environmental and reuse of waste in social education, industrial design and public procurement. The programme also proposes to increase spending on R&D relating to sustainable consumption in Germany.

In 2012, the federal government adopted the first Germany Resource Efficiency Programme (Überblick zum Deutschen Ressourceneffizienz-programm [ProgRess]), which is updated every four years. One of its strategic aims is to develop a circular economy that uses raw materials efficiently. The federal government wants the German economy and industrial production to become less based on primary raw materials. It aims to increase support for initiatives preventing the waste of raw materials and wider use of recycled products. The programme contains a list of efforts by the federal government, German Länder (regions) and social and professional organisations to move towards an economy that consumes less resources and is more efficient.

4.4 Estonia, Latvia, Lithuania

Overview of key indicators

Estonia scored 47 percent, Latvia 39 percent and Lithuania 46 percent in our CEA index. Estonia outclasses its Baltic counterparts in the "retake" dimension. Circular materials account for 12 percent of material used in Estonia; in Latvia and Lithuania, it is 4 percent and 5 percent respectively. Moreover, 3.9 percent of Estonia's trade comes from transactions involving recyclable raw materials, 1.1 and 1.9 pp more than for Latvia and Lithuania. Accordingly, the "retake" indicators when aggregated gave Estonia a score of 92 percent, the best in the BSR. Latvia scored 56 percent and Lithuania – 55 percent.

Moving on to "reuse", in all the Baltic States, private investment, jobs and gross value added relating to the circular economy sectors makes up between 1 and 1.1 percent of the countries' GDP and contributes to 2–3 percent of total employment. Latvia is the only state where most companies (54 percent) say they undertake some circular economy activities; this is 47 percent in Lithuania and 44 percent in Estonia. Latvia also leads in terms of the share of renewable energy in gross final energy consumption, which is 37.2 percent, compared to 28.2 percent for Estonia and 25.6 percent for Lithuania. The aggregated "reuse" score of Lithuania and Latvia is the same, reaching 44 percent, whereas Estonia lags in this category with a score of 29 percent.

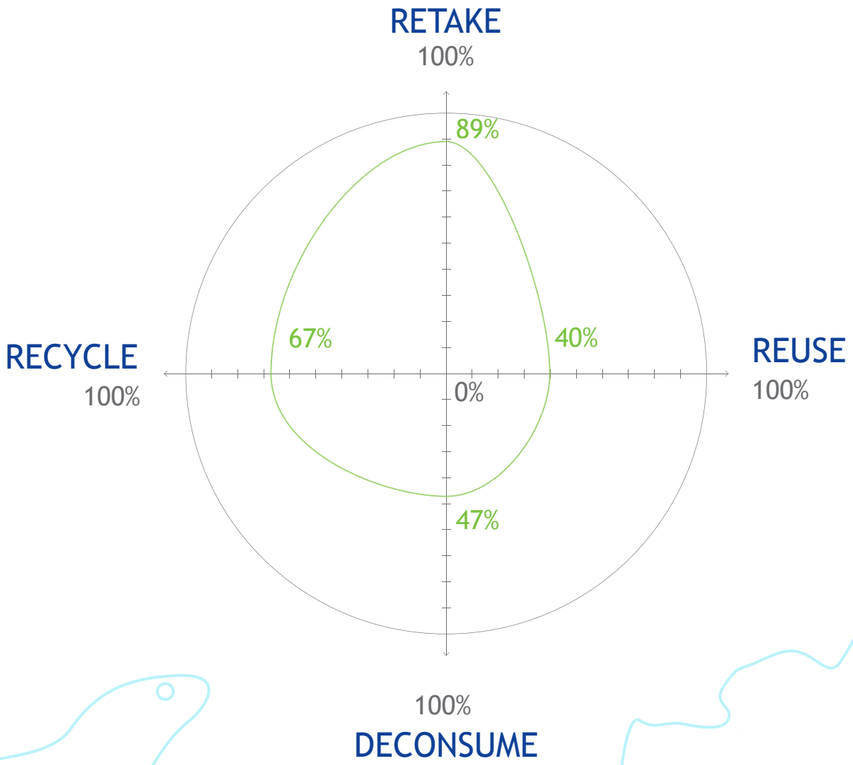
As for "deconsume" indicators, 11 percent of Latvia's, 8 percent of Estonia's and 6.5 percent of Lithuania's tax revenue comes from environmental taxes. Lithuania spends the most on protecting the environment (EUR 697 million), with Latvia at the other end of the spectrum (EUR 386 million). Lithuania leads in this sphere with a score of 72 percent, Latvia is second with 66 percent and Estonia is third with 47 percent.

Finally, moving on to “recycle”, Estonia emits the most GHG and by far the most CO_2 among the Baltic states; the latter amounts to 14.8 m^3 per capita, compared to 4.4 m^3 per capita in Lithuania and 3.5 m^3 per capita in Latvia. Lithuania emits the most PM 2.5, but recycles the most municipal waste. It also generates the most municipal waste per capita (455 kg annually), followed by Latvia (438 kg) and Estonia (390 kg). Estonia generates by far the most waste, excluding major mineral waste, per GDP unit and as a share of domestic material consumption. Accordingly, Estonia and Latvia are almost on par in the “recycle” category with a score of 67 and 66 percent respectively. Latvia lags with a score of 50 percent.

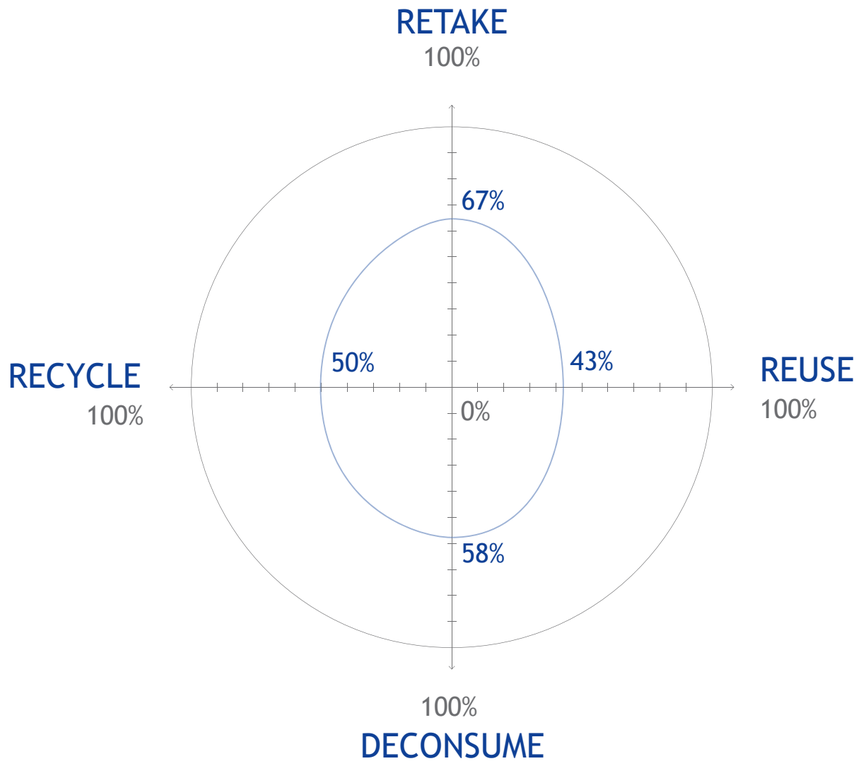
Legislation

Estonia

Like other Baltic States, Estonia is behind when it comes to introducing policies relevant to the circular economy. It has not introduced laws on GHG. The household recycling rate is 32 percent and is unlikely to meet the EU target of 50 percent in 2020. The Estonian government started working on its national Circular Economy Action Plan (nCEAP) in 2018. Preparatory work will continue until the end of 2019, with plans to adopt the document in 2020. The plan will include solutions on investing into resource efficiency and the circular use of materials, resource audits, environmental management systems, promoting start-ups and industrial symbiosis, as well as awareness raising. A new law will be introduced as part of the plan, making GPP obligatory for public institutions. It will also encourage businesses to treat waste as a resource, rather than a burden, for the economy. Currently, Estonia’s share of renewable energy sources in gross energy consumption nears 30 percent, already surpassing its 2020 target of 25 percent. The country takes 65 percent of its renewables from wind and 25 percent from biogas, solar, hydro and waste sources.



Despite the lack of national legislation, there are examples of bottom up circular solutions in Estonian industry. At the company level, Eesti Energia is reclaiming industrial landscapes, recycling company OSAMAT turns oil shale ashes into road construction products and the Estonian Cell AS waste treatment company uses its biological water treatment plant to produce biogas. Also research and educational institutions are already taking further steps to promote the circular economy. Tallinn University of Applied Sciences' Institute of Circular Economy and Technology offers educational programmes, including placement schemes in the circular economy. The Estonian Development Fund and Research Estonia focus on research and foresight analysis, including relating to the circular economy. KredEx financial services provide technology loans in cooperation with the Environmental Investment Centre.



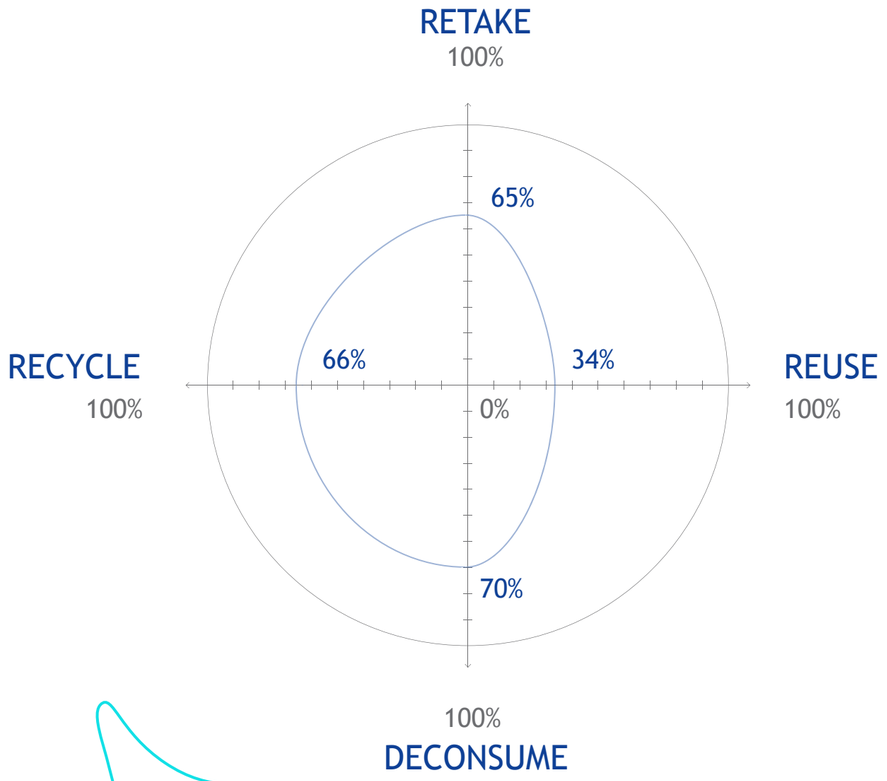
Latvia

Latvia lacks a coherent strategy for moving towards a circular economy, but the government is pursuing separate sectoral initiatives, mainly relating to public procurement and waste targets, that are on par with circular goals. Latvia's Ministry of Environmental Protection and Regional Development introduced a new law on Green Public Procurement (GPP) in July 2017. The regulation identifies product groups and services where GPP is obligatory, including food and catering services, street lightning and office IT equipment. The legislation also lists groups of products and services where GPP is voluntary and presents guidelines for each list of products. In line with EU requirements, Latvia aims to increase the share of recycled and reused waste to 50 percent by 2020 and to 80 percent by 2030. Right now, less than 30 percent of waste is recycled, so the country is unlikely to meet its 2020 target. Latvia generates the second least waste per capita in the EU (1,292 kg, second to Croatia), based on 2016 data.

On a more positive note, Latvia is one of the leaders in the EU in terms of the usage of renewable energy sources as they account for 38 percent of gross final consumption of energy. Hydropower accounts for 97 percent of Latvia's renewable energy production whereas 3 percent are split between wind and biomass. The country is nearing its target of renewable sources contributing 40 percent to Latvia's gross final energy consumption. Moreover, the Latvian government submitted its National Energy and Climate Plan for 2021–2030 to the Commission in December 2018. After incorporating the Commission's suggestions, the Latvian government plans to adopt the plan in the fourth quarter of 2019.

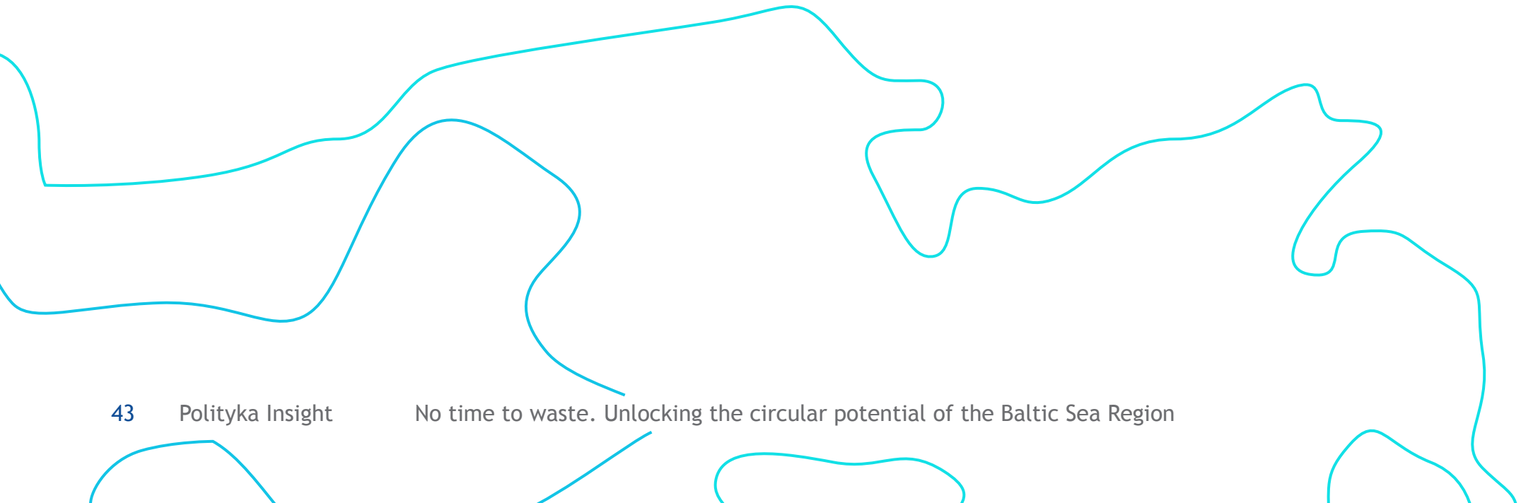
Lithuania

Lithuania does not have a coherent circular economy strategy, nor has the government published plans to introduce one in the near future. However, the country is prioritising the development of waste management infrastructure, energy efficiency and the promotion of renewable energy. The 2001 Law on the Management of Packaging and Packaging Waste has gone through several amendments, most recently in 2012 and 2015, which fulfilled new environmental requirements. Two key changes were introduced. Firstly, the new law provides municipalities with direct subsidies for introducing recycling schemes. Secondly, it obliges all major retailers in the country to accept used glass, metal and plastic packaging from consumers. Incentives for consumers were also introduced; by returning packaging to dispatch boxes, they are rewarded with part of the product's price. The policy has worked: in 2016, 74.4 percent of plastic packaging waste in Lithuania was recycled, the highest percentage in the EU.



These policies aim to help Lithuania reach its national target of recycling 65 percent of household waste by 2020. Yet this target is at odds with the construction of a waste incineration plants in Kaunas and Vilnius, raising the state's incineration capacity for mixed municipal waste to 540,000 tonnes per year. The country currently produces around 1.3 billion tonnes of mixed municipal, so hitting the 65 percent target would leave it with 455,000 tonnes per year, less than the plants' combined capacity. Lithuania's demographics suggests that the amount of waste will decline, casting further doubt on the construction of the incineration plants and threatening the target for recycling household waste.

In addition to legal efforts, non-legislative projects promoting the circular economy in Lithuania have developed in recent years. The Žiedinė Ekonomika (Circular Economy) NGO has been raising awareness, including through staff training sessions and seminars. A project called Kita Forma (Another Form), organised by RV Agentūra, aims to do so through educational programmes.



4.5 Nordic EU member states (Denmark, Finland, Sweden)

Overview of key indicators

In terms of the circular economy indicators, Sweden (48 percent) and Denmark (50 percent) fare relatively well compared to other countries in the BSR. Finland (40 percent) has some catching up to do, as it ranks second-to-last among the EU member states analysed in our study.

When it comes to our indicators related to "retake" category, both Swedish and Danish economies are very efficient in terms of material consumption, with around 0.3 kg of material consumed per USD 1 of GDP. This is slightly better than Germany and well ahead of Poland and the Baltic States. All three countries' energy sectors are moving towards zero emissions, with very low energy subsidies (0.5 per in Finland, 0.3 percent in Sweden), however they lag behind when it comes to national expenditure on environmental protection. Overall, Sweden fares best of all three in this category, as its index of 70 percent in "retake" related indicators ranks four among all countries treated in our study.

In "reuse", Sweden again scores better than Denmark and Finland, with high performance in categories such as production-based CO_2 productivity, declared investment in resource efficiency, circular economy activities undertaken by companies, and share of renewable energy in gross final energy consumption. Its final index for "reuse" of 43 percent would be higher if not for a relatively small size of circular economy sectors both

in terms of value added and employment, as well as low number of recycling-related patents. Finland's performance in "reuse" category scores above that of Denmark, thanks to the fact that more than 50 percent of its energy consumption is satisfied by renewable energy sources, and efforts to shift towards a circular economy in the business sector as 79 percent of Finnish companies say they have been involved in circular activities. According to our results Danish circular economy sector is the smallest among the analysed states for which data is available.

Denmark leads all countries in our study when it comes to "deconsume" indicators (with a score of 80 percent), with Sweden coming in second (73 percent). Denmark fares well when it comes to share of environmental taxes in total tax revenue (8 percent), and has the highest index of proenvironmental actions. Sweden has the highest level of demand-based CO_2 productivity, and ranks second when it comes to proenvironmental attitudes. As for Finland, its demand-based $C0_2$ productivity lags behind the two other Nordic EU member states.

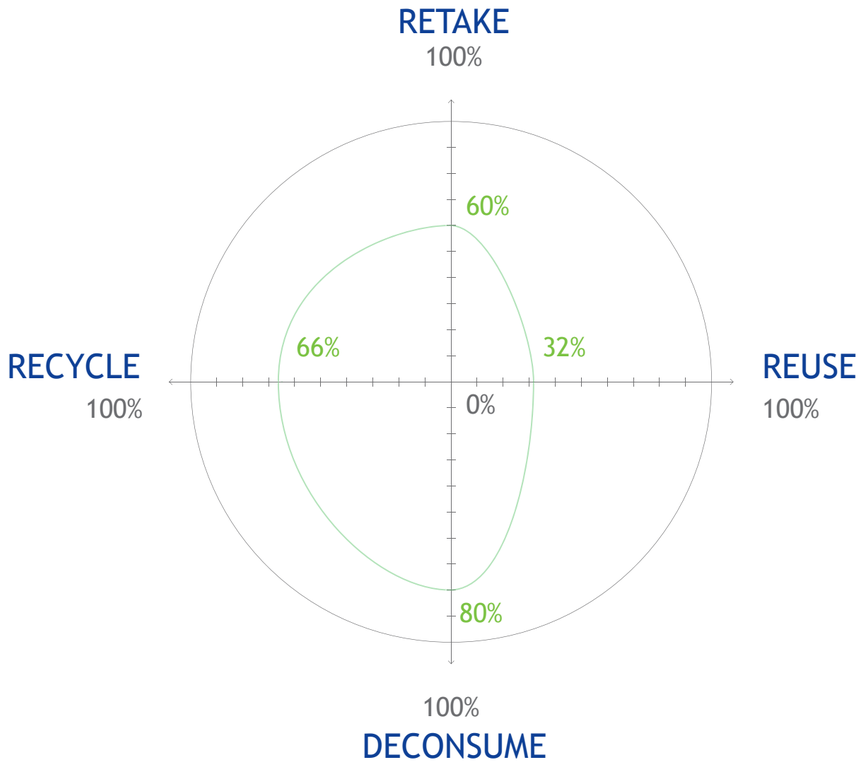
Finally, when it comes to "recycle" indicators, the three Nordic EU member states are doing well, with Sweden leading the way. Denmark, Finland and Sweden are among the top performers when it comes to urban waste water treatment and recycling of packaging waste; in Denmark, the rate is 79 percent (highest of all countries in our study). The areas requiring further work are well known: Denmark produced by far the most municipal waste per capita among the EU members in our study (781 kg, compared to 452 kg in Sweden), while Sweden recovers a low percentage of construction and demolition waste. Finally, all three countries have some way to go when it comes to recycling of municipal waste. With between 40 percent (Finland) and 46 percent (Denmark and Sweden) of municipal waste recycled, they lag behind the leader in the region, Germany (67 percent).

Legislation

Denmark

In December 2018, Denmark published its new strategy on plastic, entitled "plastic without waste". It contains 27 initiatives promoting a sustainable approach to plastic. It continues the country's general waste strategy from 2013, Denmark without waste, and its 2015 successor, Denmark without waste II. While the country is a global leader in producing energy from incinerating waste, much of that waste could be recycled. According to a report commissioned by the Innovation Fund Denmark, 60 percent of all plastic waste is currently incinerated, even though more than 4 million of the country's inhabitants (out of 5.7 million) regularly sort their plastic waste at home. Meanwhile, just 17 percent of household plastic packaging waste is recycled.

Despite the state's willingness to shift from incineration to recycling, the construction of the Amager Bakke waste-to-energy plant in Copenhagen shows that Denmark's long-standing commitment to incineration remains. With the capacity to burn 400,000 tonnes of municipal waste per year, the plant will require continuing import of waste to operate at full capacity. While incineration that generates energy should be part



of efforts to establish a circular economy, the Commission's communiqué on the role of waste-to-energy in the circular economy underlines that it should be limited to its place in the waste hierarchy. However, as we have mentioned before, waste incineration poses threats to the development of the circular economy. For countries with very high rate of waste incineration, the risk is that priority solutions, such as preventing waste, as well as recycling and reusing, are being pushed aside, preventing the loop from being closed.

The renewable energy act of 2018 provides the definition of renewable energy and contains a set of measures promoting renewable energy sources, which include grants for companies, premium tariff for renewable energy, loan guarantees for renewable investments and net-metering. The country is also promoting a transition away from petrol and diesel fuelled cars, as in October 2018 the government announced a ban on sale of new cars with internal combustion engine from 2030 onwards.

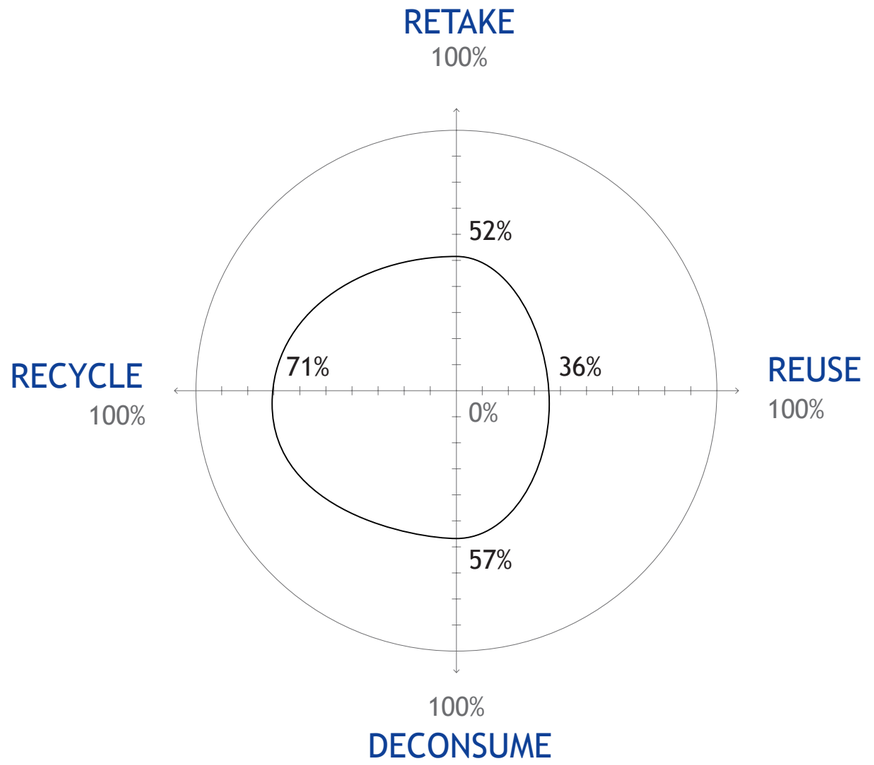
Regarding food waste, the Stop Wasting Food NGO founded in 2008 has been successfully advocating for initiatives aimed at food waste reduction, leading to a decrease in food waste by 25 percent between 2010 and 2015. All supermarkets in Denmark have a food waste reduction strategy and in August 2018, the Danish Environment and Food Ministry announced its intentions to launch a government think-tank to further tackle food waste.

Denmark is prioritising soft law measures and cooperation between the public and private sector, underlining the need for collaborative efforts between business, government and individuals to reduce waste and promote sustainability. The new plastic strategy urges municipalities to implement uniform arrangements for collecting plastic waste separately. Based on a voluntary agreement with the Danish chamber of commerce, several leading retailers committed to halve use of plastic bags by 2023. This will be facilitated by legislative plans by the Ministry of the Environment, which intends to ban light-weight plastic bags. Retailers will have to charge customers for other types of plastic bag.

Finland

Finland was the first country in the world to adopt a national road map to circular economy, the "Finnish road map to a circular economy 2016-2025". Its goal was to make Finland the global leader in the circular economy by 2025. It emphasised five focus areas: 1) a sustainable food system, 2) forest-based loops, 3) technical loops, 4) transport and logistics, and 5) joint actions. While the roadmap is very general and lacks concrete legislative proposals, it emphasises the need to revise key government domains, such as public procurement and taxation. It suggests that Finland should consider radically shifting the focus of taxation, such as moving it away from work and entrepreneurship, towards supporting sustainable growth. Although it is not mentioned, this would probably focus on externalities and consumption. The roadmap also stipulates that Finland propose these tax reforms on the broader, EU scale.

Promoting a circular focus in public procurement, the KEINO Competence Centre supports the Finnish public authorities in sustainable and innovative procurement. The Ministry of the Environment and Ministry of Agriculture and Forestry are also developing a funding mechanism – the environmental impact bonds (EIB) – to attract private investment and channel it into funding projects that contribute to the growth of the circular economy. Like in Denmark, the Finnish emphasises the need to involve the private sector and encourage the development of the circular economy through funding and non-binding measures, such as roadmaps, programmes and action plans, rather than legislation.



When it comes to waste management, there has been no major change in legislation over the past five years, except the 2017 Government Decree on recovering certain waste in construction. While the Finnish Ministry of the Environment claims that Finnish waste legislation is either in line with or stricter than EU legislation, in September 2018 the Commission issued an early warning for Finland concerning the implementation of the EU waste

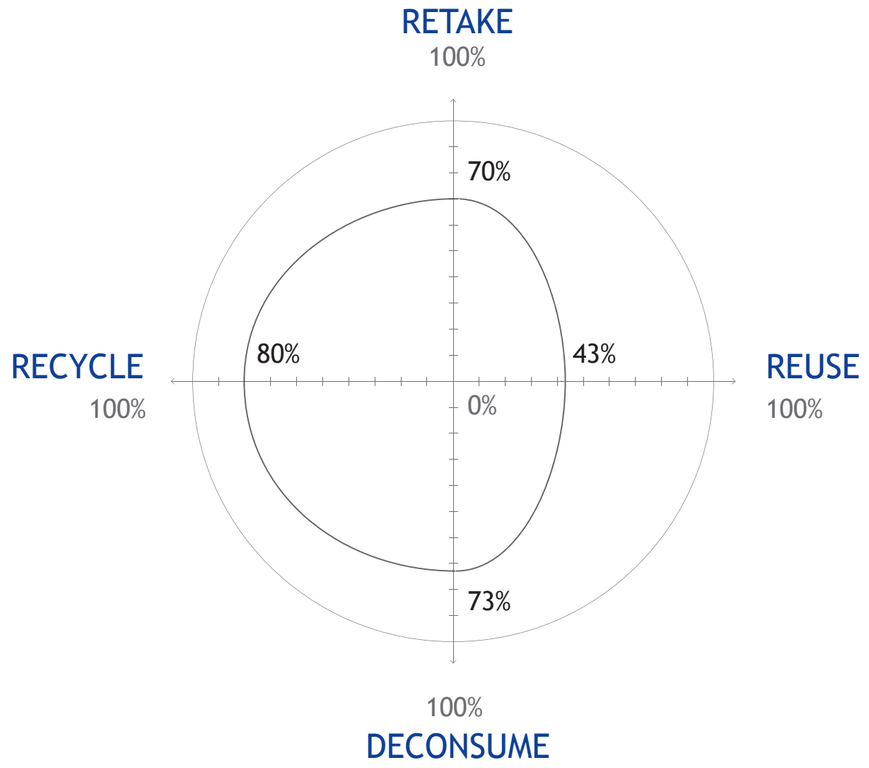
legislation. According to the Commission's report, Finland is at risk of missing the 2020 preparation for the reuse/recycling target for municipal waste, which stipulates that all member states should reach at least 50 percent. While Finland is close (42 percent), the level is stagnating, or even decreasing, rather than growing. Much like Denmark, Finland too relies heavily on incineration, as the share of waste disposed in waste-to-energy plants has been rising over the last years, partly at the expense of recycling. Finland wants to introduce mandatory targets at the municipal level and involve municipalities more in enforcing recycling and punishing non-compliance.

Concerning food waste, Finland does not have a national plan focusing specifically on the issue, which means it falls under the general National Waste Plan 2030, which calls for a 50 percent reduction in food waste by 2030. It sets out a number of measures to achieve this goal, including developing a roadmap, introducing a voluntary material efficiency commitment in the food sector to promote food waste reduction, and providing funding for research focused on reducing food waste.

Approximately 40 percent of Finland's energy consumption comes from renewable energy sources, and the National Energy and Climate Strategy stipulates that it should reach 50 percent before 2030. To achieve that, renewable energy is supported via subsidies both for investment in sustainable energy generation and renewable energy-oriented research and a premium tariff for renewable energy producers.

Sweden

While Sweden does not have a comprehensive strategy for its shift towards circular economy, the government commissioned an inquiry into how the transition could be implemented. The 2017 report, entitled "From Value Chain to Value Cycle – how Sweden will achieve a more circular economy",



states that “Sweden is not considered to be one of the leading countries in the development of a circular economy. Clearly stated ambitions and goals and a strategic context are lacking, which weakens the impact of all the ongoing individual activities”. It calls for new taxes to incentivise the transition towards a less wasteful economic model and ensure that the total cost, including externalities, is included in the price of goods and services. According to the report, Sweden has one of the lowest percentages of tax income from environmentally-oriented tax streams in the EU.

The tax streams do not capture the positive impact of another fiscal mechanism: tax cuts and deductions to incentivise behaviour that helps create a more circular economy. In 2017, Sweden introduced legislation that slashed the value-added tax for repaired goods and repair services in half. According to the 2017 report, just 0.8 percent of all consumer goods spending is on repairs. It encourages legislators to supplement the recent tax cuts with tax deductions for spending on repaired and rented durable goods. Sweden already has tax deductions for building repairs and maintenance, which allow taxpayers to deduct up to 50 percent of the cost of labour for the service. Although they can be used for the repair of large household items, the conditions are strict; for instance, the repair must take place at the home. The report estimates that expanding the current provisions to repairing and renting consumer products will create ten thousand jobs, while contributing to the development of the circular economy.

Regarding food waste, Swedish government has a goal to ensure that by 2020 at least 50 percent of the food waste from households, catering, shops and restaurants will be sorted out and treated biologically so that plant nutrients are utilized, and at least 40 percent of the food waste is treated so that energy is also utilized. In addition, the country is aiming at achieving the halving of food waste by 2030 and established an action plan in 2018 entitled “More to do more” which proposes 42 measures to achieve this goal, focusing on industry cooperation, consumer education, and research and innovation.

In Sweden nearly 52 percent was recycled in 2014, compared to 49 percent in 2017. Landfill accounts for just 0.5 percent, while waste-to-energy disposal hovers around 50 percent. While the latter allows Sweden to achieve its lofty goals concerning the transition to a non-fossil fuel-based economy, it could slow down the process of establishing an economy with much less waste. With waste-to-energy plants serving a central role in municipal heating systems and contribute to household electricity provision, their overcapacity means that like Denmark, Sweden relies on importing waste from other EU members, in particular the UK.

Regarding renewable energy, it accounts for 54 percent of all energy consumed in the country, with goal of reaching 100 percent by 2040. To promote the transition towards renewable energy, Sweden is using a number of preferential measures, including subsidies and tax preferences. However, unlike in Denmark, renewable energy does not enjoy priority access to the grid. To promote a transition away from fossil fuels in automotive industry, Swedish Prime Minister announced in January 2019 a ban on sales of new cars with diesel or petrol engines from 2030 onwards.

4.6 Other Nordic states (Norway and Iceland)

Overview of key indicators

Norway (50 percent) and Iceland (51 percent) lead in our composite ranking of indicators. The caveat is that it was impossible to estimate the result in several of our categories, as there was much less data than for EU member states.

Norway and Iceland are leading the way in terms of "retake" indicators. Both states enjoy very high efficiency of material consumption in generating GDP, using less than 0.25 kg per USD 1 of GDP and have low energy subsidies.

When it comes to "reuse" subindex, both Norway and Iceland rely strongly on renewables, which cover 70 percent of their energy consumption. They also score well when it comes to the size of circular economy sectors, with Iceland leading all countries when it comes to employment related to circular economy, and ranking second with respect to declared investment in resource efficiency.

In terms of "deconsume" indicators, Iceland has some work to do to reduce energy consumption, as it uses three times more energy per capita than Norway and almost five times more than Germany. This is partly reflected in attitudes to the environment, where Iceland lags significantly behind other Nordic countries, as well as the Baltic states.

Finally, when it comes to the analysis of "recycle" measures, just 1 percent of Iceland's urban waste water receives tertiary treatment, compared to more than 80 percent in Sweden, Denmark and Finland, and 64 percent in Norway. Despite high share of renewables in the energy mix Norway and Iceland have the highest greenhouse gases emissions per capita of all the BSR countries. It is closely related with wealth – citizens of these countries can afford to consume more, which leads to higher per capita emissions. Recycling of municipal waste is below average, at around 35 percent. Both are among the countries producing the most municipal waste; only Denmark produces more.

Legislation

As Norway and Iceland are in many respects frontrunners in the transition to a circular economy, they do not have to look to EU law for inspiration. However, they are part of the European Economic Area, which requires that they implement environmental legislation. Neither of them has started to implement the Circular Economy package, but earlier European legislation on waste and water treatment has been transposed.

Norway

In June 2017, the Norwegian government issued a White Paper on waste policies in a circular economy. It focuses on reducing marine litter and microplastics, which it hopes to achieve through a Plastic Strategy. The strategy centres on multi-level governance. On the one hand, it seeks to incentivise local authorities to take more decisive action by proposing a grant scheme rewarding efforts. On the other, it calls for European and international cooperation to solve the problem on a global scale.

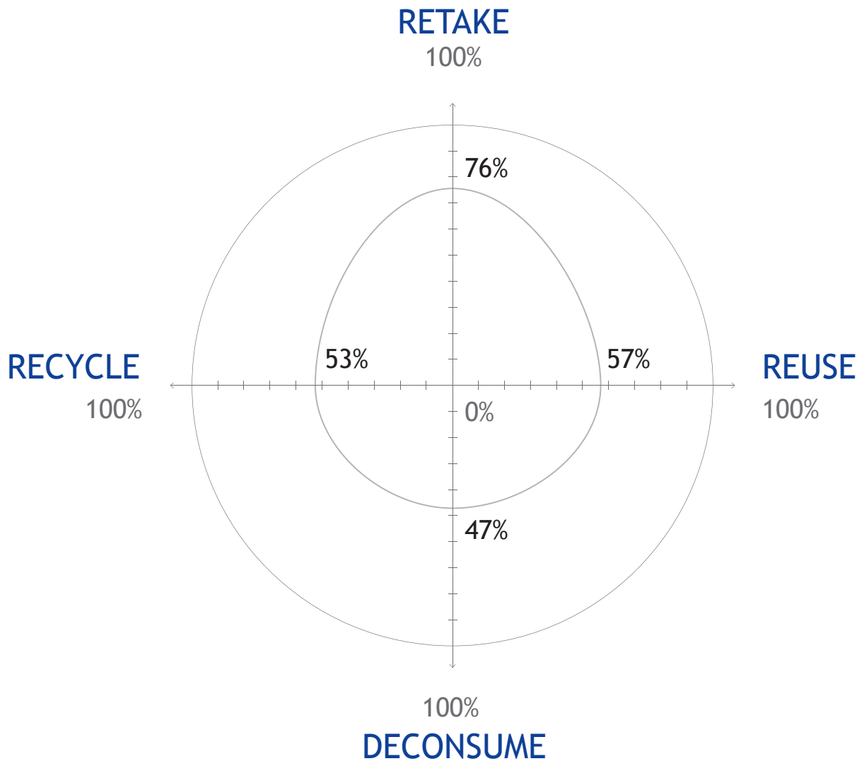
The government has adopted several other laws and binding agreements to reduce waste and transition towards a circular economy. Over the past two decades, Norway has been considered a role model in terms of recycling plastic bottles. In 1999, the container deposit legislation was passed, making producers responsible for collecting and recycling containers that they sell beverages in. All vendors of drinks containers are obliged by law to accept them back and return the deposit to consumers. A special excise tax is levied on each container; the amount is reduced based how successful each company is at retrieving bottles and cans. If the return rate exceeds 95 percent, the tax for that company is zero. More than 95 percent of plastic bottles and cans in the country are returned.

Norway has also been among the frontrunners when it comes to managing waste electrical and electronic equipment (WEEE). The law of 1999 introduced a take-back requirement for producers and importers of electrical and electronic goods, which means that they must have an arrangement with a state-approved take-back company. The consumer can deliver them to municipal waste treatment facilities or distributors of electrical and electronic goods for free. As a result, in 2017 approximately 85 percent of WEEE was recovered and 8 percent was processed for energy recovery.

A more recent effort from 2017 seeks to reduce food waste. The agreement between the Norwegian government and twelve food industry organisations stipulates that food waste will be halved by 2030. Although the agreement was voluntary, the resulting commitment is binding for contracting parties.

Much like Denmark and Sweden, Norway relies heavily on waste-to--energy incineration plants, with more than 50 percent of municipal waste incinerated at these facilities. Attempts to reduce the amount of waste have not proven successful recently, with the increase in waste outpacing GDP growth over the past twenty years.

Norway is at the forefront of electric car adoption, and the country has announced a ban on registration of new fossil-fuel powered cars by

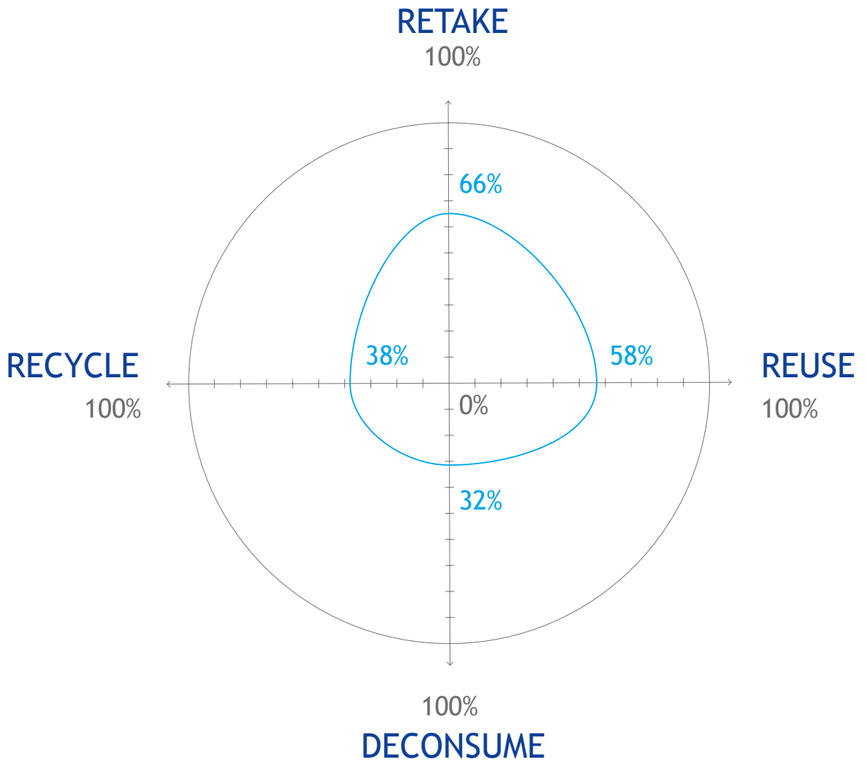


2025. Already in 2017, more than half of all new cars registered in Norway were electric or hybrids, with electric vehicles accounting for almost 40 percent of all sales in the sector.

Iceland

The country does not have a comprehensive strategy on the circular economy. However, it does have a state waste prevention programme, called "United against waste. General policy on waste prevention 2016–2027". Despite its strategic approach and long timeframe, it does not set any tangible quantitative targets for waste prevention. Iceland was the first country to introduce legislation on recycling fees for disposable beverage containers, the 1989 Act on Recycling Fees. The law has served as a model for similar legislative initiatives in other countries, with Norway, Denmark and Finland the most successful examples. Despite thirty years of experience, Iceland's results are somewhat behind other Nordic countries; in 2017, 82 percent of plastic bottles were recycled.

According to a study conducted by the Environment Agency of Iceland, the country has ways to go when it comes to food waste, with 70 percent of households admitting that they throw out a significant amount of food, and supermarkets throwing out approximately one-third of shelved food. As of yet, there is no national strategy or roadmap that specifically tackles food waste. The waste management act was amended in 2014 to strengthen data collection and increase understanding of waste statistics. Although Iceland has tried to transition towards a system of waste management that is better aligned with the EU's waste hierarchy, in 2014 49 percent of all municipal waste was sent to landfill.



With easy access to hydro- and geothermal energy, Iceland differs significantly from the other Nordic states when it comes to incineration rates. Less than 10 percent of municipal waste is send to incineration plants, as 100 percent of household electricity consumption is satisfied by renewable energy sources.

4.7 Belarus and Russia (other neighbouring countries)

Overview of key indicators

In Belarus and Russia, circularity remains more of an aspirational concept. Not many policies have been implemented and most of the key metrics tracked in the EU are not monitored in Belarus and Russia. This lack of progress in moving towards a more circular and sustainable economy is visible in our ranking: across all four indicators, Belarus scored just 24 percent and Russia 23 percent, putting them in second-last and last place.

Both countries struggle especially in the "retake" and "reuse" categories. They inherited the legacies of Communism, which prioritised industrial output over environmental or societal externalities. As such, the sustainability of inputs and production chains is not a priority. Russia's economy, which is focused on the extraction and export of fossil fuels, takes nearly all inputs from the natural environment; unsurprisingly, it scored just 4 percent in the "retake" category. Belarus, with its economy based on manufacturing chemicals, fertilizers and machinery, scores slightly higher with 19 percent, though it is still far behind the EU. In turn, Russia's resource-cursed economy (Russia is the world's greatest net exporter of non-renewable energy; exports of oil and gas generate 15 percent of its GDP) scored just 4 percent in the "Reuse" subindex due to its large carbon footprint and the absence of recycled material. Belarus is even worse. Its lack of energy efficiency and inability to use recycled chemical waste in key products, especially saline, places it at the bottom of the ranking.

The advancement in "deconsume" is a little bit more promising, with Belarus and Russia score 74 percent and 49 percent. These are largely in line with other European countries and higher than in Poland. Environmental activism has a strong tradition in both Belarus and Russia, especially since the Chernobyl nuclear disaster in 1986. Today, municipal waste removal and pollution are directly linked to wider problems such as corruption and the lack of government transparency, serving as a catalyst for protest. However, good scores in "deconsume" subindex are at least to some extent connected to lower economic development of these countries which, on the one hand, restrains households to engage in excessive consumption and waste generation, and, on the other hand, it incentivises consumers to repair and reuse goods instead of buying new ones.

Belarus and Russia still have a long way to go when it comes to more sustainable methods of waste disposal. Again, both countries rank lowest the "recycle" category, with Belarus slightly ahead of Russia (37 percent, compared to 32 percent). Both countries have very low recycling rates; in Russia, there is no regional or municipal sorting of household waste at all. To recycle, individuals must take items to small, private processing centres, which are often unprofitable due to the lack of scalability. In terms of pollution, the impact of Soviet industrialization on the environment is evident, e.g. Belarus has the second-worst air quality in Europe on average (in terms of PM 2.5), second only to Poland. In Russia, emissions are

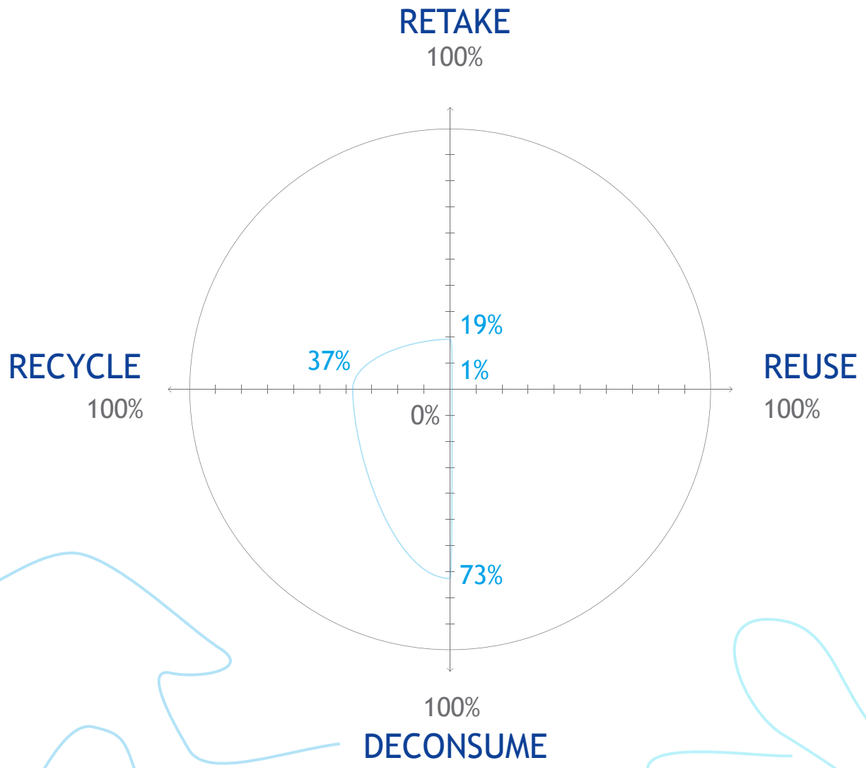
the highest per capita in Europe and air pollution remains a significant problem, despite the country's size and abundance of forests. In 2017, the country spent just 0.7 percent of GDP on the environment. Moreover, Belarus faces a difficult structural problem with chemical waste, which accounts for 68 percent of its waste. More importantly, 98 percent of this chemical waste is saline waste from potash fertilizer, which has extremely limited recyclability. Small amounts of saline waste can be used for table salt production or mine stowing, but Belarus produces approximately one-fifth of the world's potash fertilizer; 32 million tonnes per year in 2012–2017. Including saline waste in Belarus's overall waste disposal calculations significantly affects its rating in the circular economy indicators.

Legislation

While Russia and Belarus are likely to lag far behind EU countries in the BSR when it comes to designing and enforcing policies that would make their economies more circular, the EU is discussed as a model for practical approaches to sustainability. Still, much needs to be done to enact real change. Significant structural and political barriers will be difficult to overcome.

Belarus

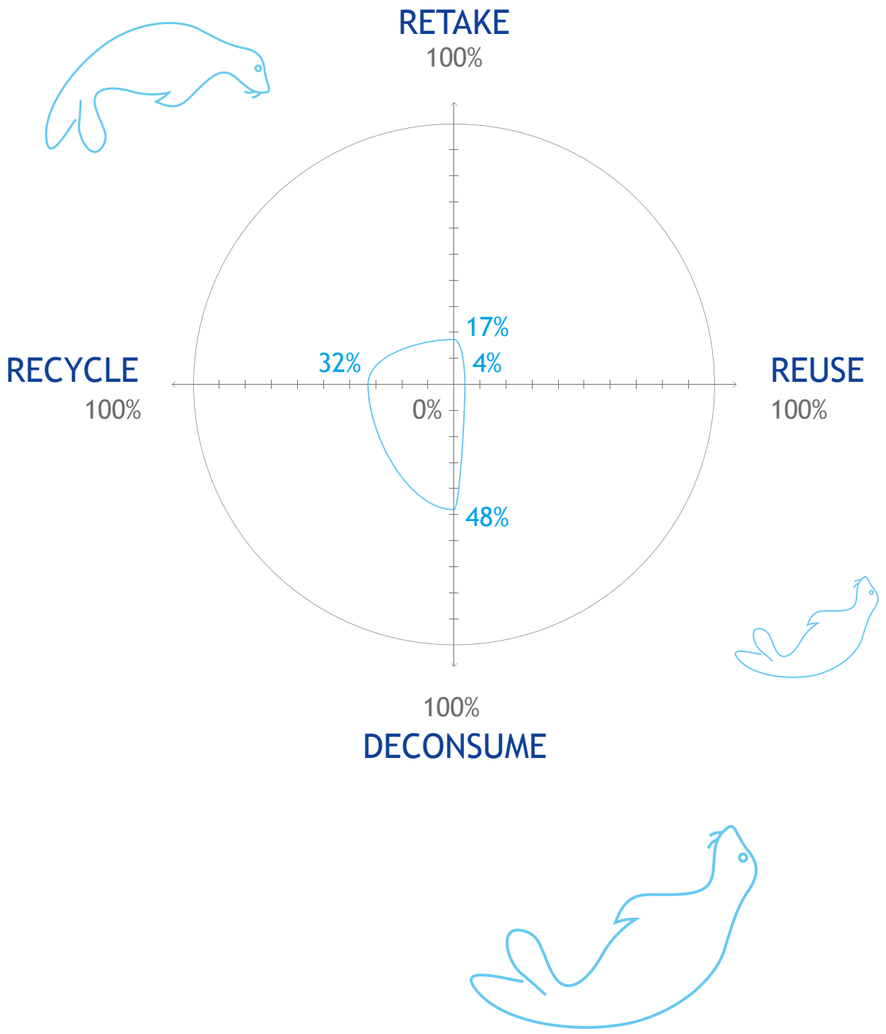
Belarus, which frequently seeks to play a balancing role between Europe and Russia, views the EU's approach to creating a more circular economy favourably. Minsk has emphasised environmental standards in its National Strategy for Sustainable Socio-Economic Development until 2030,



which proposes to increase recycling of municipal solid waste (MSW) to 40 percent (from 15.4 percent in 2016). In governmental discussions on the draft strategy until 2035, the EU's approach to circularity and the metrics it uses have been praised for their practicality. One of the first steps that Belarus should take is to start collecting data on a range of metrics outlined by the EU. More information – especially on patents, innovation and the recycling rate for different types of waste – would be a good way to start.

Russia

Like that of Belarus, the Russian Federation's economy is rooted in industrial practices that openly eschew the concept of sustainability. However, the concept of the circular economy has gained public support in the wake of the recent demonstrations against an unpopular trash collection reform that took effect on January 1, 2019. The plan included moving trash from the Moscow municipality to storage facilities across the country. This prompted protests in more than 26 of Russia's regions; the largest drew 30,000 people. Russia has a serious trash crisis, as there is no sorting system for separating and processing recyclables. 90 percent of Russia's solid municipal waste ends up in landfill sites; many are now overflowing and have become a health hazard. As part of the reform, a new interactive "dump map" was launched, enabling citizens to file complaints about illegal trash dumps to the federal authorities. Signi-

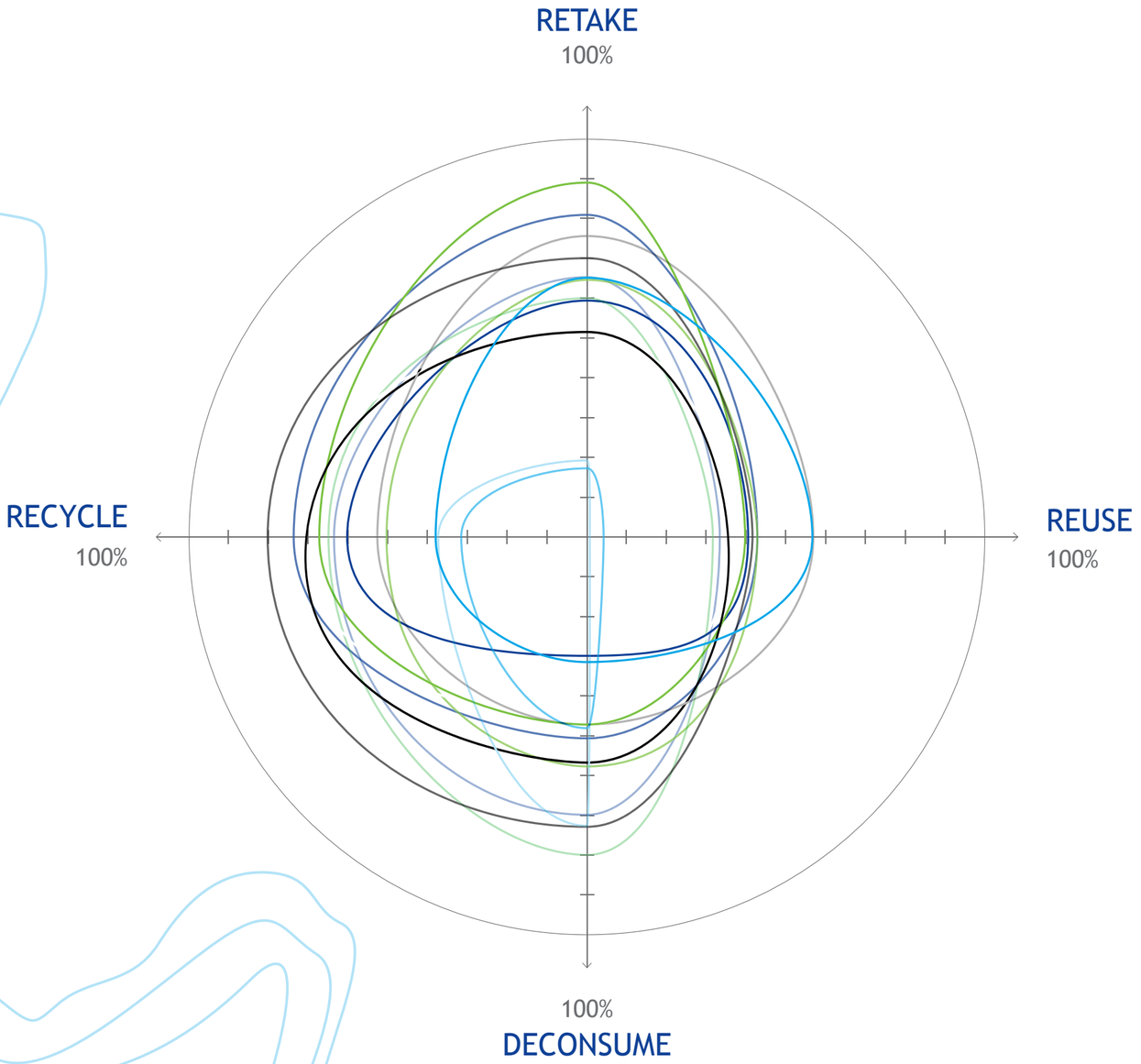


ficantly for the Baltic Sea Region, Kaliningrad region has more than 275 active complaints.

The Russian legal regime regulating waste management is quite robust. In 2014, Vladimir Putin signed several bills prioritizing sustainability and environmental protection, including provisions incentivizing the maximum use of materials, encouraging recycling, waste reduction and the effective treatment of hazardous and non-hazardous materials. However, economic incentives and enforcement capabilities have not caught up with the spirit of the law.

There is much more money to be made from storing and incinerating trash in Russia than recycling it. Regions often receive a standard sum per capita from the federal budget for waste removal. If the population produces less waste than its budget allows, it can expect a smaller budget in the future. Corruption and cronyism also plays a role. The latest reform bill noted that government contracts for big new waste storage facilities around the country were not auctioned off transparently. Tenders for just one of the facilities, worth USD 157.5 million, were not made public and given to a company with links to the Moscow city authorities.

Russia has a long way to go before it makes headway in investing in the circular economy. Structural difficulties and endemic issues with transparency and good governance will continue to prevent the development of sustainable consumption and production. If anything pushes the government and businesses forward, it will be Russians' activism and the business potential for innovative solutions in the EU.



Country	CEA
Poland	42%
Germany	48%
Estonia	47%
Latvia	39%
Lithuania	46%
Denmark	50%
Finland	40%
Sweden	48%
Norway	50%
Iceland	51%
Belarus	24%
Russia	23%

The CEA index measures the advancement of each BSR country from a linear towards a circular economy in four dimensions: retake, reuse, deconsume and recycle. The progress in each category is reflected on the respective axis – the higher the value of each subindex the farther lays a given point from the center of the graph. The line for a given country connects these points, hence, the larger the circle the more progress in advancing towards a circular economy has that country already made.

5. Trends and scenarios for the circular economy in the BSR

The transition to a circular economy will not happen in a vacuum. As we have demonstrated in previous chapters, to close the loop for resource use, the current linear model will have to be almost completely reorganised. This is what makes circular economy attractive as an idea, providing solutions for many of the challenges faced by today's economies and ecosystems, while making it sensitive to and dependent on external factors. Economic, social and demographic trends are especially important for policymakers; they inform policy decisions and rank priorities, which can affect the availability of funding for circular economy projects. Moreover, certain trends can facilitate (or obstruct) the transition to the circular model. For this reason, any circular economy strategy needs to take them into account.

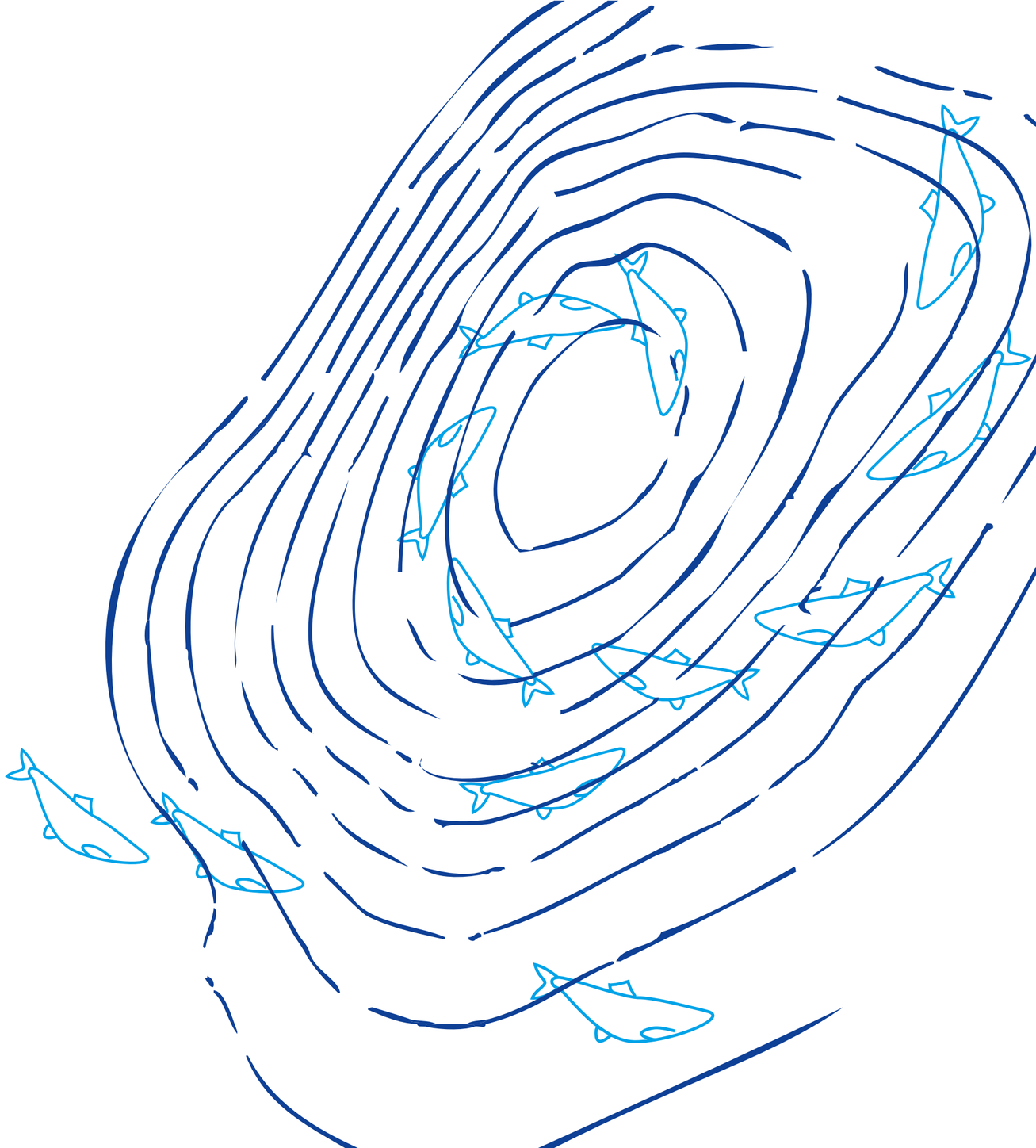
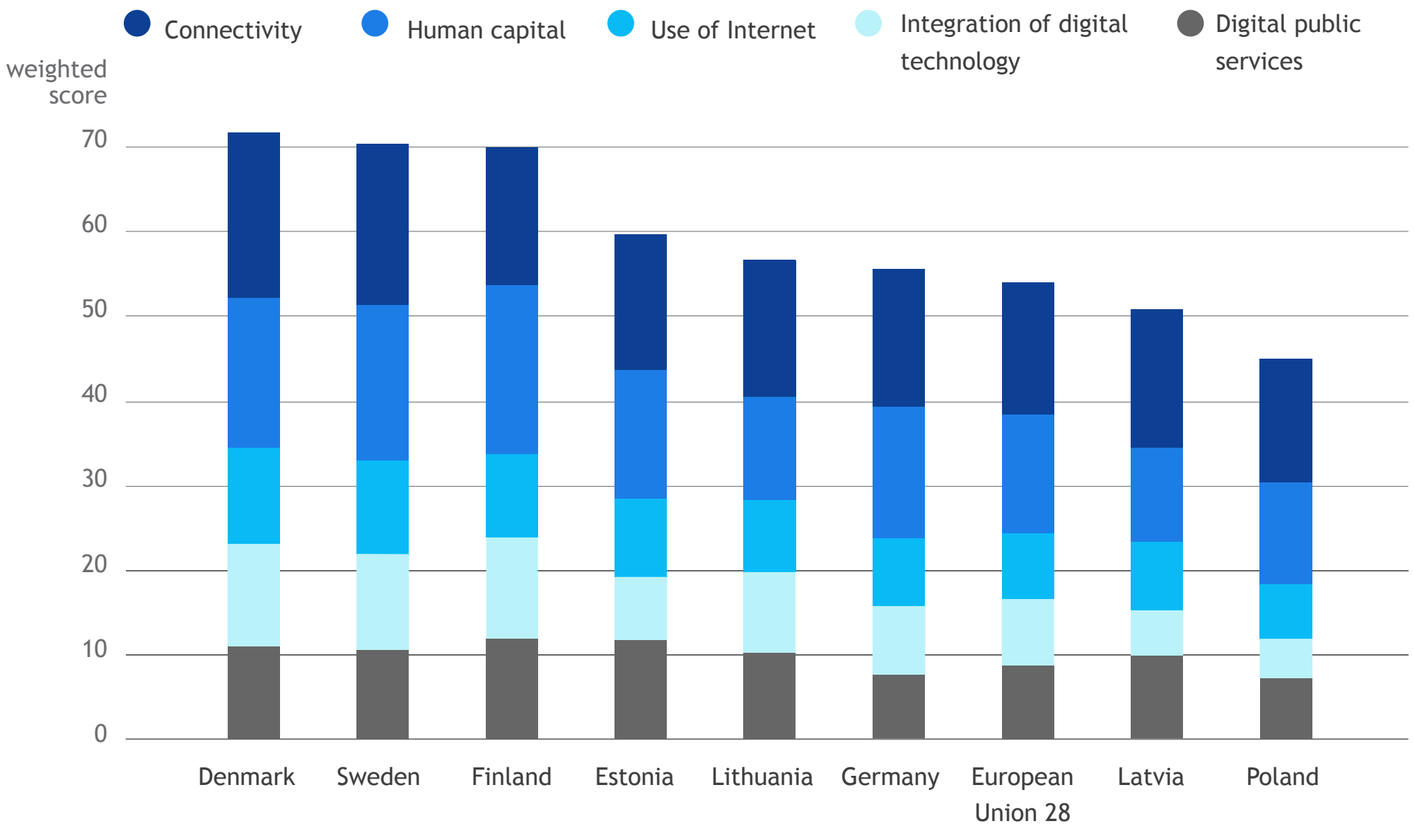


CHART 9. DIGITAL ECONOMY AND SOCIETY INDEX



Source: European Commission, Digital Scoreboard (2018).

Economic trends

With globalisation and economic integration in the EU, Baltic Sea Region countries are affected by global trends, albeit in different proportions. One such trend is the **growing importance of services** in the economy. Between 2000 and 2016, the value added of services in the BSR countries and neighbouring states as percentage of GDP increased by 5 percentage points on average (World Bank). The increase was significant in nearly all countries analysed, except Poland, Germany and Estonia. The growing importance of services can have a positive impact on the transition to a circular economy; services are generally less polluting and generate less waste than, say, manufacturing. At the same time, at least some of this shift was achieved by offshoring production with all negative environmental impacts including GHG emissions (see Chapter 2.2 for an assessment of that trend).

Another economic trend affecting all the countries in the BSR is **digitalisation**. According to the Digital Economy and Society index developed by the European Commission (CHART 9.), the Nordic states and Estonia are particularly advanced in this area. The growing use of ICT in all sectors of the economy is necessary for the transition away from the linear model in several dimensions. Firstly, advocates of the circular economy argue for a switch from selling durable products to individual customers to leasing, sharing and renting. These circular economy business models (see also Chapter 3), known as product as a service systems and sharing platforms, are enabled by digital infrastructure. This fosters a sharing economy, as communication devices allow the same durable goods to be used by many

citizens, from parking lots to means of transport (such as cars, electric scooters, taxis), via IT and washing machines. Moreover, the evolution of blockchain-based technologies will most likely facilitate fast and cheap pay-per-use payments that will allow for higher price discrimination, i.e. icreasing the availability of sharing economy to low income households. They also make consumption more efficient through the collective purchases of goods, services and materials (as well as energy). This trend has many positive externalities, as it reduces demand for durable goods, the materials used to produce them and the cost of disposing of them. However, a sharing economy has drawbacks, too: it reduces the costs of using durable goods, altering consumer decisions and generating greater demand for durable goods with high negative externalities; for instance, people use more cars, rather than public transport.

Secondly, digitisation and especially the AI revolution are increasing the lifespan of capital goods, especially in manufacturing and construction. Predictive maintenance can lower the cost of repairs and extend the working-life of a machines. New devices that analyse big data (temperature, noise, velocity, vision and so on) from different sensors can help predict which part of a machine will break in the near future and whether it should be replaced or repaired to minimise the risk of severe damage.

Thirdly, new, very precise devices that communicate with each other in Industry 4.0 can help make material use more efficient and minimise production waste. ICT can be used for advanced product tracking, which facilitates reuse and recycling, minimizing waste after the „consume" phase.

Finally, production will be automated through digitisation. This alters demand for labour, as employees shift from routine, manual tasks to cognitive, non-routine jobs. In turn, that increases the share of services in the economy and reduces demand for materials, as AI-based production is more precise and more efficient than humans, generating less waste in the manufacturing process. It is worth noting that not all aspects of digitalisation support the transition to a circular economy. For example, growing demand for electronic devices requires larger material input, including rare earth elements, the extraction of which is detrimental for the environment. This effect can be alleviated to some extent by more robust recycling rules and stricter production design requirements, preventing planned obsolescence.

The third trend that will influence how the BSR countries' economies function is **resource scarcity**. In developed countries, demand for resources – from non-renewable ones like fossil fuels and minerals to ones extracted from the biosphere, such as farmland, fisheries and forests – is growing at a non-sustainable rate. Paradoxically, this creates a good environment for the transition to a more circular economy. As resources become more expensive and less available, policymakers will be incentivised to reduce dependence on them by increasing their national economies' material efficiency. It will also affect businesses, forcing them to adopt circular business models. This will not be limited to manufacturing; services will be affected, too. In recent years, tech giants like Facebook and Google have raced to reach renewable energy targets of 100 percent. Other companies will follow suit, in energy and other areas.

Also changes in global economic policy and geopolitics can affect the pace of transition to a circular economy in the BSR. As from the global financial crisis many countries around the world, especially developed ones like the United States, have changed their attitude towards globalisation and engaged in protective policies. The pace of introducing **protectionism** measures accelerated recently, what can have drawbacks on implementing circular economy business models in the BSR as many countries in the macroregion are importers of waste recycling services. If trade wars intensified, those countries would need to deliver such services domestically, which would increase their costs and hence slow down the increase in the share of recycled waste in total disposed materials.

Finally, a non-economic trend influencing production, especially in agriculture, is **climate change**. It influences policy decisions in two ways. Firstly, as we underlined in Chapter 2, all BSR countries have committed to mitigate climate change, with targets for reducing GHG emissions. For governments, the circular economy's policy toolbox will make these targets more attainable. Facing increasingly stringent climate policy measures, businesses will be incentivised to use fewer resources. Secondly, even in the most optimistic scenario, in which every country meets their Paris Agreement emission reduction target, the climate will still change and states will be forced to adapt. Global warming will exacerbate resource scarcity, reduce the land surface available for agriculture and increase demand for certain goods (such as fertilizers and water). This will eventually lead policymakers and businesses to embrace the circular economy.

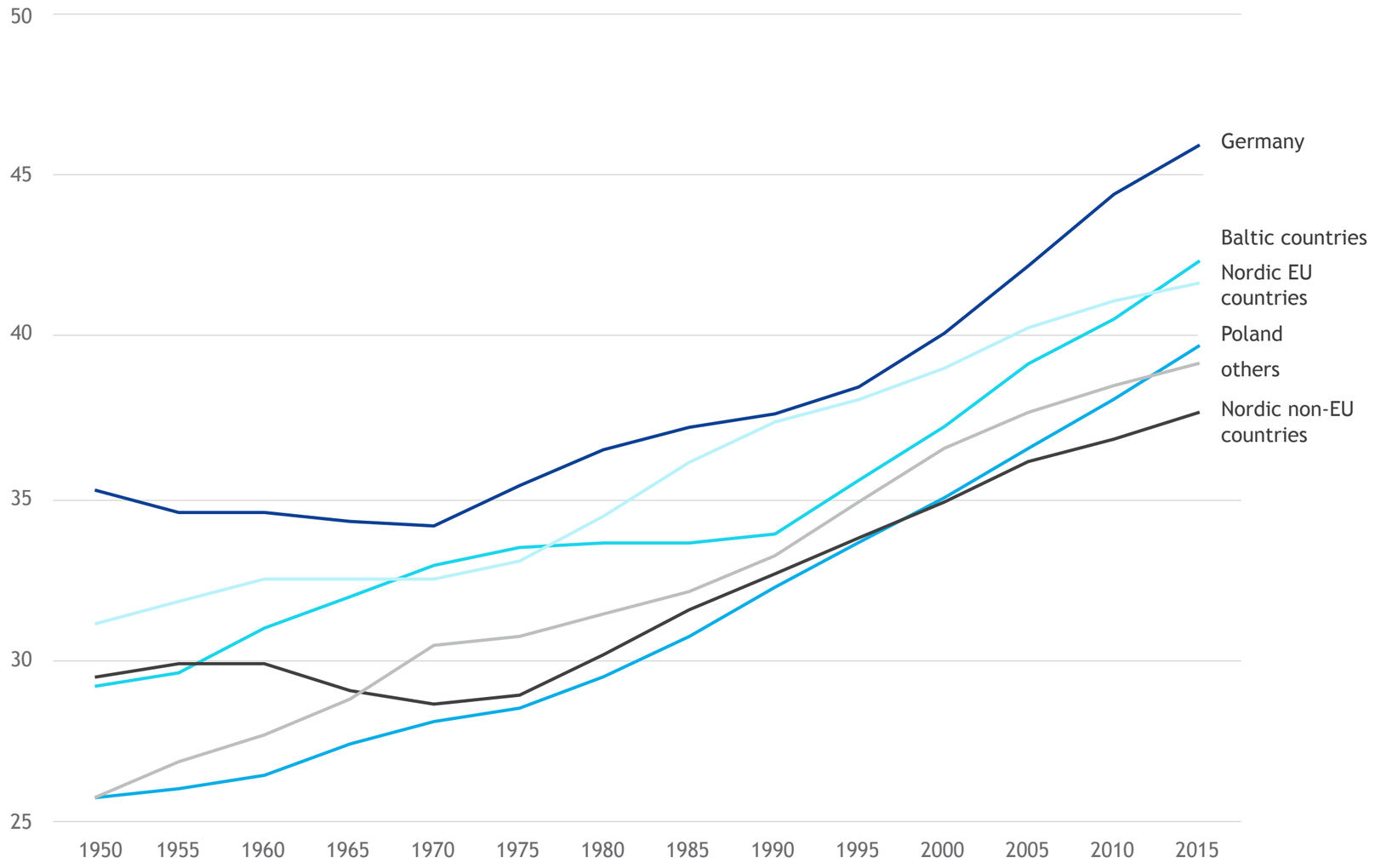
Demographic trends

The BSR has an **aging population** (CHART 10.). This process will accelerate in the nearest future due to low birth rates, especially in the richest countries (such as Germany, Sweden and Finland) and those struggling with high emigration (such as Poland, Latvia and Lithuania). This means that the consumer base will change to reflect senior citizens' behaviour, starting the transition to a silver economy. Despite the challenges for the labour market, production and social security, it could be good news for the circular economy in the BSR.

Ageing affects consumers' behaviour. Older people buy and consume less than the youth, which could mean that fewer goods are produced. Numerous studies show the senior citizens are much more likely to save energy and water or repair broken items, rather than throwing them away. Generally, the consumer habits of older people are much more eco-friendly than those of the rest of the population, which fosters circularity. However, these are the economic habits of today's senior citizens; they could change over time, as social attitudes evolve. Experts are observing a shift in the lifestyle of the eldest citizens, from a traditional senior's model to a modern one.

The use of pharmaceuticals should also be considered. The eldest citizens tend to consume them in much larger quantities than the youngest, but this is strongly related to senior citizens' health. On the one hand, both the production and processing of pharmaceuticals are harmful for environment and will be difficult to fit into the circular economy. On the other hand, most of the pharmaceuticals (incl. antibiotics) is used

CHART 10. AGEING PROCESS IN BSR COUNTRIES (MEDIAN POPULATION AGE)



Source: UN.

in farming, so the impact of aging will not have a drastic influence on demand for these substances.

The BSR countries' populations will not only be shaped by ageing. Europe has become a top destination for immigrants from around the world; this will include most BSR states, too (except Latvia and Lithuania). The **immigration** rate varies depending on the level of economic development. Germany, Sweden, Denmark and Norway welcome many people from abroad, considering the process a vital part of the political discussion. They are well prepared, in terms of their budgets and migration strategies. At the same time, Poland is entering a migration transition, with a growing number of foreign workers on its labour market. Nowadays Poland is already a leader among BSR countries in the inflow of new short-term immigrants searching for work. Still, there has been no strategic planning concerning BSR population change, housing or increased need for public transport. This will make it much more difficult for countries like Poland to adjust to the rules of the circular economy when migration pressure suddenly intensifies. Scale matters, too; for Iceland, which faces the highest migration pressure, state budget planning under such conditions could be much more challenging than for countries with less dynamic population fluctuations.

States with a declining population, such as Latvia and Lithuania, could transition to a circular economy more quickly, as the circulation of goods is easier to close with a smaller consumer base.

There is **growing social interest in environmental issues**, not just in the richer countries in the BSR, such as Norway or Germany, but also in the poorer ones. Since the 1980, ecological awareness and activism have increased, with more social groups viewing environmental threats in terms of their personal interests. Across Europe, there are numerous local initiatives focused on issues relating to the circular economy, such as protests against open pit mining, deforestation, polluting water with industrial sewage or protests against single use plastics. Locally, they can persuade policymakers, making them potential allies in the move to a circular economy in the BSR.

Emerging styles of consumption are key to the circular economy. Enthusiasts of the latest trends, such as zero waste, slow fashion (which includes reducing purchases and wearing second-hand clothes) and veganism, often stress their lifestyle's eco-friendly dimension. However, they remain a minority. It is crucial to reduce the need for consumption, driven by constant business growth. Consumers who stop replacing household goods or clothes constantly can be a powerful source of change from linear to circular production.

As consumers change and become more aware of the environmental challenges induced by the linear economy model, so will investors. Interest in "impact investing", with the aim of acheiving not only financial profit, but also broader, societal and enviromental gains, is likely to grow. This will directly benefit circular economy initiatives, which can be beneficial for society (as we explained in Chapter 2), while at the same time being economically viable.

Although environmentalism is becoming a crucial topic in the European public debate, social attitudes towards protecting the environment vary between BSR countries. People in BSR agree that climate change is happening and humans are to blame, but differ in their assessment of its consequences and taking responsibility. According to the European Social Survey conducted in 2016, Russia, the Baltic States' and Poland's populations are less concerned about climate change than energy affordability, unlike those of Norway, Sweden, Germany and Iceland. Similar differences can be found when analysing personal norms and beliefs. The inhabitants of Germany, Sweden and Norway feel personally responsible for saving the environment, unlike respondents from post-communist countries. They are also much more optimistic about the outcome and more convinced that they can use less energy.

This can create a social feedback loop: the more policymakers focus on the circular economy and eco-friendly policies, the more important these two become for citizens, creating stronger pressure for further changes. Promoting the circular economy in the BSR could foster a change in social attitudes on protecting the environment and support the move away from a linear economy.

Which way are the BSR countries heading

Baseline scenario – gradual circularization of the economy

In this chapter, we analyse the most probable pathway for developing a circular economy in the BSR by 2030. In the baseline scenario, the transition to a circular economy will only happen partially. We assume that cooperation between the BSR countries will remain on a roughly the same level, with EU policy as the main unifying factor.

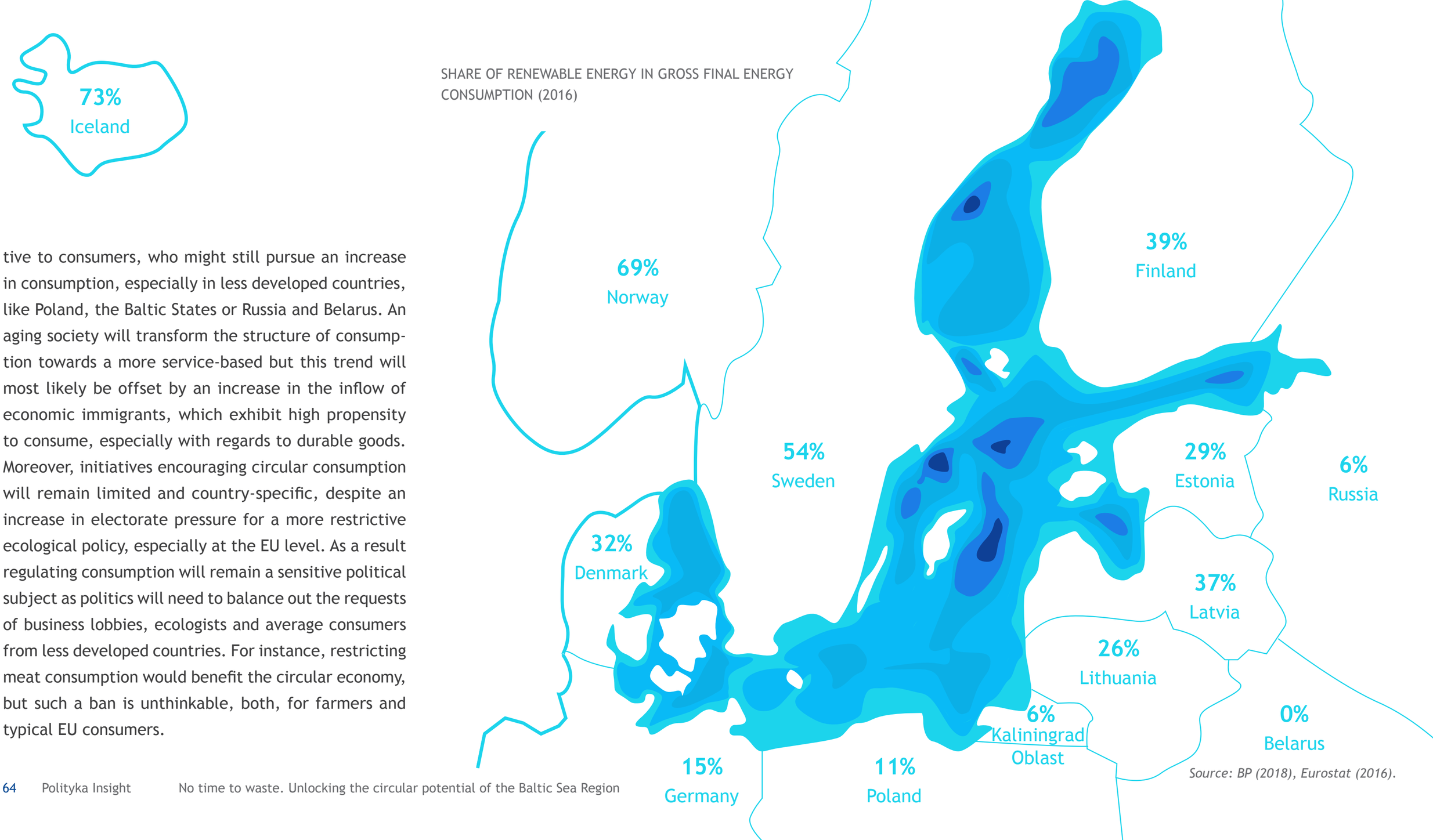
Until the end of the next decade, **extraction and material use** will largely fit the linear model, with just a fraction of material input from secondary raw materials. A small shift towards circularity will be mainly driven by resource scarcity, as new materials become less available and more expensive. As a result firms will turn to circular economy business models, based on recycled materials and remanufacturing and reuse of products. This process will be facilitated by technological advancement. Digitalisation will lead to a general decrease in material use, and the IT revolution will lower maintenance costs and increase the lifespan of capital. Electrification of transport will decrease carbon footprints, even in countries with high percentage of coal in their energy mix. However, over the next decade economic growth will be still closely correlated to an increase in material consumption and as a result offset gains in material efficiency. A side-effect of this process will be the relocation of heavy industries (mines, steel mills and chemical plants) to countries with lower labour costs and less stringent environmental rules, outside the BSR.

The advancement in applying **circular economy business models** will be substantial in the next decade. Innovative and environmentally friendly business models will benefit from the growing importance of impact investing. This will be especially visible in the energy sector, where the relative cost of producing energy from renewable sources is falling sharply and is expected to further decrease. Also more stringent measures will be implemented for GHG emissions, including tightening emission cap in the fourth phase of the Emissions Trading System. For the BSR countries, the development of the offshore wind energy market will be especially important, as the potential for solar energy is limited by climate, especially in the northern part of the BSR. Another key element will be an advancement in product design technics consistent with the circular economy and development of product-as-a-service business models. This transition will be stimulated by several new pan-EU requirements on product lifespan, recyclability and their environmental impact. This includes the implementation of the Ecodesign directive and further advancement in banning the use of plastic bags and other plastic products, like straws and food boxes. At the same time we expect the EU to refrain from introducing more Pigouvian taxes and other hard measures that change the distribution of incentives for producers. Future legislation will most likely focus on creating opportunities and encouraging a shift, rather than forcing it.

Consumption patterns will not change significantly, as shifts in environmental actions can take generations, despite the change in attitudes in most countries. The demand for products will depend on their price and availability, which can only be reduced through strict regulation. Grassroots consumer movements (such as zero-waste, slow fashion) will intensify, but their impact will be limited as they won’t be attrac-

tive to consumers, who might still pursue an increase in consumption, especially in less developed countries, like Poland, the Baltic States or Russia and Belarus. An aging society will transform the structure of consumption towards a more service-based but this trend will most likely be offset by an increase in the inflow of economic immigrants, which exhibit high propensity to consume, especially with regards to durable goods. Moreover, initiatives encouraging circular consumption will remain limited and country-specific, despite an increase in electorate pressure for a more restrictive ecological policy, especially at the EU level. As a result regulating consumption will remain a sensitive political subject as politics will need to balance out the requests of business lobbies, ecologists and average consumers from less developed countries. For instance, restricting meat consumption would benefit the circular economy, but such a ban is unthinkable, both, for farmers and typical EU consumers.

SHARE OF RENEWABLE ENERGY IN GROSS FINAL ENERGY CONSUMPTION (2016)



Source: BP (2018), Eurostat (2016).

The growing amount of **waste** resulting from increased consumption and external factors such as the Chinese waste import ban will force policymakers to accelerate the introduction of an increasingly stringent waste management policy. It will remain the focus of the EU Circular Economy policy, as reducing the amount of waste sent to landfill and increasing recycling are widely accepted goals for the public and endorsed by entrepreneurs. The same goes for legislation on pollution, which especially in Poland becomes a more and more important political issue, and, in the baseline scenario, it will lead to stricter policies in this area, regardless of EU legislation. **The largest beneficiary of the advancement in reducing waste disposal across the BSR will be the Baltic Sea**, which in the forthcoming decade will become less contaminated by both inshore and offshore pollutants. An important role in the process will be played by technological advancement as the number of electric and hybrid ship engines is expected to increase rapidly, what will be a side-effect of the increase in fuel prices which are crucial for maritime shipments.

The key policy decisions influencing the development of the circular economy in the BSR will be made in Brussels, which will largely freeze the existing **discrepancies between BSR countries** that are inside and outside of the EU. Some convergence is to be expected in energy generation from renewables, but the gap between countries like Norway or Iceland and Poland or Russia will not vanish. Accordingly, the differences in air pollution or waste recycling will also be slightly smaller in the forthcoming decade but mostly, the current differences will remain in place as they are derived from the level of economic development and social awareness, both of which are changing only gradually over time.

Alternative scenarios for the development of the circular economy

The scenario above assumes that political, economic and social development in the BSR will continue at its current pace and in the same direction, meaning that the transition to the circular economy will be gradual. However, there are alternative, less probable scenarios linked to possible changes in the socio-economic environment. These can accelerate or slow down the shift from a linear to a circular economy. Below, we list the risks (positive and negative) to the baseline scenario, briefly analysing how they might affect the BSR countries' economic transition.

Better transnational policy coordination. At the moment, there are just a few supranational bodies coordinating environmental policies in the BSR, like the Baltic Sea States Subregional Co-operation (BSSSC) or Baltic Marine Environment Protection Commission - Helsinki Commission (HELCOM). Most central and local governments rely on directives and recommendations from Brussels and (with some noteworthy exemptions) do not engage in transnational cooperation, which is key to a faster transition in the "dispose" or "make" areas. This could change as municipalities become aware of the benefits of closer cooperation. The positive consequences will include sharing best practices, better access to EU funding for circular economy investments and keeping up with neighbouring countries in terms of economic competitiveness when jointly introducing environmental taxation or restrictive regulations on product design. These incentives can help step up the pace of transition from

a linear to a circular economy, of which the largest beneficiary will be the marine environment.

A spike in commodity prices. A few years ago, the scenario of exponential growth in commodity prices, especially crude oil and natural gas, was one of the most likely alternative scenarios considered in investment funds' and governments' long-term strategies. These days, the threat of a spike in commodity prices is usually neglected, but wars or shifts in the foreign policy of the US, Russia, China or countries in the Middle East could prompt it to re-emerge abruptly. The same applies to other scarce materials used on a mass scale, especially conductors and semiconductors, such as alloys of silver, copper, aluminium, zinc and nickel. They are excavated in just a few locations worldwide, so supply is vulnerable to risks caused by political tensions or social unrest, especially in countries in equatorial Africa. A spike in commodity prices caused by these factors would immediately accelerate the transition to a circular economy by increasing the recovery of scarce materials from e-waste and increased energy efficiency. Expensive state-of-the-art technologies would become a financially viable alternative to standard linear production.

Paradigm shift to a degrowth policy. As global warming and social awareness of the negative externalities of human economic activity proceeds, there could be a paradigm shift from a growth-oriented policy to a degrowth approach in some countries, especially the most developed ones. If decision-makers and big business agree to change the priorities of economic policy then circular production can be introduced much faster through country-based regulations and taxation. In this alternative scenario, discrepancies between more and less developed BSR countries will increase, unless they are accompanied by better transnational policy coordination.

Ground-breaking technological revolution. Technological progress is usually characterised by leapfrog advancements, as a period of incremental change is followed by a technological revolution caused by one or several related ground-breaking innovations (such as the steam engine, television broadcasting, the Internet or vaccines). This could also be the case for circular innovation, as there is considerable R&D investment in that field worldwide. Possible new technological frontiers include carbon dioxide sequestration, solar fuel devices, cheap electricity storage, as well as new recyclable and renewable materials for construction. Every technological revolution could accelerate the transition to a zerowaste economy in any of the dimensions analysed, from "take" to "dispose".

Ecological disaster. One can pinpoint several possible adverse events that will instantaneously shift social attitudes, business awareness and the policy stance in BSR countries to a similar degree that the Fukushima disaster transformed the global disposition towards nuclear power plants. Sinking or severe leakage of a tanker, dissolution of chemicals and weapons disposed in the Baltic Sea, speeding up of climate change resulting in long-lasting heat waves or large floods across the region are

only the most likely events that could happen in the next decade. Each of these scenarios will force politicians to introduce various rigid measures to accelerate the circular economy transition in the region. The economic costs of such a scenario will be much wider endorsed by consumers and entrepreneurs, when they will be connected to mitigating the repetition of an ecological disaster.

Black swan scenarios. Lastly, some unlikely adverse scenarios are also worth mentioning as they could substantially alter the transition to a circular economy. Events like mass migration to Europe caused by wars and natural disasters, on a scale much larger than in recent years, would dramatically increase consumption of energy and FMCG goods in the BSR, reversing the trend of more responsible use of materials. A war between EU countries and Russia or Islamic states would shift the paradigm in economic policy away from circularity, as producing weapons quickly and cost-effectively would become the priority, increasing material use and waste. In contrast, mass human extinction caused by an epidemic or natural disaster would lead to a fall in consumption, as forecast by degrowth theorists since the 1970s, reducing the need for a circular transition. Finally, the dissolution of the EU would halt transnational cooperation and stop the shift towards a more circular economy, especially in less developed countries in the BSR, from Poland to Belarus.

6. Policy recommendations

The aim of the report was to analyse the circular potential of the BSR countries and predict how they could move away from the current, linear, take-make-consume-dispose model over the next decade. Policies relating to the circular economy have existed in the BSR for years, but they have been scattered between different policy areas, such as waste management, environmental protection and fighting climate change. This is starting to change, mostly due to the mainstreaming of the circular economic model by the EU. Policy will play a crucial role; it could even invalidate our baseline scenario and push the BSR countries towards a much faster transition. We divide our recommendations into those that would be easiest to introduce at the EU level (although they would require buy-in and cooperation between all levels of government) and those specific to the revised BSR strategy.

General recommendations

Circularising green public procurement (GPP). Including environmental conditions in public procurement contracts is gaining popularity in the BSR countries. This trend is expected to continue. As it stands, EU legislation on GPP consists of voluntary criteria for various sectors and serves as inspiration for countries willing to adopt stricter environmental policies. In the future, when some GPP rules become mandatory, they should include promotion of the circular economy: using products that are easy to reuse or recycle, using secondary raw materials, and so on. Circular economy requirements are already being added to revised EU sectoral recommendations on GPP - this process should be accelerated. Mainstreaming the circular economy in other policy areas. This is the EU's approach to climate policy, involving considering the impact of new policies adopted at the EU level on GHG emissions. Introducing the same requirement for the circular economy would support the transition not only through environmental policy, but also through regulations on construction, transport or even the single market.

Introducing EU-wide Pigouvian taxes. As higher taxation decreases the international competitiveness of the country introducing it, Pigouvian taxes, which provide incentives to accelerate the transition to a circular economy, must be imposed throughout the EU. This encompasses direct taxation on companies with a high CO_2 footprint and indirect taxes on non-recyclable products. Introducing both at the country level inside

the common EU market would be largely ineffective, as it would create incentives to avoid tax and increase the offshoring of linear modes of production to countries with lower taxation. An EU-wide bonus/malus system, i.e. granting subsidies (bonus) to products consistent with circular economy goals that are financed from taxes on products (malus) that are non-recyclable, have a high CO_2 footprint and have a short lifespan, is the most desired solution, as it is self-financing and easy to implement. Moreover, the decision on EU-wide Pigouvian taxes should be excluded from the unanimity rule that applies to all tax decisions made by EU institutions.

Ecological conditionality when allocating EU funds. In the longer term, spending money from the EU budget should be conditional on advancing the move to a circular economy, as measured by the milestones in the EU's 2015 Action Plan. This should work on a similar basis as the conditionality proposed in the post-2020 Common Agriculture Policy, which will link all farmers' income support (and other area- and animal-based payments) to the application of environmentally conscious and climate-friendly farming practices. We propose that the disbursement of EU cohesion and structural funds, especially for municipalities should be conditional on the fulfilment of circular economy goals. This would increase incentives – especially for poorer BSR countries – to introduce circular modes of production on a wider scale, not just in the energy sector. At the moment, politicians, especially in local government units, are not penalised for not promoting the production of recyclable goods with longer lifespans.

Providing incentives for introducing circular economy business models. The system of public circular economy incentives should not be solely focused on products (e.g. product energy efficiency, carbon footprint, recyclability) but also it should start to promote circular economy business models. Companies that follow a set of predefined rules that classify them as circular should be gratified with subsidies or at least higher CIT tax credits. Such measures, similar to tax credits for foreign direct investment in special economic zones, could promote larger availability of circular economy services (sharing platforms, products-as-a-service solutions), which are hard to promote with typical product-based incentives.

Extending the EU green taxonomy. Many companies in the BSR lack proper access to funding for large-scale investments introducing circular business models. A step towards increasing the availability of financing for circular economy investment has been made in 2018 in Commission's Action Plan on Sustainable Finance, as an EU classification system of sustainable finance and EU labels for green financial products has been put forward. However, this taxonomy was mainly focused on green energy investment. In our opinion this is a good direction to follow and the taxonomy should cover also investment that are aimed at introducing other

circular economy business models, from product design to product-as-a-service platforms.

Creating a green bond union. Green bond markets have emerged in countries such as Germany, Britain and Poland, UK or France, but access to them is mainly limited to large companies from these countries. Many companies from the BSR are excluded, especially if they operate outside the eurozone. Establishing a green bond union backed by the European Central Bank (ECB) or European Investment Bank (EIB) as market makers would create funding opportunities for circular economy investments. On a macroregional scale such a common bond market could be established by the Nordic Investment Bank or a cooperative of national development banks (e.g. BGK or KfW). Apart from providing liquidity to the market banks and government should also provide a set of market rules and classification system based on an extended 2018 Commission's Action Plan on Sustainable Finance that will help also smaller companies to start emitting green bonds. In further phase, the ECB could start accepting these green bonds in LTRO or even buy them as a part of its quantitative easing programme, decreasing the effective cost of funding and providing additional liquidity.

Recommendations for the revised EUSBSR

The lack of additional funding and limited competences mean that the role of macro-regional cooperation in the transition to the circular economy is limited. However, the transition is a complex task and every level of government needs to support it. Although some projects coordinated or funded via the EUSBSR foster the transition, there is significant room for improvement. The ongoing process of updating the EUSBSR Action Plan is the perfect opportunity to ensure that countries in the around the Baltic Sea are cooperating in this area.

Introducing circularity as horizontal action. Projects concerning circular economy currently fall into one of the existing policy areas (PA); for instance, PA Hazards, PA Nutri, or PA Innovation. Introducing a "Circularity" horizontal action (HA) would allow the strategy to channel funding into projects that can benefit many policy areas. This was the logic behind HA Climate, which can also support the strategy's goals.

Creating a regular forum on the circular economy for the BSR. In its current form, the EUSBSR's greatest strength is creating a platform for cooperation between different stakeholders, from governments, through regions and municipalities, to businesses and NGOs. An annual or biannual event would foster the development of networks and allow for the dissemination of knowledge and best practices. It would also raise awareness of the benefits of the circular economy among decision-makers.

Establishing a working group on the circular economy in the BSR. In addition to a regular forum, a working group could be set up to share experiences and identify problems with circular economy policy implementation. It would not require many resources and would generate considerable added value. The working group could develop indicators and share data on the circular economy, as collecting information and progress assessment is badly needed for the transition.

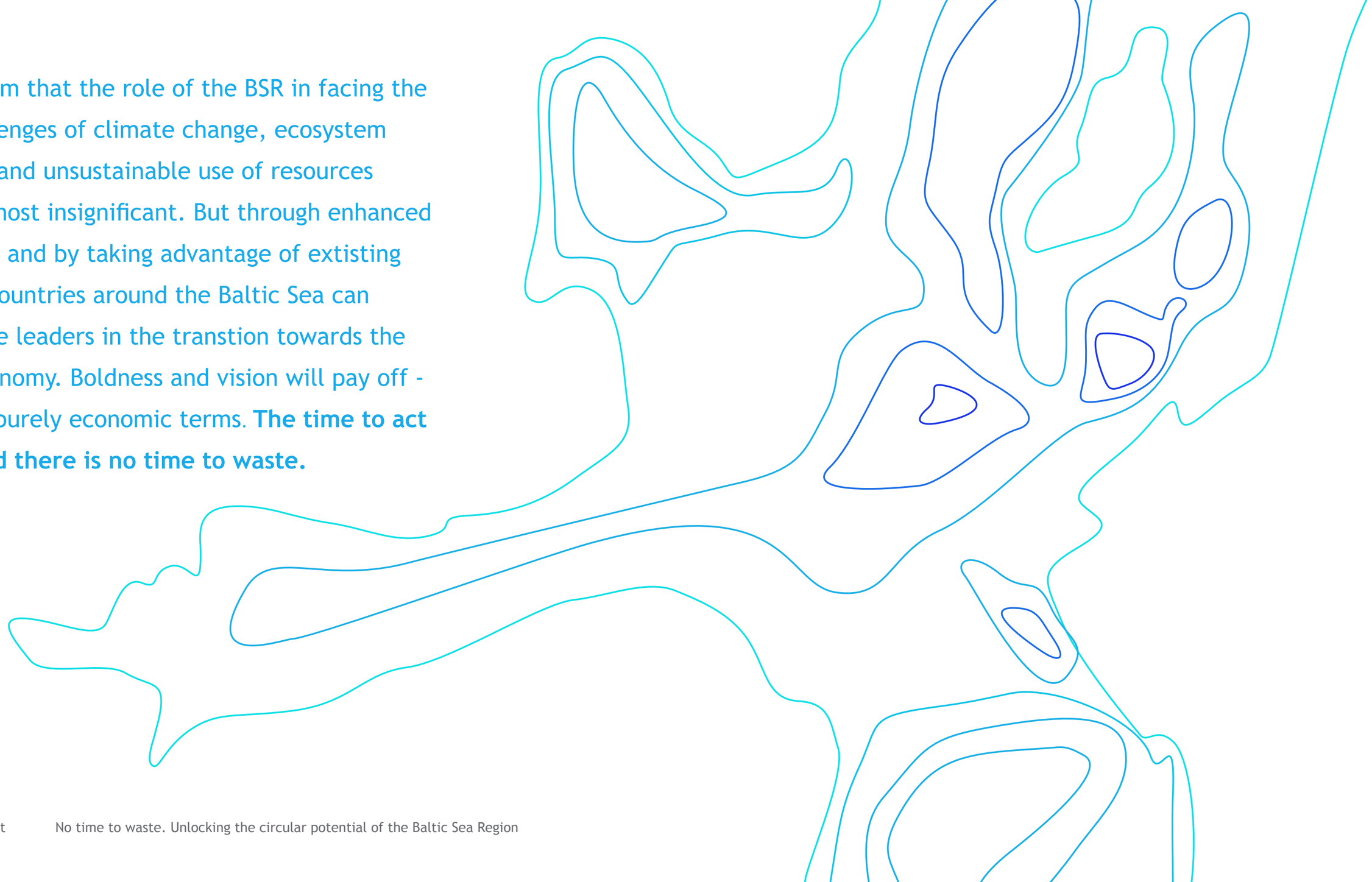
Unlocking additional funding for circular economy projects. As the transition away from the linear model will require substantial investment, there is a need for funding, especially for innovation in this area. In principle, macro-regional strategies mostly use existing EU-funds, but with enough political will, the BSR countries could create an additional fund for circular economy initiatives in the macro-region.

Identifying sectors with potential for creating competitive advantage. Given the capacity of the circular economy to create added value and address pressing environmental challenges, both developed and developing countries will invest in circular economy technologies and business models. The BSR countries are therefore the more likely to succeed in creating competitive advantage, the more they specialise in specific sectors. The Baltic Sea itself provides such opportunities. Applying circular economy principles to the so called “blue economy” would allow for a more sustainable and more efficient use of marine resources. Other examples include maritime transport innovation (for example electrification) and sustainable tourism.

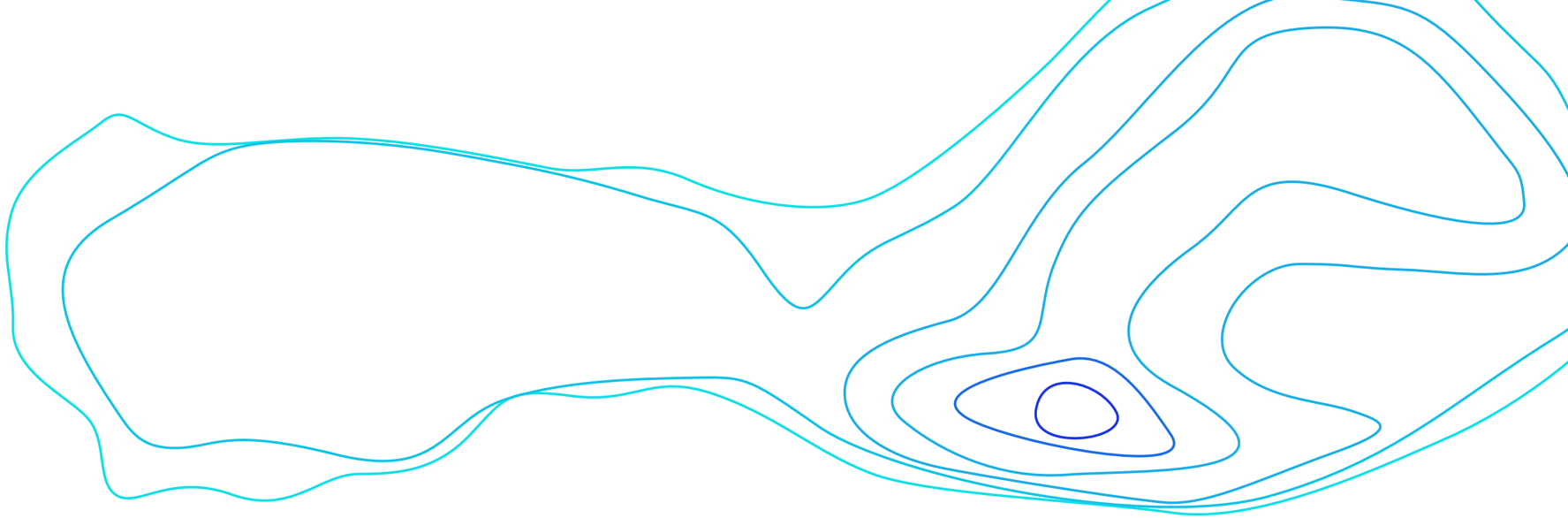
Improving stakeholder engagement. Private capital and businesses will play a crucial role in the transition to the circular economy in the BSR. That is why it is essential to engage business leaders in every step of the process. There is plenty of room for improvement. Communication should be streamlined, and more resources and efforts should be put into raising awareness of EUSBSR initiatives concerning circular economy. While drafting the updated strategy, it is important to consult the private sector, and – wherever possible – to shape the strategy according to the sector’s needs.

Strengthening governance in the BSR. The basis for such reform could be the cooperation between the Nordic (the Nordic Council of Ministers) and Baltic countries (Baltic Council of Ministers). This model of intergovernmental cooperation could be implemented for the entire BSR, enabling the EU Strategy for the BSR to have a higher profile, which would facilitate the implementation of circular policies in the macro-region. The foundation is already there – the Council of Baltic Sea States – but the organisation should be reinforced. It could be achieved for example by more frequent ministerial meetings, by not only foreign affairs ministers. Ministers of the BSR countries could also cooperate in the Council of the EU, especially in issues relating to circular economy.

It might seem that the role of the BSR in facing the global challenges of climate change, ecosystem breakdown and unsustainable use of resources is small, almost insignificant. But through enhanced cooperation and by taking advantage of extisting potential, countries around the Baltic Sea can choose to be leaders in the transtion towards the circular economy. Boldness and vision will pay off - not only in purely economic terms. **The time to act is now - and there is no time to waste.**



7. Methodology



To calculate the Circular Economy Advancement (CEA) index we used 24 variables divided into four categories (Retake, Reuse, Deconsume, Recycle) that represent the four areas of circular economy activities that we investigate in this report. All variables used, together with the respective data sources and missing observations information, are presented in the table below. Each variable has been subject to uniform transformation so that 100 pts was assigned to the country with the highest (lowest) value and 0 pts to the country with the lowest (highest) value of the transformed variable for those measures that are positively (negatively) related to circular economy advancement (see table for information whether a given variable has positive or negative impact on the CEA index).

Subsequently, to take account for missing observations, those variables were allocated into groups that measure a similar aspect of the circular economy and a simple average for all transformed variables in a given group was calculated. If none of the observations for a given country were available 0 pts was assigned. Lastly, to compute the index for each of the four categories a simple average of respective group averages was taken. The CEA index is a simple average of all four categories' indices.

Variable group	Impact on index	Variable name	Unit of measure	Year	Source	Data unavailable for
			RETAKE			
t1	negative	Domestic material input	kg per USD of GDP	2017	UNEP	
t1	positive	Circular material use rate	share in total material use	2016	Eurostat	Norway, Iceland, Belarus, Russia
t2	negative	Post-tax energy subsidies	percentage of GDP	2015	IMF	
t3	positive	National expenditure on environmental protection	percentage of general government revenues	2015	OECD	Iceland, Belarus
			REUSE			
m1	positive	Non-energy material productivity	GDP per unit of domestic material consumption (USD/kg)	2015	OECD	Belarus
m1	positive	Production-based CO_2 productivity	GDP per unit of energy-related CO_2 emissions	2016	OECD	
m1	positive	Patents related to recycling and secondary raw materials	percentage of all patents	2014	Eurostat/ World Bank	Norway, Iceland
m1	positive	Share of renewable energy in gross final energy consumption	percent	2016	BP 2018	
m2	positive	Gross value added related to circular economy sectors	value added at factor costs as percentage of GDP	2016	Eurostat	Belarus, Russia

REUSE						
m2	positive	Jobs related to circular economy sectors	share in total employment	2016	Eurostat	Belarus, Russia
m2	positive	Private investments related to circular economy sectors	gross investment in tangible goods as percent of GDP	2016	Eurostat	Iceland, Belarus, Russia
m2	positive	Circular economy activities undertaken by companies	Percent of positive responses to the question: "Has your company undertaken some circular economy related activity?"	2016	Eurobarometer 2016: European SMEs and the Circular Economy	Norway, Iceland, Belarus, Russia
m2	negative	Declared witholding of investment in resource efficiency	Share of repondents answering "Nothing" to the question: "Over the past two years, how much have you invested on average per year to be more resource efficient?"	2017	Eurobarometer 2017: SMEs, resource efficiency and green markets	Belarus, Russia
DECONSUME						
c1	positive	Demand-based CO_2 productivity	GDP per unit of energy-related CO_2 emissions (USD/kg)	2015	OECD	Belarus
c1	negative	Energy use	kg of oil equivalent per capita	2014	World Bank	
c1	negative	Gross inland energy consumption growth	Cummulative increase in percent	2006-2016	Eurostat	Belarus, Russia

			DECONSUME			
c2	positive	Proenvironmental attitudes	Average of mean shares of positive answers to questions Q85A, Q85C, Q85G in a given country from the World Value Survey	2008	WVS	
c2	positive	Proenvironmental actions	Average of mean shares of positive answers to questions Q5aH and Q5bH in a given country from the World Value Survey	2008	WVS	
			RECYCLE			
d1	positive	Urban waste water treatment	Percent of population connected to urban wastewater tertiary treatment (i.e. removing nutrients from water)	2015	European Environment Agency	Belarus, Russia
d2	negative	GHG emissions	in CO_2 m^3 equivalent per capita	2016	European Environment Agency/Rosstat	
d2	negative	CO_2 emissions	m^3 per capita	2014	World Bank	
d2	negative	PM2.5 air pollution	µg per m^3 per annum	2016	World Bank	
d3	positive	Recycling and composting of waste	percent of all waste	2016	World Bank	
d3	negative	Generation of municipal waste	kg per capita	2017	World Bank	

Chosen initiatives relating to the Circular Economy implemented by the European Commission (see Chapter 4)

Production	Ecodesign Working Plan 2016–2019	The plan operates as part of the Ecodesign Directive, which aims to introduce environmentally-friendly standards in product design in the EU.
	Proposal for Implementing Regulation on Televisions and Displays	Member states voted in favour of this proposal in December 2018. It builds on the Ecodesign requirement for the sector, focusing on material efficiency when producing TV and computer monitor displays.
Consumption	Proposal for a Directive on the Online Sales of Goods	First presented in December 2015 and amended two years later, this proposal aims to strengthen consumer rights in the EU. In doing so, it will reduce the number of products being disposed of by consumers.
	Fitness check of Ecolabel	The check happened in June 2017, widening the product categories eligible for the Ecolabel.
	Action on Green Public Procurement	The new/revised EU green public procurement criteria integrating circular economy requirements published since December 2015 include computers and monitors, textiles, furniture, indoor cleaning services, paints and varnishes, road design, construction and maintenance, and office building design, construction and maintenance.
Waste management	Revised Legislative Proposal on Waste	Adopted in May 2018, it entered force in July 2018, introducing new ambitions for applying the circular economy in the field, including introducing long-term recycling targets for municipal and packaging waste.
	Initiative on Waste to Energy in the framework of the Energy Union	The communiqué “The role of waste-to-energy in the circular economy” was adopted on 26 January 2017 to get more energy from less waste.

Market for secondary raw materials	Proposal for a revised fertilisers regulation	The EP reached a political agreement on this in December 2018. It promotes organic fertilisers, giving them a CE stamp and boosting the internal market for innovative organic products.
	Proposed legislation setting minimum requirements for reusing water for irrigation and groundwater recharge	Adopted in May 2018, the proposed legislation sets minimum requirements for reusing water for irrigation in agriculture. It seeks to encourage the safe, efficient and cost-effective reuse of treated urban wastewater, turning a wasted resource into a valuable one for further use, while addressing water scarcity.
Sectoral actions	Strategy on plastics in the circular economy	Published in January 2018, it consists of four pillars: (1) making recycling of plastic more economical, (2) curbing plastic waste and littering, (3) promoting innovation and (4) harnessing global action.

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