BACKGROUND // SEPTEMBER 2020

The Green New Consensus

Study Shows Broad Consensus on Green Recovery Programmes and Structural Reforms

German Environment Agency

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Legal notice

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"A recovery from the coronavirus crisis must not take us just back to where we were last summer. It is an opportunity to build more sustainable and inclusive economies and societies – a more resilient and prosperous world."
UN Secretary General, António Guterres,
April 30, 2020

This study is based on the evaluation of 130 scientific studies and relevant statements that deal with the design and effectiveness of green economic recovery programmes. It shows that there is a broad consensus on the necessity and benefits of green recovery programmes, the eligibility criteria to be applied and the particularly suitable areas of support. In addition, research is increasingly calling for linking green economic recovery programmes with structural reforms to prevent flash-in-the-pan effects.

Some differences exist in the valuation of individual instruments and measures. In addition, some political actors and part of the business community have fundamental reservations about green recovery programmes. These reservations also reflect the different interests in the business community: While some business sectors benefit greatly from green economic recovery programmes and structural reforms, others fear that they will be adversely affected by the socio-ecological transformation.

Green economic recovery programmes

Putting green recovery programmes at the centre of economic policy

There is broad consensus across the studies analysed that the billion-euro economic recovery programmes for overcoming the economic crisis are a unique opportunity to pave the way for more climate protection, the conservation of ecosystems and the preservation of resources. Should this opportunity be missed and the economic recovery programmes revert to the status quo ante, for example by promoting fossil fuel activities, destroying natural habitats or wasting resources, it will become impossible to achieve the Paris climate targets. We will also be laying the foundations for future crises caused by climate change and the overexploitation of our planet, with even more catastrophic consequences, especially for future generations.

There are further arguments in favour of overcoming the current economic crisis by green economic recovery measures. Empirical analyses of green recovery programmes during the 2008/09 financial crisis show that they can successfully boost the economy. In addition, numerous scientific studies conclude that the positive demand and employment effects of green recovery measures are often many times higher than those of measures promoting fossil activities. Green economic measures also have a variety of positive medium- and long-term effects for the business community and society, for example by increasing productivity and long-term competitiveness, developing new markets with excellent employment opportunities, cutting environmental costs, making the economy more resilient and improving the quality of life. Considering all aspects of welfare, the balance of green economic programmes is therefore noticeably more positive than is the case with traditional measures to revive the economy.

Select green instruments and measures based on economic policy and COVID-19 specific criteria, taking social effects into account.

Their prompt implementation, targeted combating of the causes of the economic crisis, the time limit on the burden on public budgets and their contribution to the socio-ecological transformation are considered central criteria for green economic instruments and measures. In the current economic crisis, we must also examine whether interrupted international supply chains and health protection issues may limit the effectiveness of such instruments and measures. Many studies also emphasise that green measures and instruments should take social aspects into account. It also makes sense from UBA's perspective, to provide targeted support to socially disadvantaged households, for example by giving advice on energy saving.

Focusing on particularly suitable areas and measures for support

There is also broad agreement regarding which areas of support are particularly suitable for green economic recovery programmes. The expansion of renewable energies (especially solar energy and wind power on land), the energy-efficient renovation of buildings, measures for sustainable mobility and the ecological transformation of industry (especially establishing a hydrogen economy and promoting cross-cutting technologies to increase energy and material efficiency) are repeatedly cited. Climate adaptation measures and nature-based solutions (e. g. reforestation) are also frequently recommended.

Many studies emphasise how important it is to provide local authorities with the necessary financial resources for green investment. Priority should be given to projects with a short planning lead time. However, experience shows that the timely implementation of green investments often fails due to a lack of municipal planning capacities. It is therefore important to address this problem in green economic programmes (especially capacity development in local authorities, external consulting).

Some studies point out that small and medium-sized enterprises (SMEs) need special support in the corona crisis and in their conversion to sustainable solutions. This can be achieved for example through subsidies or tax breaks for green innovations or through government support for consulting services. This is because in comparison to large companies, SMEs often lack not only financial reserves but also the technical expertise to implement transformative processes, since available resources are committed to core business. A strategy of this kind would also ensure the survival of "green" consultancies, which have been severely affected by the crisis and which are crucial for socio-ecological transformation.

Structural reforms

Embedding green recovery programmes in structural reforms

A policy that confines itself to green recovery measures runs the risk that successes in environmental protection and resource conservation are merely a temporary flash in the pan. This is a key finding of the studies that analysed the effects of green economic recovery programmes during the financial crisis of 2008/09. Green recovery programmes must be embedded in an overall concept of structural reforms that creates the necessary framework for socio-ecological transformation. Only then can the trend of rising emissions, increasing resource consumption and the destruction of natural habitats be reversed.

Numerous studies emphasise that a dual strategy of green recovery measures and structural reforms also has considerable economic advantages as it facilitates a sustainable economic recovery, thereby making the economy more resilient. Moreover, short-term measures implemented in economic recovery programmes have the potential to increase the effectiveness of structural reforms. For example, supporting pilot projects could pave the way for the market diffusion of innovative climate protection technology, which would then enjoy more rapid success in an environment of rising CO_2 prices.

Some studies indicate that such a dual strategy also has fiscal advantages. For example, the reduction of environmentally harmful subsidies and combined with CO_2 pricing could contribute to the financing of economic recovery measures or, subsequently, to the consolidation of public budgets. In addition, fewer fiscal incentives for climate protection measures are required when rising prices for CO_2 make climate-friendly products and technology more competitive. In some cases, the removal of regulatory barriers is enough to stimulate green investment. A prominent example is the lifting of the cap on photovoltaic development in Germany.

Key areas for structural reform

Most studies emphasise the following structural reforms to improve framework conditions:

- A significantly **higher CO_2 price and the reduction of environmentally harmful subsidies**, as this provides the necessary economic incentives for sustainable investments, business models and consumption decisions;

- the **dismantling of regulatory barriers to green investments** (e. g. upper limits for the expansion of renewable energies) and the **introduction of regulatory requirements** (e. g. quotas for electric cars);

- **systematic support for environmental innovations and their introduction to the market** (e. g. through pilot projects, environmentally-oriented public procurement);

- **qualification measures** (especially training, further training and continuing education), which prevent a shortage of skilled workers and create job opportunities for those who are losing or have already lost their jobs in the current economic crisis and

- the **establishment of a sustainable financial system** that prices in environmental risks in lending and investment decisions and improves financing options for sustainable projects. An important requirement for this is the **broadening of corporate reporting to include environmental and social aspects**, as this creates the necessary transparency and supports sustainable business models.

As part of an integrative strategy, many studies also recommend linking **national green recovery programmes with the EU recovery and resilience facility and the medium-term instruments and measures of the Green Deal**. Discussion on this is, however, only in its early stages. EU-wide initiatives can be particularly useful in industrial policy measures, such as support for the promotion of low carbon breakthrough technologies, as demonstrated by the Battery Alliance example.

Greening of all measures in economic recovery programmes

Only a fraction of the stimulus measures adopted worldwide have so far been "green" according to available estimates, and some of the measures are even "brown", i. e. they tend to have a negative impact on the environment. In light of this, numerous studies emphasise the need to take environmental aspects into account in the non-environmental instruments and measures in economic programmes. Some studies call for a sustainability check of all economic recovery measures and for the definition of exclusion criteria (e. g. no support for fossil fuel technology) to ensure that economic recovery measures are not in conflict with the goal of a socio-ecological transformation.[1] There are also frequent calls for companies or industries that receive state support to commit to the development of a more sustainable business model. Such agreements have already been implemented in practice with airlines in France and Austria, for example. In other fields, several studies contain non-sector-specific proposals for ecological compensation. However, they stress that compensation should be proportionate, and should take into account the size and environmental relevance of the companies concerned.

Combining digital transformation with socio-ecological transformation

There is currently another far-reaching transformation in the form of digitisation, which in some cases can be combined very effectively with green recovery programmes. Many studies underline the huge potential of digitisation in diverse areas. These include implementing the energy and mobility transformation, accelerating planning procedures and implementing continuing education programmes, in particular during the COVID-19 crisis. Specific economic policy measures cited include the development of green IT and subsidy programmes for the ecological modernisation of data centres.

A medium-term, special support programme for sustainable digitisation could also make an important contribution to ensuring that digital transformation and socio-ecological transformation are consistently combined. The development of digital infrastructures, production structures, products and software could be made ecologically and socially compatible right from the outset. The programme should also promote cooperation and better networking between stakeholders on both sides. This would help to ensure that digital solutions and socio-ecological transformation are increasingly thought of in conjunction with each other.

Establish monitoring processes in order to implement adjustments

Both the impact of the economic recovery programmes and the measures and instruments for improving the framework conditions for the socio-ecological transformation should be continuously monitored. This is also advocated in some of the studies analysed. Monitoring makes it possible to identify problems and missed targets, readjust measures and to learn continuously (dynamic governance).

1 It would also appear to be advisable from UBA's point of view to extend the exclusion criteria and the sustainability check to existing support programmes.

1 Introduction

The world is in a severe **economic and social crisis** due to the **COVID-19 pandemic** and it is uncertain how long the crisis will last. Numerous states have launched stimulus programmes on a historically unprecedented scale to prevent the economy from collapsing (c. f. e. g. IMF 2020a, Bruegel 2020).[2] Other programmes are planned to revive the economy and support long-term economic development. The design of these programmes will, by virtue of their size alone, have a decisive impact on economic and social development and prosperity in the coming decades (c. f. e. g. IMF, 2020).

At the same time the world is also in an **ecological crisis**. Environmental pressures lead to high economic, social and health costs, such as air pollution, soil degradation, marine pollution and over-exploitation of natural resources. If we are not successful in limiting the rise in temperature to the target set in the Paris Climate Convention, climate change threatens to have far more catastrophic economic and social consequences than the COVID-19 pandemic. And unlike COVID-19, there is no hope of a vaccination against the consequences of climate change. This also applies to the increasing loss of biodiversity and natural habitats. Recent research findings also show that climate change and loss of biodiversity increase the risk of further pandemics through the transmission of viruses to humans via animals (UNEP and International Livestock Research Institute, 2020).

As a result, there is now a broad consensus among scientists and in international organisations for solving these two central challenges together and combating the current economic crisis by means of **green economic recovery programmes**. At the same time, an increasing number of studies call for a combination of green economic recovery programmes and **structural reforms** in order to create the necessary legal and economic framework and infrastructure for socio-ecological transformation (c. f. e. g. OECD 2020h, IWF 2020b).

Critics of green economic recovery programmes argue that considering its severity and its social consequences, the economic crisis should be resolved first and only then the ecological crisis. However, this is neither realistic nor sensible. Model calculations show that the goals of the Paris Climate Agreement are only achievable if swift and decisive action is taken, i. e. strong stimuli to promote climate protection are integrated into the programmes to combat the current economic crisis.

From a fiscal point of view, the recovery programmes represent a unique window of opportunity for the rapid implementation of climate and environmental protection measures, which are now necessary. Conversely, in view of the sharp rise in government debt the probability for these measures to be funded in the coming years is remote. Ultimately, it would also be a mistake, both economically and in terms of employment policy, to use economic recovery programmes to promote fossil fuel investments and infrastructure now. These will only become stranded investments in a few years' time due to the increasingly stringent climate protection requirements (Stern 2020).

The world is therefore currently at a crossroads. Either governments use the stimulus programmes as a window of opportunity to advance socio-ecological transformation through green recovery programmes, thereby simultaneously achieving ecological, economic and social goals. Or, they finance environmentally harmful production and consumption patterns that destroy the natural foundations of life and economic activity in the short, medium and long term.

On the basis of a **literature analysis**, this paper **examines the options for designing green recovery programmes in industrialised countries and linking them to structural reforms**. The analysis contains a total of 130 scientific studies, statements from scientific advisory bodies, European and international organisations as well as economic and environmental associations. We have focused on publications with high relevance. Annex 1 contains an overview of the studies and statements analysed. The literature analysis does not claim to be exhaus-

2 By April 2020, the G 20 states had already adopted aid programmes amounting to USD 7.3 trillion (especially emergency programmes: only a small part was aimed at reviving the economy, c. f. Hepburn et al. 2020).

tive given the large number of publications. The status of the literature analysis is the end of June 2020.

The paper starts by offering an **analysis of the green recovery programmes during the financial crisis of 2008/2009** and of the lessons to be learned therefrom (Chapter 2). Chapter 3 then provides an overview of the proposals made in the evaluated studies **for the design of green economic recovery programmes** aimed at combating the current economic crisis. The central issues are the following: What are the arguments in favour of green recovery programmes? Which criteria and aspects are particularly relevant for their design? Which fields of action are central and which instruments and measures are particularly suitable?

Chapter 4 discusses the recommended **structural reforms for the socio-ecological transformation**. The following issues are central. Which strategic approaches, instruments and measures are particularly important for achieving socio-ecological transformation and how can they be linked to green recovery measures? And how can ecological transformation be linked to social goals and digital transformation?

Chapter 5 contains an overview of proposals for **greening all instruments and measures in the economic recovery programmes**. This aspect is becoming increasingly important with respect to the enormous dimensions of public stimulus programmes. This poses two central challenges. How is it possible to prevent a programme to address the COVID-19 crisis from having significant negative impacts on the environment? And what ecological compensation should companies receiving state aid through the economic programmes provide? At the end of the chapter, reference is made to the relevance of comprehensive **monitoring of all measures** in order to be able to implement any necessary adjustments promptly. Chapter 6 concludes by presenting an outlook on future research needs.

2 Lessons learned: Findings from the economic recovery packages during the 2008/2009 financial crisis

In response to the financial crisis in 2008/2009, numerous countries launched economic stimulus programmes. Some even included green measures to stimulate the economy (c. f. Fig. 1). Top of the list with a share of 79 per cent was South Korea, which explicitly described its programme as part of a Green New Deal. In a study that examined 20 economic packages, the share of green measures averaged 15 per cent (Robins, Clover, and Singh 2009).

Nevertheless, it has not been possible to reverse the trend in greenhouse gas emissions and other major environmental problems. On the contrary, although global greenhouse gas emissions declined slightly by 1 per cent in 2009 due to the financial crisis, in 2010 they rose by 4.5 per cent. This is well above the 5-year average of 2.4 per cent. High government spending on fossil-based activities as part of the economic recovery programmes and low energy prices were responsible (Peters et al. 2012). This shows how important it is **to exclude fossil fuel activities from stimulus programmes** and to counteract the crisis-related decline in the price of fossil fuels **by pricing CO_2 and/or reducing fossil subsidies**.

At the same time, the question arises as to what economic, social and ecological effects the green measures had and what lessons may be drawn from these for the design of green recovery programmes to combat the corona crisis. The different starting situations during the financial crisis and the current economic crisis need to be taken into consideration.

Lessons learned from the green economic recovery programmes during the 2008/2009 financial crisis

Experience during the financial crisis shows that it is advantageous in terms of economic and growth policy to anchor green measures in economic recovery programmes. Empirical analyses conclude that **green fiscal stimuli contributed more effectively to the recovery than traditional fiscal stimuli** (c. f. e. g. Allan et al. 2020, Barbier 2010).

The literature also refers to tangible **examples of success**:

- The American Recovery Act of 2009 has improved the energy efficiency of more than 800,000 residential buildings and created more than 200,000 jobs (CAT 2020). It also created almost one million jobs in the wind and solar energy industry between 2009 and 2015 (CEA 2016, World Resources Institute 2020b). The measures were aimed at expanding production capacities, promoting research projects and also included training programmes. This approach enabled the renewable energy sector to achieve the highest employment rate of all sectors after the crisis (DIW 2020a).

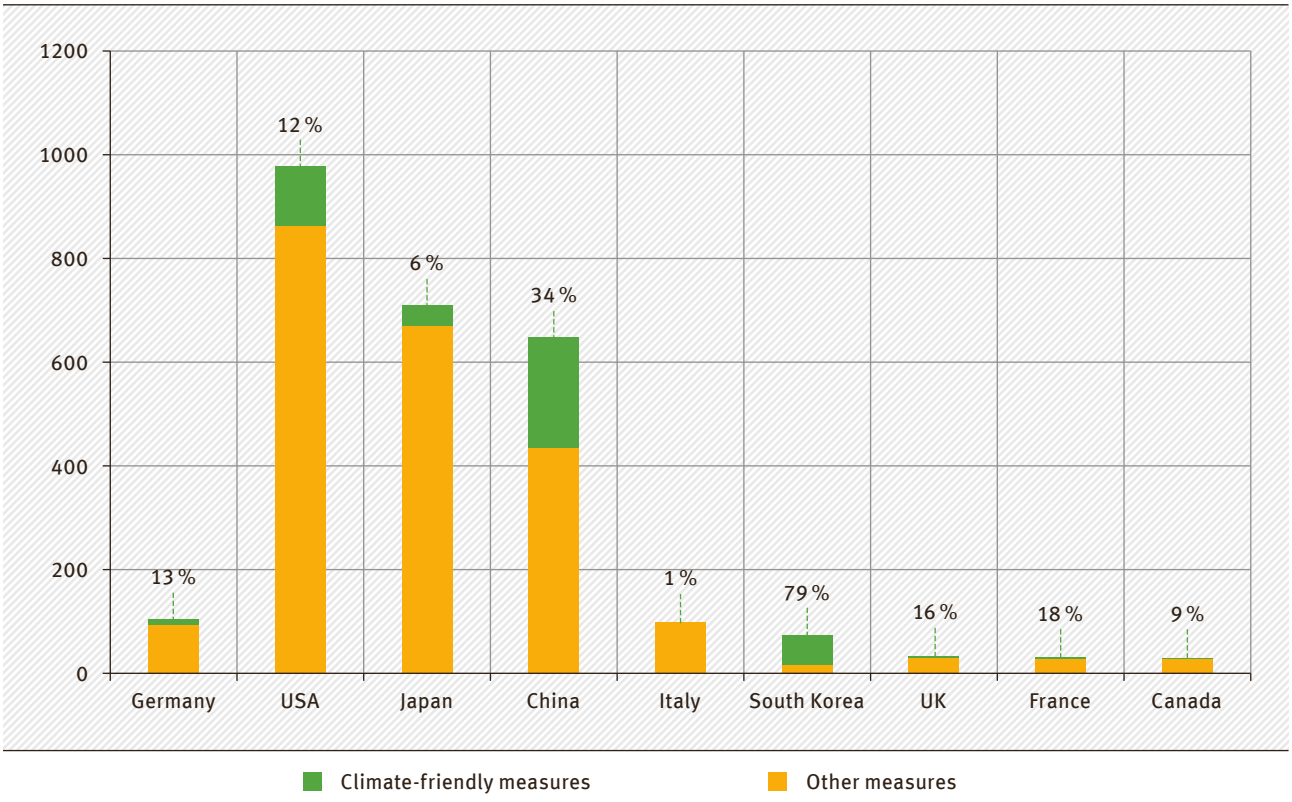
- South Korea had by far the largest share of green measures in its economic recovery programmes and managed the crisis particularly successfully at the time. For example, South Korea recorded a growth rate of 2.8 per cent in the third quarter of 2009, one of the highest in the OECD (Robins, Clover, and Singh 2009).

Experience also shows that it makes economic sense **to link non-environmental support measures to ecological conditions** (c. f. also Chapter 5). Thus, the US government linked the support of the automotive industry via equity investments to ambitious consumption standards for vehicles. This had a positive impact on innovation intensity and employment in the industry (World Resources Institute 2020).

Lessons may also be drawn from some negative experiences for the design of green recovery programmes in the future. In South Korea, for example, the “Four Major Rivers Restoration Project”, which had considerable negative impacts on ecosystems, was supported (c. f. DIW 2020a). This example illustrates that all measures should **first be carefully examined for undesirable environmental consequences** (c. f. Chapter 5). The purchase premiums granted in some countries for passenger cars were also economically and ecologically problematic. This applies in particular to purchase premiums that were not linked to ambitious environmental targets. They embedded fossil and car-centred transport structures, were very expensive in fiscal terms and in

Figure 1

Share of green measures in 2009 for G7, South Korea and China in billions of US dollars and percentages



Source: DIW, 2020 based on data from Barbier, 2010

some cases led to high deadweight and pull-forward effects (c. f. e. g. OECD 2020b, ICCT 2020, Gawel and Lehmann 2020).

If green measures are meant to serve as a means of stabilizing the economy, their **speed of implementation** also needs to be examined. This proved to be a problem in Germany, for example, when there was support for energy efficiency in public buildings. The economic recovery programme was provided with ten billion euros for a local authority investment programme, of which only 13 percent had been utilised by the end of 2009 (Agora Energy/Transport Turnaround 2020).

The **central problem with green recovery programmes during the financial crisis was that they were not embedded in an overall concept for a socio-ecological transformation**, i. e. they were not systematically linked to changes in economic, legal and infrastructural frameworks: "One of the key lessons of the 2008 stimulus programmes ... was how failure to enact basic market reforms, e. g. removal of inefficient fossil fuel support, or supportive policies, standards and carbon prices, placed many green programmes and projects at a disadvantage to incumbent technologies and did not allow momentum to build that could disrupt long-standing development approaches" (Bhattacharya and Rydge 2020, S. 26). In these circumstances, green measures in economic recovery programmes tend to generate only positive one-off effects, but no radical and long-term change towards sustainable production and consumption patterns. This danger is even greater when support measures lead to lock-in effects, which solidify environmentally harmful structures (c. f. e. g. OECD, 2020h).

If we do not learn the necessary lessons from this, the green recovery programmes to combat the current economic crisis are also unlikely to achieve the urgently needed transformation in climate protection and other environmental goals. Instead, it must be expected that, similar to the situation after the financial crisis, an economic upturn will lead to a rebound effect, which will more than outweigh the emission-reducing effect of the green measures.

Differences between the financial crisis and the current economic crisis

The situations at the outset of the financial crisis and the current economic crisis differ in key respects (c. f. e. g. OECD 2020b, IEA 2020c):

- The need for action is greater as the current economic crisis is more profound and more comprehensive. The scope of the economic recovery programmes and their impact are consequently greater. At the same time, ecological pressure to act has increased sharply since the financial crisis, especially with regard to climate protection and the conservation of biodiversity. All support measures therefore need to be subject to very ambitious ecological requirements, such as compatibility with the goals of the Paris Agreement.

- The causes of the crises vary, as do their economic manifestations and the restrictions that apply when combating them. For example, there were major upheavals in the financial sector in 2008/2009, which spread to other areas. The current situation is more complex: It is characterised by a web of supply and demand problems that affect a variety of industries and supply chains. It therefore seems sensible to support areas that are less dependent on international supply chains, such as the building industry or service sectors (GWS 2020).

- The pandemic poses new challenges and also offers new opportunities to support socio-ecological transformation, for example in the transport sector due to the increased appeal of cycling and the need to reduce the risk of infection in public transport, or changes in the working environment (increased numbers of people working from home, replacing business trips with virtual forms of communication).

- The costs of green technology have declined sharply in recent years, for example in the areas of wind power and photovoltaic. This facilitates the use of financial incentives in green recovery programmes to stimulate investment and create jobs.

- Digitisation currently represents another far-reaching transformation that is well suited to green recovery programmes. New investments in infrastructure, production structures and durable products, which are required to be ecologically and socially compatible right from the very outset are in the offing.

Table 1

Lessons learned from economic recovery packages during the 2008/2009 financial crisis

Overview of lessons learned
Use green measures more intensively and on a larger scale because of their high multiplier effects and the pressure of ecological problems.
Embed green recovery programmes in a transformative overall concept that creates the necessary framework for lasting economic recovery and socio-ecological transformation.
Favour green measures that can be implemented quickly.
Establish green markets by promoting research, development and market diffusion and bolstering this with training programmes.
Tie financial support for industries/companies to ecological conditions.
Check all economic recovery measures for any undesirable environmental effects.
Exclude from support activities that exacerbate climate change or have significant negative impacts on other environmental objectives.
Counteract the crisis-related drop in the price of fossil fuels by pricing CO_2 or reducing fossil subsidies.

3 Green recovery programmes to overcome the Corona crisis

3.1 Specific advantages of green recovery programmes

A key advantage of green recovery programmes is the numerous **co-benefits** that accompany them. Reducing greenhouse gas emissions, conserving natural habitats and other environmental benefits have extremely high economic and social benefits, as the following examples demonstrate:

- **Climate protection, conservation of biodiversity and prevention of man-made environmental disasters:** In the opinion of the participants at the World Economic Forum, climate change, failure to protect the climate, loss of biodiversity and man-made environmental disasters are among the greatest global risks for the world economy over the next decade (c. f. Fig. 2). This is even before we consider the fact that climate change and the destruction of natural habitats increase the risk of future pandemics – with unforeseeable consequences for the business community and human health, as the current corona crisis reveals.[3]

- **Improved air quality:** Reducing air pollution from nitrogen oxide, ground-level ozone and particulate matter could prevent more than 400,000 premature deaths across Europe (EEA 2019). Diseases caused by air pollution also reduce worker productivity and are associated with high costs to the health system and those affected. In 2018, 4.5 million people worldwide died prematurely from air pollution caused by fossil fuels, and the global cost of air pollution amounted to US$ 2.9 trillion (Myllyvirta 2020). In this context, respiratory diseases play an important role. They also increase the risk of severe disease progression in COVID-19 infections (c. f. e. g. Stern 2020).

- **Reduced water pollution:** The annual additional costs incurred by water suppliers in providing drinking water due to nitrate pollution in groundwater alone are estimated at between € 580 and € 767 million per year in Germany (UBA 2017). For instance, the costs of obtaining good quality water resources are explicitly not considered.

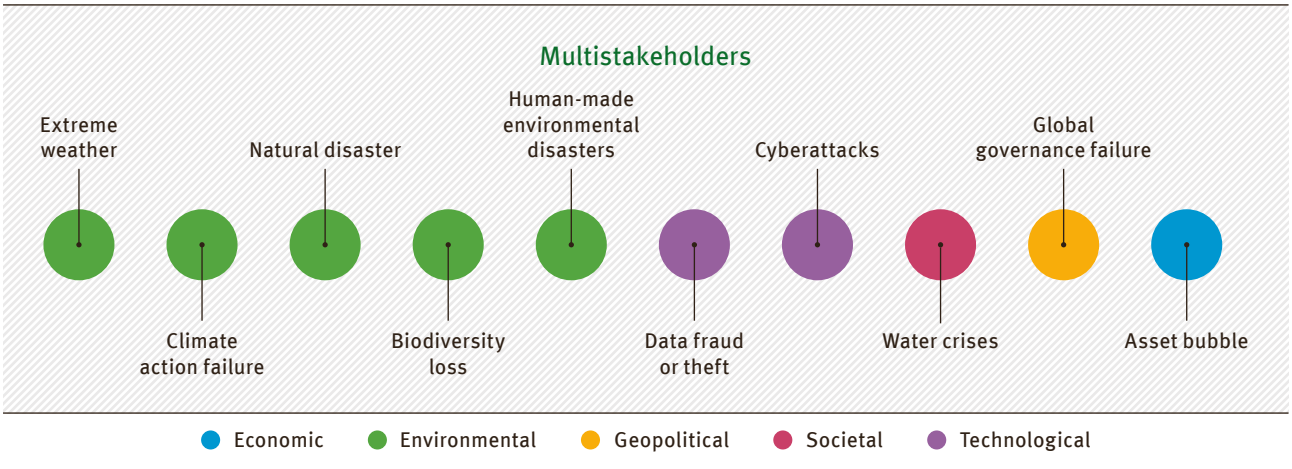
The World Economic Forum concludes in a new report that more than half of the world's total gross domestic product is dependent on ecosystem services – this corresponds to an economic added value of US$ 44

3 The OECD has therefore just drawn up a "Recovery for Resilience Strategy", which increases the resilience of the economy and society through green economic programmes. OECD 2020 Policy brief Recovery for Resilience (R4R)

Figure 2

Top 10 risks over the next 10 years

Long-term risk outlook: Likelihood



Source: Global Risks Report 2020

trillion (World Economic Forum 2020a). It identified US$ 10 trillion worth of business opportunities that could create 395 million jobs by 2030, which together could pave the way for humane and environmentally friendly development which is resilient to future shocks (ibid.).

When economic policy measures are viewed under a **"well-being lens"**, green economic measures perform particularly well (c. f. OECD 2020h). Their positive effects on welfare and resilience enable transformation that raises the business community and society to a higher quality standard compared to the situation before the crisis ("building back better", World Resources Institute 2020b).

Green recovery programmes are also advantageous from the perspective of **intergenerational justice** on account of their medium and long-term benefits. This applies, for example, to the development of resilient infrastructures: "Overall, the rates of return on resilient infrastructure – whether in transport, energy, water, agriculture or NBS [Nature based Solutions, authors' note] – typically exceed those on traditional infrastructure, presenting benefit-cost ratios above 4:1, and they make the whole economy more robust" (Bhattacharya and Rydge 2020).

By contrast, economic recovery programmes that consolidate non-sustainable production and consumption patterns as part of a "business as usual" strategy are a threefold burden on future generations:

- through a deterioration of the natural foundations of life,
- the associated productivity losses and
- the risk that stranded investments with negative employment effects are created as a result of climate change and increasing political climate protection requirements.

Empirical analyses also indicate that green economic measures are capable of achieving **high multiplier and employment effects:**

- UNEP points out, with reference to relevant research findings, that "... $ 1 million invested in the oil and gas industry in the United States creates just five jobs, compared to 17 jobs per million dollars invested in energy-saving building retrofits, 22 jobs for mass transit, 13 for wind, and 14 for solar" (UNEP 2020a).
- Economic analyses for the euro area show that "... public investment in the environment, R&D and public infrastructure increases private investment by EUR 1.30 (per euro invested) more than other types of public investment, such as defence spending, security and economic affairs" (DIW 2020a, S. 3).

In summary, there are ecological, economic and social reasons for focusing on green recovery programmes in combating the current economic crisis rather than promoting unsustainable solutions. As is explained in more detail in the following chapter, however, green recovery programmes are only fully effective, if a number of criteria are observed in their practical implementation.

3.2 Key features and criteria for designing green recovery programmes

Green economic recovery programmes should simultaneously achieve economic and ecological goals whilst also being socially just. Consequently, criteria for all three target dimensions need to be considered. Frequently cited requirements for the instruments and measures taken are (c. f. e. g. Bhattacharya and Rydge 2020, DIW, FÖS, ifso, IMK 2020):

- short-term feasibility (timely),
- high demand and employment efficacy (targeted),
- only a temporary burden on the state budget (temporary) and
- positive contribution to socio-ecological transformation (transformative).

In contrast to classic economic recovery programmes, green recovery programmes are not only about triggering short-term demand and employment impulses, but also about establishing the foundations for a sustainable way out of the crisis. The level of **long-term multiplier effects and transformative impact** are therefore also **significant evaluation criteria**. In this regard, measures for supporting environmental

innovations, for instance, develop green markets and finance green infrastructure investments, are particularly suited.

Short term economic measures, however, are only able to make a limited contribution to this transformation. As discussed in more detail in Chapter 3.1, **flanking instruments and measures** that advance the socio-ecological transformation process by changing the framework conditions and setting the right incentives are often decisive in determining whether and to what extent long-term multiplier effects and fundamental sustainable changes occur. Such an integrated strategy enables the generation of further synergy effects, such as lower fiscal costs for support measures. For example, CO_2 pricing means that as climate protection measures become more profitable the state needs to grant lower subsidies to stimulate the measures in question. The state is also able to create "crowding in" effects by dismantling regulatory barriers and introducing or tightening regulatory requirements, which leads to an increase in demand and employment, thus creating positive fiscal and economic feedback effects.

Embedding the green economic recovery programmes in an integrated strategy for socio-ecological transformation is therefore a central factor for their economic, social and ecological success.

In principle, all economic measures, including those not aimed at greening, should be observed through a **"well-being lens"** and be subjected to a corresponding **cost-benefit analysis** (OECD 2020h). In addition to the effects on business cycles and economic growth, the short, medium and long-term effects of the measures taken on the environment, health and quality of life as well as the resilience of the economic system should be examined.

In the selection and design of instruments and measures in this context, **social criteria** are also of considerable importance (c. f. e. g. OECD 2020h). Effects on income and wealth distribution, employment effects, the quality of the jobs created and social participation are all criteria of particular relevance. Green economic recovery programmes should not further aggravate the existing injustice and distributional problems at the national and global level, but rather reduce them as far as possible and contribute to a "just transition". This is a key success factor in terms of the acceptance and political feasibility of green recovery programmes. Particular attention should be paid to the issue of how green recovery programmes could contribute to solving energy and mobility poverty.

In addition, **criteria specific to COVID-19** must be considered. Therefore, the specific features of the current crisis (interruption of global supply chains, behavioural changes, sector-specific slumps in demand) need to be taken into account in the selection of support areas, instruments and measures, as do aspects of health protection. It is also crucial to use windows of opportunity for socio-ecological transformation, such as the trend toward greater use of video conferencing or the switch to active forms of mobility like cycling (c. f. Chapter 3.4).

The **rapid feasibility** of measures is a core prerequisite for the economic success of green recovery programmes. Small-scale green programmes and projects are often very appropriate from this point of view and often also exhibit high multiplier and employment effects (c. f. e. g. Bhattacharya and Rydge 2020). These include, for example, the energy-efficient renovation of buildings, support for renewable energies, cross-sectional technologies in the manufacturing sector to increase energy and material efficiency or reforestation measures. In contrast, large and complex investment projects often require long lead times for planning. Such projects are therefore only suitable for support within the framework of green economic recovery programmes when these projects are ready for contract award. Nevertheless, it may be advisable to support the planning of such projects as part of economic recovery programmes, since this boosts employment and reduces structural barriers to long-term economic development (c. f. Chapter 3.4).

The **link to existing promotion structures** also favours the timely implementation of economic measures, which should be taken into account when selecting support measures. Fortunately, there is often already a multilayer support landscape in place in the environmental sector, with which green economic recovery programmes may engage. However, a certain tension may exist with the goal of supporting measures of a transformative nature as a priority.

As already outlined in chapters 2 and 3.2, green economic measures often have higher short-term and long-term multiplier effects than traditional support measures or support for fossil structures. Above all, **high demand and employment effects** occur in investments that favour labour-intensive industries and have a low import ratio or from which – for example, in the case of research and infrastructure investments – positive growth impulses emanate. When designing support measures, however, the extent to which unused production capacities exist and sufficient skilled workers are available needs to be considered to ensure that the measures are not wasted in price increases.

Economic recovery programmes are of a short-term nature and serve to overcome an acute economic crisis. They are usually debt-financed and place a heavy burden on public budgets.[4] The burden should therefore be **temporary**. In order to achieve the goal of a socio-ecological transformation, however, it is advisable **to continue investment and support programmes in the medium term** (c. f. Chapter 4). In this case there is the option of financing these measures, for instance, by reducing environmentally harmful subsidies or introducing (higher) CO_2 prices, thus ensuring that there is no permanent net burden on public budgets.

Finally, it is essential to ensure that the support measures have a **transformative effect** (c. f. Chapter 5.1). Gradual improvements, for example in reducing greenhouse gas emissions, are often not sufficient as a means of achieving environmental goals. It is advisable to conduct a **sustainability check** and define **exclusion criteria**, e. g. for investments in fossil-based technology. It should also be investigated whether green support measures have undesirable side-effects on other environmental goals. These aspects should also be assessed in the context of non-environmental economic measures.

3.3 Stimulus areas, instruments and measures

The following chapter focuses on **stimulus areas, instruments and measures that are particularly suitable for green recovery programmes**, i. e., those that tend to combine a high economic impact with a high ecological impact and also contribute to socio-ecological transformation. Selecting particularly effective and efficient instruments and measures is also important because public funds are limited and the degree of self-financing of economic programmes is significantly higher when they are effective and efficient.[5]

An evaluation of the literature including existing meta-studies (c. f. e. g. Hepburn et al. 2020) shows that there is **a broad consensus on particularly suitable support areas.** This includes the expansion of renewable energies, energy-efficient renovation of buildings, measures for supporting sustainable mobility, support for the ecological transformation of industry (promotion of post-fossil production technologies and of cross-cutting technologies to increase energy and resource efficiency), and support for climate adaptation and nature-based solutions that boost the natural capital stock and increase resilience (e. g. reforestation). Education and training measures are also included to counteract the immediate job losses caused by the economic crisis and to facilitate the structural change towards a de-carbonised economy. If one looks at the green instruments and measures in the economic recovery programmes that have already been adopted or are planned, all can be allocated to one of these areas (c. f. e. g. Carbon Brief 2020, IMF 2020a)

The following chapter provides an **overview of central fields of action and explains the reasons for support in these areas.** The overview makes no claim to being exhaustive. This applies particularly to the level of instruments and measures, because the available scientific studies and statements contain an impressive wealth of individual proposals for overcoming the current economic crisis by green recovery measures (cf. e. g. CAT 2020, DIW et al. 2020, UBA 2020, Agora Energie-/Verkehrswende 2020). Naming

4 Model calculations show, however, that green investment programmes feature a high degree of self-financing, since they lead to a considerable increase in tax revenues and social security contributions due to their high short- and long-term multiplier effects. On balance, the fiscal burden involved may therefore be fairly moderate (DIW, 2020b). It should also be noted that an austerity policy that dispenses with state economic measures is not a viable alternative. A downward economic spiral would develop, with further slumps in tax revenues and rising social transfers.

5 It is worth noting that theoretical considerations and empirical experience enable areas with high impact potential to be identified, but that the actual impacts depend heavily on the specific design as well as the institutional and supply-side conditions, in particular sufficient planning capacities, unused capacities and the availability of skilled workers, c. f. e. g. IMF, 2020 and Hepburn et al., 2020.

them all or even presenting and evaluating them in detail would exceed the scope of this study. The following explanations are therefore limited to key strategic approaches and provide examples of significant proposals.

Given that the economic spectrum of suitable support areas is very broad, green economic recovery programmes benefit many sectors, either directly or via upstream chains. **It is therefore possible to place green instruments and measures at the heart of economic recovery programmes.** An example of how great the potential significance of green recovery programmes is, is provided by the recently published Sustainable Recovery Plan of the International Energy Agency (IEA 2020a). The IEA estimates that additional energy-related measures and instruments alone could secure or create around 9 million jobs over the next three years and significantly reduce greenhouse gas emissions.[6]

The chapter also uses examples to illustrate that linking green economic recovery programmes with structural reforms for socio-ecological transformation (c. f. Chapter 4) generates considerable synergy effects. This is a key factor in determining whether green recovery programmes will pave the way to a sustainable solution to the economic crisis.

Expansion of renewable energy and grid infrastructure

The rapid **expansion of renewable energy sources** is a key prerequisite for achieving climate targets and shifting to post-fossil production and consumption methods, whether this be in mobility, the building sector or industry (cf. IRENA 2020a). Over the next decade alone, 52 million jobs could be created worldwide in the wind power and solar sectors. Even when the estimated around 27 million jobs will be lost during this period due to the switch to renewable energies are taken into account, The expansion of renewable energies represents a clear "win-win" option (WRI 2020a).

The speed of expansion of renewable energy sources is not yet globally sufficient to achieve the Paris climate goals. For example, the German Environment Agency estimates that Germany would need to develop around 6 GW of onshore wind energy and PV each year (UBA 2020). The average expansion in recent years has actually been far below this level (BMWi 2019). The current economic crisis reinforces the need for action, as investments in the energy sector are declining sharply. This decline can even be seen in renewable energy, which has shown considerable dynamic momentum in recent years (IEA 2020b). The decline in the price of fossil fuels contributes to this, as it makes investments in renewable energy less attractive.

It is advisable, therefore, in the light of climate protection goals, to promote investment in renewable energies through green recovery programmes. Especially since this makes an important contribution to overcoming the economic crisis: "Using stimulus spending to invest in and mobilise finance for 'shovel-ready' utility-scale renewables (e. g. wind and solar photovoltaic) remain key levers for a sustainable economic recovery" (OECD2020h). There is a broad consensus, as already noted in the introduction, that the promotion of renewable energy expansion is particularly appropriate in terms of economic policy. This applies in particular to investments in onshore wind power and solar energy, as they are employment-intensive and can be implemented relatively quickly.

Measures to promote renewable energy should be embedded in a **policy mix** that removes regulatory barriers to investment, activates existing potential (land allocation, speedy approval procedures) and strengthens the competitiveness of renewable energies by reducing climate-damaging subsidies and internalising the environmental costs of fossil fuels. This policy mix should also promote **crowding in** on renewable energy investments through binding expansion targets and regulatory requirements (c. f. Chapter 4).

Building renovation

As explained above, there is a broad consensus in the literature that measures for energy-efficient building renovation should play a major role in green economic programmes. There are several reasons for this. Energy-efficient building renovation offers

6 The majority of the new jobs would be accounted for by building renovation and other energy efficiency measures, as well as the accelerated expansion of renewable energy sources and grid expansion. Other important areas are energy efficiency measures in industry and measures to promote climate-friendly mobility.

great potential for reducing greenhouse gas emissions and the urgency for action in this area is very high. Energy-efficient renovation rates in Germany and many other EU countries would have to at least double in order to achieve the climate protection targets (c. f. e. g. Volkaert 2020). At the same time, measures for the energy-efficient renovation of buildings are ideally suited to boosting the economy in the current economic crisis. The investment volumes available for mobilisation are very high, the measures are particularly employment-intensive, and it is above all the finishing trades that benefit as they are only marginally dependent on international supply chains. (c. f. e. g. GWS 2020). In many cases, the option also exists to increase existing promotion programmes, thus simplifying rapid implementation.

Support measures have already been adopted or are planned in many countries (e. g. Germany, Denmark, Japan) (c. f. Carbon Brief 2020). The EU's Green Deal also envisages a "renovation wave" as the key to modernising the building sector. A "renovation wave" of this kind could be used as one of the main pillars in many economic recovery programmes in Europe and beyond (CAT 2020).

Before the Corona crisis both in Germany and in other countries, there were signs of overheating in the construction industry that inhibited the implementation of energy-saving renovation measures. In this respect, the current crisis represents a window of opportunity for increasing the rate of energy-related renovation. As soon as economic activity returns to the "pre-corona level", however, a renewed shortage of skilled workers in building renovation professions is likely. Green economic recovery programmes should therefore also support educational measures, i. e. training and conversion training (c. f. e. g. Agora Energie-/Verkehrswende 2020, UBA 2020). In addition, structural reforms (e. g. further development of regulatory instruments, CO_2 pricing) are also necessary to ensure the required increase in energy-related renovation rates in the medium and long term (c. f. Chapter 4).

Measures to accelerate the market launch of serial building renovation are proposed in addition to conventional support programmes (c. f. Agora Energie-/Verkehrswende, 2020). The concept developed in the Netherlands under the title "Energiesprong" is characterised by a digitalised, industrialised construction process and can quickly and affordably bring buildings up to the NetZero standard. A rapid scale-up of production would reduce the costs of restructuring and enable the development of a green market. This would offer new economic opportunities both to the construction industry and to companies with automated production lines, for example in the automotive supply industry.

In addition, the literature emphasises that as well as classic energy-efficient renovation measures (e. g. building insulation), further measures should be supported in order to accelerate the necessary structural change towards climate neutrality in the building sector. The proposal is to promote heat pumps, solar thermal systems and heating and cooling networks for the integration of renewable, non-fuel-based heat sources (in particular large heat pumps, geothermal energy and ground-mounted solar thermal systems) and waste heat (cf. e. g. UBA 2020, IEA 2020a). Some of the proposals are also explicitly linked to industrial policy objectives. This applies, for example, to Agora Energiewende's proposal to set up a one-million heat pump programme in Germany (c. f. Agora Energie-/Verkehrswende 2020).

Sustainable mobility

The shift to sustainable mobility is an important prerequisite for achieving climate goals, reducing air pollution and other environmental burdens (such as noise pollution). Climate protection is a particularly vital area where action is needed, since in recent decades there has been little success in reducing transport-related greenhouse gas emissions.

As numerous studies have shown, transport-related instruments and measures in green economic recovery packages provide important initiatives for reducing transport-related environmental pollution and for stimulating the economy. The spectrum of the proposed measures is broad and includes support for electro-mobility (e. g. through purchase premiums for electric cars and commercial vehicles, expansion of the charging infrastructure, support measures for local authorities for the purchase of electric buses, c. f. e. g. GWS 2020, Greenpeace 2020b, DIW et al. 2020), the development of overhead line structures for freight transport along motorways (cf. Wuppertal Institute 2020a), the expansion of public transport (e. g. additional investment in the rail network) and support for active forms of mobility (e. g. expansion

of cycle path networks). Various proposals also focus on promoting innovation. These proposals include, for example, the establishment of a state investment fund for "New Mobility" start-ups and innovation competitions for rural mobility (c. f. Agora Energie-/Verkehrswende 2020) or the funding of a digitisation initiative (c. f. Agora Energie-/Verkehrswende 2020, Öko-Institut 2020).

Purchase incentives for cars are often viewed very critically. In some cases, reference is also made to negative experiences with scrapping incentives that were introduced in some countries during the financial crisis (c. f. Chapter 2). High deadweight and pull-forward effects, low environmental relief combined with high fiscal costs, negative distributional effects and the danger of a consolidation of car-centred forms of mobility are the disadvantages cited in respect to this.

Numerous studies stress that support measures should be bolstered by structural reforms (c. f. also Chapter 4). These reforms could include, for example, increasing fuel taxes (e. g. IMF 2020b), introducing a Bonus Malus scheme for the purchase of passenger cars (DIW et al. 2020, Agora Energy/Transport Shift 2020) or, with a view to changing the modal split, introducing a city toll, reducing the number of parking spaces and charging higher parking fees (c. f. Greenpeace 2020a).

Ecological transformation of industry

One of the most urgent challenges of the socio-ecological transformation is the **shift to post-fossil production technologies in energy-intensive industries.** These industries are responsible for a significant share of greenhouse gas emissions, the facilities often have a very long service life meaning the changeover needs to be initiated as quickly as possible. Numerous studies suggest that green economic recovery programmes should speed up this process by increasing support for research and development and financing demonstration facilities.

The switch to post-fossil production technology also requires the parallel **establishment of a hydrogen economy**, since the substitution of fossil fuels by green hydrogen is currently the only realistic option for achieving greenhouse gas neutrality in some industries. Support measures to establish a hydrogen economy therefore also figure prominently in the literature (e. g. Agora Energy/Transport Shift 2020, Wuppertal Institute 2020a, DNR et al. 2020). In its recently adopted economic recovery package, Germany has focussed on support for a hydrogen economy. A total of about EUR 9 billion is being allocated to this area (Federal Government 2020). Alongside this, the EU is also pursuing a hydrogen strategy (EU 2020a).

Supporting investment to increase energy and resource efficiency is also very suitable for green recovery programmes. Here, there is high investment potential that is quickly mobilised and which contributes significantly to climate protection and resource conservation (e. g. Baum e. V. 2020). In some cases, investment in recycling processes and in the digitisation of waste management is also proposed (c. f. DIW 2020b).

As already outlined above using the example of serial renovation and heat pumps, some proposals also aim to create a surge in demand for green products by means of a green economic recovery plan. This will lower production costs through economies of scale and increase the competitiveness of green products compared to alternatives produced using fossil fuels. In this way market diffusion of green products and the **development of green markets** can be driven forward together with structural reforms (c. f. Chapter 4). The proposal is to **support green innovations** by increasing state funding for research and development (c. f. e. g. Hepburn et al. 2020, DIW et al. 2020). In particular, support for innovations close to the market, e. g. through real laboratories and subsidies, can contribute to economic revival (DIW, FÖS, ifso, IMK 2020).

Green start-ups are a key driver of green innovation and ecological structural change, but they have also been severely affected by the economic crisis. Various studies therefore propose measures to support green start-ups. Proposals include, for example, the establishment of a state support programme for green start-ups, the launch of structured funds in which the state takes over the first loss tranche, or support to allow unemployed persons to set up start-ups by means of a start-up subsidy (for further proposals c. f. e. g., Öko-Institut 2020, DIW 2020b).

Local authority support programmes

Numerous studies stress that it is very important to integrate local authority support measures into green economic recovery programmes (c. f. e. g. Hepburn et al. 2020, DIW, FÖS, ifso, IMK 2020, DIW 2020b, Agora Energie-/Verkehrswende). There are several reasons for this:

- The expectation is that local authorities will significantly curtail their investment activities as local authority tax revenues collapse and social spending rises at the same time as a result of the Corona crisis. This would intensify the economic crisis.
- Local authorities account for the majority of public investment, i. e. their investment activity is of considerable importance to the economy as a whole.[7]
- The investment and funding requirements for socio-ecological transformation are very high at the local authority level (e. g. expansion of public transport and bicycle infrastructure, energy-efficient renovation of public buildings).[8] This also affects community corporations, which are often key stakeholders in the socio-ecological transformation, particularly in the transport, energy and housing sectors.
- Local authority investments, for example in green infrastructure, have high short- and long-term multiplier effects and are therefore extremely suitable for economic recovery programmes (c. f. Section 3.1).

The focus of green economic programmes should be on projects that can be quickly implemented and require little planning. Green recovery programmes should also include measures to speed up planning processes and increase local authority planning resources, e. g. for transport planning and approval procedures, to ensure that green investments are implemented promptly (c. f. Agora Energy/Transport Shift 2020, Greenpeace 2020c). It is also conceivable that local authority planning resources be supported by federal companies or by financing through external consulting firms (DIW et al. 2020). Increasing planning capacities would have an immediate positive impact on employment and could often also boost long-term economic development, since insufficient planning capacities in many countries are a major obstacle to investment at the local level (c. f. IMF 2020b).

Support for SMEs

Empirical studies show that small and medium-sized enterprises (SMEs) are particularly affected by and require special support during the corona crisis (OECD 2020f). So far, the support measures have mainly concentrated on liquidity support and other measures that focus on ensuring the short-term survival of companies (OECD 2020f). In addition to these measures, further measures should be considered which help companies convert to sustainable solutions. This can be accomplished, for example, through tax breaks or subsidies for green innovations (c. f. e. g. DIW, FÖS, ifso, IMK 2020). Participation in research collaborations and networks should also be supported (DIW 2020b), as should government aid for consulting services. Unlike large companies, SMEs often lack not only financial reserves but also the technical expertise to implement transformative processes, since the core business ties up all capacities. Supporting the employment of consulting services also ensures the survival of "green" consulting firms, which have been severely affected by the current economic crisis and play an important role in the social-ecological transformation.

Sustainable digitisation

It is also important to **closely dovetail the Green Economic Stimulus Packages and digital change**, i. e., to use digitisation as an important "enabler" for socio-ecological transformation, while at the same time reducing the negative environmental impacts of digitisation, such as the consumption of energy and raw materials by the digital infrastructure. Measures, such as support programmes for the ecological modernisation of data centres or for green software development in economic recovery packages can contribute to this (c. f. Öko-Institut 2020, BAUM e. V. 2020). For example, a funding programme for digitisation in local authority waste management is also proposed, including investments in telematics and logistics solutions to optimise operational

7 The municipalities are by far the largest public investor in Germany. Around two thirds of all construction investments are accounted for by cities and communities (c. f. DIW, 2020b).

8 Moreover, there is a considerable investment backlog at the municipal level in Germany, which has accumulated to around EUR 130 billion in recent years (KfW Communal Council, referred to in DIW 2020b).

processes and sensor technology solutions to meet the demand for collection and disposal (Wuppertal Institute 2020c). In addition, it is also necessary to fund programmes designed for the medium term and support the digitisation process with environmental policy instruments (c. f. Section 4.3).

Nature-based solutions

Investments in what are referred to as Nature Based Solutions (NBS)[9] are particularly well suited to economic recovery programmes. They offer employment opportunities on a similar level to infrastructure investments (cf. OECD 2020h) and, according to an estimate by the World Resource Institute, for the same investment volume create more than 10 times as many jobs as investments in fossil fuels (cf. WRI 2020a). In addition, the employment effects are quickly felt and benefit in particular employees with low qualifications (c. f. BUND 2020, DNR et al. 2020). In the current economic crisis, a further advantage is that these activities have very low dependence on international supply chains (c. f. GWS 2020). At the same time, NBS have high long-term benefits. For example, they contribute to climate protection and adaptation, to the stability of ecosystems and the conservation of biodiversity, and to increasing food security. They are therefore also an essential component of a "Recovery for Resilience Strategy" (OECD 2020h).

The range of possible support measures is wide. Proposals include, inter alia, support programmes for the renaturalisation of watercourses as a precaution against flooding, drought and species extinction (NABU 2020), reforestation with climate-resilient tree species (also in cities), (GWS 2020), the wetland restoration, nature-based coastal protection measures and the development of green-blue infrastructures in cities (EU 2020b). The principle of the "sponge city" is relevant for the development of green-blue infrastructures. In a "sponge-city", rainwater seeps away on site, is temporarily stored and used in dry phases for the irrigation of green structures. Moreover, there should be an overall increase in biodiversity and nature conservation programmes.

9 The OECD defines NBS as "...measures that protect, sustainably manage or restore nature, with the goal of maintaining or enhancing ecosystem services to address a variety of social, environmental and economic challenges" (OECD 2020i).

4 Structural reforms for the socio-ecological transformation

4.1 Setting the right incentives through structural reforms

Public recovery measures have the potential to cushion the economic and social consequences of the COVID-19 crisis in the short term. At the same time they can provide important incentives for containing the climate and environmental crisis. In the medium and long term, however, both crises can only be overcome through a clear change in the direction of private investment, since this determines the greater part of economic development[10]. The economic framework for this reorientation has to be created in parallel to, or at least promptly after the adoption of the direct support measures. Otherwise the recovery measures are simply a flash in the pan (c. f. Bhattacharya and Rydge 2020). This requires structural reforms.

The overarching goal of structural reforms is thus the sustainable use of capital and labour and the avoidance of stranded investments and stranded jobs (c. f. Stern 2020). Both these objectives are achievable provided macro economically optimal investments, which also minimise negative social and ecological consequences, are also financially profitable. This has not been the case so far for a number of reasons, resulting in the wrong type of incentive structures. The most important reasons are:

- Negative social and ecological consequences of activities are not borne by the polluter (external effects) and are therefore not considered in investments and decisions (e. g. costs of global warming,

10 The relevance of private investments for overcoming the crisis is emphasised inter alia by the German Council of Economic Experts (c. f. Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung 2020).

damage to ecosystems, environmental pollution). This results in an implementation deficit with regard to climate and environmental policy goals.

- In addition, government subsidies favour environmentally harmful activities over environmentally friendly activities (e. g., kerosene tax exemption, diesel privilege).
- From the investor's point of view, environmentally-friendly projects have higher risks due to unfavourable framework conditions and lack of standardisation, and therefore, poorer financing conditions.
- Environmentally-friendly technical and social innovations do not reach market maturity or reach it only with a delay due to distortion of competition, financial restrictions, regulatory barriers, non-consideration in standardisation, etc.
- The lack of information or information comparable only with difficulty (e. g. in CSR reporting) on the environmental risks and environmental performance of companies makes it difficult for customers, investors, etc. to assess these companies on the market.

A further difficulty may be that the implementation of socially and environmentally compatible investments is hampered by bottlenecks in the labour market (e. g. energy-efficient building renovation).

It is imperative that these obstacles be removed consistently and promptly through reforms in the areas described below if the economic policy framework is to be sustainable. The respective measures should be regularly checked for achievement of objectives and possible side effects. If necessary, the measures should be adjusted to accommodate new findings, developments and requirements.

Consistent pricing of environmental damage

Polluters can be charged for the social costs of environmental damage, through taxes and certificate trading for example, and in this way these costs can be integrated into economic decisions (known as the internalisation of external effects). Existing approaches in the climate sector include the taxation of fossil fuels within the framework of the energy tax as well as the pricing of CO_2 through European emissions trading and the fuel emissions trading planned in Germany. So far, the prices per ton of greenhouse gas for the polluters are, however, considerably lower than the damage caused[11]. A significant, continuous and predictable increase in these prices is necessary to make investments in climate neutrality profitable for companies and investors (c. f. Bhattacharya and Rydge 2020, Agora Energie-/Verkehrswende 2020). Clear price signals are needed not only for greenhouse gases but also for other external effects (OECD 2020b, E3 g 2020). They not only lead to an improvement in the competitive situation of sustainable business models, but – combined with reliable political statements on their development – also increase the urgently needed planning and legal certainty for the business sector (CEPS 2020). This helps to build confidence in the direction of economic policy and thus promotes investment (Stern 2020, Bhattacharya and Rydge 2020). Finally, the pricing of greenhouse gases generates revenues that can be used elsewhere to overcome the crisis (Bhattacharya and Rydge 2020, WRI 2020).

Reduction of environmentally harmful subsidies

In addition to the lack of pricing for external effects, environmentally harmful subsidies lead to financial benefits for environmentally harmful activities and thus to competitive disadvantages for sustainable production and consumption patterns (c. f. also Bhattacharya and Rydge 2020). For example, government support for e-mobility and public transport is counteracted by subsidies such as the diesel privilege in Germany and the kerosene tax exemption. The economic and ecological effectiveness of recovery measures would be significantly improved by reducing these and other subsidies (c. f. e. g. 2020, Gawel and Lehmann 2020).

Furthermore, a reduction of subsidies in this area would not be associated with additional burdens due to the current – and probably also medium-term – low fuel prices (c. f. WRI 2020, EPRS 2020, Bhattacharya and Rydge 2020). Irrespective of this, environmentally harmful subsidies should be reduced in such a way that no social hardship is caused and the reduction in subsidies is used to help socially disadvantaged households (c. f. in the international

11 C. f. the estimation of damage costs in the method convention 3.0 for estimating environmental costs (UBA 2019).

context IEA 2020a). Measures could include hardship provisions (e. g. for long-distance commuters with low incomes in the case of the German distance allowance), the creation of alternatives (e. g. support for local public transport) or (partial) compensation for the additional burden (for the compensation option c. f. WRI 2020).

In addition to reducing distortions of competition between environmentally harmful and environmentally-friendly economic activities, the pricing of environmental damage and the reduction of environmentally harmful subsidies generates funds that can be used, for example, to cushion the social consequences of the crisis or to support education or training measures (c. f. e. g. WRI 2020).

Establishing sustainable financial systems

The bulk of the private capital required by the economy is provided through banks and financial markets. Once all distortions of competition that disadvantage environmentally friendly products and processes – such as external costs, subsidies, reporting deficits, etc. – have been eliminated, this capital will flow increasingly into sustainable projects. In the meantime, government support measures for green investments must (at least partially) compensate for these distortions in order to avoid stranded investments and to support sustainable economic development with future-proof jobs (see IMF 2020b, RNE 2020).

Climate and environmental risks should also be perceived as financial risks in financial market regulation, priced in and accounted for in investment decisions (c. f. Stern 2020, WRI 2020, Bhattacharya and Rydge 2020). Government guarantees and warranties could be granted for particularly sustainable projects in order to reduce the risk in green infrastructure projects and other sustainable investments for investors and to strengthen the sustainable economy in the long term (c. f. IMF 2020b, SFB 2020).

In Germany, as the German climate and sustainability bank, the Kreditanstalt für Wiederaufbau (KfW) has a special role to play in promoting green investments. Instruments here include the increased issuing of green bonds (RNE 2020, EPRS 2020), the expansion of green credit lines (Gawel and Lehmann 2020), support for sustainable projects in industry and infrastructure that are attractive to investors (SFB 2020), as well as the establishment of a project platform that brings together investors and ecological projects in a targeted manner (UBA 2020, in the international context c. f. also Bhattacharya and Rydge 2020). When investing their own funds (from reserves, etc.), central banks and governments should also act as role models and invest exclusively on the basis of ambitious sustainability criteria and in green bonds (E3 g 2020, UBA 2020).

Success in establishing sustainable financial systems, however, requires joint efforts. The Action Plan on Financing Sustainable Growth and the Renewed Sustainable Finance Strategy should therefore be consistently implemented on a European level. Similarly to the KfW in Germany, the European Investment Bank (EIB) should be further developed into a sustainability bank at the European level (EIB 2020), whose scope can be extended by the issuing of green bonds (Agora Energie-/Verkehrswende 2020).

Corporate Reporting

Investors and customers are able to exert considerable influence on corporate policy. This can for example be achieved by rewarding the reduction of emissions and resource consumption – and the associated reduction in risk – through increased demand and more favourable financing terms. As a consequence, sustainable business models gain competitive advantages. However, this mechanism depends on the availability of reliable information on environmental performance of companies (Bhattacharya and Rydge 2020). Currently only a few companies are required to report on this. But even this reporting does not result in reliable and comparable information (Alliance for Corporate Transparency 2019). The current revision of the EU's Non-Financial Reporting Directive – and the German national implementation law (CSR-RUG) – should both massively expand the circle of companies subject to reporting requirements and substantiate and extend the reporting requirements (RNE 2020). Additionally, the reporting format for companies' environmental performance should be aligned with or integrated into their financial reporting to enable investors to make a simple and holistic assessment (e. g. as environmental accounting, also included as a measure in the European Green Deal). The transparency thus created contributes significantly to an environmentally and socially compatible corporate policy being rewarded in the product, service and financial markets.

Support for innovation and diffusion

Technical and social innovations are essential for the development of an environmentally sound, competitive, social and crisis-resistant economy and to secure sustainable jobs. The promotion of green innovations – from research to market diffusion – should therefore be both an important part of the current economic recovery programmes and an indispensable long-term strategy (DIW et al. 2020, E3 g 2020). Cost reductions and productivity gains in the industry concerned are not the only effects of promoting the dissemination of green innovations in the market. In fact, the entire economy benefits from the resulting knowledge transfer (Bhattacharya and Rydge 2020). The multiplier effect of promoting innovations is significantly increased by the resulting economy-wide energy and resource-saving effects compared to promoting fossil fuel alternatives (ibid.)

Support for green innovations should include the development of funding structures in areas that are particularly relevant to sustainable development (e. g. sustainable digitisation, DIW 2020b) and the introduction of minimum green criteria in existing innovation programmes to avoid stranded investments (UBA 2020).

Training Initiative

Many people are on part-time work contracts or have lost their jobs as a result of the measures taken to contain the pandemic. At the same time, the current crisis is accelerating transformation in some industries. Vocational training measures can significantly improve these people's chances in the job market. At the same time, there is a lack of skilled workers in many areas of socio-ecological transformation (e. g., energy-efficient renovation and sustainable construction[12], sustainable digitisation). A training initiative geared to existing and future needs can facilitate new employment for those affected by the COVID-19 crisis and transformation. This will also support socio-ecological transformation by alleviating the existing shortage of skilled workers, thereby securing jobs in the long term (OECD 2020b, Hepburn et al. 2020). Digital services should also be used extensively to conduct training measures, especially during the restrictions imposed by COVID-19 measures (University of Oxford 2020).

In parallel to this, the future-proof occupations needed for transformation should be made more attractive, for example through better working conditions and higher wages. A campaign to support careers in the sustainable economy should also be launched (UBA 2020).

Improving the legal framework for sustainable alternatives

The expansion of renewable energies, the diffusion of environmentally-friendly mobility alternatives and drive technologies, the transition to a circular economy, the spread of nature-based solutions etc. is essentially determined by the legal framework. Sustainable solutions and the creation of future-proof jobs can be supported by improving the regulatory framework without the state having to set up costly support programmes. Besides the national framework, which in Germany includes the distance regulations for wind power (Agora Energie-/Verkehrswende 2020), the limitation of the expansion path for renewable energy (Gawel and Lehmann 2020, DIW et al. 2020) or the subsidising of diesel vehicles (FÖS 2020) – in many cases this also concerns regulations in the European context, such as performance standards for industrial processes, products and buildings (E3 g 2020).

Providing sustainable infrastructures

The long-term effectiveness of green economic recovery measures depends in no small measure on establishing and expanding green infrastructures (e. g. IMF 2020b, BUND 2020, CEPS 2020). For example, converting to renewable energies while at the same time ensuring security of supply requires a smart grid infrastructure that includes both electricity and communication networks (BDEW 2020) and storage capacities (University of Oxford 2020). The mobility transformation also requires measures to expand the charging infrastructure (DIW et al. 2020, University of Oxford 2020). This can be achieved for example by supporting charging infrastructure in private households, for handicraft businesses and in the workplace (Greenpeace 2020c), or a fund for additional personnel capacities in local authorities to accelerate approval and planning processes when processing applications for charging points (ibid.,

12 There is no shortage of skilled workers in this field at present, as COVID-19 measures have decreased activity in construction and renovation. Once the economic measures – especially in the building sector – take effect, however, it is likely that the pre-corona condition will become even worse, unless countermeasures are taken.

c. f. also Section 3.3). In addition, sustainable infrastructure development in the mobility sector should include public transport infrastructure (e. g. bus and rail) and cycling infrastructure (c. f. e. g. University of Oxford 2020, I4CE 2020).

Investments in green transport infrastructure have positive effects on employment, economic growth and labour productivity in addition to their direct effects (OECD 2020b). They are an essential prerequisite for sustainable private investment and consumption decisions, reduce the costs of sustainable business models and increase planning reliability for companies and consumers.

Implementing the European Green Deal, making international cooperation sustainable

The improvement of the above-mentioned framework conditions is just as fundamental in the European context as in the national context and is often more effectively implemented there. The European Green Deal addresses this in many respects. These include the sustainability audit of investments, corporate reporting and environmental accounting, the integration of environmental risks into the financial market systems, the reduction of environmentally harmful subsidies and an ecological tax reform. Its consistent, ambitious and timely implementation is therefore of fundamental importance (Leopoldina 2020, DIW et al. 2020, Baum e. V. 2020, Stiftung 2Grad 2020, EPRS 2020, etc.). It should also serve as a guideline in the design of national economic recovery programmes (c. f. e. g. Agora Energy/Transport Shift 2020, World Economic Forum 2020b).

The principles of the Green Deal and the creation of an economic policy framework supporting sustainability, as called for in the Green Deal, should also form the basis for international cooperation outside of Europe. Major examples are international trade (c. f. also UNEP 2020b) and development policy.

4.2 Connecting the ecological transformation with social goals

Green economic recovery programmes, like structural reforms, should be designed in such a way that they consistently take social aspects into account (Volckaert 2020, CEPS 2020, IEA 2020a). This is a key factor for the success of ecological transformation, because unless the respective social consequences are carefully weighed up, measures and instruments will lack support from society (BUND 2020, Wuppertal Institute 2020c). This is of particular importance in the current situation, since the economic crisis is significantly exacerbating social problems and inequalities.

It is essential to understand and communicate the green transformation as part of a comprehensive policy of improving general welfare (OECD 2020h). As discussed in Section 3.1, a green transformation has a positive impact on social goals in several respects, e. g., by reducing environment-related health damage and risks, improving the quality of life, or securing and creating jobs. Moreover, low-income households often benefit to an above-average extent from an improvement in environmental quality (e. g. in terms of traffic-related environmental pollution). These synergies need to be used consistently.

There is also a positive nexus between green transformation and social goals in building green infrastructure. The promotion of cycling, like the promotion of public transport, but unlike the promotion of car transport supports in particular people on low incomes (Greenpeace 2020a). In addition, support measures can be used in a targeted manner to reduce energy poverty and at the same time promote climate protection. It is proposed, for example, that support measures to increase the energy efficiency of buildings should be targeted at low income groups (Hepburn et al. 2020) or focus on socially disadvantaged residential areas (Öko-Institut 2020). Another option is free energy consultancy services for low-income households, coupled with appropriate investment grants and a broad marketing policy.[13]

In Germany, there are also proposals to lower electricity prices in the current economic crisis by reducing the EEG levy or the electricity tax (c. f. e. g. Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung 2020, Agora Energie-/Verkehrswende 2020). This boosts purchasing power, provides above-average relief for low-income households and supports sector coupling. There are also various proposals to ensure that the CO_2 pricing necessary for climate protection is socially just, for example by means of a climate incentive

13 In Germany, for example, the electricity savings check for low-income households has reduced energy costs in the households advised by more than 300 million euros. C. f. www.stromspar-check.de

(c. f. e. g. DIW, FÖS, ifso, IMK 2020). On balance, these measures reduce the net burden on low-income households. Another option for positively linking environmental protection and social objectives is to abolish or reform environmentally harmful subsidies, since some environmentally harmful subsidies have a negative distributional effect (ibid.)

Another proposal is to ensure that the transition of emission-intensive industries, such as the aviation industry, is socially responsible (c. f. e. g. Greenpeace 2020e). This can for example be achieved by linking state aid given to ailing companies to social conditions (c. f. also Chapter 5.2).

4.3 Connecting social-ecological and digital transformation

Digitisation represents another far-reaching transformation that can to an extent easily be connected with green economic recovery programmes (c. f. Chapter 3.3), as well as with structural reforms. Even in times of COVID-19 (FÖS 2020), many studies see great potential for digitisation in such diverse topic areas as the implementation of energy and mobility transformation (BDEW 2020, Agora Energie-/Verkehrswende 2020), the acceleration of planning procedures (BDEW 2020) and the implementation of further education programmes . In this context, investments in the network infrastructure and digital equipment for schools and administration are required (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung 2020, BAUM e. V. 2020).

In many places, digitisation is leading to fundamental changes in production, infrastructure, goods and services beyond actual intersections with green economic measures. It promises to become a central enabler of socio-ecological transformation in many areas, such as energy, mobility, industry, cities, consumption and nutrition (Wuppertal Institute 2020a). Significant transformation potentials through digitisation arise, for example, from the fast and cost-effective provision of environmentally relevant data.[14]

However, if the investments associated with digitisation are not designed to be ecologically and socially compatible, structures are created that place a heavy burden on the environment and threaten social peace, and which need to be expensively overhauled in the foreseeable future (stranded investments).

In order to prevent this, the UBA believes that a medium-term special funding programme for sustainable digitisation would be advisable. It should pursue the goal of developing digital infrastructures, production structures and products as well as software development in an ecologically and socially compatible manner from the outset. Supporting cooperation and networking between stakeholders from both areas should play an important role. In this way, the programme would contribute to the joint conception of digital solutions and socio-ecological transformation. Furthermore, the digital transformation should be consistently bolstered by environmental policy instruments.[15]

14 For example, a "digital twin" in the form of a digital product passport could provide information on all the environmental and material data of a product, so that consumer decisions tend to be more sustainable and companies are able to comply with reporting obligations more easily. The introduction of a standardised digital product passport is one of the central measures of the Environmental Digital Agenda and is also advocated in the European Green Deal of the EU Commission. https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/broschuere_digitalagenda_bf.pdf.

15 This concerns, for example, the development and establishment of award criteria for environmental labels such as the Blue Angel for delivery and shipping services, energy efficiency standards for data centres or resource-efficient software products.

5 Greening and monitoring of all measures in economic recovery programmes

5.1 Sustainability checks and exclusion criteria

Current analyses of the environmental impacts of measures already adopted to combat the COVID-19 crisis show that a considerable proportion promote "brown", i. e. environmentally harmful activities (Vivid Economics 2020). There is therefore a danger that like with the financial crisis of 2008/2009, the positive environmental effects of green instruments and measures will largely fizzle out. All environmentally relevant instruments and measures implemented to overcome the economic crisis should therefore undergo a **sustainability check** (c. f. e. g. World Bank 2020b). Lock-in effects, especially in the case of infrastructure investments and other investments with long lifetimes must also be examined (c. f. e. g. OECD 2020h). Should the assessment reveal that significant negative environmental effects are being generated or that the activities supported are not compatible with the objectives of the Paris Climate Convention and other key environmental objectives, other instruments and measures should be taken.

The sustainability check should be conducted quickly and with as little effort as possible for practical reasons. In this context, various options are proposed in the literature, including the use of the EU climate taxonomy and the embedded "Do no harm" principle (principle of damage avoidance).

Environmental exclusion criteria are also important to ensure the ecological integrity of green economic recovery programmes. The current discussion focuses on the demand for all investments, technologies and products based on fossil fuels to be excluded from support (c. f. e. g. CAT 2020). This could be supplemented by further exclusion criteria, for example for bio-based technologies and products that cause massive damage to biodiversity and ecosystems or investments that conflict with a circular and resource-conserving economy.

5.2 Environmental compensation for state aid

The current economic crisis has severely affected numerous companies whose business models are not sustainable. Airlines are a notable example. If the state secures the survival of such companies through capital injections, it contributes to short-term economic stabilisation and job security, but it also blocks the process of socio-ecological transformation. **Ecological compensation for the use of state aid** is one way out of this dilemma and paves the way for a socio-ecological transformation. The literature analysed contains numerous proposals for such ecological compensation measures (c. f. e. g. CDP Worldwide 2020, IMF 2020b).

As the experience of the support for the US automotive industry during the financial crisis of 2008/2009 shows, such a strategy also offers benefits for the companies concerned (c. f. Chapter 2). Their resource

Environmental offsetting of financial support to airlines

The government of **Austria**, in rescuing Austrian Airlines, stipulated that flights to destinations reachable by train in "well under three hours" shall no longer be scheduled. It has been agreed that by 2030 CO_2 emissions will be reduced by 30 per cent in comparison to 2005 and that aircraft noise is to be reduced by 60 percent. In addition, airlines are no longer permitted to offer their tickets below the statutory fees and charges, which are currently around EUR 40 (TAZ 2020).

In **France,** Air France is required to halve its carbon dioxide emissions per passenger kilometre by 2030 (domestic emissions by the end of 2024) and to use 2 per cent of alternative fuels by 2025. Where rail travel offers an alternative journey time of less than 2.5 hours, domestic flights must be cancelled (World of Aviation 2020).

efficiency increases and financial environmental risks decrease, as does the probability of damage to their reputation or stranded investments due to insufficient adaptation to changing market conditions in times of climate change. In the current crisis, some governments have already tied their support for national airlines to environment-related compensation measures.

Ecological compensation for state aid is not only an option for large, emission-intensive companies. In many cases, other sectors, such as the hotel and restaurant industry also receive financial aid. They are not very emissions-intensive, tend to a large extent to be SMEs and their sales collapsed in the course of the crisis. In these cases there is the chance to initiate a broad-based process of change through ecological compensation, whereby a combination of consulting services and support measures enables companies to make their restart ecological and therefore more crisis-resilient.

For reasons of proportionality and practicability, it is advisable to differentiate ecological compensation in accordance with the size and environmental relevance of the companies. In the case of **large companies,**[16] the following considerations may come under discussion:

- A commitment to introducing comprehensive environmental reporting (c. f. Chapter 4), which provides information on the company's environmental performance, environmental risks and environmentally-friendly investments,
- Reporting of financial climate risks in accordance with the recommendations of the Task Force on Climate-related Financial Disclosures,
- Definition of ambitious environmental goals (in particular greenhouse gas neutrality by 2050 at the latest) and a sustainable corporate strategy to achieve these goals,
- Commitment to invest verifiably and measurably in socio-ecological transformation in the coming years, in particular in climate-friendly processes and products,
- Agreements on specific environmental protection measures, e. g. commitment to the use of electricity from renewable energy sources at the company's sites or, in the case of airlines, to abolish short-haul flights (see box).

Small and medium-sized enterprises could be obliged to perform an environmental check within a fixed period of time (UBA 2020). The object of this would be to identify energy and resource efficiency potentials and to initiate the corresponding investments. Free consulting services within a consulting programme for SMEs on the transition to sustainable business models and support in implementing this could complement this assistance.

5.3 Monitoring

No one knows at present how long the corona crisis will last and whether there will be further waves. Good timing and flexibility are therefore essential for successfully overcoming the current crisis (Allan et al. 2020). In addition, in the current situation, which is characterised by the pandemic and great uncertainty, it is particularly difficult to predict how the multiplier effects will actually materialise (Hepburn et al. 2020).

Both the impact of the economic recovery programmes and the measures and instruments for improving the framework conditions for the socio-ecological transformation should therefore be continuously monitored (OECD 2020b). This makes it possible to solve problems as they emerge, learn lessons and constantly readjust measures and instruments (UBA 2020).

Dynamic governance, which in the medium and long term is an essential prerequisite for effective and efficient management of the socio-ecological transformation process, is thus possible. This also involves testing on a small scale (e. g. in real-world laboratories), as well as adapting regulations, financial incentives etc. to technical or social developments.

16 Requirements that address social and fiscal objectives are also relevant. This includes, for example, employment promises or proof that public funds are not used for manager salaries and profit distribution.

6 Conclusion and research issues

In the course of the Corona crisis, scientific publications on green economic recovery programmes have proliferated and have contributed a great deal to increasing knowledge. The evaluation of the studies shows that there are already **numerous proposals in the pipeline for feasible green recovery programmes and structural reforms, which can be** quickly implemented. **What is crucial now is the political will to implement them** and to set up a monitoring system that allows timely and needs-based adjustments to be made when needed.

Consistently combining economic recovery programmes with structural reforms creates the framework for successful socio-ecological transformation, rather than simply producing a flash in the pan. At the same time, we need to ensure that digitisation, the second fundamental transformation currently underway, develops in a sustainable way and supports socio-ecological transformation.

Irrespective of the fact that action is now both possible and imperative, a number of research issues are raised. These concern the following issues:

- the development of integrated policy mix concepts to dovetail green recovery programmes with structural reforms,
- the analysis of synergies in ecological, economic, fiscal and social terms,
- the analysis of best practice for rapid administrative decision-making and planning processes and for maintaining a green project pipeline. This is needed in order to improve the rapid implementation of green recovery measures and thus also to extend the boundaries for the practical application of green recovery programmes,
- the identification of the skills needed for a sustainable economy and the development of strategies to meet these needs in the short and medium term,
- the development of instruments to integrate sustainable digitisation as a cross-sectoral issue in green economic measures, and
- the development of instruments that support the implementation of a greening of all measures in economic recovery programmes (e. g. design of sustainability checks where a balance between the required analytical depth, practicability and the necessary speed of political decision-making processes in economic crises needs to be struck).

In addition, there is a wealth of research issues in the individual fields of activity that are necessary for a socio-ecological transformation, e. g. with regard to the development of a sustainable financial system.

Appendix: Overview of the analyzed studies and statements

A. National studies and statements

Author	Title
Advisory bodies of the German Federal Government	
Energieministertreffen	Energieministertreffen (2020): Energieministerinnen und Energieminister, Senatorinnen und Senatoren der Länder (Energieministertreffen am 4. Mai 2020): Energiewende als Impuls für Wachstum und Klimaschutz nutzen, https://www.umwelt.niedersachsen.de/download/154915/Beschluss_Energieministertreffen_Mai_2020.pdf, last accessed on July 15, 2020
Gesellschaft für Internationale Zusammenarbeit (GIZ)	Gesellschaft für Internationale Zusammenarbeit: Build forward better. Integrating Responses to the COVID-19 Pandemic with Transformative Climate and Sustainability Action. A GIZ Cross-Project Synthesis Paper, June 2020
Leopoldina, Nationale Akademie der Wissenschaften	Coronavirus-Pandemie – Die Krise nachhaltig überwinden, https://www.leopoldina.org/publikationen/detailansicht/publication/coronavirus-pandemie-die-krise-nachhaltig-ueberwinden-13-april-2020/, last accessed on July 15, 2020
Nachhaltigkeitsrat	Nachhaltigkeitsrat (2020): Raus aus der Corona-Krise im Zeichen der Nachhaltigkeit, https://www.nachhaltigkeitsrat.de/wp-content/uploads/2020/05/20200513_RNE_Empfehlung_Raus_aus_der_Krise_im_Zeichen_der_Nachhaltigkeit.pdf, last accessed on July 15, 2020
Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung	Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2020): Feld, L P; Grimm, V; Schnitzer, M; Truger A; Wieland, V (2020): Ein Konjunkturpaket im Zeichen des Strukturwandels, https://www.sachverstaendigenrat-wirtschaft.de/themen/konjunktur-und-wachstum/aktuelles/ein-konjunkturpaket-im-zeichen-des-strukturwandels-2345.html?returnUrl=%2F&cHash=bfcbdd6a3ec0b2533afc6097bf23cb20, last accessed on July 15, 2020
Sustainable Finance Beirat der Bundesregierung	SFB (2020): Sustainable Finance als wichtiger Beitrag zu einer zielsicher aufgestellten Transformation – Konjunkturprogramme zu COVID-19 zukunftsgerecht und nachhaltig ausrichten https://sustainable-finance-beirat.de/aktuelles/, last accessed on September 18, 2020, last accessed on September 14, 2020
Umweltbundesamt	UBA (2020): Gibis, C; Kosmol, J; Matthey, A; Schubert, T; Wehnemann, K; Neßhöver, C (2020): Nachhaltige Wege aus der Wirtschaftskrise – Umwelt und Klima schützen, Beschäftigung sichern, sozialverträgliche Transformation einleiten, https://www.umweltbundesamt.de/publikationen/nachhaltige-wege-aus-der-wirtschaftskrise, last accessed on July 15, 2020
Wissenschaftlicher Beirat beim BMWi	Wissenschaftlicher Beirat beim BMWi (2020): Wirtschaftspolitische Aspekte der Corona-Krise, Brief des Wissenschaftlichen Beirats beim Bundesministerium für Wirtschaft und Energie (05.05.2020), https://www.bmwi.de/Redaktion/DE/Downloads/Wissenschaftlicher-Beirat/brief-wissenschaftlicher-beirat-corona-krise.pdf?__blob=publicationFile&v=8, last accessed on July 15, 2020

Author	Title
(Economic) Research institutes	
Agora Energie-/Verkehrswende	Agora Energiewende, Agora Verkehrswende (2020): Der doppelte Booster: Vorschlag für ein zielgerichtetes 100-Milliarden-Wachstums- und Investitionsprogramm, https://www.agora-energiewende.de/fileadmin2/Projekte/2020/2020-05_Doppelter-Booster/179_A-EW_A-VW_Doppelter-Booster_WEB.pdf, last accessed on July 15, 2020
DIW	DIW (2020a): Kröger, M; Sun, X; Chiappinelli, O; Clemens, M; May, N; Neuhoff, K; Richstein, J (2020): Green New Deal nach Corona: Was wir aus der Finanzkrise lernen können, https://www.diw.de/de/diw_01.c.786330.de/publikationen/diw_aktuell/2020_0039/green_new_deal_nach_corona__was_wir_aus_der_finanz-krise_lernen_koennen.html, last accessed on July 15, 2020
DIW	DIW (2020b): Belitz, H; Clemens, M; Fratzscher, M; Gornig, M; Kemfert, C; Kritikos, AS; Michelsen, C; Neuhoff, K; Rieth, M; Spieß C K (2020): Mit Investitionen und Innovationen aus der Corona-Krise, DIW Wochenbericht 24/2020, S. 442–451, https://www.diw.de/de/diw_01.c.791596.de/publikationen/wochenberichte/2020_24_5/mit_investitionen_und_innovationen_aus_der_corona-krise.html?pic=figure1, last accessed on July 15, 2020
DIW, FÖS, ifso, IMK, Studie im Auftrag des BMU	DIW, FÖS, ifso, IMK (2020): Bach, S; Bär, H; Bohnenberger, K; Dullien, S; Kemfert, C; Rehm, M; Rietzler, K; Runkel, M; Schmalz, S; Tober, S; Truger, A (2020): Sozial-ökologisch ausgerichtete Konjunkturpolitik in und nach der Corona-Krise, Forschungsvorhaben im Auftrag des Bundesministeriums für Umwelt, Naturschutz und nukleare Sicherheit, https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Wirtschaft_und_Umwelt/sozial_oek_konjunkturpolitik_forschungsvorhaben_bf.pdf, last accessed on July 15, 2020
DWR	DWR eco (2020): Medick, J und Wortmann, D: Grünes Konjunkturprogramm – Eine Übersicht der aktuellen Vorschläge, https://www.dwr-eco.com/de/uebersicht-vorschlaege-fuer-ein-gruenes-konjunk-turprogramm, last accessed on July 15, 2020
FÖS Studie in order of Greenpeace	FÖS (2020): Bär, H und Runkel, M (2020): Wie notwendige Wirtschaftshilfen die Corona-Krise abfedern und die ökologische Transformation beschleuni-gen können, Policy Brief (03/2020) in order of Greenpeace https://foes.de/publikationen/2020/2020-03-FOES-Wirtschaftshilfen-Corona-Krise.pdf, last accessed on July 15, 2020
FÖS (in order of WWF)	FÖS (2009): Schmidt, S; Prange, F; Schlegelmilch, K; Cottrell, J; Görres, A (2009): Sind die deutschen Konjunkturpakete nachhaltig?, study in order of WWF, https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Konjunkturpaket_D_V25_12-06-2009.pdf, last accessed on July 15, 2020
GWS	GWS (2020): Lutz, C; Wolter M I; Lehr, U (2020): Die Post-Corona-Welt – Investi-tionen für Wirtschaft und Umwelt, GWS-Kurzmitteilung 2020/04, http://www.gws-os.com/downloads/GWS-Kurzmitteilung_2020_04.pdf, last accessed on July 15, 2020
Ifo	Ifo (2020): Fuest, C (2020): Die politische Agenda für die Zeit nach der Pandemie, Gastbeitrag in der WirtschaftsWoche vom 09.04.2020 https://www.ifo.de/node/54966, last accessed on July 17, 2020
Ifw Kiel	IfW Kiel (2020): Schmidt, U (2020): Öko-Abwrackprämie trägt wenig zum Klimaschutz bei, Wirtschaftspolitischer Beitrag in Kiel Focus 05/2020 https://www.ifw-kiel.de/de/publikationen/kiel-focus/2020/oeko-abwrackpraemie-traegt-wenig-zum-klimaschutz-bei-14322/, last accessed on July 17, 2020

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RWI & IW	RWI & IW (2020): Bardt, H; Hüther, M; Schmidt, C M; Schmidt, T (2020): Mit neuem Wachstum aus der Krise – Überlegungen zu einer Modernisierungsstrategie für Nordrhein-Westfalen https://www.rwi-essen.de/media/content/pages/presse/downloads/20200522_rwi_iw_neues_wachstum_aus_der_krise.pdf, last accessed on July 17, 2020
UFZ	Gawel, E und Lehmann, P (2020): Grüne Irr- und Auswege aus der Coronakrise, https://background.tagesspiegel.de/energie-klima/gruene-irr-und-auswege-aus-der-coronakrise, last accessed on July 15, 2020
Wuppertal-Institut	Wuppertal Institut (2020a): Fischedick, M und Schneidewind, U (2020): Folgen der Corona-Krise und Klimaschutz – Langfristige Zukunftsgestaltung im Blick behalten. Wirtschaftliche Hilfen geschickt lenken und Synergiepotenziale für dringend notwendige Zukunftsinvestitionen ausschöpfen. Diskussionspapier, März 2020, Wuppertal Institut (Ed.), https://wupperinst.org/fa/redaktion/downloads/publications/Corona-Krise_Klimaschutz.pdf, last accessed on July 17, 2020
Wuppertal Institut	Wuppertal Institut (2020b): Schostok, D (2020): Covid-19 im Licht der Sustainable Development Goals – Was haben wir zu gewinnen bei all' den Einbußen? Diskussionsimpuls, April 2020, Wuppertal Institut (Ed.), https://wupperinst.org/fa/redaktion/downloads/publications/Diskussionsimpuls_Covid-19_SDGs.pdf, last accessed on July 17, 2020
Wuppertal Institut	Wuppertal Institut (2020c): Fischedick, M; Baedecker, C; Bienge, K; von Geibler, J; Hermwille, L; Kiyar, D; Kobiela, G; Koska, T; Liedtke, C; März, S; Rehm, A; Samadi, S; Schostok, D; Schüwer, D; Speck, M; Thomas, S; Wagner, O; Wehnert, T; Wilts, H (2020): Konjunkturprogramm unter der Klimaschutzlupe: viele gute Impulse, aber Nachbesserungen für nachhaltige Wirkung erforderlich?! Eine erste Bewertung des Konjunkturprogramms der Bundesregierung unter besonderer Berücksichtigung des Klimaschutzes, Diskussionspapier, June 2020, Wuppertal Institut (Ed.), https://wupperinst.org/fa/redaktion/downloads/publications/Corona-Konjunkturmassnahmen.pdf, last accessed on July 17, 2020
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BDI	BDI (2020b): Neustart und Erholung – Szenarien und wirtschaftspolitische Maßnahmen, BDI-Dokumentennummer D 1161 https://bdi.eu/publikation/news/neustart-und-erholung/, last accessed on July 16, 2020

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BDI	BDI (2020c): Bürokratie abbauen, Neustart unterstützen – 66 Maßnahmen für einen erfolgreichen Wiederhochlauf der Industrie, BDI-Dokumentennummer D 1183, https://bdi.eu/publikation/news/buerokratie-abbauen-neustart-unterstuetzen/, last accessed on July 16, 2020
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