



ALLIANZ RESEARCH

MANAGING THE CURVES: SHAPING A SUSTAINABLE COVID-19 RECOVERY

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- 04 The issue at hand
- 06 The economic rationale for greening the Covid-19 recovery
- 09 Designing recovery measures—applicability of proposed policies
- 12 Scalability of proposed policies
- 13 Avoid sustainability pitfalls



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EXECUTIVE SUMMARY



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The economy needs to be jump started while maintaining a flat infection curve and concurrently bending the global temperature increase to stay within the 1.5 degrees warming limit. A global alliance of cross-party political decision-makers, business and financial leaders, NGOs, scientists and think tankers alike, have been emphasizing the necessity to use the opportunities of the economic recovery from COVID-19 as an accelerator for the transition to a net-zero emissions¹ society.

The COVID-19 pandemic represents a historic window of opportunity to accelerate the global transition to a net zero emission society. Fiscal measures providing immediate pandemic relief have surpassed USD 7 trillion in total. But only a fraction of the current programs addresses energy transition infrastructure or other 'greening' activities. Instead of encouraging companies to return to their pre-crisis paths, economic recovery programs should rather incentivize companies to account for externalities by measuring and managing associated effects.

Public funds are not without limit. Overstressing public budgets will suppress long-run growth. Providing appropriate conditions for the potential crowd in of private sector green finance will significantly accelerate the recovery. It will thus unburden public entities by inducing a substantial leverage on the available financial resources. In addition, it will provide essential signals to the financial system and thus direct capital towards 'green' and 'greening' activities. It will align the allocation of investments with policy targets and will allow for the system-wide application of metrics to measure progress against environmental targets.

Beneficiaries of fiscal pandemic relief and recovery measures should be in line with these principles if they have 1) a commitment to a net zero by 2050 emission pathway, 2) a mitigation strategy including intermediary targets and details on how to achieve this plan, and 3) metrics that allow to verify progress and contribution of new investments to achieving the emissions' reduction trajectory. The immediate COVID-19 recovery measures are different in their nature from policy measures originally intended to mitigate climate change. Additional approaches are needed to close the gaps in available policy frameworks and utilize the COVID-19 measures to develop their fullest potential, i.e. ensuring economic recovery while simultaneously building the foundations for achieving climate targets. Incentivizing the implementation and the disclosure of net-zero transition strategies could close this gap. In addition, it is important to prioritize a preferential set of fiscal recovery policy types which offer high economic multipliers and substantially positive climate impact.

A long run strategy for sustainability and resilience attracts investors and customers. Sustainability and resilience are continuously gaining attention. Integrating sustainability and managing greenhouse gas (GHG) emissions in line with net-zero pathways is key to the resilience of business models as well as a corner stone for building trust towards investors and customers. Furthermore, companies pursuing net-zero pathways can generate positive spillovers by incentivizing public entities to substantiate their long-term strategies (LTS) and Nationally Determined Contributions (NDCs).

Avoiding sustainability pitfalls will be key. It is imperative to avoid continually increasing disparities resulting from lock-ins in brown technologies and therefore potentially stranded regions. Only sustainable and inclusive growth promotes convergence by empowering society to participate in the benefits of green growth and ensuring that no one is left behind.

Scope

Only 4% of the current and immediate COVID-19 relief measures can actually be considered 'green' according to a recent study (Hepburn et al., 2020). In strong contrast to this, policy makers broadly expressed the intention to integrate climate and sustainability targets when designing post-pandemic economic recovery programs. How is a 'greening' of these programs possible? And how can further measures support existing policies in limiting climate change and meeting the UN Sustainable Development Goals? Developing and disclosing net-zero transition strategies would be a solution that should be considered when designing criteria for companies receiving financial incentives. This would subsequently result in crowding in additional private sector green finance, thereby leveraging fiscal support considerably. The view presented here is applicable to currently discussed recovery programs. It opens an additional perspective for programs focused on investing in green infrastructure. It addresses areas that are particularly well-suited in supporting the recovery as well as the transition to a net-zero society. Beyond the scope of this contribution is the comprehensive discussion of 'green' recovery funds and complementary carbon pricing policies. Nevertheless, both are issues which must not be neglected



THE ISSUE AT HAND

The current debate provides profound suggestions for the pandemic relief measures to concurrently satisfy a 'green' objective, but this perspective is often missing when concrete policies are being formulated. The 'green' in the context of these debates predominantly refers to climate change. For progressing further and greening the recovery path, it is thus urgent to translate the climate objective into actual and applicable conditions or criteria that can be linked to commitments for receiving financial support. In principal, those conditions and commitments need to reflect our societies' imperative of pursuing a resilient, sustainable and inclusive growth path. Acknowledging the available regulatory frameworks to date, at least the climate objective should be addressed appropriately. Current policy frameworks, like the EU Taxonomy, to date are intended to assess and promote activities that are specifically focused on climate change mitigation and adaptation. However, the Taxonomy is not suitable for designing fiscal measures focusing on a broader recovery perspective in its current stage of development. Given that the taxonomy focuses on economic activities and not entire companies, it proves to be challenging to apply this framework for assessing COVID-19 support measures that will be targeted at company level. Yet, the taxonomy

does neither address activities that are not particularly harmful to the climate (e.g. student loan) nor activities that are particularly harmful to the climate (as they would fall under 'do no significant harm' rule), thereby excluding companies as a whole from benefits which are pursuing such activities. In order to address these challenges, a constructive approach would be to specify requirements on a company level. Acknowledging the commitment to a net-zero transition strategy as an eligibility criterion for these measures or certain benefits could be a viable way forward:

Fiscal measures should be designed in a way that – as a result - they support and accelerate amongst beneficiaries the disclosure of:

1. a commitment to a net zero by 2050 emission pathway,
2. a mitigation strategy including intermediary targets and details on how to achieve this plan, and
3. metrics that allow to verify the progress and the contribution of new investments for achieving the emissions reduction trajectory.

As sustainability and resilience are continuously gaining attention by investors and customers, the advantages for companies in pursuing such a strategy will be far-reaching. Only companies that are credibly able to prove their

sustainability and resilience will be able to keep investors and customers from turning away. Furthermore, companies pursuing net-zero pathways can generate positive spillovers by incentivizing public entities to substantiate their long-term strategies (LTS) and Nationally Determined Contributions (NDCs). Greenhouse gas emissions are currently the center of attention, but further issues like biodiversity and circular economy are already lining up.

Figure 1 positions the proposal for a net-zero disclosure within the larger policy agenda and time-frame of the recovery. In the first stage during the lockdown, the measures for immediate relief and support were distributed without a 'green' objective. It is desirable to evolve from the lockdown stage of 'blank relief' and liquidity provision to the national deconfinement stage and a 'smart relief' with a climate co-objective. The illustration focuses on fiscal policy measures for companies but monetary policy and support for households at the bottom of the figure are important complementary areas for policy measures. While current policy frameworks like the EU Taxonomy provide guidelines for assessing the 'greenness' of specific well-defined activities, investments or processes, they are not (yet) well suited for assessing a company as a whole.

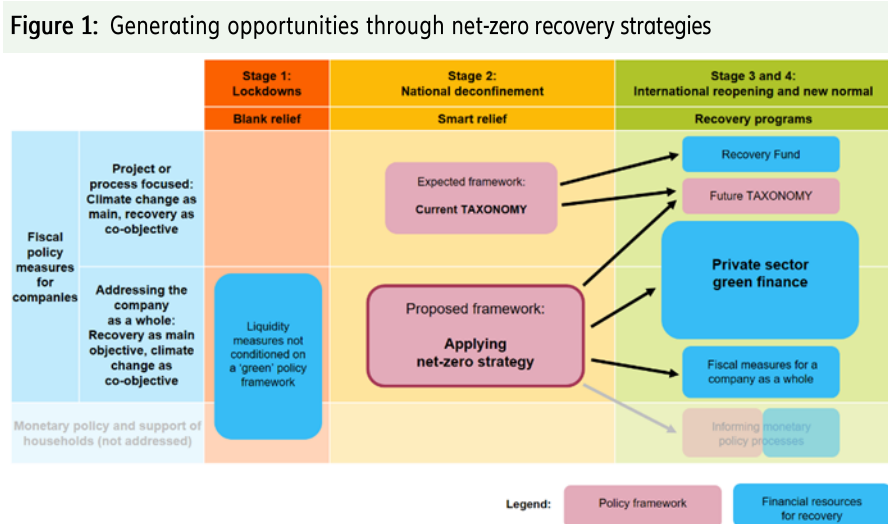
Acknowledging the commitment to a net-zero transition strategy could fill this gap and not only crowd in further private sector green finance but also be a useful extension of the Taxonomy for allocating specific green activities of a company within its transition path and allow for future measures supporting the transition process as a whole.

As public budgets are constrained and already stretched, it is important to prioritize a preferential set of activities which offer high economic multipliers and positive climate impact and, for instance, will be supported by a recovery fund. These activities include, among others, investments into renewable energy, energy storage (including climate compatible hydrogen), grid modernisation, CCS technology, building & industrial energy efficiency, education and training, natural capital investment and clean R&D investment.

It is imperative to learn and collabo-

rate, internationally and locally. International coordination of green recovery measures need to be based on credible and widely accepted guidance or frameworks. Domestic policy development should involve collaborating and coordinating with international approaches. COVID-19 has disrupted the global political order and severely impacted multilateral institutions like the WHO. The pandemic has exposed weaknesses in international and multilateral partnerships. It revealed a lack of global leadership as governments that are supposed to lead are occupied by managing their national crisis. Collaboration and the strengthening of multilateral institutions has been jeopardized by blame-gaming and personal political ambitions. These challenges to international institutions immediately impact the climate crisis as climate change negotiations have been affected and the COP26 postponed. On the other hand, the COVID-crisis

offers an opportunity to collaborate and share knowledge on green economic recovery packages. Hepburn et al. (2020) point out that acceptance and desirability of policies will increase with the generation of co-benefits that reach beyond climate or even economic attributes. For instance, electric vehicle promotion can reduce local air pollution in densely populated urban areas or supporting energy efficiency retrofits could be directed towards lower income households to decrease social and health inequality while upgrading the social status of neighborhoods. Ensuring the uptake of digital solutions, the potential arising from applying artificial intelligence technologies for instance in building operations, sector coupling are further examples. Identification of co-benefits needs to be an essential component of the policy design stage and need to be adapted to local needs.



Sources: Allianz Research

THE ECONOMIC RATIONALE FOR GREENING THE COVID-19 RECOVERY

The Carbon Budget compatible with a 1.5°C temperature increase is rapidly depleting. The decline in economic activity due to the COVID-19 pandemic is hardly sufficient for taking a breath in addressing the threats of climate change. Without government intervention, emissions will rebound as the lockdowns are gradually phased out and the crisis recovery progresses. Collapsed oil prices pose a particularly tempting peril to greening the recovery and are threatening the profitability of investments in renewables². On the other hand, current price levels in fossil fuels offer a historic window of opportunity for structural change³. Massive investments are needed for the energy transition, the realization of efficiency improvements, as well as a range of further activities⁴. And they are needed soon to achieve the necessary annual emission reductions of 7-8% between 2020-2030 (UNEP, 2019).

The benefits outweigh the effort. Fiscal measures addressing immediate relief connected to COVID-19 have surpassed USD 7 trillion by now. Figure 2 relates the scale of COVID-19 recovery measures to the scale of investments needed for the transition of the energy system necessary to limit the temperature increase to 1.5°C. The COVID-19 recovery measures can be broadly related to categories like transfers and guarantees or public investment⁵. According to IRENA, 2019, the additional total investments until 2050 required to

transition from current policy commitments to a 1.5 pathway are estimated to be USD 15 trillion or about 17% of current annual global GDP^{6,7,8}. Including further maintenance and operation costs would increase the system costs to USD 21 trillion, including renewable subsidies to USD 26 trillion or 30% of current annual global GDP. However, the pure economic benefits in value added and employment very likely outweigh the investment needs. Hepburn et al., 2020 derive the pure economic 'super-multiplier' from a literature review and ballpark it a range of USD 2.5–3.0 per dollar invested⁹. Including further monetarized positive externalities such as savings from avoided subsidies for fossil fuels, reduced environmental and health damages as well as less stranded assets results in benefits of about USD 2.5–6.0 per dollar spend (IRENA, 2019)^{10,11}. The benefits resulting from the additional system costs and policy support measures until 2050 (needed for moving from current policies to a 1.5°C path) are thus in the range of 75%–180% of current annual global GDP, with net benefits of 45%–150%. Unfortunately, the beneficiaries of the investments are typically not the same entities that have to bear the investment costs and the desired market for compensation and realization of the economic gains cannot work without multilateral cooperation and intervention of governments. It should be very clear that this comparison is primarily useful to develop an idea for

relating the financial scope of addressing the COVID-19 crises to investment estimates of what is needed to address the climate crisis.

These numbers illustrate that coupling the COVID 19 response to committing to a transition to net-zero emission could be an important step in realizing both, the net benefits of a global economic recovery as well as the as well as limiting temperature increase to a 1.5°C.

Use the most effective direct green investments. Hepburn et al. (2020) specify a preferential set of fiscal recovery policy types which offer high economic multipliers and positive climate impact. They combined the responses from a global survey of 231 leading economists and experts with evidence from the literature to define five areas where politicians need to accelerate investments that stand apart from the rest:

- clean physical infrastructure investment in the form of renewable energy assets, storage (including climate compatible hydrogen), grid modernisation and CCS/CCU technology,
- building efficiency spending for renovations and retrofits, including improved insulation, heating, and domestic energy storage systems,

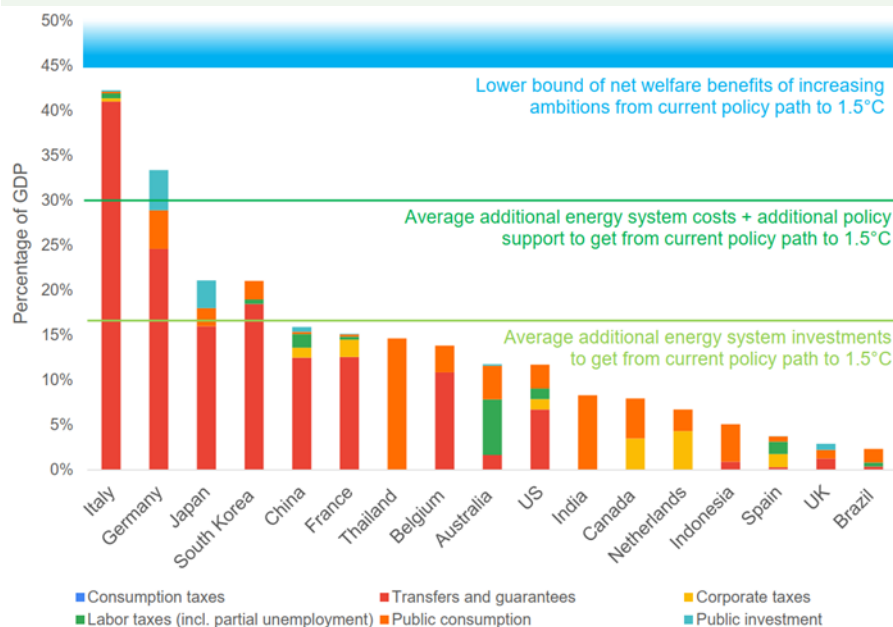
- investment in education and training to address immediate unemployment from COVID-19 and structural shifts to decarbonisation,
- natural capital investment for ecosystem resilience and regeneration including restoration of carbon-rich habitats and climate-friendly agriculture, and
- clean R&D investment.

Green investments are ideal for recovery. Green investments are typically capital intensive, while having low operating costs. As such, they benefit from the lasting downward pressure on interest rates that the crisis is expected to bring about. Concurrently, green invest-

ments induce high demand in products and services of the construction sector, the electrical equipment sector, the wholesale sector, and for sector coupling-related products in the information technology sector. All these sectors cause particularly high spillovers over the value chains to the rest of the economy, and these spillovers, or ‘Keynesian multipliers’, are particularly high when the economy doesn’t operate at full. Renewable energy investment is attractive in both the short and the long run as it generates more jobs in the short run and thus in times of recession, causing an additional boost on spending and increasing short-run GDP multipliers. Renewable energy conveniently requires less labor for operation and maintenance, freeing labor re-

sources as the economy returns to full capacity (Blyth et al., 2014). But financial stimulus isn’t the sole solution. As, for instance, energy efficiency measures typically have a positive payoff already, their implementation or effectiveness is often prevented by other obstacles, which need to be addressed as well. They include rebound effects on energy demand, misinformation, distrust or the lack of qualified workers who are able to implement the measure. The results can be discouraging odysseys as well as negative sentiments and fake campaigns against these measures.

Figure 1: Generating opportunities through net-zero recovery strategies



Sources: Allianz Research

The very upper bound of substitution costs for fossil fuels in aviation and sea transport are determined through electricity-based synthetic fuels and synthetic methane. For the production facilities currently under construction, the cost premium for electricity based synthetic fuels or methane over fossil fuels is estimated to be around USD 0.17 per kWh (for a price of USD 0.05 per kWh of kerosene before tax and levies,

(AGORA, 2018)). In abatement costs, this translates to a carbon price of USD 640 per ton of CO₂ (assuming 0.266kg CO₂/kWh), which seems rather high compared to alternative abatement options. The premium is estimated to fall below USD 0.05 per kWh in the long run and thus below USD 190 per ton of CO₂, which lies within long run carbon price expectations (typically USD 275 per ton of CO₂ in 2050 (Volckaert,

2020)). In practical terms, the sold kerosene will need to be composed of a mixture of fossil and synthetic in which the share of the synthetic component is increasing by about 3% per year. It should be mentioned that it is ambitious to increase production capacities that quickly. Adding 3% of synthetic fuel would limit the cost increase in the final product to USD 0.05 per year and liter of kerosene (assuming 9.8 kWh/liter).

Fossil energy cannot be replaced in all processes, or can it? The challenge remains how to address applications and processes in which fossil fuels are hard to replace or where process-related emissions need to be avoided. For coal, additional capacities are hardly conceivable following scientific assessments. Moreover, a full phase-out of coal needs to be implemented as quickly as possible (around 2040 globally) in order to have a change to stay within the 1.5°C limit. For aviation and shipping the substitution of oil products is particularly challenging and substituting heavy oil with natural gas for shipping

is merely an intermediate solution.

Fortunately, with electricity-based synthetic fuels, suitable substitutes for aviation and shipping are technically available¹². The question – as with most energy transition related issues – is ‘how much does it cost to switch the whole value chain’ rather than ‘when does someone come up with a solution’.

There is no R&D gap. It seems an established misperception that the problem of climate change prevention is a R&D gap, while the true problem is an implementation gap (Kavlaka et al.,2018; Knitter et al.,2017; Anadon et al.,2017).

Available technologies suffer mainly from lacking the cost savings through economies of scale and not from those of deficient research. Research can be a main driver in further reducing the costs of the energy transition but it cannot be an excuse for delaying the full-scale implementation. Moreover, the potential cost savings will never be achieved without starting the large-scale employment of the available technologies¹³. What stands in the way of many renewable products becoming mass products is not yet being able to benefit from the cost advantages of being a mass product.



Photo by Andreas Gückhorn on Unsplash

DESIGNING RECOVERY MEASURES

APPLICABILITY OF PROPOSED MEASURES

We are still lacking the necessary risk literacy. It has been broadly expressed, that the economic recovery programs should not focus on boosting the revenues of companies in order to resume pre-crisis structures while returning back to their pre-crisis paths. Rather companies should ideally be incentivized to account for externalities via a holistic approach for measuring and managing associated effects and risks. To do so, the corresponding macroeconomic growth measures should incorporate the impacts on natural as well as on human capital, rather than focusing solely on GDP. Unfortunately, a consensus on such measures is not in sight (and probably needs to be addressed with a higher priority). While rapidly progressing on assessing the risks associated with the climate or the biodiversity crisis, we (the society including the institutions and the financial sector) are currently still lacking the necessary risk literacy for an adequate evaluation. An appropriate inclusion of the climate crisis, for instance, would expose and quantify its property as a threat multiplier for future economic shocks and reveal its imminent threat to sustainable growth. However, a comprehensive and adequate risk assessment requires the provision of an adequate context:

- Comprehensive and globally consistent sectorial pathways and scenarios in line with the 1.5 target of the Paris Agreement that are necessary for climate risk manage-

ment and supervision are under development, but are not yet available. However, following the recommendations of the TCFD or the anticipated development of the related regulatory frameworks in the European Union will result in the provision of adequate scenarios for risk management in the near future

- Given the urgency, recovery programs need to start while some deficits in the available analytical frameworks still exist. Conditioning benefits from such programs to the consistent provision of a comprehensive scenario-driven climate risk assessment by the beneficiary is not applied practice yet. Such scenario-based risk assessments could and need to be taken into consideration as additional evaluation criterium once they become available.
- Even without such inclusive growth measures or adequate risk literacy, existing frameworks, like the EU Taxonomy, provide a starting point for assessing the sustainability of COVID-19 recovery programs.

The EU Taxonomy is not the answer, yet. The EU Taxonomy in its available status addresses climate change mitigation and adaptation for the most impactful economic activities but still lacks a broad range of further activities that substantially contribute to sustainability (like biodiversity and circular economy).

Still, in the process of fleshing out stimulus programs over the coming weeks or months, governments could integrate the existing and expedite the prospective analytical basis of the taxonomy. In establishing thresholds for taxonomy screening criteria, the taxonomy states climate change mitigation objectives to meet net-zero emissions by 2050 and a 50–55% reduction by 2030 (against 1990 levels). The current processes in the refinement and further development of the taxonomy provide the perspective for considering the sustainable COVID-19 measures and finance products as ‘green’ if they satisfy the recommendations for the disclosure of a net-zero transition strategy. Improving the taxonomy for application in stimulus programs should thus focus on two components. Firstly, the desired climate mitigation transition pathways for economic activities need to be made explicit and available. Secondly, achieving or outperforming the desired transitions pathways needs to be acknowledged as a substantial contribution to climate change mitigation. According to the current taxonomy timeline, the European Commission will by 1 June, 2021, adopt a delegated act specifying how the corporate disclosure obligations should be applied in practice. This opportunity could be seized for adopting the proposed recommendations.

A practicable way forward would be to apply the available criteria for the time being and complement them with a list of clearly defined exclusions related to those environmental objectives where the comprehensive and detailed analysis is planned until 2021. A second aspect is how to link the taxonomy concretely to stimulus programs. In case of preferential loans, the interest rates or repayment conditions, in case of transfers the amount of transfers or the actual eligibility for access, could be linked to degrees of taxonomy compliance. Thirdly, a way to practically apply this could be through contractual “covenants”. These concrete questions of application require thorough evaluation to ensure the effects desired will materialize.

A comprehensive net-zero emissions strategy should include the following aspects:

- Commitment to a transition pathway to net-zero emissions by 2050 that specifies the dates for interim targets including an orientation for scope 3 emissions for sectors where it is most material.
- A transition strategy to achieve that pathway which defines measures to be implemented by when, with appropriate measures being aligned with or identified by a suitable framework.
- The provision of short term metrics that allow monitoring of the progress towards achieving the proposed pathway. These metrics should go beyond simple current emissions footprint metrics. They

should include the contribution of new investments for achieving the emissions reduction trajectory and provide transparency on how well governance details of the transition strategy, for instance conditioning executive compensation to the progress, are enforced.

Additionally, the requirements for the disclosure of the transition strategy should be based on proportionality. Especially for SMEs, the reporting requirements, for instance with regard to the scope of emissions, can be linked to company size and the relevance of their emissions. The strategy could be filed subsequently within a practicable time frame. Ultimately, measuring and managing environmental risk through disclosure is in the companies’ best interests as it helps to build up resilience and sustain growth.

Consistent sectoral transition pathways are central to allow companies to disclose credible and achievable transition commitment and strategies as proposed in this paper. Figure 3 illustrates such sectoral transition paths as suggested by BDI (2018) for Germany. It is apparent that especially the intermediate 2030 targets might vary substantially between sectors. Since national economies are interconnected, further credible and realistic sectoral pathways in line with net-zero ambitions need to be developed (i.e. across regions). These pathways need to be easily applicable by actors in the real economy and the financial system.

Financing the transition of the economy along such sectoral transition pathways is of central concern and the crisis in-

duced reorientation of the strategies of the majority of companies poses a window of opportunity to incorporate these pathways. As shown in Figure 3, the biggest chunks of the GHG reductions are due to the renewable energy infrastructure related to the ‘energy transition’ and the measures reducing energy demand related to ‘efficiency’. Given that the use of synthetic fuels in aviation and sea transport will in part also reduce emissions beyond the German borders the total avoided emissions will be larger than 97% of 2015 emissions.

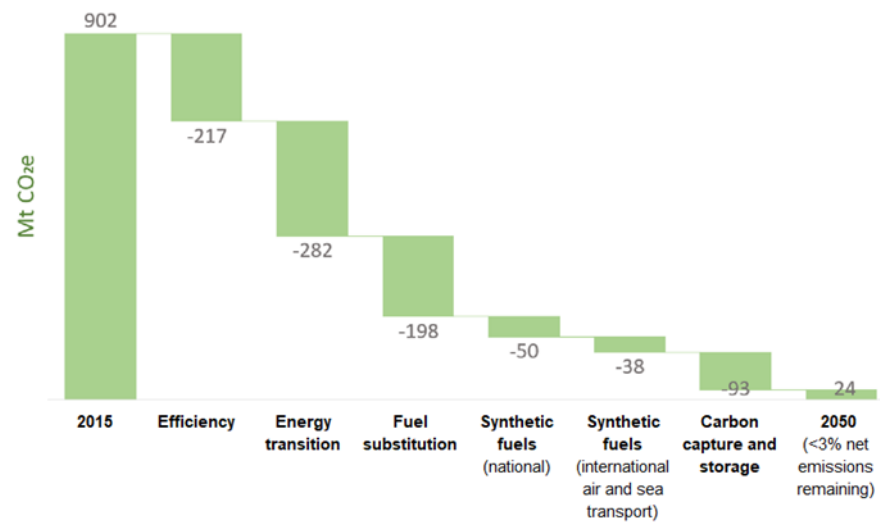
Substantial capacity extension is required to quickly establish the analytical capacity in the EU, allowing for efficient, consistent administration of recovery programs while providing clear and credible guidance to markets and decision makers in the private sector. Granting additional stimulus benefits for clear progress and transparent reporting related to a performance assessment could generate lasting incentives. Given the expectation that such programs will be developed for periods of up to and beyond five years (with potential impacts and lock-ins that could determine economic activities for centuries), annual performance assessments seem reasonable, with initial reporting to be expected within 6-12 months.

Figure 1: Generating opportunities through net-zero recovery strategies

Sector specific reductions (95%-reduction scenario)

	1990 - 2030	1990 - 2050
Industrial Process Emissions	-43%	-87%
Industrial Energy Emissions	-55%	-99%
Households and Buildings	-74%	-100%
Transportation	-26%	-100%
Power Sector	-64%	-100%
Agriculture	-32%	-49%
Other	-87%	-96%
All Sectors	-57%	-95%

Green house gas reduction by major lever



Sources: BDI, BCG, Prognos, 2018; Climate Paths for Germany.

SCALABILITY OF PROPOSED POLICIES

Create the right conditions for crowding in of private sector green finance. Providing liquidity, addressing solvency issues and boosting guided investment will involve a multitude of measures, including provision of guarantees and trade finance, direct lending, capital injection and deferral of utility and rent payments. In the light of the ultimately limited availability of public funds, it is of paramount importance to promote the crowding in of private sector green finance with a suitable setting and thus potentially multiply the available financial resources. IMF, 2020a; 2020b; 2020c and BMU, 2020 lay out several desirable conditions for pandemic relief measures that, if well applied, will stimulate and enable a crowd in and broad provision of private sector green finance as well. These conditions are extended by the proposals in this paper:

- To establish marked trust and acceptance, it is crucial to ensure the firm-specific support is done transparently and aimed at enforcing good corporate governance.
- Government accounting should make it possible to identify beneficiaries and the benefits should be systematically disclosed.
- Measures need to be implemented to prevent greenwashing, moral hazard and fraud.
- Implications of the support measures can be sizable for government budgets and debts. Therefore, the associated risks need to be controlled and monitored, financial support measures need to be long-lasting in their effect, reliable and support provisions need to be tracked.
- Implemented measures need to be periodically assessed and decisions on exit strategies need to be clearly communicated and sufficient lead time needs to be provided.
- Adverse selection of supported firms and 'zombification' of the economy need to be avoided by limiting guarantees and clearly specifying the purposes for which guaranteed loans can be extended.
- Gatekeeper procedures, like the approval by the minister of finance or cabinet, need to be implemented for major support activities and consistency with the overall policy goals should be ensured.
- In addition, extended carbon pricing policies can also facilitate the transition. Adequate carbon prices help firms in their efforts to follow their net-zero strategy by setting complementary incentives. Besides increasing carbon prices, setting carbon price floors and extending emission trading to additional sectors, a further policy to be considered are border carbon adjustment as they are particularly suited to preserve the competitiveness in selected sectors.
- Financial support should be conditioned on disclosure of a net-zero emission strategy.
- Long run compliance to the net-zero strategy should be rewarded with lasting public financial incentives.
- **Credibly** proving sustainability and resilience by informing about their environmental and societal impact is a key to attracting investors (and customers). Disclosure of a net-zero strategy thus generates additional benefits.

The recent weeks saw intense discussion on which instruments should be used to mobilize public finances. Given the dynamic developments in the EU with the endeavor to establish a recovery fund, care should be taken in ensuring that the refinancing instruments are established through mechanisms that allow the maintenance of timeliness as is required. Further, existing budgetary frameworks such as the Multiannual Financial Framework (MFF) of the EU should be taken into account, given they already allocated resources.

AVOID SUSTAINABILITY PITFALLS

Don't get stuck on the brown path. It is imperative to avoid continued increasing disparities resulting from lock-ins in brown technologies and therefore potentially stranded regions. Lock-ins will dampen the growth efforts in the long run while sustainable and inclusive growth promotes convergence. It empowers the society to participate in the benefits of green growth and ensures that no one is left behind. However, some rescue policies will inevitably target emission-intensive firms. Some of the largest or strategically important firms confronted with insolvency risks due to COVID 19 have been struggling with initiating or delivering on their transition from brown to green. This holds particularly true for energy and transport-related firms but can be extended to industries with capital-intensive and long-lasting infrastructure development needs.

As transition strategies are exceptionally demanding for brown firms, the risk of non-compliance to a stated net-zero transition strategy is high. Governments and regulators therefore have an inte-

rest in employing additional enforcement devices like convertible debt. At the same time, provision of additional debt is often no viable option for those firms. An advantage of an equity injection is the immediate improvement of the balance sheet and a reduction in funding costs, enabling additional investments. As a shareholder, the government will have a stronger influence on the green orientation of the firm and its compliance to the net-zero emission strategy. As equity is junior to debt, it should be considered that it may be riskier for the government in case of a prolonged crisis. Further, some transition pathways depend on available and fully functioning infrastructure such as grids, pipeline networks or other components. These should be addressed with particular concern and following concerted and consistent European policy strategies such as the increase in climate ambitions, e.g. the 2030 target adjustment.

Experiences from previous policy inter-

ventions and the recovery from the financial crisis tells us that it is imperative for COVID-19 recovery programs to not support companies whose business model and long-term strategies are inconsistent with achieving 1.5°C pathways. Inspired by a number of measures that The Climate Action Tracker (2020) has identified as being counterproductive, creating negative lock-ins or disqualifying in a DNSH assessment, the following list of **DON'T'S should be considered in any COVID-19 recovery program:**

Energy and electricity supply

- Don't revive plans for 'shovel-ready' fossil fuel power plants
- Don't waive oil and gas industry environmental regulations
- Don't bail out fossil fuel companies without conditions for net-zero-emission-strategies (including Scope 3 emissions)
- No extension of fossil fuel based capacities

"While political and other circumstances related to the national interest may render some climate-negative policies unavoidable, even these policies can be designed to have long-term positive climate outcomes by attaching appropriate conditions. For instance, conditional green bailouts for airlines could require achievement of net-zero emissions by 2050 with intermediate targets set at 5- or 10-year intervals. If airlines are unable to meet these targets, bailout funding would be converted to equity at today's very low stock market spot prices." Cameron Hepburn, Brian O'Callaghan, Nicholas Stern, Joseph Stiglitz and Dimitri

Land-based transport and mobility

- Don't roll back emission standards or plans to tighten those for cars
- Don't support automobile companies without conditions for a severe tightening of their emission reduction strategy and a production phase-out date for combustion engine vehicles (ideally in the early 2030s for two-wheelers and passenger cars)
- Don't use policies stimulating demand, in the form of vehicle-scraping and purchase subsidies, which will initially lead to a rebound of sales of combustion engine vehicles.

Aviation

- Don't support airline companies without commitments for emissions reduction strategies that are consistent with science-based transformation pathways in line with the 1.5 C limit
- Don't roll back regulations and taxes (e.g. ticket taxes)
- Don't recalibrate CORSIA baseline without substantially improving entire scheme¹⁴

Industry

- Don't roll back climate measures and regulation.
- Don't support industry without con-

ditions for zero-emission transition

Buildings / Infrastructure construction

- Don't employ stimulus programs for new buildings without energy efficiency criteria linked to zero carbon
- Don't employ stimulus programs for individual refurbishment measures that are not tied to/ linked to the overall building performance improvements to zero heat energy

Land-use & environmental protection

- Don't roll back environmental regulations
- Don't dismantle the enforcement of state protection for natural habitat

Conclusion

It is evident how badly the global economy was prepared for the systemic risk of COVID 19, despite early, continuous, and relentless warnings from scientists, NGOs and international organizations. It is hard to ignore the parallels to the climate crisis.

Climate change was linked to at least 15 extreme weather events in 2019 alone, each event causing losses between US\$ 1-10 billion (IPCC 2018). By now scientific predictions are clear that global warming will increase the frequency of such extreme weather events (Kramer and Ware, 2019). We don't

know exactly when climate change will bring which catastrophic event, but we most certainly know that these events will eventually occur. What excuse can there be for not being prepared and for not taking preventive actions?

We have to seize the chance to leverage the massive economic stimulus packages to enable the sustainable and equitable economy of tomorrow and avoid locking in the past. Following the COVID-19 recovery, societies' financial resources will be constrained for the years to come, limiting the scope for climate policy action. Most of the recovery measures will be debt-financed, constraining the financial flexibility for subsidies and investments into the green economy. Debt service will induce the desire for higher taxes or levies, which conflict the recovery of the private sector. The limited possibilities beyond these packages makes it so essential to utilize the triple dividend of economic recovery, striving to a sustainable pathway and promoting resilience, to the fullest potential. **Providing financial incentives within the pandemic relief measures conditional on disclosing and committing to a net-zero strategy can support this ambition. A smart policy setup and suitable extensions of the EU Taxonomy can crowd-in private sector green finance and distinctly accelerate the recovery.**

"There is little interest in reducing these risks because the costs of avoidance are being borne by few already today while the benefits divide among many and will only become apparent in the future. This applies equally to pandemics and climate change. Warnings are ignored for years. It is only acted when the risks, even with a lot of imagination, can no longer be denied or if massive damage has already occurred as is now the case of the corona crisis. Nobody really likes avoidance. Those who have to bear the costs today are of great importance in political negotiations, while the future generations are of little importance." Ottmar Edenhofer

References

¹ Net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period. Where multiple greenhouse gases are involved, the quantification of net zero emissions depends on the climate metric chosen to compare emissions of different gases (such as global warming potential, global temperature change potential, and others, as well as the chosen time horizon) For Europe net zero would translate into 95% emissions reductions and 5% removals (e.g. afforestation).

² As they increase the relative additional costs of a green path vs. a brown path, see e.g. BDI, 2018.

³ As they expose vulnerabilities due to the dependence on fossil fuels.

⁴ Check Figure 3 for the major levers.

⁵ Only measures that were quantifiable and could be assigned to one of the categories were included. Most recent data can be provided upon request as it is continuously updated.

⁶ The IRENA assessment of the 'energy system' includes renewable energy (USD 27 trillion; include investments needed for deployment of renewable technologies for power generation as well as direct end-use applications (eg. solar thermal, geothermal)), electrification and infrastructure (USD 26 trillion; including power grids, energy flexibility, electrification of heat and transport applications as well as renewable hydrogen), efficiency measures (USD 37 trillion; includes efficiency measures deployed in end-use sectors (industry, buildings and transport) and investments needed for buildings renovations and structural changes (excluding modal shift in transport)) and fossil fuel related and other investments (USD 20 trillion; includes nuclear, carbon capture and storage (CCS)).

⁷ Global GDP 2018 according to the world bank USD 86 trillion, <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD>.

⁸ The total investments for the global transition of the energy system until 2050 are estimated by IRENA to be around USD 110 trillion (USD 96 trillion due to current policies and an additional USD 15 trillion for achieving 1.5°C) of the current annual global GDP. This assessment follows the recent trend of considerable reductions of the projected investment needs relative to previous estimates, the reason being unexpectedly high cost reductions for renewable energy investments. Other studies consider the investment-gap for the EU to be around USD 300 billion annually (compared to the USD 50 billion annual average of the IRENA case) and thus much higher (Volckaert, 2020) It should be remarked that the focus of the USD 300 billion annually is on the next 10 years and that the sizable transport sector investments are included which puts the figures a bit more in perspective.

⁹ See also IMF, 2014; Abiad, 2015; Mourougane, 2016. This presumes that the post COVID-19 economy is not running at full capacity as Keynesian multipliers are not effective in economies at full capacities since government spending would then crowd out other economic activities. Hepburn et al. also only claim validity of the super-multipliers for their recommended policies outlined in the 'Use the most effective direct green investments' section below.

¹⁰ Apparently, losses due to stranded assets are lower in the more ambitious scenarios as less 'brown' investments take place within the early years of the ambitious scenario.

¹¹ The IRENA report is inconsistent here as it does count the avoided fossil fuel subsidies but not the additional renewable subsidies for the 'payoff calculation' and thus states net benefits of about USD 3.0 – USD 7.5 per dollar spend. For the energy system costs including the renewable subsidies it would be more consistent to use USD 26 trillion instead of USD 21 trillion and relate it to USD 65 trillion for the low benefit estimate and USD 157 trillion for the high benefit estimate.

¹² UBA, 2020 and BDI, 2018, for instance, emphasizes the further exploitation of electricity-based synthetic fuels for aviation and shipping.

¹³ Kittner et al., 2017 provide a decomposition of scale effects and R&D contribution to cost decreases.

¹⁴ It is expected that intercontinental flights will ultimately fall under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) developed by the International Civil Aviation Organization with the purpose of stabilising CO2 emissions at 2020 levels through a progressively evolving cap-and-trade system.

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