Climate Solutions

Why climate is the world's most pressing challenge – and what you can do about it

European Investment Bank
The EU bank

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Published by the European Investment Bank.
Layout: EIB GraphicTeam
Printed on FSC Paper. Cover and interior: Munken Polar, FSC Mix

print: QH-04-19-719-EN-C ISBN 978-92-861-4484-4 doi:10.2867/651790
eBook: QH-04-19-719-EN-E ISBN 978-92-861-4482-0 doi:10.2867/583145
pdf: QH-04-19-719-EN-N ISBN 978-92-861-4483-7 doi:10.2867/64444

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Introduction

Werner Hoyer

Climate change is a challenge to humanity so complex, so great, that it is hard to know what each of us, as individuals and institutions, can do to counter it. Climate Solutions details the challenges, lays out solutions and indicates which ones you can make part of your life.

Climate action is already part of life at the European Investment Bank. The EU bank is committing an increasing share of its impressive resources to the fight against climate change. We pledged to invest $100 billion in climate action between 2016 and 2020 – and we are well on course to hit that target. Since 2012, the European Investment Bank has shown that it is, indeed, the EU climate bank with €127 billion in climate action investment. Even farther back, in 2007, the European Investment Bank invented green bonds, an innovative financial tool designed to attract more investment to climate projects. Green bonds are now a €700 billion market set to grow still more. (Read about them in Chapter 5.)

We have to invest in brand new climate technologies, too, which means engaging with the startups developing these innovations.

Of course, finance may not be the first thing that comes to mind when you think of the climate crisis. You are more likely to conjure up images of melting ice caps, tropical storms and grasslands turned to desert, or simply to remember that you were hotter last summer than ever before in your life. But if we are truly to confront global warming and its devastating results, we need to finance greater use of renewable energy and energy efficiency products. We have to invest in brand new climate technologies, too, which means engaging with the startups developing these innovations. This is what the engineers, economists, loan officers and risk management specialists at the European Investment Bank are working on, and we are expanding our partnerships in every possible corner of the financial world to maximise our effectiveness in this existential battle.

As the EU's climate bank, the European Investment Bank finances a full range of climate action. The experts who work on our climate projects are the authors

of the chapters in this book. The experience they have built over the years makes them highly effective in delivering the investment needed to tackle the climate crisis. It also gives them insights into the kinds of everyday actions you can take. Because we want to work in partnership with you, too.

In each of the chapters of this book, our experts share their knowledge. They will help you figure out what you can do in areas that range from how you get around to what you eat, from protecting our oceans and rivers to cutting the energy consumption of your home. You might also learn to love the weeds in your garden or windowboxes (in Chapter 6).

The European Investment Bank has ambitious climate action plans for the next, crucial decade. I hope this book will increase your awareness of the issues facing all of us across the globe – and give you some ideas about how you can contribute to the solution.

Werner Hoyer is President of the European Investment Bank

Chapter 1

Urban development

The city as a sponge

Leonor Berriochoa Alberola
and Giulia Macagno

Urban climate adaptation is the next step for cities that need to protect themselves – and their citizens – against the inevitable effects of climate change. Here are some ideas about how to do it.

The risk of floods and other increasingly extreme weather events is a major headache for planners in historic cities, who can do little to change the dense, narrow streets of old centres.

That's why Florence, whose centre is about as historic as they get, is putting into effect a plan to create areas around the Ema, a tributary of the city's biggest river, the Arno, that will sop up future floods like a sponge. When the river isn't in flood, these areas will be parks to be enjoyed by citizens.

Cities are adapting to the consequences of climate change with nature-based solutions that also make the city more attractive and pleasant for residents.

It's a clever plan and it's something that more and more cities all over the world are going to be doing. Cities are adapting to the consequences of climate change with nature-based solutions that also make the city more attractive and pleasant for residents.

The European Investment Bank has a long relationship with Florence, making many loans to the Tuscan city over the decades. Recently the bank has responded to the climate crisis by encouraging all kinds of borrowers to think about what it means for them. In the case of cities, of course there are some obvious measures that can be taken. Buildings can be made more energy efficient, for example, with better insulation, heating systems and windows. Meanwhile, energy can be generated through solar panels, rather than through polluting fuels.

A role for urban climate adaptation

Energy efficiency and renewable energy schemes fall into the category of climate mitigation. They reduce the net emissions of greenhouse gases and, thus, counter global warming head on. That's important, because most of the emissions heating up the global climate come from cities.

But cities also need to face up to the often disastrous impact of climate change as it already affects them – and as it's likely to continue to affect them in coming decades, even under the most favourable scenarios. **This adaptation to climate change is important in cities, because of the economic and social consequences of floods or extreme heatwaves on unprepared populations.**

None of this is easy. Every mayor knows their city has to adapt and is developing climate strategies. But the implementation and financing of climate-resilient projects is a challenge. Technical and financial teams in public administration need to work together to:

- understand climate risks and vulnerabilities
- integrate into projects the right improvements and safeguards to protect the city against climate change
- understand the budgetary framework to finance these new resilient projects.

The Hub for urban climate adaptation

Here's how the European Investment Bank worked with the City of Florence on the definition of its climate strategy and climate-resilient projects that could be financed by the Bank.

Through the European Investment Advisory Hub, a partnership between the bank and the European Commission, we recruited a consultant to work with the Florence municipality to improve upon a planned flood protection scheme, so that it would also tackle additional climate change risks. The study aimed to create new Green-Blue infrastructure on the Ema to:

- reduce heat island effects
- improve the Ema's water quality
- improve sustainable mobility with bicycle paths connecting local towns and nearby cultural sites
- reduce urban runoff and potential water pollution

- provide alternative water resources in case of water scarcity
- increase biodiversity.

Thus, the study developed a plan to improve the capacity of the area around the Ema outside the city centre to absorb rising water levels. This would lead to less damaging floods in the city centre.

With the consultant's help, Florence coordinated with two smaller municipalities on its borders and developed a project that utilises a park around the banks of the Ema for a **nature-based solution** to the problem. Instead of building concrete tanks to collect flood water, they built hills and valleys in a park that can absorb the flood and, when there's no flooding, double as a place for recreation, including bike paths.

The adaptation project may be included in an existing €225 million loan from the European Investment Bank that will help finance other urban infrastructure schemes.

What is Green-Blue infrastructure?

Green-Blue infrastructure is a city planning term that means incorporating natural landscapes into public spaces (green) and combining them with good water management (blue).

How to replicate adaptation projects for unique urban challenges

Florence's adaptation project is a good one. Like most adaptation measures, it also doesn't eat up too much of the city's budget.

But it required a lot of thinking, because **each city's adaptation solution is unique.**

Cities need to bring in an expert to suggest tailor-made solutions. That's the difficulty of adaptation. There are a lot of things that can be done, yet it's hard to identify the most cost-effective and most suitable solution in any specific case, because the climate risks and vulnerabilities are unique for each project. Some cities don't have the internal resources for this and they may need external specialists.

How unique is each adaptation project? Some things apply everywhere, of course. If there's a risk of floods, one common adaptation practice is to put heating and air-conditioning machinery on the roof, instead of in the basement where it can be inundated by water. However, when it comes to the design of public infrastructure, things become more complicated.

Here are a few unique examples that we've noticed either through projects we worked on or from observing how cities are dealing with the challenge:

Cities are testing things out, because adaptation is clearly a field of urban development that will be increasingly important.

- Growing grass or trees in the south of Spain is a challenge, because of low rainfall. In Malaga, it wasn't feasible to plant trees to provide shade for citizens. So the municipality put up large parasols in pedestrian areas. The result: people go out even in the sunshine, which is good for business, tourism and social life.

- Barcelona saved a lot on climate adaptation measures for social housing projects, just by finding the right orientation of the buildings to create cross-ventilation and to maximise the exposure to the sun at the right time.

- In Paris, air-quality measures were presented to residents less as a climate issue and more as a matter of health, which made them popular even with people who would have been unwilling to accept them just for the sake of climate action.

- Rotterdam is taking away paved areas of the city. Those impermeable surfaces, which do not allow water to drain away fast enough, are being replaced with sand, soil and plants. The aim is to use the city as a sponge, retaining water for later use.

There are a lot of options that are relatively low-cost. Cities are testing things out, because adaptation is clearly a field of urban development that will be increasingly important. The key element that we always drive home in our consultations with cities is that **adaptation should be part of an integrated plan**. Random, small interventions can add a lot of value, particularly in cities where there is little new development. However, as long as the masterplan doesn't take adaptation fully into account, then it's difficult to make the city truly resilient to climate change.

Urban climate adaptation in Athens

Athens is a good example of a city that has really made adaptation central to its resilience strategy.

The urban fabric of Athens is made up of dense constructions that cover 80% of the city's surface. So much asphalt and concrete retains heat during the extended heatwaves to which the city is increasingly exposed. These **urban heat islands** in the city centre can be more than 10°C warmer than the suburbs. But asphalt and concrete are not just a liability when the weather's hot. They also stop water seeping away into the ground during rainstorms. The result: frequent local flash floods.

The city set out to solve these problems, which are the result of climate change. Athens is entering into a set of innovative climate adaptation projects financed by the Natural Capital Finance Facility, a programme run by the European Investment Bank in cooperation with the European Commission that focuses on nature conservation, biodiversity and adaptation to climate change through nature-based solutions.

The Athens Natural Capital Finance Facility project is expected to create at least 25% more green areas and introduce several climate adaptation measures that include birdhouses and trees. Green corridors are very important for biodiversity, because they allow species and air masses to move.

They're also very pleasant for city residents.

What is an urban heat island?

An urban heat island is a city area that is much warmer than nearby rural areas, because the heat of the sun is retained by buildings, roads and other built surfaces. Energy use in the city also contributes to the higher temperature.

Nature-based urban climate adaptation

These parts of the overall project, backed by the Natural Capital Finance Facility, are included in the framework loan from the European Investment Bank signed in December 2018 that's intended to support Athens' "2030 Resilience Strategy," drawn up by the city in 2017. The main part of the loan

will finance refurbishment of public infrastructure, including energy upgrades and earthquake fortification for municipal buildings, as well as sustainable mobility and waste management initiatives. The important thing to note here: **the adaptation element is part of an integrated plan, and that's what is likely to make it more effective – and easier to finance.**

The quality of life for citizens is an important factor in adaptation projects.

Athens is the first city to be financed under the Natural Capital Finance Facility, which includes technical assistance granted free to the municipality, in part to pay for an international consortium of consulting firms to assess the design of the plan. The consultancy will also follow the implementation and development of the range of projects that will be covered by the bigger loan from the European Investment Bank. It is a pilot project, which we think could be expanded to many other cities.

Urban climate adaptation and air quality

The quality of life for citizens is an important factor in adaptation projects. For one thing, greening areas once covered by impermeable concrete generally leads to parks or natural areas that residents enjoy.

Other environmental urban projects that are not strictly adaptation can be of similar benefit to the lives of citizens. Improvements in air quality are very important in this regard, because they counter the emission of greenhouse gases and bring health improvements to residents who find themselves breathing cleaner air.

We worked on a project with the city of Milan that grew out of the EU's Urban Agenda, which includes a section on air quality. The Urban Agenda calls for the preparation of a technical assistance guide for cities and local authorities that lays out how to finance urban air quality plans – without jargon.

We prepared this guide by going through the process of developing an air quality plan with Milan. City officials had good data on how much they might be able to reduce emissions with improved heating systems and urban green areas. They wanted to know specifically:

- how to finance the project
- how to develop general guidance to be shared with other cities.

We prepared user-friendly guidance that shows in graphic format how to structure the financing based on a fundamental difference: does the measure generate revenue, or not? If it doesn't, the municipality is unlikely to get private investment. That might seem like a basic and rather obvious fact, but it's not clear to every municipality. City plans are typically made by technicians, not financiers, and they need guidance so that they can consider the potential sources of financing early in the planning process.

What is the Urban Agenda for the EU?

The Urban Agenda for the EU is a working method approved in 2016 to promote cooperation between all EU member states, the European Commission, cities and other institutions, such as the European Investment Bank. The aim is to make cities more liveable and innovative, to build social inclusion and to foster economic growth.

Government or private investment for urban climate adaptation

Air quality plans generally include a wide array of measures, from the reduction of emissions from cars and other vehicles, to the improvement of energy efficiency in buildings and the expansion and improvement of urban green areas. While many cities know how to tackle air quality problems, identifying the most suitable sources to pay for them is often a challenge.

That depends on whether it's revenue-generating or not, as mentioned earlier. However, some measures can generate revenue – or not – depending on their main purpose. For example, a low-emission zone can generate revenue if people are allowed to use their cars in return for the payment of a fee. But such a scheme may be unsuccessful in reducing emissions, since people are often happy to pay a price so that they can still use their car. In that case, the result is that the project brings in revenue, but doesn't improve air quality.

The document we prepared through our Urban Agenda Partnership for Air Quality provides examples of different sources of financing for municipal air quality projects. It also shows the part the European Investment Bank can play, from technical advice by the European Investment Advisory Hub's URBIS platform through to "framework" loans, in which a variety of urban projects can be included within a single loan from the Bank.

The idea is to share knowledge about a sector that:

- requires technical faculties some cities don't have
- has a lot of aspects in common with the urgent task of tackling climate change.

Thus, the very highly motivated technical staff working for municipalities will be able to use the guide as a tool to define an appropriate combination of financing sources in cooperation with their budget offices.

The bottom line is that cities need to adapt to climate change. They also need to adapt to, well, the idea that adaptation is part of that process.

We are now about to launch a study of the economic value of adaptation in urban areas. This is also a result of the Urban Agenda adaptation partnership. We intend to select three or four cities with specific projects and a resilience or adaptation strategy, working with them to assess their options through the lens of a cost-benefit analysis.

The bottom line is that cities need to adapt to climate change. They also need to adapt to, well, the idea that adaptation is part of that process. Our challenge is to help prepare them for this increasingly important part of managing a city.

Climate solutions: Urban climate adaptation if you're a...

Policymaker: Reflect on how climate change impacts your city and its infrastructure. Reflect on how to translate this into your masterplan at the city level. Once you have that level of general planning, it's much easier to prioritise individual projects, because they can be seen to help reach the bigger goal. To define priorities, you need to plan and look at the city as a whole. Adaptation isn't an issue that will just make you look up to speed on a major current issue – climate change. Rather, it has an economic impact and a social impact on the quality of life of your citizens.

Citizen: Be aware and push local authorities to make adaptation key to their city plans. Ask questions about the impact of climate change on your city. Is it a health impact, because heatwaves send people to the hospital? Is it an economic impact from frequent floods that destroy what you have stored in your basement?

Financial institution: We have a responsibility to steer local authorities and project promoters into thinking about adaptation. We have to strengthen our technical capacity, especially at commercial banks that lack experts with an understanding of these risks. This is, in itself, an additional risk to which these banks are exposed. We have to find a way to reward municipalities that take adaptation into account. If they have an increased cost that ultimately mitigates a risk, it has a positive impact on their long-term financial stability, so we have to take that into account in the pricing of a loan. The benefit has to be financial for it to be taken up widely.

Leonor Berriochoa is an engineer and Giulia Macagno is an economist in the urban development division of the European Investment Bank.

Chapter 2

Agriculture and food

Your stomach can help save humanity

Janel Siemplenski Lefort, Arnold Verbeek, Surya Fackelmann and Brendan McDonagh

To fight climate change food has to be produced more efficiently. Here's how data and technology can make our food choices environmentally friendly.

Our quest for food has historically come at the planet's expense. For millennia, nature was pushed aside to make room for growing crops and raising animals.

As much as half of the Earth's forests were felled over the last 5 000 years. In the first decade of this century, tropical countries lost seven million hectares of forests each year, mainly for agriculture.

Nourishing the world's 7.6 billion people is degrading ecosystems, depleting water resources and driving climate change. Agriculture for food and for non-food products like leather accounts for over one-third of global greenhouse gas emissions and roughly one-third of global energy demand, much of which comes from non-renewable sources. Part of the carbon emissions come from food production, but another big part comes from the clearing of forests, which eliminates important carbon sinks.

The world's population is expected to hit 11 billion by 2100. If we are to feed everybody without destroying the last of our natural resources, agriculture needs to find a way to coexist with Mother Nature. We have to make agriculture more efficient through innovation, reduce the roughly 30% of food that is currently lost or wasted and rethink what and how we eat.

What is agriculture's carbon footprint?

Agriculture for food and other products like leather account for over 30% of global greenhouse gas emissions and roughly 30% of global energy demand, much of which comes from non-renewable sources. Part of the carbon emissions come from food production, but another big part comes from the clearing of forests, which eliminates important carbon sinks.

Innovation: Growing more, better

Before the industrial revolution, a farmer was lucky if he was able to feed his family. After the industrial revolution, advances in machinery and technology enabled that one farmer to feed several hundred people. While the industrial production of food is often criticised, it enables us to feed large populations with relatively small human resources.

We may have overdone it.

The ability to produce more food, more cheaply has led to overdoses of chemical fertilisers, pesticides and industrial animal production. The price of food became the main driver, and for a long time the environmental impact was largely ignored. We're reaching the limits of that approach. While global demand for food is expected to grow 98% by 2050, the available land suitable for agriculture will remain unchanged, according to a recent EIB report "Feeding future generations: How finance can boost innovation in agrifood". **We have to make agriculture less resource-intensive, more productive and more sustainable.**

How technology can help

Big data is already helping farmers track and better target their production. GPS soil sampling, for example, allows farmers to create soil fertility maps with information about a field's nutrients, pH level and other data. That enables farmers to make better decisions about which seeds to plant where and what kinds of fertiliser to use. Farmers can also integrate data from other areas of the farm: information on crops or animal growth, financial figures, inventory levels or upcoming weather patterns, to name but a few. That information helps farmers to make quick and rational decisions in otherwise complex surroundings.

It's not just about tracking life on the farm. Farmers can analyse the costs and benefits of certain kinds of production and better track supplies to reduce unnecessary inventory. Those efforts can in turn increase profitability and output.

For most businesses, big data analytics can increase productivity by 5-10%. For agrifood companies to benefit from those gains, however, the exchange of data and the compatibility of different agriculture data tools need to improve.

An automated milking system can store about 200 000 data points per year for a single cow.

Some of the agricultural areas that could most benefit from better access to data are:

- horticulture (tomatoes in greenhouses)
- poultry production
- the dairy sector
- precision farming, which relies on technology for better and more precise crop management.

In dairy farming, for example, the adoption of automated milking systems will lead to an explosion of data that can be analysed. An automated milking system can store about 200 000 data points per year for a single cow.

Digitalisation along the supply chain

The integration of real-time data across farms and their networks of suppliers could eventually cut out the middleman, enabling farmers to order new supplies directly from wholesalers. That direct link to wholesalers would also help suppliers plan their own production better and let farmers maintain lower levels of inventory, reducing their overheads.

Linking agrifood companies directly with retailers could result in similar efficiencies. When retailers share upcoming demand with a farmer, it reduces the farmer's uncertainty over their choices of crops or livestock, quantities and prices. At the same time, farmers could transmit the quantity and quality of their production to help retailers stock their stores. **Real-time data integration could effectively cut the fat out of the agrifood supply chain.**

Another way to make farms more efficient is to link them directly to the consumer through agrifood platforms, which enable retailers to drive the entire supply chain with forecasts of consumer demand. Big data algorithms could then help connect retailers back to the farms to order more products.

Tracing products with blockchain

Technologies like blockchain-based smart monitoring systems aim to increase the transparency of supply chains by allowing a product to be traced back to a specific farm. Blockchain basically stores all transactions in "blocks" of code that are combined to form a single blockchain. The technology is able to track products according to certain parameters, such as temperature, time to market and origin.

Technologies like blockchain-based smart monitoring systems aim to increase the transparency of supply chains.

Being able to track a product in such detail helps build consumer trust and improve food safety. For example, frozen food can be monitored to determine whether the food remained at freezing temperature during transportation. Blockchain can also replace costly paper or computer reporting, while reducing the risk of fraud, corruption and data tampering.

Blockchain technology has limits though. Storing a large number of transactions provides an incredible amount of information about a product, but the accumulation of information will increase the size of the blockchain over time. For blockchain to work in the agrifood industry, the technology needs to be able to manage greater amounts of data than is currently possible. For example, the current size of the blockchain for the cryptocurrency Bitcoin is over 165 gigabytes.

Because every user has a complete copy of the blockchain, keeping the size manageable for the many participants in an agrifood supply chain will be a challenge.

Barriers to technology adoption

Trying to get farmers to take advantage of technology is tough for several reasons:

- farmers are naturally risk-averse
- technology requires money to invest that they may not have or be able to get

- many farmers fear losing control of their own data
- most of Europe's farmers are no longer spring chickens.

While the average age of farmers differs widely between countries, 56% of farmers in the European Union are 55 or older, and 31% are 65 or older. **Most of these farmers were trained and educated before digital tools became widespread.** However, the higher average age means that European farming is due for a change of guard, with a younger generation taking over. Younger generations grew up in a digital environment and tend to have a basic understanding of digital tools.

Addressing agrifood companies' fear of losing control of their data is harder. Farmers and other producers worry that opening up access to their data will take away their ability to negotiate prices and turn them into mere field hands. One solution is to create data cooperatives run by farmers, like the Grower Information Service Cooperative. This cooperative enables farmers to securely store their data and also provides anonymous data from a network of farms that members can use as a benchmark. The Farmers Business Network and Farmobile provide similar services. The network allows farmers to anonymously share data about everything from seed performance to chemical pricing. It then aggregates the anonymous data and makes it available to all members.

Limits of harvest cycles

Farms aren't like manufacturing plants. A farmer can't build a prototype in two weeks and then perfect it over the next few months. To see if a new digital application actually results in a higher yield of corn, a farmer has to wait for the corn to grow – and corn can only be grown once a year.

Also, land is finite. If a farmer dedicates part of her fields to a new, innovative way of growing corn, then she may have to take those fields out of production while she tests the new approach. That means lower output and lower revenue.

Animal production has similar limits. **A piglet takes 170 days on average to reach its slaughter weight.** While the farmer can control the breeding conditions, such as pig selection, feed, temperature and other variables, he only has a couple of chances during the year to get it right.

Europe's role

The European Union is the largest trader of agricultural goods in the world. As such, it has an important role to play in reshaping agriculture.

Along with being an important source of exports, agriculture is also a major employer in Europe. The food and beverage industry accounts for 9% of the European Union's gross domestic product and employs about 15.4 million people. It is often the biggest employer in disadvantaged regions.

Despite its huge size, European agriculture isn't as productive as it could be. Small-scale farms dominate – 73% of all farms are family businesses. The owners of those small farms often have difficulty getting financing for innovative projects. New innovative machinery, for example, is expensive and the investment is hard to recoup on a small farm. Farmers are also naturally cautious and reluctant to take risks with new ways of working. That lack of innovation weighs on agriculture's productivity. Labour productivity in European agrifoods is equal to about 67% of the automotive industry and 71% of the engineering sector.

One reason for that lower productivity is a lack of investment. Agrifood companies in the European Union invest only 0.2% of their annual revenue in innovation, according to research by the European Investment Bank, compared with 0.44% for American firms or 0.65% for Japanese companies.

Those low investment levels are partly due to a dearth of financing in Europe, particularly venture capital funds for start-ups and innovative projects. Total annual venture capital investment in the United States is four times the level of the European Union.

That gap needs to close if Europe is going to produce more food, more sustainably.

Changing what we eat

While some people still go hungry, most of us eat more food than ever – and we definitely eat more meat.

Since the 1960s, the amount of food produced globally has exploded. Meat and vegetable oil production has doubled since 1961, according to the Intergovernmental Panel on Climate Change, and the supply of food calories per capita has grown by about one-third.

Changes in eating habits have resulted in about 2 billion adults being overweight or obese, the Intergovernmental Panel says, while an estimated 821 million are still undernourished.

The problem with meat and dairy products, particularly cattle ranching, is that they produce more carbon emissions and require more land than vegetable

sources of protein. **By simply changing what we eat to focus our diets more on whole grains, legumes, fruits and vegetables, nuts and seeds, and meat and dairy produced in a sustainable way, we could significantly reduce the environmental impact.** By 2050, dietary changes alone could return several million square kilometres of land to nature and radically reduce carbon emissions.

Beef's big carbon footprint

Meat, fish and seafood, eggs and dairy use about 83% of the world's available farmland and account for 56-58% of agriculture's emissions (carbon, methane and others), but we only get 37% of our protein and 18% of our total calories from those foods, according to a study published in Science Magazine. Emissions from animal products are typically higher because it requires twice as much vegetable protein to feed an animal as the protein gained from the animal's meat.

That's not the only problem. Carbon is released when forests are destroyed. In Brazil the Amazon rainforest has often been burned or chopped down to make room for cattle ranching and crops used to feed livestock. In addition, livestock feed is usually produced in one place (soybean crops in the Amazon) and then transported to ranches in other areas (European cattle). Those factors increase meat's overall carbon footprint.

The amount of greenhouse gas emissions generated by beef production per 100 grams of protein are 12 times greater than those created by dairy farming, and the land used is 50 times greater, the study found. Dairy cows, in turn, produce 36 times more carbon emissions and use six times more land than peas, a good source of vegetable protein.

We could just all become vegans. Excluding animal products from our diet could reduce the amount of land used in agriculture by about 76% and lower carbon emissions by 49%, according to the study. Rewilding land no longer needed for food production could remove about 8 billion metric tonnes of carbon emissions from the atmosphere each year over the next 100 years.

While veganism may be unpalatable for many people, simply cutting the amount of animal products we eat can make an impact on carbon emissions. By halving the amount of animal products consumed globally, the study found that emissions could be cut by about 10 billion metric tonnes, or about 71% of the total reduction achievable by eliminating meat, while land use could be reduced by 67% of the total if we all went without meat.

We could also track where our food comes from to support low-impact producers. The study found that a few high-impact producers were responsible for the majority of emissions. For beef, the highest-impact 25% of producers accounted for 56% of greenhouse gas emissions and 61% of land use. Avoiding beef from those producers could already go a long way towards reducing the environmental impact.

Cutting food waste

The numbers are stunning. About 25-30% of the food produced globally is wasted, according to the Intergovernmental Panel on Climate Change. Wasted food accounted for 8-10% of greenhouse gas emissions (carbon, methane, nitrous oxide and fluorinated gases) from 2010-2016.

Ending food waste would go a long way towards feeding 11 billion people by 2100. To do so, every step of food production needs to be improved, from harvesting techniques, to on-site storage at the farm, to infrastructure, to transport, packaging, retailing and education.

In recent years, several European governments have turned their attention to the problem. France throws away an estimated 10 million tonnes, or 10 billion kilos, of food each year. So France passed a law in 2016 that requires supermarkets of over 400 m² to stop throwing out or destroying unsold but still consumable produce. Instead they have to give it to foodbanks or other charities. A number of countries have followed France's lead in passing similar laws, including Italy, Finland, the Czech Republic and Peru. In 2018, France went a step further and passed a law requiring the agrifood and industrial catering industry to do the same.

About 25-30% of the food produced globally is wasted, according to the Intergovernmental Panel on Climate Change.

The average German throws away 55 kilograms of food a year. While Germany doesn't yet have any laws dealing directly with food waste, the government has started a push to cut food waste by half by 2030 through an initiative involving consumers, agrifood companies, non-profit organisations, politicians and scientists.

What is the amount of food waste globally?

About 25-30% of the food produced globally is wasted. Wasted food accounted for 8-10% of greenhouse gas emissions (carbon, methane, nitrous oxide and fluorinated gases) from 2010-2016.

Food waste apps

A host of apps have sprung up in recent years to help combat food waste. Some of them, like FoodCloud, put restaurants and other businesses with surplus food in touch with local charities. Others, like Karma and OptiMiam, help restaurants, cafes and grocery stores sell their leftover food to individuals.

Other apps, like Too Good To Go, are veritable "waste warriors." Too Good to Go has a four-pillar approach to cutting waste – households, businesses, education and politics – with specific outreach goals assigned to each pillar. Originally inspired by a Dutch food app, Too Good to Go has lists of food offerings from local stores and restaurants that individuals can order and then pick up at a specified time. The rapidly expanding company has 350 employees and a long list of job openings in Europe. Too Good To Go currently operates in 12 European countries.

Apps to cut food waste

A number of apps have sprung up in recent years to help individuals and businesses tackle food waste. Some of them sell restaurants' leftover food at discounted prices, while others help people better organise their kitchens to prevent food from being forgotten at the back of the pantry.

Below are just some of the food waste apps available.

1. **FoodCloud** puts restaurants and other businesses with surplus food in touch with local charities.
2. **OptiMiam** helps restaurants, cafes and grocery stores sell their leftover food to individuals.
3. **Too Good to Go** has lists of food offerings from local stores and restaurants that individuals can order and then pick up at a specified time.
4. **Olio** connects neighbours and local businesses with each other to avoid good food being thrown away, be it vegetables from your garden or food in your fridge before you leave on vacation.
5. **Magic Fridge** helps cut down on food waste at home by offering recipes that use food you already have in your kitchen.

6. **Karma** connects consumers with low-price surplus food from restaurants, cafes and grocery stores. Founded in Stockholm in 2016, the company is now active in 150 Swedish cities along with London and Paris.
7. **Zéro Gachis** (No Waste – not to be confused with the No Waste food inventory app) is another app that links soon-to-expire products from supermarkets with local consumers.
8. **A Consommer** (To Consume) allows you to register the food in your cupboard and be alerted when it is about to expire. You simply enter the details of the food, where it is stored in your kitchen and the expiry date (or an estimation for fresh fruit and vegetables).
9. **Save Eat** stores an inventory of your fridge and kitchen pantry, and can alert you when items are about to expire. In addition, the app proposes recipes using the food you already have at hand.

Where do we go from here?

The future isn't just about having more food to feed more people. It's about coming to terms with our unsustainable approach to food production and adjusting our public policies, lifestyles and taste buds to support a form of agriculture that isn't at war with nature.

We need to use the enormous technological tools we have at our disposal to make agriculture less invasive and more productive, and we must help the countries that are behind in innovation to catch up.

The United Nation's Sustainable Development Goals provide a framework to do that. How we produce food is a key component of many of the 17 goals, from *Zero Hunger* to *Good Health* to protecting ecosystems in *Life on Land* and *Life below Water*. The goals provide a framework for international organisations and multilateral lenders like the European Investment Bank to direct their resources towards protecting the planet.

But feeding future generations requires more than just big words. We need to use the enormous technological tools we have at our disposal to make agriculture less invasive and more productive, and we must help the countries that are behind in innovation to catch up. That requires money, and new ways of funding agrifood innovators – things like crowd-lending platforms, mini-bonds and risk-sharing financial instruments.

None of this matters, though, unless societies start to see the real impact of our daily food choices and adjust accordingly, whether it be to cut waste or to eat differently. For their part, governments need to look at agriculture not just

as an industry, but through the prism of the environment. Then they can put the necessary policies and incentives in place.

As the saying goes, "You are what you eat." Feeding future generations very much depends on what we choose to eat, and how we choose to produce it, today.

Climate solutions: How to contribute to climate-friendly agriculture if you're a...

Policymaker: Policymakers should come up with a list of environmental indicators to complement existing food labelling and encourage agrifood companies to adopt and publicly disclose those indicators. Products that are difficult to trace, like commodity crops, would have to rely on self-reporting by producers. For animal products, strict rules already exist that enable them to be traced back to their source. The next step is to communicate the environmental footprint of animal products to consumers.

Citizen: Use any one of the myriad apps available to cut your own food waste and help prevent other sources of waste. Pay attention to where your food is coming from and its environmental impact. Make sure that crops that damage the environment, like palm oil, come from sustainable sources. Reduce the amount of meat and dairy products you eat or at least try to consume meat and dairy from producers with good environmental practices.

Financial institution: Recognise the importance of the sector in achieving the Sustainable Development Goals. Reach out to the European Investment Bank for technical and financial advice on how to jointly support innovation in the agrifood sector. Build up your knowledge on the specificities of the risks and rewards of investing in the sector, and provide patient capital. Innovate in your financial engineering and closely engage with the sector.

Arnold Verbeek, Surya Fackelmann and Brendan McDonagh are the authors of Feeding future generations: How finance can boost innovation in agrifood. *Verbeek is a senior adviser and Fackelmann is an analyst in Innovation Finance Advisory at the European Investment Bank. McDonagh is an advisor at the European Investment Advisory Hub, but contributed to the report through his previous work at Innovation Finance.*

Chapter 3

Development and adaptation

When climate action means better roads

Diego Ferrer, Birgitte Keulen and Meryn Martens

In development, climate solutions build the tools that help countries adapt to climate change, including extreme weather events that can damage existing infrastructure.

To those of us in the developed world, climate action means switching to electric vehicles, taking a bike or public transport. By contrast, in the developing world, climate action also requires better roads.

That's not because we want people in the developing world to drive more fossil-fuel cars. It's to protect them against the disastrous human and economic effects of climate change that occur when roads are flooded, covered by landslides or interrupted by unusable bridges. This is an important element in the battle against climate change and it requires major contributions from multilateral development banks like the European Investment Bank and supranational bodies like the European Union.

This "**adaptation**" to climate change is an important component of the European approach to climate action, making sure infrastructure and people are better prepared to cope with extreme weather and protected from its consequences. The European Investment Bank, which is expanding its adaptation work with the support of the European Commission, has built substantial climate expertise on innovative European projects. Ally that with its extensive financial resources and it can have a real impact in the world's poorest countries.

Even if the world succeeds in keeping temperature rises below the target of 2 degrees Celsius set out under the Paris Agreement, the climate has already

Even if the world succeeds in keeping temperature rises below the target of 2 degrees Celsius set out under the Paris Agreement, the climate has already changed enough to put many countries and regions at greater risk from extreme weather events.

changed enough to put many countries and regions at greater risk from extreme weather events. **Rising sea levels and the increased intensity of storms already affect many areas, particularly in developing countries, including small island states.**

In this context, adaptation has a very clear economic and human angle. When a road has been washed away by a storm, there is an obvious economic cost in lost trade, because the road is impassable to commercial trucks. However, the road is also impassable to workers or visitors, as well as to emergency services dealing with the effects of the storm. In the longer term, children can't get to school and patients can't schedule regular hospital treatments.

What is climate adaptation?

Climate adaptation moderates harm or finds beneficial opportunities that result from changes in natural or human systems caused by actual or expected climatic stimuli or their effects.

Three development climate solutions

Why are developing countries so vulnerable? It's to do with the way they build their roads.

Roads are built to last from 20 to 50 years and to withstand extreme weather events that occur only once in 50 to 100 years. Climate change means that these events will become more severe. **In developing countries, design standards and maintenance provisions are sometimes lower due to budget constraints and are not always based on recent extreme weather predictions**. At the same time, existing infrastructure may degrade faster due to harsh weather conditions, resulting in the need for earlier upgrade and replacement.

Three recent projects approved by the European Investment Bank show the scope of its adaptation work.

In December 2018, the EU bank signed a €20 million loan to the Lao People's Democratic Republic. In concert with a €5 million grant from the EU's Asia Investment Facility signed in April, this will ensure that 1 400 km of vulnerable

rural roads across six Laotian provinces are protected against the effects of the country's increasingly long and dramatic rainy season.

The project improves and reinforces roads so the 1.6 million Lao in those provinces can stay connected to vital economic and social networks.

The European Investment Bank works in close cooperation with the EU External Action Service, the European Commission and the EU delegation to the Lao People's Democratic Republic on the ground, as well as with other development banks. It builds resilient roads, and together with other multilateral development banks it ensures that besides actual project implementation capacity building is also taking place to build the long-term sustainability of its investments in developing countries.

The EU bank's development adaptation work often includes technical assistance and project advice that helps local engineers adapt to an uncertain future climate. For example, the European Investment Bank is advising on a project to build a coastal defence system for the capital of São Tomé. Its contribution requires a lot of time, funding and coordination. But it will result in climate-adapted infrastructure that will be hugely beneficial to our partner countries in the long term.

What is capacity building?

Capacity building is the process by which skills, experience and technical and management capabilities are developed. These elements might be developed within a range of organisations, including contractors, consultants or agencies. Capacity building is often the result of the provision of technical assistance, training and specialist inputs.

A bridge to development

Similarly the European Investment Bank has also approved infrastructure projects in Haiti and the Dominican Republic after natural disasters struck there.

In Haiti, the European Investment Bank approved a €25 million loan to Haiti in April 2019 to build bridges and rebuild bridges destroyed by Hurricane Matthew. The bridges are needed as evacuation routes during storms – increasingly frequent, due to climate change – as well as providing economic links for people

who presently are cut off during rain storms. The bridges will be financed through the European Investment Bank loan and supported by help on the ground and grants from the Inter-American Development Bank and the Caribbean Investment Facility, a regional blending facility of the European Union.

Across the border in the Dominican Republic, a similar post-disaster reconstruction project will include social housing, waterworks to prevent flooding, and of course rural roads that are more resilient. This will be financed through an EIB loan and a grant from the Caribbean Investment Facility.

Development climate adaptation for future extremes

These experiences help us lay important foundations for development. Our methodology for assessing adaptation investment – developed in coordination with other multilaterals – brings rigour to the planning of infrastructure work that will increase the impact of the investment and make it last longer. As well as helping to repair infrastructure that has been damaged, the European Investment Bank also ensures that the quality of the rehabilitated roads or bridges is of a higher standard and that they are thus better able to withstand future extreme weather events.

This is as important for transport projects that are aimed at cutting greenhouse gas emissions, such as our major investments in the Lucknow and Cairo metros, as it is vital in adaptation projects, such as the loan for roads in Laos.

That also means partnership. We already mentioned the Haiti bridge project that is being implemented in collaboration with the Inter-American Development Bank. The European Investment Bank also joined with the Asian Development Bank to finance the Vientiane Urban Transport project to introduce a bus rapid transit system in the capital of Laos and substantially increase the quality of life in the city. The Bank is also examining other areas of infrastructure cooperation with the Asian Development Bank and the World Bank, in line with overall EU policies to reduce poverty according to the agenda 2030 and the socio-economic development plan of Laos.

Bespoke urban climate adaptation

Rural roads are not the only aspect of mobility and development in which adaptation is of increasing significance. The city is the nexus of one of the greatest climate challenges facing international institutions. Climate change runs on a parallel track to the massive increase in urban population forecast

for the coming decades. By 2030, the UN predicts that 68% of the world's population will live in cities, compared to 55% now. Much of this growth will come in developing countries and is linked to broader demographic trends. Some African and Asian countries are expected to double their populations by 2050, according to the UN, and most of that growth will be in cities.

Urban transport solutions are different from those for interurban mobility. Cities in Asia, the US and the EU require bespoke solutions, because of different density characteristics. (Think of Tokyo and then think of Los Angeles. One size does not fit all.)

We need to keep working on these solutions and to increase the resources we devote to them. That's why the European Investment Bank should get the financing it needs for its activities outside the EU. It is also why we are planning to set up a subsidiary devoted to development work.

In cooperation with other European institutions, we will build on our current expertise to expand our future impact.

Climate solutions in transport if you're a...

- **Policymaker**: consider
  - adaptation policies that make our infrastructure more resilient to climate change
  - mitigation policies that help to avoid or reduce travel-related greenhouse gas emissions, such as teleworking, good public transport, cycling and walking infrastructure and electric cars
  - policies that help develop and scale up technologies that fit with a decarbonised future.
- **Citizen**: As a citizen, you cannot adapt the infrastructure, but you can live closer to your work. Consider whether you need to take that long trip. Take public transport, a bike or go by foot and switch to an electric vehicle.
- **Financial institution**: Invest in the solutions that help climate adaptation and mitigation.

Diego Ferrer is a lead economist for strategic roads at the European Investment Bank. Birgitte Keulen is senior engineer for regional transport programmes, and Meryn Martens is lead engineer for urban mobility.

Chapter 4

Energy efficiency

The fast way to save energy

Louise White and Reinhard Six

If you're looking for a smart, quick way to cut emissions and reduce utility bills, here's one path to energy efficiency savings.

The electricity and fuel used to heat, cool and light buildings account for nearly 40% of energy consumption in Europe and are responsible for around 35% of greenhouse gas emissions. Buildings are the single biggest consumers of energy, so making them more efficient can have a big impact on the race to meet climate goals.

The challenge is immense. Nearly half of all European residential buildings were constructed before 1970, when materials, standards and techniques didn't consider how much energy was consumed. Many of these older buildings will still be in use in 2050 and beyond. **The European Commission estimates that 75% of buildings and housing could be made more energy efficient, while less than 1% of housing is renovated each year for energy efficiency.**

The European Union wants to cut overall emissions by 40% by 2030 and increase energy efficiency by more than 30%. The European Investment Bank's ambition to finance €1 trillion in climate action by 2030 is key to achieving these targets. Here are some of the tools the EU bank and its partners will be using to get the job done.

Consuming less energy

Energy efficiency in buildings is achieved by measures that result in lower gas or electricity consumption for the same comfort. For example, by retrofitting a home — adding better insulation to the roof and walls, or installing a new boiler — you get the same comfortable temperature, but you use less energy.

Modern LED lighting and skylights provide the same illumination levels, but use much less electricity. Smart homes that turn off gas or power after a certain time also help cut energy use. Energy efficient windows and doors can make a difference in energy bills and comfort. Smart meters also help save money.

What is retrofitting?

Retrofitting is the renovation of a building to make it more energy efficient and comfortable. This involves new heating and cooling systems or better insulation in the walls or roof. Retrofitting reduces the cost of living or working in a building and cuts energy use substantially.

Moving faster on energy efficiency savings

Making homes and businesses more efficient is a key way to address global warming and meet our climate targets. To support the European Union's policy objectives, the European Investment Bank offers many financial and advisory products and initiatives aimed specifically at building renovation. These products can help many stakeholders, such as owners, developers, cities, municipalities, housing companies, investment funds, corporations and financial intermediaries.

Making homes and businesses more efficient is a key way to address global warming and meet our climate targets.

One initiative run by the European Investment Bank and the European Commission, the Smart Finance for Smart Buildings Initiative, targets energy efficiency in existing buildings, particularly in the residential sector. This programme aims to unlock billions of euros in public and private energy efficiency investment by 2020.

The EU bank lends money directly to projects, but it also provides loans through regional and national banks and other institutions. These banks then pass on loans to small businesses and homeowners. The Private Finance for Energy Efficiency programme, run by the European Investment Bank with the European Commission, offers loans and credit-risk protection to commercial banks, which then finance energy efficiency projects at small and medium-sized companies around Europe.

To make the loan process easier, a new Private Finance for Energy Efficiency tool, called the Energy Efficiency Quick Estimator, can be customised by local banks to help people understand the savings for typical energy efficiency

projects, such as replacing a boiler or adding LED lights and solar panels. You can enter basic information, such as the project's location or whether solar panels will be integrated, and the tool estimates energy savings, cost savings and emission reductions.

What is energy efficiency?

Energy efficiency refers to the amount of output that can be produced with a given input of energy. In practical terms, it means using less gas or electricity in a home to get the same level of comfort.

Getting an energy efficiency project off the ground

Before a project can get off the ground or receive financial support from the private and public sectors, it often requires technical assistance. Another European Investment Bank programme run with the European Commission and centred on preparing energy efficiency projects is ELENA, the European Local ENergy Assistance facility.

ELENA's grants pay for actions that help develop projects, such as feasibility studies, programme structuring, business plans, energy audits, and the preparation of tenders and contracts.

Over the past 10 years, ELENA has provided more than €168 million in grants for technical assistance on energy efficiency and renewable energy in buildings, homes and urban transport. The initiative has helped add new windows and boilers in schools and kindergartens, improved insulation in social housing, built tram networks and installed rooftop solar systems. Ultimately these 95 projects so far are expected to lead to over €6 billion in investment in energy and transport efficiency, with savings of more than 3 600 GWh of energy and 1.4 million tonnes of carbon emissions each year.

In one ELENA project, the Slovenian capital of Ljubljana asked for help to renovate 70 schools, libraries, health centres and even a landmark castle. ELENA's assistance helped the city lower its district heating costs and put it on track to become a sustainable city by 2025.

In Ireland's County Tipperary, an ELENA grant is enabling the Tipperary Energy Agency to prepare energy audits and feasibility studies for hundreds of energy renovations in private homes, helping residents install and replace older heating systems with modern heat pumps. ELENA assistance also includes projects for:

- more energy efficient housing in Poland
- reduced energy consumption in Romanian schools
- new hybrid buses in Spain.

ELENA also supports the targets of the Smart Finance for Smart Buildings Initiative, which has helped:

- install solar panels in social housing in Flanders, Belgium
- the Belgian province of Limburg assess and finance energy efficiency measures in individual homes
- a Latvian financial institution assess and finance building upgrades in small businesses.

Climate Solutions: How to promote energy efficiency savings if you're a...

- **Policymaker:** As the lending arm of the European Union, the European Investment Bank supports projects that help make EU policy a reality. As one of the world's largest providers of climate finance, our projects, including energy efficiency work, will continue to help meet the EU's carbon neutrality target by 2050.
- **Citizen:** When local banks take advantage of "intermediated" lending from the European Investment Bank, this can provide citizens with loans that have long-term tenors and favourable rates. Help for citizens may also be available from ELENA-supported programmes.
- **Financial institution:** The EIB has a close partnership with hundreds of banks and financial institutions across the EU and in other countries in which we have signed a cooperation mandate. Such partnerships combine the European Investment Bank's financial strength with the specific expertise of the local banking sector and in turn help the world meet the Paris Agreement goals through energy efficiency projects on the ground.

Reinhard Six and Louise White are senior energy engineers at the European Investment Bank.

Chapter 5

Green bonds

Confucius and green finance

Aldo Romani

Now that 'green' is on the path to a clearer definition at last, green bond markets can chart a more reliable path towards a low-emission, climate-resilient and environmentally-friendly future.

When Zilu asked Confucius what his first priority would be if he were entrusted with the government of the state, the master replied, "To rectify names." The key to good government, Confucius tells us, is that words should mean the same thing to everyone. This applies to capital markets, too: investor confidence relies on clear rules and definitions.

The recent global financial crisis undermined the credibility of finance and plunged it into a deep crisis of legitimacy. Arjun Appadurai has identified the origin of this crisis in a "failure of language" caused by derivative finance. Finance must now re-establish trust by building confidence in the promises it makes on the green use of capital.

If we are to boost support for projects that truly fight climate change and protect the environment, we need to make sure that we develop a common language for green finance. Only then can investors know that they are buying something truly "green" and understand the impact of their money. This is even truer in another essential and still largely uncharted dimension of sustainable investment: "social" investment.

The good news is that Europe is moving towards this common language. An EU classification of sustainable financial instruments based on the relevant underlying economic activities is at the heart of the European Commission's Action Plan on Financing Sustainable Growth. This EU Sustainability Taxonomy

will measure how the financed activities contribute to sustainable objectives in a more reliable and comparable manner.

When adopted, the Taxonomy will provide a shared definition of core aspects of sustainability, so that a consistent set of standards can be developed for sustainable investment (for example, green loans and green bonds). That is vital to ensure that policy signals as well as issuer and investor disclosures can be used as a basis for conscious and informed decisions in the market. It is also essential to ensure that competition is fair and effective, so that real value is produced for society.

The development of the green and sustainable bond market, inaugurated by the European Investment Bank in 2007, is particularly significant here, since this market moves faster than other product segments and acts on expectations rather than looking backward. It is, therefore, particularly effective in shedding light on sustainability objectives and their actual implementation on the ground.

Green bond market potential

Driven by investor demand for clarity, the green bond market has already shown its potential, developing to over €700 billion in little more than a decade, with exponential growth in the past five years. Further growth, which is directly linked to the expansion of loans and other investments that are eligible for allocation from the bonds, is key to our chances of developing a sustainable economy with the help of finance.

Further growth, which is directly linked to the expansion of loans and other investments that are eligible for allocation from the bonds, is key to our chances of developing a sustainable economy with the help of finance.

The Taxonomy is bound to align investment and issuance classification, since the EU Green Bond Standard requires alignment with it. The European Investment Bank, the largest supranational issuer, is also the first issuer to have tailored the documentation of its green and sustainable bonds to the upcoming Taxonomy to enable a gradual extension of loan eligibility for allocations in line with evolving EU legislation.

The European Investment Bank is a member of the European Commission's Technical Expert Group which has worked on the Taxonomy and the related EU Green Bond Standard. The EU bank's contributions build on the expertise

of both project evaluation specialists in the Projects Directorate and sustainability funding officers in the Finance Directorate, who have worked together for years on the development of best practices. Their work has helped to structure the green and sustainable bond market since its initial stages. The European Investment Bank has thus been able to lead the Green Bond Principles, non-binding market guidelines coordinated by the International Capital Market Association, in the first three years of their existence.

The tangible progress we have observed bears testimony to the capacity of the bond markets to engage globally in politics, science, technology, finance and civil society in a pragmatic discussion on what is "green" and more generally what is "sustainable".

The greatest challenge is not finding investors willing to buy the bonds. Rather it is to build mutual understanding and confidence between issuers and investors along the entire investment chain and across multiple jurisdictions. This is what ultimately links finance with the real economy and facilitates cross-border capital flows to serve goals of global relevance.

Climate Awareness Bonds for accountable climate change mitigation

With its inaugural Climate Awareness Bond in 2007, the European Investment Bank pledged to allocate the funds exclusively to disbursements in support of eligible renewable energy and energy efficiency projects, with a greater focus on investment flows – not only approved loans – and ongoing monitoring of their expected impact over time. This is important, since market conditions may constrain the actual flow of funds and, as projects are implemented, the initial impact assumptions may change.

In this way, Climate Awareness Bonds introduced the notion that it is possible to report on actual investments by sustainability objective, rather than by mere sector, as per current prevailing practice. This highlighted the possibility of a systematic measurement of the environmental impact on the economy that the capital market can understand and promote. One recent consequence is the emergence of "green loans," so labelled because they respond to capital market requirements and are eligible for green bond allocation.

Let us consider the energy efficiency renovation of apartment buildings, for example. The investor should be able to gauge how effective the investment is by:

- accurate reporting of the energy saved and
- the amount of greenhouse gas emissions avoided as a percentage of the total project cost.

There are more and more investors who want to invest in climate action and are keen to prove climate commitment – and impact – to their shareholders.

This has become increasingly important because there are more and more investors who want to invest in climate action and are keen to prove climate commitment – and impact – to their shareholders.

It is a trend that regulators can use to promote sustainability, by asking investors to measure and report impact in a uniform manner, sourcing relevant information in the real economy and using official technical screening criteria that can help comparative analysis.

What are Climate Awareness Bonds?

Climate Awareness Bonds are bonds whose proceeds have so far been allocated to renewable energy and energy efficiency projects. Their documentation has recently been tailored to EU sustainable finance legislation, which considers activities contributing substantially to climate change mitigation eligible for allocation. This potentially extends Climate Awareness Bond-eligibility to broader portions of the European Investment Bank's Climate Action.

Pragmatic interaction of markets and policy

Experience on the ground has also shown, however, that neither science nor markets are capable of achieving sufficient consensus among different actors with regard to core objectives, the combination of diverging priorities and the methodology to be used for objective impact measurement. The intervention of official authorities like the European Commission is therefore required for the coordination of an iterative process leading to the definition of such aspects by cooperative agreement of all relevant constituencies.

Rather than diminishing the role of capital markets versus the institutional framework, this observation highlights their complementarity. **Capital markets require simple, comparable and reliable information, which policymakers**

are then encouraged to facilitate in the form of clearer and more coherent policy signals. In addition, capital markets are global, fostering international cooperation among official authorities.

A versatile institution like the European Investment Bank can act as an interface, testing solutions on the ground and providing feedback to markets and official authorities. A case in point is the "*White Paper on the need for a common language in Green Finance*" that the European Investment Bank and the Green Finance Committee of the China Society for Finance and Banking published jointly in 2017 (a second edition was published in 2018). The document, the result of months of technical work and market consultations in cooperation with the World Wildlife Fund, provided a framework to compare the China Green Bond Endorsed Project Catalogue with classifications used by the European Investment Bank and other multilateral development banks as well as external reviewers. That's important because China, the EU and multilateral development banks have the largest share of the green bond markets.

The findings of the paper, together with a concrete classification proposal for climate change-mitigating activities, fed into the work of the EC's Expert Groups on Sustainable Finance and provide a reference for further work in the context of the International Platform on Sustainable Finance that the EC officially presented at the International Monetary Fund Annual Meetings in Washington – with the support of the People's Bank of China and the European Investment Bank – in September 2019.

Credibility from transparent disclosure and third-party certification

Investors used to evaluate their performance based only on financial returns. It now appears more and more important to understand where the money is going, for what purposes it is used and how its impact is measured. In addition to alignment of the use of proceeds with the Taxonomy, the EU Green Bond Standard requires that issuers describe their strategy and intended practice in a green bond framework and publish both allocation and impact reports, with accredited verification and certification of allocation reports, at least. How does this model compare with the European Investment Bank's practice?

1. The documentation of the EU bank's green and sustainable bonds has already been tailored to the upcoming Taxonomy in order to enable a gradual extension of loan eligibility for allocations in line with evolving EU legislation.

This will be achieved through progressive adaptation of eligibility criteria and establishment of the required procedures and information technology infrastructure

2. The European Investment Bank's projects are earmarked as eligible for green bond or sustainability bond allocation during their appraisal
3. A project can be between 0 and 100% green bond or sustainability bond eligible. For example, if the percentage of eligible renewable energy components amounts to only 40% of the total project cost, green bond proceeds will be allocated only to 40% of each disbursement to that project
4. Dedicated project experts determine and review Climate Awareness Bond eligibility on an ongoing basis to ensure that eligibility percentages and allocations are up to date. (It may happen that the scope of some projects changes after the original approval, requiring a change in new allocations)
5. Allocations are made only to new disbursements that follow the issue date of the bonds; they are performed daily on a first-in, first-out basis by an IT tool, without manual intervention by the back office
6. Twice a year, allocations to eligible projects are frozen and booked in the European Investment Bank's systems as a basis for the verifiable preparation of allocation and impact reports
7. Once a year, the European Investment Bank publishes a Climate Awareness Bond Framework paper including a detailed description of strategy and administration as well as allocation and impact reports
8. The Climate Awareness Bond Framework paper is audited and certified by an independent auditor with "reasonable assurance" – a higher degree of assurance than the limited assurance that is still customary in the market.

This provides investors with high confidence that the reported data is correct, and they trust the integrity of the recording, monitoring and reporting procedures.

Sustainability Awareness Bonds for broader sustainable development

The action plan on sustainable finance is not just limited to climate change mitigation. **The EU is designing a policy framework for broader sustainable development**. In its regulation proposal, it underlines that the EU is committed to implementing the UN's 2030 Agenda for Sustainable Development and takes on board in all its actions and policy initiatives the Agenda's Sustainable Development Goals.

Our €500 million Sustainability Awareness Bond in September 2018 marked the European Investment Bank's first capital market move in this direction. Sustainability Awareness Bonds complement Climate Awareness Bonds by extending the same approach from climate to other areas of environmental and social sustainability. Investors were keen to back the new product, with demand exceeding €1 billion. In the autumn of 2019, the issue was increased to €1 billion and complemented by a second SEK 3 billion Sustainability Awareness Bond.

What is a Sustainability Awareness Bond?

Sustainability Awareness Bonds are financial bonds whose proceeds are allocated to projects contributing to sustainability objectives beyond climate change mitigation. So far, allocation has been to water projects contributing substantially to two environmental objectives (water conservation and pollution prevention and control) and/or two social objectives (access to water and sanitation and natural disaster risk management). Sustainability Awareness Bond eligibility has recently been expanded to health and education projects as well.

The EU bank's €50 million loan to the Juan Diaz Water Treatment Plant in Panama City was the first project allocated with both Sustainability and Climate Awareness Bond proceeds. The Sustainability component, allocated from Sustainability Awareness Bonds, amounted to €13.1 million. The climate change mitigation component amounted to €1.5 million. Specifically, the plant's water treatment capacity will be doubled from 190 000 m^3 to 380 000 m^3, benefiting 450 000 people in the area.

More clarity on sustainability may facilitate riskier projects

Clarity on what is "green," favoured by the further growth of the green bond market, may also entice investors willing to take more risk, facilitating access to credit for those who are not able to access mainstream capital markets directly, such as, for example, sustainable small businesses. This may take the form of loans with preferential pricing or a stake in funds that can take on investment in risky green bonds.

The European Investment Bank will, for example, invest up to €60 million in a fund managed by Amundi, the largest asset manager in Europe, to buy high-yield green bonds, green loans, and green securitised credit. The EU bank and Amundi's Green Credit Continuum programme will provide up to €1 billion to finance green investments in the EU.

Green and sustainable loans and bonds are no longer a niche product. There is potential for substantial market growth. In the context of the EU Action Plan and the Taxonomy regulation that the Commission, Parliament and Council of the European Union are presently discussing, European Investment Bank President Werner Hoyer has announced three ambitious sustainability objectives for the EU bank:

1) Align all financing activities with the principles and goals of the Paris Agreement by the end of 2020

2) Expand green financing activities (climate and environmental goals) from nearly 30% of new commitments in 2018 to 50% by 2025

3) In partnership with public and private partners, help unlock at least €1 trillion of sustainable investment by 2030

Climate solutions if you are a ....

Policymaker: Provide clear policy signals (objectives and targets) and significant thresholds for sustainable investments

Citizen: Buy green bonds and recognise the value of green finance

Financial institution: Reclassify and measure the impact of your investment portfolio

Aldo Romani is Head of Sustainability Funding at the European Investment Bank in Luxembourg.

Chapter 6

Biodiversity

Working with nature

Stephen Hart and Andrew Neill

Nature is our best ally in delivering a liveable world to future generations. To tackle climate change biodiversity provides answers that can buy time for innovation and economic transformation.

Nature is at the heart of stable carbon, water and energy cycles. We often don't see the microscopic living connections and sometimes fail to grasp the bigger picture of how they weave and flow around the planet. It's an adaptable system that has evolved and changed, modified by human intervention and natural disasters. But we mustn't take that adaptability for granted.

What we consume and burn feeds a blanket around the planet, seeps into the oceans and pervades our own bodies and every other living thing. We have severed many of nature's living connections and cycles. Our economic progress has been accompanied by a reckless disregard for the cost to our world. Mankind not only depends on nature for physical survival and shares the same physical vulnerabilities, but there are also profound implications for our sense of place in the world.

We have a chance to build a new connection between biodiversity and our well-being.

We have a chance to build a new connection between biodiversity and our well-being. Choosing between innovative, thriving communities or the natural world is a false dilemma, but first we need to become aware of the connections. When we invest in and maintain our biodiversity, we expand our way of thinking about economics. Biodiversity and connections in the landscape are our natural infrastructure. It is just as important to economic development in the decades ahead as the infrastructure we build with concrete, steel and fibre-optic cables.

Here's a new ABC for decision-makers, complementing age-old truths with the urgency of the climate crisis, recent discoveries and important developments in green finance.

Ecosystem engineers

The ability of nature to claim and continuously reclaim all realms of the earth has evolved with biodiversity. Nature's own builders create their habitats and pave the way for other life, including ours. These are the ecosystem engineers. Let me explain how they work.

In natural landscapes, species such as large herbivores, beavers and wild boars create shifting mosaics of open and dense vegetation, shape rivers and work the soil. They engineer environments for other plants and animals which also play an important role in soil generation and the recycling of nutrients.

Predators have a special place in this story, influencing behaviour and controlling populations of herbivores, which would otherwise be able to strip vegetation and start a cycle of landscape degradation. In today's landscapes, these ancient behaviours and relationships can be difficult to observe. Many species exist on the fringes of their original habitats as wilderness disappears.

Healthy soil sustains a resilient cover of vegetation, a cooling engine of vertical transport of water and heat.

Soils are the digestive system of plants. They store more carbon than the atmosphere. Healthy soil sustains a resilient cover of vegetation, a cooling engine vertically transporting water and heat. Long-lived soil carbon is sequestered by plants, fungi and other microflora and fauna over decades – even centuries – conditioned by geology and natural fertilisation. Natural forests shape local climate systems and shelter vast ecosystems and underground carbon stores.

The physical and chemical properties of water make the oceans the Earth's main sink and conveyor of heat and carbon dioxide. However, life in the oceans plays a critical role. Plankton, for example, produce half the world's oxygen and sequester carbon as they dive into the deep. They are also the basis for a food web that extends up rivers and to birds and animals on land, thus returning nutrients.

Even though hunted to small numbers, whales play an important role alongside physical processes and other species such as krill for the recycling and

redistribution of nutrients and the earth's climate by feeding in the deep and fertilising the plankton.

Eroding natural infrastructure

This natural infrastructure is being eroded with insufficient protection and space. The breaking down of nature's regulators of carbon, energy and water worsens the impact of human greenhouse gas emissions by releasing stored carbon and preventing natural processes from reabsorbing them.

Replacing the living connections provided by nature can be costly or impossible. Think about what we stand to lose in the near future if we do not act now. We can create a sense of financial scale by trying to quantify the role that nature has in our economies.

We need healthy, stable populations of multiple pollinator species to ensure food security.

A good example is the pollination of crops that is essential to the fruit and vegetables grown across the world. We need healthy, stable populations of multiple pollinator species to ensure food security and adequate nutrition for a growing population, or else we face the costs of disrupting the food system. **Globally, crop pollination contributes the equivalent of €150 billion every year, a figure created by native biodiversity with very low costs.** Yet alarmingly, pollinator populations are in severe decline.

We can attempt to capture the combined value the world's ecosystems provide to the economy, so-called ecosystem services. For those ecosystem services that can be assigned a financial value, it is estimated that they contribute $125 trillion to $140 trillion a year. However, the complexity of ecosystems means that we don't always understand which threads in nature's tapestry are the most important for the whole picture, and we don't understand the full consequences of losing them.

In its landmark 2019 report, the International Science-Policy Platform on Biodiversity and Ecosystem Services said that one million species are in imminent danger of being lost. The consequences for mankind of such disruption of nature will be severe. Loss of diversity is already occurring within species, causing a decline in genetic variation, including in staples for humans, and making food systems less naturally resilient to disease and climate change.

The greatest pressures on nature and biodiversity are land-use change, a growing population and inefficient resource use and distribution. Nature will need space to have a chance of adapting to climate change. Over the coming decades, climate change is set to become a major driver of extinction alongside land use, as many regions are moving out of life-sustaining temperature ranges for their ecosystems.

Climate change and land use

We are not managing soils sustainably. Land degradation has occurred in different times and places throughout human history. However, population pressure, global trade and the mechanical and high-input agricultural practices of the 20th century have turned land degradation and loss of topsoil into an accelerating, global phenomenon. Twenty-three percent of our land is experiencing reduced productivity, and this percentage is increasing.

Protection of existing forests and appropriate afforestation are essential to halt rising atmospheric CO_2.

Industrial exploitation of soil, with high inputs, has created high agricultural yields, but it is changing the deep structure and life of soil, releasing carbon back into the atmosphere. It has also created a dependence on energy, chemicals and water abstraction. The result is often an erosion of the capacity of soils to absorb and retain water, reducing their ability to buffer drought and flooding. Clearing of woodlands and inappropriate livestock management have also set in motion a chain of degradation and erosion of topsoil and water management.

Intentional clearing of natural forests and more frequent fires – with immediate loss of habitat and the release of vast amounts of carbon dioxide into the atmosphere – are compounded by a loss of trees from the migration and import of diseases and pests caused by global trade and the shifting climate. The protection of existing forests and appropriate afforestation are essential to halt rising atmospheric CO_2.

Commercial forestry can support sustainable landscapes and foster rural economic growth and employment, if principles of sustainable forest management are respected. In addition, the biomass from forests is an important renewable fuel resource. Global demand for wood, renewable fibre and other forest products continues to grow steadily at 3% a year. This demand is driven primarily by biodegradable packaging, soft tissue products and renewable energy. Wood is also central to meeting the demand for innovative biomaterials such as

construction materials that can store carbon and replace those that require a lot of energy to produce.

In the EU, forests and other wooded land accounts for over 40% of the land. In recent decades, afforestation and natural succession, for example on abandoned land, have increased this area by about 0.4% a year. The actual volume of the EU's forests is also rising, with only 60% of the annual forest growth being harvested. With government programmes, large-scale and rapid afforestation is possible, but we need to act faster.

Protecting our ocean allies against climate change

Whales and all other marine life are affected by rising temperatures, declining oxygen and rising acidity from CO_2. Ecosystems, notably near-coastal waters and coral reefs, have been altered by an overload of nutrients from land and the decimation of predators, such as sharks, tuna and trout. The loss of seagrass meadows is removing one of the world's largest carbon sinks and nurseries of ocean life, including key commercial species. Noise pollution, marine traffic and trawling of the sea floor for fishing are also taking a heavy toll.

The polar regions are most affected. In the Arctic an irreversible train of rising temperatures, melting, runoff from decomposing soils and acidification is projected to change the face of the Arctic Ocean and land in the next two decades – faster than native species are likely to adapt.

An estimated 8 million metric tonnes of plastic waste enter the oceans every year, threatening marine ecosystems.

Plastics and chemicals affect every part of the marine food web, including consumers such as ourselves. An estimated 8 million metric tonnes of plastic waste enter the oceans every year, threatening marine ecosystems and the communities that depend on the seas for their livelihood. Ninety percent of plastic waste enters the oceans through 10 major river systems, two in Africa and eight in Asia. About 2 billion people worldwide still lack access to regular waste collection, while around 3 billion lack access to controlled waste disposal. Lack of wastewater collection and treatment in many developing cities is another major source of plastic waste.

In the coming decade, **marine energy, marine biotechnology, coastal tourism, transport and food production are poised to offer large development and investment opportunities**. With the oceans already in a state of overexploitation, **it is important to prioritise restorative business models that contribute to rebuilding ecosystem health**.

Most of the ocean lies beyond national jurisdictions, requiring complex international cooperation, while coastal zones belong to exclusive economic zones and have the potential to be addressed through effective national policies and regulation and sustainable development. The financial sector potentially also has an important role to play in encouraging a sustainable blue economy.

The European Investment Bank's Sustainable Blue Economy Finance Principles point the way to what sustainable investment looks like in an ocean context. The goal is to ensure that ocean-related investment delivers long-term value without having a negative impact on marine ecosystems, on efforts to reduce carbon emissions, or on ocean-based businesses of all sizes and the livelihoods of people who depend on them. The Principles are also intended to support the development of financial instruments and development models that prove most effective in the context of ocean investment, gradually building a coalition of financing institutions in support of the Principles.

Biodiversity on nature's own terms and coexistence

Population centres have always challenged the landscape and nature around them. Like beavers, humans have sought to tame rivers to make them less capricious and more reliable as a resource. For nature to grow, it needs space on its own terms, connectivity and a reversal of overexploitation and chemicals flowing into land, rivers and sea.

Different visions for the way we use land in the future emerge, and they can exist side by side and strengthen each other. One way involves nature taking its course, with human influence restricted to a minimum, also called rewilding. Another way involves a rich biodiversity coexisting with human activities, in managed open and forest landscapes, and even in cities. When we promote the return of the wild, it is important to work with communities and consider potential conflicts between wildlife and people.

Against the backdrop of diminishing arable land and growing environmental challenges, the world looks to agriculture and agribusiness to increase productivity and efficiency. To nourish the 815 million people who are hungry around the world and the additional 2 billion people at risk of being undernourished by 2050, investments in agriculture and food production are crucial.

Increased efficiency and productivity of agriculture and an innovative bioeconomy are also essential for releasing some agricultural land back to nature for recovery

and improving the chances of adapting to unavoidable climate change. Producing more food with fewer inputs, the use of by-products and waste recovery will support competitiveness, resilience to climate shocks and sustainable value chains.

There are also agricultural approaches that restore the health of soil and its water retention capacity, yielding multiple benefits. At the core of these approaches, we must manage the simultaneous transformation of the land and the livelihoods of people that depend on it, creating supply chains that share the benefits more equitably.

Some of the key challenges to be overcome are entrenched ownership and land valuations inflated by subsidies, slowing down progress on the transformation of land use, even where the opportunity cost in terms of other economic activity is low, for example where land is already degraded.

Working with nature brings new opportunities and risks

Much of the world's biodiversity stands to be lost in the coming decades, and that has economic implications as well as natural ones. We need to build a sustainable economy and financial system with new opportunities and risks. Our approach to land should not be determined by history. Rather it must be about active choices grounded in the present and a tangible recognition of the costs involved in developing and maintaining nature.

Investing in nature's own infrastructure for climate regulation is a necessary component of climate mitigation and adaptation, and for reversing the large-scale release of carbon from degrading natural carbon stores. Working with nature to regulate water and heat will also be an important tool for maintaining liveable environments on regional and local levels, such as in cities. Restoring and releasing areas back to nature on land and at sea will be essential for improving the chances of ecosystems to adapt to inevitable changes in climate.

When we work with nature we tap into life's connections and synergies. It is up to us to capture the multiple benefits. Finance can become an enabler of transformation if the timescales and specific risks relating to natural outcomes can be managed. The EU is at the forefront of exploring new sustainable financial approaches, such as the Natural Capital Financing Facility, which is yielding lessons for a future architecture revolving around biodiversity and nature-based solutions.

We have the knowledge and understanding to create a future where our actions are in balance with natural processes and in which the fruits of nature are distributed more evenly. To gain time for the innovations that will transform our economies to a low-carbon future, we must invest in natural solutions now.

Innovation and technology can work for the benefit of efficiency and equity – alongside nature.

Climate solutions on biodiversity if you're a...

Policymaker: Create regulations that mandate actions and investment in nature. Create new revenue sources for rebuilding and maintaining nature. The financial system will follow this investment. Establish stable, long-term objectives for natural infrastructure on nature's terms, with adaptable strategies that will allow innovation and entrepreneurship. Transform subsidies so that they do not stand in the way of projects that reconnect landscapes and give back space to nature. Reward biodiversity and climate benefits as well as innovation for efficiency and resilience in agriculture – think in terms of long-term food and climate security. Invest in governance and effective implementation of these transformations. Enforce the simple, free things. For example, stop the use of poisons and damage to physical habitats and their cumulative erosion. Create the monitoring and statistics that establishe the true drawdown on nature at home and in the countries from which we import. Give science the resources and freedom it needs to light up the road ahead.

Financial institution: Learn about biodiversity, nature and climate risks. Study resilient and circular business models. Use excellent resources, such as the Global Assessment Report on Biodiversity and Ecosystem Services and the European Investment Bank's Natural Capital Financing Facility, exploring ways to develop the financial system for nature. Our publication, Investing in Nature, sets out ways to develop cases for financing nature projects. There is an increasing need for mission-driven financial players and intermediaries with the right skills to provide transformative finance that can support changes in livelihoods, landscapes and innovation for nature and climate. Engage with the European Investment Bank to devise the instruments that will help you deal with climate risks and uncertainties.

Citizen: Be curious and compassionate about the natural world and the people affected by the changes. A world with more nature is a place that you and your children will want to live in. Help politicians make the right choices and get involved in local initiatives. Within your daily routine, find out what you can do to give nature a little space. Weeds can be pretty – learn to love the ugly ones.

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Chapter 7

The Blue Economy

Investment to save the seas

Alessandra Borrello and Jonas Byström

We need to make blue economy investment a priority to protect the oceans from plastics and waste. Here's a range of project and policy initiatives that will do just that.

An estimated eight million tonnes of plastic ends up as waste in the oceans each year. If we want to stop this pollution, we shouldn't focus on the oceans.

To save the seas, we need to change our work on land.

Every day, plastics are thrown or washed into streets, backyards, rivers, beaches and coastal areas all over the world. A lot of this waste ends up in the oceans. It also clogs drains and increases flooding in many cities, creating a breeding ground for disease-bearing insects and rodents.

One key problem is that people buy too many single-use plastics such as bags, bottles and straws, and they throw them away after a short time. There is a simple fix to this problem: stop buying and using such products and packaging. There is no simple fix to the other problem: improving the poor waste collection and disposal methods in many parts of the world. Both of these problems send a lot of plastic into the seas.

About 40% of the plastic that ends up in the oceans comes from rubbish discarded in or near rivers by the two billion people who lack waste collection services. **Of all the plastic arriving in the oceans from rivers, 90% comes from just 10 rivers, mainly in Africa and Asia**. Fast population growth and rapid urbanisation in many cities around the world, particularly in coastal areas, add to the plastics problem.

The need to conserve the oceans is one of the United Nation's Sustainable Development Goals. Over the past few years, the European Investment Bank and other development institutions have been working hard to safeguard the seas and help the world meet these goals.

Nearly half the population depends directly on the seas for their livelihoods.

After all, investments in the oceans should not be an afterthought. Oceans cover nearly two-thirds of our planet. We rely on them for water, food, climate and oxygen. Nearly half the population depends directly on the seas for their livelihoods. Oceans are a source of renewable energy, natural resources and new ingredients for plant, animal and medical care.

A stop sign for plastics

A lot of the environmental news in the headlines over the past few years has been related to plastic waste in the oceans. Whales washed ashore with stomachs full of plastic. Microscopic plastic particles were found in fish samples around the world. The oceans contain trillions of miniscule pieces of plastic, as well as giant "garbage patches," the biggest of which, the Great Pacific Garbage Patch, is estimated to cover an area three times the size of France. Plastic contains hazardous chemicals that are eaten by fish and then consumed by people, leading to many health issues.

What are microplastics?

Microplastics are tiny plastic pieces polluting the oceans. Microplastics include broken-down plastic waste, synthetic fibres and beads found in personal hygiene products. They harm marine life, which mistake them for food, and are consumed by humans via seafood and tap water. Microplastics account for the large majority of plastic debris on the oceans' surfaces.

To fight plastic waste, the European Investment Bank launched the Clean Oceans Initiative in 2018 with the German and French development banks, KfW and Agence Française de Développement. The three banks are providing technical advice and up to €2 billion in financing over five years for projects that collect and manage plastics and other waste and clean up wastewater before it reaches the ocean.

The initiative is primarily helping cities in coastal and riverine areas, in the developing countries of Asia and Africa. It will help public authorities and private companies of all sizes. It also encourages research and innovation.

The projects eligible for support involve:

- collection, recycling and proper disposal of plastics
- reduction of plastic discharge in ports and harbours
- innovative ideas that reduce plastic waste or develop reusable plastic
- wastewater collection and treatment
- storm water projects that prevent plastics from entering rivers or seas during heavy rains.

Cleaner water for thousands of people

About a dozen investments are in the planning stages or have been signed. Here are three that have been approved:

- A €50 million loan for Cotonou on the south coast of Benin to renovate storm water systems and protect the area from floods every rainy season. **This will help 187 000 people and cut down on pollution in the Gulf of Guinea**.
- An €80 million loan to improve water and sanitation services in Buenos Aires, extending a sewer network and a wastewater treatment plant, as well as upgrading a water treatment plant in the metropolitan area. **This will improve access to water and the quality of the water for more than 24 000 people**.
- A €214 million loan to reduce pollution in the 69-kilometre Kitchener Drain, a system of canals in the Nile Delta of Lower Egypt. This is one of the most severely polluted canal systems in the country. **A large amount of plastics will be removed from wastewater in the canals, heading off this pollution before it makes it to the Mediterranean Sea.**

This new Bank initiative focuses on developing countries, but projects in other parts of the world are eligible if they make a big difference in cleaning the seas. In Warsaw, for example, the Bank financed a wastewater management project that stopped untreated sewage from being dumped into the Vistula River and ending up in the Baltic Sea.

It can be difficult to find bankable projects, and preparing projects in the developing world takes a lot of time and resources. But if we don't do the difficult work now, we will suffer and so will the oceans in the decades ahead.

Blue economy investment counters plastic threats

There are many threats to the oceans besides plastics. Because of climate change and the damage brought on by the seven billion people on Earth, the oceans are suffering from:

- melting ice caps
- rising acidity
- overexploitation
- coastal degradation
- untreated wastewater disposal.

Cooperation is the key to tackling global challenges and protecting shared natural resources such as the oceans.

We are working closely with other development institutions and the public and private sectors to address these problems, so we can involve everyone who relies on the ocean. This includes the shipping industry, fisheries and tourism, aquaculture, energy, and biotechnology. Cooperation is the key to tackling global challenges and protecting shared natural resources such as the oceans.

While the European Investment Bank is focusing its ocean efforts on projects aimed at plastics, we are **working on a wide range of sustainable ocean and coastal projects**. These involve adaptation, biodiversity and ecosystems, and they aim to improve the health of the seas and coasts while increasing their resilience to climate change.

Coastal communities thrive with blue economy investment

In 2018, the European Investment Bank was a principal player in the adoption of the Sustainable Blue Economy Finance Principles. These principles explain how to make sure investments do not hurt marine life or coastal development or erode the ocean's health. There are 14 principles designed to address habitat destruction, plastic pollution and overfishing as well as foster cooperation on ocean health, scientific research, data collection and innovation.

What is the blue economy?

The blue economy involves all economic activities related to the oceans, seas and coasts. It covers a wide range of sectors and refers to the sustainable use of ocean resources for economic growth, improved livelihoods and jobs.

The European Investment Bank also supports the Sustainable Ocean Fund. This fund, launched in 2018, helps fisheries, aquaculture, the seafood supply chain, and coastal development, mainly in Latin America, Africa and Asia. The EU bank is investing up to €20 million in this fund.

The Sustainable Ocean Fund is raising $100 million to invest in as many as 20 ocean projects in emerging markets. This will conserve fishing communities and improve the lives of people who rely on the ocean for food and jobs. The fund will support more than 5 000 jobs in underserved coastal towns and preserve 14 000 jobs in supply chains and related businesses.

This is all because the ocean isn't only an ecological issue. It's an economic issue. When big institutions like the European Investment Bank get involved, we crowd in private investors who see that they can make a profit with green investments. That's good for the ocean. It's also good for growth and jobs.

It is hard to overstate how important it is to step up our actions to preserve the oceans. People must realise that the rivers and oceans are not for waste disposal. We are cleaning the seas for the good of humanity. We have to do it, to preserve our future.

That's good for the ocean. It's also good for growth and jobs.

Climate Solutions:

For policymakers: Take steps to reduce or prevent the use of single-use plastics. Require producers of plastic packaging to take responsibility for the waste created. Acknowledge that collecting and recycling plastics is good for the oceans and for the climate.

For citizens: Throwing away waste in a proper way will improve the environment and public health. Separating plastics also can be a source of income. Participate in river or beach clean-up activities.

For financial institutions: The focus should be on finding circular solutions to prevent plastic pollution. Encourage recycling and recovery rather than disposal.

Alessandra Borrello and Jonas Byström are senior sector experts at the European Investment Bank in Luxembourg.

Chapter 8

Urban transport

The road to Utopia

Neil Valentine, Meryn Martens and Birgitte Keulen

With better urban transport carbon emissions will drop and our air will be healthier. Here's how we can head further down the road to the cities — and the climate — of the future.

Close your eyes and imagine a city without traffic jams. Cars honking and screeching are gone, and vehicles hum along softly. The only real nuisance is the occasional cries of children playing football. You take a deep breath. The burnt smell in the air has been replaced by the sweet scent of fresh earth. Your child's persistent cough has cleared up, and your eyes no longer sting.

We have a lot to gain in the fight against carbon emissions and other nuisances from transport. Cities have not always been the healthiest places to live, but that is changing. Good sanitation, industry regulation and better vehicle standards have already improved city life remarkably. But more can be done.

Goodbye to tailpipe emissions

The fight against climate change and the decarbonisation of transport can bring untold benefits to cities. Among other things, the transition to electric vehicles will put a stop to tailpipe emissions. An electric vehicle isn't only cleaner than an internal combustion vehicle, it's also more efficient. In rough terms, electric vehicles consume one-third of the energy of traditional cars.

While the market penetration of electric cars is still low, their numbers are growing exponentially. In 2018, the number of electric vehicles on the road surged to 5.1 million, up 2 million from 2017. Most of those electrical vehicles, 45%, were in China, with the European Union making up 24% and the United States 22%, according to the International Energy Agency. While the growth is impressive, electric vehicles still represent only a small fraction of the more than 1 billion cars on the road.

Some European countries are changing that. Norway is one of the most successful countries in adopting electric vehicles. In 2019, for the first time ever, fully electric vehicles accounted for the the majority of new car sales. In the Netherlands, the market share of electric cars is increasing fast. In June 2019, the Tesla Model 3 became the top selling model in the Netherlands.

Europe has also made progress addressing the other part of the electric puzzle: the charging infrastructure. The number of charging stations in the European Union surged from a mere 3 800 in 2011 to more than 150 000 expected by the end of 2019. The rollout is being fuelled by projects like Enel X Mobility, which plans to install 14 000 charging stations in Italy by 2022. The European Investment Bank is supporting the project with a €115 million loan. Other similar projects are also receiving EIB support, like Allego and GreenWay.

What is the EU transport challenge for the climate?

Under the Paris Agreement, the European Union pledged to cut carbon emissions 40% by 2030, compared to 1990 levels. The European Commission has an even grander vision: a carbon-neutral economy by 2050. In 2016, transport accounted for about 27% of the European Union's greenhouse gas emissions (including aviation and maritime transport). Transport will play an important role in curbing emissions.

The challenges for electrification

While all this is good news, electric vehicles still face many challenges. For one, the costs of batteries have to come down for electric cars to be as affordable as conventional cars. Progress is encouraging. Data from BNEF, Bloomberg's research service, shows that electric car prices fell 85% from 2010 to 2018.

Another challenge is transforming vehicle manufacturing and transport infrastructure, both public and private. That transformation will require massive investment. In a white paper, the International Council on Clean Transportation analysed the costs, benefits and necessary government funding to transition passenger vehicles to zero emissions. The Council reported that by mid-2018, carmakers had already announced more than $300 billion in investments. In the Council's view, those investments will eventually pay

for themselves through savings on fuel and maintenance. The benefits start to outweigh the investment costs by 2025 in the United States and by 2028 in Germany.

Does electric work for all transport?

E-mobility doesn't work for everything yet, and maybe it never will.

Electric batteries are (still) too heavy to carry all the energy needed to run long-haul trucks, planes or maritime transport like long-haul cargo ships. The problem is that big vehicles like trucks, planes and ships need to store on board all the energy needed for a trip. While electric vehicles use energy more efficiently than internal combustion cars (up to three times as efficient), they are not very good at storing it.

To illustrate this, 1 litre of gasoline has an energy density of 9 500 Watt hours per litre (Wh/L). The electric battery of a Renault Zoe car holds almost 35 times less energy (275 Wh/L). The difference in energy density is a challenge for passenger cars, but it is an even bigger obstacle for larger vehicles and vessels like trucks, planes and ships. Researchers and developers are working hard to come up with new solutions, like making batteries capable of storing more energy and charging it faster, but we will probably also need other solutions such as sustainable biofuels and synthetic fuels like hydrogen.

'Zero tailpipe emissions' does not mean 'zero greenhouse gas emissions'

Electric cars still produce emissions. They just aren't at the tailpipe.

The first source is electricity – and here there is a bit of good news. In Europe, emissions from electricity production have fallen steadily, from over 500 grams of carbon per kilowatt hour in 1990 to less than 300 grams of carbon per kilowatt hour in 2016. That decline means that electric cars produce less emissions per kilometre driven than conventional cars, throughout the European Union.

The manufacturing of electric vehicles is also a source of emissions. Making an electric car requires more energy than a conventional combustion engine car. This means more emissions, unless renewable energy is used. To tackle the problem, the EIB has been investing in companies like Sweden's Northvolt, which makes electric batteries more efficiently. Asian companies had taken the lead on electric battery development, but it is not too late for Europe to catch up.

‘Zero tailpipe emissions’ does not equal ‘zero road emissions’

Some emissions do not add to our carbon footprint, but they do harm our air quality. Air pollution in Europe is still too high and continues to harm Europeans, especially those living in urban areas. Air pollution also has a considerable economic impact, cutting lives short, increasing medical costs and reducing productivity through work absences caused by illness.

Transport’s most prominent air pollutants are particles released by vehicles (PM 2.5 for the smallest particles and PM 10 for the slightly larger particles) and nitrogen dioxide. Electric vehicles do not combust fuels and therefore do not emit nitrogen dioxide or particles from the tailpipe, but that’s not the full story.

Particle emissions also come from the wear on tyres and brake pads. When absorbed by humans, these particles cause damage. Electric vehicles are heavier than conventional vehicles, so there is concern that particle emissions may exceed those of traditional cars. Regenerative braking, which allows the energy from a slowing car to flow back to the battery, may soon replace conventional brakes, which would cut down on pollution.

What is the health benefit of cleaner transport?

The benefits of switching to cleaner transport aren’t just environmental. The World Health Organisation estimates that more than five million people die each year from outdoor air pollution and traffic accidents.

Cars don’t fit well in cities

Even if all cars were electric, we would still have accidents and congestion.

Accidents

While road safety in the European Union has improved greatly in recent decades (EU roads are the safest in the world), the number of deaths and injuries is still far too high.

Technology may help here as well. The rapid progress made in technologies such as machine learning, real-time data transfer and artificial intelligence is transforming the automotive industry. These technological improvements have

enabled the development of connected automated vehicles. The deployment of these vehicles may be as revolutionary as the switch from horses to cars.

The prevalence of fully autonomous vehicles in the future is highly uncertain as adoption depends on a variety of factors, such as public acceptance, liability concerns and legislative constraints. The benefits and challenges of the wider deployment of autonomous vehicles have already been the subject of multiple research papers. Safety is one of the benefits often cited in these papers, since more than 90% of all accidents are caused by human error. But there are also drawbacks. With automated cars, the cost of time lost to traffic decreases (you can do something else), meaning some people might actually be willing to spend more time in a car – thus aggravating congestion instead of reducing it.

Stuck in traffic

In 2016, London drivers spent more than 73 peak hours in traffic jams, according to Inrix, which keeps an annual scorecard of traffic congestion worldwide. In Paris, drivers spent 65 peak hours in jams, while in Moscow that number was 91. Los Angeles topped the list at 104. The high density of European cities requires transport to move more people in less space. If we all continue to drive our cars into the city, even if they are clean and safe, Utopia will remain elusive.

Within dense urban environments, collective and shared transport modes, along with bikes (electric or traditional) and walking, are the most efficient forms of mobility. But people will only use these types of transport if they are easy, fast and affordable. We need to adapt our cities so that walking, cycling or public transport is feasible and cost-effective for commuters. Improving the attractiveness of public transport will increase use, and make it easier to finance.

If we design our cities well, using public transport should get even easier. We already have immediate access to public transport data on our phones, through apps that tell us whether a bus, metro or tram is the fastest way to get to our destination. In addition, a plethora of shared transport services like bikes, electric scooters, small motorcycles and cars have appeared on our streets. Who knows what the future will bring. The challenge will be to develop these services so that they are a help and not a hindrance (blocked pavements, pedestrians run down). We need to ensure that these new services do not cannibalize public transport and that they are safe.

Clean urban transport may sound like a fantasy, but cities across Europe and the world are taking steps to make it a reality. The technologies in themselves will not save the climate or make city life better, but if we manage them well, urban living could have a bright future. Transport is changing fast, and there are many ways to accelerate the transition. Most important, though, is creativity. A jet powered hoverboard (flyboard) has already crossed the English Channel. What else can we invent?

New transport solutions are only limited by the power of our imagination.

Europe's carbon progress

The European Union has some way to go to reach zero-carbon transport.

According to a 2018 briefing by the European Environmental Agency, after years of decline emissions from transport rose from 2014-2017 and were an estimated 28% higher than in 1990. Transport continues to be a top emitter of air pollution for particle matter and nitrogen dioxide, although emissions have fallen over the last decade or so. Transport is also an enormous source of noise pollution – about 73 million urban residents in the European Economic Area are exposed to harmful levels of road noise (over 55 decibels).

The challenges – and the bright spots

- European cars remain reliant on diesel fuel. In 2016, diesel fuel accounted for 67% of all fuel sold for road transport. That trend seems to be changing, though. Less diesel cars are being sold and the share of sales of electric cars (including hybrids) is increasing rapidly.
- The European Union isn't close to its own 2020 target that 10% of energy used in transport come from renewable sources. That figure stood at 7.2% in 2017, and only two countries, Austria and Sweden, have managed to reach the target. Most of the energy powering urban transport comes from biofuels burned in a combustion engine. But the share of electric vehicles is increasing and electricity production is getting cleaner. The challenge is to make the transition quickly enough.
- The growth of sales of bigger cars (SUVs) challenges efforts to reduce emissions from passenger cars.

Climate solutions: Mitigating transport emissions if you're a...

Policymaker: Start to see everything through a carbon-neutral prism. Look at how you can improve your city planning to privilege developments linked to existing public transport or with small extensions. Support innovative companies that are trying to improve transport and work to make your infrastructure run on electric or some sort of renewable energy. If needed, offer subsidies for companies supplying public transport networks to help them convert to electric technology. And create a safe space for pedestrians, cyclists, and others by building protected (bike) lanes.

Citizen: Think about your daily transport choices, including where you choose to live. Are there ways to get around without taking your car? Factor in the cost of parking and insurance before purchasing a car. Is it really worth it? Can you just use a car-sharing service instead? Walk and cycle. Think about whether you really need to go to that meeting, especially if you need to take a plane.

Financial institution: Take a risk. Disruption comes in all shapes and forms, be open to ideas that seem improbable or even impossible. Help cities to calculate the true cost and benefits of converting transport systems to electric, so that they can make smart decisions. Support intelligent urban development that privileges self-contained communities that are well-connected to existing transport links. Consider if the investment fits within a decarbonised future.

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Climate Solutions

Why climate is the world's most pressing challenge – and what you can do about it

print: QH-04-19-719-EN-C ISBN 978-92-861-4484-4 doi:10.2867/651790
eBook: QH-04-19-719-EN-E ISBN 978-92-861-4482-0 doi:10.2867/583145
pdf: QH-04-19-719-EN-N ISBN 978-92-861-4483-7 doi:10.2867/64444